# Understanding and Defining Climate-Smart Cocoa:
## Extension, Inputs, Yields, and Farming Practices

January 2014

NCRC
NATURE CONSERVATION RESEARCH CENTRE

FOREST TRENDS

# Understanding and Defining Climate-Smart Cocoa: Extension, Inputs, Yields, and Farming Practices

Rebecca Ashley Asare, Forest Trends & Nature Conservation Research Centre

December 2013

Accra, Ghana

## Acknowledgements

This work was conducted on behalf of the Climate Smart Cocoa Working Group; an informal group of stakeholders from the private sector, civil society, and government who have been meeting since early 2011 to contemplate how to foster a shift from Ghana's current cocoa production system to a future climate-smart sector.

Many people have provided input or help in the preparation of this working paper. In particular, the author would like to recognize the following individuals for providing valuable information, insights, and contributions during the drafting of this document: Vince McAleer (Armajaro), Dr. Stephen Ampofo (Cocoa Abrabopa Association), Victor Mombu (Rainforest Alliance), Vincent Manu (Solidaridad), Angela Deppeler (Bern University of Applied Sciences), Mawuko Fumey (Environmental Consultant), Dr. Winston Asante (Kwame Nkrumah University of Science & Technology), and Thomas Addaquay (DePauw University). Thanks are also extended to John Mason (NCRC), and all the members of the climate-smart cocoa working group for commissioning this work and providing guidance, and suggestions along the way. Finally, thank you to Phil Covell, Frank Hicks, Kerstin Canby, and Michael Jenkins, President of Forest Trends, for their guidance and support.

This work is supported by Forest Trends with a grant from UKaid, Department for International Development (DFID). Additional support has been provided by IUCN-Netherland's Ecosystem Alliance.

UKaid
from the British people

# Table of Contents


**Executive Summary** ........ **1**

**1. Background** ........ **3**

1.1 Introduction: What Are We Trying to Do ........ 3

1.2 Historical Context of Cocoa Farming in Ghana ........ 4

1.3 Current State of Cocoa Farming: Productivity, Extension Services, and Practices ........ 10

**2. Climate-Smart Cocoa** ........ **28**

2.1 What is Climate-Smart Agriculture? ........ 28

2.2 Outlining Climate-Smart Cocoa in Ghana ........ 29

2.3 Why Is Current Effort Not Climate-Smart ........ 31

2.4 Defining the Climate-Smart Cocoa Approach ........ 33

**3. Conclusions & Next Steps** ........ **41**

3.1 Conclusions ........ 41

3.2 Next Steps ........ 41

**References** ........ **43**

# Executive Summary

Ghana is one of the leading countries in Africa showing a strong commitment to reduce emissions from deforestation and forest degradation. Early in its REDD+ readiness process, agriculture and specifically cocoa farming were identified as the major drivers of deforestation and forest degradation across the high forest zone. Initial thinking and testing of the potential REDD+ cocoa play, led by Nature Conservation Research Centre (NCRC) and Forest Trends, underscored the need to address cocoa farming as a major driver of forest degradation, but raised a number of technical and methodological challenges to developing such a project. As an alternative, NCRC and Forest Trends highlighted the opportunity presented by a climate-smart agriculture (CSA) approach. In 2011, key private sector, public sector and civil society stakeholders came together to explore the potential for climate smart cocoa production in Ghana. Cocoa is one of Ghana's major agricultural commodities, but as a leading cause of forest degradation, and ultimately deforestation, it was felt that there was a need to begin to think critically about the state of cocoa farming in the country, threats to the long term sustainability of the sector, and what a more sustainable future scenario would look like.

According to the FAO (2013b), climate-smart agriculture refers to agriculture that sustainably increases productivity, resilience (adaptation), reduces or removes GHG emissions (mitigation) and enhances the achievement of national food security and development goals. The concept gained prominence in 2010 during international climate change negotiations, and despite the lack of consensus towards an international agreement, REDD+ discussions were making slow but steady progress. However, many countries and influential stakeholders felt that agriculture was not adequately captured in the evolving REDD+ space, and thus the issue was formally raised.

The main challenge facing the sector is that extensive (or expansive) cultivation of cocoa in Ghana is still the most widely practiced and ubiquitous land use across the five major cocoa producing regions, as compared to increasing national production via substantial yield increases on-farm. As a result, the gap between farmers' yields (approximately 400 kg/ha) and their potential yield (>1000 kg/ha) remains unacceptably large and the pressure on forests reserves from smallholder cocoa farmers' expansion continues. Many of the agronomic problems that challenged Ghana's cocoa sector in the mid to late twentieth century are the same problems that projects and programs are trying to address today. These include ineffective extension systems, low yields, over-aged trees, and limited use of agricultural inputs. The responses to the problems are also similar—increasing access to hybrid planting material, targeting farmers with trainings and information, and providing farmers with credit in the form of inputs and materials. As a smallholder crop and a commodity of national and international importance, there is both a demand for a climate-smart approach to cocoa cultivation and a tremendous opportunity to increase the sustainability of the cocoa production landscape. The demand emanates from the very real need for mitigation actions, and the urgency to adapt the cocoa farming system to increase its resilience in the face of global warming. Across Ghana's high forest zone, cocoa continues to be a major driver of deforestation and degradation, and the farming system continues its evident shift away from complex cocoa agroforests to low or no shade systems that will be more susceptible to reductions in rainfall (particularly during the dry season) and increases in temperature, both of which present threats to cocoa (Anim-Kwapong and Frimpong 2008). At the same time, chocolate companies also recognize a growing consumer demand for climate-smart production systems and products.

The Cocoa Board already aims to make Ghana, "the number one best quality producer of cocoa in the world". This strategy, according to the government, necessitates cocoa becoming, "a sustainable product in a way that takes good care of the environment and also gives the farmer the best income for what he produces, and also satisfy the requirements of the international market." For a sector that has predominantly relied upon an expansionist production strategy and has significantly contributed to the degradation and deforestation of the high forest zone over the past 100 years, this statement represents a major shift in environmental thinking.

In Ghana, for Climate-Smart Cocoa (CSC) to work it cannot focus at the individual farm scale, as is currently the case with certification and other extension efforts. Instead, it becomes the capstone to a bundle of coordinated but diverse actions that can be monitored at a landscape level and collectively result in the production of climate-smart cocoa beans by virtue of being produced from a climate-smart landscape. Given the nature of Ghana's cocoa production system, the challenges facing the sector and the identified pillars of CSA, the main elements of a CSC approach will not be equal. The CSC approach in Ghana needs to be founded upon the following main elements:

- **Mitigation** coupled with MRV and data management;
- **Increases in yield**, founded upon effective extension systems, access to inputs, targeting of appropriate soils, and farmer risk reduction packages;
- **Economic development** that centers on land-use planning.

The by-products or benefits that will derive from these foundational activities will include adaptation and food security.

In articulating this system, the report argues that by expanding the existing extension network and increasing access to critical farm resources, farmers will have the capacity to adopt the recommended climate-smart practices and increase their yields—one of the underlying pillars of the concept. If yield increases are combined with serious land-use planning and the implementation of a multi-scale MRV/data management system, then mitigation through the adoption of CSC practices can be achieved. When the resulting yield increases and mitigation impacts are taken at a sector level it will also be possible to highlight economic, adaptation and food security benefits, and ultimately the production of a climate-smart cocoa bean.

This report represents the first time that anyone has specifically defined CSC production practices and measures. While many of these practices overlap with existing recommended practices, on-going efforts largely exist in isolation, without a clear focus on the climate (and how climate will pose a threat to cocoa, in addition to the cocoa emissions footprint) and without linking yield increases, farm to landscape-level monitoring and reporting (MRV), data management, and land use planning.

In articulating this system, the report argues that by expanding the existing extension network and increasing access to critical farm resources, farmers will have the capacity to adopt the recommended climate-smart practices and increase their yields—one of the underlying pillars of the concept. If yield increases are combined with serious land-use planning and the implementation of a multi-scale MRV/data management system, then mitigation through the adoption of CSC practices can be achieved. When the resulting yield increases and mitigation impacts are taken at a sector level it will also be possible to highlight economic, adaptation and food security benefits, and ultimately the production of a climate-smart cocoa bean.

# 1. Background

## 1.1 Introduction: What Are We Trying to Do

Ghana is one of the leading countries in Africa showing a strong commitment to reduce emissions from deforestation and forest degradation. Early in its REDD+ readiness process, agriculture and specifically cocoa farming were identified as the major drivers of deforestation and forest degradation across the high forest zone. Initial thinking and testing of the potential REDD+ cocoa play, led by Nature Conservation Research Centre (NCRC) and Forest Trends, underscored the need to address cocoa farming as a major driver of forest degradation, but raised a number of technical and methodological challenges to developing such a project. As an alternative, NCRC and Forest Trends highlighted the opportunity presented by a climate-smart agriculture (CSA) approach.

The CSA agenda came to the forefront of international discussions around climate change mitigation and adaptation in 2010, at the first global conference on Agriculture, Food Security and Climate Change in The Hague. At the time, it was clear that agricultural expansion was often a significant driver of deforestation and degradation, and that there was a need to find incentives and opportunities to reduce agricultural drives. However, there was also wide spread recognition of the significance of agricultural production for southern economies and of its importance as a sources of food and income for millions of smallholder farmers and farming families. In addition, there was consensus that many agriculture and agroforestry systems can play an important role in sequestering carbon and increasing resilience to climate change. Thus, the concept of climate-smart agriculture emerged in the international negotiations as parties struggled to make progress on other fronts.

In early 2011, Forest Trends and its local partner NCRC initiated a working group to explore the potential for climate-smart cocoa. Cocoa is one of Ghana's major agricultural commodities, but as a leading cause of forest degradation, and ultimately deforestation, it was felt that there was a need to define strategies to reduce the entry of illegal cocoa and other farms into forest reserves based on improved cocoa productivity in off-reserve areas. It was equally focused on maintaining forest patches and maintaining/increasing tree cover in existing cocoa farms across the landscape. Over the course of 12 months, the working group—which was made up of government institutions, major private sector entities (including cocoa buying companies, banks, and insurance agencies) and civil society organizations—began to think critically about the state of cocoa farming in the country, threats to the long term sustainability of the sector, and what a more sustainable future scenario would look like. The key output at the end of 2011 was a consensus report entitled: "The Case and Pathway toward a Climate-Smart Cocoa Future for Ghana."

The report concluded that the sector was on an unsustainable path due to the following factors:

- Impending threats from climate change, namely changes in temperature and rainfall patterns;
- Singular focus on intensification without thought to how yield increases could promote further expansion and deforestation;
- Complete lack of land use planning.

In an effort to change the "business as usual" scenario and to put the sector on the path to a more sustainable future, it recommended adoption of a climate-smart cocoa (CSC) approach. The model for climate-smart practices (as defined in this document) reflects a sustainable intensification strategy that combines increased shade cover (40-50%), as recommended by the Sustainable Tree Crop Programme (STCP),[1] with the adoption of "best practices", including key elements of the High Tech and CODAPEC programs, that lead to significant yield increases, as has been demonstrated by the Cocoa Abrabopa Association (CAA) (among other organizations).

Under a CSC production scenario, climate-smart practices would result in higher productivity per unit area, in addition to increases in the climate resilience of the cocoa systems as fertilizer and shade trees contribute to better litter decomposition rates and higher drought resistance. The climate-smart scenario would also reduce the degradation and deforestation pressure on forest reserves and forest/trees in the off-reserve landscape, leading to the maintenance and enhancement of carbon stocks in the landscape. However, keen enforcement of land-use plans has to be a key measure of "best practice" cocoa management to prevent situations where increasing productivity will increase deforestation. If farmers and farming communities adopt these farm

[1] http://www.treecrops.org/

level and landscape scale practices, then they qualify for a range of benefits, including access to risk reduction packages, like cocoa yield insurance and credit, and access to possible climate benefits for community projects.

Finally, the report identified critical gaps to achieving the "desired state" of cocoa production. These included:

- **Increasing yields** — The need to define and describe climate-smart cocoa best practices, including a focus on extension, inputs, and appropriate soils that will lead to yield increases.
- **De-risking cocoa farming** —The need to develop climate yield insurance and expand access to credit facilities so as to reduce farmers risks.
- **Landscape planning** —The need to harness a process or mechanism to implement community level landscape planning to curb expansion into forest reserves, target the most appropriate cocoa soils, retire over-age high biomass cocoa farms, and grow forest and trees in the landscape.
- **Data management & MRV** — The need to identify or construct a platform and system to manage and link data at multiple scales related to climate-smart cocoa so that mitigation impacts can be measured and monitored over time.

Activities have been drawn up to address all of these gaps. This report focuses on the first gap—determining how to increase yields using an assemblage of extension models, input packages, and recommended farming practices that in unison provide the foundation for a CSC production system.

The report is organized into two sections. Section 1, takes a broad historical look at cocoa production and yields, cocoa extension services, and farming practices (both recommended and practiced) in Ghana so as to better understand the long terms trends associated with the farming system and their influence on contemporary programs and practices. It then describes current projects and programs and the associated extension systems and input packages that are available to farmers. In Section 2, the report defines CSA, and based on this understanding makes an argument as to why current efforts in the cocoa sector are not in line with a climate-smart approach. The report defines what a climate-smart cocoa production system can and should look like, giving specific detail about what would constitute climate-smart practices and how they need to be linked or networked together. Finally, the report draws some overarching conclusions and outlines critical next steps.

This is the first time that detailed recommendations have been put forth outlining climate-smart practices for a major West African small-holder commodity. The ultimate aim of this report is to define the practices, resource packages and extension systems needed to support climate-smart cocoa production and ultimately the creation of a new type of commodity.

## 1.2 Historical Context of Cocoa Farming in Ghana

Contrary to popular belief, "peasant" farmers were not the founders of Ghana's cocoa growing industry. Ghana's cocoa economy was created by capitalist farmers and spread through wide scale migration across the forest belt, while remaining anchored by traditional structures and social relations (Hill 1963). Even before the introduction of cocoa, inhabitants of The Gold Coast[2] were already experts of the market economy as Ghanaians were actively involved in various commercial markets and trade routes, including the trade of palm oil and oil palm kernels in the mid-19th century, and wild rubber at the turn of the 20th century[3] (Berry 1992). Despite the presence of Britain's colonial government, and unlike other producing countries where European companies owned plantations and controlled the trade, Ghana's cocoa industry was fueled by Ghanaian capital, Ghanaian enterprise and Ghanaian technology (Hymer 1971).

Over the decades, the institutional structure managing the cocoa sector grew in scope and scale, but farmers' entrepreneurial mindset continued to drive production trends, resulting in both growth and decline of the sector. In particular, producers' responses to market fluctuations, government policy, resource scarcity and abundance, and natural events( like diseases and fire) explain why national production has fluctuated over time, why the center of production has shifted, and why farming strategies have shifted from viewing cocoa as a land-based investment opportunity to that of a diversified, extensive, livelihood production

[2] The name given to the British colony, which later became known as Ghana upon independence in 1957.

[3] 1.5 to 4 million lbs. of rubber were produced between 1885 and 1895. After 1900 this market collapsed in response to over-tapping, competition from Malaysia, and attention to new cash crops. Berry, S. (1993). No Condition Is Permanent. Madison, Wisconsin, The University of Wisconsin Press.

system that, while perhaps performing below its potential, has considerably fewer risks as compared to an intensive, capital demanding system.

