CLIMATE-SMART AGRICULTURE AND AGROFORESTRY IN COCOA

Guidance Document on
Approaches, Financing Needs and Opportunities

Swiss Platform for
Sustainable Cocoa

Summary and Outlook

This document is intended to provide high level guidance for stakeholders in the cocoa sector seeking to establish a broad range of actions that take the complexity of crop- and site-specific impacts of climate change and the realities of smallholder cocoa farmers into account. It provides an overview of the terms and concepts and shows how they complement and possibly overlap with each other.

The document does not cover all elements of climate smart agriculture and agroforestry practices in detail, but gives an overview of the different characteristics, commonalities and distinctions of the approaches, and is intended to fill in the 'blank space' of investment needs and transition periods to define financially viable economic models. For this purpose, we compared a total of seven case studies of SWISSCO members as well as a number of scientific research reports on these topics. Some of our key findings are:

- **The SWISSCO members projects examined show that the system pays for itself within a short period of time and that the initially high implementation costs can be amortized.** Three of these projects were able to demonstrate this achievement through data, while the other four expressed it in qualitative ways. It is important to continue working with farmers on viable farming systems that deliver quick wins and tangible benefits while overcoming doubts.
- **Recent scientific research shows that cocoa agroforestry systems have the potential to compete with cocoa monocultures** in terms of economic performance and key system services such as climate change adaptation and carbon sequestration, as well as overall system yields. This is supported by several case study findings as part of this report and a meta-analysis by Neither et al. (2020), facilitated by the former SWISSCO Working Group on Climate Resilience and Biodiversity, which was based on 50+ scientific papers. The key conclusions and recommendations of this meta-study were:
    - Cocoa yields in agroforestry systems were 25% lower than in monocultures, but total system yields were about ten times higher, contributing to food security and diversified incomes.
    - Cocoa agroforestry contributed to climate change mitigation by storing 2.5 times more carbon and to adaptation by lowering mean temperatures and buffering temperature extremes.
    - Recognising the lower cocoa yield might still be one of the most relevant factors hindering a broader adoption of diversified production systems. Further research focusing on increasing cocoa yields in agroforestry systems is crucial, e.g. breeding shade tolerant varieties or adapt management practices to increase pollination rates.
    - Building and enabling access to new alternative markets and value chains for agroforestry products is crucial, as is compensating farmers for cocoa yield reductions through fair prices for sustainable cocoa production or carbon storage.

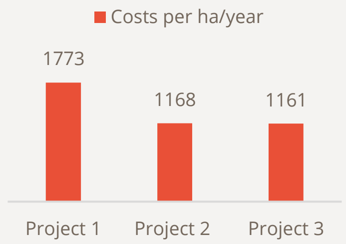
- **In order to reap the potential benefits of agroforestry systems, careful planning and preparation are needed, as well as farmer participation.** The systems and associated overall design, tree species selection and tree density should reflect the general factors of the landscape and be based on the farmer's individual needs and preferences. Such systems are dynamic and require ongoing support over time. The potential benefits can only be fully realized if farmers are motivated and given adequate incentives and support. It is also important to recognise that there are risks posed by poorly designed or managed cocoa agroforestry systems.
- **Climate and nature finance has a strong potential to assist the financing of such transition to climate smart agriculture and agroforestry but it is not yet widely used.** Amongst others, the reasons for non-adoption include lack of stakeholders' consensus on carbon valorisation mechanisms to implement at scale (e.g. Science-Based Targets carbon premium or carbon credit offsetting), high transition and transaction costs as well as complex management and eligibility criteria. All of this needs to be addressed and overcome for climate and nature finance to reach its full potential.
- **The data basis and the willingness by supply chain actors (or partners) to share high-quality data is still inconsistent**, which makes comparisons and final assessments difficult. It is therefore imperative that there is a tighter, more uniform monitoring as well as definitions, with consistent KPI and metrics. More empirical evidence is required to understand future improvement requirements and investments needs.
- **Initial experiences suggest adopting evidence-based recommendations for sustainable cocoa farming.** The concept of good agriculture practices may be further enhanced by increasingly proven agriculture practices based on climate-smart agriculture and agroforestry. Carbon finance can be a catalyst but cannot be the only underlying logic for action. A model that focuses solely on carbon finance runs the risk of focusing too unilaterally on the number of shade trees or the potential for carbon sequestration, which can lead to further damage and unintended consequences over time. A sustainable agroforestry system requires a holistic approach to enhancing soil quality, carbon sequestration, biodiversity, diversification of income sources, and adaptation to climate change.

Based on the seven evaluated projects from SWISSCO members:

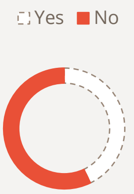
1 year

after the implementation of an agroforestry system, a farmer can earn a net income

Implementation costs (CHF)



57% do not use climate and nature finance



Concrete Working Areas

Need	Action
Agreement on key cocoa farming definitions and practices, as well as on cocoa carbon performance accounting and reporting	Development with the scientific and practitioner communities of sector definitions and best practice guidelines for certain key terms, concepts and practices such as cocoa climate-smart agriculture, cocoa agroforestry, and cocoa regenerative agriculture. As part of this work, recognize the already significant body of knowledge and know-how, drive consolidation and stakeholder consensus, and catalyse research in areas still to be further understood and elucidated. Development of a sector approach to carbon performance accounting and reporting, update databases of carbon emission factors across cocoa producing countries to ensure adequate representation of performance and benchmark-ability and develop information set on carbon removals potential of agroforestry systems. Subsequently, it is important to proactively participate and contribute to the World Cocoa Foundation and at the European level, e.g. in the ISCO Working Group on Forestry and Agroforestry, to advance ongoing efforts in this area.
Piloting innovative approaches through collaboration between SWISSCO members and supply chain stakeholders	Further define and take forward through the SWISSCO Innovation Call a set of innovation actions including: • Piloting a range of agroforestry systems with impact studies across cocoa sourcing countries with the purpose to further establish cocoa agroforestry design and management best practices within a local and context-specific region, quantify and value the ecosystem services provided by agroforestry/ climate-smart agriculture systems, identify new ways to improve cocoa yield within an agroforestry farming system, and develop markets for the agroforestry products. • Pilot climate & nature financing projects through Science-Based Targets carbon premium, carbon credit mechanisms, Payments for Ecosystems and other potential mechanisms. As part of this work, key would be to also explore various approaches to incentivize and reward farmers and communities for delivering and sustaining the improved performance.

Engage with cocoa producer country stakeholders to create an enabling environment for agroforestry and climate-smart agriculture	Explore ways to create a conducive ecosystem to support the implementation at scale of agroforestry and climate-smart agriculture practices by anchoring the capacities in local institutions and, thus to reduce implementation costs and to allow for a sector-wide adoption of these practices (e.g. agriculture training curriculums, production standards, academic and vocational training.)
Support long-term scientific research to further ensure the efficacy and efficiency of agroforestry systems/ climate-smart agriculture/ regenerative agriculture and improve data quality and sharing.	Engage with key research institutions and catalyse the need for on-going long-term research to address already identified key knowledge gaps such as: • How best to increase cocoa yields in agroforestry systems is e.g. breeding for shade tolerant varieties or adapted management practices to increase pollination rates. • Further building knowledge on detailed species-specific information on shade trees. • The role of different shade trees on soil nutrient dynamics, including competition and synergies for resources, within the specific context of a given cocoa producing region, its different soil types and land-use histories. • Understanding the role of cocoa agroforestry in biodiversity regeneration and conservation at the cocoa farm and landscape level. • How best to build and enable access to new alternative markets and value chains for agroforestry products. • Encourage SWISSCO members to improve their monitoring systems and regularly share (anonymous) data for analysis and learning at SWISSCO and ISCO levels. • Supplement the available data with concrete impact studies on topics relevant to SWISSCO and its members.

Table of Content

List of Figures

List of Tables

Acknowledgements

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Abbreviations

AFI	Accountability Framework Initiative
AFOLU	Agriculture, Forestry and Other Land Use
ART	Architecture for REDD+ Transactions
COP27	27th Conference of the Parties
CSA	Climate-Smart Agriculture
DAF	Dynamic Agroforestry
DAFS	Dynamic Agroforestry System
ES	Ecosystem Services
FCPF	Forest Carbon Partnership Facility
FLAG	Forest, Land and Agriculture
GAP	Good Agricultural Practice
GHG	Greenhouse Gas
ICCO	International Cocoa Organization
IPM	Integrated Pest Management
ISFM	Integrated Soil Fertility Management
LEAF	Lowering Emissions by Accelerating Forest Finance Coalition
LUC	Land Use Change
MERESE	Mecanismos de Retribución por Servicios Ecosistémicos
MRV	Monitoring, Reporting and Verification
PES	Payment for Ecosystem Services
SBT	Science-Based-Target
SDG	Sustainable Development Goal
SECO	Swiss State Secretariat for Economic Affairs
SOC	Soil Organic Carbon
TREES	The REDD+ Environmental Excellence Standard

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1 Introduction

Globally, cocoa is produced by five to six million smallholder farmers and contributes to the livelihoods of 40 to 50 million people, often providing the main source of income for farming households. It generates export revenues, income and employment for producing countries, and is one of the central economic sectors for lifting people out of poverty and contributing to the social inclusion of marginalised groups.

Despite these favourable aspects, global cocoa production faces considerable environmental and social challenges. Cocoa farming is seriously threatened by the effects of climate change with consequences for millions of smallholder farmers and their families, national economies of cocoa producing countries, and the global cocoa/chocolate industry.

In the coming decades, agricultural production and productivity will face various changes, some of which are predictable, others not (**Figure 1**). As extreme weather events such as longer dry seasons, reduced rainfall and extreme temperatures become more common, some cocoa growing areas are likely to become hotter and wetter, making them less suitable for cocoa farming altogether, while other areas will continue to be suitable but might face uncertain climatic conditions.

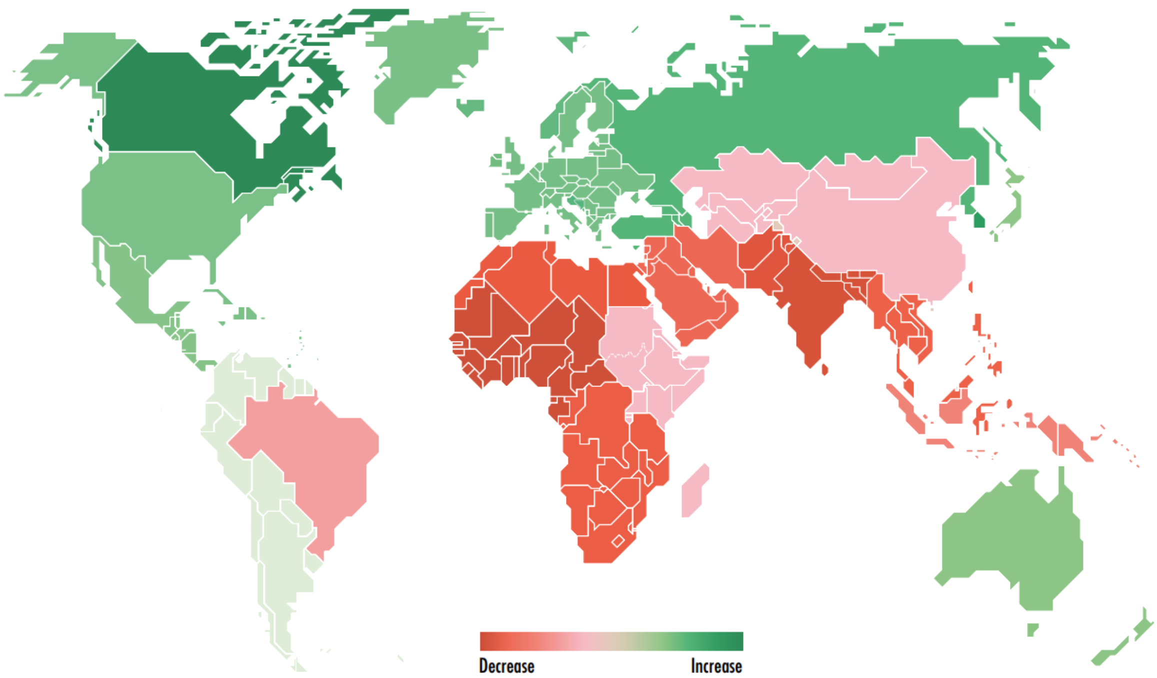

Figure 1: Projected Changes in Agricultural Production by 2050

Source: (FAO, 2018)

Aging plantations, poor farm management, soil degradation and increasing pest and disease pressure further aggravate cocoa production. To meet the demand in the absence of productivity gains, cocoa producers often rely on clearing forest, which leads to biodiversity loss, the release of greenhouse gas (GHG) emissions and weakens the integrity of forest ecosystems. On average, the chocolate industry contributes around 2.1 million tonnes of GHG emissions to the atmosphere every year, according to a study by Konstantas et al. (2018). The calculations of the carbon footprint of chocolate can vary widely due to differences in methodologies, variations in supply chains, uncertainties in data, the scope of the analysis, and assumptions and parameters. These factors can significantly impact the final carbon footprint result. This can be seen in **Figure 2**, where the total carbon footprint ranges between 1.8 and 5.2 kg CO_2-e/kg.

