PROF. DR. HEITOR MANCINI TEIXEIRA
Department of Soil Sciences, Universidade Federal de Viçosa, MG, Brazil

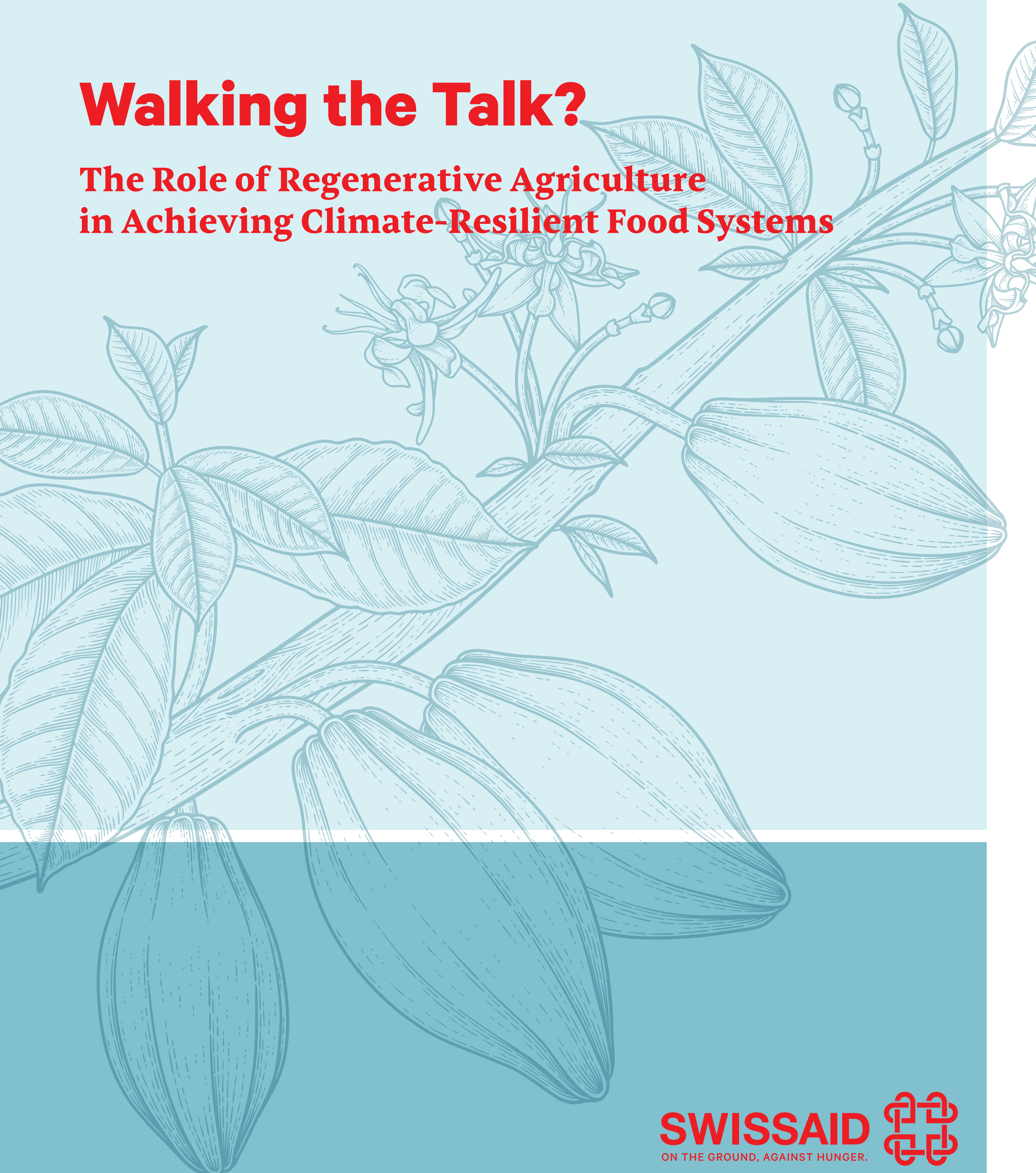
SONJA TSCHIRREN
Senior Climate Advisor, SWISSAID

DELIA HÜRLIMANN
Climate Advisor, SWISSAID

PROF. DR. JOHANNA JACOBI
Department of Environmental Systems Science, ETH Zurich

Walking the Talk?

The Role of Regenerative Agriculture in Achieving Climate-Resilient Food Systems



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ABOUT THE AUTHORS

Prof. Dr. Heitor Mancini Teixeira has over 15 years of experience in research and education focused on the analysis and design of complex farming systems. He has worked at Wageningen University and Utrecht University in the Netherlands and is currently a soil biology professor at Universidade Federal de Viçosa in Brazil.

Sonja Tschirren is a Senior Climate Advisor at SWISSAID, working on the intersection of climate change and food systems. She holds a Master of Arts and an Advanced M.Sc® in Innovations and Policies for Sustainable Food Systems (IPAD) of the Institut Agro Montpellier. She has been working on policy in the UN context and with NGOs for over 15 years.

Delia Hürlimann holds a Master's degree in Environmental Systems Science and Policy with a specialization in sustainable food systems. Her master's thesis focused on different types of cocoa production in Ghana, with a particular emphasis on dynamic agroforestry systems. Formerly part of the Agroecological Transition research group at ETH Zurich, she has contributed to SWISSAID's program on climate and sustainable food systems, including to prepare the present report.

Prof. Dr. Johanna Jacobi is an Assistant Professor of Agroecological Transition at the Department of Environmental Systems Science at ETH Zurich. Her research explores agroecology as a transformative science, a practical approach, and a social movement. In her projects, she focuses on agroforestry systems and power relations within food systems, drawing on approaches and methods from political ecology.

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IMPRESSUM

Authors: Prof. Dr. Heitor Mancini Teixeira, Sonja Tschirren, Delia Hürlimann, Prof. Dr. Johanna Jacobi
Reviewers: Sophie Scherger (Institute for Agriculture and Trade Policy (IATP)), Francesco Ajena (SWISSAID)
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SWISSAID | Lorystrasse 6a | 3008 Bern | Switzerland | Phone +41 31 350 53 53
info@swissaid.ch | www.swissaid.ch | CP 30-303-5

ABBREVIATIONS

Abbreviation	Definition
ACORN	Agroforestry CRUs for the Organic Restoration of Nature
ANR	Assisted Natural Regeneration
B-ACT	Business Agroecology Criteria Tool
CBD	United Nations Convention on Biological Diversity
CH_4	Methane
CO_2	Carbon Dioxide
CO_2eq	Carbon Dioxide Equivalent
CRU	Carbon Removal Unit
CSO	Civil Society Organization
EY	Ernst and Young
F-ACT	Farm Agroecology Criteria Tool
FAO	Food and Agriculture Organization of the United Nations
FAT	Nestlé's Farm Assessment Tool
GHG	Greenhouse Gas
KPI	Key Performance Indicator
SAI	Sustainable Agriculture Initiative
SBTi	Science-Based Target Initiative
SWISSCO	Swiss Platform for Sustainable Cocoa
TAPE	FAO's Tool for Agroecology Performance Evaluation
UNCCD	United Nations Framework Convention on Climate Change
UNFCCC	United Nations Convention to Combat Desertification
NIAS	Nestlé Institute of Agricultural Sciences
N_2O	Nitrous Oxide
VSLA	Village Savings and Loan Associations

EXECUTIVE SUMMARY

Regenerative agriculture (RA) is gaining momentum. The approach is increasingly promoted by corporations and civil society actors as a strategy to improve soil health, increase biodiversity and strengthen rural livelihoods. In the coffee and cocoa sectors, agroforestry emerges as a main regenerative practice. By integrating shade trees, fruit trees and other crops into cocoa and coffee systems, agroforestry is expected to deliver multiple benefits for climate mitigation and adaptation. However, outcomes on the ground are highly dependent on socio-economic as well as ecological system configuration.

To shed more light on how RA can contribute to climate mitigation and adaption, this report investigates how companies and other entities integrate RA into their strategies and plans, how narratives are translated into agricultural practices, how systems are monitored, and what outcomes are reported across projects. We based our analysis on a literature review combined with interviews with five organizations — Nestlé, Barry Callebaut, Earthworm Foundation, Solidaridad and reNature. We selected projects and initiatives implemented by these organizations to illustrate both the opportunities and the limits of RA approaches in the cocoa and coffee sectors.

Photo below: Diversified coffee agroforestry system with banana and native shade trees.

Our Key Takeaways Are:

1. The current carbon market logic is **not adequate for the agricultural sector**. Projects and operations at the production level must seek system multifunctionality to mitigate and adapt to climate change.

2. There is often a **misalignment** between publicly communicated **objectives**, their **monitoring** and reported **outcomes** in RA projects.

3. There is a **lack of transparency** towards the public regarding monitoring and verification protocols and the reporting of results. This makes it **difficult to track progress** of the projects against the stipulated objectives.

4. A focus on indicators related to **scale rather than quality hampers the understanding** of agricultural systems' actual capacity to mitigate and adapt to climate change.

5. The **active involvement and stable financial support for farmers** and their organizations is key for the successful implementation of climate-effective practices on the ground. So far, the single farmer draws the short straw: many risks associated with the durable establishment of an agroforestry system rest on his or her shoulders.

6. A **fair farmgate price** per unit of cocoa or coffee cannot be substituted with payments for carbon credits or the enrolment of farmers in RA projects.

7. There is a need to set **clear definition criteria for RA** and to strengthen governmental and international oversight where RA is used to mitigate GHG emissions.

Based on the findings, we call for an integrated perspective on RA, bringing together governments, scientists, companies, farmers, civil society organizations and consumers. Governments should agree on RA's expected results and practices as well as oversee progress. This requires validated, science-based indicators and public monitoring protocols that capture the complexity of regenerative systems and their expected benefits. More formalized, proven approaches such as agroecology and organic agriculture provide a good benchmark.

Corporate and public actors in the sector should implement RA for GHG emission reduction purposes and for reducing their financial risks in the supply chain by fostering the producers' adaptation to climate change. Therefore, public and private finance for RA should move away from carbon compensation schemes towards programs that take on a rights-based and farmer-centered focus beyond carbon sequestration, generating measurable and durable benefits for people, landscapes and the climate.

CONTENT

1. INTRODUCTION

Climate change is deepening social inequalities and accelerating environmental degradation. At the core of this downward spiral lies intensive farming, with agriculture now standing as the world's second-largest source of greenhouse gas (GHG) emissions.[1] At the same time, the sector itself is highly vulnerable to ongoing climatic shifts.[2] In response, corporate commitments to regenerative agriculture (RA) have expanded rapidly, with promises to restore biodiversity, enhance soil health, and strengthen resilience to climate change. Despite the multiple benefits expected, translating these commitments into effective implementation, rigorous monitoring, and large-scale impact remains a major challenge. Within the cocoa and coffee sectors, companies increasingly showcase RA as proof of sustainability, underscoring the need to critically assess how such pledges are enacted on the ground and whether they deliver measurable results. This report explores the gaps between corporate rhetoric and practice. It sets out recommendations for enabling RA to drive genuine resilience, equity, and climate-effective transformation.

The Role of Systemic Approaches for Climate Change Mitigation and Adaptation
Climate change is accelerating environmental degradation and deepening social inequalities worldwide. These impacts are largely fuelled by human activities, leading to desertification, biodiversity loss, disruption of biogeochemical flows, poverty and land concentration-driven inequality.[3,4,5,6] Agriculture, which occupies nearly half of the world's habitable land,[7] contributes to these impacts, remaining highly vulnerable to them.[8] Therefore, addressing these global challenges requires the urgent and fundamental redesign of agricultural systems to enhance climate resilience and long-term sustainability.

Systemic approaches in agriculture are increasingly recognised as promising solutions to both mitigate and adapt to climate change, while simultaneously addressing associated global socio-environmental problems and injustices.[9,10,11]

Rooted in agrobiodiversity, systemic approaches generate multiple ecosystem functions, regulate key earth-system processes (e.g. global biogeochemical flows, temperature, and precipitation regimes) and provide for society's basic needs such as diverse and nutritious food, clean water and air.[12,13,14,15] They are considered systemic when they incorporate the socioeconomic dimension, encompassing both the well-being of rural farming populations and the interests of consumers.

Therefore, systemic approaches are key to improving livelihoods[16] by simultaneously addressing the three main UN conventions on environmental issues:

- (1) the UN Convention on Biological Diversity (CBD) — through agrobiodiversity;
- (2) the UN Framework Convention on Climate Change (UNFCCC) — through the food systems' resilience to climate impacts and mitigation capacity; and
- (3) the UN Convention to Combat Desertification (UNCCD) — through soil conservation and ecosystem services.

The effective implementation of these approaches can make a major contribution to resolving interconnected global issues related to climate change, human development, and environmental well-being.

Regenerative Agriculture and Climate Change

RA is considered a systemic approach that can contribute to climate change adaptation and mitigation. Part of its growing appeal lies in its suggested potential to enhance carbon sequestration from the atmosphere in soil and plant biomass through sustainable practices such as agroforestry (see infobox 5).

The potential of regenerative systems to sequester carbon in the soils and in biomass — while enhancing biodiversity and resilience to disturbances — has attracted growing interest from the parties to the UNFCCC, particularly as they operationalize Article 6 of the Paris Agreement. Interest has also been rising within the voluntary carbon markets, where regenerative agriculture has been promoted for its capacity to deliver nature-based climate solutions. Indeed, the value of the global voluntary carbon market cracked USD 1 billion for the first time in 2021. It could be reaching USD 5–30 billion per year by 2030 according to estimates by the World Economic Forum, with two thirds of this invested in nature-based solutions, supposedly filling the existing gaps in climate finance for nature.[17] As a result, increasing financial resources are being channelled into projects focused on carbon sequestration and the generation of carbon credits from agricultural land as part of global climate mitigation efforts.

Beyond the carbon credit market, investments in RA and sustainable agriculture are expanding across all actors — from public and private investors to philanthropists. In Brazil, for instance, investments into sustainable agricultural approaches — including RA — are growing rapidly, having reached USD 3.67 billion since August 2022, with projections indicating continued growth.[18] Similarly, in Switzerland, the Swiss Platform for Sustainable Cocoa (SWISSCO) has set the goal that 30% of all cocoa growing areas should become agroforests — a common RA practice — before 2030.[19]

When channelled into regenerative and sustainable practices that truly work in the field, investments could become a powerful lever to both actively reduce emissions and enhance community resilience to climate change. However, for such investments to deliver meaningful results, it remains crucial to clearly understand how project objectives are planned, what specific agricultural practices are adopted, what indicators are used for monitoring, and how results are shared and evaluated. Equally important is to grasp the critical distinction between GHG emission reductions and CO_2eq removals, as each entails different implications for climate mitigation strategies.