### 1.2.1 Migration & Production Trends

Although Basel missionaries are noted to have transported cocoa to Ghana in the mid to late 19th century, Ghanaian legend honors Tetteh Quarshie as bringing cocoa to the Gold Coast (Ghana) in 1872 (Cocoa Board 2000) from Fernando Po (now Sao Tome), and cultivating it in the Akwapim Mountains in what is today's Eastern Region. According to Hill (1963), the westward migration began in 1892, and by 1910, cocoa had been so vigorously adopted and adapted into the farming and trade systems of the area that for a time Ghana was the world's largest exporter (Berry 1992), a feat that Ghanaians accomplished without significant influence or teachings from Europeans (Hill 1963). Before 1920, land shortages in Akwapim prompted the spread of cocoa to other hospitable growing locales across the Densu River as local chiefs were reserving the remaining uncultivated forest for food production (Berry 1992). Southern farmers easily adopted cocoa because it conformed well to their forest farming methods, and because they were already attuned to using forest products as cash crops. Cocoa cultivation also proved comparatively easy to plant as it demanded little labor, and was quick to yield (Leiter and Harding 2004).

Then, in the 1920s, cocoa farmers in Eastern Region witnessed the emergence of the endemic cocoa swollen shoot virus disease (CSSVD). By the '30s and '40s CSSVD had nearly devastated the local industry. In response, the colonial government initiated a major campaign to cut-out diseased trees, and farmers adapted by searching for new areas in which to plant their cocoa. Cocoa cultivation continued westward following the moist semi-deciduous forest belt into Ashanti Region and then to the Brong-Ahafo area of the country by the late 1940s. Over this period, outputs in today's Eastern Region fell by 60%, but the country's total production remained relatively stable for the next twenty-five years as losses were offset by gains from expansion and new plantings in Ashanti and Brong-Ahafo regions (Berry 1992).

Eventually cocoa became the dominant cash crop of the forest. By migrating, cocoa farmers were adapting to a series of environmental, economic, and social changes and disturbances. Localized land shortages, cocoa diseases, market fluctuations, and the increasing number of cocoa producers created an environment that drove farmers to travel to more and more remote forest areas to cultivate cocoa (Okali 1983). At its start, the migration involved three main ethnic groups—Akwapim, Krobo, and Ga—but over time came to include the Ashanti and Brong people, as well as Ghanaians who lived north of the forest belt (Amanor 1996).

As its cultivation area expanded, cocoa propelled the construction and extension of roads (both private and public) and railways that were used to bring the beans to the port (Hill 1963; Berry 1992). Large family houses and whole towns were built on the back of cocoa farming revenue. But as timber harvesting increased, many eastern migrants, trailed by migrants from Ashanti and Brong, followed the logging roads that were opening up in western parts of Brong-Ahafo (Berry 1992) and other prominent timber areas. Cocoa cultivation crossed down into the moist evergreen forest of the Western and Central regions in the early 1960s.

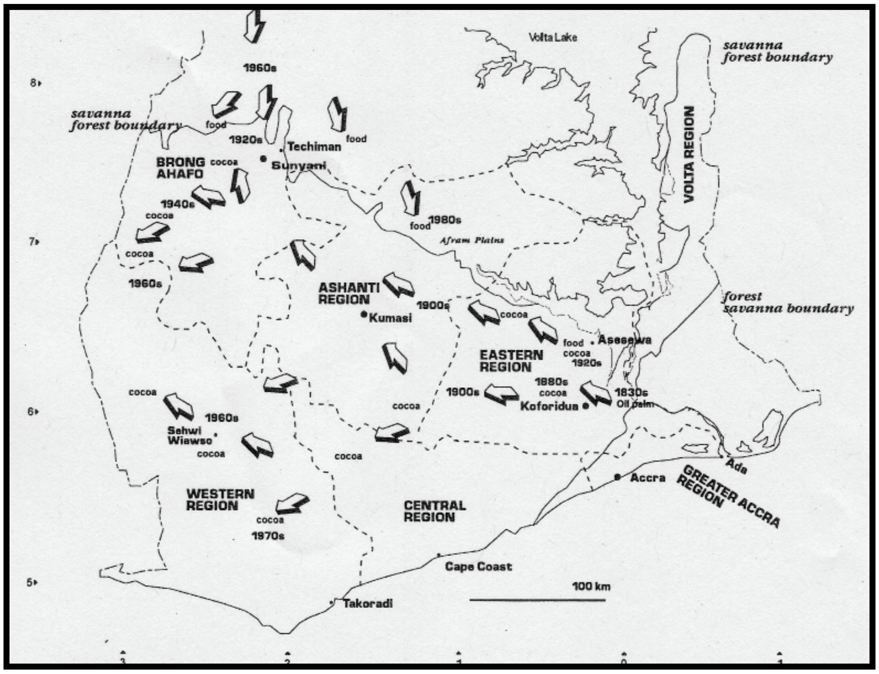
During the 1964/1965 growing season production hit a high of 580,000 tons, but then began a twenty year decline. Berry (1992) cites changing trade conditions, heavy taxation, and a production boom in neighboring Côte d'Ivoire that drew labor away from Ghana as being partially responsible for the decline. The Ashanti Cocoa Project (World Bank 1975) cited low producer prices, lack of technical assistance to farmers, inadequate farm input delivery system, over-aged trees, and the lack of a sector development plan as contributing to the decline. Figure 1 provides an overview of cocoa production from 1961 to 1999 (FAOSTAT 2013).

In the '70s, the yields from trees planted thirty to forty years prior began to wane and in 1976 and 1977 production had fallen to 324,000 tons, and Côte d'Ivoire took over as number one global producer. When market conditions improved, farmers responded with a new phase of expansion that spread deeper into Ahafo, Western and Central regions, including the wet evergreen forest zone of Western Region (Amanor, 1996). Map 1 depicts the pattern and time frame of this migration.

World Bank reports written during this time period suggest that by 1975 cocoa cultivation covered between 1.2-1.8 million ha (3-4.5 million acres), and nearly a quarter of Ghana's total population or 2.5 million people were directly involved in cocoa farming (World Bank 1975). From 1971-1973, cocoa accounted for 62% of foreign exchange earnings and provided about one third of government revenues, a significant increase from five years earlier when it only accounted for 16% of the government's revenue (World Bank 1975).

Up to this time, expansion into previously uncultivated forest areas was the main way for farmers to adapt to local land shortages, outbreaks of diseases, and changes in cocoa market dynamics. By moving from one forest area to another, farmers tapped the "forest rent" (Ruf and Schroth 2004). The soils of the moist semi-deciduous forest type were ideal for cocoa cultivation, being rich in organic matter and nutrients. The soils of the moist evergreen and wet evergreen forest types were not well suited to cocoa, but the perception that cocoa grows best on newly cleared forest soils was already deeply engrained, and thus the migration continued.

**Map 1: Patterns of Cocoa & Food Crop Migrations**



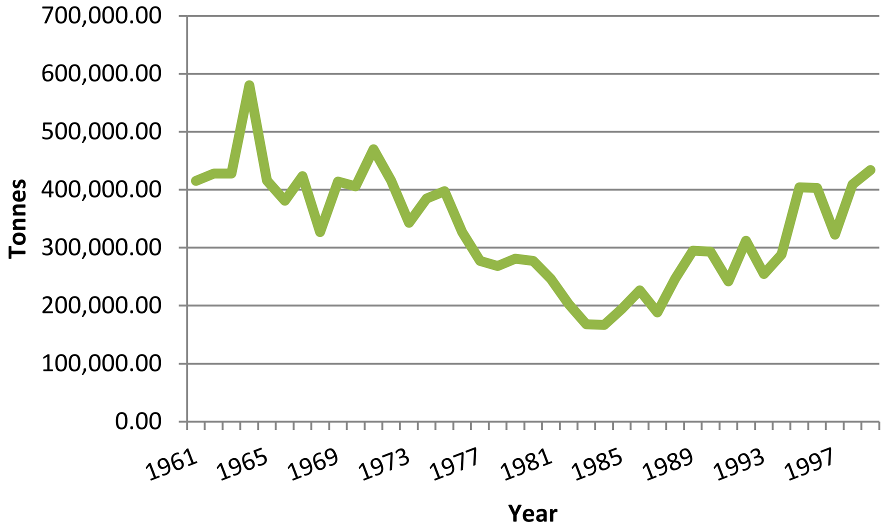

*Source: Amanor 1996*

For the migrant farmer, cocoa farms functioned as savings banks or investment mechanisms; farmers took the earnings from one farm and put them into obtaining land for a new farm. According to Hill (1963:180), "expanding was the process of securing the future", and farmers never had any problem taking a long-view given that 10 to 30 years could pass before land holdings were actually converted to cocoa fields, and cocoa itself could take up to 15 years to reach full maturity. Both examples speak to the socio-economically adaptive and forward thinking qualities of Ghana's cocoa farmers.

In 1983, after a series of years with poor rainfall, devastating bush fires swept through the country's forest belt, destroying thousands of hectares of cocoa. In the same year, the government's adoption of a structural adjustment program devalued Ghana's currency, eliminated subsidies on fertilizers and pesticides to farmers, and raised the farm gate price (Edwin and Masters 2005). In the older cocoa growing areas this raised the profitability of using the land for other agriculture crops, caused a reduction in localized cocoa expansion (Benhin and Barbier 2004) and prompted farm diversification (Amanor 1996). Some farmers entirely cut out their cocoa trees, while others just abandoned it to go into other food and tree crops, including oil palm, banana, coconut, pineapple, and even vegetables like tomatoes in the northern transitional zone of the Brong-Ahafo Region (Amanor 1996). During this period, production fell to a meager 158,000 tons placing Ghana in 12th position internationally.

Cocoa specific intervention also took place amidst the downturn, including the distribution of new cocoa varieties. Coupled with the increased farm gate price, these interventions sparked a new wave of expansion in the west of the country (where issues of disease and soil fertility were not yet manifest), resulting in production increases. From the mid-'80s to the early 2000s national production increased at a rate of 4 per cent per year (Abenyega and Gockowski 2003), as evidenced by Figure 1 (FAOSTAT 2013).

**Figure 1: Ghana National Cocoa Production (1961-1999)**




### 1.2.2 Farming Practices and Available Resources up to the Turn of the Century

In the early days, cocoa was grown by removing the forest understory, thinning the forest canopy, and planting the cocoa seedlings as a new understory cohort; thus establishing a multi-strata cocoa-agroforest. Many old cocoa farmers attest to conditions having been easier during the time of their parents and grandparents. Whether this is true or not is hard to determine, but certainly cocoa beans germinated very well in the fertile forest soils and seedlings sprouted and grew with little competition as weeds were not as prevalent in the forest understory.

> "In the days of my grandmother, you could just throw beans and they would sprout. Then you would clear the underbrush. This was the way that people got big farms."
>
> *- Mr. Owusu Boeteng, former supervisor at the CSSVD Unit in Nkawie (Ashanti Region) and an old cocoa farmer himself.*

Ruf (2011) refers to this type of system as a "complex cocoa agroforest", and notes that it saw a massive expansion in Ghana in the 1940s, which endured well into the 1980s. This system was distinguished by the large number of forest tree species, of considerable height and girth that made up the multi-strata canopy. In the early years, there was no need for fertilizer given the fertility of the moist-semi deciduous forest soils, and outbreaks of pests and diseases were dealt with through migrations. When mature, forest tree species can grow to a considerable height and girth, and to fell such trees during the land preparation process would have been a formidable task. Complex cocoa agroforests likely prevailed because there was no available technology to facilitate the easily removal of large forest trees. In terms of farm management, weeding was not necessary and it is unlikely that pruning was part of the common practice.

From the time that cocoa was first introduced to Ghana, up until the1950s, the Amelonado and Trinitario varieties of cocoa (commonly called "Tetteh Quarshie") were the only cocoa varieties available to farmers (Edwin and Masters 2005). These varieties took six to eight years to bear fruit, were found to be quite susceptible to cocoa swollen shoot virus, and showed little resistance to mirids. However, farmers described the "Tetteh Quarshie" trees as having been quite robust. The Mixed Amazon varieties, which derived from Peru, initially became available to farmers in the 1950s, when they were tested in on-farm trials. By 1961, sufficient pods and seeds had been distributed to plant an estimated 60,000 ha (Glendinning and Edwards 1962 in Edwards and Masters 2005). The Mixed Amazon varieties showed greater precocity and vigor in response to disease and pest attacks (Edwin and Masters 2005). They also had the advantage of producing pods two times in a year, as opposed to just once.

Contrary to what is commonly cited today, hybrid cocoa trees do not represent "new" varieties; but are an agricultural technology that has been available for well over forty years. During the sixties and seventies (1966-1970), research at the West African Cocoa Research Institute (WACRI) led to the development of the Original Series II Hybrids (a cross of Upper Amazon, Amelonado, and local Trinitario varieties) and in the following decades (1971-1985) Modified Series II Hybrids (Upper Amazon and Amelonado cross). Not only did these hybrids show greater disease and pest resistance, but they were able to bear pods only two to three years after planting. From the mid-1980s into the 1990s newer hybrid varieties became available as a result of efforts by a British Research Team (BRT) and then CRIG researchers. These trials resulted in the BRT collection and the Mutant Hybrids (MV5) (Edwards and Masters 2005).

In response to the availability of new technologies and extension messages, farmers' practices changed considerably. Despite being high yielding, the hybrid varieties were also comparatively tolerant to low/no shade conditions; thereby reducing shade requirements on cocoa farms (Ruf and Schroth 2004). At the same time, the increasing prevalence of chainsaws, linked to a growing timber industry, facilitated an efficient removal of "excessive" shade (Ruf and Konan 2001). Farmers' who adopted hybrid trees and lower shade levels likely did so in response to strong extension campaigns, which also promoted the use of fertilizers and pesticides. It is also probable that for some farmers, forestry laws that enable logging in off-reserve lands discouraged the retention of timber species in cocoa farms. As a result of these combined factors, Freud and colleagues (1996) estimate that in the mid-1990s 50% of productive farms in Ghana and Cote d'Ivoire had low[4] shade levels and 10-35% of farms had no-shade monocultures.

### 1.2.3 Cocoa Institutions, Extension, and Projects

Two types of cocoa institutions have prevailed throughout the history of cocoa in Ghana—a produce control and management authority, and a research institution. While the names and centers of control have shifted somewhat over the decades, many aspects of the institutional government structures have remained the same. During the colonial era, cocoa was regulated under the West African Produce Control Board. In 1947, the Cocoa Board was officially established by ordinance, though it is frequently noted that it actually traces its beginnings back to the cocoa "hold up" of 1937 (Hill 1963; Cocoa Board), an event in which cocoa beans were withheld from the market due to struggles between the Gold Coast government, and farmer associations and cooperatives over pricing and access to markets. Over most of its history, Cocoa Board has regulated all aspects of production, including research, pricing, purchases, payments, processing, marketing, exporting, extension, and overall development (Cocoa Board 2013).

A centre for cocoa research was established by the colonial government in Tafo, in June 1938 as the Central Cocoa Research Station of the Gold Coast Department of Agriculture. The establishment of the research centre was part of the colonial government's strategy to combat the upsurge in pests and diseases (Afrane and Ntiamoah 2011). Later, in 1944, the station was expanded and called the West African Cocoa Research Institute (WACRI). Following independence, WACRI was dissolved and replaced by the Cocoa Research Institute of Ghana (CRIG) and the Cocoa Research Institute of Nigeria (CRIN). CRIG was administered by a series of scientific bodies up until 1973, when it was managed as a subsidiary of the Ghana Cocoa Marketing Board, and then the Ministry of Cocoa Affairs in 1976. By 1979 the Ministry was dissolved and the institute reverted to the management of the Ghana Cocoa Board (Cocoa Board 2013).