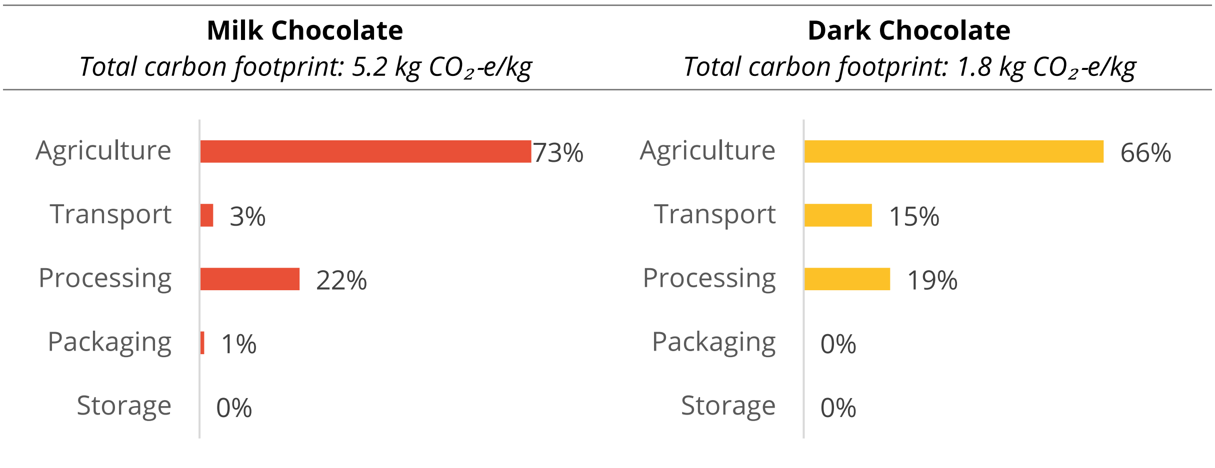

Figure 2: Example of a Chocolate carbon footprint

Source: (Carbon Cloud, n.d.)

From an environmental perspective, the misuse or overuse of pesticides and chemical fertilisers and outdated farming methods further degrade the quality of local water resources, contaminate soils and put pressure on the local ecosystem. Producers alone cannot upscale sustainable cocoa production. Rather it asks for a coordinated process involving multiple stakeholders, from governments to private sector actors to other parties across supply chain, involving major investment in the entire supply chain and the key sourcing landscapes. Hence, guidance on site-specific adaptation of the smallholder-dominated sector based on a financially feasible economic model is required to ensure a sustainable cocoa sector.

Against these global challenges of climate change and its manifold adverse risks and impacts on the main cocoa producing countries, SWISSCO has defined a "deforestation-free and climate-friendly cocoa supply chain" as a key target area in the joint Roadmap 2030 in alignment with the Sustainable Development Goals (SDGs) (SWISSCO, 2021b). It is thus in line with international efforts to halt deforestation caused by cocoa production area expansion and prevent forest degradation and is also in line with the implementation of the envisaged EU legislation for deforestation-free supply chains.

The following concrete targets have been defined in this regard that stand out:

1) **Engage in at least 5 cocoa sourcing landscapes.**
    - The "SWISSCO Landscape Call 2022" was launched in June 2022 and aims to collectively engage in selected sustainable sourcing landscapes, co-financed by the Swiss State Secretariat for Economic Affairs (SECO). Such landscapes are defined as "programs that are confined to a specific sourcing region and/or jurisdictions and involve multiple stakeholders and business partners beyond individual supply chains, and that credibly measure progress with a common monitoring system to achieve a set of goals and targets in close collaboration with local counterparts from both the public and private sectors" (SECO & SWISSCO, 2022, p. 2).
2) **Enable at least 150'000 cocoa farmers to adopt effective climate-smart agriculture and agroforestry practices.**
    - The number of farmers represents the approximate number of farmers being part of the Swiss cocoa supply chain where SWISSCO members shall enable cocoa farmers to adopt effective climate smart agriculture or agroforestry practices by 2030 (SWISSCO, 2021b).
    - Good Agriculture Practices (GAP) are explicitly linked to climate-smart agriculture in the SWISSCO MEL Framework (SWISSCO, 2021a).
3) **Commit to a pathway towards net zero emissions with focus on the cocoa supply chain.**
    - SWISSCO member companies are guided by science-based targets (SBTs) that provide a clearly defined path to reduce GHG emissions in line with the Paris Agreement goals (SWISSCO, 2021b).

As an important starting point, there is the necessity to clarify the investment needs and financing options to accompany and support the path towards achieving the set targets. To this end, this report gathers and systematises knowledge within SWISSCO on the **investments needed** to transition to sustainable cocoa production models based on agroforestry and climate-smart farming practices (on-farm) (target 1 and 2) and **assesses climate and nature finance** and other innovative financing options (target 3).

Chapters 2-5 define and contextualise various existing and emerging transformative agricultural production models that can also be applied to cocoa production. Between May and September 2022, the SWISSCO coordination office approached several SWISSCO members to learn more about their specific project metrics through a survey and interview and to learn from their experiences. The results of these consultations are presented in different case studies and are described in more detail in **Chapter 6**. The final chapter concludes with recommendations for SWISSCO members for further research and implementation.

2 Climate-Smart Agriculture

Climate-Smart Agriculture (CSA) is an approach for transforming and reorienting agricultural production systems and food value chains under the new realities of climate change. It has three main objectives, the so-called "the three pillars of CSA" (**Figure 3**): sustainably increase agricultural productivity and incomes; adapt and build resilience to climate change and reduce and/or remove GHG emissions, where possible (FAO, 2021).

Productivity

CSA aims to sustainably increase agricultural productivity and incomes from crops, livestock and fish, without having a negative impact on the environment. This, in turn, will raise food and nutritional security. A key concept related to raising productivity is sustainable intensification.

Adaption

CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others. These services are essential for maintaining productivity and our ability to adapt to climate changes.

Mitigation

Wherever and whenever possible, CSA should help to reduce and/or remove GHG emissions. This implies that we reduce emissions for each calorie or kilo of food, fibre and fuel that we produce. That we avoid deforestation from agriculture. And that we manage soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO_2 from the atmosphere.

Figure 3: Three Pillars of Climate-Smart Agriculture

Source: Adapted from (CGIAR, N.A.)

Like other sustainable agricultural approaches, CSA is based on principles of increased productivity and sustainability. However, it is distinguished by a focus on climate change, explicitly addressing adaptation and mitigation challenges while working towards food security (CGIAR, N.A.). In essence, CSA incorporates resilience concerns while at the same time seeking to reduce greenhouse gas emissions, resulting in the following equation:

$$\text{Equation 1: CSA} = \text{Sustainable Agriculture} + \text{Resilience} - \text{Emissions}$$

At the cocoa farm level, the CSA approach translates into the implementation of a wide spectrum of farm management practices to the management of cocoa that consider the contextual specificities (e.g. climate conditions and predictions) of a given region. CSA is not a single action but rather an approach consisting of several possible actions, such as practices associated to the concepts of Good Agricultural Practices (GAP), Integrated Pest Management (IPM) and Integrated Soil Fertility Management (ISFM). An overview of the practices that can be counted as CSA practices can also be found in (SWISSCO, 2021a).

3 Agroforestry

Agroforestry systems describe production systems that incorporate and maintain non-cocoa tree species on the same plot as cocoa production. There is no single model for how cocoa agroforestry systems can be implemented or designed, and the diversity of options enhances the potential to achieve a number of environmental, climate, production as well as socio-economic benefits (**Figure 4**).

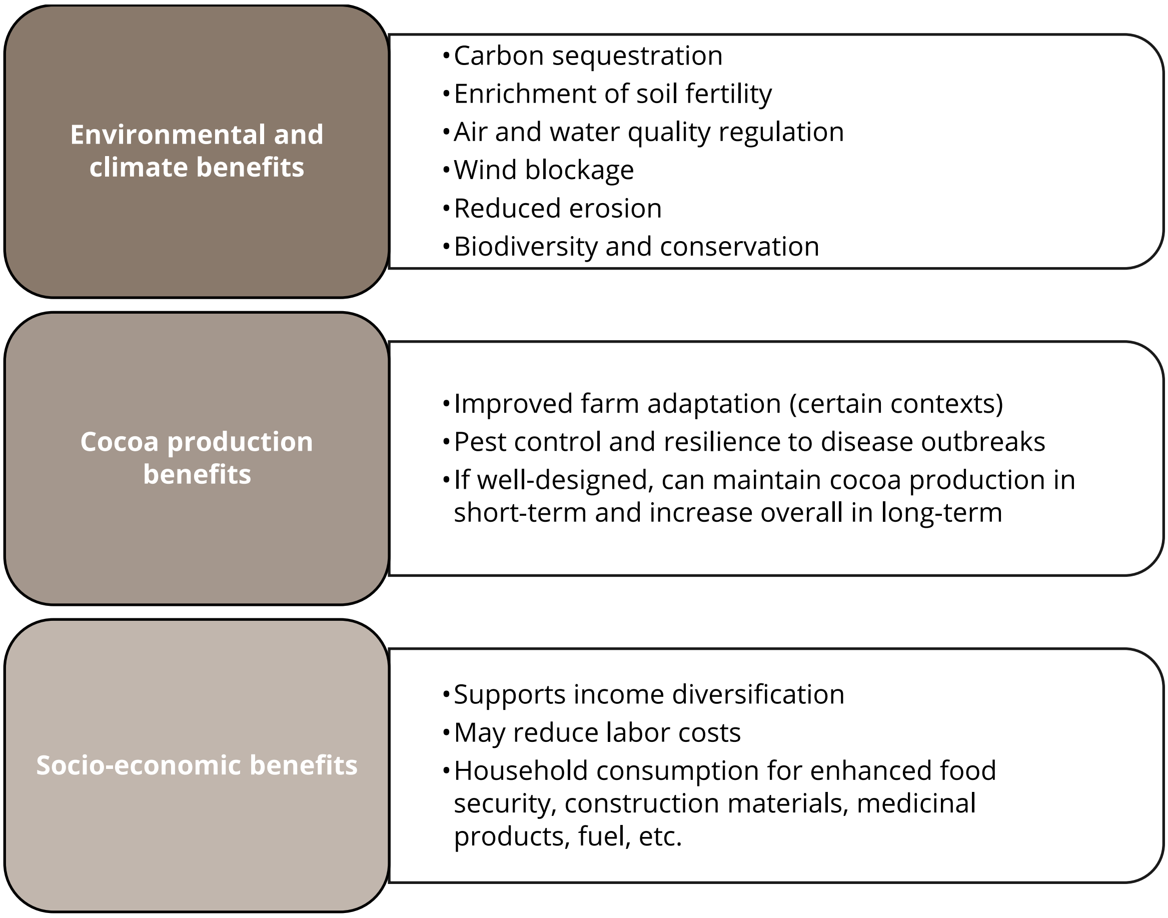

Figure 4: Benefits from Agroforestry

Source: Adapted from Thomson et al. (2020)

Achieving these benefits requires careful planning, preparation, and farmer participation to reap the full potential of such systems and can only be fully realized if farmers are motivated and given long-term adequate incentives and support. If carefully designed and implemented, cocoa agroforestry systems "[...] have the potential to compete with cocoa monocultures in terms of economic performance, and [...] outperform them in crucial system services such as adaptation to climate change and carbon sequestration, as well as in total system yields", as found by a SWISSCO funded study by Niether et al. (2020, p. 9).

The transition period of a cocoa agroforestry systems varies based on the current state of the farm and the complexity of the envisaged system. An overview of the different agroforestry level is given below in **Table 1**.

Table 1: Different level of agroforestry systems

Entry level	Basic level	Advanced level
- At least 16 non-cocoa trees/ha - Different tree species, preferably endemic	- At least 40% canopy cover - At least 5 different endemic tree species	- At least 40% canopy cover - At least 12 different endemic tree species (no pioneer species) - 15% coverage by endemic vegetation - Replica of the natural habitat for cocoa - Two tiers or stratus and shade providing species should reach a minimum height of 12-15m

Source: Adapted from (HALBA, 2022; Thomson et al., 2020)

Further, an agroforestry system transitions through several stages over its life cycle of approximately 20+ years. Thomson et al. (2020) categorize this lifecycle in three phases, as shown in detail in **Figure 5**.

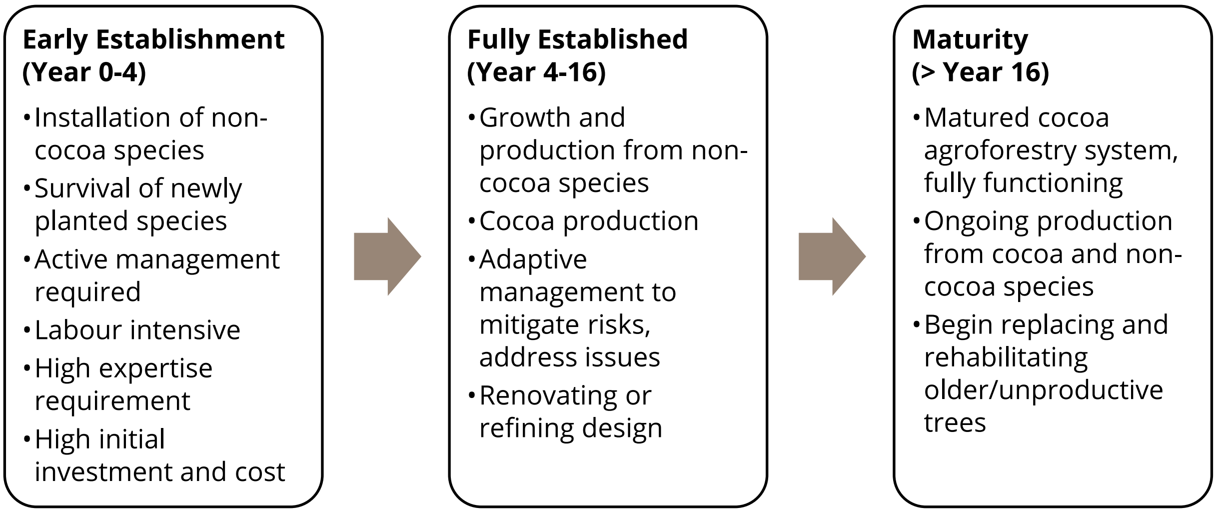

Figure 5: Phases of Agroforestry System Development and Key Objectives

Source: Adapted from Thomson et al. (2020)

Concerning (long-term) cocoa yields, a 22-year experiment in Honduras conducted by Ramírez-Argueta et al. (2022) was able to show that cocoa yields can range from 800 to 1,100 kg per ha/year between the 8th and 12th year after planting, and from 1,200 to 2,300 kg per ha/year between the 13th and 16th year. In general, cocoa production curves reached the best yields between 15 and 18 years after planting. After 22 years, the total income was determined by the share of each component of the agroforestry systems and it was found that they can generate an income of about 3500 CHF per hectare per year.

