Business guidance *for deeper regeneration*

→ *Regenerative Agriculture Metrics: Climate chapter*

World Business Council *for Sustainable Development*

one planet business for biodiversity

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Introduction

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01. Introduction

The imperative to transition to resilient and regenerative agricultural models

Amid the escalating climate crisis and compounding agricultural challenges, a shift in agricultural systems is becoming increasingly imperative. Farmers and agriculture value chain players are feeling the detrimental effects of these challenges while the economic system continues to rely on unsustainable practices. Regenerative agriculture emerges as a powerful counterpoint to business as usual – one that is adaptive, mitigative and resilient.

The opportunities from regenerative agriculture

Regenerative agriculture has gained momentum as a holistic solution to address climate challenges, reverse biodiversity loss and enhance soil health. Forward-thinking farmers have been pioneers in adopting regenerative practices on their lands. However, to scale up regenerative agriculture into a solution that drives a significant impact on the environment and help society live within planetary boundaries, it is urgent to agree on how to measure and reward the outcomes at both the farm and supply chain levels.

The strong momentum to transition to resilient and regenerative agricultural models

The private sector is increasingly embracing regenerative agriculture for several reasons. First, the resilience of value chains depends on it. The agricultural industry is highly dependent on nature for ecosystem services, making it particularly vulnerable to climate change, biodiversity loss and water scarcity. Second, companies and financial institutions are shifting from voluntary to mandatory sustainability reporting and disclosure, which includes ambitious net-zero emissions and nature-positive strategies. Third, financial investments in regenerative agriculture are on the rise, supporting and de-risking the transition of farmers to these practices.[1] Furthermore, favorable policy environments in regions like the North America and the European Union are creating incentives for the adoption of regenerative agriculture, encouraging businesses to champion this cause.

OP2B's working definition of regenerative agriculture

Related to agroecological evidence and principles, regenerative agriculture is a holistic, outcome-based farming approach that generates agricultural products while measurably having net-positive impacts on soil health, biodiversity, climate, water resources and farming livelihoods at the farm and landscape levels. It aims to simultaneously promote above- and below-ground carbon sequestration, reduce greenhouse gas (GHG) emissions, protect and enhance biodiversity in and around farms, improve water retention in soil, reduce pesticide risk, improve nutrient-use efficiency and improve farming livelihoods.

Convergence on measurement: The imperative to scale up

To accelerate the transition to regenerative agriculture and agricultural models that operate within planetary boundaries, it is essential to converge on an integrated measurement architecture. Business must address and overcome the key challenges to alignment: fragmented and siloed data collection and reporting, a lack of alignment on definition and outcomes, a need to translate global frameworks into local action plans, and a lack of inclusivity of farmers and Indigenous peoples and local communities (IPLCs) in the process.

As regenerative agriculture gains momentum, the need to establish an aligned method for measuring progress on outcomes grows. This will support more transparency around claims made by businesses to counter greenwashing and unlock investments to finance the transition, as the world is already starting to hold business accountable for the progress it is making. The demands for increased accountability and transparency will only continue to rise. This was highlighted in the recently published **CEO Guide to Climate-related Corporate Performance and Accountability System (CPAS)**, which lays out a practical pathway to align the performance and innovation power of business with the right incentives from financial markets, while simultaneously meeting the rising demand for corporate accountability **(Annex A)**.

The World Business Council for Sustainable Development (WBCSD) has prioritized strengthening climate-, nature- and equity-related Corporate Performance and Accountability System[2] by launching the joint Regenerative Agriculture Metrics working group with the One Planet Business for Biodiversity (OP2B) coalition.[3] This collaborative effort involves more than 50 members and 27 business-focused partners, engaging more than 1,100 businesses.

The working group's goal is to align farm-, landscape- and global-level metrics with corporate reporting and to influence accounting, reporting and disclosure bodies to develop specific guidance for regenerative agriculture. Working group members and partners have initiated progress on this goal by aligning on metrics to measure climate outcomes. This guidance reflects the beginning as we work to align the remaining environmental outcomes in early 2024 and socioeconomic outcomes by mid-2024.

Fostering alignment beyond the private sector requires a collective effort. WBCSD is a partner of Regen10, a multi-stakeholder initiative that brings together representatives from across food systems – from farmers and landscape stewards to corporates – to explore the potential of regenerative approaches. Regen10 is currently developing a farmer-centric outcomes-based framework, to complement existing approaches and frameworks towards regenerative food systems. The framework will support food system actors, including farmers and landscape stewards, through a holistic approach to incorporate socio-cultural, environmental and economic outcomes and metrics into how they measure and track change in their farms and landscapes. Following an analysis of more than 150 existing frameworks, Regen10 published the Zero-Draft of the Outcomes Framework at COP28.[4]

The Outcomes Framework is being rigorously tested with key stakeholder groups through extensive dialogues, consultations and on-the-ground trials throughout 2024. The final framework, when applied, will enable farmers and landscape stewards to collect primary data and evidence, be rewarded for positive outcomes and mobilize finance, thus accelerating a transition to deep regeneration. Through the Regenerative Agriculture Metrics working group, WBCSD aims to identify and align on regenerative agriculture metrics, connecting global ESG-level with landscape- and farm-level metrics. WBCSD is connecting with the Regen10 Outcomes Framework on farm and landscape-level outcomes and metrics.

Achieving an *outcome-based approach*

02.

02. Achieving an *outcome-based approach*

Regenerative Agriculture Metrics working group members and partners support an outcome-based approach to regenerative agriculture that, at the broadest level, recognizes the need to incorporate and measure against environmental, social and economic categories. These three systems interlock to form a holistic outcome-based approach to regenerative agriculture that can bridge the gap between stakeholders and empower farmers by being cost-effective, context-specific, transparent and measurable.[5,6]

Figure 1 outlines the concept we used to organize and understand how metrics contribute to achieving regenerative agriculture outcomes that more broadly connect to the respective environmental, social and economic categories.

Figure 2 outlines a working set of outcomes for regenerative agriculture that encompasses the economic and social aspects that are critical to the success of regenerative systems, alongside environmental elements in line with the planetary boundaries associated with agriculture. While there is a general consensus on the environmental outcomes, the socioeconomic outcomes still require development through a multi-stakeholder approach. This report focuses on climate-related outcomes: maximize the carbon sequestered above- and below-ground and greenhouse gas (GHG) emissions reductions (highlighted in Figure 3). We will refine the remaining working set of outcomes as the work progresses in 2024.

It is essential for industry to align at a metric level to measure these outcomes to ensure a homogenous value chain approach to regenerative agriculture. Alignment on metrics will drive consistency and comparability and underpin the challenges related to financing the transition to regenerative agriculture.

Figure 1: Taxonomy for outcome-based regenerative agriculture and how they relate to the three categories for a holistic approach to regenerative agriculture

Source: Adapted from Soloviev, E. & HowGood, Inc. (2023). Framework.