Farm research and extension initially arose in response to pest and disease outbreaks. Reported to have emerged as early as 1918, cocoa swollen shoot virus (commonly called Cocoa Swollen Shoot Virus Disease (CSSVD)) was officially discovered in 1936 (Afrane and Ntiamoah 2011) in the Eastern Region where it had a devastating effect. Given the crop's economic importance to the Gold Coast economy, the colonial government took the threat very seriously, initiating a major "cutting out" campaign to remove trees infected by CSSVD; however, this was not well received by farmers who felt that it exemplified the colonial regime's opposition to Ghana's cocoa industry. The response also involved the establishment of a cocoa research centre (as noted above), the initiation of a quality control inspectorate, the grading of cocoa beans, and extension services (Afrane and Ntiamoah 2011).

Despite these efforts, a 1945/1946 survey indicated that CSSVD posed a major threat to the industry and was present in all major cocoa growing regions (CSSVD Control Unit 2013). In response, the government set up the Cocoa Services Division (CSD), which, combined with efforts by its predecessor colonial government institution, carried out the removal through "cutting out" of approximately 135 million diseased trees between 1918 and 1961. In 1962, the division was abolished and the responsibility of disease control handed over to farmers; however, this proved ineffective and the Division was reestablished in 1965 with a mandate to cut out visibly infected and contact trees, replant all treated farms with high yielding hybrid cocoa, and maintain replanted farms for at least 3 years before handing over to the owner (CSSVD Control Unit 2013). The Division's role in this scheme was comprehensive, i.e., to cut and replant. It resulted in a massive increase in the labor force (CSSVD Control Unit 2013).

[4] Low commonly refers to a low density of shade trees, not the quality of light passing through the canopy.

During the 1970s, cocoa regulation and management came under the Ministry of Cocoa Affairs (MCA), which oversaw the Cocoa Marketing Board (CMB) and the Cocoa Division (CD). In 1978, the Ministry was dissolved and the Cocoa Board, which reported directly to the Office of the President was reinstated. During this era, cocoa extension focused on the promotion of improved cocoa varieties (hybrids) and capsid pest control; though it is noted that out of a 3-4.5 million acres this was only practiced on 10% of farms (World Bank 1975) because existing seed gardens could only support the replanting of <1% of farms and the supply of inputs to farmers was insufficient due to bureaucratic and economic bottlenecks and an inefficient distribution system. At the time, the World Bank recommended that input supply would be better placed in the hands of the private sector (World Bank 1975).

### 1.2.4 Eastern Region & Ashanti Cocoa Projects

In 1970, the Government of Ghana received a US$ 8.5 million loan from the World Bank to resuscitate a declining cocoa sector. The loan supported a 5-year project (1970-75) to rehabilitate and replant 87,000 acres of cocoa in the Suhum area of the Eastern Region, which had been devastated by disease or was suffering from neglect and abandonment by farmers. The Ashanti Region Cocoa Project followed five years later, in 1975, and similarly sought to rehabilitate and replant 30,000 acres of degraded cocoa land supported by a loan of US$ 14 million. Table 1 (World Bank 1975) provides an indication of land use conditions at the start of the Ashanti project.

**Table 1: Land Use of the Ashanti Cocoa Project Zone and Project Area (Acres)**

| | Mampong | Konongo | Bekwai | Total | % |
|---|---|---|---|---|---|
| Cocoa - good | 104,000 | Negligible | Negligible | 104,000 | 7 |
| Cocoa – moderately to severely diseased | 20,000 | 136,000 | 71,000 | 227,000 | 16 |
| Cocoa – poor/old | 10,000 | 48,000 | 35,000 | 93,000 | 7 |
| Secondary forest and fallow | 101,000 | 182,000 | 180,000 | 463,000 | 33 |
| Cultivated land | 103,000 | 124,000 | 186,000 | 413,000 | 30 |
| **TOTAL AREA** | **405,000** | **516,000** | **478,000** | **1,399,000** | **100** |

According to the project (World Bank 1975), the cocoa sector was in the midst of a major decline and farmers were unwilling to invest in their farms or new plantings due to the following factors:

- Government's policy of low producer prices that inhibited maximization of production from existing trees, militates against new investments in cocoa, in particular, replanting low yielding over-aged trees, and encourages smuggling;
- Lack of effective technical assistance to farmers;
- Inadequacy of the farm input delivery system coupled with an import licensing system that gave no apparent priority to inputs for the cocoa sector;
- Unfavorable age profile of Ghanaian cocoa trees due to its excessive component of over-aged trees;
- Lack of a coherent overall development plan for the cocoa sector.

Combined, the two projects sought to finance the rehabilitation (following CSSVD) and replanting (over-aged farms) of 117,000 acres of cocoa with high yielding varieties in an effort to revitalize cocoa production in what had once been the "traditional" production area. Due to the cost and labor required to rehabilitate and replant old cocoa farms this was not common practice. Instead of reinvesting in farms, farmers opted to migrate and so the bulk of production was coming from new plantings in the Brong-Ahafo and Western Regions, where farmers were making new cocoa farms under the forest canopy and benefiting from the absence of diseases and fertile forest soils.

For farmers, the extension-inputs package consisted of:

- Cash credit to hire laborers,
- Input credit consisting of:
  - Spray machines,
  - Pesticides,
  - Fertilizers,
  - Plantain suckers (for early shade),
  - Improved planting material (hybrid seedlings).

- Training for farmers and staff in rehabilitation and replanting techniques--according to farmers who participated in the program, the project promoted no-burn land clearing techniques, locally termed the proka system.

The project also focused on improving the management of seed gardens, improving cocoa marketing techniques, and improving / building feeder roads.

Overall, it was agreed by the World Bank and GoG that the projects would constitute the initial phase of a major replanting program, that would also have WB support, extending over many years and hundreds of thousands of acres. On its own, the Eastern and Ashanti projects were structured to last seven years—3 years for farm establishment and 4 years for the trees to yield pods—and were expected to increase farmer income by US$ 50/acre during the initial debt repayment period (up to 18 years) and US$ 110/acre after debt repayment, assuming a 40 year cocoa tree lifespan[5] (IBRD 1975).

Both projects encountered major setbacks and neither was able to meet its target planting time frame. Consequently, both projects ended up extending their missions for an additional four years. The main challenges to success included:

- A low producer price that discouraged farmer investment in the sector, and the absence of sector reforms.
- Very poor farmer participation due to the low producer price, poor communication and attitude of extension staff, and conflicting messages between the project, government and farmers. For example, a government mass spraying campaign that ran from 1971-1973 discouraged project farmers from taking credit for disease control inputs. In some instances, farmers were so reluctant to engage that extension workers took over farms to meet their planting demands and then had to maintain the farms for the life of the project. Even by the time the Ashanti project wrapped up, many farmers were even reluctant to harvest their cocoa due to the low price and the fact that the project had effectively done all of the work for them.
- Lack of access to recommended inputs. An insufficient number of sprayers and insecticides were available to farmers as a result of procurement problems. There was also a serious shortage of seedlings, due to production and distribution limitations.
- Failure to purchase beans in a timely manner by the Ghana Cooperative Marketing Association causing farmers to sell their beans to other buyers, thereby circumventing the project's credit repayment mechanism.
- Severe drought in 1973 caused massive seedlings losses for the Eastern Region project.

Overall, it is hard to assess the legacy of this project because in 1983, severe bush fires swept through the country, destroying 11,000 acres (30%) of Ashanti project farms, and an unknown area of farms under Eastern Region project.

## 1.3 Current State of Cocoa Farming: Productivity, Extension Services, and Practices

Many of the agronomic problems that challenged Ghana's cocoa sector in the mid to late twentieth century are the same problems that projects and programs are trying to address today. These include ineffective extension systems, low yields, over-aged trees, and limited use of agricultural inputs. The responses to the problems are also similar—increasing access to hybrid planting material, targeting farmers with trainings and information, and providing farmers with credit in the form of inputs and materials (spray machines). Yet, for the most part, real changes in production have come in response to increases in producer price, predominantly in the form of new plantings. The main differences between historical trends and contemporary patterns is the attention that is now given to shade levels, as well as the social and environmental impacts of production, and the increased engagement of the private sector at the farm level.

### 1.3.1. Productivity, Programs and Projects

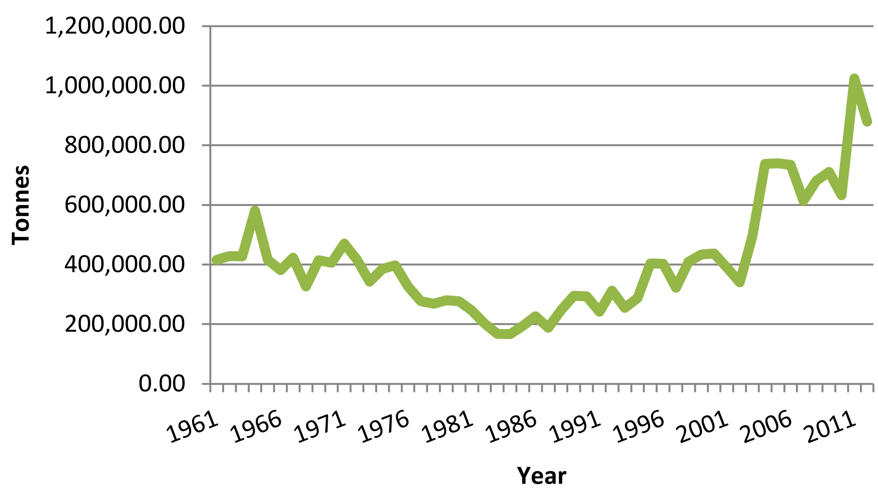
Since 2000, cocoa production in Ghana has increased by approximately 588,000 tons from a base of 436,600 tons. In 2005/2006, national production peaked at 740,000 tons and then continued upward to hit an all-time high of just over 1 million tons in 2011/2012, only to decline slightly the following year (879,011 tons). [See Figure 2.]

[5] This was estimated on the basis of a producer price of ¢16 (USD 13.9) per 60 lb (27.3 kg) head load.

The steady rise in national production since the year 2000 has occurred in concert with a consistent increase in the producer price for farmers (Figure 3)[6] and the introduction of a number of farm-level projects and programs, including a national High Tech Program to boost productivity on farm. Table 2 lists 14 current (or recent) projects and programs. The majority aim to increase on-farm yields and improve farmer and farming community livelihoods so as to ensure the long-term sustainability of the sector in Ghana.

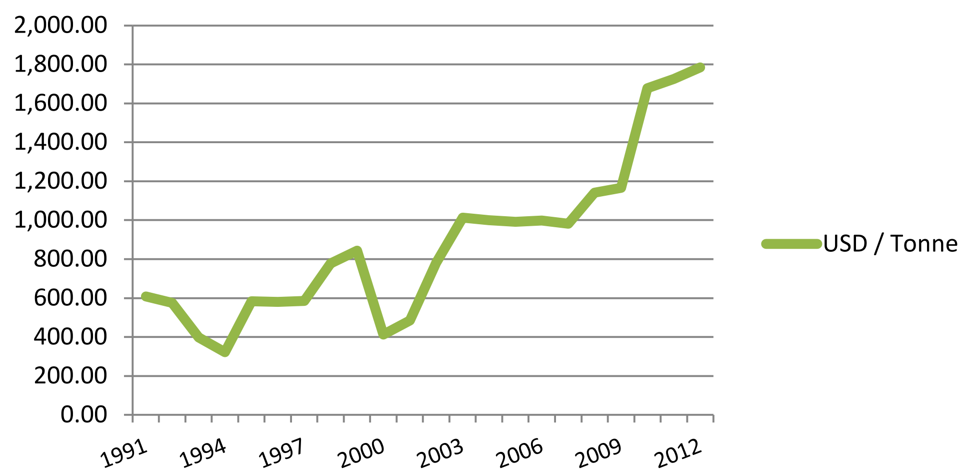
The most common institutional arrangement has been the use of public-private partnership (PPP) models. The introduction of social and environmental standards through certification, and efforts to improve access to education and other social amenities has also been the focus of these projects and social corporate responsibility initiatives. Despite the number of projects and programs in operation, very little data is available about the sector or the impact of these initiatives since monitoring results are rarely made public or monitoring does not occur in the first place.

**Figure 2: Ghana Cocoa Production (1961-2012)**




*Source: Production data reflects FAO-Stat for years 1961-2005. Data for the years 2006 to 2012 reflects LBC purchases as recorded by Armajaro.*

**Figure 3: Ghana Cocoa Producer Price**




*Source: Producer price data from FAO-Stat.*

[6] Cocoa Board made a commitment to pay producers 70% of the net freight on board (fob) price, which when implemented following the introduction of the High Tech Programme in 2001, nearly doubled the official producer price.

**Table 2: Cocoa Projects and Programs**

| Program/Project (Proponent/Donor) | Description |
|---|---|
| **African Cocoa Initiative (World Cocoa Foundation)** | A public-private partnership that aims to double productivity for 100,000 cocoa farm households in West and Central Africa through the strengthening of local and national institutions, and in doing so raise farmer incomes by 150-200%. Overall goal to institutionalize effective public and private sector models to support sustainable productivity growth and improved food security on diversified cocoa farms in the region.<br>This initiative is implemented from 2011-2016. |
| **Armajaro Geo-traceability (Source Trust)** | Project to collect data on small-holder famers and trace the cocoa bean along the supply chain. Collects personal data on farmers, as well as farm area, geographic location, and information about the management and conditions of the farm. It can then analyse and present results on web-based platform. This project has also tested a rapid biodiversity assessment method. |
| **Kraft Cadbury Cocoa Partnership** | In 2008, Cadbury started project to invest £30 million over 10 years in projects in Ghana to help transform cocoa farmers' lives. With funding from Kraft Foods, aim is to ensure that cocoa production is sustained in Ghana, and yield increased by 20% by 2012 and 100% by 2018, that farmers understand farming as a business, and to whip up support of the youth in cocoa farming, while discouraging child labour. Work is in partnership with Cocoa Board, UNDP, VSO, and CARE. As of May 2010, ten thousand farmers and their families in 100 cocoa-farming communities, as well as 55,000 members of the Kuapa Kokoo farmer's co-operative in Ghana, were benefiting from the project. Additional 109 communities have been partnered since 2011. |
| **Cocoa Abrabopa Association** | Train farmers in farm management and business skills so that cocoa farming becomes more of a business. Farmers are trained in Good Agricultural Practices, based on CRIG recommendations, and given access to credit to purchase and use inputs. Within first 3 years farmers are able to boost production from national average of 3 bags/acre (192 kg/acre or 422 kg/ha) to between 8-12 bags/acre (512-768 kg/acre or 1126-1689 kg/ha).<br>Implementing Rainforest Alliance and UTZ standards. CAA holds certificates on behalf of farmers. |
| **CocoaLink (World Cocoa Foundation)** | A mobile technology service that delivers farming, social and marketing information to cocoa farmers in 15 communities in western Ghana to improve incomes and livelihoods.<br>Pilot phase (2011-2013) |
| **Cocoa Livelihood Program (World Cocoa Foundation)** | Aims to increase farmer income while strengthening local service capacity. Three main objectives:<br>• Improve market efficiency and build capacity of farmers and farm organizations;<br>• Improve production and quality of cocoa at the farm level. Specifically, increase productivity to 840kg/ha in 5 years via Good Agricultural Practices;<br>• Improve farmers' competitiveness on diversified farms.<br>Monitoring of income and productivity. Concentration on shade systems and biodiversity by University of Arkansas scientists. Cocoa production efficiency and quality are reported to have improved at the farm level (over 106,000 farmers have been trained in good agricultural practices and farm management skills; and have increased access to improved cocoa varieties and quality agro-inputs. This is anticipated to contribute to significant yield gains above the average 400 kg/hectare of the cocoa smallholder. |