It becomes clear that agroforestry systems provide habitat that increases the biological diversity of agricultural land, including soil biodiversity and agrobiodiversity (Gassner & Dobie, 2022, p. 16). Hence, well-designed agroforestry systems with more ecological functionality offer a unique opportunity to transform cocoa monocropping systems in cocoa producing countries (**Table 2**).

Table 2: Advantages and disadvantages to different cocoa models

	Advantages	Disadvantages
Monoculture	- High short-term cocoa yields - Comparatively simple production model and technological package - Low training needs for farmers - Known production costs	- May jeopardize long-term sustainability - Lower adaptive capacity to climate impacts - Higher vulnerability to pest and disease - High inputs costs for fertilizers and pest control - Detrimental to biodiversity - Higher emissions and limited carbon sequestration
Intercropping	- Can improve farmer food security and income diversification - Moderately improves resilience to climate change, pest and disease - Moderately improves biodiversity - Moderate carbon sequestration - Entry point to more diverse systems	- May decrease short-term cocoa productivity - May require new markets for non-cocoa crops - Requires additional inputs, training, and finance - Lower biodiversity value, carbon sequestration, and resilience compared to multi-strata systems
Multi-Strata	- Secures long-term cocoa production - Maximizes long-term resilience to climate change, pests and disease, and carbon sequestration - May serve forest restoration goals - Can improve farmer food security and income diversification - Reduced cost for fertilizers and pest control	- May decrease cocoa productivity - May require new markets for non-cocoa crops - Requires sophisticated design and training - Requires more complex inputs incl. seedlings - Higher implementation cost and financing needs - Higher labor costs during planting and ongoing management

Source: Thomson et al. (2020)

There have been clear, beneficial results for both farmers and ecosystems from agroforestry systems, increasing smallholders' yields, diversifying farmers' income, enhancing cocoa-producing households' food and nutritional security, and reducing pressure on forests and the environment (World Agroforestry, n.d.). Based on the comprehensive evidence, such systems have the potential to reduce the need to establish new cocoa farms at the expense of natural forests and could thus limit deforestation and could make cocoa landscapes more resilient (World Agroforestry, n.d.).

An Agroforestry System

© Stella Bernrain

3.1 Dynamic Agroforestry

Dynamic agroforestry systems (DAFS) are built on an understanding of the succession and structure of natural ecosystems. It is an advanced cultivation method that focuses on optimizing the overall system rather than maximizing individual crops. By mimicking natural forests and thus the original habitat of the cocoa tree in a humid tropical primary forest environment, these systems provide numerous benefits such as improving soil fertility, reducing pest and disease pressure, erosion control, and diversifying income. The main characteristics of DAFS are (i) high planting density and diversity, stratification, and high energy flow, usually no use of external inputs; (ii) management practices such as different types of pruning and (vi) selection of productive planting material (Andres et al., 2016; HALBA, 2022).

The crops are classified according to their lifespan into pioneer, secondary and primary species, which are planted or sown at the same time. Pioneer species include rice, manioc or pigeon peas. These are eventually replaced by secondary species such as pineapple, and banana, as well as slower-growing secondary and primary tree species that develop simultaneously in their shade. The cocoa tree is the primary species with a potential life span of more than 100 years. After about 10-15 years, secondary species dominate the system and are ultimately replaced by the primary species, as shown in **Figure 6** and **Table 3** (Andres et al., 2016; HALBA, 2022).

A Dynamic Agroforestry System plot in Bolivia

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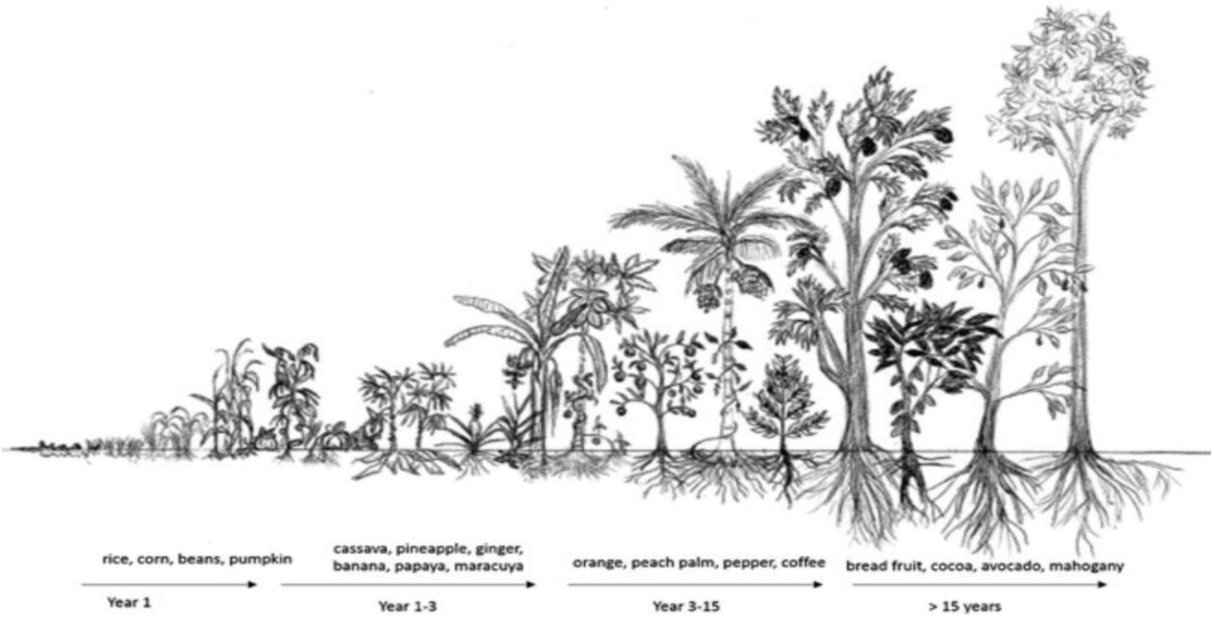


Figure 6: Example of Crops in a Dynamic Agroforestry System

Source: Andres et al. (2016)

Table 3: Development of a DAFS over a 30-year period

Type	Plants/ha		Notes
	Year 1	Year 30	
Cocoa trees	832	832	Grafted, certified species
Native timber trees	208	130	Species with medium-long live cycles, at least 12 species from natural regeneration such as *Terminalia and Nauclea*
Biomass trees	832		Short-live cycle pioneering species such as *Senna Acacia*, *Albizia*, at least four species
Palms	72	72	Coconut and/or oil palms, at least two species
Fruit trees	144	144	Citrus, mango, avocado and others
Cashew	832	30	For additional biomass production
Gmelina	832		For additional timber production after 10 years
Banana/Plantain	832		Common and popular local species to cover own needs and the local market
Biomass shrubs (seeds)	20 kg		*Bixa orellana*, pigeon peas, at least two species
Leguminous plants (seed)	72 kg		Bush beans, *Canavalia*, cowpeas, peanuts
Manioc cuttings (rods)	625		For consumption and/or sale on the local market
Yam (seeds)	1600		For consumption and/or sale on the local market
Corn (seeds)	16 kg		For consumption and/or sale on the local market
Vegetables (seeds)	120 g		Aubergines, chilli peppers, tomatoes
Other	TBD	TBD	

Source: (HALBA 2022)

4 Regenerative Agriculture

Regenerative agriculture has recently received a great deal of attention from producers, retailers, researchers, and consumers. Despite the widespread interest in regenerative agriculture, there is no legal or regulatory definition of the term nor has a generally accepted definition emerged in common usage (Newton et al., 2020; Rhodes, 2017; Schreefel et al., 2020). Table 1 shows a comparison of different terminology. However, both, Rhodes (2017) and Schreefel et al. (2020) conclude that regenerative agriculture is an outcome-based approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple ecosystem services. Its main intention is to improve soil health or restore highly degraded soils, which will symbiotically improve the water quality, biodiversity, and livelihoods.

By using regenerative agriculture methods, such as reducing or eliminating tillage, refraining from using synthetic fertilisers or pesticides and/or using cover crops and crop rotations, it is possible to increase the amount of soil organic carbon in existing soils. The potential benefits of such methods are outlined in the following **Table 4**.

Table 4: Benefits of Regenerative Agricultural Practices on Natural Resources

Impact • Minor •• Moderate ••• Major	Soil	Water	Biodiversity	GHG mitigation
Cover crops	•••	••	••	•••
Diversified crop rotation	•••	/	•••	••
Mulching & crop residues cover	•••	••	••	•••
Minimum tillage	•••	••	••	•••
Organic fertilizers	•••	•••	••	•••
Integrated nutrient management	•••	•••	••	•••
Irrigation technology	•	•••	/	•
Riparian buffers	•••	•••	•••	•••
Intercropping	•••	••	••	••
Agroforestry & Silvopastoral systems	•••	•••	•••	•••
Hedgerows & green buffers	•••	••	•••	•••
Integrated pest management & bio-controls	••	•••	•••	/
Precision farming	•	•••	••	••
Manure storage & process	••	•••	/	•••

Source: Adapted from (Nestlé, 2021)

4.1 Biochar

Biochar, known as the *black gold of agriculture*, is produced by slow pyrolysis from agricultural waste such as sustainably produced biomass, ideally waste from forestry or food processing can be used as a natural fertiliser to improve soil quality and create carbon sinks. It is a stable solid rich in carbon and ashes that can act as a sponge to retain water and water-soluble nutrients and serves as a habitat for beneficial soil microorganisms. The application to cocoa farms is a novel approach that has proven potential to significantly increase crop yields in tropical agricultural systems. Taking into account the simplicity of the production process and the efficiency of CO_2 adsorption, cocoa shell biochar can be considered a good option for CO_2 capture (Ferry et al., 2022; Meyer zu Drewer et al., 2022; Najafabadi et al., 2021).

Biochar production from cocoa pods in Ghana

5 Climate and Nature Finance

Climate and Nature Finance is a driving force for sustainable cocoa production, and innovative financial solutions are central to scale up approaches such as agroforestry or climate-smart agriculture. SWISSCO has already published an in-depth and high-level technical paper on Climate and Nature Finance in collaboration with South Pole and Earthworm. For further information, please refer to (SWISSCO, 2021c).

It's important to note that the **climate finance options and mechansims described in the following are often mutually exclusive and will not be able to be stacked due to the risks of double accounting, selling and/or claiming of the carbon performance**. For example, if the carbon performance is translated and valorised through a voluntary carbon credit mechanism, then that carbon performance cannot as well be used to demonstrate a decarbonisation of the cocoa farming activities and progress on the delivery of the cocoa or chocolate companies' science-based targets (SBTs) in the value chain. It is therefore critical to assess these various options and their viability at the design stage of developing a carbon project and climate finance program.

In summary, Climate and Nature Finance is a concept bringing together all types of financial mechanisms that will assist companies, cooperatives, farmers and governments to deliver a Climate and Nature Net Zero or even Net Positive performance.

- **Climate Finance** refers to local, national or transnational financing drawn from public, private and other sources that seeks to support mitigation and adaptation actions that will address climate change. This term covers all types of climate finance mechanisms, including GHG or Carbon Finance, carbon tax regimes, climate adaptation finance, climate insurance, green bonds and loans.
- **Nature Finance** refers to the financing of projects that improve, for example, biodiversity, water stewardship and any other aspects of nature and ecosystem services.
- **GHG or Carbon Finance** is a subset of Climate Finance and a general term for resources that go towards projects that avoid, reduce or eliminate GHG and carbon emissions, in the form of the purchase of such performances - for example, certain carbon reducing actions may generate carbon in- or offset credits that can be traded on the voluntary carbon market, or specific carbon emission permits for a particular carbon compliance market. These can then be bought by other market actors to help them offset their own emissions.

The next sections explain in more detail how GHG or Carbon Finance can help cocoa and chocolate companies meet their Net Zero, SBTs and Climate Neutral commitments, focusing on the following four types of carbon and nature project and valorisation pathways:

- **On-farm carbon projects** implemented within the value chain and counting towards the company's climate SBTs.
- **Off-farm carbon projects** that are implemented at landscape and community level that generate in- or offsetting carbon credits for companies (in the cocoa and chocolate sector as well as any other sector) that wish to compensate their residual carbon footprint emissions to claim carbon neutrality or net zero (but cannot be used to deliver SBTs, i.e. footprint decarbonisation).
    - An **offset** is a carbon credit generated by a carbon project not connected or related to a company value chain.
    - An **inset** is a carbon credit generated by a carbon project close by or connected to a company value chain.
- **National carbon programs** and their associated benefit sharing schemes, such as the Ghana and Côte d'Ivoire REDD+ programs, where there is a certain performance-based incentive through the program's benefit sharing for both on and off-farm carbon impacts.
- **Payment for Ecosystem Services (PES)** are incentives or contracts offered to farmers or landowners by users of certain ecosystem services in exchange for managing their land to provide and sustain the given ecological service e.g. climate mitigation and water quality management.

5.1 Recap on a company's carbon footprint as per the GHG Protocol

The *GHG Protocol Corporate Accounting and Reporting Standard* provides requirements and guidance for companies and other organizations preparing a corporate-level GHG emissions inventory. The standard covers the accounting and reporting of seven greenhouse gases covered by the Kyoto Protocol – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

In order to delineate the direct and indirect sources of GHG emissions, improve transparency and increase the usefulness for different types of organisations and different types of climate policies and business goals, three scopes (Scope 1, Scope 2 and Scope 3) are defined for GHG accounting and reporting. These scopes indicate which activities are taken into account when measuring the company's emissions. They can be limited to the company's own activities (Scope 1 and 2) or extend to activities in the company's value chain (Scope 3), as shown in **Figure 7**.