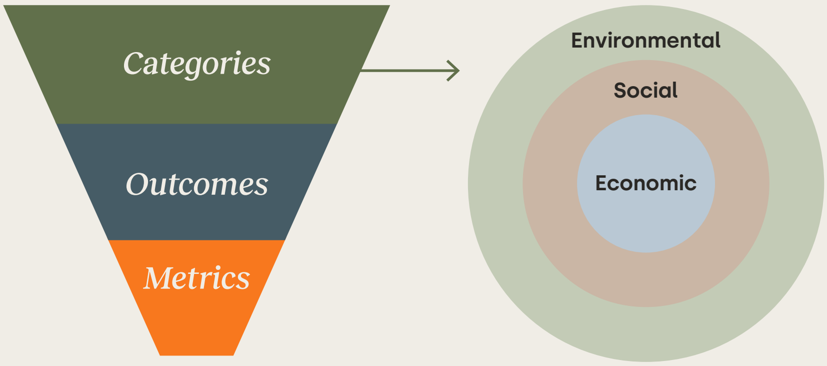
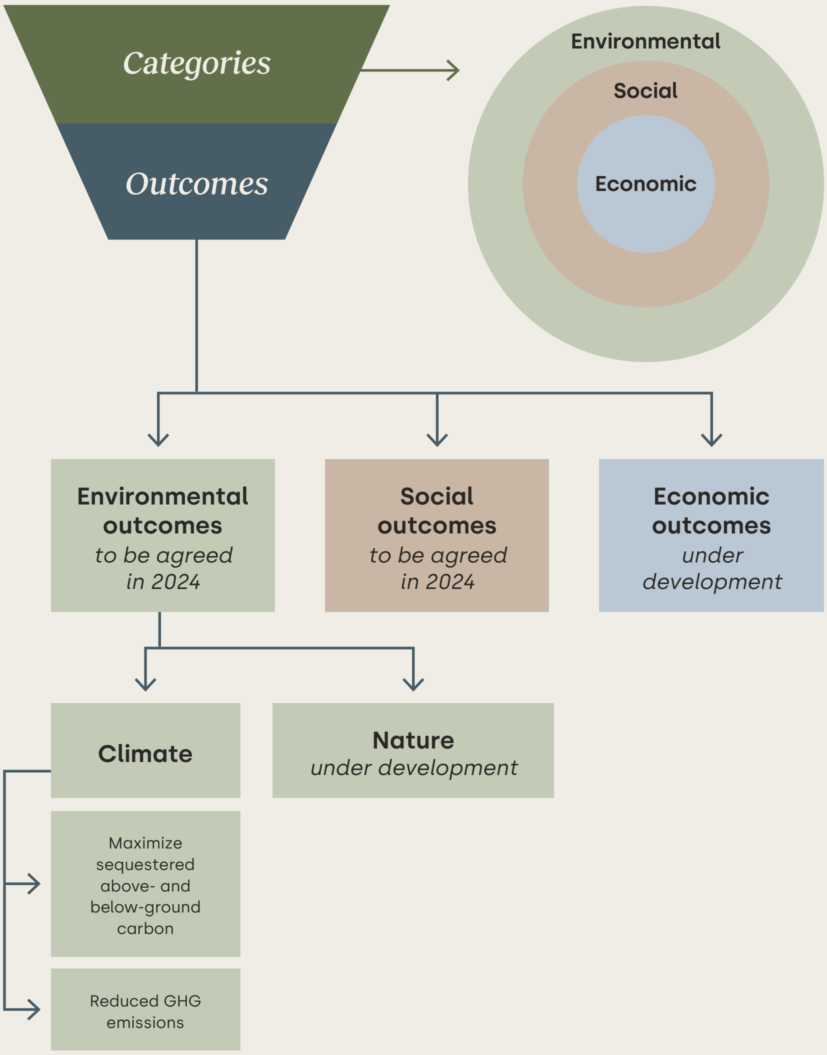


Figure 2: Working outcomes for regenerative at the corporate level showcasing agreed climate outcomes

Source: Includes figure adapted from Soloviev, E. & HowGood, Inc. (2023). Framework.



Measuring and reporting progress on Regenerative Agriculture at a company level

One of the major challenges for companies is to demonstrate their progress credibly and transparently towards Regenerative Agriculture. To measure and report progress, companies typically measure progress either in terms of surfaces transitioned to Regenerative Agriculture (e.g., 30% of the sourcing regions converted to regenerative agriculture by 2030) or in terms of the share of ingredients sourced from Regenerative Agriculture (e.g., 30% of ingredients sourced through regenerative agriculture by 2030).

However, both approaches have challenges. Measuring based on surfaces may cause a company to neglect a commodity with a significant impact that only occupies a small surface. On the other hand, by measuring based on ingredients, a company should define the correct unit (e.g., number of ingredients, share of volume, share of value) and may neglect an ingredient with high impact but represents a small share.

For companies that engage with SBTN, measuring their impact is obtained by considering the quantity and origin of raw materials, the pressures on Nature of each of these materials, and the vulnerability of Nature in the sourcing locations. These considerations require detailed information about the company's value chains and their nature-related materiality. However, in some cases involving a small number of key commodities with similar volumes and origins, measuring surfaces may be used as a proxy to measure the impact.

It is critical to measure the outcomes of regenerative agriculture using a holistic approach that considers environmental, social, and economic outcomes to ensure a complete picture of the impacts.

Climate *context*

03.

03. Climate context

3.1 GHG emissions and removals in agriculture

Agrifood systems are a major contributor to greenhouse gas (GHG) emissions, accounting for approximately one-quarter of global emissions.[7] The agriculture and food value chain is unique in mitigating climate change through both emissions reductions and removals (long-term storage of atmospheric carbon on land, for example through the conservation, restoration and management of nature).

There are three main categories of sources of emissions from agriculture and food: land management, land-use change, and pre- and post-production activities.

According to the Food and Agriculture Organization of the United Nations (FAO), land management emissions are responsible for about half the emissions of agrifood systems.[9] Of the various land management emissions, the highest contributor is enteric fermentation (digestive gas from cattle and other ruminants), followed by manure management, peatland and other organic soil drainage, rice cultivation, synthetic fertilizers and on-farm energy use.

Reversing agriculture and forestry from a net source of GHG emissions to a net sink is essential to meet 1.5°C scenarios. Doing so requires the promotion of agricultural and forestry practices that increase long-term CO2 removal through carbon sequestration. Globally, establishing forests has the highest potential for carbon removal, followed by cropland soil carbon sequestration, agroforestry and biochar.[10] The restoration of peatlands and coastal wetlands is also critical.[11]

Figure 3: Greenhouse gas emissions from agrifood systems

Land management

Emissions of the nitrous oxide (N_2O) from fertilizer application

Methane (CH_4) emissions from plant residues and livestock (enteric emissions and manure management)

Fossil carbon dioxide (CO_2) emissions in relation to use of fuels and energy (irrigation pumps, tractors, etc.)

Biogenic (derived from life) CO_2 released from soil stocks due to tillage, which exposes the soil organic matter to oxygen

46%

Land-use change

Deforestation and conversion for agricultural purposes; converting naturally grown trees and soils to agricultural land can emit the CO_2 that they store to the atmosphere.

19%

Pre-and post-production

Production and transportation of inputs,[8] such as fertilizers and pesticides

Processing and packaging of agricultural products

Transportation and waste of food

35%

3.2 Climate impacts of regenerative agriculture

Regenerative agriculture is one approach to reducing emissions and increasing removals through **land management**. The scope of the Regenerative Agriculture Metrics working group does not include **land-use change**. However, we do consider this a pre-requisite, in line with globally recognized frameworks (companies with the Science Based Targets (SBTi) Forest, Land and Agriculture (FLAG) targets must publicly commit to reaching zero deforestation across all emissions scopes by 2025 at the latest).