| | |
|---|---|
| **Echoes (World Cocoa Foundation, USAID)** | Empowering Cocoa Households with Opportunities and Education Solutions (ECHOES).<br><br>Strengthens cocoa growing communities by expanding opportunities for youth and young adults through basic and adult education, strengthen capacity of CBOs, and improve cocoa household incomes for livelihood development. Currently supporting 41 communities in Ashanti Region and Western Region. |
| **Fairtrade Certification (Kuapa Koko, Twin Trading)** | This model is geared to make the producers operate like a business. Fairtrade International supports the cost of group formation and farmer trainings. Working with 12 farmer cooperative unions in Ghana, including Kuapa Kokoo |
| **High Tech Program (Cocoa Board)** | In 2001 the Ghana Cocoa Marketing Board embarked on a set of policy actions designed to improve farmers' yield and generate growth in the cocoa sector. The ensemble of these actions became known as the High Tech program (HTP) with the established target of 1 million tons of cocoa by the year 2012, and an average on-farm production target of 1,000 kg/ha[7].<br><br>The HTP involved two initiatives and two supporting policy actions:<br><br>The Cocoa Diseases and Pest Control (CODAPEC) program[8]assists cocoa farmers in reducing damage from pests and diseases. In addition to other measures, it provides one free yearly spraying for each cocoa farmer.<br><br>A new Cocobod extension system financed through public private partnerships launched in 2009. Based on the farmer field school method, but integrating regional and district level officers, it implements CRIG recommended practices. Funding is primarily through donor and private sector investment. For example, over 300 regional and district coordinators of cocoa extension officers have been trained from 6 producing areas at Bunso training college by GIZ.<br><br>A commitment to pay producers 70% of the net freight on board (fob) price which when implemented nearly doubled the official producer price;<br><br>Liberalization of internal cocoa markets which has led to the vertical integration of cocoa buyers into the provision of cocoa inputs and producer credit. These have incentivized farmers to purchase and apply the fertilizers and agrochemicals promoted by the HTP.<br><br>Cocobod's current interest is in how to work with the private sector to bridge the gap between potential yield and actual output of farmers. |
| **International Cocoa Initiative** | Oversee and sustain efforts to eliminate the worst forms of child labour and forced labour in the growing and processing of cocoa beans and their derivative products. |
| **International Institute of Tropical Agriculture/Sustainable Tree Crops Program** | Though STCP has wrapped up, this research for development program was able to study and recommend specific extension methods. As a result, yields increased by 2-3 fold. It was also able to reduce the volumes of agro-chemicals applied, reduce child labor and increase planting of hybrid planting material. Challenges included high illiteracy amongst farmers, land tenure, training sharecroppers and caretakers. IITA continues to conduct farm-level research on shade, biodiversity and yields, amongst other key variables. |

[7] Opoku, E.A. 2011. A presentation on Ghana cocoa sector at the STCP regional executive committee meeting. Accra, Ghana. 3rd May. Ghana Cocoa Board.

[8] Adjinah and Opoku, no date. The national cocoa diseases and pest control (CODAPEC): Achievements and Challenges. COCOBOD.

| | |
|---|---|
| **Organic Cocoa Certification**<br>**(Yayira Glover, AgroEco-Louis Bolk Institute, Armajaro)** | Approximately 5,000 MT of organic cocoa is produced in the Suhum-Craboar-Coaltar district in Ghana's Eastern Region. These beans are purchased by Yayra Glover, and are produced by 4000-plus smallholder farmers. Organic beans can be traced to the particular farm it was produced in.<br><br>Agro-Eco Louis Bolk supports and works with the Cocoa Organic Farmers Association (COFA) which includes 350 farmers. |
| **Rainforest Alliance Certification- SAN Standard & Climate Module**<br>**(Rainforest Alliance, Olam, Armajaro, Cocoa Abrabopa Association)** | The objective of the SAN Standard is to encourage farmers to analyze and consequently mitigate environmental and social risks caused by agricultural activities through a process that motivates continual improvement. The standard is based on the themes of environmental soundness, social equity and economic viability. It focuses on Social & Environmental Management System, Ecosystem Conservation, Wildlife Protection, Water Conservation, Fair Treatment & Good Working Conditions for Farmers, Occupational Health & Safety, Community Relations, Integrated Crop Management, Soil Management & Conservation, Integrated Waste Management.<br><br>In Ghana, the goal is to bring large areas of cocoa agroforestry landscapes under sustainable management while increasing cocoa production and securing premium payments for certified beans.<br><br>Promoting certified cocoa in Ghana with multiple private sector and public partners.<br><br>Testing SAN Climate Module to be added to current RA standard.<br><br>Farmers organized into groups using lead farmer model. Each group has farmer leader and documentation officer. Both receive training in SAN standards.<br><br>833 farmers from 12 communities certified in December 2012. Now being prepared for Climate Module verification. Expansion to 20 more communities. As of Nov 2012, over 50,000 MT RA Certified cocoa from Ghana |
| **UTZ Certification (Solidaridad, Cocoa Abrabopa Association, Conservation Alliance, LBCs)** | Started in 2009. Approximately 100,000–150,000 engaged in certification. Create a sustainable supply chain from producer to consumer. Focus is on Good Agricultural Practices, Cocoa Communities, Natural Resources & Biodiversity, Effective Implementation of the Code of Conduct, Product Flow Control, Social Responsibilities, Internal Control System, Internal Inspection and Registration of Producers.<br><br>3 way relationship between Solidaridad, Akuafo Adamfo and Cargill to support sustainable cocoa production through certification. Farmer groups pursuing certification: AHANSUCOFA, SWACOFA, COMFA, Cocoa Abrabopa, Conservation Cocoa Association |

Despite major gains in national production, pricing, and the prevalence of farm-level projects, extensive (or expansive) cultivation of cocoa in Ghana is still the most widely practiced and ubiquitous land use across the five major cocoa producing regions, as compared to increasing national production via substantial yield increases on-farm. As a result, the gap between farmers' yields (approximately 400 kg/ha) and their potential yield (>1000 kg/ha) remains unacceptably large and the pressure on forests reserves from smallholder cocoa farmers' expansion continues.[9]

An assessment of land use change in five administrative districts in one of the most productive cocoa producing areas in the country (Bia, Asunafo North, Asunafo South, Juabeso, and Asutifi Districts) shows a 6.1% deforestation rate between 2000 and 2011. Further analysis of this land use change shows that there are two types of "deforestation" taking place:

- First type of deforestation, and most damaging from an ecological and climate perspective, is associated with encroachment into forest reserves and other protected forests;
- Second type of deforestation reflects the widespread conversion of high shade cocoa farms to low shade farms.

### 1.3.2. Extension Systems & Farmer Access to Agricultural Resources

In 1983, Ghana launched an economic stabilization and structural adjustment program (Economic Recovery Program (ERP)). As part of the ERP, the government introduced a series of policy reforms in the cocoa sector, aimed at removing constraints to its development. Though significantly delayed in implementation, the extension arm of Cocoa Services Division (CSD) (a subsidiary of the Cocoa Board) was eventually merged with the extension directorate of the Ministry of Food & Agriculture (MoFA) in 2000 as part of this Cocoa Rehabilitation Project (CRP) (ADB 2002).

Unfortunately, the merger of cocoa extension with MoFA extension did not increase efficiency or effectiveness of extension services to farmers. Following the dissolution of the Cocoa Extension Services (CES), all staff, both junior and senior, were transferred to MoFA and trained in General Agric to enable them to combine extension in cocoa and other crops and livestock. As such, MoFA was given full responsibility for providing technical support to cocoa farmers, in addition to their normal duties with respect to food crops, other tree crops, and livestock. But in spite of this transfer, no serious effort was made by MoFA towards cocoa extension.

In the years that followed, farmers and Cocoa Board officials complained that MoFA agents lacked adequate cocoa knowledge and motivation. The late Francis Ackom, Obuasi District Officer for the CCSVD Unit , was part of the group from CES who were transferred to MoFA in an effort to bridge the knowledge gap. In Mr. Ackom's experience, it was a difficult integration and after only a couple of years he and a few other staff were re-engaged into Cocoa Board's CSSVD Unit, though many others stayed with MoFA. The end result for cocoa farmers was that for almost a decade (from 2000-2009), they operated without a reliable and ready source of information or guidance. Given that some CES officers had been moved to the CSSVD Control Unit, CSSVD and the Seed Production Units (SPU) became the informal source of information, being the only institutions on the ground with real knowledge of cocoa trees and production systems.

More than a decade after its dissolution, the Cocoa Board inaugurated a new extension system, replacing the defunct Unified Extension System (UES) model, which used a "training and visit" (T&V) approach with a Farmer Field School (FFS) system supported by public-private partnerships and donor funding. Initially, the German Government (GIZ) supported the training of 300 Regional and District Coordinators of Cocoa Extension Officers and Community Agents from six producing areas at Bunso Cocoa College (GBC 2012). As of 2013, the companies and NGOs partnered with Cocobod in the implementation of cocoa extension include Cadbury/Kraft/Mondelez, Armajaro, Kuapa Kokoo and Solidaridad, contributing 100% of the cost. Under the Cocobod model of FFS, which deviates to some degree from the IITA/STCP model, extension officers facilitate the field school to farmers, but because funding is limited only a limited number of farmers can be reached. In comparison, FFS implemented by the companies or NGOs get better outreach as their field supervisors (extension officers) deliver the training to lead farmers and it is the lead farmers who deliver trainings to farmers, which allows far greater numbers to be reached.

Available extension methods and training models that have been in use in Ghana since 2000 include the FFS method, which was originally implemented and monitored by the Sustainable Tree Crops Program (STCP) of the International Institute of

---

[9] CCAFS, 2011. Evaluation of COCOBOD Hi-tech Programme and its impact on rural incomes and forest resources. http://ccafs.cgiar.org/our-work/research-themes/pro-poor-mitigation/high-tech-cocoa-intensification

Tropical Agriculture (IITA); the Farmer Group & Promoter method in use by Cocoa Abrabopa Association, and the mobile 'telefony' platform of CocoaLink, a project of the World Cocoa Foundation. Figure 4 outlines elements of these extension models. Table 3 provides a full description of projects, the associated extension methods, and the inputs and resources that have been made available to farmers through each project.

At the core of these projects and extension systems are a basic set of recommended cocoa farming practices and input products (with the exception of organic practices), and some farmers also have access to a range of economic resources. The recommended practices and inputs are largely based on CRIG recommendations, while the available economic resources depend on the project.

Certification programmes also draw some of their criteria from these recommended practices, UTZ more so than Rainforest Alliance, which has a stronger focus on meeting a wide range of social and environmental criteria.

**Figure 4: Examples of Cocoa Extension Models and Available Resources Used in Cocoa Projects in Ghana**

**Farmer Field School**

- Based on discovery learning
- Each community has 1-2 farmer leaders with 25-30 farmers, led by a trainer in a 4 week course spread over 10 months (every 2 weeks)
- Farmers trained on a demonstration plot- learning by doing
- Follow-on "demonstration groups" of those farmers who completed FFS
- Focus on establishment of new farms–line & pegging, replanting old farms, nursery establishment

**Farmer Groups**

- Farmers organize into groups & sign contract with CAA and open bank account.
- Groups put into clusters and assigned to extension agent--Promoter.
- Promoter provides training and supplies inputs on credit to the group.
- Inputs repaid following harvest. Group is responsible for each individual's repayment.

**CocoaLink**

- Mobile technology service
- Delivers farming, social and marketing information to farmers
- Subscriber farmers receive and share practical information via text or voice message in English or Twi
- Focus on farming practices, safety, child labor, crop disease prevention, post harvest production, marketing.

**Types of Resources Available to Some Project Farmers**

- Cutlasses, Wellington boots
- Agro-chemical inputs on credit, either through loan agencies (e.g. Opportunity Int) or projects (e.g. CAA).
- Spray machines and protective gear on credit or from the project
- Farm area measurement using GPS
- Payment of certification premiums in kind or cash (range Gh¢ 2-Gh¢ 20. Median = Gh¢ 7/64 kg bag of cocoa)
- Hybrid germplasm
- Shade trees

**Table 3: Description of Extension/Training Systems and Agric Input Resources Available to Farmers from Various Cocoa Projects & Programs**

| Program/Project (Proponent) | Description of Training / Extension Available to Farmers | Method | Agric. Inputs & Resources Available to Farmers |
|---|---|---|---|
| **Armajaro Geotracability** | Data being collected from farmers:<br>Personal data, personal family data, farm location and area, number of tree species, number trees, DBH, number dead trees standing, adjacent land cover type, species abundance.<br>Data used to inform farmer training and remittance strategies; promote the value of biodiversity, target industry development, inform regeneration programmes | Farmer interviews and farm visits | Distribution of spray machines, as well as many other non-agricultural resources (like bikes, solar lanterns, bore holes, solar panels, and education materials).<br>Community Challenge Fund established to support community projects work Gh₵ 1.7 million (2010-2012). |
| **Kraft Cadbury Cocoa Partnership** | Trained and support approximately12 extension staff for all 100 CCP communities in partnership with Cocoa Board.<br>Provide book-keeping, management and personal finance tips<br>Boost access to quality education | Farmer Field Schools using Training Manual developed by CRIG<br>Reading Clubs | |
| **Cocoa Abrabopa Association** | Working with 16,190 farmers organized into 1,884 farmer groups, covering 43,530 acres (17,616 ha).<br>44 extension agents called Promoters located across 7 regions. Groups are formed (sign contract with CAA), farmers register, farmers open bank account, groups organized into clusters and inputs supplied at cluster level. | Extension agents who train and work with farmer groups. | Groups have access to inputs, repayment following harvest.<br>Inputs from Wienco and Cocoa Board per 1 acre farm include:<br>3 bag 50kg Asase Wura fertilizer<br>1 bag of Nitrabar fertilizer<br>24 sachets of Ridomil<br>24 sachets of Nordox<br>8 bottles (30 ml each) of Confidor<br>1 matabi newmatic sprayer ($1^{st}$ year only)<br>Measurement of farm area and location via GPS.<br>Combined RA/UTZ premiums about Gh₵10.6 per bag. Paid directly to farmers. Some groups decide to use it to pay off their input credit. |