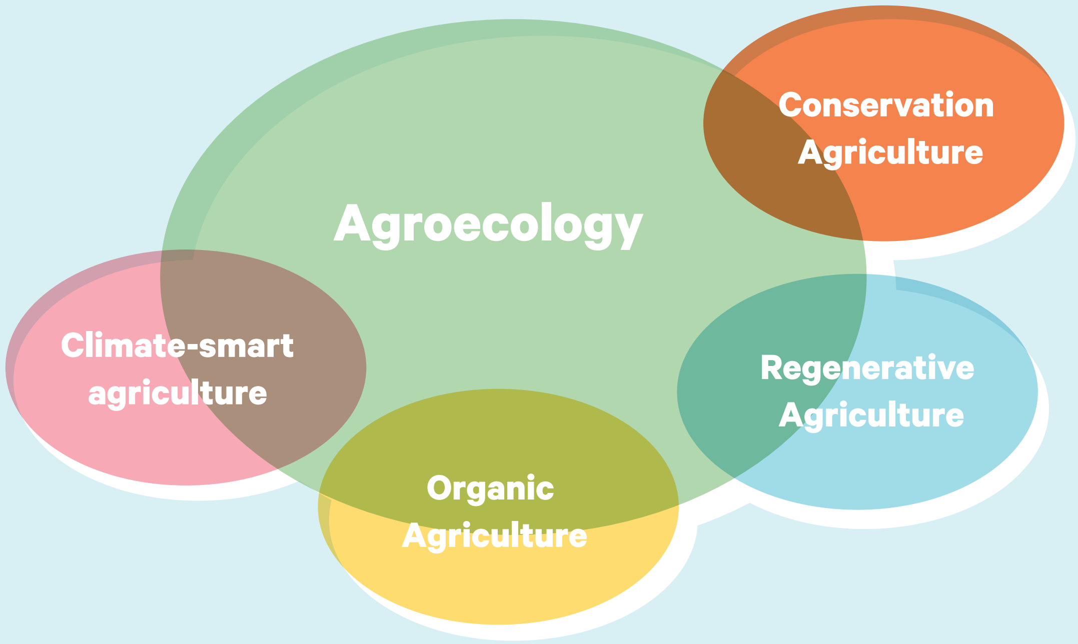


Figure 1: *Agroecology and other sustainability approaches in agro-ecosystems.[24]*

Regenerative Agriculture: from Corporate Commitments to Practices

Companies are adopting the term RA in their communication and marketing strategies to demonstrate their commitment to transitioning towards more sustainable and climate resilient food systems.

RA can be generally defined as an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production. In fact, there are multiple definitions to the concept of RA. Although soil often plays the central role, some definitions embed social and cultural dimensions while others are restricted to its ecological benefits.[20,21]

RA is generally regarded as part of the umbrella of sustainable agricultural approaches, understood above in figure 1 as agroecology. Within this context, RA stands alongside other established approaches such as conservation agriculture, organic agriculture and climate smart agriculture (see figure 1). While concepts such as organic agriculture and agroecology are clearly defined, for instance through well-established certification standards or principles endorsed by governments, RA so far lacks a common and coherent definition. This definitional ambiguity positions RA closer to the flexibly framed concept of climate-smart agriculture, whose contours similarly vary depending on context and interpretation.

Despite the lack of a common definition, 24 of the world's 30 largest food and beverage producers now reference RA in their sustainability communications according to a report from the NewClimate Institute (2024), a non-profit working in Climate Policy and Global Sustainability.[22] Among these, 18 companies provided explicit definitions of RA, but only 8 established quantitative targets for its implementation.

A report by FAIRR (2023), a collaborative investor network, confirms this pattern after assessing 79 global food and retail companies.[23] While a majority (50 out of 79) mention RA in their disclosures, only 36% have set quantified, company-wide targets for adoption. Furthermore, just 16% discuss specific metrics and data, with only four companies having established baselines to track progress. Only 8% have committed to providing financial support to farmers adopting RA practices.

INFOBOX 1

Net Zero Plans and Roadmaps

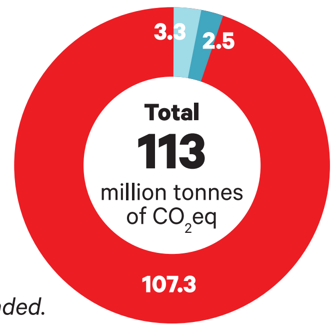
The bulk of greenhouse gas (GHG) emissions within the value chains of multinational companies operating in the agriculture and food sector stems from on-farm agricultural production and land-use changes related to agriculture.[25,26] These are categorized as Scope 3 emissions, which are considered indirect from a corporate perspective, occurring at the level of suppliers, downstream or upstream, in the supply chain.

Nestlé's Net Zero plan illustrates the dominance of Scope 3 emissions in agricultural supply chains: they account for 95% of the company's total value chain emissions.[27] In contrast, Scope 1 emissions, which the company directly controls, account for only 3%, and Scope 2 emissions, related to purchased energy make up 2.2%.

Under European Union legislation — notably the Corporate Sustainability Reporting Directive[28], which is currently under revision[29] — large companies operating in the European market are required to develop Net Zero transition plans. These must detail emissions across scopes 1, 2, and 3, and outline a roadmap for their progressive reduction. In addition, Switzerland — where Nestlé and Barry Callebaut are headquartered — has adopted a Climate Protection Law in June 2023. The law mandates companies to diligently report on all three scopes of GHG emissions, and to define reductions for 2030 and up to 2050 consistent with limiting warming to 1.5°C in alignment with the Paris Agreement.[30] The law's implementation directive recommends setting five-year reduction targets to ensure regular progress assessment and accountability. In addressing how to avoid/ reduce or remove emissions from the agriculture and food industry, the GHG Protocol and the Science-Based Target Initiative (SBTi) provide key guidance on accounting methodologies, target setting, and emission reductions and removals (see infobox 6).[31]

Figure 2:
Nestlé's Total GHG Emissions by Scope[34]

Million tonnes of CO_2eq, in 2018



* *Figures have been rounded.*

Scope 1 Emitted Directly	3.3	3.0%
from sources we own or control such as on-site combustion (coal, natural gas, fuel for company's vehicle fleet).		
Scope 2 Emitted Indirectly	2.5	2.2%
from the generation of purchased energy like electricity and heating/cooling network.		
Scope 3 All Other Indirect Emissions	107.3	94.8%
in our value chain, both upstream and downstream, such as sourcing and use of sold products.		

Nestlé's Net Zero targets, approved by SBTi, foresee reduction and removal initiatives, using regenerative agriculture and farming practices like improving soil health, integrating trees into livestock foraging areas, reducing fertilizer use or switching to organic fertilizers and increasing the ability of farmland to store carbon while improving yields.[12] By 2030, 50% of Nestlé's emissions shall be reduced, partly through the use of renewable energy and the sourcing of "50% of key ingredients from regenerative agricultural methods." Finally, avoiding deforestation and fostering the planting of trees on-farm or around farms in agroforestry systems is another key measure of the strategy when it comes to regenerative agriculture. Such practices are expected to mitigate emissions by fostering microclimates and humus-rich soils thereby reducing the use of fertilizer and water. They are also designed to remove carbon dioxide (CO_2) from the atmosphere, by storing carbon in soils.[32]

In the context of Net Zero plans, it is essential to distinguish between GHG emission reductions and GHG emission removals. *Reductions* refer to a decrease in the quantity of GHG emissions released into the atmosphere and should always be prioritized. GHG emission removals on the other hand, are to be used as last resort. *Removals* describe activities such as technological measures to capture carbon or rather CO_2 which is otherwise released into the atmosphere, or actions — and this is relevant in the present report — to sequester carbon in biomass and agricultural soils for instance. This distinction is key, as carbon sequestration in soils and vegetation can be reversed, which means that the associated GHG emissions would potentially be released back into the atmosphere. Moreover, in corporate and governmental Net Zero accounting, different GHG emissions — incl. methane (CH_4), nitrous oxide (N_2O) and CO_2 from agricultural operations — are converted into 'CO_2 equivalent emissions (CO_2eq)', so that they can be netted against the carbon stored in biomass or soils. This is tricky, as said GHG emissions have different levels of potency and stay in the atmosphere over different timescales.[33]

This report examines how specific actors in the food industry engage with RA, looking specifically at the cocoa and coffee sector. By analyzing corporate projects, as well as the perspectives of NGOs and other actors, we aim to identify both the opportunities and limitations of current practices and approaches in the sector. The report is understood to be a contribution to the discussion on how to define, implement and measure RA systems which deliver on climate change mitigation and adaptation.

2. METHODOLOGY

First, we conducted a review of existing frameworks used to assess the sustainability of agriculture and food systems. Second, we created an interview guide (see appendix 1) to explore key dimensions of RA adoption: the motivations driving companies and organizations to engage with RA, the specific practices they promote, their monitoring approaches, and the main outcomes they report.

We selected several entities engaged in RA based on their focus on coffee and cocoa value chains, considering their scale, relevance, and connection to the global market.

Our focus on coffee and cocoa systems stems from their socio-economic importance and their high vulnerability to climate change. Both are major global commodity crops, with a combined market value of more than USD 340 billion in 2023/24.[35] Together, they support the livelihoods of around 30 million farmers, mostly smallholders,[36,37] and cover approximately 23 million hectares of agricultural area.[38,39] Cocoa and coffee are also part of the most important agricultural crops exported from African countries.

Photo below: Cocoa pods in a monoculture in Ghana.

These crops are thus strongly linked to global trade, with production concentrated in the Global South supporting the coffee and chocolate industries of the Global North. Among European countries, Switzerland plays a particularly prominent role in the global coffee and cocoa trade: while it imports substantial volumes of raw beans, it exports high-value processed products such as roasted coffee and chocolate. For instance, in 2023 Switzerland imported nearly 70 thousand kilograms of cocoa beans[40] and 182 thousand kilograms of green coffee,[41] while exporting around USD 4.8 billion of chocolate and coffee products.[42] The country also hosts the headquarters of several major multinational companies active in in these sectors.

For the purpose of this study, five companies and civil society organizations (CSOs) working with coffee and cocoa were ultimately selected as case studies (see infoboxes 2 and 3): (1) Nestlé; (2) Barry Callebaut; (3) Solidaridad Eastern and Central Africa Expertise Centre; (4) Earthworm foundation (Earthworm); as well as (5) reNature.

These cases do not represent a comprehensive list of RA initiatives in the cocoa and coffee sectors. Rather, we focused on companies and organizations that publicly communicate their engagement with regenerative practices and the initiatives they referenced to us.

To evaluate the case studies, we conducted a review of documents complemented by interviews with company managers and directors responsible for project implementation and evaluation. Due to methodological constraints, field-level observations of ongoing projects could not be undertaken. All the interviews took place between March and July 2025.

Structure of the Report
The report is organized in three main sections:

First, we present a brief overview of main frameworks used by the selected actors to understand and monitor regenerative systems. **Second,** we present our findings on how the interviewed companies and CSOs interpret and operationalize the concept of RA. **Finally,** building on these results and our expertise, we discuss a set of integrated recommendations for transforming food systems through systemic approaches.

INFOBOX 2

Interviewed Companies

Barry Callebaut | www.barry-callebaut.com

Barry Callebaut is a multinational company and one of the world's largest chocolate manufacturers, supplying cocoa and chocolate products to global brands. Headquartered in Switzerland, the company works with over a million smallholder farmers across West Africa, in Côte d'Ivoire, Ghana and Cameroon. It is further also active in Latin America and Asia. Within its Net Zero strategy released in 2024, one of the main levers is 'low-carbon agriculture,' under which regenerative agriculture is mentioned.[43]

Nestlé | www.nestle.com

Nestlé is the world's largest multinational food and beverage company, with coffee and cocoa among its flagship product categories. Through its Nestlé Cocoa Plan and its Nescafé Plan 2030 as well as broader climate commitments, the company has announced significant investment in regenerative agriculture as part of its pathway to reach net zero emissions by 2050. According to Nestlé's Net Zero Roadmap 2023, it aims to source 20% of key ingredients through regenerative agricultural methods by 2025 and 50% by 2030. Nestlé reports that it promotes practices such as intercropping, agroforestry, and soil conservation across all its main ingredients, including in cocoa and coffee sourcing regions, often in partnership with NGOs and local organizations.[44]

INFOBOX 3

Interviewed Civil Society Organizations (CSOs)

reNature | www.renature.co

reNature is a social enterprise based in the Netherlands that designs and implements regenerative agriculture and agroforestry projects worldwide. In cocoa and coffee, the organization says it works directly with farmers and cooperatives to establish regenerative models that improve biodiversity, restore degraded land, and increase resilience to climate change. reNature positions itself as a bridge between corporate actors seeking regenerative solutions and farming communities implementing them: it aims to design projects which can reach scale.

Earthworm Foundation (Earthworm)
www.earthworm.org

Earthworm is an international CSO based in Switzerland working in several countries with the main aim to improve agricultural supply chains and promote sustainable land use in collaboration with global partners. According to Earthworm, the organization is active in cocoa and other commodities such as palm oil and rubber, with the goal to regenerate soils and forests for and with people depending on them.

Solidaridad Eastern and Central Africa Expertise Centre

www.solidaridadnetwork.org
› Region › East and Central Africa

Solidaridad Eastern and Central Africa Expertise Centre, referred to as Solidaridad in the text, is an international CSO working in Kenya, Uganda, Ethiopia, and Tanzania with the main goal to improve livelihoods through more sustainable and inclusive supply chains through public-private partnerships. It is part of the broader Solidaridad network, an international network organization with a long history of working with smallholder farmers in the Global South. Their network secretariat is located in the Netherlands and different regional teams operate all around the globe. The broader network states that it promotes sustainable livelihoods, gender equity, and environmentally friendly farming practices. They also position themselves as an organization that supports farmers to adopt agroecological and regenerative methods, while advocating for fairer supply chains and stronger farmer representation.

INFOBOX 4

Projects and Initiatives

Rabobank's ACORN Program, Selected Projects

Project website

ACORN (Agroforestry CRUs for the Organic Restoration of Nature) is an initiative developed by the Dutch multinational banking and financial service company Rabobank. The program aims to empower smallholder farmers in developing countries to transition to sustainable agroforestry practices. It focuses on carbon sequestration on smallholder farmland in the Global South, primarily through tree planting, thereby generating carbon removal units (CRUs) that can be sold on the voluntary carbon market. Solidaridad works closely with ACORN, supporting smallholder farmers with technical assistance, training and monitoring to implement agroforestry systems across different countries. For the matter of this report, we looked more specifically into two projects implemented in Uganda around Mount Elgon[45] and in Kenya in Bungoma, Kericho, Nandi and Transzoia[46].

Cavally Landscape Initiative

Project website

The Cavally Landscape Initiative was initiated in 2020 in the South-Western part of Côte d'Ivoire and is led by Earthworm in collaboration with partners such as Barry Callebaut and Nestlé which fund the project along with the Swiss State Secretariat for Economic Affairs and SWISSCO, Touton and Cocoasource.[47] It seeks to conserve forests in the Cavally region, a major sourcing area for Barry Callebaut and Nestlé, while strengthening farmers' resilience and promoting sustainability in cocoa and rubber supply chains. Using a landscape approach, the project addresses both on-farm practices and the management of adjacent forests, combining nature restoration with the transformation of agricultural practices across the entire landscape.[48] For the purposes of this report, we focused specifically on the farm-related aspects of the initiative.