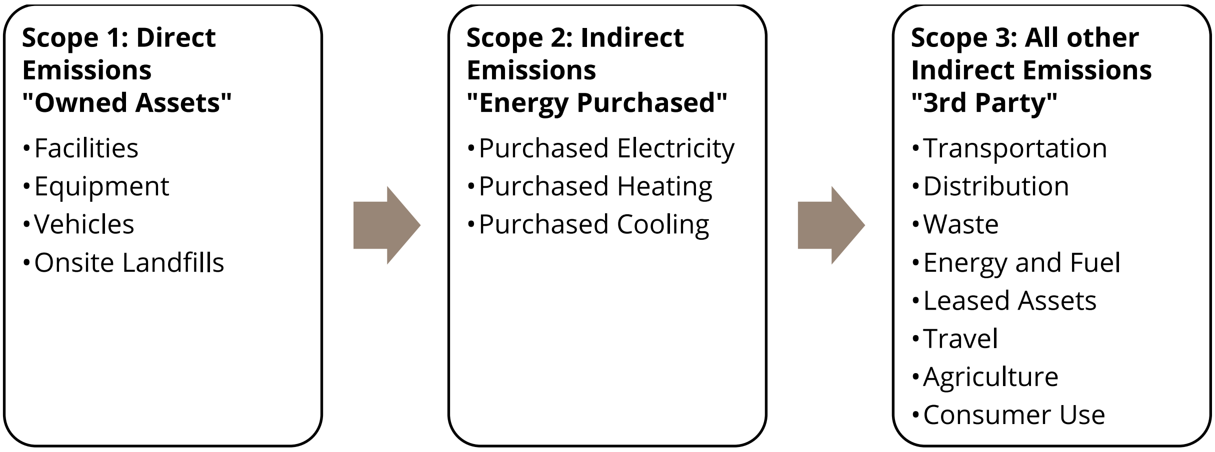


Figure 7: Scope of Activities

Source: Adapted from (GHG Protocol, N.A.)

For the cocoa and chocolate sector, and indeed for the agri-food sector in general, as well as for most sectors across the economy, the vast majority of GHG emissions fall into Scope 3, as shown in **Figure 8**.

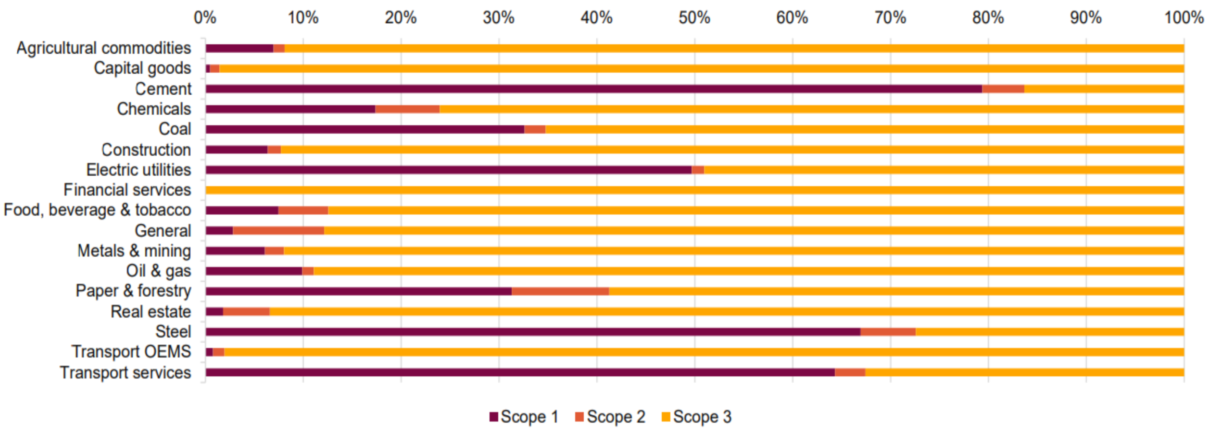


Figure 8: Scope 1, 2 and 3 Emissions by Sector

Source: (CDP, 2023)

5.2 Recap on the Climate Science-Based-Targets

SBTs provide a clearly-defined pathway for companies to reduce GHG emissions, helping to prevent the worst impacts of climate change and future-proof business growth. Targets are considered 'science-based' if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement – limiting global warming to well-below 2°C above pre-industrial levels and pursuing efforts to limit warming to 1.5°C (SBTi, 2022). SBTs do not allow carbon credit offsetting to achieve targets. The Science Based Targets initiative (SBTi) defines and promotes best practice in setting targets aligned to the latest climate science and offers resources and guidance to reduce barriers to adoption. It is important to note that the emission reduction targets developed by a company are independently assessed and verified by the SBTi (SBTi, 2021).

Recently, the SBTi issued the so-called Forest, Land and Agriculture (FLAG) SBTs that must be met by cocoa and chocolate companies committing to the SBTi targets (please refer to SBTi & WWF, 2022).

In short, the FLAG SBTs are:

- Science-based targets that apply to a company's GHG emissions from Agriculture, Forestry and Other Land Use (AFOLU), including GHG emissions associated with land use change (LUC) (e.g. biomass and soil carbon losses from deforestation, conversion of coastal wetlands, conversion/draining and burning of peatlands, conversion of savannas and natural grasslands), emissions from land management (e.g. nitrous oxide and methane from enteric fermentation, biomass burning, nutrient management, fertilizer use and manure management) and biogenic removals (e.g. forest restoration, silvo-pasture, improved forest management, agroforestry and soil carbon sequestration).

- FLAG targets are separate from other fossil, industrial or non-FLAG targets and are therefore additional SBTs for companies with significant GHG emissions from AFOLU[1].

- The SBTi provides two approaches to FLAG target setting to enable companies to calculate GHG reduction targets in line with the Paris Agreement. Firstly, the FLAG sector pathway for companies with diversified FLAG emissions and secondly, the FLAG commodity pathways, which include 11 pathways for specific commodities (beef, chicken, dairy, leather, maize, palm oil, pork, rice, soy, wheat, as well as timber and wood fiber).

The key requirements of the SBTi FLAG guidance are as follows:

- *Set science-based targets for fossil emissions:* Businesses with land-based emissions are required to set FLAG SBTs as well as SBTs, since all companies produce fossil emissions.

- *Set near-term FLAG SBTs:* 5–10-year emission reduction targets in line with limiting warming to 1.5°C.

- *Set long-term FLAG SBTs:* Companies in the forest, land and agriculture sectors will reduce at least 72% of emissions by no later than 2050. They should use the SBTi Net-Zero Standard to set long-term FLAG SBTs.

- *Zero deforestation targets must be set for no later than 2025:* In line with the Accountability Framework initiative (AFI).

- *Accounting of removals in FLAG SBTs:* CO_2 removals can be accounted to deliver the FLAG SBTs (only CO_2 removals and no other GHGs removals). CO_2 removal includes such measures as improving forest management practices and

[1] For companies with FLAG-related emissions that total 20% or more of overall emissions across scopes.

enhancing soil carbon sequestration on cultivated land. GHG emissions and CO_2 removals need to be accounted for separately, and the overarching FLAG target can be netted out emissions and removals, as an inventory approach allows changes to be accounted for as emissions or removals, depending on the starting point. Removals may only be included in FLAG targets when the appropriate requirements are met, following the GHG Protocol Land Sector and Removals Guidance[2]. The removals may not be used to meet any other energy or industry targets under the SBTi.

5.3 Recap on Climate Net Zero Standards and Guidelines

The SBTi's Corporate Net-Zero Standard, in the following referred to as Net-Zero Standard, is the world's first framework for corporate net-zero target setting in line with climate science. It includes the guidance, criteria, and recommendations companies need to set science-based net-zero targets consistent with limiting global temperature rise to 1.5°C. The standard provides a common, robust, and science-based understanding of net-zero. It gives business leaders clarity and confidence that their near- and long-term targets are aligned with climate science. The development of the Net-Zero Standard followed a thorough, inclusive, and transparent process where input and expertise were provided by a diverse range of stakeholders and with close consultation from an independent expert advisory group from academia, civil society, science and business. The key requirements of the Net-Zero Standard are the following:

- *Focus on rapid and deep emission cuts:* Rapid, deep cuts to value-chain emissions are the most effective, scientifically-sound way of limiting global temperature rise to 1.5°C. This is the central focus of the Net-Zero Standard and must be the overarching priority for companies. The standard refers to the entire emissions of a company's value chain and most companies will require deep decarbonization of 80 - 98% depending on the sector to reach net-zero (**Figure 9**).
- *Set near- and long-term targets:* Companies adopting the Net-Zero Standard are required to set both near-term and long-term SBTs. This means making rapid emissions cuts now and halving emissions by 2030. By 2050, organizations must produce close to zero emissions and will neutralise any residual emissions that are not possible to eliminate.
- *No net-zero claims until long-term targets are met:* A company is only considered to have reached net-zero when it has achieved its long-term SBTs. Most companies are required to have long-term targets with emission reductions of at least 90% by 2050. At that point, a company must use carbon removals to neutralize any limited emissions that cannot yet be eliminated.

[2] In final draft version, to be finalised in 2023.

- *Go beyond the value chain:* The SBTi recommends companies to go further by making investments outside their SBTs to help mitigate climate change elsewhere. There is an urgent need to increase short-term climate finance, but these investments should be in addition to deep emissions cuts, not in place of them. Companies should follow the mitigation hierarchy, committing to reduce their value chain emissions before investing to mitigate emissions outside their value chains.

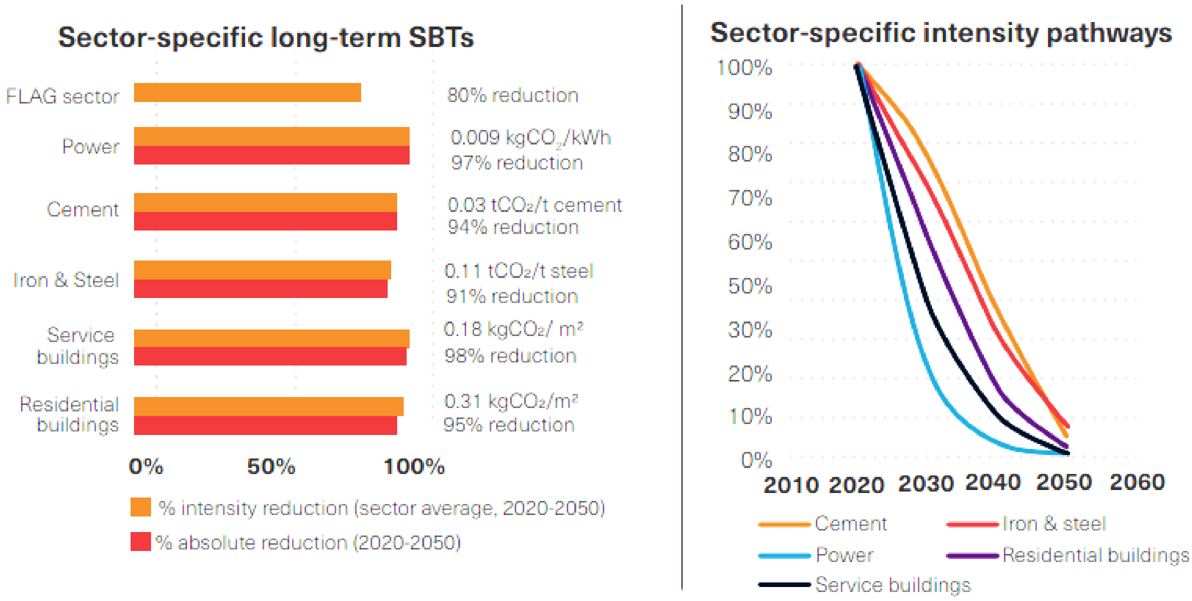


Figure 9: SBTi Net Zero standard sector pathways

Source: (SBTi, 2021)

The ISO Net Zero Guidelines, hereafter the Guidelines, were launched at the 27th Conference of the Parties (COP27) and address the fragmented net zero governance landscape. Competing approaches and concepts to net zero create confusion. The Guidelines provide a common reference for collective efforts and offer a global basis for harmonising, understanding and planning for net zero for actors at state, regional, city and organisational levels and set a common path for:

- *The definition of net zero and related terms* that clarify the differences between direct emissions, indirect emissions from purchased energy and other indirect emissions resulting from an organisation's activities.
- *High-level principles for all actors* who want to achieve climate neutrality.
- *Actionable guidance* on getting there as soon as possible, by 2050 at the very latest.
- *Transparent communication, credible claims, and consistent reporting* on emissions, reductions and removals.

The Guidelines build on the momentum of existing voluntary initiatives and amplify their impact, as globally accepted net-zero claims are more easily comparable, create a virtuous circle of ambition and can be scaled up through better regulation.

5.4 Possible levers for the chocolate and cocoa sector

As concerns over climate change and environmental sustainability grow, the chocolate and cocoa sector faces increasing pressure to reduce its carbon footprint and promote more sustainable practices. One way the sector can achieve this is by leveraging various types of Carbon and Nature Finance. In the following, four selected types are discussed. By leveraging these, the sector may take steps towards a more sustainable and climate-friendly future.

5.4.1 On-farm projects and the emerging SBTs carbon projects and finance

On-farm carbon projects can be associated with many interventions including sustainable improvement of the cocoa yield, halting on-farm deforestation beyond the farm deforestation and extension, agroforestry and better soil management as well as input use. These are generally called climate-smart farming practices and a number of guidelines have been developed specifically for the cocoa sector[3].

Low carbon cocoa could be produced over a period of years through implementing such climate-smart farming practices. It should be accompanied by a premium value to be agreed by the value chain partners in order to provide farmers with a continuous incentive to improve their climate performance. To do so, appropriate farming and trading standards need to be developed to better reward farmers' efforts towards climate-smart cocoa production. Such farming and trading practices are still nascent but are rapidly developing.

Key tools and standards for assessing and verifying the carbon footprint of cocoa include: the GHG Protocol and its various product and project level guidelines, the Cool Farm Tool, ISO 14064 and the Gold Standard Value Chain Intervention Standards.

The guidelines for on-farm projects are constantly being refined to better reflect realities. An important technical development recently was the recognition by SBTi that carbon removals (e.g. agroforestry trees) should contribute to companies' SBTs. This was done under the SBTi FLAG initiative (please refer to SBTi & WWF, 2022).