In a meta-analysis of 57 studies, Tamburini et al. assessed the impact of regenerative agriculture on carbon sequestration and emissions reduction and found that regenerative agriculture practices can reduce GHG emissions from agriculture by 4.3 to 6.9 Gt CO2e per year, accounting for a reduction of between 30% and 50% in current agricultural emissions. The study also found that regenerative agriculture has the potential to increase soil organic carbon (SOC) sequestration by 0.5-0.8 Gt CO2e per year in agricultural soils.[12]

The evidence is clear that regenerative agriculture has the potential to reduce emissions and increase carbon removal. The potential is, however, highly dependent upon regional effects as well as the duration of practices applied. The study identified several key practices that have the greatest potential for reducing emissions and increasing carbon sequestration. These include cover cropping, reduced tillage, crop rotation and agroforestry. Considering the impact of regional effects, including climatic and soil conditions, there is a need to focus not on practices, which are commonly associated with regenerative agriculture, but metrics that capture the outcome of the application of regenerative agriculture.

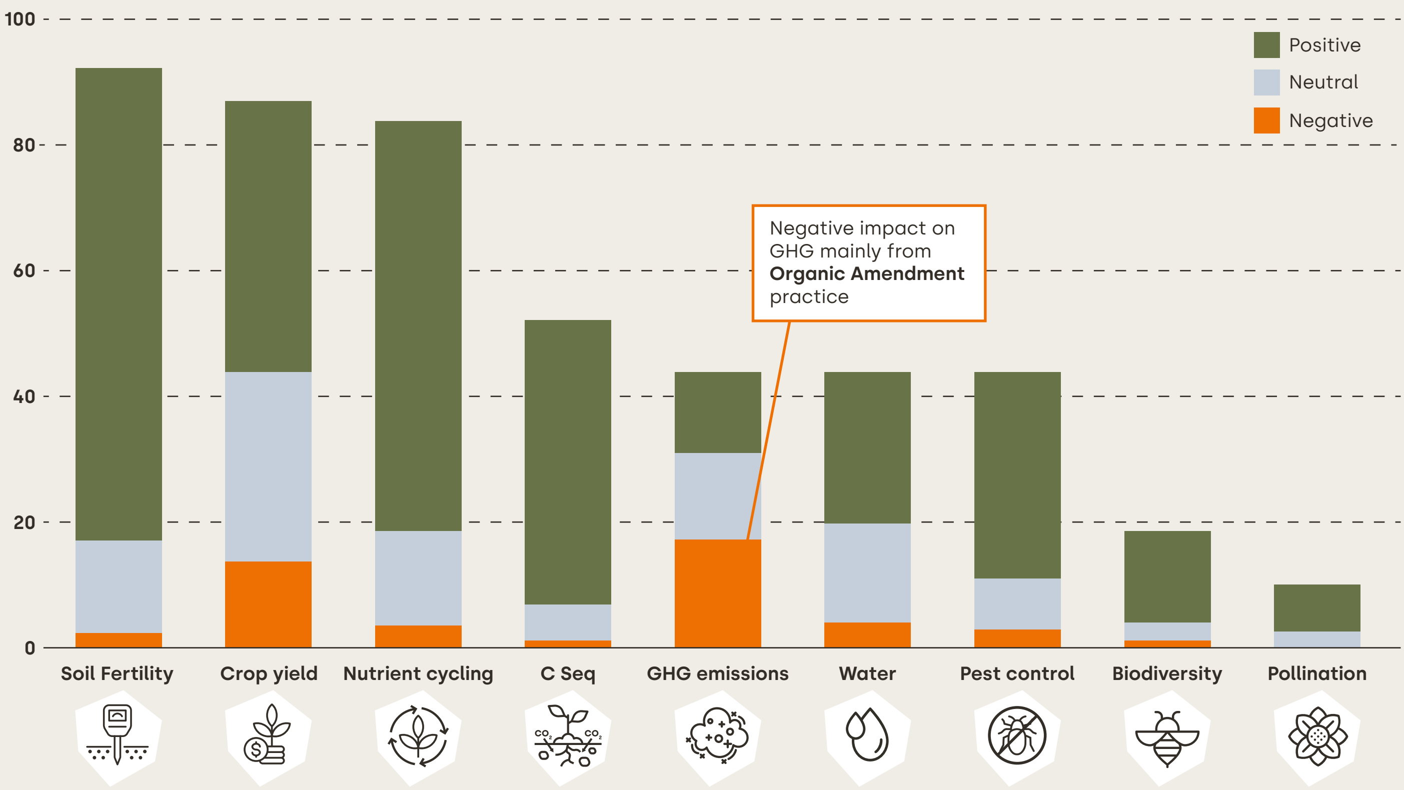
Figure 4: Overview of scientific research into benefits of regenerative agriculture on environmental outcomes

Note: This data considers the impact of 6 main regenerative agriculture practices (organic amendment, reduced tillage, crop diversification, non-crop diversification, inoculation, organic farming) on 9 environmental dimensions.

All practices considered overall neutral impact on GHG emissions (due to organic amendment still highly emitting and reduced tillage impact on crop yield) while research shows significant positive impact on carbon sequestration.

Caveat: Non-weighted impact – This analysis is an overview of the latest regenerative agriculture research studies where the individual environmental impacts of each study have not been weighted against each other.

Source: Tamburini et al. (2020).[13]



The metrics and *how we designed them*

04.

04. The metrics and *how we designed them*

4.1 Climate sub-group on corporate metrics for regenerative agriculture

Within the Regenerative Agriculture Metrics working group, the climate sub-group convened technical experts from 15 member and partner organizations over a four-month period. The objective of this sub-group was to identify metrics to support the climate-related outcomes of regenerative agriculture (Figure 2).

This climate guidance reflects the first step as we work to align the remaining environmental outcomes in early 2024 and socioeconomic outcomes by mid-2024.

The group agreed on a set of principles to guide this work:

1. Ensure clarity of connection between metrics and ultimate outcomes.
2. Develop metrics that are clearly usable for companies and incorporate simple, scientific and robust agreed definitions.
3. Identify and build on synergies with existing efforts (frameworks, guidance, etc.) that measure and track metrics. This includes aligning emissions categories and terminology with SBTi FLAG and the *GHG Protocol Land Sector and Removals Guidance* (LSRG).
4. Ensure clarity on how data flows between farm-, landscape- and global corporate levels.
5. Consider and communicate the interconnectedness of sub-group metrics with other impact areas.

4.2 Metrics to measure the climate outcomes of regenerative agriculture

The working group has aligned with two climate outcomes: *minimize greenhouse gas emissions and increase above- and below-ground carbon sequestration.*

We recommend alignment on four core metrics according to measure these two outcomes

1. Intensity-based GHG emissions total from regenerative agriculture;
2. Total GHG emissions from regenerative agriculture programs;
3. Total carbon sequestered from regenerative agriculture programs;
4. Total soil carbon sequestered from regenerative agriculture programs.

Core metrics align with disclosure requirements and together seek to represent net GHG emissions from regenerative agriculture, which includes both emissions reductions and sequestration.

We have designed these metrics for use in tracking the performance and contribution of regenerative agriculture programs over time. This will help identify the contribution of regenerative agriculture to corporate climate goals.

Companies will measure the metrics against a historical baseline for their projects. Each company will define the relevant baseline, for example, previous year or year the regenerative agriculture project commenced.

If relevant, companies may also use the metrics to benchmark regenerative agriculture programs against conventional agriculture programs – although this is not the primary objective and companies would need to consider the comparability of methodologies.