Large-Scale Agroforestry Landscape Project

Project website

This project is implemented by Barry Callebaut and operates at large scale in several countries, among them Côte d'Ivoire, with Nestlé as partner. It takes place under the Thriving Nature Pillar of Barry Callebaut's Forever Chocolate Program and is focusing on the implementation of 11,500 ha of agroforestry to deliver climate adaptation and mitigation outcomes for 6,000 farmers in the cocoa value chain, aiming to remove up to 1.3 million tons of CO_2eq over 25 years.[49]

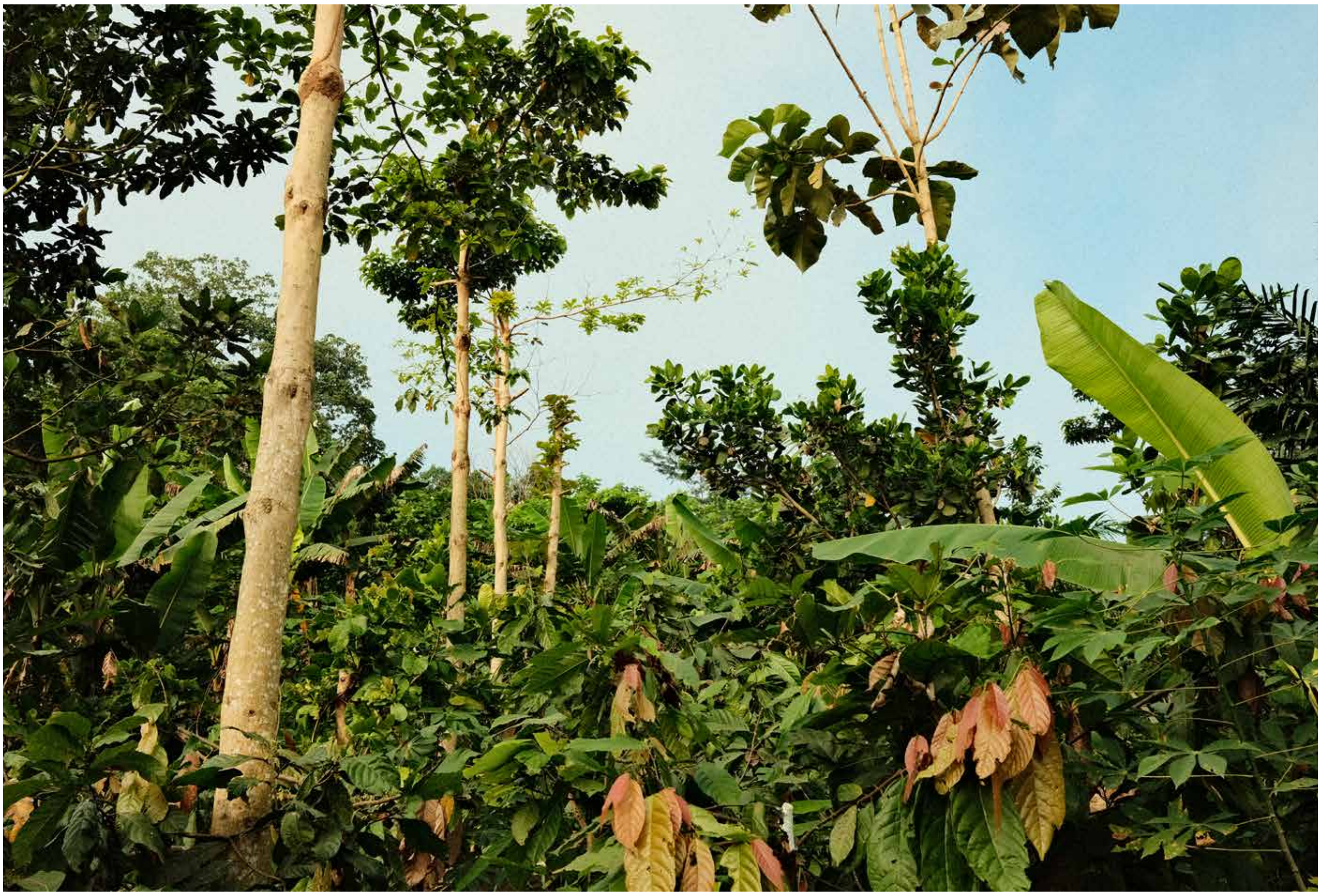
Income Accelerator Project

Download report

The Income Accelerator Program, launched by Nestlé in 2020, is described by the company as a family-centered initiative aimed at supporting cocoa-farming households in Côte d'Ivoire and Ghana. Nestlé communicates about the program as targeting multiple objectives: improving household incomes, reducing child labor risks, promoting sustainable farming practices, and encouraging agroforestry and school attendance. The company centers the initiative on incentives to motivate households to adopt good agricultural practices, diversify income sources, participate in agroforestry, and ensure children attend school.

Scaling Assisted Natural Regeneration in Côte d'Ivoire

In 2024, Barry Callebaut, in collaboration with RISOME, a French non-profit organization, and Cirad, the French Agricultural Research Centre for International Development, launched a pilot project on Assisted Natural Regeneration (ANR) in Côte d'Ivoire.[l1] The initiative aims to restore degraded cocoa landscapes by promoting the natural regrowth of trees and vegetation while supporting farmers to protect and manage these areas effectively. More information on ANR in chapter 4 and 5.



3. WHAT IS EXPECTED FROM REGENERATIVE AGRICULTURE

Photo above: An example of a complex agro-forestry system.

As Agroecology and RA are gaining momentum, a variety of frameworks and tools have been developed to assess how well systemic approaches perform. For example, the Farm Agroecology Criteria Tool (F-ACT) and the Business Agroecology Criteria Tool (B-ACT), developed by Biovision, evaluate how businesses align with agroecological practices.[50] Both frameworks operationalize the 13 agroecological principles, which were intergovernmentally agreed upon.[51] However, despite their systemic perspective, the inclusion of impact metrics remains optional. Moreover, the proposed qualitative metrics can be broad and subjective, making it difficult to aggregate results across farms and preventing the tool to capture on-the-ground implementation details.[52] The FAO's Tool for Agroecology Performance Evaluation (TAPE) offers a more comprehensive combination of qualitative and quantitative parameters as it combines a participatory assessment with standardized ecological and social indicators such as dietary diversity, land tenure, and soil health.[53]

Despite overlaps and similarities with the agroecology approach (see figure 1), assessment frameworks associated with RA are often more outcome-focused, prioritizing standardized performance data. For instance, the Sustainable Agriculture Initiative's 'Regenerating Together' is a global initiative to create a unified, industry-aligned approach to evaluate regenerative agriculture across the food and beverage sector. The platform proposes outcome measures under five pillars — climate, soil, biodiversity, water, and livelihoods.[54] Similarly, Nestlé's Farm Assessment Tool (FAT) links regenerative commitments to corporate key performance indicators (KPIs) considering almost the same pillars as SAI: Soil, Biodiversity, Water and Livelihoods.[55] While these RA frameworks are useful for generating measurable, aggregable data required by businesses, they often overlook the social, cultural and political aspects of sustainability that agroecological frameworks emphasize, such as a need for quality and diversity of local foods, or aspects such as access to natural resources like water, land and farmers' seeds.

On the one hand, agroecology-based assessments offer a holistic and systemic perspective, explicitly integrating social justice, governance, cultural preservation, gender equity, and farmer participation with ecological benefits. On the other hand, RA-based frameworks provide practical, outcome-oriented metrics that are often easier to scale across corporate value chains. Despite differences in definition, agroecology and RA approaches can only be successful in climate adaptation and mitigation if they are designed to enhance the multifunctionality of agricultural systems. In essence, both approaches aim to build healthier soils, sequester more carbon, improve water use efficiency, and restore biodiversity and ecosystem services. At the same time, they are expected to contribute to more resilient livelihoods by reducing dependency on external inputs, and by diversifying the production and income streams of farmers.

Photo below: Woman harvesting cocoa in a complex agroforestry system.

4. WHAT COMPANIES SAY ABOUT THEIR RA PRACTICES, MONITORING AND OUTCOMES

4.1 Agricultural Practices

The studied companies and CSOs position RA as a response to climate pressures and the need to meet net zero and supply chain sustainability targets. Interestingly, the definition of RA is not always unequivocal to the companies themselves. For instance, one interviewee from Barry Callebaut openly reflected on whether their system can currently be labelled as regenerative or whether they simply follow good agricultural practices[I1] — even though regenerative agricultural practices are mentioned as activities for low-carbon agriculture in their roadmap to net zero.[56] Despite definitional ambiguities, companies recognise the rising consumer demand for sustainable products, and therefore, production labelled as regenerative can be perceived as attractive, suggesting high-value commodities in the marketplace.[I2] This raises a fundamental question: What practices truly make an agricultural system regenerative?

Agroforestry Dominates Corporate Regenerative Agriculture Efforts
Across all companies and CSOs interviewed, agroforestry emerged as the predominant RA practice within cocoa and coffee systems.

All the entities rely mainly on tree planting as the primary strategy to implement agroforestry, although the degree of system complexity may differ. Nestlé emphasized that the system configuration needs to be adapted to local conditions, as highly complex systems may not be suitable for all types of coffee or cocoa farms. In Brazil, large-scale mechanized coffee farming remains predominantly a monocultural approach, while in Colombia the agroforestry design will have to be adapted to mountainous areas in certain regions.[I2] Earthworm mentioned that they implement agroforestry models combining cocoa with rubber or palm oil as cash crop species, and complementing them with fruit crops or trees and/or forest species where appropriate.[I3]

The complexity of these systems thus depends on the number and diversity of additional species — including fruit and shade trees — integrated into the production system.

All interview partners point to the need of more complex agroforestry systems, recognizing the potential of planting different fruit trees (e.g., mango or avocado) and multiple shade tree species to enhance both ecological and livelihood benefits.[I1,I2,I3,I4,I5] Nestlé has launched programs to promote multi-species systems,[I2] Barry Callebaut distributes a mix of shade tree seedlings and establishes thresholds in their Rainforest Alliance/Sustainable Agriculture Network farms (at least 40% canopy cover and a minimum of 5 native species per ha),[57] Solidaridad incorporates a mix of 6 shade tree species that are planted over a period of 3 years to reach a target tree density of 126 trees/hectare,[58] and reNature mentions complex agroforestry models for cocoa and coffee, including a diversity of shade trees, fruit trees and food crops.[59]

INFOBOX 5

Agroforestry and its Potential for Regenerative Agriculture

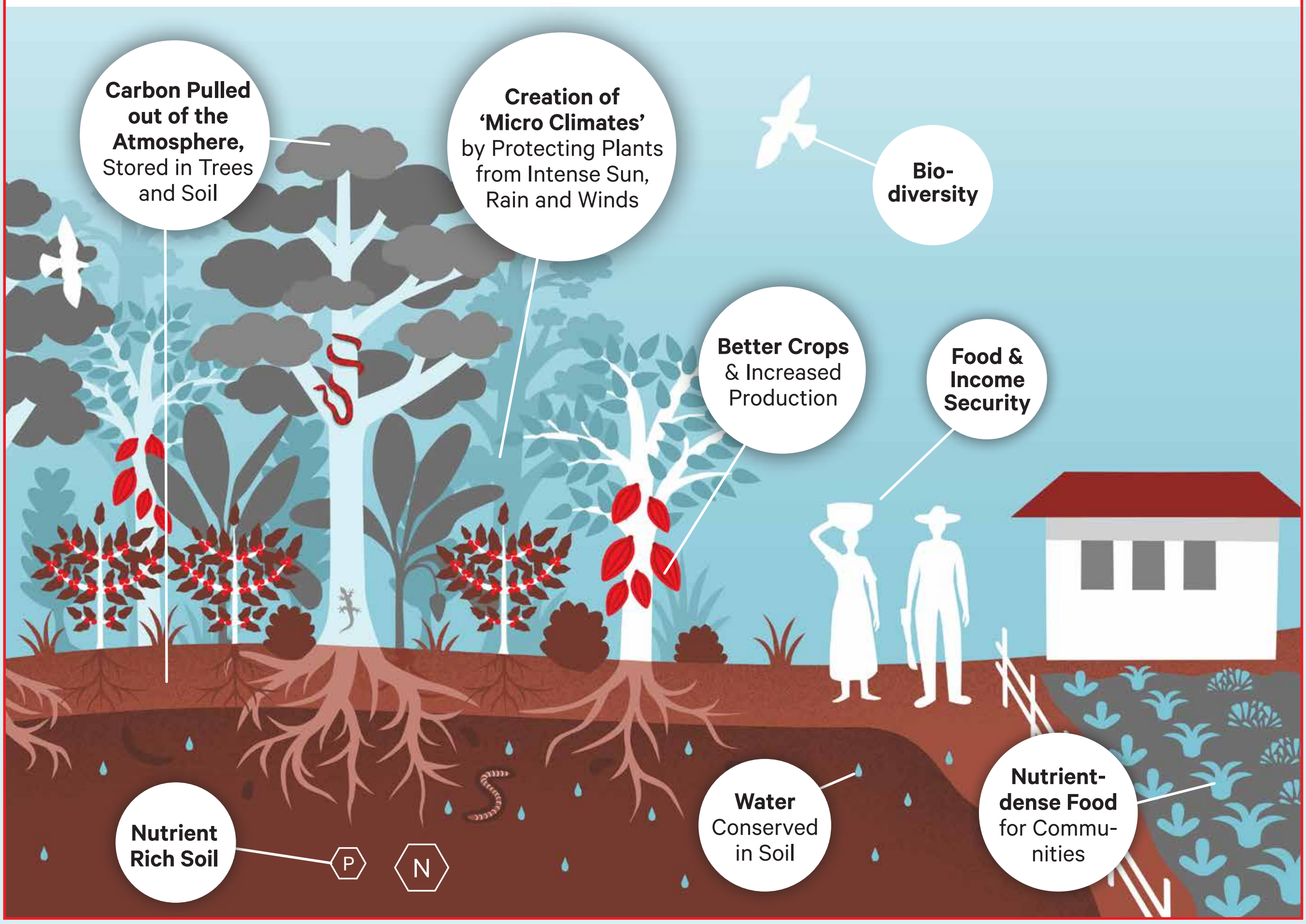
Agroforestry is one of the most recognized practices promoted in RA systems.