Another recent development is the work of Gold Standard and ISEAL which provides sustainability systems with approaches to align their commodity certification with GHG emission reporting good practices (please refer to Gold Standard & ISEAL, 2022).

[3] The most prominent are the training manual Climate-Smart Agriculture in Cocoa (World Cocoa Foundation & Rainforest Alliance, 2018) and the climate-smart cocoa guidelines (Alliance Bioversity and CIAT & Rainforest Alliance, 2022).

5.4.2 Off-farm projects and the carbon in- or offsetting credits finance

Off-farm carbon projects[4] for the cocoa sector are typically associated to either:

- *Forest conservation, reforestation, afforestation projects* - overall so-called REDD+ projects
- *Wetland restoration projects*
- *Community projects* such as cookstove, water filter, and biomass to energy projects

Off-farm carbon projects have been developed and certified to ensure compliance with recognised carbon project standards such as the Verra VCS and CCB Standards, the Gold Standard or the Plan Vivo Standard, and potentially other specific requirements associated with a particular voluntary carbon market. Carbon credits generated by certified carbon projects are sold to buyers in the relevant voluntary carbon markets and consequently retired from the relevant carbon standards registry.

It is important to note the development of a new REDD+ jurisdiction initiative called the Architecture for REDD+ Transactions (ART) and its standard called The REDD+ Environmental Excellence Standard (TREES) in recent years. The key features of this new REDD+ approach include the large size of the jurisdictions to avoid carbon leakages to other nearby areas and stricter carbon standard criteria. Seven REDD+ jurisdictions have now been approved including selected jurisdictions in Brazil and Ghana. In association with this new REDD+ scheme, the Lowering Emissions by Accelerating Forest finance (LEAF) Coalition was launched, bringing together governments and companies committed to halting deforestation and protecting tropical forests at scale.

Currently, there are more than 2000 carbon projects worldwide, spanning different technologies, projects and regions. However, off-farm carbon projects are still rare in cocoa landscapes around the world. Below are two common approaches of carbon projects and corresponding initiatives as examples.

5.4.2.1 On- and off-farm projects and National Carbon Program finance

REDD+ is the most common type of National Carbon Program associated with forest conservation and regeneration in cocoa origins. In the last 10 years, it has become an important mechanism for mitigating climate change worldwide. The mechanism aims to reward stakeholders for conserving or restoring forests as a means of reducing carbon emissions.

One of the main sources of financing of rewards has been carbon credits from the voluntary carbon market or other schemes such as the World Bank's Forest Carbon Partnership Facility (FCPF). This monetization of carbon has made it possible to channel a large volume of resources to conservation activities in developing countries. However, REDD+ projects face the major challenge of creating equitable benefit-sharing that ensures that the largest share of carbon benefits goes to the communities that protect

[4] An offset is a carbon credit generated by a carbon project not connected or related to a company value chain. An inset is a carbon credit generated by a carbon project close by or connected to a company value chain.

the forests. In this regard, many projects around the world are continuously improving the distribution of REDD+ benefits through a number of strategies, including strengthened local governance, transparency in the administration of money in the long term and the appropriate oversight of different entities involved.

5.4.2.2 Payment for ecosystem services

PES are based on linking buyers (usually corporate actors) with sellers of ecosystem services to create the necessary incentives for their conservation or improvement (there must be at least one buyer and one seller). PES schemes are defined in this paper as innovative private deals and government led programs structured around the premise that natural ecosystems provide valuable services (carbon, water or biodiversity-related) and that paying landowners and other stakeholders to provide such services can help ensure their continuance while generating income for those willing to participate.

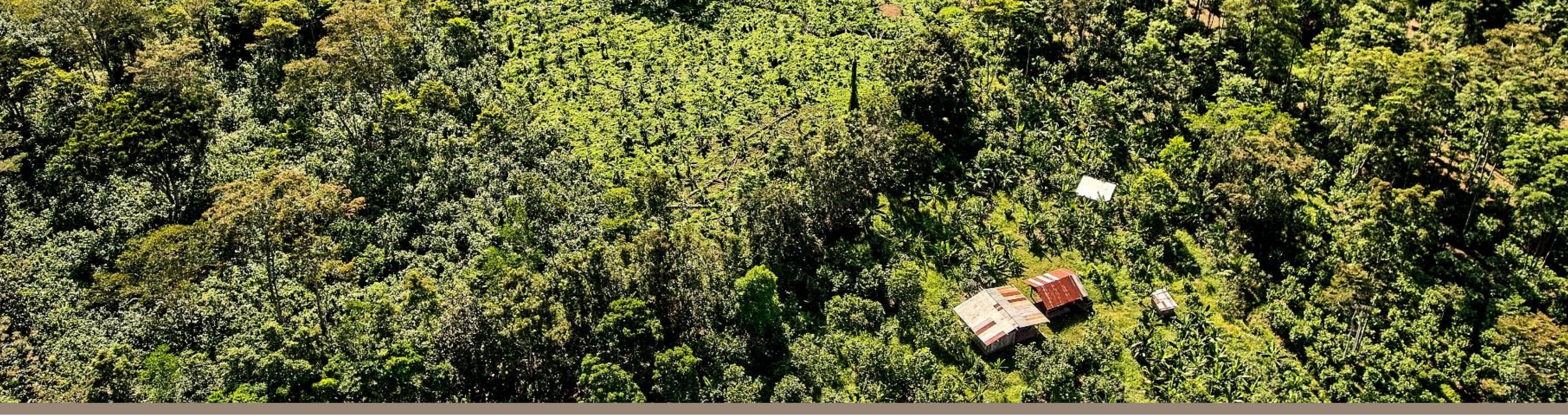
PES should target areas and ecosystems of strategic interest for the provision of environmental services. It is therefore suitable as a strategy for landscapes where cocoa is grown or cultivation tends to be expanded. The aim of PES is to encourage landowners and land managers to achieve the greatest impact with available resources by conserving and restoring the greatest possible area, thereby reducing transaction costs. PES should be additional, meaning that the gain in ecosystem services should be the result of the measures implemented, which would not have occurred otherwise. To demonstrate this, a PES must have a Monitoring, Reporting and Verification (MRV) system in place to assess the impact and effectiveness of the system and, as a PES is not a grant, the results must be substantiated.

The benefits of PES can include improving livelihoods and creating a new source of income for landowners and land managers, maintaining and restoring healthy ecosystems, introducing sustainable or regenerative agricultural and forestry practices to a large group of farmers in a given landscape, producing new products and accessing new markets, and empowering local stakeholders and ensuring long-term sustainability and stewardship of their landscape.

Even though, the application of PES concepts to the cocoa and chocolate sector is still quite new, there are a number of projects and initiatives emerging. For example, the International Cocoa Organization (ICCO) and South Pole are currently implementing the “Feasibility of Payments for Environmental Services in Cocoa Farming” project across Africa, Latin America, Asia and Oceania (please refer to ICCO, 2022). Further, the Peruvian government's PES initiatives and their application to the cocoa sector through the Mecanismos de Retribución por Servicios Ecosistémicos (MERESE) regulatory framework is another emerging concept. MERESE is an instrument that allows for the generation of and investment in actions aimed to conserve ecosystem services through voluntary agreements between ecosystem services buyers and sellers. The most important ecosystem service among the projects developed so far is water regulation, but new projects are emerging in the cocoa sector in Peru.

6 Member Case Studies

We conducted interviews with various SWISSCO members between June and October 2022, focusing on investment costs and project features that promote regenerative or climate-friendly cocoa production. The following chapter includes a comprehensive analysis of project data from Bolivia, Peru, Colombia, Ghana and Côte d'Ivoire.



6.1 Choba Choba: Huayabamba Valley Landscape (Peru)

Financing	Total budget	Transition period	Supported farmers	Use of Climate & Nature Finance/Certification
-	-	-	35-50	No

Agroecosystem degradation combined with low productivity is a major problem in the region. The project takes an approach to improve farmers' livelihoods and resilience. The main objective is to increase average cocoa income and productivity per hectare by promoting climate-resilient agroecological practices and improving farmers' management tools and skills. This has the potential to empower farmers to become independent and make informed decisions according to their specific circumstances and preferences. By 2023, 35-50 farmers will benefit from the project, with the potential to expand the approach to about 3000 farmers in the Huayambamba Valley, Peru.

First, an economic model was developed pre-implementation to calculate the expected costs over a period of 10 years (**Figure 10)**. The establishment costs in the first year are estimated at CHF 1'945 per ha. In the first two years of the agroforestry system an income from annual crops can be derived, amounting to CHF 1'699 in year 1 and CHF 1'589 in year 2. In year 3, it is predicted that cocoa trees can be harvested for the first time, adding to the annual revenue. Gradually, an income of approximately CHF 3'000 by year 10 can be generated from one ha of agroforestry.

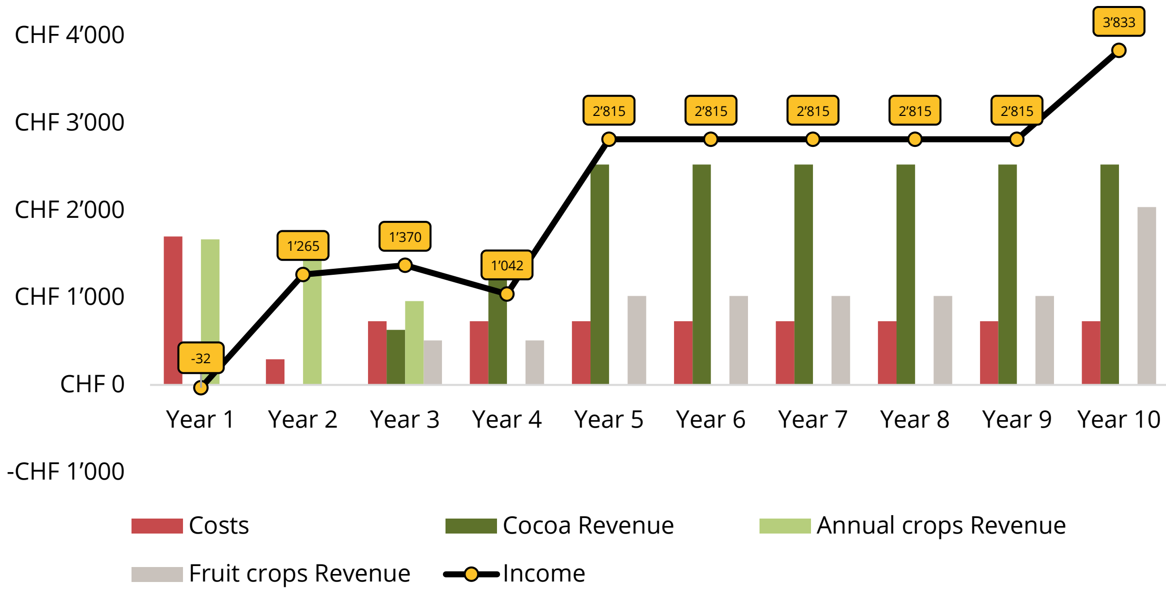


Figure 10: Choba Choba economic model of expected income from agroforestry

After one year of implementation the first real farmer data is available from five farms. As can be seen in **Figure 11** and **Figure 12**, the results obtained deviate from the economic model due to various reasons. The economic model (**Figure 10**) predicted an average income of CHF -32, however, the actual average income from the novel farming system amount to CHF -1103 excluding subsidies and CHF -125 including subsidies. Contrary to the economic model, the farmers cover about 33% of work with (unpaid) family labour. For this reason, the costs are lower than in the model, where it is assumed that 100% of the labour is paid. Further, the setting up of the plots is not yet completed and therefore different activities considered in the model are not yet executed.

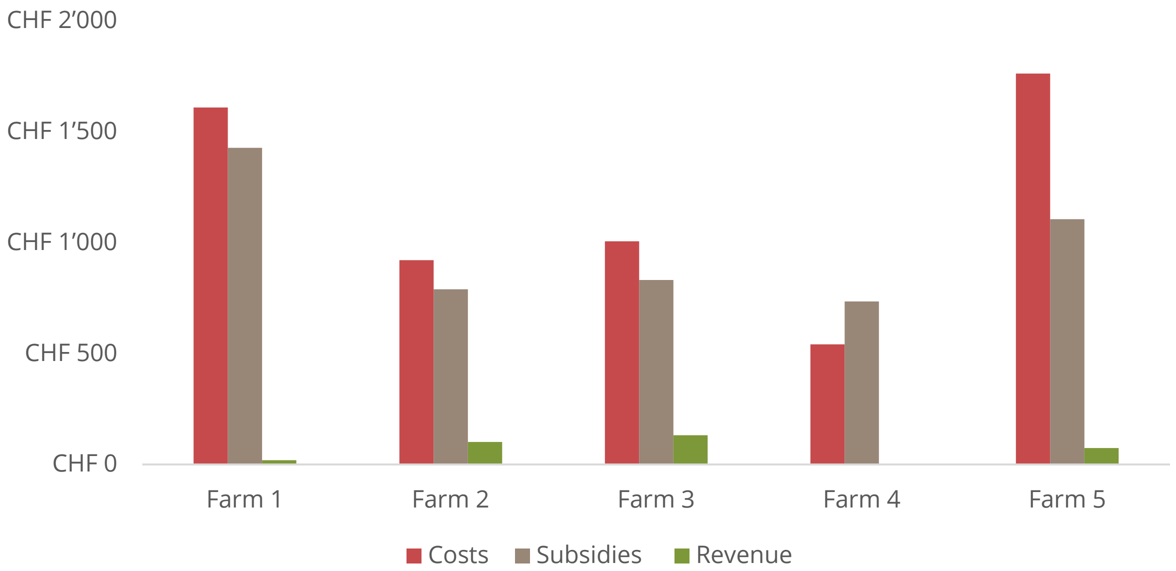
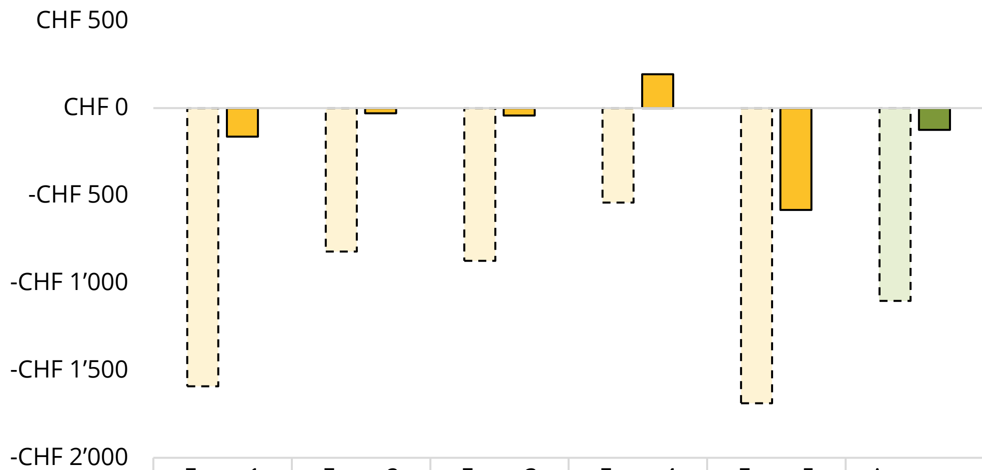


Figure 11: Choba Choba Cost and Revenue structure

Moreover, the financial support provided by the Choba Choba Foundation, as indicated in the figure above contributed to the cost struture of each farm. The foundation supported the producers by subsidising part of the labour used in the course of the plot installation and provided the members with seeds and the timber and fruit tree seedlings free of charge. This financial support represents an incentive for producers to participate in this first phase of transition to agroforestry systems previously unknown to them. It can be seen that the financial subsidy contributed to the overall costs of the installation and the actual income per hectare has to be adapted accordingly (**Figure 12**).