| | | | |
|---|---|---|---|
| **CocoaLink (World Cocoa Foundation)** | Mobile technology service that delivers farming, social and marketing information to farmers. Subscriber farmers (must have a cell phone) receive and share practical information via text or voice messages in English or Twi.<br><br>CRIG provides pertinent agriculture and social messages to CocoaLink. Focus on improving farming practices, farm safety, child labor, crop disease prevention, post-harvest production and marketing. | Mobile phone SMS and voice messages.<br><br>Monitoring methods: literacy training, cocoa quantity measures, improved incomes | Each community has access to extension agents and trainers to support program success |
| **Cocoa Livelihoods Program (World Cocoa Foundation)** | This program uses a variety of extension and training methods.<br><br>Trained 35 Cocoa Board Extension Agents. Each agent forms 16 groups of 30 farmers each. Each group selects facilitator and assistant.<br><br>It partners with ACDI/VOCA, GIZ and TechnoServe.<br><br>Operating through farmer groups, farmers receive farmer business skills training, have access to business service centres (BSC) which provide a hub of services including credit and market information. 13 BSC established to date via public-private partnerships. Hosted by agro-dealers and micro-finance institutions to improve farmers' access to quality inputs. | Farmer Cooperatives<br><br>Farmer Field Schools;<br><br>Farmer Business Schools;<br><br>Business Service Centres;<br><br>Trainings; | Increased access to inputs and improved planting material (hybrids). Experience showing that timely supply of fertilizer to farmers is problematic due to Cocoa Board bureaucracy.<br><br>Working with banks and loan agencies (Opportunity International) to support farmers with credit.<br><br>Access to Business Service Centers |
| **ECHOES (World Cocoa Foundation)** | Scalable model for education in rural West Africa.<br><br>5,481 students in Ghana completed a one-year in-school agriculture training which includes classroom lectures and age-appropriate practical training.<br><br>1,347 out of school youth also participated in agriculture vocational training | Vocational agric training;<br><br>Agriculture clubs;<br><br>Scholarship Awards;<br><br>Teacher and Community Resource Centers;<br><br>Functional literacy trainings;<br><br>Teacher and Admin trainings | |

| | | | |
|---|---|---|---|
| **Fairtrade Certification** | Work with farmer cooperatives. Farmers must be registered either as cooperative or with Registrar General as a CBO.<br>Cost of group formation and farmer training is supported by Fairtrade International. | Trainings via Kuapa farmer groups | Input costs for 5000 farmers based on average 2 acre/farmer and CRIG's recommended practices is about US$ 1 million.<br>Gh¢ 2/bag; cutlass, community projects |
| **High Tech Program--Cocoa Board Extension** | A new extension system was initiated in 2009 to try to bridge the gap between potential yields and actual output of cocoa farmers. Funding is through public private partnership.<br>Monitoring and evaluation are conducted by CRIG.<br>With GIZ support, 300 Regional and District coordinators of Cocoa Extension Officers and Community Agents from 6 producer areas trained at Bunso. | Farmer Field School Method????<br>Extension agent placed in communities | 1 free spraying to reduce myrids (akate) or black pod<br>Extension officers in some communities<br>Recommended farming practices based upon CRIG recommendations—promotes the application of:<br>• 371 kg ha-1 of 0–18–23 NPK fertilizer plus micronutrients<br>• hybrid cocoa<br>• planted at 1,111 trees per ha<br>• maximum shade tree density of 12–15 trees per ha[10]. |
| **International Cocoa Initiative** | January, 2013, Farmer Field School training of trainers (79 participants).<br>Overall goal is that with better farming techniques, farmers can increase their yields and increase their income, which farmers would use to increase their children's access to school and to hire adult labours on farms. | 10 month Farmer Field School training | |
| **International Institute of Tropical Agriculture / Sustainable Tree Crops Program.** | FFS= farmer centered extension approach that uses discovery learning. Each community has 1-2 farmer leaders, who train 25-30 farmers. 4 week course spread over 10 months based on cropping cycle. Farmer leader trains farmers every 2 weeks on a demonstration plot (half acre) in the community. Plots divided into farmer practice, integrated crop pest management | Farmer Field School<br>Video Viewing Clubs<br>Farmer Learning Demonstration Groups | |

[10]Gockowski, J., and D. Sonwa. 2010. Cocoa intensification scenarios and their predicted impact on $CO_2$ emissions, biodiversity conservation, and rural livelihoods in the Guinea Rain Forest of West Africa. *Environmental Management* 48:307-321.

| | | | |
|---|---|---|---|
| | (ICPM), and ICPM plus fertilizer, plus 5 trees per stratum.<br>Video Viewing Clubs= community leader (different) chosen to facilitate technical video sessions. Videos contain lessons on GAPs. Guidebook written to accompany videos<br>Farmer demonstration groups for planting, replanting and diversification= focuses on teaching farmers who are establishing new farms. Training in line and pegging, replanting old farms, and setting up nurseries. | | |
| **Organic Certification** | | | Some farmers paid Gh¢ 8/64 kg bag, other farmers paid Gh¢20. Depends on LBC. |
| **Rainforest Alliance Certification** | Data collected on size of farm, sketch of farm, number of shade trees, self-reported yield (farmer estimate). Group registers with Cooperative Dept.<br>Increasing production and livelihoods good angle for biodiversity conservation and trees in landscape.<br>Certification is an incentive for farmer buy-in, but process is expensive and requires lots of logistics and staff time. | Training of trainers<br>Train farmer groups | Premiums to farmers--Gh¢ 6.5/64kg bag of cocoa<br>Goal to increase access to credit through sustainable finance initiative |
| **UTZ Certification (Solidaridad)** | Over 4 years, 15,000 farmers will be covered. | Training of Trainers workshops<br>Farmer Field School method | UTZ certification has started to pay premiums to farmers. Gh¢ 7/64 kg bag of cocoa<br>Farmers paid total of $164,103 for UTZ certified beans<br>Shade trees will be made available to farmers engaged in replanting. |

### 1.3.3 Recommended and Adopted Farming Practices

The majority of projects that are focused on improving or guiding farm management techniques and practices derive their curriculum from either CRIG recommended practices or the IITA/STCP Good Agricultural Practices (GAP) for sustainable cocoa production (Asare and David 2011). Certification standards, like that of the Fair Trade (FLO 2011), UTZ (UTZ Certified 2009 ) and Rainforest Alliance (SAN 2010; SAN 2011) standards, also derive some of their code of conduct requirements and recommendations from these sources, but each standard ultimately reflects its individual mission and unique focus, and is set based upon input received through a consultative process with industry stakeholders and experts.

For the purposes of this work, the recommended cocoa farming practices that are outlined below focus on farm management practices, pest and disease control, and shade management practices. However, given that research has shown that the practices that farmers typically adopt and use are not always in line with what is recommended, this section presents the full suite of recommended and possible cocoa farming practices juxtaposed against data showing real life adopted practices and management decisions.

Generally speaking, experts and practitioners make the following recommendations to farmers:

- Use hybrid planting material;
- Plant hybrid cocoa seedlings or hybrid beans at 3x3 meter spacing;
- Apply fertilizer (371 kg/ha of 0-18-23 NPK) to mature cocoa planted on land that has been previously cultivated. Brands with different compositions include Assasewura , Cocoa Master and Nitrabor;
- Shade tree density of 12-15 trees mature trees/ha;
- Prune the cocoa canopy to remove diseased or dead branches and pods and maintain appropriate tree height;
- Use spray machines to apply pesticides;
- Apply fungicide (e.g., Ridomil, Nordox) to control blackpod and other fungal diseases as needed;
- Apply insecticide (e.g., Confidor) 4 times/year (August, September, October, December) to control mirids (Akate).

Despite these recommendations, farmers often choose alternative practices due to economic constraints, socio-cultural values, or sector bottlenecks.

Each *possible* or *recommended* practice carries a symbol, or two symbols, depending on whether it is:

Recommended across projects and programs

Recommended or required by the Certification standards – as outlined in Certification Capacity Enhancement-Sustainable Cocoa Trainer's Manual ( Dohmen et al. 2012)

Possible, but not addressed by experts, thus neither recommended but also not prohibited

Possible but is specifically not recommended or is prohibited

Prohibited by Certification

Figures 5-9 depicts adopted practices and actual management decisions. The data for the presented results on adopted practices was drawn from three sources:

1) *=Adapted from Asare (2010);
2) += Adapted from Hainmueller et al. (2011)
3) ° = Adapted from Climate-Smart Cocoa Working Group (2011), based upon STCP data.