Agroforestry is defined as the deliberate integration of trees with crops and/or livestock in the same area, arranged in space or time to maximize beneficial ecological interactions.[60] With the addition of perennial woody species, including fruit trees and native shade trees, agricultural systems are expected to increase biodiversity, buffer temperature and moisture extremes, enhance nutrient cycling, improve soil health, diversify agricultural production, and — in principle — store carbon above- and below-ground. Carbon can be stored in the vegetation, with trees accounting for the majority of biomass storage across trunks, branches, leaves, and roots. Carbon can also be stored in the soil as dead and living soil organic matter (SOM), including fungi, bacteria, soil particulate and dissolved organic carbon, decomposing wood and leaves.

Therefore, when well designed, agroforestry systems can contribute to climate resilience through the regulation and provision of multiple ecosystem services, such as pollination, biological pest control, erosion control, food production, nitrogen fixation and water infiltration.[61,62] The provision of ecosystem services is linked to enhanced livelihoods, as it fosters system resilience to socio-ecological changes, provides additional produce for sale or consumption, and offers opportunities for farmers to access carbon payments or payments for ecosystem services.

To realize these systemic wins, adequate design must consider agroforestry as a complex socio-ecological system in which plants, animals and people interact. Its performance depends not only on farm level choices and constraints — input use, mechanization levels, seed or seedling access, farm size and household resource endowment as well as weather patterns — but also on access to public policies on land, seeds, nutrients and water, access to adequate extension services, access to financial resources and to fair markets.

Figure 3: Illustration of a diversified agroforestry system and some of its expected benefits. (Adapted from[63]).



Assisted Natural Regeneration (ANR): an Alternative to Tree Planting
In response to the limitations of current tree planting approaches, Barry Callebaut is piloting an alternative project focusing on Assisted Natural Regeneration (ANR). Unlike conventional tree planting, ANR focuses on protecting and managing naturally occurring seedlings already present on farmers' fields, enabling them to grow into mature trees. According to Barry Callebaut, this method can not only reduce the costs and risks associated with seedling survival but also tends to produce more diverse and resilient tree stands, better aligned with local ecological conditions and farmers' needs.[I1] Solidaridad on its part mentioned that the natural regeneration of trees works well in some of the areas they visited — although they do not explicitly use ANR as an approach to agroforestry.[I4]

Complementary Practices to Agroforestry
None of the interviewed companies and CSOs view agroforestry as a stand-alone intervention; rather, they see it as part of a broader package of agricultural practices. The need for pruning was mentioned to ensure the right balance between canopy cover and crop yields.[I1,I2,I4] For instance, Solidaridad combines pruning with integrated pest management practices such as pest scouting and low-tech traps used to reduce reliance on chemicals.[I4] Barry Callebaut sets up labor groups from within farming communities to carry out pruning and fertilizing on neighboring farms. Beyond the technical advantages and impact on productivity, this is intended to be an income generating activity.[64]

Nutrient management was also highlighted by all interviewed companies and CSOs. Nestlé pointed to the importance of cover crops, which it suggests can reduce soil erosion and eventually lower fertilizer use.[I2] In its latest framework, Nestlé reported placing strong emphasis on soil health through measures such as minimum soil cover, mulching, erosion control, and riparian buffers.[65] Earthworm referred to biochar, compost, green fertilizer, mulching as regenerative practices alongside agroforestry.[66] Solidaridad stated that they encourage farmers to do mulching and weeding. reNature described a system redesign approach, embedding agroforestry within diversified farming models that include cover crops, nitrogen fixing plants and living fences.[67]

4.2 Reported Monitoring Strategies

The interviewed companies and CSOs approach RA through different frameworks, varying in formality and structure. Several overlapping frameworks and programs may govern the objectives and indicators of the studied initiatives and projects.

Frameworks and Objectives

Solidaridad is partnering with Rabobank to support the implementation of its ACORN program though specific projects. It relies on a framework developed by ACORN itself. The ACORN framework focuses on three main system components: carbon storage, local livelihoods and environmental improvements.[68] The program is presented as a mechanism enabling coffee farmers to generate income through tree planting to achieve carbon sequestration in their soils. The approach requires satellite imagery and modelling to measure the carbon stored in newly planted trees, which is then converted into Carbon Removal Units (CRUs) that can be sold in the voluntary carbon market to offset other companies' GHG emissions[I4,69] (see infobox 6).

Regarding the studied coffee agroforestry projects, Solidaridad mentions several objectives the project intends to reach, with baseline indicators, including on biodiversity, the resilience of communities and their empowerment. The relevant documentation further includes nutritional diversity and other optional indicators.[I4,70]

Photo above: Drying cocoa beans in a rural community in Ghana.

Barry Callebaut operates through its corporate roadmap Forever Chocolate, which is structured around four pillars: Thriving Nature, Prospering Farmers, Human Rights, Sustainable Ingredients. All methodologies and key performance indicators (KPIs) under these pillars, including those related to agroforestry, are externally verified by PwC.[11,71] They are part of the World Cocoa Foundation's Cocoa & Forest Initiative, as well as the industry platform SAI which is providing its own framework 'Regenerating Together' to promote sector alignment (see chapter 3).

Agroforestry is adopted primarily under the Thriving Nature program; however, because it also contributes to good agricultural practices and income generation, it overlaps with the Prospering Farmers pillar. Although an explicit and detailed RA framework is missing, the website refers to 'regenerating ecosystems', through practices such as shade tree planting, soil regeneration, water conservation, and biodiversity enhancement.[72]

With regards to the studied project, the company further provided a detailed methodology to assess emissions and estimate carbon sequestration, which is verified by SustainCert.[73] Based on the interviews and the documentation, agroforestry is also expected to lift cocoa farmers above the poverty line (at the time determined by the World Bank to be USD 2.15/day) and provide a living income by 2030. Moreover, it should help reduce GHG emissions, sequester carbon and thereby contribute to the decarbonization of the company's footprint.[11,74]

Nestlé has developed a detailed Agricultural Framework and collects primary data through its crop-specific regenerative Farm Assessment Tool (FAT). The FAT explicitly defines RA principles (soil, water, biodiversity, farmer livelihoods) and encompasses crop-specific KPIs. These KPIs are divided between practice-based and outcome-based indicators.[75] Nestlé uses the FAT combined with other criteria to classify farmers in 3 levels of involvement with RA: (1) Engaged, (2) Advanced, and (3) Leading. The company's framework strategically aligns with the industry-level SAI and its 'Regenerating Together Framework'.

The agroforestry in cocoa introduced in Côte d'Ivoire is further governed by the so-called Income Accelerator Program, investing in local pruning and composting groups, seedling distributors and Village Saving and Loans Associations (VSLAs).[76] The company also reported adherence to SBTi guidelines and employs an internal team dedicated to GHG accounting and reporting which is annually third-party audited with limited assurance by Ernst and Young (EY).[I2,77] However, actual monitoring protocols for assessing other system components in cocoa and coffee systems, such as soil health, biodiversity, water regulation and livelihood improvements, were not shared with us and could not be found in the public domain.

Earthworm applies the Agri Boussol Framework, developed by Earthworm France, though it currently covers only annual crops in Europe.[I3] No specific framework appears to be applied to perennial crops such as cocoa or coffee. The organization is on the Advisory Board of the SAI 'Regenerating Together' Framework (see chapter 3).[I3]

In practice, Earthworm implements a value chain approach, partnering with both local and multinational companies, including Nestlé and Barry Callebaut.[I3,78] The approach is kept flexible to suit their clients' needs.[I3] In the Cavally landscape initiative, their objective is to work with farmers on agroforestry to reach increased productivity, and a diversified income. They further aim for reforestation, carbon sequestration and biodiversity recovery in the adjacent forest reserve.[I3,79]

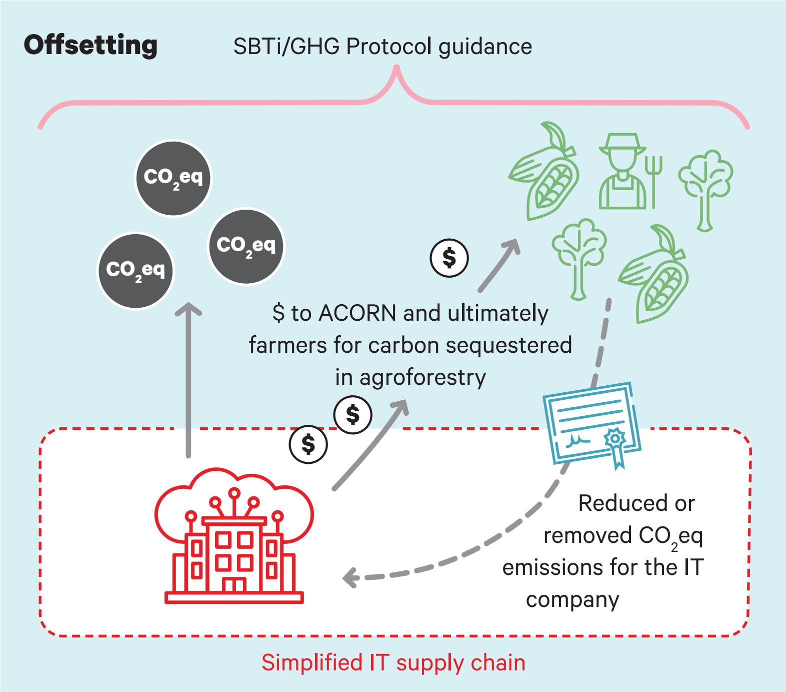
reNature advances agroforestry via its tailored Model Farms framework, a three-phase cycle of design, implementation, and scaling.[I5,80] We could not find their specific criteria for defining a regenerative system. Specific indicators are defined based on the client's needs, and existing frameworks are used or adapted (e.g. the FAO's TAPE tool, see chapter 3). It is important to note that companies' schemes may depend a lot on the implementing partners on the ground, with consequences for how they monitor systems and how they approach farmers.[I5]

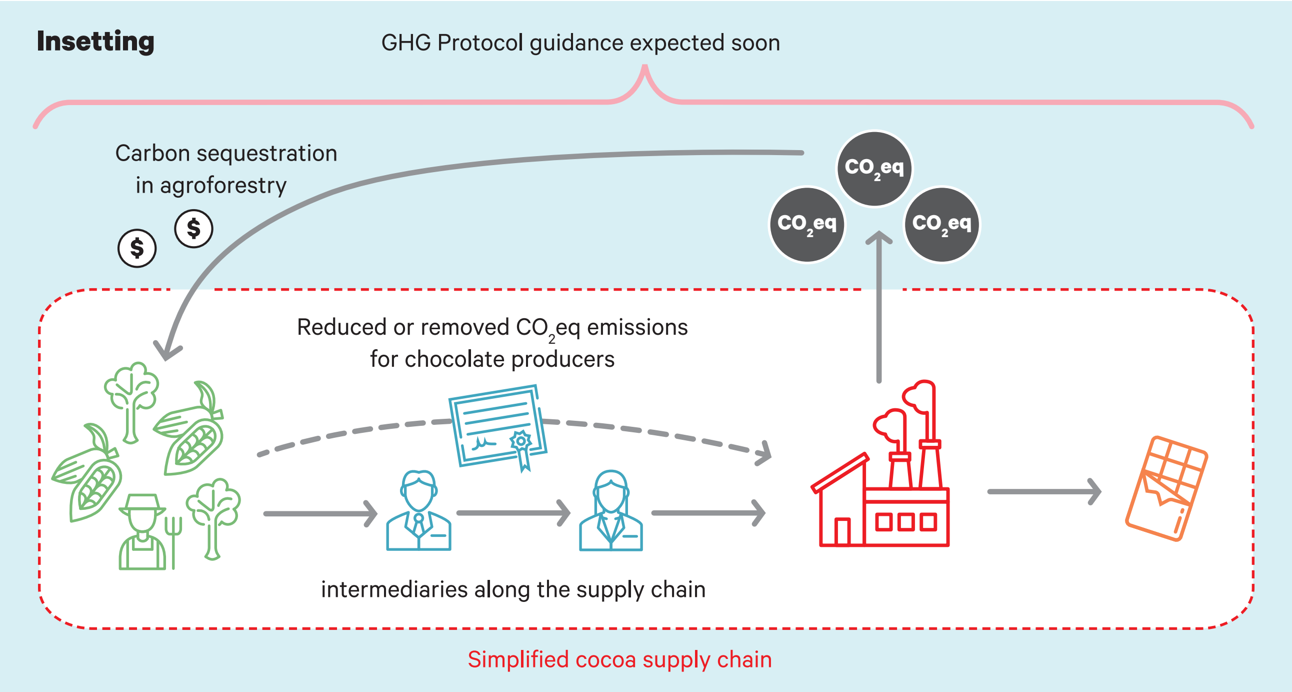
Offsets and Insets Based on Carbon Sequestration in Soils and/or Biomass

Offsetting and insetting are currently seen as means by corporations, governments and individuals to compensate for emissions that — in principle — cannot be reduced (so-called 'residual emissions').

Offsetting (Figure 4, right): *A company in any GHG emission intensive sector (e.g. construction sector, IT, fossil fuels, aviation etc.) can purchase certificates (commonly called 'carbon certificates') which claim that GHG emissions were reduced or removed somewhere else by a different company or organization, to 'compensate' for a lack of climate action on their end. Source: own illustration.*

Insetting (Figure 5, below): *Insetting is in principle limited to one and the same supply chain: the credits generated based on carbon sequestration with farmers are used to compensate for GHG emissions which are released somewhere else in that same supply chain.[87] Source: own illustration.*





INFOBOX 6

Generating Offsets

Carbon sequestration in biomass and the soils via agroforestry is an approach to generate carbon certificates, claiming that this amount of CO_2eq has been removed from the atmosphere. Take the case of Solidaridad: the CSO works with farmers sequestering carbon by planting trees. The tonnes of carbon generated in the soils and trees are then commodified and monetized by ACORN as CRUs: One tonne of carbon sequestered is meant to represent 1 CRU. Rabobanks' ACORN team sells these CRUs to companies such as Microsoft, which is compensating its residual GHG emissions with an equal amount of credits bought (the so-called 'tonne for tonne approach').[I4] Plan Vivo, as an external certifier of such offsetting projects, attests to the quality of the project design and verifies the quality of the sold CRUs.

Through ACORN, the farmer receives 80% of the sales price, which according to the website was approximately EUR 35 in 2023 for one CRU (the website indicates that the price may fluctuate).[81] Rabobank's ACORN program retains 10% (for certification and auditing costs) and 10% (for facilitating project teams and project monitoring) goes to the partner, in this case Solidaridad. As Solidaridad states in its annual report 09/2024 to 09/2025 on the studied Kenyan project on coffee farming: "The project has reached 6,773 onboarded farmers, representing a total extension of 3,969 hectares. From this, 1,327 CRUs have been generated and sold, amounting to a total of EUR 36,784.44, of which 90% is paid to the Local Partner so that they can distribute 80% to the participants (EUR 29,427.55), and keep 10% (EUR 3,678.45) to cover their administrative costs." While the report doesn't dive into the specifics, the farmer would therefore get EUR 22.18 per CRU generated (EUR 29,427.55/1327 CRUs). For this amount per CRU, he agrees to maintain the trees in place for at least 15 years, so as to comply with the carbon market principle of permanence, which requires that the GHG emission reductions or removals from the mitigation activity shall be for the long-term or, where there is a risk of reversal, there shall be measures in place to address those risks and compensate reversals.