	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Average
Income without subsidy	-1590	-820	-874	-541	-1689	-1103
Income with subsidy	-163	-30	-43	194	-582	-125

Figure 12: Choba Choba income per hectare

On average, the subsidy for seeds and seedlings accounts for CHF 509 (52 %) per hectare and CHF 496 (48 %) for labour.

Questions to the interviewee

Are there aspects of the project design that you would do differently in retrospect? At the moment only the data of one year after the first interventions on the plots are available. Various tasks involved in the installation of the plots are still to be carried out, so the total costs of the installation are not yet available. In order to be able to observe the performance, we need to continue with the recording of information from the farmers in order to be able to see the economic performance (of the installation as well as of the coming years). In addition, the need to put more emphasis on good record keeping was identified. An important lesson is certainly that the daily reality of the producers (as well as their working habits) differs from the theory based on economic models. This was foreseeable and demonstrates the importance of the context.

Which opportunities do you see for the future development of the project? During this first installation phase, it was possible to note a great deal of learning on the part of the producers in the practices and management of the system - a factor that will allow us to get closer to the theory of the model and the reality of the producers.

6.2 Pakka: Cacao + Sostenible (Colombia)

Financing	Total budget	Project period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	CHF 12'346	1 year	50	No

The project supports smallholder cocoa farmers from two cooperatives with 2-5 hectares of land through participatory processes. The farmers are required to plant trees and maintain them over a period of one year which is supported with training and monitoring from an advisory team. At implementation, the farmers must consider the food, commercial potential and conservation value of the trees they choose. As shown in **Figure 13**, the programme costs total CHF 12'346, with the costs being highest in the first four months after implementation due to input and staff costs.

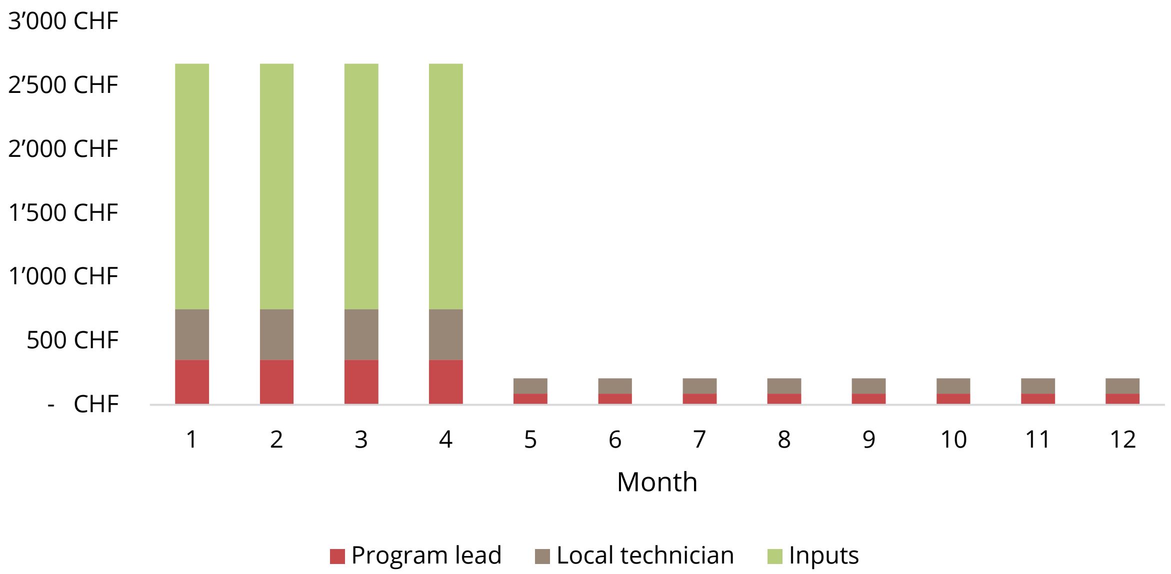
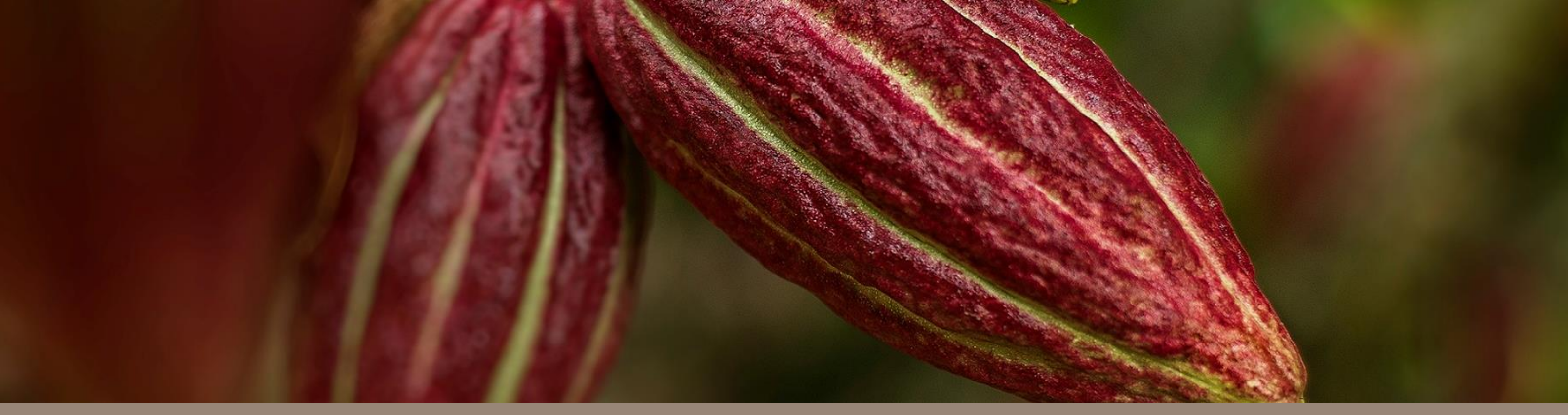


Figure 13: Pakka Cacao + Sostenible annual costs

At the beginning of the project, the farms were assessed and amongst other things it was highlighted that the farms had greater than the recommended shading. Farmers in Cooperative 1 had an average shade level of 48%, while members of Cooperative 2 had an average of 63%. This led to a focus on barriers and conservation rather than further planting within the crops. A total of 4'989 "living barrier plants" (a barrier between conventional and organic production required for certification) and 3'357 conservation plants were planted. The mix of trees considered local consumption, other income crops as well as conservation.

Question to the interviewee

Are there aspects of the project design that you would do differently in retrospect? It is typically not possible to hire a technician part time, so a larger program or integration with other program activities should be considered. Additionally, this should be partnered with investigation and technology, as well as other incentives such as carbon credits and cost reduction strategies such as local production of inputs. Also, a special focus should be on a reduction of costs as this is the largest growing challenge for regenerative agriculture in Colombia.



6.3 Colcocoa: PlanT (Colombia)

Financing	Total budget	Transition period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	-	3 years	14	Yes

Colcocoa set up a reforestation programme to promote environmental conservation and ecological restoration through agroforestry and sustainable agricultural practices on Colombian cocoa farms. Its offsetting model operates on the voluntary market and is facilitated by PlanT, a marketplace tool that allows individuals to purchase carbon credits and financially support the reforestation programme. Better to say PlanT uses 'smart contracts' to provide transparent and traceable mechanism.

PlanT, the venture supported by Colcocoa, has planted over 30'000 trees in Colombian Cacao Farms. Each tree is estimated to offset between 0.2 and 0.5 tonnes of carbon during its 12-20 year cycle and is valued at USD 3.5, of which the producer receives 60% in cash. Colcocoa's PlanT is now expanding its reach to smallholder producers that can receive compensation for the carbon captured in their farms (agroforestry, forest conservation). This is done through integrating connecting smallholders with existing platforms and complementing it with PlanT's carbon compensation credits that are expected to be sold at a price of CHF 12/MT- 15/MT.

Another option for farmers is to participate in the planting of trees. Colcocoa receives CHF 3.5 for each tree planted, of which the producer receives 60% in cash. In all cases, the farmers sign a contract with Colcocoa that sets out the objectives and obligations of each party. This contract is registered in the *Registro Nacional de Reduccion de Emisiones* to avoid double counting. Colcocoa guarantees payments for the first year, equivalent to approximately CHF 1100 CO2-equivalents (CHF 7), which is higher than the price paid on the national market (CHF 3).

Question to the interviewee

Are there aspects of the project design that you would do differently in retrospect?

The main challenge remains in making the programme sustainable by reducing the operation costs and securing sufficient sales of carbon credits to cover the costs. Another key challenge is integrating the different initiatives and opportunities for PES from the farmer's side, including but not limited to carbon capture.

6.4 FiBL: SysCom (Bolivia)

Financing	Total budget	Project period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	-	Start: 2007	~1000 visiting farmers per year ~7000 video views	No

SysCom is a research project with the focus of comparing different cacao production systems in a long-term trial. In addition, through participatory on-farm research activities, it looks for practical oriented solutions to improve organic agroforestry systems. Apart from the comparison of organic and conventional management, the project especially assesses the performance of diverse cocoa agroforestry systems in comparison to cocoa monocultures. Bolivia is not a big producer of cocoa on the world market but has a long tradition of organic cocoa production. About 2000 farmers produce cocoa in the region of Alto Beni. More than 1200 cocoa farmers are organised in cooperatives and these cooperatives adhere to the umbrella organisation El Ceibo. El Ceibo, the farmers, own the whole value chain up to final chocolate bars for local and export market.

The long-term experiment was established in 2008/2009 to compare the agronomic, economic and ecological/environment performance of different cacao production systems: to study conventional and organic cocoa production in monocrop (full sun) and agroforestry (shaded) systems[5].

- **Monoculture**, full sun (in the cocoa production phase) with **conventional management**
- **Monoculture**, full sun (in the cocoa production phase) with **organic management**
- **Agroforestry system** with **conventional management**
- **Agroforestry system** with **organic management**
- **Dynamic agroforestry system** (DAF) without external inputs

As shown in **Figure 14**, the long-term trials show that the cocoa yield per ha is highest in full-sun monocultures with conventional management, organic production reaches slightly lower but similar yields. Cacao yields in Agroforestry systems are lower than monocrops but identical for organic and conventional agroforestry. Lowest cacao yields are reached in the most complex dynamic agroforestry systems.

[5] Details on the treatments can be found on https://systems-comparison.fibl.org/project-sites/bolivia/lte.html.

In all systems a mix of 12 cacao-varieties has been planted. Highest yielding clones are 4 clones from a local participatory selection programme of El Ceibo.

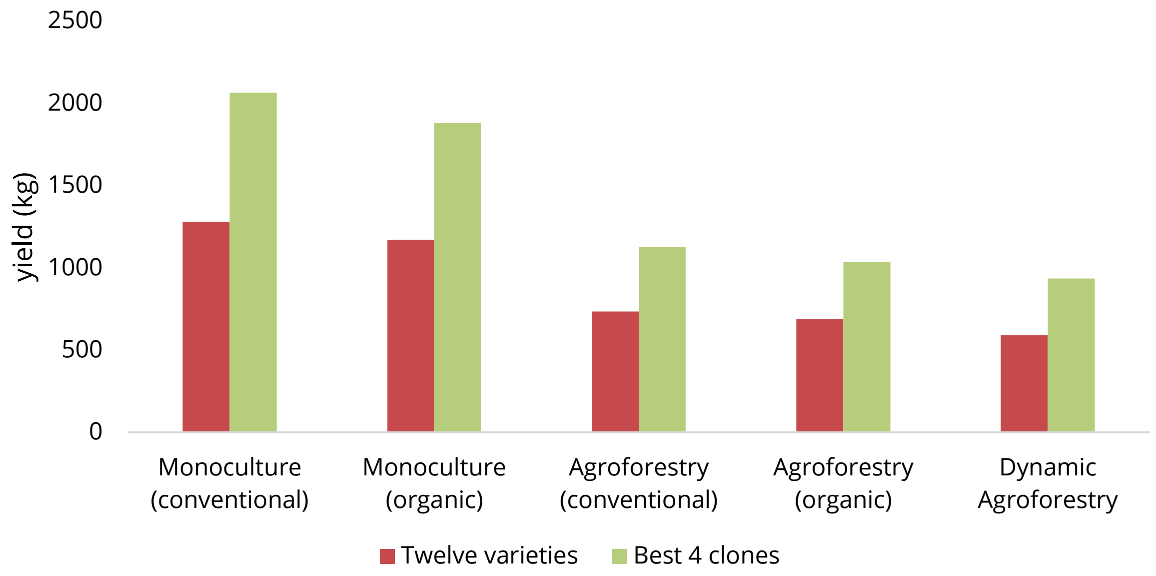


Figure 14: FiBL SysCom avg. annual cocoa yields (ha) in mature systems

Note: Data from 3 years, preliminary data.