**Figure 5: Preparing the Land**

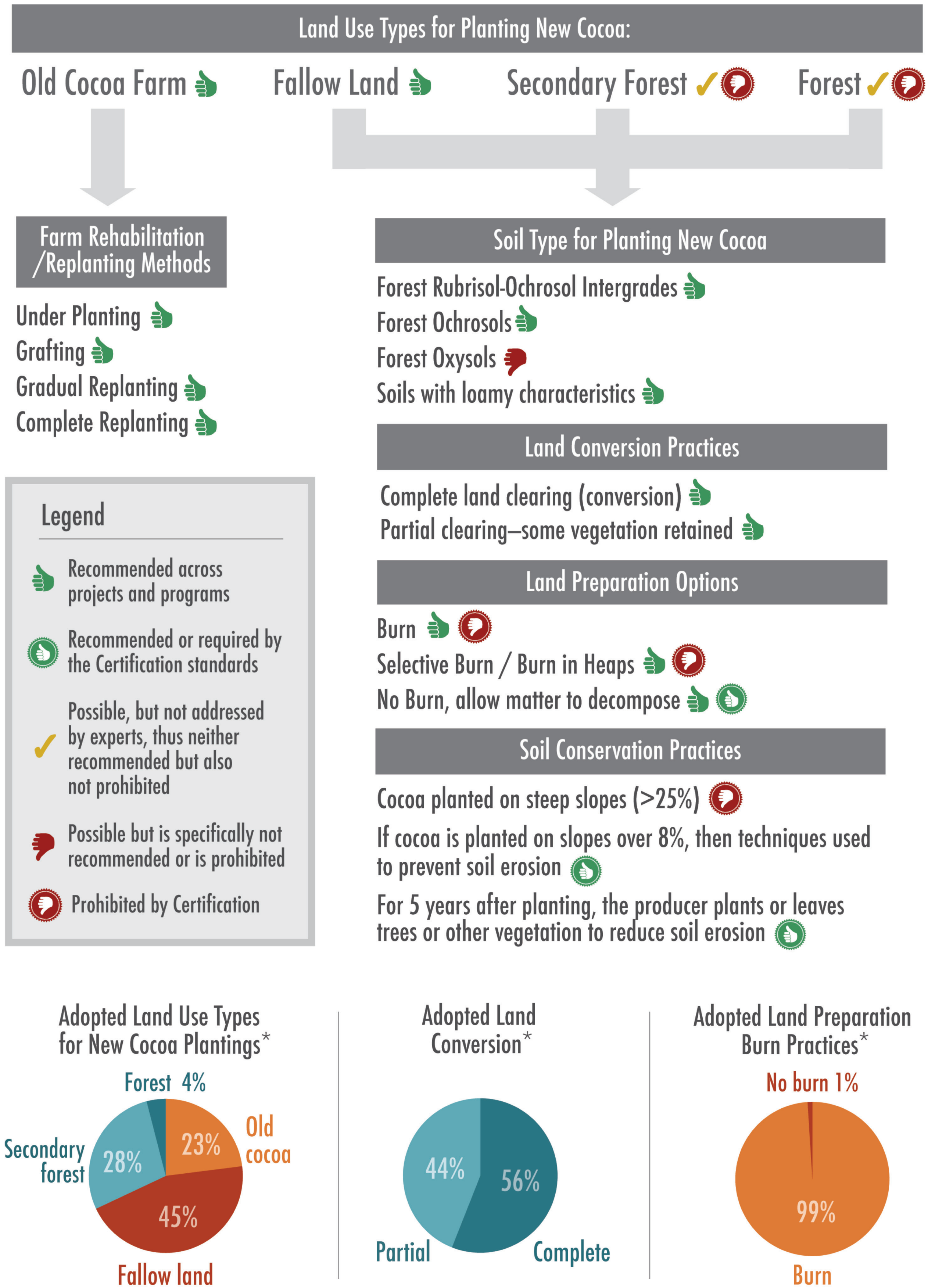


**Figure 6: Initial Shade**

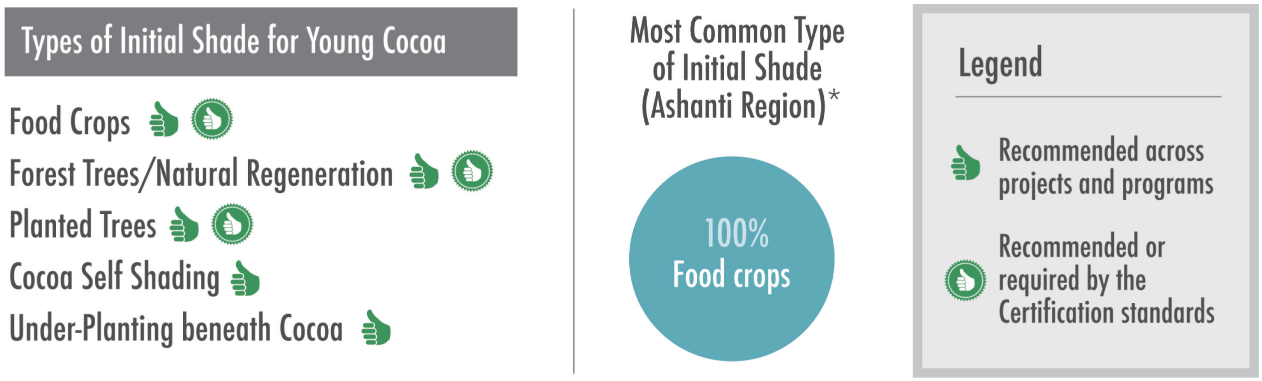



**Figure 7: Planting Cocoa**

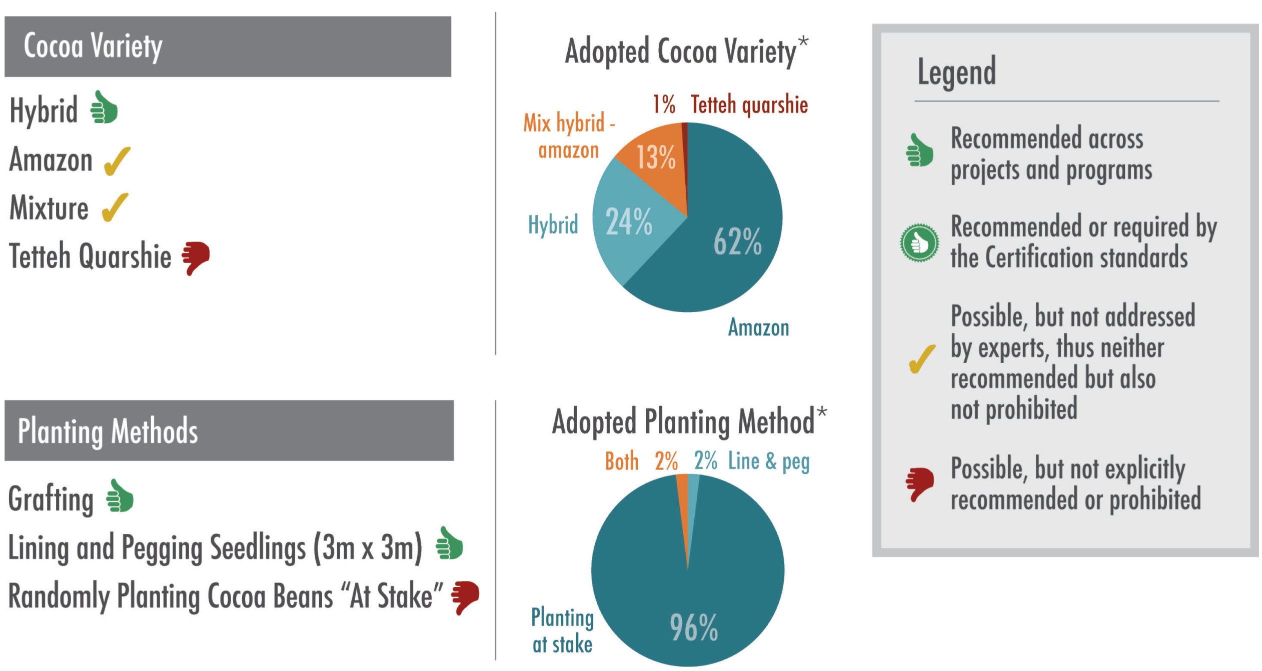
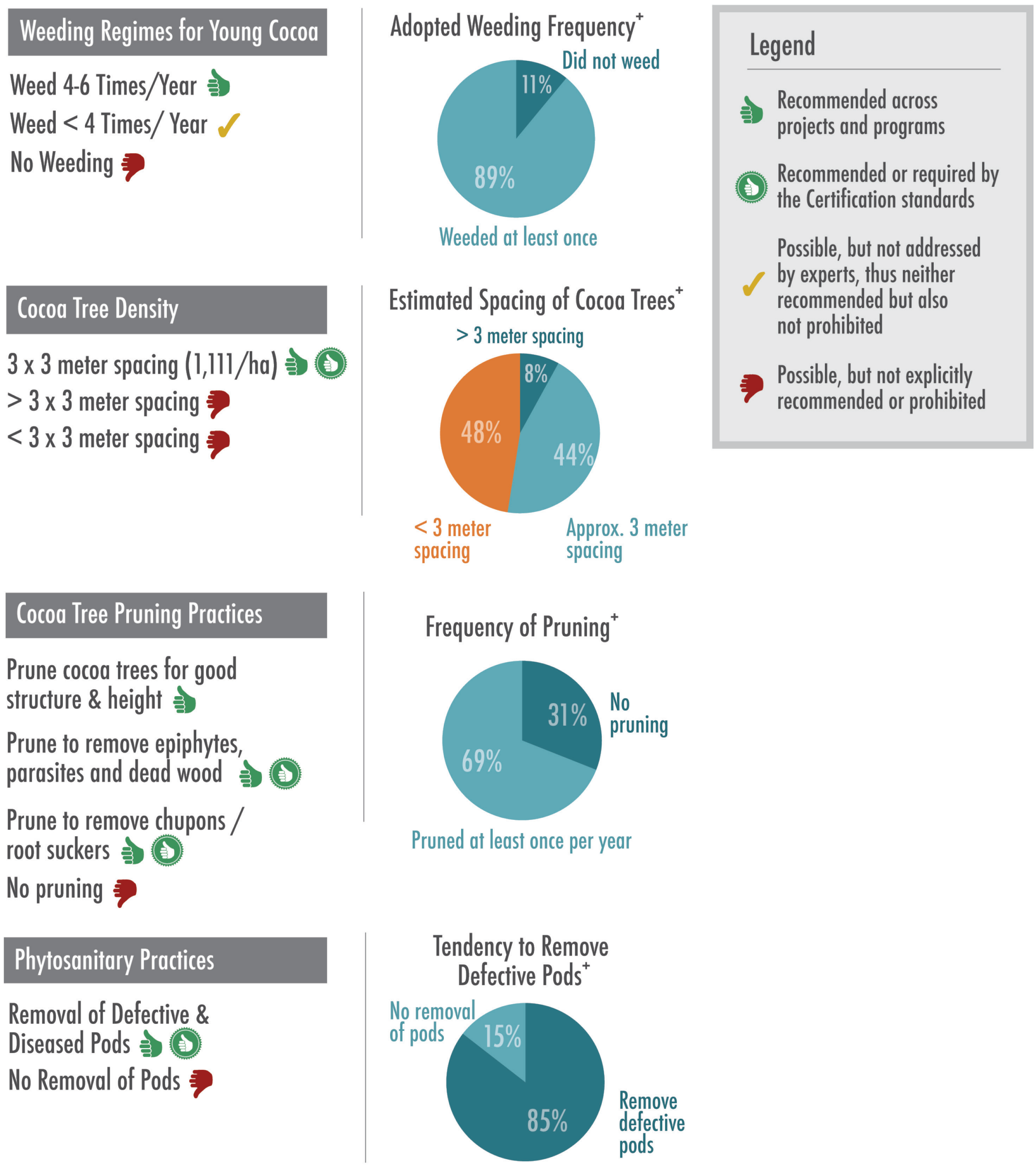


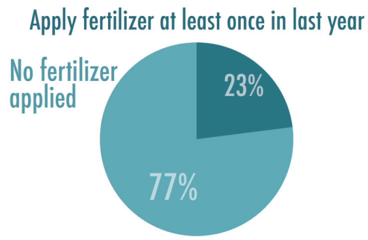
Figure 8: Farm Maintenance Practices



## Application of Fertilizer:

- Apply Fertilizer – 371 kg NPK/ha
- Partially Apply Fertilizer Regime ✓
- No Fertilizer
- Use Organic Fertilizer

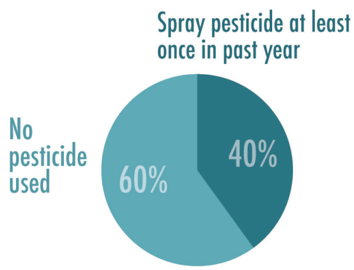
### Farmer Tendency to Use Fertilizer[+]




## Use of Pesticides

- Spray Against Myrids 4 Times (Aug, Sept, Oct, Dec)
- Spray Against Fungal Diseases
- Partially Follow Pesticide Regime ✓
- No Pesticide
- IPM and Least Possible Use of Agrochemicals

### Farmer Tendency to Use Pesticide[+]




## Production Strategy

- Intensification
- Extensive practices

### Legend

- Recommended across projects and programs
- Recommended or required by the Certification standards
- ✓ Possible, but not addressed by experts, thus neither recommended but also not prohibited
- Possible, but not explicitly recommended or prohibited

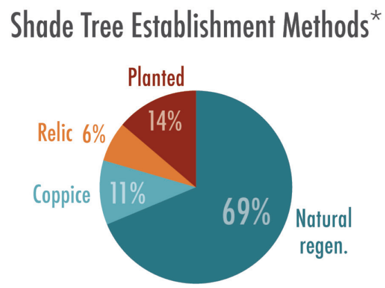
### Distribution of Cocoa Farmers According to Pesticide and Fertilizer Use[°]

| | Pesticide Extensive<br>Pesticide ≤ to the 50th rank percentile of GHc 21.63 ha (group mean level of GHc 9.72 per ha) | Pesticide Intensive<br>Average use was GHc 57.6 kg per ha |
|---|---|---|
| Fertilizer Extensive<br>Fertilizer application ≤ the 70th rank percentile of 24.7 kg/ha (with group mean level of 0.85 kg/ha) | 41% of all producers | 29% of all producers |
| Fertilizer Intensive<br>Average use was 204 kg per ha | 9% of all producers | 21% of all producers |

**Figure 9: Cocoa Shade-Management Practices**

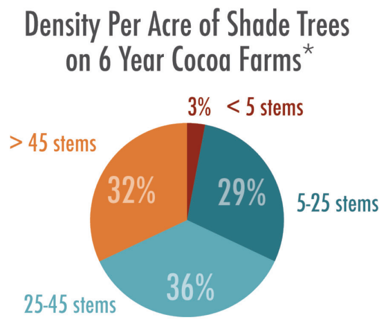
## Methods to Establish Shade Trees

- Plant Trees @ 12m x12m, later thin
- Natural Regeneration ✓
- Coppice ✓
- Relic Trees ✓



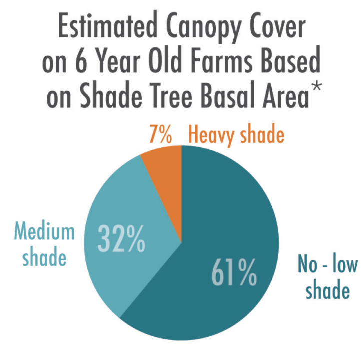

## Shade Tree Density

- 16-18 Mature Trees / ha
- < 16 Mature Trees / ha ✓
- > 18 Mature Trees / ha ✓
- No shade trees




## Canopy Cover

- High: > 40% Canopy Cover ✓
- Moderate: 30%-40% Canopy Cover
- Low: < 30% Canopy Cover ✓
- No Canopy Cover
- (Young Farm: 70% Canopy Cover)




## Shade Tree Diversity

- Shade trees consist of minimum of 12 native species per hectare on average
- The tree canopy compromises at least two strata

## Legend

- Recommended across projects and programs
- Recommended or required by the Certification standards
- ✓ Possible, but not addressed by experts, thus neither recommended but also not prohibited
- Possible, but not explicitly recommended or prohibited
- Prohibited by Certification

**Table 4: Additional Certification Recommendations/Requirements on Forests, Terrestrial Ecosystems, and Buffer Zones**

| UTZ CERTIFIED Good Inside (2009) |
|---|
| Producer protects water sources against contamination and pollution and uses water prudently, including leaving strip of native vegetation 5 meters wide along streams and sources, and does not use crop protection products within 5/10/15 meters of water body depending on size/nature of the source |
| The producer plants or maintains enough trees to eventually have at least 18 mature shade trees per hectare dispersed on the farm. |
| If a producer wants to clear land in or near identified natural habitat, the certificate holder is notified in consultation with an environmental expert, they come to a joint decision. |
| Cocoa production does not take place in protected areas or in the vicinity (2 km) of these areas. Government is responsible (Forest Services Division) to ensure that farming does not take place in those areas. |
| If in the vicinity of a protected area, the certificate holder monitors encroachment and recent encroachment is reversed through community awareness raising or reporting to the authorities. |
| Degradation and deforestation of primary forest is prohibited and none takes place after 2008. Degradation and deforestation of secondary forest that is at least 20 years old is also prohibited. |

| Sustainable Agriculture Standard (SAN 2010) |
|---|
| Farms register their energy use, try to reduce it and use renewable energy sources. |
| Farms have not destroyed high value ecosystems after November 2005 and establish, regenerate or conserve natural vegetation close to terrestrial and aquatic ecosystems, as well as areas of human usage. |
| Production areas must not be located in places that could provoke negative effects on national parks, forestry reserves…etc. |
| The harvesting or taking of threatened or endangered plant species is not permitted |
| There must be a minimum separation of production areas from natural terrestrial ecosystems where chemical products are not used. |
| Aquatic ecosystems must be protected from erosion and agrochemical drift and runoff by establishing protected zones on banks of rivers, etc. |
| Cocoa farms in areas where the original natural vegetative cover is forest must establish and maintain a permanent agroforestry system distributed homogenously throughout plantations. |
| New production areas must only be located on land with the climatic, soil and topographic conditions for intensity level of the agricultural production planned. The establishment of new production areas must be based on land use capacity studies that demonstrate long term production capacity. |
| The farm must implement practices to diminish its emissions of greenhouse gases and increase carbon dioxide sequestration. Such practices include soil cover management, planting trees and other perennial vegetation, proper sourcing and management of fertilizers and fuel, etc. |

# 2. Climate-Smart Cocoa

## 2.1 What is Climate-Smart Agriculture?

According to the FAO (2013b), climate-smart agriculture refers to agriculture that sustainably increases productivity, resilience (adaptation), reduces or removes GHG emissions (mitigation) and enhances the achievement of national food security and development goals. The concept gained prominence in 2010 during international climate change negotiations, and despite the lack of consensus towards an international agreement, REDD+ discussions were making slow but steady progress. However, many countries and influential stakeholders felt that agriculture was not adequately captured in the evolving REDD+ space, and thus the issue was formally raised.

CSA offers the opportunity to deliver multiple gains on food security, climate resilience (adaptation) and mitigation to craft a sustainable agricultural commodity (FAO, 2010). So despite the fact that there is no decision or work program dedicated to agriculture under the UN Framework Convention on Climate Change (UNFCCC), the Cancun Agreements (2010) calls for consideration of drivers of deforestation and enhanced adaptation action. Agriculture is relevant under both agenda items. Accounting for about 13.5% of global greenhouse gas (GHG) emissions, the sector also holds significant emission reduction potential (IPCC 2007); making climate-smart agriculture a relevant mitigation and adaptation strategy.

The main pillars of a climate-smart agriculture approach include:

**Increase in productivity, yield, income**

**Adaptation**

**Mitigation**

**Food security**

**Economic development**

Yet efforts that simply capture, in one way or another, these five pillars do not necessarily result in CSA. CSA initiatives need to be linked by a networked approach that provides access to financial, human and social capital. For a CSA approach to be adopted by farmers, it has to contain a risk reduction strategy because current risk will only further increase due to changing climate conditions. And CSA needs to result in a set of primary impacts that also offer multiple benefits. Depending on the crop or production system, the primary goals as compared to the benefits may play out differently.

Boxes 1 and 2 briefly give examples of existing CSA projects.

**Box 1: Strengthening Capacity for Climate Change Adaptation in Land and Water Management (Kenya)**

The programme operates in three counties in Kenya--Bungoma (West); Siaya (West) Machakos (South-East. It is a three year-project (2011-2013) funded by the Swedish International Development Cooperation Agency (SIDA) and implemented by FAO and the Kenya Agricultural Research Institute (KARI) that partners with a network of NGOs and government ministries responsible for agriculture, fisheries and irrigation.

About 12 000 households are expected to benefit by strengthening adaptation to climate change risks in the selected watersheds and districts. The idea is to create a mosaic of partners working together to leverage investment as a key component of the management of natural resources and the adaptation strategies.

Specifically, FAO and KARI are working with non-governmental organizations to enhance and transform smallholder agriculture productivity in cultivated watersheds where natural resources are under threat due to climate change and variability risks. Local authorities are sought out to provide technical backstopping in related areas that help to coordinate and enhance district development efforts.

Main activities include building, boosting and managing healthy soils through soil and water conservation measures, crop-residue mulching, leguminous cover crops and other sustainable land management practices are aimed at increasing productivity. Local authorities are sought out to provide technical backstopping in related areas that help to coordinate and enhance district development efforts.

*http://www.fao.org/news/story/en/item/178889/icode/*

**Box 2: The East Africa Dairy Development Project (EADD)**

A regional industry development program (Kenya, Rwanda, Uganda) implemented by Heifer International and a consortium of partners including TechnoServe, International Livestock Research Institute (ILRI), The World Agroforestry Center (ICRAF) and African Breeding Services (ABS TCM). The project is funded by the Bill & Melinda Gates Foundation.

In Kenya, 21 farmer organizations have been established since 2008 and work through a "hub"' model. These hubs provide services such as chilling plants, storage, agro-veterinary services, and artificial insemination services among other services. In Nandi South District in the Rift Valley Region, where a chilling facility is located in Ndurio (5,000 l tank) and in Kaptumo (10,000 l tank). The hubs are managed by the Dairy Farmer Business Associations (DFBA), which are shareholders.

The majority of the farmers practice mixed farming; they grow crops and keep livestock. Maize is the main staple crop in the area, as well as beans, bananas and tea. Some farmers also plant Napier grass. About 40% of the farmers are able to provide food for the whole year from their own production; moreover maize yields have been declining by more than 50% over the past years. Many farmers are also replacing maize with tea, as the price for this cash crop is increasing, and provide a constant income source. The majority of farmers own dairy cattle, as well as some chicken. The EADD project is supporting the farmers' increased milk production by intensifying the production, which means reducing the number of cattle per household and improving productivity through artificial insemination and nutritious feeding. As the land is very densely populated, the free ranging of cattle has become limited.