We have developed eight **intermediate metrics** that companies may need to calculate the core metrics. Companies can optionally report these metrics as standalone metrics if they find it useful to highlight a particular source of emissions or removals. Intermediate metrics can also help with the immediate identification of hotspots and data interpretation (Table 1). The ultimate objective of the metrics is to measure the climate-related outcomes of regenerative agriculture. By defining a baseline, companies will be able to use these metrics to measure and report:

- **Reductions** in GHG emissions in regenerative agriculture programs;
- **Increases** in carbon sequestration in regenerative agriculture projects.

Table 1: Recommended climate metrics – November 2024

Outcome	Indicator	Core metric	Metric description	Intermediate/optional metrics	Links to other regenerative agriculture outcomes
Minimize greenhouse gas emissions	Greenhouse gas emissions	MT CO_2e/yield or metric ton of product	Intensity-based GHG emissions total from regenerative agriculture programs	→ Emissions related to a production area – MT CO_2e/hectare → Disaggregated emissions for specific on-farm activities, e.g., from livestock management or use of fertilizer → Disaggregated emissions for different GHGs, e.g., CH_4 or N_2O	Biodiversity, soil
	Greenhouse gas emissions	MT CO_2e total	Total GHG emissions from regenerative agriculture programs		
Increase above- and below-ground carbon sequestration	Total carbon sequestration	MT CO_2e total	Total carbon sequestered from regenerative agriculture programs	→ Disaggregated sequestration for different carbon pools, e.g., above-ground carbon, below-ground carbon → Intensity-based sequestration – MT CO_2e per yield/unit (e.g., metric ton product) → Sequestration related to a production area – MT CO_2e/hectare	Biodiversity, water, soil
	Soil carbon sequestration	MT CO_2e total	Total soil carbon sequestered from regenerative agriculture programs	→ Intensity-based sequestration – MT CO_2e per yield/unit (e.g., metric ton product) → Sequestration related to a production area – MT CO_2e/hectare	Biodiversity, water, soil

Minimize greenhouse gas emissions

We recommend both intensity-based and absolute metrics for emissions.

- Companies need **intensity-based metrics** (GHG emissions per unit of product) to arrive at total metrics (which are the intensity multiplied by the volume) and some standards require their reporting (e.g., SBTi FLAG commodity pathways).
- Companies must always report **total metrics**. It is possible that total GHG emissions can increase even as intensity decreases, depending on the volumes the company is procuring.

Increase above- and below-ground carbon sequestration

Although corporate accounting frameworks do not currently require separate reporting of metrics for above- and below-ground carbon, these two carbon pools have very different data requirements and agricultural practices associated with them. Therefore, we recommend companies track these metrics separately.

- **Below-ground carbon** includes – but is not limited to – soil organic carbon (SOC), biochar and carbon in roots;
- **Above-ground carbon** is any biomass (plant material) above the ground, including – but not limited to – hedges or trees.

We recommend soil carbon sequestration as a standalone metric because there is strong scientific evidence of the positive impact of regenerative agriculture practices on soil carbon sequestration. Soil carbon is also a proxy for many other outcomes, such as soil health, biodiversity and water holding capacity.

4.3 Navigating climate-related data and reporting requirements for regenerative agriculture

Analysis of metrics required by corporate disclosure frameworks

To align the metrics with existing corporate reporting requirements, the group conducted an analysis of the climate metrics required by major frameworks, including the *GHG Protocol Land Sector and Removals Guidance* (LSRG), which serves as the go-to protocol for reporting according to the Science Based Targets initiative (SBTi) Forest, Land and Agriculture (FLAG) framework, as well as reporting for the Task Force on Climate-related Financial Disclosures (TCFD), Corporate Sustainability Reporting Directive (CSRD), CDP, Global Reporting Initiative (GRI) and International Sustainability Standards Board (ISSB).

Although the metrics required by different reporting standards may vary (Table 2), there are some consistencies across frameworks that can help guide companies.

Typical outcome metrics required by these frameworks include intensity and area-based indicators. Intensity refers to the GHG emissions or removal amount per unit of product. Area refers to the GHG emissions or removals over a geospatial zone such as a hectare of production.

There may also be a need to disaggregate the emissions or removals, for example to also report on the fossil CO_2, nitrous oxide (N_2O) and methane (CH_4) emissions of an agricultural system. Regardless of the framework, it may be necessary to calculate some intermediate metrics, although it may not be mandatory to report them.

As an example, reporting frameworks usually do not require area metrics but are likely to need intermediate information, which the company then scales by yield to arrive at the reported intensity metrics.

Table 2: Alignment with corporate disclosure requirements

Outcome	Indicator	Metric	Unit**	GHG P-LSR	SBTi FLAG	TCFD	CSRD	CDP	GRI	IFRS
Reduced GHG emissions	GHG emissions	Intensity, i.e., emission per unit (metric ton) of product	MT CO_2e/unit	I	V (I)	V (I)	I	V (I)	N	V (I)
		Area i.e., emissions related to a production area in a year	MT CO_2e/ha/yr	I	I	I	I	I	I	I
		Disaggregated emissions (e.g., for categories like LUC, or different GHGs)	MT CO_2e total*	N	N	V	I	I	I (N)	I (N)
		Total absolute emissions per relevant scope	MT CO_2e total	N	N	N	N	N	N	N
Increased sequestered above-an-below ground carbon	Removed CO_2	Intensity, i.e., removals per unit (metric ton) of product	MT CO_2e/unit	I	I	I	I	I	I	I
		Area, i.e., removals related to a production area in a year	MT CO_2e/ha/yr	I	I	I	I	I	I	I
		Disaggregated removals (e.g., for above and below ground carbon pools)	MT CO_2e total*	V	V	I	I	I	I	I
		Total absolute removals	MT CO_2e total	V	V	V	V	V	V	V

**Could potentially be relevant for intensity or area units as well.*

***Company lists most pragmatic unit (e.g., hectare); however, it could also use imperial unit systems (acre).*

Metric Abbreviations

MT = metric tons = 1,000 kg

CO_2e = Carbon dioxide equivalents, note for removals this is interchangeable with metric tons C by using the molecular weight ratio of CO_2: C, 44/12 **if the removal is assumed permanent**

HA = hectare

Yield = agricultural yield, usually in metric tons of final product or crop

Yr = year

Key

N: Needed metric for reporting

V: Voluntary metric, not required for reporting

I: Intermediate metric that may be needed to calculate end results

Accounting for GHG emissions and removals from regenerative agriculture: Farm to corporate level

For any company aiming to transition to regenerative agriculture and report GHG emissions and removals, there is a need to build **farm-level evidence** of emissions reductions and carbon sequestration.

Because multinationals often need to assess hundreds of crop-country combinations in their corporate footprinting, GHG accounting sometimes relies on generic agricultural product life-cycle inventory (LCI) databases. Created by professionals to capture the impacts of crop cultivation based on publicly available information from the FAO and other literature or agronomic knowledge, generic datasets are not true averages but aim to represent common agricultural activities using the best data available (which can be limited). Such generic data are useful in identifying hotspots (areas of concern) and making strategic decisions about portfolio shift (such as to lower animal products); however, by nature generic data are not useful in tracking progress in relation to transitioning to regenerative agricultural practices for specific farms. Furthermore, although there are individual studies on regenerative agriculture, data are not always available in database formats. Additionally, due to risks of greenwashing, there are likely to be strict rules for accounting for removals that require going beyond generic data and obtaining farm-specific, statistically significant evidence, for example through soil sampling. **This means farm-level datapoints are critical in accounting.**

Figure 5 shows the types of data used in metrics required for credible GHG accounting (emissions and removals) of regenerative agricultural systems – to go from farm-level activities to GHG outcome metrics.