As offsetting has been criticized by NGOs and the media in the past years, including for overestimations of the amount of carbon effectively stored (also see chapter 5.2 and 5.3), companies are increasingly moving towards so-called insets.

Generating Insets

Nestlé and Barry Callebaut are engaging in insetting according to the interviews.[I1,I2] Barry Callebaut further mentioned the tonnes of carbon removals achieved as an enabling KPI to contribute to the decarbonization of its footprint by 2030.[82]

From the company's perspective, compensating its GHG emissions in the supply chain with insets from tree planting projects of direct or indirect suppliers appears highly efficient. In Côte d'Ivoire, Barry Callebaut operates in a so-called 'supply shed', following guidance by the third-party certifier SustainCert.[83] The concept signifies that Barry Callebaut can compensate its supply chain emissions with claims of carbon removals stemming e.g. from this landscape or market, even if the farmers that are actually planting tree seedlings for carbon sequestration in cocoa are simply farming in the same geographical area where Barry Callebaut sources its cocoa from (so-called 'supply shed producers') — without necessarily supplying the company with cocoa. In other words, although there is no direct link between these farmers and Barry Callebaut, the company can still buy their carbon removal credits to compensate its supply chain emissions.

Insetting is currently endorsed by the corporate standard SBTi. However, critical experts point out that this approach offers no significant difference from the offsetting of emissions.[84] They further insist on the risk that, since the claimed removals can stem from a geographical 'supply shed', where several suppliers and buyers pertaining to different supply chains are active, several companies might actually be counting these same tonnes of carbon sequestered towards achieving their net zero targets (so-called 'double-counting'). Finally, as several companies of a same supply chain can currently inform consumers about their carbon removals and claim to compensate their GHG emissions, there is currently no guarantee for the average consumer that each company has actually undertaken additional efforts to achieve those results and that they are not claiming the same impact twice (risk of 'double-claiming').[85]

This is particularly problematic, as key principles for high integrity carbon markets require, among others, that:

- The GHG emission reductions or removals from the mitigation activity must not be double counted to be able to achieve mitigation targets or goals.
- The reductions or removals must be additional, i.e. they would not have occurred without the incentive created by carbon credit revenues.

One could argue that if a company sets the incentive for its farmers, another company cannot do so at the same time, and therefore should not be allowed to claim the resulting reductions or removals.[86]

The Approaches to Tracking Metrics and Data

Solidaridad's carbon monitoring follows the ACORN program framework and focuses on above and below ground tree biomass and carbon. Measuring GHG emissions occurring on the farms is optional while soil carbon, the biomass of non-woody species and other system components (e.g. litter) are not included in the assessment.[14,88]

The methodology is designed following the Plan Vivo PV Climate Methodology requirements.[89] Drones and satellite imagery provide the basis for carbon sequestration estimates, while field sampling is used to calibrate the models.

The monitoring plan includes indicators such as the total area under sustainable land management, the number of seedlings planted, their annual tree-survival rate and tree carbon biomass. The indicators of local livelihood and environmental improvements — including agricultural land-use productivity, farmer income, the nutritional variety and youth employment — are optional and context dependent.[90]

Detailed monitoring protocols on the measurement of environmental and livelihood indicators are generally not publicly accessible. The available information is limited to methodological notes on how the indicators can be measured (e.g. survey) or the data sources used (e.g. FAO TAPE tool). For example, the nutritional variety indicator is based on the 'Household Dietary Diversity Score Indicator Guide' — although its application remains optional within the framework.

Barry Callebaut focuses its large-scale agroforestry program on above-ground biomass, combining field visits with satellite imagery data collection during the first three years, followed by exclusive remote monitoring via satellite afterwards. Indicators used include the number of seedlings distributed and their survival rate, the amount of carbon sequestered in biomass, the total area covered by the program, the number of farmers involved, and the number of farmers lifted out of poverty. Soil carbon sequestration is assessed based on an established methodological tool for estimating changes in soil organic carbon stocks.[91,92] Tree carbon estimates are derived from field monitoring and satellite images. Traceability down to the farm level is rapidly increasing.[93] Yet, field monitoring generally stops after year three, precisely when system-level effects begin to show. Thereafter, monitoring is exclusively implemented via remote imagery.[94]

Both Solidaridad and Barry Callebaut have made their protocols for monitoring above and below ground carbon available.

Nestlé uses its FAT to monitor KPIs related to regenerative agriculture. These include soil organic matter, yield, fertilizer use efficiency, tree species diversity, proportion of natural vegetation, herbicide and pesticide use, water footprint and net income. To qualify as 'engaged' in regenerative agriculture, a farm must achieve at least 25% of the maximum FAT score.[95] The requirements for this category remain relatively unambitious: farms can be considered engaged in regenerative agriculture including if they neither have a fertilizer and herbicide management plan nor integrate soil cover and sustainable water use.[96]

Nestlé emphasized that this classification is meant to represent a transition pathway — from 'engaged' to 'advanced', and ultimately to 'leading' farms. However, the specific criteria required to achieve the minimum 25% score, or to progress to the higher categories, were not disclosed, nor are they publicly available for cocoa and coffee production systems.

Nestlé mentions carbon sequestration in trees (both above- and below ground) and in the soil as a way to store a targeted 5 million tonnes of CO_2eq by 2030 through agroforestry systems.[97] The company also reports using tools to estimate the farm carbon footprint such as the Cool Farm Tool.[98] It follows SBTi standards, and the referenced draft of the

GHG Protocol Land Sector and Removals Guidance, as well as limited assurance verification by external auditors (EY).[99] However, no specific protocols to estimate carbon sequestration or other ecological benefits are publicly provided.

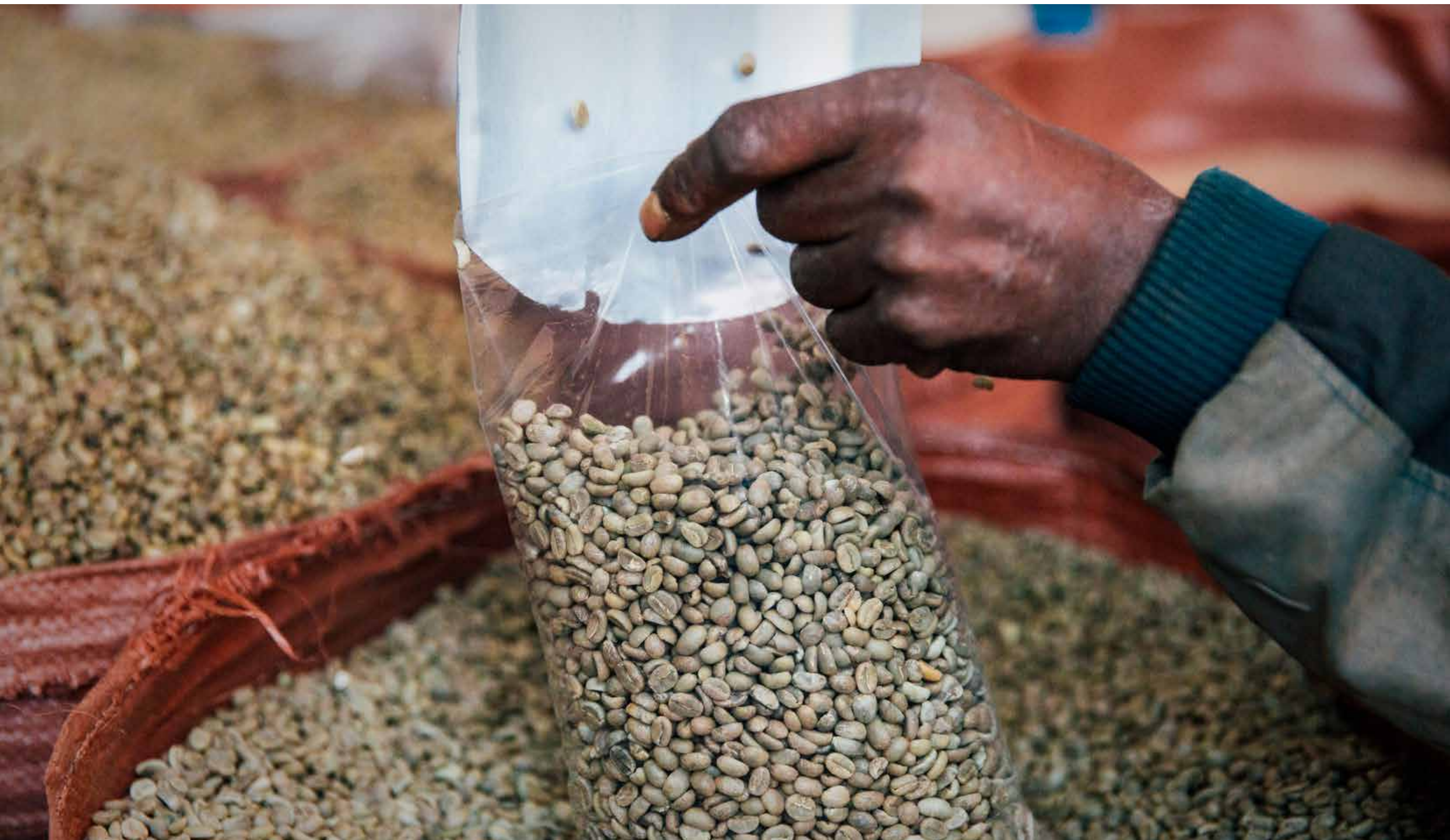
Under the Income Accelerator Program, monitoring focuses on the number of hectares pruned by community pruning groups, the number of households part of the VSLAs, the number of families committing to send their children to school as well as the number of forest and fruit seedlings planted and the number of farms engaged in composting.[100]

Earthworm's agroforestry systems aim to increase farmers' income through crop diversification and premium pricing.[13,101] The monitoring of the systems and of additional on-farm regenerative practices is conducted by field officers who do quarterly reporting, checking progress against targets.[13] In terms of metrics and indicators, their focus lies on scale and practice-check, for instance, number of plantations and hectares under agroforestry; number and diversity of people involved in trainings and project activities, number of farmers who have access to financing, and type of practices adopted.[102] We did not have access to detailed monitoring protocols.

The estimation of carbon stocks, sequestration potential and work on carbon credit implementation is mentioned as part of the outlook for 2023–2025 in the report on phase 1.[103]

reNature provides examples of KPIs that can be used according to client's needs, including socio-economic (e.g. Human Workload, Diversity of farmer income, Women empowerment and Community benefits) and environmental components (e.g. tree diversity, plant diversity, carbon sequestration, soil health, soil diversity and bird diversity).[104] During the (at least) nine-month implementation phase, technical staff fine-tune a monitoring and evaluation plan, then collect field data (e.g. quadrant counts, transect walks, soil tests) to verify the system design.[105] The above-mentioned FAO TAPE tool was cited — among others — as a reference for defining indicators. However, the monitoring protocols and the results are kept private.[15]

Photo below: Green coffee beans being packaged in a local market.



4.3 Reported Strategies to Involve Farmers

The type and level of farmer involvement vary not only across companies and CSOs, but also across projects. In Barry Callebaut's and Nestlé's projects, farmer involvement is largely structured around cooperatives. The cooperatives collaborate with the companies' field teams or with partners of the company.[12,106] The cooperatives pilot regenerative practices, which they integrate into the farmers' cocoa farms, supported and checked upon by the companies' teams or partners in the value chain, as well as via satellite imagery. Training plays a central role, and farmers are linked into sustainability certification schemes. Finally, as cocoa and coffee are sourced from geographically concentrated regions where multiple suppliers and organizations operate, the cooperatives frequently engage with several initiatives simultaneously and farmers may thus be enrolled in several programs.[107,108]

In the **Solidaridad**-ACORN project, farmers are engaged through field schools and demonstration plots that aim to build their skills in regenerative agriculture practices. They participate directly in training sessions and disseminate knowledge through peer-to-peer exchange within their communities.

In the **Earthworm** case, according to the organization, farmer engagement is highly participatory. They are involved in testing practices, collecting feedback, and contributing to the refinement of agroforestry models, especially in terms of tree species selection and placement.

With **reNature**, farmers are engaged in a stepwise process that begins with the participatory design of models and continues with technical guidance on implementation. Farmers are also involved in validating agroforestry layouts, such as density and crop-tree interactions, and in providing ground-level data during monitoring, including via mobile phones.[15]

4.4 Reported Outcomes and Impacts

All companies and CSOs report benefits of their RA programs mostly in terms of scale-related outputs, such as the number of farmers reached, the hectares under 'sustainable management' or agroforestry, and the number of trees planted and/or seedlings distributed.[109,110,111,112,113,114]

Concerning carbon sequestration in planted trees and soils, four out of five CSOs highlight measurable carbon sequestration outcomes and claim it to be a benefit for both farmers and the companies. While the claims are aligned with SBTi standards and current GHG Protocol standards, no disaggregated results could be obtained, nor were any publicly available, on the actual amount of carbon effectively stored within the discussed programs and projects. Solidaridad is the exception: its results are communicated on the ACORN webpage.[115,116]

In addition, although tree mortality is mentioned as a target indicator and reportedly monitored,[11,12,14] data on tree losses is not reported in the available documents.[117,118,119] Across all studied reports, indicators assessing the quality of outcomes — such as biodiversity enhancements (e.g. number of adult tree individuals, number of tree species, number of animals species), improvements in soil cover and health (e.g. soil biological activity, soil moisture, amount of soil litter), increase in soil carbon after the start of the project, and reductions in pesticide and input use — are not reported.