If differentiated further according to the cost structure of the various systems, it becomes clear that organic agroforestry and DAF systems achieve comparable incomes (CHF 2'945 and CHF 3'182 respectively) to organic monocultures (CHF 3'204), but also provide ecosystem services and diversify the income of farming households (**Figure 15**). Also, the costs per ha are significantly lower in agroforestry systems compared to conventional monocultures.

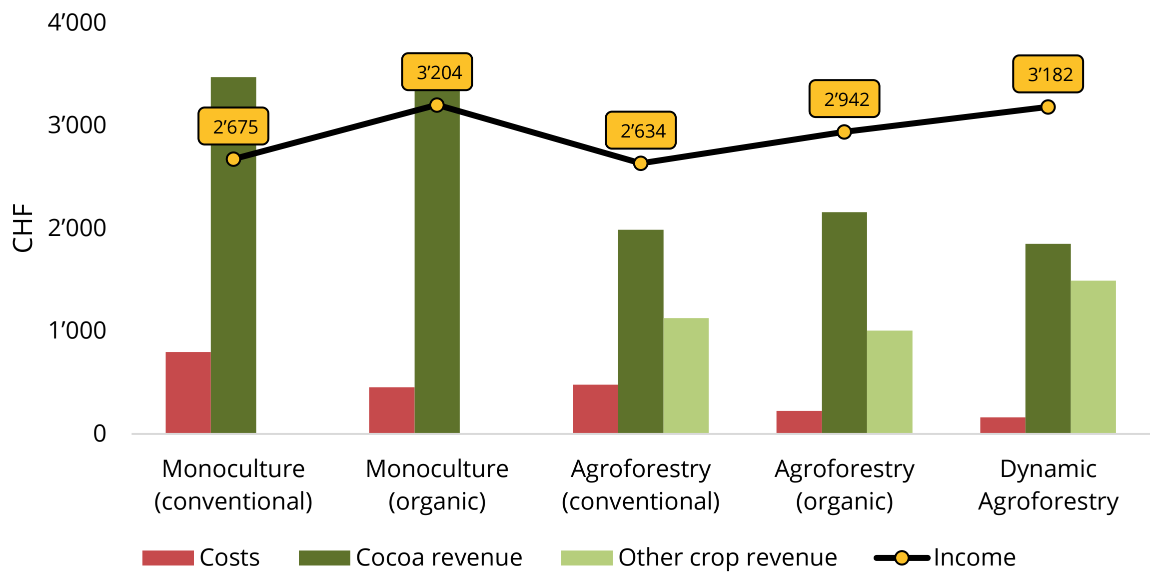


Figure 15: FiBL SysCom income generation in mature systems (ha/year)

Note: Data from 3 years, preliminary data.

In organic systems where weeding is done mechanically and compost needs to be produced (only applied in monocrops since 2016), these two activities increase labour time compared to conventional systems. In Agroforestry systems regular shade tree pruning to homogenize canopy cover is labour intensive. Pest and disease control is done with regular removal of pods in all systems. Conventional systems, especially monocultures, have higher cost related to the external inputs. As shown in **Figure 16**, this leads to a shift of different activities in the respective production systems and to an increase in total labour days per year (**Figure 17**). These are highest in DAF plots (145 days) and lowest in conventional monocultures (102 days).

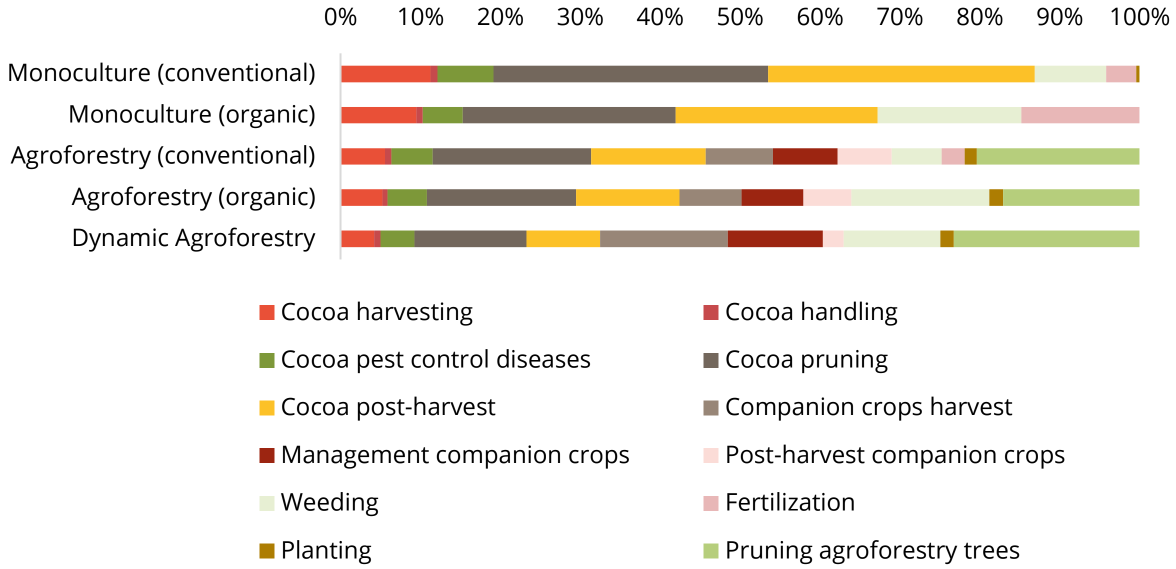


Figure 16: FiBL SysCom share of different activities in mature systems

Note: Preliminary data.

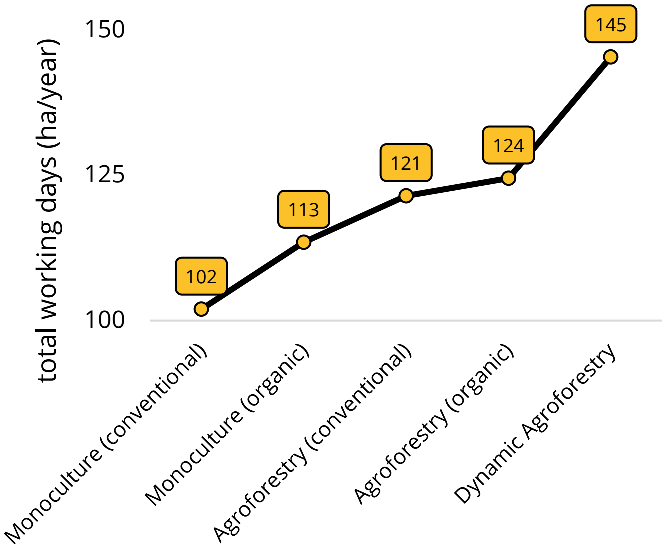


Figure 17: FiBL SysCom total working days in mature systems

Note: Data from 3 years, preliminary data.

Question to the interviewee

Are there aspects of the project design that you would do differently in retrospect?

Pruning has been done too often in recent years and will be done less frequently in the future. This is not yet reflected in the current data but will lead to fewer total working days in agroforestry and DAF systems.

6.5 HALBA: Sankofa - Alliances for Action (Ghana)

Financing	Total budget	Current project period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	3'500'000 CHF	2019-2023	2877	Yes

The Sankofa Project combines complex DAFS that mirror the natural environment of cocoa trees with CO_2 offsetting using the Gold Standard. Given the ongoing degradation of soils, the focus is on optimising overall farm productivity rather than solely maximising cocoa production, taking into account income diversification, food security, resilience to climate variability and the reduction of the use of inputs such as pesticides and fertilisers.

As shown in **Figure 18** below, the costs of implementing the project on 100 ha/year amount to CHF 481'100 in the first year, with establishment costs including seedlings and seeds accounting for the largest share (CHF 176'000). By year 5, the total costs of the project decrease to CHF 187'500 with staff costs accounting for the largest share.

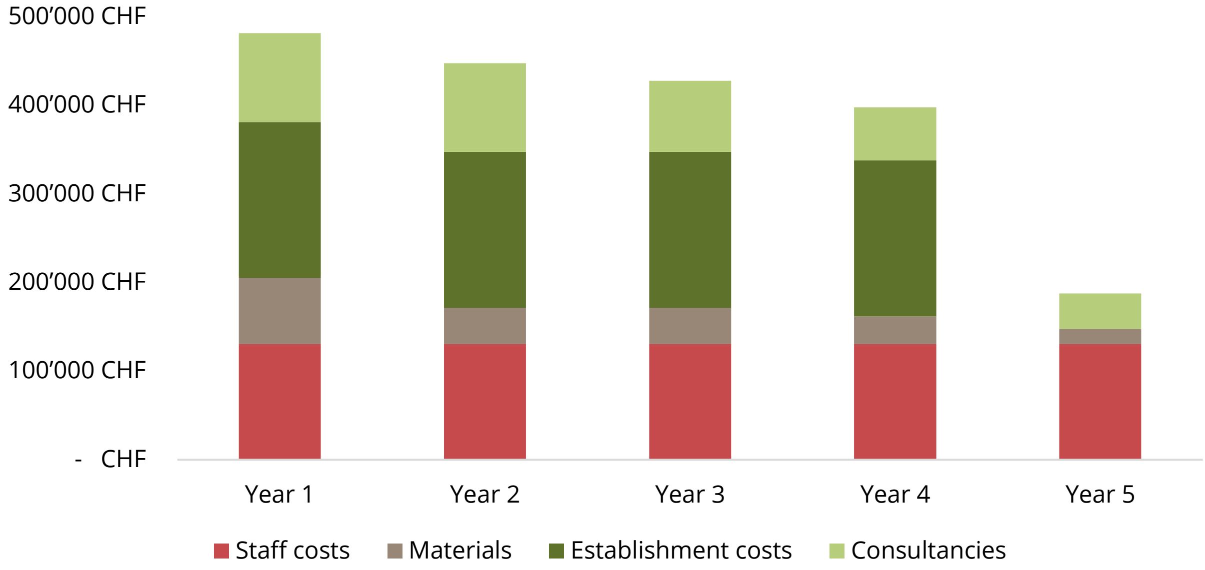


Figure 18: HALBA Sankofa costs

The cost of planting 1 ha of DAF is CHF 1'161 (**Figure 19**), with a planting density of 2700 trees of more than 20 species in addition to cocoa trees one year after implementation. The canopy cover ranges from 30 to 100%. Through the years, the tree density may be reduced and individual trees removed. This applies primarily to fast-growing trees with a short life cycle. In a 30-year-old DAF plots, the canopy cover is between 90% and 115%. However, this can be reduced to 30% with heavy pruning.

The establishment of a cocoa plantation is to be considered as an investment, with a life span of at least 50 years. There is no data available to cover the whole life cycle, but an insight can be gained into the investment costs of the first few years.

Due to the complex structure of the DAF system, revenue can be generated from year one, while costs are incurred for implementation, marketing and harvesting. A net income can be earned from month 14 onwards. In the third year, there will be only little income from annual crops and the main income will come from bananas, minor crops and firewood. From the 4th year, the cocoa and from the 5th year, the fruit trees will bear fruit and contribute to the income. After about 10-12 years, cocoa should reach a production of 800 kg/ha if well managed, and from year 5, precious woods can contribute to the income.

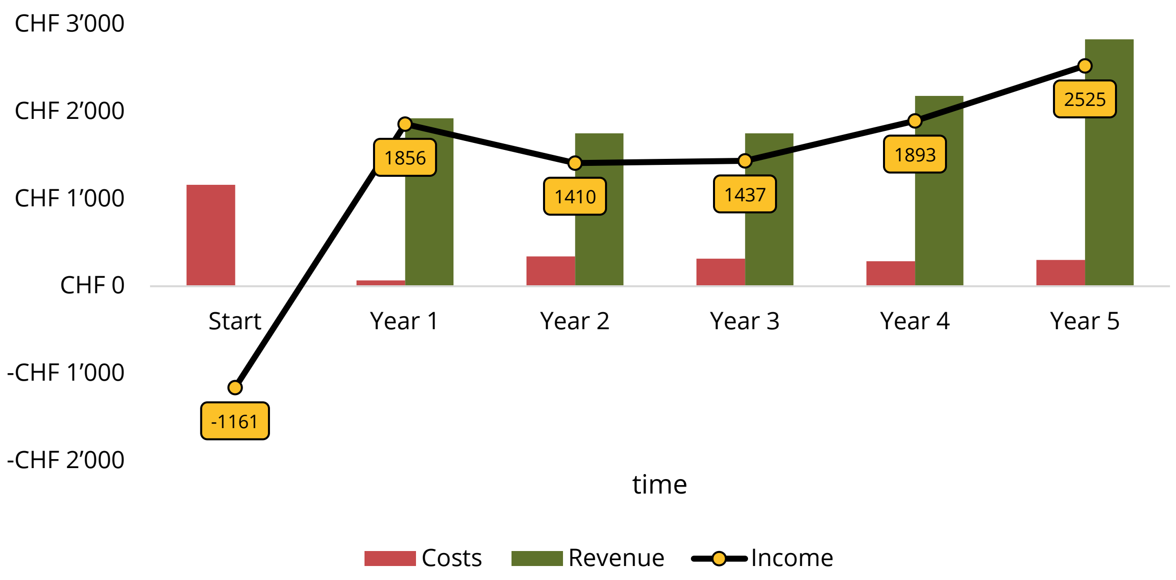


Figure 19: HALBA Sankofa net benefit year 1 (ha)

It was calculated that 1 ha can stock 120t CO_2. **Table 5** shows that, depending on the price per ton of CO_2 that can be paid, 1 ha can result in a return of between CHF 2'040 (CHF 17 per t/CO_2) and CHF 12'000 (CHF 100 per t/CO_2).