Activity data

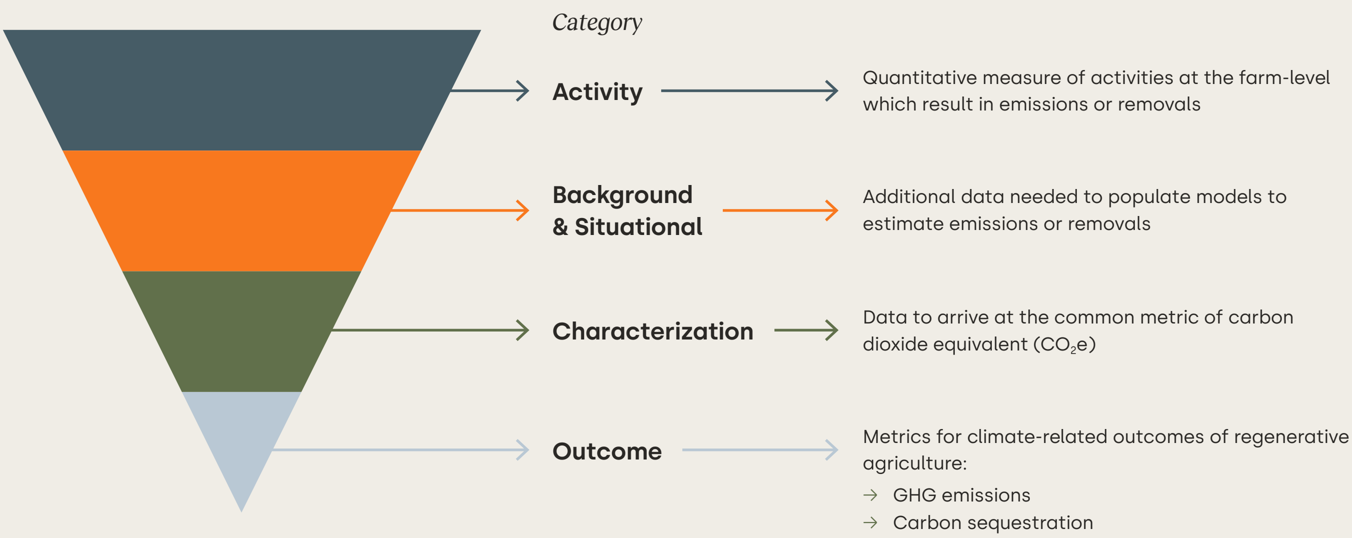
Activity data is a quantitative measure of a level of activity that results in GHG emissions or removals.[14] In the context of regenerative agriculture, this describes farmer activities that occur in the agricultural system for crop cultivation. Examples of common activity data include inputs (type, amount and application method of fertilizer, pesticides), residue management (burning, incorporating, composting), tillage intensity and use (or not) of cover crops or irrigation practices.

Background and situational data

After collecting activity data, the company uses this data to create an inventory of all the physical flows (such as emissions of N_2O, CH_4, CO_2) that are relevant to the agricultural system. Transforming activity data into inventory data usually requires populating models or coupling the activity data with other generic data. Although there are many technical terms for these types of data and model parameters, for the sake of simplicity we refer to all of these data types as "background and situational data".

As an example, most standards require the climate region (or other temperature and precipitation data) to estimate the direct GHG emissions from *applying* fertilizers. As another example, to estimate the GHG emissions from *producing* fertilizers, companies can use a "background" dataset that includes the electricity or energy mix used in the region of production. The activity data describes how much and what type of fertilizers the company ultimately couples with the direct emissions model(s) and the fertilizer production emission factor(s) to obtain the inventory of GHG flows that it needs to characterize to obtain carbon dioxide (CO_2) equivalents.

Figure 5: Data funnel – How we arrive at an outcome-based metric



Characterization

After estimating emissions or removals of various GHGs, the company moves to the characterization step to arrive at the common metric of CO_2e, which represents the impact over a 100-year timescale according to Intergovernmental Panel on Climate Change (IPCC) convention.[15,16] For example, N_2O emissions are about 300 times worse than CO_2 for the climate. Therefore, the company applies a characterization factor of about 300 to arrive at the outcome of CO_2 equivalent.

In all, there is a need for various levels of data and metrics to translate on-farm activities to the ultimate outcome metrics recommended for corporate reporting.

Case study 1: Cool Farm Tool and SAI Platform

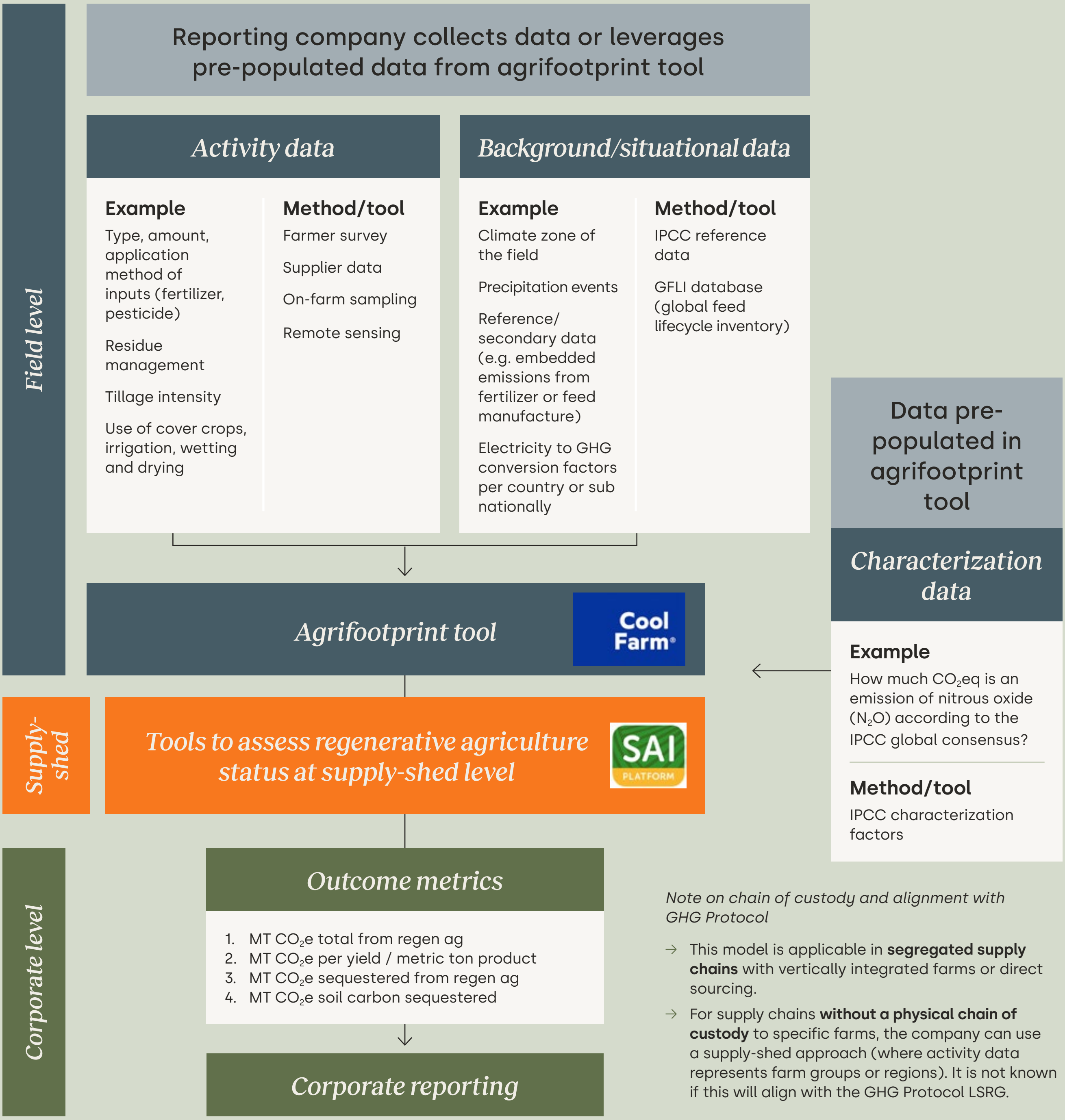
***Figure 6** illustrates the type of farm-level datapoints collected and how they inform the calculation of supply-shed level metrics and the final outcome metrics that the company reports at a corporate level.*