The smallholder farming systems in Kaptumo are characterized by low land and livestock productivity due to unreliable and inadequate rainfall, infertile soils, poor agronomic practices, undeveloped marketing channels and lack of agricultural inputs. According to the socio-economic baseline survey, conducted in 2011 in the area, farmers are aware of the effects and impacts associated with climate change, which are mostly associated with variations in rain patterns. They experience frequent droughts, excessive rains in the wet season and subsequent crop failures and decline in livestock productivity which increases their vulnerability to food insecurity and poverty.

*http://weadapt.org/knowledge-base/synergies-between-adaptation-and-mitigation/climate-smart-agriculture-put-into-practice-in-smallholder-dairy-development-project-in-kenya*

## 2.2 Outlining Climate-Smart Cocoa in Ghana

As a smallholder crop and a commodity of national and international importance, there is both a demand for a climate-smart approach to cocoa cultivation and a tremendous opportunity to increase the sustainability of the cocoa production landscape. The demand emanates from the very real need for mitigation actions, and the urgency to adapt the cocoa farming system to increase its resilience in the face of global warming. Across Ghana's high forest zone, cocoa continues to be a major driver of deforestation and degradation, and the farming system continues its evident shift away from complex cocoa agroforests to low or no shade systems that will be more susceptible to reductions in rainfall (particularly during the dry season) and increases in temperature, both of which present threats to cocoa (Anim-Kwapong and Frimpong 2008). At the same time, chocolate companies also recognize a growing consumer demand for climate-smart production systems and products.

For multiple reasons, responding to this demand needs to be a priority for the country and the cocoa industry; however, it also represents the perfect opportunity to leverage all of the existing projects and programs, to introduce new and innovative measures, and to coordinate actions and monitoring at multiple scales. In doing so, Ghana would effectively create a new type of commodity—a climate-smart cocoa bean grown in a climate-smart landscape that generates yield increases, market premiums, climate benefits, and myriad co-benefits for the producer.

The Cocoa Board already aims to make Ghana, "the number one best quality producer of cocoa in the world". This strategy, according to the government, necessitates cocoa becoming, "a sustainable product in a way that takes good care of the environment and also gives the farmer the best income for what he produces, and also satisfy the requirements of the international market." For a sector which has predominantly relied upon an expansionist production strategy and has significantly contributed to the degradation and deforestation of the high forest zone over the past 100 years, this statement represents a major shift in environmental thinking.

National production has increased dramatically over the past decade, but these gains are not equaled by substantial yield increases on-farm. Rather, they have been attributed to modest yield increases in some cocoa producing areas, and to a continuation of expansive production strategies that result in expansive practices and outright encroachment into forest reserves. Thus, there is still considerable scope to increase yields. However, making the shift to a sustainable, climate-smart producing landscape will require significant changes, including extensive coordination and collaboration between the private sector, communities and land owners, and government agencies, many of which have traditionally not collaborated, like the Cocoa Board and the Forestry Commission. The sector will have to shift from its expansive business-as-usual (BAU) scenario in which production gains continue to come at the expense of forests and trees in the landscape, to a desired state in which the majority of farmers have access to resources (agronomic, technical, financial) which foster yield increases, while landscape planning and adoption of climate-smart practices reduce pressure on forests and lead to more trees on farm.

The cocoa sector in Ghana is facing challenges associated with yield, sustainable economic development, deforestation (mitigation), and adaptation to global warming—all core elements of climate-smart agriculture. The only element of a CSA approach that is not typically highlighted is the issue of food security. Yet, food crop production is a crucial component in all cocoa production systems in Ghana. As shown in Figure 6 (Section 1.3.3—Recommended and Adopted Farming Practices), all farmers inter-crop their new cocoa plantings with food crops to generate income, produce food, and grow initial shade for the emerging cocoa seedlings. In some areas, migrant farmers who do not have access to land for planting food crops, use cocoa sharecropping opportunities as the only means to grow food. In other areas, the land has been so extensively converted to cocoa that there is no land left for food crop production and shortages persist.

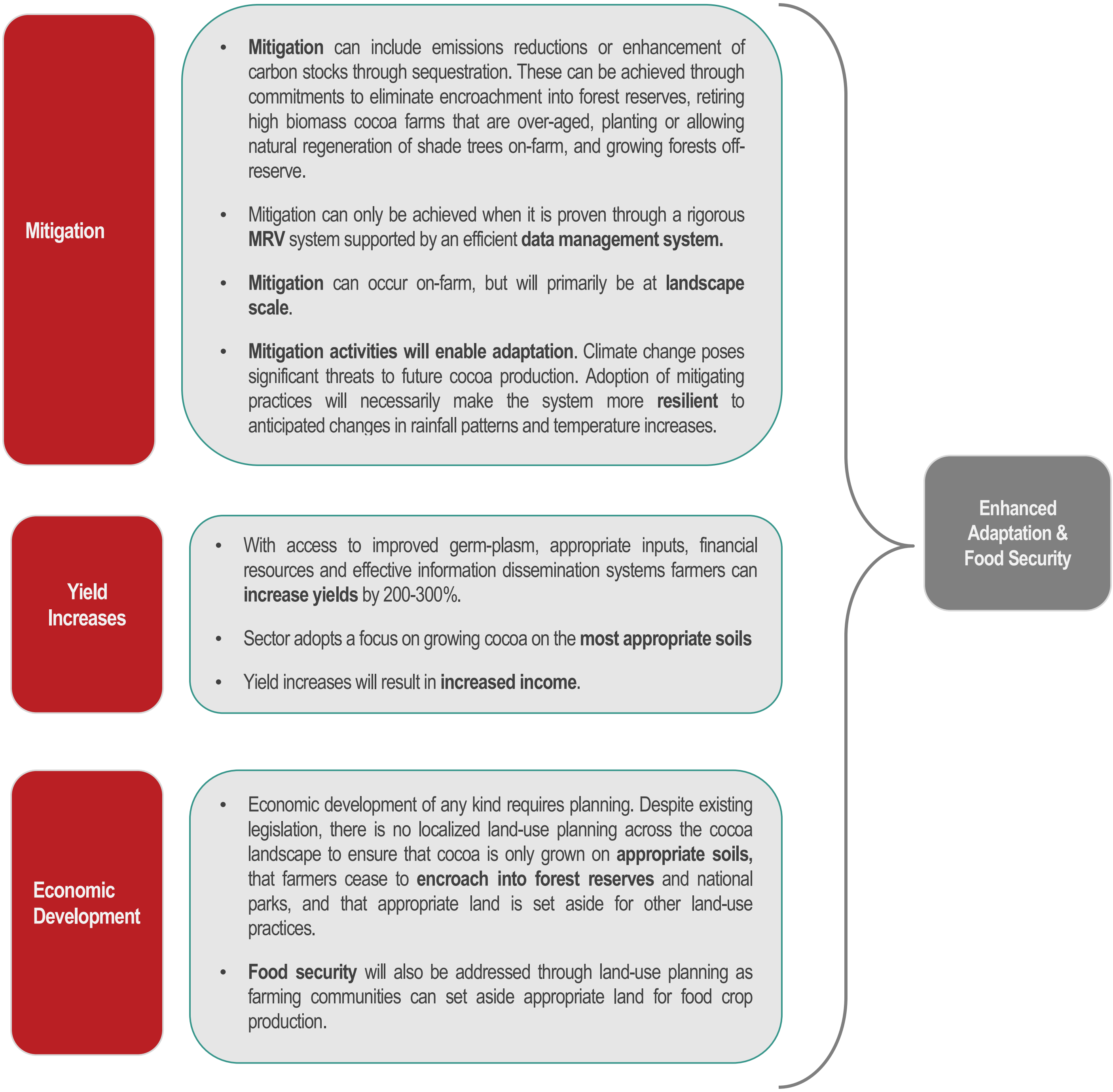
In Ghana, for Climate-Smart Cocoa (CSC) to work it cannot focus at the individual farm scale, as is currently the case with certification and other extension efforts. Instead, it becomes the capstone to a bundle of coordinated but diverse actions that can be monitored at a landscape level and collectively result in the production of climate-smart cocoa beans by virtue of being produced from a climate-smart landscape. Given the nature of Ghana's cocoa production system, the challenges facing the sector and the identified pillars of CSA, the main elements of a CSC approach will not be equal.

The CSC approach in Ghana needs to be founded upon:

- **Mitigation** coupled with MRV and data management;
- **Increases in yield**, founded upon effective extension systems, access to inputs, targeting of appropriate soils, and farmer risk reduction packages;
- **Economic development** that centers on land-use planning.

The by-products or benefits that will derive from these foundational activities will include adaptation and food security. Figure 10 describes the rationale.

**Figure 10: Description of the Main Elements of a Climate-Smart Cocoa Approach**




## 2.3 Why Is Current Effort Not Climate-Smart

Many elements of existing cocoa projects and programs contain pieces of a climate-smart approach, but cocoa production in Ghana is still far removed from being climate-smart for the following reasons:

- It is not the goal. The current focus is on production increases and sustainability, but the term sustainability is used very broadly, and is as much about corporate social responsibility as it is about environmental sustainability.
- While many of the elements of a climate-smart approach are in play in the sector, they are neither tied to a landscape approach, nor are they meaningfully linked or working in concert. Projects remain inwardly focused on project goals and achievements.

- Despite progress, extension and access to inputs and resources has yet to go to scale.
- The absence of sector-wide data, data management systems, or MRV. Given the absence of producer/production data, and deforestation and degradation rates, measurable carbon accounting and mitigation is not possible.
- There is only a minimal effort to reduce expansion and understand its links with yield increases. Analysis has shown that since the start of the High Tech program, rates of deforestation and degradation have increased in key production landscapes.

Even the most coordinated and environmentally focused of initiatives—cocoa certification—is not climate-smart. At this point in time, it is important to make the distinction between climate-smart cocoa production and cocoa certification.

Since consumers started to drive the commodity production agenda, industry stakeholders in Ghana (and across West African producer countries) have shown a growing interest in certification and the widespread adoption of social and environmental standards. In some instances it has been implied that certification equates to mitigation or that certification can foster mitigation, but these assumptions are flawed. There are many reasons why this is the case, but perhaps the most important reasons reflect the goals of certification, its scale, and the absence of a performance-based orientation.

- **Certification is not about mitigation:** All of the currently applied certification standards in Ghana have broad ranging goals that are focused on meeting a minimum of social, environmental, and good agricultural practice criteria. The goal of certification has not been to reduce greenhouse gas emissions or enhance their sinks, though positive climate benefits are often cited.
- **Weak, unsubstantiated carbon benefits:** Certification requires farms to make efforts to increase shade canopies through tree planting, without acknowledging rates of seedling survival in a closed canopy system, rates of sequestration from seedlings or young trees, or expected carbon benefits. The standard notes that farms cannot be established in forest or secondary forest, but this begs the question of how this can be validated or monitored since only mature farms are certified. Current standards rely on farmer-reporting of the previous land use type. This is a significant flaw to existing standards.
- **Standard development process may obviate the rigor required for sound carbon accounting:** National standards have been developed through a broad stakeholder process that is inclusive of all perspectives and opinions, whether technically informed or not. The problem is that the resulting criteria can reflect the lowest common denominator of environmental sustainability, or selected indicators do not necessarily equate to the desired environmental goal.
- **Certification is focused at the wrong temporal scale**: Certification happens on mature farms, and thus there is inadequate attention to cocoa farm establishment patterns, where the bulk of emissions occur in Ghana (e.g., conversion of an old, high biomass cocoa farm to a new farm without mature shade trees). Such issues are mentioned in the codes of conduct or standards, but modes of monitoring are very weak and unrealistic as the current practice is to ask the farmer to report on the previous land use type.
- **Certification is focused at the wrong geographic scale**: Certification is oriented to certifying beans; it cannot certify what is happening in the surrounding landscape, especially given that not all farmers in the landscape are certified. In addition, farms located in proximity (2 km with UTZ CERTIFEID (2009)) to protected forests (like national parks or forest reserves) can be excluded, as are farms located inside of these areas. However, from a mitigation standpoint, these are the exact farmers that a climate-smart approach needs to be working with in order to reduce emissions from the sector.
- **Lack of an MRV component**: Certification is about ensuring a minimum percent of compliance to a set of criteria, but it does not purport to prove or demonstrate that compliance equates to a change in practice. Certification fails to specifically address, at the landscape scale, cocoa's role in deforestation/degradation given that there are no publically available BAU baselines from which to measure change, or to what degree certification is reducing emissions or enhancing carbon stocks. To date there is no evidence of mechanism to measure or monitor deforestation and degradation trends in the landscape. Certification is based on the assumption that yield increases will lead to reductions in deforestation and degradation. The UTZ standard (UTZ CERTIFIED 2009) assumes that government will keep farmers out of protected areas. It is likely that deforestation/degradation is increasing more rapidly in the areas being certified in Ghana than in areas not targeted by certification schemes.

- **Certification assures that a standard is met, not that change has happened**: Even though certification assures the consumer that a minimum standard of practice has been achieved, no one should assume that these practices were not in place without certification. In fact, there is evidence to show that many of the environmental standards reflect the common practice.

Despite these differences, certification can serve as an important extension method under a climate-smart approach, to help increase yields and offer additional benefits to farmers. However, any certification effort will need to be couched within a set of MRV-data management-landscape planning measures that can bring the required mitigation and accountability.

## 2.4 Defining the Climate-Smart Cocoa Approach

For cocoa production in Ghana to become climate-smart, a series of actions need to take place.

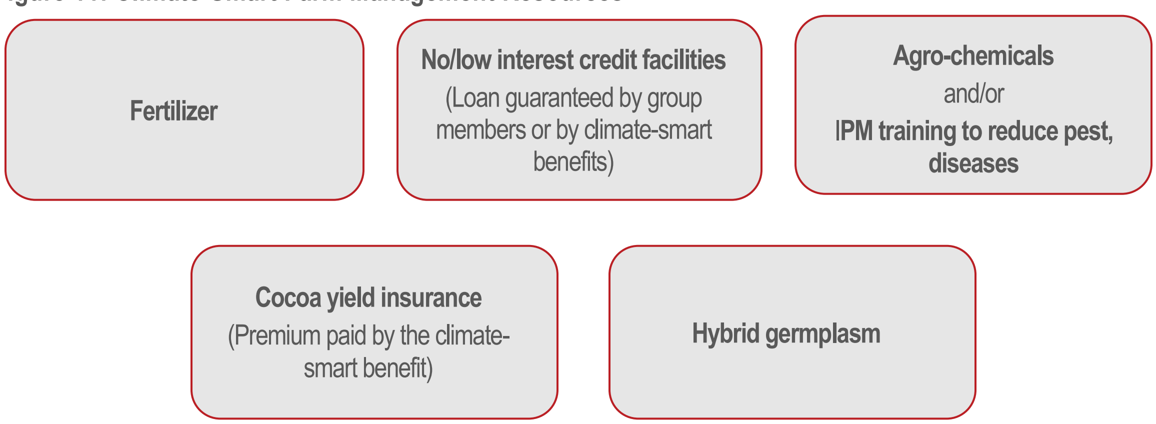
First, farmers need to substantially increase their yield. Yield increases will be the primary benefit to producers, and will serve as the foundation of the climate-smart approach.

For this to happen, farmers will need to adopt the core climate-smart cocoa management practices (as outlined in Table 5, below). Some of these practices purely focus on increasing yields, while others have a dual effect of increasing yield and producing modest climate benefits.

Ironically, many of these practices have been recommended and available (even if only in a limited extent) to producers for over 30 years and yet adoption has been low. The factors limiting adoption are three-fold: 1) the limited scale or absence of extension and training opportunities; 2) the cost and risk associated with the adoption of the recommended practices, many of which are capital and labor intensive with no guarantee that yields will increase, especially in the face of poor rainfall years; and 3) the pervasive lack of wide spread access to critical economic and agronomic resources.