Table 5: HALBA Sankofa calculations of CO_2 per ha

CHF/t CO_2	CHF/ha
17	2'040
30	3'600
50	6'000
100	12'000

6.6 CABOZ: Village Cocoa Competence Centres (Côte d'Ivoire)

Financing	Total budget	Project period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	CHF 531'746	3 years	1200	No

The project co-financed with Bahlsen GmbH & Co. KG aims to diversify and rejuvenate a total of 300 ha, with each participating farmer receiving a ¼ ha demo plot. The approach is based on the concept of DAF to ensure long-term soil fertility and favourable conditions for cocoa cultivation as well as other crops such as staple foods, fruit and timber trees. As a result, farmers and their families benefit from long-term productivity and diversification of their income through the production of staple crops and eventually from an increase in their income.

As shown in **Figure 20**, agronomic costs such as seeds and seedlings account for 36% of project costs. Local costs, such as logistics and infrastructure, amount to 10% and consultancy costs to 9%. The largest share of costs (45%) is attributed to other costs such as administrative and labour costs.

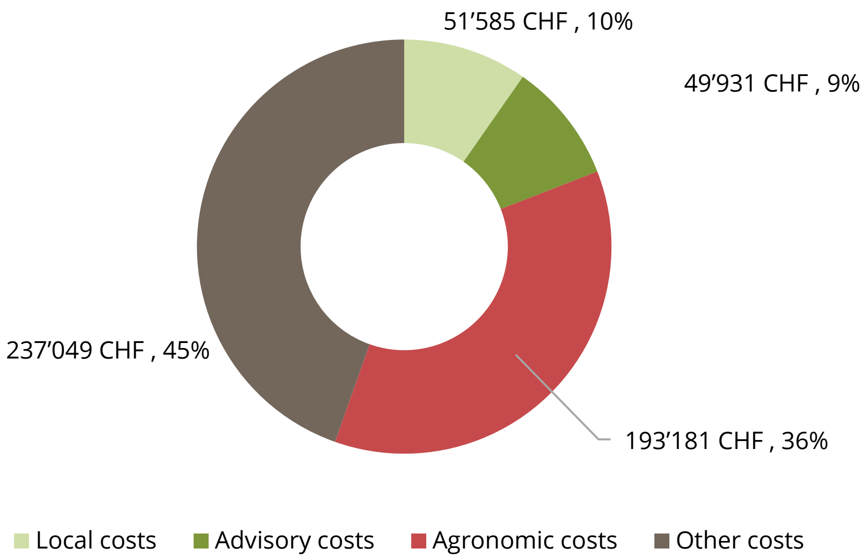


Figure 20: CABOZ Village Competence Centres project costs

The entire transition takes about ten years but develops dynamically over time. The plantations have a great diversity of about 2800 trees and plants per hectare, arranged in a low, medium and high layer, so that a high CO_2 sequestration of 156 t CO_2 per ha after

13 years can be expected, taking into account only above-ground biomass and discounted with 40%. The total sequestration is even higher and comparable to a young secondary forest.

During the first three years income and food is generated though the production of staple food and bananas on the same level as income from the old monoculture cocoa plantation. Many plants and trees are planted and continuously pruned to enrich the soil. After three to five years, the cocoa and fruit trees begin to produce, and the production of staple foods is continuously reduced.

The return on labour is higher in dense agroforestry system compared to monoculture systems. The total income from all products produced on the plantation is higher and more diversified compared to the previous monoculture. Although less cocoa trees per ha are planted, the production of the mature plantation trees is higher due to the fertile soil compared to monoculture and depending on the species, forest trees can be used from about 10 to 20 years of age.

Questions to the interviewee

Are there aspects of the project design that you would do differently in retrospect? The current strategy, based on the concept of DAF, was chosen based on the experience we gained in a previous three-year project. It focused strongly on the rejuvenation of cocoa trees with the integration of 25 ha of shade trees. Our experience shows that the main interest of the farmers is cocoa as their main income (survival rates of cocoa trees of over 95%). Integration of shade trees was possible but less successful overall (survival rate of 65%). Farmers tend to perceive shade trees as competitors to cocoa trees. The value of shade trees (climate change resilience, improved moisture balance, positive impact on soil fertility) is perceived as too far in the future or too abstract. The immediate benefit for farmers right at the beginning of the project is crucial to gain their trust.

Which opportunities do you see for the future development of the project? Increase the number of participants without compromising the quality of training and support for farmers and develop agronomic strategies and markets for secondary products that are suitable to local conditions. It is to be verified if a PES model (carbon reduction) is sustainable and/or the right incentive for farmers to practice more sustainable agriculture, because of the absence of a consistently agronomic policy that would embed such mechanisms in a legally binding framework offering more security for both parties.

6.7 *Barry Callebaut: Landscape Approach to Reduce Deforestation and Increase Farmer Income (Côte d'Ivoire)*

Financing	Total budget	Project period	Supported farmers	Use of Climate & Nature Finance/Certification
Co-financed	CHF 781'000	2020-2022	720 with PES 1000 with capacity development	Yes

This project focused on stopping deforestation and providing cocoa farmers with an alternative income through innovation to address these issues and fulfil company commitments to zero deforestation and improve farmers' incomes. To this end, a PES system was established with voluntary contracts for cash and/or in-kind contributions subject to compliance with a land use plan and/or changes in farming practices. The PES contribution was intended to provide farmers with funds to conserve trees, in addition to motivating them to keep the trees in place. The approach had a project cost of approximately CHF 576'000 in year 1 and 2 (**Figure 21**). The exact cost breakdown for year 3 is not available, but the costs amount to CHF 204'929.

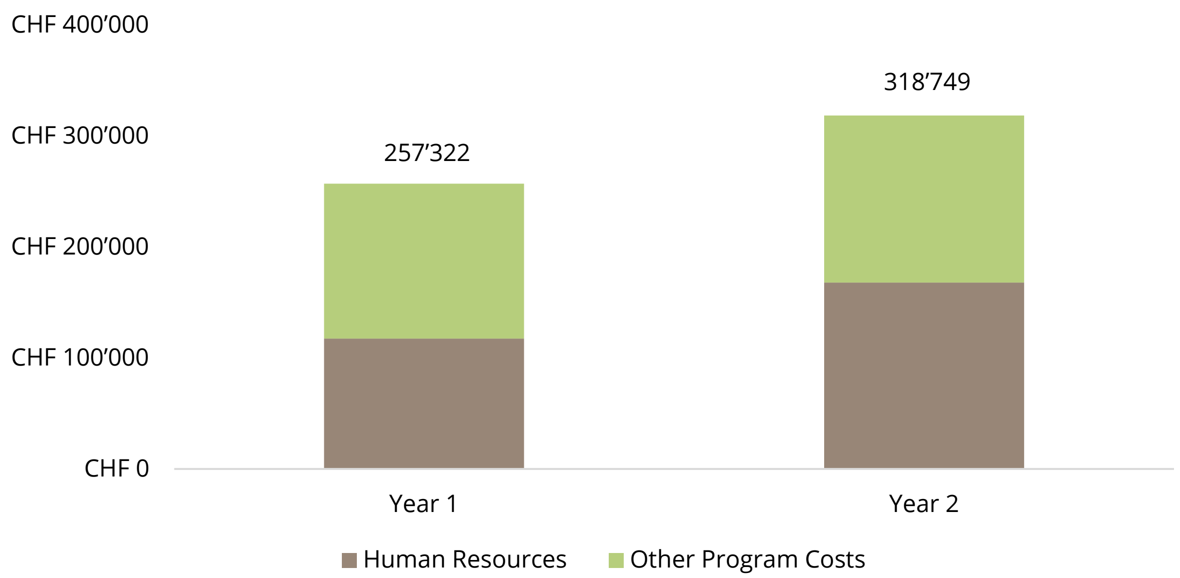


Figure 21: Barry Callebaut project costs Year 1 and 2

By the end of the project in 2022, 1200 ha of cocoa agroforestry systems have been established, 15 ha of native forest conserved, 90 ha of land reforested, and 720 PES contracts worth USD 75'000 have been signed. While the PES Scheme was welcomed by the project participants, the cost - benefit ratio is questionable as the PES payment was too low according to farmers. Farmers received ~1 CHF / Tree for three years (in total). During focus groups, farmers responded that they would like to receive 2-6 times more than they got. This is based on feedback from qualitative focus groups with project participants. As a result, and despite the successful implementation of the PES program, the original hypothesis did not prove true, i.e., farmers' income did not increase significantly.

Questions to the interviewee

Are there aspects of the project design that you would do differently in retrospect?

Some cocoa farms are in classified forests, and farmers were concerned that they would be displaced because of a participation in the project. Therefore, initial interest was lower and additional awareness raising and community involvement was needed. In addition, it is important to involve farmers in the design of agroforestry and PES - tree species preferences may vary from region to region. Difficult logistics also need to be considered, and flexible seedling delivery infrastructure needs to be put in place to accommodate unpredictable planting schedules. It should also build on the existing infrastructure for paying sustainability premiums to save resources. Forest conservation in Côte d'Ivoire has proven difficult, as there are few forested areas left that are not small and scattered. Nevertheless, reforestation has proven to be a promising intervention that is gaining traction in farming communities as their knowledge and experience of climate change increases.

Which opportunities do you see for the future development of the project?

Work with local authorities to create conditions for agroforestry (especially land tenure) - without the support of authorities, scaling up is highly unlikely and costly and channel joint sectoral investments into interventions that deliver ES.

6.8 Showcase: M-Climate Fund

Since 2019, the Migros Group has been committed to the SBTi and set itself ambitious CO_2 reduction targets for 2030 in line with the Paris climate protection agreement. By 2050 at the latest, the Group is set to have net zero emissions. By targeting this goal, the Migros Group aims to continue setting a good example in the area of climate protection. The M-Climate Fund supports the ambitious and science-based climate goals of the Migros Group, with money from the fund going to finance measures for the reduction of CO_2 emissions along the value chain. Companies throughout the Migros Group and their suppliers will thus be offered a financing instrument for the promotion of effective climate protection domestically and abroad. The M-climate fund, managed by myclimate, will be financed through the pricing of CO_2 emissions in Migros Group companies and through customer offsetting. These financial resources will be used to support climate protection projects developed specifically for the fund, which effectively reduce CO_2 emissions along the company's own value chain, both in Switzerland and internationally. If these projects are realised in accordance with international standards, they can also be used for the offsetting of greenhouse gas emissions. The financing mechanism of the M-climate fund further contributes to the reduction of CO_2 emissions, because the Migros Group sets itself a financial incentive for the reduction of these emissions by putting a price on them and thereby making use of the tangible incentivising effect of internal carbon pricing.

Project ideas can be submitted by Migros Group companies as well as by their suppliers. All projects that are supported by the M-climate fund must meet at least the following requirements.

- Effective and measurable reduction of CO_2 emissions along the Migros value chain
- Contribution made towards sustainable development
- Evidence that the project idea would have no chance of implementation without the funding

Additional requirements apply for insetting projects that are implemented and certified based on a recognised project standard. The M-climate fund relies on your project ideas! Get in touch if you would like to submit a potential project for further investigation. myclimate will help you assess your project idea and check whether it meets the necessary requirements. You can find more information on the submission of project ideas and the requirements in the support application at myclimate.org/migros or contact us directly: m-klimafonds@mgb.ch.

Lessons learned

- Project sourcing is more time consuming than originally expected. It needs way more time to evaluate value chains suited for project development. At start, Migros was expecting to get enough request for financing projects within the value chain without investing a lot of time and resources.
- Get the people from procurement on board since they are the ones with most contact with the suppliers and therefore a valuable support in the project sourcing process.

6.9 Showcase: The Forests and Communities Climate Fund (FCCF)

Globally, scientists predict that up to 10 GtCO2 will need to be removed annually from the atmosphere by 2050 to reach net zero. In 2021 almost 45% of large companies surveyed by South Pole have already set a net zero target requiring them to offset credits they cannot avoid. Sourcing removals is becoming very expensive because of:

- Huge demand: >75% of countries and 50% of large companies will have to source carbon credits to meet net zero goals
- Limited supply: demand for removals is either limited (nature based) or very expensive (engineered)

The FCCF allows investors to secure access to high-quality nature-based carbon removals to meet their needs. The FCCF is an investment vehicle that efficiently pools private and public resources and expertise to facilitate long-term investment in high-impact forestry projects. These projects will improve community livelihoods while storing carbon and reducing emissions across tropical landscapes, which generates high quality carbon credits.

How it works:

- $100m of capital from South Pole other investors, invested in carbon projects
- Portfolio targets 90% forestry carbon removal credits, 10% Jurisdictional-REDD+
- Technical assistance from public funder to bring projects to match the funds requirements

Management: The FCCF will be managed by South Pole, the largest developer of high-quality climate action projects globally. South Pole draws on over 15 years' worth of experience designing, developing, financing, implementing, operating, monitoring and verifying the impacts of more than 700 international climate action projects.

Eligibility criteria: FCCF is looking to invest in high-quality nature-based projects that fit the following requirements:

- Geographic focus: countries producing key commodities (incl. cocoa, palm oil, beef, soy and sugarcane) that investors source from and are important for their brand stories such as Ghana, Côte d'Ivoire, Indonesia, Brazil, India, Columbia, Vietnam, Ecuador, Peru and Mexico
- Project types: at least 90% nature-based removals only. Maximum 10% avoidance or removal credits from jurisdictional carbon programs.
- Minimum investment per project: USD 2m needed investment
- Project counterparts with track record and experience with project type and location
- Attractive in terms of profits: this means that it meets investors' market price expectations for the particular project type and location

Potential points for collaboration: The FCCF is looking to connect with experienced and reputable project developers who are looking for funding and is looking to source a pipeline of eligible nature-based projects that meet the above required criteria.

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