Cool Farm Tool and SAI Platform are partners in the RAM workstream, to support the alignment of measurement and reporting across farm, supply-shed and corporate level.

Farm-level: Cool Farm Tool is a leading carbon accounting tool for agriculture.

Supply-shed level: SAI Platform supports companies to utilize metrics by developing protocols and systems to assess regenerative agriculture status at supply-shed level.

Figure 6: Type of farm-level datapoints collected and how they inform the calculation of the final outcome metrics



Note on chain of custody and alignment with GHG Protocol

- This model is applicable in **segregated supply chains** with vertically integrated farms or direct sourcing.
- For supply chains **without a physical chain of custody** to specific farms, the company can use a supply-shed approach (where activity data represents farm groups or regions). It is not known if this will align with the GHG Protocol LSRG.

Opportunities for *implementation of climate-related metrics*

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05. Opportunities for implementation *of climate-related metrics*

To implement these metrics and achieve the potential of regenerative agriculture in decarbonization, there are several key considerations that demand the attention and action of the agrifood value chain. These present opportunities for us to continue to work with members and partners to accelerate the uptake of these metrics and overall progress on the climate-related outcomes of regenerative agriculture.

1 Frameworks

Various standards can support corporate target-setting, emissions accounting and disclosure in relation to these metrics. However, gaps remain, notably in the accounting space.

To date there are no standardized guidance and frameworks for corporate accounting and reporting of emissions and removals from regenerative agriculture. To fill this gap, the *Greenhouse Gas Protocol Land Sector and Removals Guidance* is under development, with the final draft expected in late 2024. It is critical to ensure this guidance is robust, pragmatic and aligned with clear adoption pathways for business, including:

- Requirements for traceability and acceptable chain of custody models for emissions reductions and removals from regenerative agriculture. This should consider the nature of agrifood supply chains that rely on dynamic farm systems (meaning farms with rotations), supply sheds (such as groups of farms that aggregate product) and other steps of the agrifood supply chain (like trading and processing). Guidance on accepted chain of custody models for cases where there is no segregated supply chain is critical.
- Allocation methodologies to account for emissions reductions and removals according to specific commodities or products. For example, how to account for cover crops in a crop rotation and which crop product the company can allocate emissions and, potentially, removals to in association with cover cropping.
- Rules for characterizing removals to allow comparability with emissions in a GHG accounting balance.

There is a further need for guidance on managing the potential "double counting" of emissions reductions or removals from regenerative agriculture practices as in some scenarios it is possible to capture them in both carbon credits and in-value-chain (scope 3) reductions (when a commodity does not have traceability to a specific farm).

2 Data & accounting

To enable the implementation of the metrics in line with the standards and frameworks mentioned above, there is a need for practical accounting approaches and monitoring, reporting and verification (MRV) tools for reductions and removals from regenerative agriculture. There is a lack of consistency in methodologies, data sources and tools to measure, monitor, report and verify land-based emissions and removals – making it difficult to compare measurement between organizations or projects.

The availability of data of sufficient quality and granularity to measure the climate impact of regenerative agriculture interventions is a key challenge. Companies struggle to identify when to leverage primary data, remote sensing data and secondary data in a credible way. The usefulness, applicability and feasibility of collecting these different data types can vary significantly between contexts, commodities and geographies. There is also a need for guidelines or protocols for activity data collection specifically for regenerative systems with more nuanced activities (co-cropping, integration, cover cropping), for example the number of farms companies are required to sample and in what time frame to be statistically relevant.

In particular, there is a need for pragmatic approaches to measure soil carbon sequestration that balance scientific rigor with feasibility. The complex and variable nature of soils within agricultural land areas present particular challenges when accounting for sequestration. Key considerations raised by this working group include permanency requirements, possible saturation points, the need for a holistic measurement approach to capture possible trade-offs and co-benefits, as well as time and cost requirements for primary data collection.

However, it is important to note that the variety of tools and data sources to quantify climate-related metrics is not a reason for inaction. Transparency in methods to measure metrics is critical to ensuring credibility in communicating with stakeholders.

IPCC methodology for greenhouse gas inventories: Use of tier 3 methodology to account for carbon sequestration from agriculture

In IPCC guidelines, a tier represents a level of methodological complexity. Tier 1 is the basic method, tier 2 is intermediate and tier 3 is the most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as higher tier methods and are generally considered to be more accurate on condition that adequate data are available to develop, evaluate and apply a higher tier method.[17]

For carbon removal monitoring and claiming, the *GHG Protocol Land Sector and Removals Guidance (LSRG)* requires the use of a tier 3 method (according to IPCC categories[18]). The future European regulation on Carbon Farming, as part of the Green Deal, via the Carbon Removal Certification Framework (CRCF) will have the same level of requirement.

Tier 3 IPCC methods mainly fall into 2 categories:

1. Soil analyses;
2. Coupling of soil analyses and soil carbon models (predictive models of soil carbon dynamics).

Approach 1 (soil analyses) encounter some operational limits:

→ Cost: To be considered robust, the level of sampling required is dense and thus expensive and time consuming;

→ Margin of error: The average margin of error of a soil test is greater than the average 5-year carbon storage expectancy.

For these reasons, sometimes the preferred approach is soil analysis for long- to very long-term scientific trials under controlled conditions or carbon farming on large areas (the number of soil analyses is not linear with the project area; it decreases proportionally with the project size). Soil analysis are important in many cases, such as to answer research questions (like if a crop practice can increase soil organic carbon) and establish or calibrate models. For large-scale monitoring through MRV (such as of multiple fields), using calibrated models is a pragmatic option that can reduce costs overtime.

To be considered IPCC tier 3, it is critical to have independent observations of country or region-specific field locations that are representative of the variability of climate, soil and agricultural management systems in the country or region the model is representing to validate the soil model.

Several options are possible for the use of the soil model: companies can use it alongside a plant biomass model (which they can feed with Earth Observation data or satellite image analysis results) or use it "alone" by directly entering biomass inputs (from certified field-specific databases).

Case study 2: Agrosolutions (Invivo Group) Carbon Extract

Agrosolutions has developed the Carbon Extract digital tool to monitor, report and verify the GHG emission reductions and carbon removals of crop farms.[19]

Carbon Extract is certified by Bureau Veritas and automates life-cycle analysis-based methods for calculating GHG emissions and an IPCC tier 3 soil carbon model for carbon removals, all fed with specific data at plot/field scale.