Generally, although scientists are sometimes prominently involved in the design of conceptual and analytical frameworks for regenerative agriculture in cocoa and coffee, like in the case of Nestlé and Barry Callebaut's ANR pilot, there is limited participation of scientific institutions in data analysis, results' interpretation and publication.[I1,I2,I3] According to Nestlé, these tasks are usually undertaken by external stakeholders (e.g. the Rainforest Alliance, in the case of the Nestlé Cocoa Plan) or by in-house scientists from the Nestlé Institute of Agricultural Sciences (NIAS).[I2]

In their work with coffee farmers, **Solidaridad** reported several positive outcomes, such as improved crop productivity, increased tree diversity, enhanced soil health, better protection of cropland from climate change, and access to additional income through carbon storage via the ACORN program.[I4] However, the quantitative outcomes are communicated through scale-based indicators such as the number of farmers involved, tonnes of CO_2eq stored, number of carbon credits issued, and hectares under sustainable land use.[120,121] In terms of direct farmer benefits, the organization mentioned that both seedlings and training are provided by the project. Farmers are further paid for the carbon they have actually stored in plant biomass, with prices subject to fluctuation (see infobox 6). Payments are made gradually as carbon accumulates. Solidaridad mentioned that ACORN-linked payments represent a valuable source of income for smallholders, even if the absolute amounts per farm remain modest and contingent on the modelled tonnes.[I4]

Similarly, **Barry Callebaut** reports KPIs related to scale, i.e., the number of farmers who participated in farm services activities, total hectares covered by the program, number of farmers lifted above the poverty line, seedlings distributed, tonnes of carbon removals achieved, hectares with newly established agroforestry, and the share of women farmers participating in sustainability programs.[122] Barry Callebaut further mentions that farmers engaged in its own tree planting projects eventually secure monetary returns through carbon financing (EUR 0.83 per surviving seedling annually).[I1,123] They mention that such carbon payments attract early participation but that longer-term incentives should be explored to sustain the farmers' stewardship of the agroforestry system.[I1]

The outcomes from **Nestlé's** regenerative agricultural activities are centred around GHG emissions reductions and removals within its value chain, as part of its Net Zero ambition.[124] However, during the interview, Nestlé clarified that the bulk of the carbon removal outcomes were generated in reforestation projects in the sourcing area, not necessarily from on-farm activities.[I2] According to the company, the larger part of its interventions are focused on GHG reductions, which accounted for 91.2% of Nestlé's total GHG performance in 2024.[I2]

Nestlé further reports to have reached its target of sourcing at least 20% of its key ingredients from farmers practicing regenerative practices by 2025.[125] It should be noted, however, that their engagement levels are tiered, and in the figures provided for 2022, most product volumes came from farms classified as the lowest level: Level 1 — Engaged Farmers.[126] Apart from this general fact, Nestlé does not provide any quantitative data for 2022, nor for more recent years (see chapter 4.2).

Regarding monetary benefits for the farmers, financial incentives for adopting agroforestry are not calculated based on tonnes of carbon sequestered but rather tied to the adoption of specific on-farm practices. In the Income Accelerator Program, farmers can earn up to EUR 500 annually for the first two years and EUR 250 per year thereafter if they comply with four criteria: (i) enrollment of children in schools, (ii) adoption of good agricultural practices (i.e, pruning), (iii) planting tree seedlings and (iv) participation in VSLA for the community members to pool individual financial resources with others and receive loans when needed.[127] Again, outcomes are mainly reported in terms of scale — for instance, the number of farmers involved, total hectares covered, seedlings planted, children enrolled in schools. Yet, there are also some figures on socioeconomic improvements, including percentage increase in cocoa yields and living income as well as qualitative progress measured such as proportion of women classified as empowered.[128] In terms of productivity, while overall yield increases are reported, Nestlé adds that regenerative plots may still face 'down years', but the decline tends to be less pronounced in conventional systems.[12] Some reported figures are averaged per household, for instance, average cash transfer per household.[129] Specific figures on system configuration (e.g. tree species diversity and abundance), biodiversity, and soil health remain unavailable or have not yet been reported.

In the Cavally project implemented by **Earthworm**, no carbon credits were generated during the first phase 2020–2023.[13] Earthworm reports an overview of the scale of the impact, including the number of farmers engaged in their activities, total hectares under agroforestry, and number of VSLAs that were set up. The organization also emphasizes diagnostic assessments of local farming systems, which shed light on current management choices (e.g. pesticide application), school attendance, proportion of male and female farmers, land ownership, land use configuration, and farmers' perceptions on forest degradation and their income increase. However, indicators reflecting qualitative improvements such as biodiversity, soil health or even income, are not reported.[130]

Photo below (left): Diplopoda found in a coffee agroforestry system, indicating good soil quality.

Photo below (right): Soil aggregate showing signs of regeneration.

While the **reNature** website reports significant global impacts, such as regenerating 1.8 million hectares and sequestering 9 million tonnes of CO_2eq, no further details are provided.[131] In our interview, despite the lack of quantitative figures and publicly available information, reNature described perceived improvements in dietary diversity, income diversification, and early gains in soil organic matter. Yet, perceived benefits remain anecdotal, as reNature did not disclose any outcomes, nor are its results currently reported in the public domain.

5. DISCUSSION AND RECOMMENDATIONS

5.1 The Role of Agroforestry in Regenerative Systems: Regenerative only if Done Right

As financing and compensation mechanisms are heavily focused on carbon sequestered by trees, agroforestry tends to receive most of the attention, while other practices are treated as complementary in the studied RA projects and initiatives. In general, the integration of trees within cocoa plantations is widely recognized for enhancing biodiversity, improving microclimates, supporting soil health, and providing additional sources of income or food.[132,133] Therefore, trees can play a central role in these systems, offering shade, habitat, and ecosystem services that are critical for climate adaption and mitigation.[134,135] However, the emphasis on trees inevitably brings practical questions about species choice, system configuration, costs, and survival rates, all of which determine whether agroforestry delivers its promised benefits on the ground.

Tree Planting Problems

A central concern relates to the origin of trees (i.e. where trees come from) and how they are incorporated into cocoa or coffee systems. In all the case studies reviewed, tree planting was mentioned as the main strategy to develop agroforestry systems. Although tree planting can play an important role in increasing system diversity and its associated benefits (e.g., fruit trees for income diversification and food security), it should not be seen as a silver bullet. One challenge is that farmers in tree planting programs need to rely on external inputs (i.e. seedlings), distributed by implementing companies and organizations. A related issue is the assumption that providing an external input (i.e. tree seedling) will automatically result in diverse and resilient systems. In reality, ecological success depends on a myriad of factors including tree species choice and mortality, but also farmer knowledge, agency, and the management of the whole system.

It is therefore vital to avoid overestimating the ecological benefits of seedling distribution or assuming that planting alone guarantees success. For instance, in a video about RA cocoa in Côte d'Ivoire,[136] an apparently low diversity system is shown whilst the presenter talks about the principle of agroforestry pointing to a small seedling in the middle of many cocoa plants. He affirms that after one year the seedling would turn into a tree 3–4 meters tall, which is unrealistic even for fast growing tropical species, especially under shaded conditions. A scientific study shows that almost three years (140 weeks) after planting, tropical seedlings growing in full sun did not exceed 1.6 meters in height across all 25 species analyzed.[137]

There are reported attempts to make tree planting better tailored to local conditions. For instance, Nestlé highlights the importance of planting local species, following feasibility studies conducted by expert partners, to ensure seedling quality, and to take tree mortality into account for carbon estimations.[12] However, tree planting programs generally tend to prioritize the number of trees planted rather than their survival, management, or functional role within the cocoa and coffee plots. Consequently, the survival rates of seedlings are often low and the approach tends to favour the mass distribution of trees without ensuring their long-term integration into farming systems.[138] For instance, a scientific study in cocoa systems in Côte d'Ivoire reinforces this concern, showing that despite efforts of large tree planting programs in the studied regions, only 13.1% of the trees found in cocoa systems have been planted; and that spontaneous trees (natural regeneration) represent 77% of the future timber resource.[139] Similarly, another study in Côte d'Ivoire showed that only 29% of the trees present in cocoa agroforestry systems were planted — predominantly exotic species — whereas remnant and spontaneous trees exhibited a high diversity of species.[140]

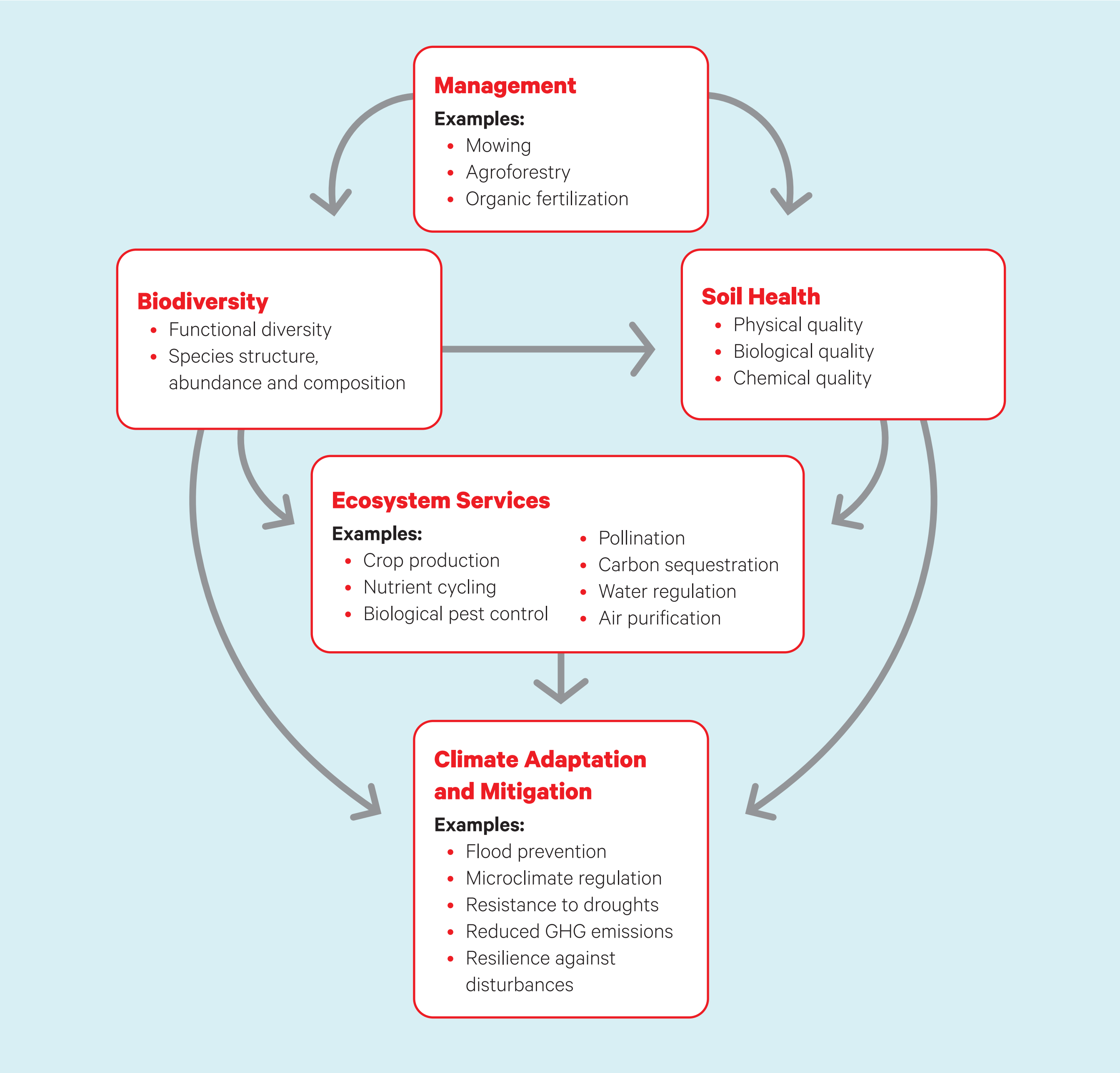


Figure 6: *Schematic overview of how agroecosystem management of biodiversity and healthy soil leads to climate adaptation and mitigation through ecosystem services provision. Source: own figure.*

Criticism of tree planting-centric approaches has pushed some companies to rethink their strategies. In its pilot initiative, Barry Callebaut has begun to pivot away from tree planting targets towards ANR — protecting, thinning, and managing the spontaneous seedlings already present in farmers' fields. This shift in approach flags how the 'tree planting problem' has become evident and how research findings and traditional farming practice can and should guide the design of RA projects. Although ANR is relatively new in corporate programs, it has been practiced over decades by agroforestry farmers supported by the agroecological movement, with proven benefits for promoting multiple ecosystem functions.[141]

Types of Agroforestry: Diversity Matters

The success of seedling survival as well as positive impacts of agroforestry systems on climate change adaptation and mitigation is highly dependent on the configuration of the system. Therefore, it becomes important to understand and characterise the different types of cocoa and coffee agroforestry systems, ranging from simpler to more complex systems (high diversity of shade trees, fruit trees and other crops).[142] System complexity and configuration can be quantified based on tree structure (how trees occupy horizontal and vertical space), diversity (number of species and distribution of individuals across species) and composition (which species are present)[143] as well as management intensity, ranging from simplified and mechanised systems to more labor-intensive systems that require practices such as mowing, mulching and pruning. Despite the central role of these metrics in understanding ecological performance, corporate projects rarely report on them, leaving significant gaps in evaluating the true regenerative potential of agroforestry systems.

Although simplified agroforestry systems can present some advantages over monocultures (e.g. income diversification, shade), their low species diversity limits their capacity to address the challenges posed by climate change.[144,145,146,147] In contrast, the benefits of high biodiversity can be multifaceted. For example, managed tree diversity is associated with greater root functional diversity, which can enhance soil porosity, improve water infiltration rates, increase drought resistance, reduce erosion, and help prevent flooding.[148] In another example, tree diversity contributes to nutrient cycling, including processes of soil nitrogen fixation by leguminous trees in association with rhizobium bacteria,[149] which can lead to the reduced need of nitrogen fertilizers, resulting into lower GHG emissions. Effectively managing biodiversity and healthy soils is the key to adapt and mitigate climate change through ecosystem services provision (see figure 6) — going beyond the carbon narrative — to a broader and systemic perspective that can tackle the complexity of the problem.

Because of its increasingly recognised importance, biodiversity is often presented as central in corporate frameworks and communication. However, current corporate biodiversity monitoring and reporting outcomes rarely provide reliable information on actual improvements. This is reflected in the absence of biodiversity-related outcomes, and the lack of standardized protocols for its assessment.

To address this gap, it is essential to establish clearer criteria for what can be considered a regenerative agroforestry system. Such criteria must consider, for example, the number of adult trees, the number of adult species, the types of fertilizers used as well as the weeding and pest management strategies.

5.2 The Need to Move Away from (only) Carbon

There is broad consensus that carbon stocks and sequestration — while important — are insufficient to reflect system sustainability and resilience to climate change. For instance, monocultures of eucalyptus can rapidly accumulate aboveground biomass and thus store carbon, but often at the expense of biodiversity, water regulation, food production, and other key ecosystem functions.[150] Although carbon remains an important system component (e.g. soil carbon can contribute to water retention and soil life), a 'carbon tunnel vision' can lead to a narrow perspective on climate change adaptation and mitigation in comparison to more systemic approaches focused on diversity and multifunctionality (figure 7). Relying on carbon as a single proxy for ecosystem health and functioning can mask trade-offs and unintended consequences. Recent developments in Europe illustrate the limits of such a carbon-centric approach. Climate Farmers, a Berlin-based non-profit and one of the pioneers in European soil carbon credit systems, is now stepping away from carbon markets. As co-founder Ivo Degn explained, "We're moving away from carbon markets not because the mission was wrong, but because the market wasn't built to support regeneration".[151] Their experience reflects a broader re-evaluation of how regenerative agriculture is financed and measured, especially as climate volatility intensifies and farmers face growing risks to their production. This shift points to a deeper issue: the need to rethink not only market design, but also the metrics, mechanisms, and incentives that guide land management and determine what 'regeneration' truly means in practice.