Carbon Extract allows

1. a complete carbon footprint of the farm (initial GHG emissions: CO_2, CH_4 and N_2O) and an initial carbon removal dynamic at the farm scale with information that companies can segregate at the crop scale and per area of soil type;
2. a simulation (ex-ante) of GHG emissions reductions and carbon storage potential linked to the adoption of changes in practices and costs of practice change implementation;
3. verification (ex-post) of GHG emissions reductions and the amount of carbon stored based on the farmer's actual changes in practices and biomass production;
4. calculation of carbon credits (including buffers to calculations of GHG emission reductions and carbon removals).

In France, Carbon Extract automatically connects to the Farm Management System to import farm activity data. Companies can use Carbon Extract to produce carbon credits and for scope 3 reporting. More than 1,500 farms in France already use this tool.

In addition to the results on carbon pools, Carbon Extract provides indicators for environmental co-benefits (including biodiversity, water, soil)

Figure 7: Carbon Extract entry data and results

Source: Carbon Extract[20]

Field level

Activity data

Example (non exhaustive)	Method/tool
Type, dose of product, N/P/K content, for mineral fertilizer	Public data base
Consumption of fuel (for machinery and irrigation)	Parcel management software
Consumption of energy for storage and drying of crops	Spreading plan
Crop surface, yield, mineral fertilization, residue restitution frequency, irrigation,	Regulatory declaration (CAP common agricultural policy)
Cover crop surface, yield, type (exported or returned to the ground), species, mineral fertilization,	
Organic fertilization quantity per ha, type, N content, C content, burial time, equipment use,	

Background/situational data

Example	Method/tool
Soil parameters (clay, pH, limestone, density, organic carbon content...)	IPCC reference data
Weather data (precipitations, temperature, evapotranspiration)	GFLI database (global feed lifecycle inventory)
List of parcels	
Reference/secondary data (upstream emissions from production of mineral and organic fertilizer)	

Agrifootprint tool | carbon extract

Farm level

Outcome metrics

Initial carbon footprint : TeqCO2/ha/year at farm scale (aggregation of initial GHG Emissions and initial carbon removals (SOC)) with segregated information between GHG emissions (per each type of GHG) and carbon removals.

→ Details about GHG emissions and their origin on farm (N_2O from nitrogen fertilization, CO_2 from fuel, emissions upstream emissions (outside the farm)

Simulation of practice change impact : GHG emission reduction and removals, and cost estimation.

Carbon credit generated (emissions difference between actual agricultural practices and future agricultural practice) after the farmer decides to changes its agricultural practices and wishes to make a transition

Biomass flow returned to the soil/ha/year

Co-benefits : indicators on soil quality, biodiversity, water and air quality, consumption of fossil resources, social aspects

3 Farmer incentives & engagement

It is necessary to support producers financially for practice change to deliver regenerative agriculture outcomes. There is need for more clarity on best practices in engaging and financing farm-level practice change and data collection, including:

- Clear models for collective value chain investments at the farm or landscape level;
- Resources for producers to collect the necessary data and drive practice change.

This opens up the need to experiment with various types of frameworks to understand what works for the corporate community and for the farmers.

These challenges are complex and interconnected. To effectively advance in the adoption of outcome-based metrics, it is critical to undertake a systematic and holistic approach to addressing these challenges. The agrifood industry stands at a critical juncture, demanding a concerted effort from companies to overcome these obstacles. It is paramount to collaboratively and collectively address these challenges as doing so can pave the way for a more sustainable and resilient future for both the agrifood industry and the Earth's broader ecological landscape.

Case Study 3: Danone and Royal FrieslandCampina roll out concrete carbon reductions projects with farmers in the Netherlands

Danone works with suppliers to create a positive impact across the whole value chain and collectively achieve its climate ambitions.

Through a collaborative and data-driven approach, Danone, in partnership with FrieslandCampina and 600 dairy farmers, has reduced the environmental impact and carbon footprint of FrieslandCampina's dairy farms by implementing regenerative agriculture practices. The three-year (2017-2020) collaboration between FrieslandCampina and Danone led to a 17% reduction in GHG emissions and the use of 100% green electricity for the dairy ingredients the company and its dairy farmers provided to Danone compared to the 2015 baseline. Dairy farmers can take different measures to reduce their GHG emissions depending on the nature of the farm. Some examples of the measures farmers adopted include:

- Harvesting more protein from their own farmland to increase their feed autonomy and reduce the impact of sourcing feed from far away;
- Optimizing the cows' diet composition to increase feed digestibility to reduce enteric methane emissions and improve cows' welfare;
- Generating green electricity through the use of solar panels to avoid fossil fuel use.

This project demonstrates an opportunity for FrieslandCampina and Danone and showcases the positive impact greater collaboration in the sector can yield for companies, their farmers, their animals and the environment. The positive results from this partnership encouraged Danone and FrieslandCampina to extend the collaboration for an additional three years. By working together, they aim to continue efforts to achieve the goal to reduce GHG emissions stemming from the production of milk sourced by over 7%. This would result in GHG emissions reductions of almost 25% over the course of the collaboration. In the coming years, FrieslandCampina and Danone will continue to look at innovative solutions to scale up and speed up the transition to regenerative agriculture.

Source: Danone[21]

Next steps to *accelerate the transition to regenerative agriculture*

05.

06. Next steps to accelerate *the transition to regenerative agriculture*

Climate is one aspect of this holistic approach to measuring regenerative agriculture. Over the coming months, this working group will carry out a similar process to align on the remaining environmental and socioeconomic outcomes.

Our report indicates the need for a strong focus on interoperability and connectivity with existing frameworks and platforms, including standards, reporting and disclosure. This work seeks to align and drive the incorporation of regenerative agriculture into these systems to strengthen corporate performance accountability systems for carbon, nature and equity.

In particular, we recommend alignment on four core metrics according to the two main outcomes of minimizing GHG emissions and increasing above- and below-ground carbon sequestration:

1. Intensity-based GHG emissions total from regenerative agriculture programs (in MT CO_2e/ yield or metric ton of product);
2. Total GHG emissions from regenerative agriculture programs (in MT CO_2e total);
3. Total carbon sequestered from regenerative agriculture programs (in MT CO_2e total);
4. Total soil carbon sequestered from regenerative agriculture programs (in MT CO_2e total).

The ultimate objective of the metrics is to enable companies to measure and report on the climate-related outcomes of regenerative agriculture: reductions in GHG emissions and increases in carbon sequestration.

In 2024, WBCSD will support land-based climate action and accelerate scope 3 emissions reductions in the agriculture and food value chain.[22] This work will support the implementation of the climate metrics for regenerative agriculture by:

→ **Aligning carbon accounting standards and practices:** Carbon accounting standards and frameworks must be robust, pragmatic and aligned with clear adoption pathways for business.

→ **Accelerating the adoption of standards and practices for scope 3 emissions reductions and removals:** Standards and frameworks must be in alignment with each other and have a focus on data and measurement, reporting and verification.

→ **Ensuring coherence between in-value-chain, beyond value chain mitigation (BVCM) and nature-positive approaches:** Key platforms need to convene to align on and advocate for landscape-based approaches.