	Carbon-Centred Perspective on the capacity of systems to adapt to and mitigate climate change	**Multifunctional Agroecological Perspective** on the capacity of systems to adapt to and mitigate climate change
Agricultural Practices	One or a few practices mostly at plot level (e.g. agroforestry); focus remains on commodity crops (e.g. coffee and cocoa).	Combined set of practices across different system levels, including plot level (e.g. diversified agroforestry, intercropping, biological inputs), farm level (e.g. presence and proportion of agrobiodiversity elements such as home gardens and nature areas; integration between crop and livestock systems) and land-scape level (e.g. land distribution, integration and diversification). Systems are managed to achieve multiple benefits.
Social Components	Often limited to the number and groups of people directly involved.	Strong emphasis on social components such as connection between consumers and producers; responsible governance and public policies; social participation; knowledge co-construction; and gender and youth inclusivity.
Capacity Building	Through training; knowledge comes pre-dominantly from outside; assumption that communities need new knowledge and lack innovation capacity.	Knowledge and management strategies are co-created through participatory method-ologies and active community engagement, starting from the experiences, knowledge, and needs of local communities.
Monitoring of the System	Often limited to carbon (above and sometimes below ground carbon stocks). Limited connection to research and teaching.	Considers the multiple functions provided by the system. Uses different types of indicators. Considers local knowledge for the develop-ment of indicators. Data is open and analyzed/ published by scientists.

Figure 7: *Typology of perspectives regarding the capacity of food systems to adapt to and mitigate climate change: carbon-centered and agroecological. They form a continuum in which projects can be situated. These types were identified through the analysis.*

Difficulties in Estimating Carbon Sequestration for Carbon Credits

The way carbon sequestration in soils is assessed and promoted has been criticized as technically limited, economically uncertain, and potentially misleading for policy.[152] Soil carbon models often focus only on the topsoil and overlook key ecological processes like microbial activity, which regulates carbon assimilation and dissimilation rates.[153,154] Furthermore, total soil organic carbon is a simplified way to quantify soil carbon, which can be divided into fractions such as dissolved carbon, particulate carbon, litter carbon and microbial carbon. The types of carbon respond differently to management practices, have distinct turnover rates and, therefore, have varying implications for climate change mitigation and adaptation.[155] Even direct soil sampling can sometimes be unreliable, as carbon levels fluctuate with weather events such as droughts or intensive rainfall,[156] underscoring the need for robust sampling designs. This means that farmers may implement best practices for years, yet still be penalized by the system if external conditions or methodological uncertainties obscure measurable progress. The disconnect between expectations, farmer action and financial reward is systemic rather than merely technical. The principles underpinning carbon markets — such as additionality and permanence — add further complexity to achieving genuine climate benefits in agricultural fields.

The Challenges Associated with Additionality and Permanence Rules

The principle of additionality poses a dual challenge: first, because it is rewarding only new, additional practices and thereby excludes early adopters who have long managed their land sustainably (see infobox 6). Thereby, the requirement of additionality discourages payments for maintaining healthy soils and diverse farming systems. And second, the pressure of finding new farmers for additional ha under RA every time can also lead to accounting and measurement errors and overestimations, which generate inflated claims. A notable example of the measurement uncertainty comes from a project in Côte d'Ivoire, but unrelated to Solidaridad's operations in Kenya and Uganda studied here. Although the ACORN Program establishes validated methodologies, independent auditors indicated that carbon credits generated through tree planting (based on tonnes of carbon sequestered in tree biomass) in an ACORN project in Côte d'Ivoire were 600% higher than what could realistically be stored in that specific project.[157] ACORN globally continues its operations, while the said project has been suspended according to the ACORN website.[158]

There is little room for further improvements in terms of carbon sequestration in systems that are well managed and close to carbon saturation levels. This is particularly important given the potential negative effects of reverse transitions — that is, when farmers revert from agroforestry to intensive agriculture after the monitoring period ends. For instance, the intensification of current systems may emit up to twice the amount of carbon that could be potentially sequestered in expanded agroforestry scenarios.[159] Therefore, maintaining current agroforestry is as crucial as establishing additional systems.

If a farm reverts from regenerative to conventional practices, much of the carbon sequestered can be rapidly lost, undermining the climate benefits that were achieved. This is why the principle of permanence of carbon sequestration was adopted (see infobox 6). Controversially, the current rules of permanence can restrict farmer autonomy, by requiring the maintenance of tree cover or specific practices for up to 20 years even when adaptive management — such as adjusting shade levels through tree removal — is needed to sustain crop productivity.

Trade-offs with Other Ecosystem Functions

Besides the conflict with permanence and additionality rules, the focus on carbon sequestration often overlooks the trade-offs with other ecosystem functions and may generate negative effects. For example, increasing soil carbon stocks will require higher nitrogen inputs, since soil organic matter contains both carbon and nitrogen. As a rough estimate, an extra 100 million metric tons of nitrogen input would be needed to increase 0.4% of organic carbon in global agricultural soils. Considering most agricultural systems rely on

Photo above: Harvest of cocoa pods.

chemical fertilizers, such a high demand for nitrogen would entail an increase of ~75% of current global N-fertilizer production.[160] Such a rise would not only raise costs for farmers but also intensify GHG emissions associated with fertilizer manufacture and application. Furthermore, the pursuit for carbon may undermine other sustainability goals, such as enhancing biodiversity, increasing crop yields and improving food security. Evidence shows that strategies designed to promote carbon gains do not necessarily lead to more diverse systems,[161] and increases in soil carbon do not always translate into higher yields.[162] Projects that prioritize carbon sequestration and high cocoa yields can overlook the importance of on-farm food production. Therefore, the focus on cocoa production over diversified food systems may increase household food insecurity and farmers' vulnerability to market fluctuations. In addition, expected benefits such as enhanced biodiversity and carbon storage can be offset if cocoa yields fall short or if current systems fail to meet farmer's needs — potentially leading to land conversion elsewhere ('carbon leakage') and further biodiversity and carbon losses.[163]

The Context-Dependent Nature of Soil Carbon

Despite the need for a global perspective, soil carbon is highly context dependent. Sequestration rates vary according to climate, soil type, vegetation, and management, and soils have a saturation point beyond which further carbon accumulation is difficult. Therefore, positive outcomes for climate mitigation, productivity, and biodiversity are neither guaranteed nor universally replicable; they depend on local context, specific combinations of practices, and the presence of necessary resources such as nutrients. For instance, the carbon storage potential of soils is much greater in degraded clay soils than in sandy soils, reinforcing the importance to consider saturation levels in estimations.[164, 165] Indeed, once saturation is factored in, the estimated contribution of soil carbon sequestration to climate change mitigation is expected to decline by 53–81% towards 2100.[166] Furthermore, as soil carbon dynamics are complex and context dependent, the response of soil carbon to sustainable agricultural management is highly variable and limited.[167,168]

Beyond Scale: We Need a Systemic Perspective on Farm Multifunctionality

Because of the complex nature of carbon and agroecosystems, the emphasis of corporate projects on scale — tonnes of carbon sequestered, hectares covered, number of farmers involved — can overshadows the quality and multifunctionality of changes on the ground. Companies and carbon schemes tend to highlight the scale of their projects but rarely report on qualitative improvements such as reductions in chemical inputs, gains in biodiversity or soil health, and even average increase in soil carbon. This bias toward scale favors the generation of carbon credits but can marginalize smallholders who drive radical, positive, and systemic landscape transformations. Current mechanisms — by prioritizing commodification and quantification — risk missing the deeper, systemic transitions required for true resilience. Therefore, there is an urgent need to shift from a soil carbon paradigm towards one centered on soil health and agroecology. Such a shift would entail deep transformations in corporate and financial mechanisms, that currently flag soil health and biodiversity as important but focus their monitoring and financial schemes on soil carbon.

From this perspective, the emerging idea of commodifying other components of the system, such as biodiversity, is equally problematic. If carbon credits in agriculture are already complex and contested, creating a system for biodiversity credits follows a similar logic — but with additional challenges, as fauna are highly mobile and reliable standardized diversity indices are difficult to establish.

The Right Incentives for a Correct Risk-Reward Calculus
Ultimately, soil is not just a carbon sink; it is the living infrastructure of food, water, and climate systems. Degradation of this infrastructure is a material risk: the UN estimates that up to 40% of the world's agricultural land is degraded. Therefore, land degradation affects billions of people, and the cost of global land restoration is estimated to amount to at least USD 300 billion per year.[169] Land degradation poses a major threat to cocoa and coffee systems, and diversified agroforestry has been suggested as an effective strategy to prevent it.[170]

Yet, current incentives drive companies and CSOs working with farmers to prioritize carbon sequestration and to adopt agroforestry systems primarily as a means to achieve climate mitigation objectives, treating resilience at best as a secondary outcome. As this analysis shows, however, the real benefits of well-designed and diversified agroforestry systems, alongside other agroecological practices, do not lie solely in the carbon they store, but in their contributions to soil life, soil fertility, biodiversity, climate change adaptation, reduced GHG emissions through lower fertilizer and pesticide use, and productivity gains. In its present form, the system's risk-reward ratio fails to convey accurate signals to investors and policymakers alike. In terms of effective action against climate change, regeneration must take precedence over compensation, and soil health over simplistic simulations and estimations. Neglecting the true system rewards places at risk the very foundations of corporate supply chains. The overarching challenge, therefore, is to design financial support mechanisms as interconnected and ambitious as the agroecosystems we seek to restore.

5.3 Risks, Transparency and Accountability

As contractual partners, farmers have a right to clear and comprehensive information: how financial incentives work, the level of effort required to establish and maintain agroforestry systems, the risks involved, the implications for their future business decisions and autonomy and how gathered data about their farms is used. Transparent process and accounting rules, along with the enforcement of data rights, turn promised benefits into predictable income and protect farmers from bearing the downside of methodological, environmental, or market uncertainties.

The Farmers' Risk
The challenge of getting correct estimates for carbon sequestration can directly expose farmers to financial risks. In the case of overestimations or unforeseen events (e.g. high tree

mortality due to climatic events), farmers may fail to meet previously established targets and ultimately earn less than anticipated. For example, in Barry Callebaut projects, early payments are tied to surviving trees, which means that a heat wave- or drought-driven mortality spike can reduce payments despite farmers' efforts. Similarly, in Solidaridad's ACORN-linked projects, modeled removals accrue via remote sensing until verified, and payments are enabled ex-post. Therefore, slower-than-expected growth can delay payouts.

When implementing RA projects, farmers also run other risks, such as reductions in crop yields and higher upfront costs, especially during the transition phase. Even when regenerative systems outperform conventional ones over time, there can be 'down years' and additional labor early on.

Moreover, companies should avoid exposing farmers to market volatility in results-based schemes: recent market scans show prices paid for agricultural carbon credits often range only around 15–30 USD/tCO_2eq, frequently below the level needed to drive practice change, while activity-based sustainability premiums can provide more predictable support. Any premiums, however, still risk being insufficient if farm-gate commodity prices are low.[171] Given that the companies studied in this report are increasingly looking into lifting farmers above the extreme poverty line, defined by the UN as USD 2.15/day, targets and metrics should evolve around significantly higher and more stable farmgate prices for cocoa and coffee, rather than uncertain or even volatile, modest payments for tree planting in the short term.

Finally, farmers will likely not be eligible to generate carbon credits in the long term because their land (in the best case) is expected to reach a point of carbon saturation after a few years. Therefore, beyond enrolling farmers in projects in regenerative agriculture for insetting or offsetting purposes, companies should develop robust risk management plans to prevent unforeseen financial or operational burdens on farmers. Concretely, such plans can include minimum payment floors, force majeure clauses for climatic shocks, clear recognition of pre-existing trees and early adopters, and explicit recognition of farmers' rights to manage shade trees over time. The risk management plan must therefore help ensure that the benefits for farmers outweigh the risks, especially if the majority of farmers contracted by Nestlé or Barry Callebaut are to transition successfully and continue producing cocoa and coffee in a changing climate.

Data Usage and Ownership

Farmers and cooperatives should have access to their own data. This is salient because some implementers aggregate or retain data as proprietary information. Therefore, informed consent, guaranteed access, and farmer-facing dashboards that provide monitoring results should be part of the benefit package. Related evidence from livestock supply chains shows that companies increasingly tie their incentives to agreements on extensive farm-level data submission, sometimes with penalties for non-compliance, further shifting risks onto the farmers.[172] The credibility of monitoring schemes lies in transparency and accountability, for which open data and accessible results are a crucial part.

Carbon (Double) Accounting

Projects should be transparent to both farmers and the public regarding how GHG emissions, reductions, and removals from carbon sequestration are quantified.

Double counting represents a significant risk in cocoa 'supply shed' approaches (see infobox 6), underscoring the need for unique supplier IDs, plot/tree registries, cross-sectoral collaboration, and alignment with national regulations. In practice, some actors rely on 'supply shed' logic when direct traceability is difficult, which can blur lines with traditional offsetting and increase co-claiming and double-counting risk if multiple companies draw from the same region or farmer pool.[173,174] Furthermore, the IATP analysis highlights that some multinationals also count actions 'beyond the farm' (e.g., sourcing landscapes or

Photo above: *Coffee cherry picking.*

nearby ecosystems) as part of their supply chains, making it even harder to distinguish from offsetting because the benefits generated are not necessarily tied to changes in on-farm practices or farmer livelihoods. As the majority of land-based reductions and removals occur in big reforestation and forest conservation initiatives associating many actors, maintenance of traceability within and among the different supply chains is paramount — as is effective public oversight.

Therefore, there is an urgent need for standardized protocols and guidance on how to report and account for insetting activities. Emerging government frameworks in Côte d'Ivoire and Ghana (e.g. host country approvals and prospective national carbon registries in the context of the Paris Agreement's Article 6) are steps toward harmonized accounting and oversight, potentially helping to reduce double counting across the shared sourcing areas of cocoa and coffee suppliers. In parallel, private standards are evolving: the SBTi and GHG Protocol are revisiting when, and under what conditions, in-supply-chain claims can be deemed acceptable.[175] Nevertheless, the questions around carbon tunnel vision painstakingly remain.

Monitoring Regenerative Systems

Companies need to align their narrative, objectives, monitoring, and reported outcomes. When reporting data, companies and CSOs should be more specific on measures of quality (e.g. amount of pesticide reduction per pesticide type, biodiversity increase and soil organic matter increase) and dispersion (i.e. variation across analyzed farming systems).

Furthermore, reported outcomes should reflect the narrative and goals proposed in frameworks. For instance, biodiversity and soil health outcomes are framed positively in narratives — earthworms and birds are relatable symbols for consumers, as noted by Nestlé during our interview — but are rarely tracked with consistent field metrics. As long as monitoring remains focused on scale, the system's foundational functions — such as water infiltration, aggregate stability, nutrient cycling, erosion control and habitat for beneficial organisms and pollinators — will remain under-evidenced, which limits feedback for improving practice design and incentive structures. A systemic indicator framework for RA should comprise an analytically coherent core — spanning soil health, biodiversity, pesticide exposure, water use, dietary diversity, food security, income, tenure security, gendered decision-making, and organizational participation.