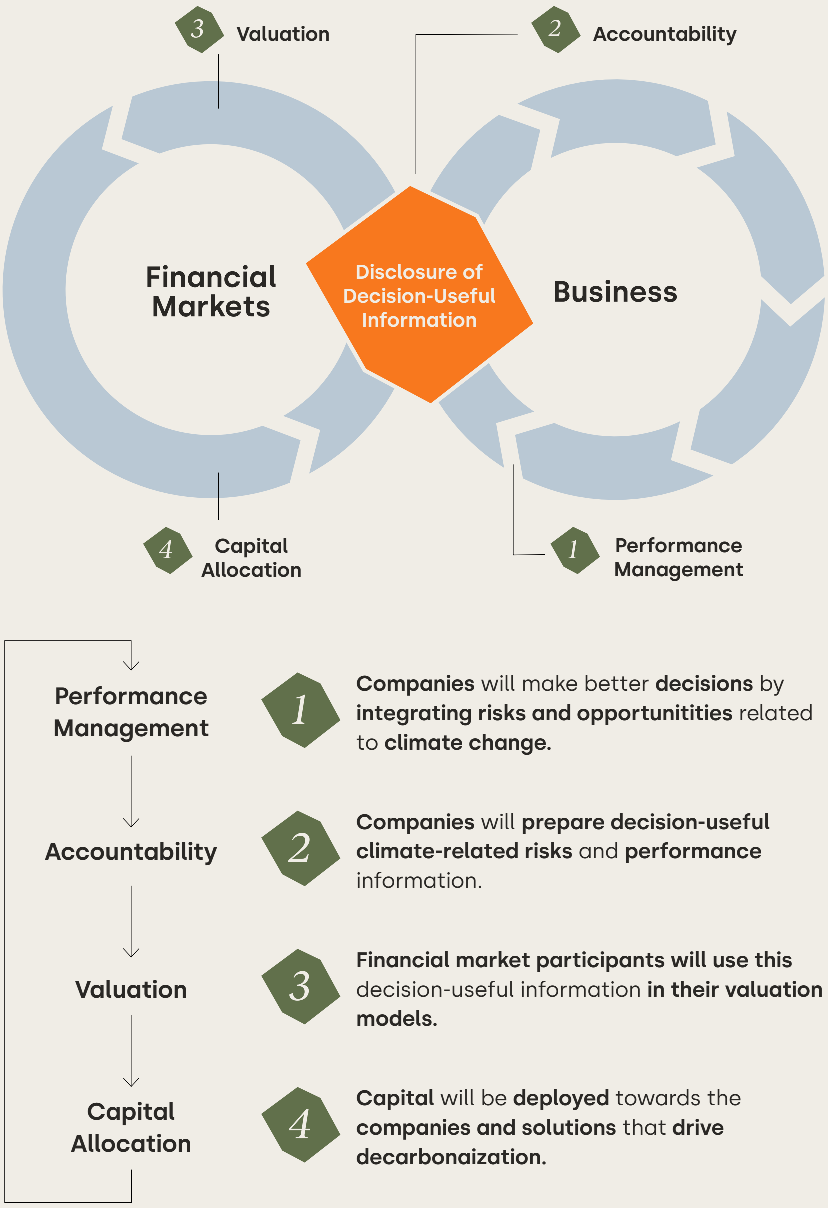
Annex A:
Integrating climate-related information will align financial markets with climate action

The [CEO Guide to the Climate-related Corporate Performance and Accountability System (CPAS)] lays out a practical pathway to align the performance and innovation power of business with the right incentives from financial markets, while simultaneously meeting the rising demand for corporate accountability. By integrating the climate-related risks and opportunities in every part of the strategic and performance management process, companies can provide financial markets – and other stakeholders – with well-managed, consistent and comparable data.

WBCSD and OP2B's work on regenerative agriculture metrics aims to address common "pain points" in the system relating to 'measure and manage performance'. Aligning on a common set of indicators to measure the outcomes of regenerative agriculture will lead to outcomes that align, incentivize and accelerate progress on net-zero targets (as well as nature and equity-related targets) and secure the necessary financing to propel the transition by cultivating transparency.

Figure 10: Integrating climate-related information will align financial markets with climate action

Source: WBCSD[23]



Annex B:
Glossary

General

Above- and below-ground carbon sequestration

Increasing the uptake of CO_2 and storage of carbon in biological sinks.[24] Includes carbon stored in the carbon pools of specific habitats, such as trees, above-ground biomass, roots and soil.[25]

CO_2 equivalent (CO_2-e)

The universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.[26]

Emissions scopes

The GHG Protocol classifies a company's GHG emissions into three scopes. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.[27]

Planetary boundaries

refers to a safe operating space for humanity based on the intrinsic biophysical processes that regulate the stability of the Earth system. The planetary boundary framework presents a set of nine planetary boundaries within which humanity can continue to develop and thrive for generations to come. Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes.[28]

Land-based carbon pools

Definitions sourced from the *Greenhouse Gas Protocol Land Sector and Removals Guidance.*[29]

Above-ground biomass carbon pool

Carbon in terrestrial living woody or herbaceous vegetation 2mm in size or greater. Example: carbon in trees, shrubs, plants.

Below-ground biomass carbon pool

Carbon in terrestrial live roots 2 mm in size or greater. Example: carbon in roots.

Soil carbon pool

- Mineral soil organic carbon (SOC): Carbon in soil organic matter that is smaller than 2 mm in size in soil types not classified as organic soils. Example: carbon in topsoil of croplands from particulate organic matter or microbial biomass.
- Organic SOC: Carbon in soil organic matter that is smaller than 2 mm in size in organic soils that have organic horizon >10 cm or which have greater than 12-20% organic carbon by weight. Example: carbon in peat soils or wetland organic soils.

Soil inorganic carbon

Carbon in soil carbonates and other mineral carbon forms. Example: carbon in calcium carbonates in desert soils.

Taxonomy

Indicators

Values or characteristics that provide insight into a particular phenomenon or situation.

Metrics

System or unit of measurements.

Outcomes

Quantitative or qualitative parameters that measure achievement or reflect changes over time; may be short or long term.

Endnotes

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Disclaimer

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

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

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About Regen10

Regen10 is a global endeavor committed to achieving regenerative outcomes for people, nature and climate. Originally funded by IKEA Foundation and The Rockefeller Foundation, Regen10 has recently secured further funding from the McKnight Foundation to support its work. Alongside WBCSD, partners include 1000 Landscapes for 1 Billion People, The Food and Land Use Coalition, Global Alliance for the Future of Food, IUCN, Leaders' Quest, Meridian Institute, Sustainable Food Trust, Systemiq, and World Farmers' Organisation.

www.regen10.org

About One Planet Business for Biodiversity (OP2B)

One Planet Business for Biodiversity (OP2B) is an international, cross-sectoral and action-oriented business coalition on biodiversity with a specific focus on regenerative agriculture. We are determined to drive transformational system change and catalyze action to protect and restore cultivated and natural biodiversity within agricultural value chains. The coalition is focused on scaling up regenerative agriculture; developing transparent outcome-based reporting for regenerative agriculture; advocating for positive policy for de-risking the transition for farmers; and promoting crop and food ingredient diversification.

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The World Business Council for Sustainable Development (WBCSD) is a global community of over 225 of the world's leading businesses driving systems transformation for a better world in which 9+ billion people can live well, within planetary boundaries, by mid-century. Together, we transform the systems we work in to limit the impact of the climate crisis, restore nature and tackle inequality.

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

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