Existing holistic frameworks, such as the ACT (Agroecology Criterial Tool) and FAO TAPE tool, can serve as inspiration for developing robust indicators, methodological approaches, and 'red flags' for what a regenerative system should not be.[176] For instance, regenerative agriculture should not rely on monocultures or pesticide-dependent systems. Scientific credibility requires temporal depth (repeated measures to capture trajectories), relational interpretation (reading indicators across dimensions), and data governance that returns data, protocols and results to farmers and communities. The results obtained should be shared openly and without reservation with policymakers, and ultimately with taxpayers or consumers, to support decision-making, accountability, and transparency in the fight against climate change.

In a context where legislation guiding the reduction of Scope 3 emissions relies primarily on accounting and process rules rather than material checks and random sampling, greater coherence between narrative, objectives, and monitoring can help steer regenerative agriculture toward durable outcomes. However, for RA to fulfil its potential as a strategy for climate-resilient food systems, it is essential that corporate actors adopt transparent, science-based, and holistic agroecological approaches that address the full complexity of agricultural sustainability.

5.4 Knowledge Co-Construction

Knowledge and learning capacity constitute the enabling environment for sustained transitions, as farmers' socio-ecological literacy plays an important role in land use and management decisions.[177,178] The presence or absence of systematic farm record-keeping (covering income, expenses, and inputs) and participation in farmer field schools, farmer-to-farmer exchange visits, and trainings show whether farmers can experiment, share knowledge, compare costs and returns, and adapt practices to local conditions. Complementary indicators include access to agroecological knowledge sources and participation in grassroots organizations, which can indicate horizontal knowledge construction. When farmers can share, validate, and build knowledge collectively, the likelihood of persistent, context-appropriate adoption increases, with positive consequences for ecological, agronomic, and livelihood effects.[179]

The success of the transition toward regenerative systems depends on placing farmers and their organizations at the heart of both decision-making and knowledge creation. Although some projects recognize the value of farmers' knowledge, the overall design of interventions often remains top-down, leaving farmers with limited real power to shape outcomes. This disconnect can undermine both the effectiveness and legitimacy of climate action, indicating the need to move from tokenistic consultation to genuine co-governance. When farmers are organized collectively, they are not only better equipped to defend their rights and interests, but also to influence the direction of programs in ways that reflect their capacities, needs and priorities, which is key especially when a crop is increasingly difficult to cultivate.

The collective agency of farmers can play a powerful role in certification and market access. For example, publicly endorsed Participatory Guarantee System (PGS) in Brazil and other Latin American countries demonstrate how groups of farmers can collectively and democratically certify their production and potentially their transition, reducing costs and ensuring that standards and indicators are meaningful and locally relevant.[180] Such participatory models do more than provide farmers access to certification — they foster trust, transparency, and a sense of ownership that is often missing from top-down certification schemes. The participatory approach also creates fertile ground for the co-construction of knowledge, moving away from the traditional, hierarchical model of technology transfer and training.

Methodological Approaches for Knowledge Co-Construction

Horizontal and empowering methodologies — such as farmer field schools, peer-to-peer exchanges, and participatory research — allow farmers to learn from one another, from technicians, and from scientists as equals. This approach not only democratizes innovation but also ensures that new practices are rooted in local experience and adapted to the specific challenges and opportunities of each context, which is essential for building climate resilient systems. The process of knowledge co-construction is thus inseparable from the process of adaptation, as it is through ongoing dialogue and experimentation that the most effective practices emerge.

However, identifying what works in one context and replicating it elsewhere is not straightforward. The diversity of agroecological and socio-economic conditions means that successful practices must be both adaptable and responsive to local realities. By fostering open, iterative feedback loops between practitioners and researchers, the sector can accelerate the spread of effective solutions while avoiding the pitfalls of one-size-fits-all approaches. But for this adaptive process to flourish, it is essential to invest in the capacity of farmers and their organizations to experiment, monitor, and share results.

Financing Knowledge Co-Construction and Experimentation

Investments for such iterative systems cannot fall solely on the shoulders of farmers, especially given the 'worse before better' curve that often accompanies the transition to regenerative and agroecological systems.[181] Short-term yield declines or increased costs can deter even the most motivated producers, unless the risks are shared and the transition is actively supported by governments, companies, and financial institutions. This means offering financial mechanisms — such as insurance or financial support — which are not tied to production volumes and carbon removals and make the transition genuinely accessible. Only by bearing these costs collectively can the sector ensure that the benefits of regeneration are realized and shared by all.

The Role of Scientists and Open Data for Knowledge Co-Construction

Frameworks on RA and financing schemes should be designed in collaboration with scientists and based on scientific evidence. However, the role of scientists in this process must go beyond the development of frameworks and protocols. Scientists should be actively involved in data analysis, working alongside farmers to interpret results and generate robust open evidence on the impacts of different practices. Open access to data is key, as it enables independent verification, fosters transparency, and allows for tracing success and ensuring accountability. Additionally, knowledge generated through these processes should remain a public good. By making data and knowledge freely available, the sector can build a shared foundation for effective mitigation and adaptation to climate change.

6. CONCLUSION AND RECOMMENDATIONS

Photo above: Woman walking in a complex agroforestry system.

Regenerative agriculture (RA) is attracting significant investments and gaining traction due to the growing concerns around agricultural production under worsening climatic conditions. For companies who rely on the cocoa and coffee sector and their partner organizations, Scope 3 emissions, defined as indirect greenhouse gas emissions (GHG emissions) occurring at the level of suppliers — downstream or upstream —, weigh heaviest in their value chains and portfolios.

The focus of these actors, along with philanthropic investors and policymakers, on the mitigation and the adaptation of these production systems through RA therefore seems both understandable and necessary. Agroforestry systems, in particular, have proven their effectiveness in cocoa and coffee production, offering significant potential to enhance resilience to climate change. A transition from conventional to increasingly regenerative systems can further help to reduce GHG emissions from input production and use.

However, for these current investments to yield results, it remains key to adopt a science-based approach to RA, one that prioritizes its actual benefits, which includes adequate monitoring of system multifunctionality, that requires farmer participation, full transparency and which actually undergoes public oversight by governments, based on a shared definition and implementation criteria of RA on their territories.

6.1 Main Conclusions of the Report

1

The fact that the concept, practices and required results of RA are defined by the very entities that apply it, remains a challenge. No public monitoring is currently required and therefore neither the mitigation results, nor the results for adaptation can be tracked. This **lack of transparency** hampers progress towards limiting global warming at 1.5° Celsius.

2

There is a significant level of uncertainty in current methods used to estimate the amount of carbon sequestered in farming plots. The **lack of precision can result in false expectations** for farmers and even the issuance of excess certificates, sending inaccurate signals to the market (especially to buyers) and to policymakers, undermining effective climate mitigation.

3

The type of regenerative agriculture studied in this report focuses on the ecological and economic aspects of agroforestry, while **overlooking social and political dimensions** such as e.g. fair farmgate prices for the commodity as such or land rights.

4

The emphasis on tree planting for carbon sequestration and its easier/less costly traceability, often at the expense of food security, agrobiodiversity, and farmers' autonomy, **can restrict farmers' adaptive choices and undermine their decision-making power** in responding to climate change.

5

For the farmers, **financial incentives** for adopting agroforestry and other RA practices **vary considerably**, ranging from basic input support to payments linked to carbon sequestration In addition, the duration of this support greatly varies, while the risks of future yield losses, tree mortality and income instability due to the intervention are not explicitly discussed.

6

Company reports present aggregated data suggesting **positive outcomes of agroforestry projects at scale,** particularly in terms of productivity and income. Evidence on actual, location-specific progress remains scarce, even more so regarding biodiversity (species richness, functional biodiversity.), water quality, soil health or smallholder livelihoods.

7

Current mitigation incentives are **designed around the commodification of carbon**. They place disproportionate emphasis on carbon sequestration in trees and (sometimes) topsoil, primarily aimed at insetting or offsetting Scope 3 emissions. This bias is at heavy risk of jeopardizing core system functions such as biodiversity and even soil health.

8

The **principle of permanence is ill-suited to agricultural practice** due to natural fluctuations in carbon stocks. Similarly, the **principle of additionality fails to reward farmers who already deliver** on systemic outcomes. However, the maintenance of current regenerative systems, e.g. diverse agroforestry systems, is as crucial as the establishment of additional systems. A reversal of an agroforestry system to conventional practices would lead to additional emissions. The carbon market logic thus remains fundamentally misaligned with agricultural realities.

9

Some companies and actors are beginning to explore **alternative approaches**, such as Assisted Natural Regeneration (ANR) which offers promising pathways to strengthen farmer autonomy and improve climate adaptation outcomes. However, ANR adopted with a carbon tunnel vision is at heavy risk not to deliver on these broader objectives.

10

In sum, **well-designed RA**, e.g. diversified agroforestry in cocoa and coffee systems, **can deliver substantial adaptation and mitigation benefits**. To realize this potential, the following recommendations should be considered.

6.2 Policy Recommendations

National or international public regulatory bodies need to provide qualitative and quantitative criteria for the different types of agroforestry systems and other regenerative approaches, consistent with the 1.5°C target and relevant SDGs.

To effectively mitigate GHG emissions from agriculture and food value chains, we cannot leave verification to third parties alone. Monitoring protocols and results need to be publicly accessible, especially where they are currently used to generate certificates and claims based on carbon sequestration.

Monitoring needs to shift from a soil carbon paradigm towards one centred on soil health and agroecology. Such a shift requires the development of a set of science-based indicators: as simple as possible, but as complex as they need to be.

In the field, RA monitoring should be a peer-to-peer monitoring among farmers and with scientists (see above), so that their knowledge can be reaped, learning incentivized and costs held low (see Participatory Guarantee System).

Countries are required to legislate or enforce legislation on the land-, privacy- and data protection rights of their farmers. Subsidies for synthetic phytosanitary products should be redirected into strengthening the farming communities and agroecology. Agronomic curricula should be updated accordingly.

The risks of the transition must be borne collectively by governments, companies, and investors, not farmers alone. Farmers need payment floors, insurance and investments to be able to kickstart their transition at field level, investment that must be additional.

The most direct and effective path to reducing extreme poverty in the cocoa and coffee sectors is to guarantee fair, stable farmgate prices — not sporadic payments tied to short-term RA projects or carbon modelling outcomes.

Performant, transparent RA systems, contributing to climate adaptation, the resilience of communities and the actual reduction of emissions in the country where they occur, should be integrated in the local NDC related planning and reporting under the Paris Agreement. They cannot be used by other governmental or private actors to compensate for their GHG emissions.

Policies must provide investors with the right signals: agroforestry and agro-ecologically managed fields deliver on the reduction of GHG emissions through fertile soils and the substitution of synthetic fertilizers and pesticides. They help the production sites and farming families adapt to climate change and thereby reduce the companies' financial risks for the future. Carbon sequestration alone should not be sought as reward from these systems, as it is unstable and even counterproductive.

To avoid double-counting and/or double claiming of emission reductions or removals, exact traceability of activities and public oversight are required in geographies and landscapes where multiple actors are active.

Bodies such as the SBTi and the GHG Protocol need to insist on high quality emission reductions: Actual GHG emission reductions where these emissions occur in the first place, are still the only reliable path to effective climate change mitigation in agriculture and food systems.

There is an urgent need to move beyond validating regenerative agriculture through carbon-offsetting and insetting mechanisms, instead creating enabling socio-political environments for genuine agroecological transitions and GHG emission reductions to comply with the Paris Agreement. This entails redirecting public and private finance away from oversimplified carbon accounting schemes and toward initiatives that promote farmers' rights, farmer-led innovation, collective learning, diverse production systems and functioning local, circular economies — the foundations of resilient, low-carbon agriculture — and food systems.

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APPENDIX 1: GENERAL INTERVIEW GUIDE

Step 0: Identify the Objectives of Regenerative Practices in the Context of the Company/CSO

Q0.1	What are the main challenges or driving factors that led your company/CSO to adopt regenerative agriculture?
Q0.2	What are the main goals your company/CSO aims to achieve through regenerative agricultural practices?
Q0.3	Are there any guiding principles or frameworks that your company/CSO uses to monitor and/or implement regenerative agriculture practices?
Q0.4	How do regenerative practices align with your company's/CSO's broader sustainability or corporate social responsibility strategy?

Step 1: Identify What Regenerative Agricultural Practices are Implemented

Q1.1	What key regenerative agricultural practices has your company/CSO adopted or is currently promoting?
Q1.2	How did your company/CSO select/decide to implement these specific practices?
Q1.3	Have the regenerative practices been adapted to suit local conditions or specific crops? How so?
Q1.4	How do you select the regions, farms, and farmers for participation in regenerative agriculture projects? I.e. which farmers or groups are targeted, or which regions or which farms and why?
Q1.5	Are the regenerative practices limited to specific products or applied across multiple products within your supply chain?
Q1.6	Which of your regenerative agriculture projects do you consider flagship or signatory projects, and why?

Step 2: Characterize Management Strategies for Each Practice

Q2.1	What management strategies does your company/CSO use to ensure the success of these regenerative agricultural practices? Could you name the management strategy for most of the practices?
Q2.2	How do you ensure that the practices are scaled or replicated across different regions or projects?
Q2.3	What resources (e.g., financial, human, technical) are allocated for managing these practices?
Q2.4	How are the farmers themselves motivated to apply the practices and management strategies? Are they gaining anything from participation in this project/program?

Step 3: Identify How the Systems Were Monitored (Which Indicators)

Q3.1	What indicators or metrics does your company/CSO use to measure the success of regenerative agricultural practices? Why these ones?
Q3.2	How do you collect data on these indicators and what tools or systems do you use to track progress over time?
Q3.3	How often are these indicators reviewed, and who is involved in the monitoring and evaluation process?
Q3.4	Do you have documentation you can share that reflects the monitoring and possibly impacts?

Step 4: Discuss the Impacts of Regenerative Practices on the Sustainability of the Systems

Q4.1	What are the observed positive and negative impacts of your regenerative projects so far?
Q4.2	Do any of your regenerative agriculture projects contribute to generating carbon credits? If yes, which ones and by which standard are they qualified for the Voluntary Carbon Market? Who is the certifier?
Q4.3	If you can say: Who is your buyer of these credits?

Step 5: Identify How Results Were Shared/Evaluated (e.g. Yearly Reporting, Communication of Results)

Q5.1	How does your company/CSO communicate the results of regenerative agriculture projects to stakeholders?
Q5.2	In which reports are carbon reductions or insetting outcomes generally included and accounted for?

Closing Question

Q6.1	Are there plans to scale these regenerative agriculture practices or integrate new practices in the coming years? Which ones?
Q6.2	Is there anything else you would like to share about your company's/CSO's approach to regenerative agriculture that we haven't covered so far?
Q6.3	And lastly, would you have contacts from other companies that have specific regenerative agricultural projects that we might also be able to speak with?

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