Therefore, to enable widespread adoption, recommended climate-smart farm management practices need to be backed up by access to information and trainings, access to credit facilities so they can afford inputs, and access to risk reduction packages so that if producers make the investment into their farms and their yields fail to increase (perhaps due to poor rainfall) then they are guaranteed a minimal return or are covered on their loans. But access to these resources would be condition upon monitored adoption of practices.These resources are laid out in Figure 11.

**Figure 11: Climate-Smart Farm Management Resources**




With the exception of cocoa insurance, most pieces of this equation are already in the system, but only at a limited scale and in isolation. For example, cocoa extension in Ghana does not need to be made uniform—both the Cocoa Abrabopa farmer group method and the STCP FFS method have proven to be highly effective and are needed, and the emerging CocoaLink program is demonstrating how mobile technology can further support farm management. The gap is in the scale. Cocoa Board can provide an oversight, monitoring, and coordinating role, but the private sector will need to vastly increase its investment and "boots on the ground" orientation to build a dynamic, integrated, widespread extension system that has impact. The cocoa sector will also need to build direct relationships with many "adjacent" institutions, like the Forestry Commission, District Assemblies, Traditional Authorities, and community-based organizations.

The above mentioned steps reflect much of what is already happening in Ghana's cocoa sector, and yet the country is not close to producing climate-smart cocoa given that deforestation and degradation continue unabated. This is because price and yield increases do not reduce expansion and extensive practices. As Polly Hill noted (1963) cocoa farmers at the start of the 20th century were capitalists, attuned to using their profits from one farm, to invest in another with a long term economic outlook.

A climate-smart cocoa program in Ghana is different from the business as usual scenario because it significantly limits landscape-level $CO_2$ emissions that derive from cocoa expansion, encroachment into reserves and protected areas, and reductions in shade levels. Therefore, a second step is land use planning with Traditional Authority (TA) and District Assembly (DA) support. As part of this, communities and TA would make collective agreements to reduce emissions in the landscape. Where encroachment is problematic, for example, communities can negotiate and set agendas to exit the forest reserve and in return qualify for results based benefits. Therefore, a monitoring, reporting and verification (MRV) system is essential—the third essential step. And as such, if no "results" were shown through the MRV, then the community, TA, and/or DA would not receive benefits.

Simplified, the formula for climate-smart cocoa is outlined in Figure 12, and is followed by Table 5, which describes the bundle of practices and measures, which together would constitute the production of climate-smart cocoa.

**Figure 12: Formula for Climate-Smart Cocoa**

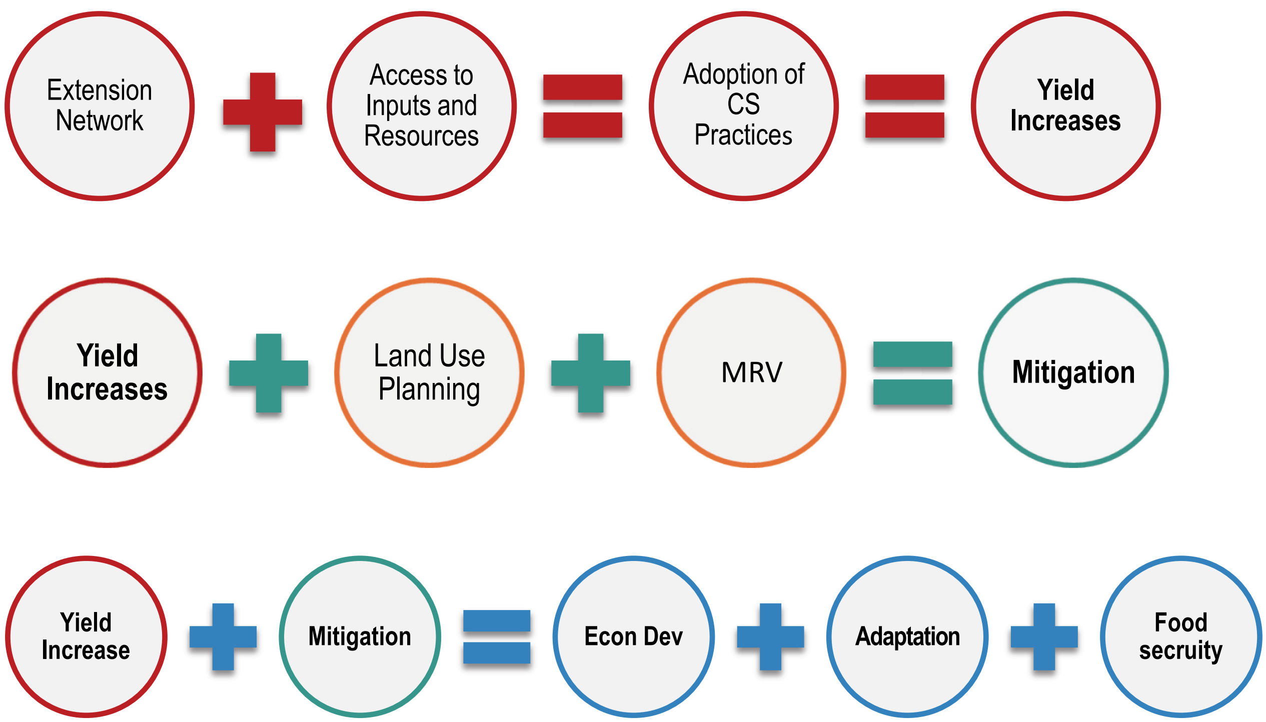


Table 5: Key Elements of Climate-Smart Cocoa at Scales of Engagement

| CLIMATE-SMART COCOA | MITIGATION | | | INCREASE YIELD | | | ECONOMIC DEVELOPMENT | FOOD SECURITY | ADAPTATION |
|---|---|---|---|---|---|---|---|---|---|
| **Practices & Activities** | **MRV** | **Data Manage-ment Indicator[11]** | **Carbon Benefit** | **Yield** | **Risk Reduction** | **Inputs & Resources** | **Land-Use Planning** | **Food crop production** | **Increased Resilience** |
| **FARM SCALE: FARM ESTABLISHMENT & MANAGEMENT** | | | | | | | | | |
| **Land Use Type:**<br><br>**Fallow**<br>**Cocoa Farm** | Farmer reported<br><br>Field Agent reported<br><br>Community monitored | Village Name<br><br>GPS coordinate.<br><br>Farm size measured<br><br>Description of land-use type | Modest avoidance of degradation/defo restation from conversion of high biomass land use types (forest, high shade cocoa) to cocoa.<br><br>Decision to "retire" old, high biomass farms in perpetuity. | Appropriate soil type | If farmers adopted CSC practices, then they gain access to yield insurance & credit package | Technical and Credit support to incentive replanting via under-planting, complete replanting of cocoa | Community decision that forest or other high biomass land (old, high shade cocoa) not selected via land use planning process. Land use type conforms to community decisions.<br><br>High biomass lands off-reserved are retired into cocoa forests. | Land use planning sets aside land for food crop production if necessary | Appropriate soil type, maintenance of forest and trees in landscape |
| **Land Clearing Methods:**<br><br>**Partial clearing**<br><br>**Full clearing** | Farmer reported<br><br>Field agent reported<br><br>Community monitored | Did farmer retain shade trees<br><br>Adopted no-burn practice? | Increases soil organic carbon via decomposition<br><br>Reduce emissions assoc. w/ burning | Increase soil organic matter, improve soil fertility | | Training on no-burn techniques and benefits | Community based discussion and acceptance of no burn system | | Improving soil fertility and structure |

[11] See "Managing and Linking Cocoa Sector Data related to Climate Smart Approaches in an Integrated Manner " (Fumey 2013) a report commissioned by NCRC and the CSCWG.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No burn** | | | Is farmer replanting, and type of method used. | | | | | | |
| **Initial Shade Type:**<br><br>**Food crops**<br><br>**Nat. Regeneration**<br><br>**Planted Trees**<br><br>**Under-planting cocoa** | Farmer reported<br><br>Field agent reported<br><br>Community monitored | Types of initial shade used, if any.<br><br># shade tree seedlings/sapling planted or observed<br><br>Seedling survival rate after 1 yr, 3 yrs. | Natural regeneration & tree planting leads to modest sequestration;<br><br>Under-planting- no emissions from clearing | | | Improved food crop planting material<br><br>Forest tree seedlings<br><br>Info on grafting | Planting of NTFP, timber species to diversify farm incomes | Cocoyam;<br><br>Plantain;<br><br>Cassava;<br><br>*No maize, | 70% initial shade makes cocoa seedlings more resilient to changes in rainfall, temp. |
| **Cocoa Variety Hybrid Bean;**<br><br>**Hybrid seedling;**<br><br>**Grafting** | Farmer reported<br><br>Field agent reported<br><br>Community monitored | Type of cocoa planted?<br><br>Source of planting material? | | Hybrid has disease resistance<br><br>Higher yielding variety | | Improve access to hybrid | Expanding access to hybrids<br><br>Nursery small enterprise development | | |
| **Planting Method:**<br>**Line & Peg @ 3x3m**<br><br>**(Traditional** | Farmer reported<br><br>Field agent reported | Was farm line & pegged? | | Reduces intra-cocoa tree competition, increases yields | | Training on lining and pegging, and thinning | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **method but cocoa is thinned)** | Community monitored | | | | | | | | |
| **Weeding:**<br>**4-6 times;**<br>**As necessary** | Farmer reported<br><br>Field agent reported<br><br>Community monitored | Number of times farm was weeded annually. | Enhancing cocoa and shade tree growth (sequestration) | Reducing competition, | | Make credit available to support labor for weeding | | | Healthy cocoa trees, greater resilience |
| **Pruning & Removal of diseased pods:**<br>**Prune trees** | Farmer reported<br><br>Field agent reported<br><br>Community monitored | Farmer practices pruning, removal of diseased pods. | | Improving growth, reducing incidence of pest and diseases | | | | | Healthy cocoa trees, greater resilience |
| **Fertilizer:**<br>**Apply recommended fertilizer regime** | Farmer reported<br><br>Field agent reported<br><br>LBC reported | Type of fertilizer received or purchased?<br><br>Quantity applied. | Increasing root and shoot growth causing enhancement of soil carbon and stocks | Significant increase in yield | | Access must be assured<br><br>Credit must be made available on reasonable terms | Expanding access to crucial agricultural inputs.<br><br>Small enterprise development | | Healthy cocoa trees, greater resilience |
| **Pesticide:**<br>**Pesticide 4x/Yr if needed** | Farmer reported | Type(s) of pesticide received, or purchased? | | Improve health of cocoa farm, increase in yields | | Access must be assured | Expanding access to crucial agricultural inputs. | | Healthy cocoa trees, greater resilience |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fungicide as needed** | Field agent reported<br>LBC reported | Number of times farm sprayed. | | | | Credit must be made available on reasonable terms | Small enterprise development | | |
| **Type of Permanent Shade:**<br>**Relics**<br>**Natural Regeneration**<br>**Plant @ 12x12 m** | Farmer reported<br>Field agent reported<br>Community monitored | Type(s) of permanent shade?<br>Farm contains >18 shade trees/ha. | Avoided degradation through retention/maintenance of mature shade trees<br>Modest enhancement of carbon stocks via tree growth | Maintain improved yield over medium to long term. | | | Expanding access to tree seedlings.<br>Diversification opportunities via NTFPs, Timber species | | Shade trees increase farm's resilience to climatic changes |
| **Shade Canopy:**<br>**High Shade (>40%);**<br>**Medium Shade (40% canopy cover)** | Remote Sensing | Shade trees @ approx.. 12x12 m spacing?<br>Farm has 30-40% canopy cover.<br>Farm has >40% canopy cover | Modest enhancement of carbon stocks compared to BAU<br>Modest avoided degradation compared to BAU | With adoption of recommended practices yield should not suffer | | | Community consensus to increase shade levels in landscape | | Increased resilience |
| **Harvest, ferment, dry:**<br>**Best practices** | Farmer reported<br>Community monitored | kg/ha | | Demonstrate increase in yield and income due to adoption of CS practices. | Receives pay-out if yield does not reach minimum thresh-hold | | | | |

| LANDSCAPE SCALE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Total Cocoa Area** | Remote Sensing | Total cocoa area (ha) | Will support monitoring of land use change and emissions over time | | | | Information used to facilitate landscape planning | | Shows areas where adaptation measures are most needed. |
| **Yield** | District /Regional production figures<br><br>LBC reported<br><br>Cocobod reported | MT/yr<br><br>Ave kg/ha | | Demonstrate increase in yield and income due to adoption of CS practices. | Receives pay-out if yield does not reach minimum thresh-hold | | | | |
| **Reduce Expansion in Off-Reserve into High Biomass Land Use Types** | Remote sensing | Land use change matrix<br><br># ha retired. | Avoided emissions from conversion of high biomass (high shade) cocoa to low shade cocoa or secondary forest to cocoa | | If farmers reduce emission / enhance carbon stock in landscape, then they gain access to yield insurance & credit package | Access to farming resources results based | Community planning results in decision to "retire" high biomass land uses types and designate as "cocoa carbon forest". | | Maintain forests and tree cover to ensure ecosystem services |
| **Reduce Encroachment into Protected Forests** | Remote sensing | Land use change matrix | Avoid emissions from deforestation or degradation | | | Access to farming resources results based | Community planning results in decision to stop encroachment | | Maintain forests & tree cover to ensure ecosystem services |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Enhance Carbon Stocks On-Farm and via Off-Farm Tree Planting, Plantations** | Remote sensing<br><br>Farmer reported<br><br>Field agent reported<br><br>Community reported. | # seedlings disbursed from nurseries<br><br># farmer planting / retaining shade trees on farm.<br><br>Total areas designated to CSE in off-reserve. | Modest enhancement of carbon stocks compared to BAU | | | Access to tree seedlings | Individuals and communities plan to grow tree plots off-reserve<br><br>Diversification of income—timber, NTFP potential | Food crops can be grown during seedling establishment | Increasing tree cover in off-reserve |

# 3. Conclusions & Next Steps

## 3.1 Conclusions

Ghana's cocoa sector has experienced decades of interventions and projects aimed at improving production through the integration of trainings, access to improved planting material, use of agro-chemical inputs, implementation of credit schemes, and more recently introduction of socially and environmentally sustainable practices. In many instances, the results have been disappointing due to an outright lack of farmer interest or limited adoption because of extension and input bottlenecks. Where projects have been more successful, they are often limited to only a small proportion of cocoa producers, and today the biggest extension challenge is how to get to scale.

From a productivity standpoint, the sector has gone through periods of boom and bust as a result of economic and environmental events like changes in market conditions and the incidence of droughts and fire. In the past decade, national production has increased substantially and farm yields have seen modest improvement, but intensification goals have primarily been off-set by the continuation of extensive practices. In fact, throughout cocoa's history in Ghana, what has remained consistent is the loss of forests and tree-cover across the cocoa production landscape.

This report represents the first time that anyone has specifically defined CSC production practices and measures. While many of these practices overlap with existing recommended practices, on-going efforts largely exist in isolation, without a clear focus on the climate (and how climate will pose a threat to cocoa, in addition to cocoa emissions footprint) and without linking yield increases, farm to landscape level monitoring and reporting (MRV), data management, and land use planning.

In articulating this system, the report argues that by expanding the existing extension network and increasing access to critical farm resources, farmers will have the capacity to adopt the recommended climate-smart practices and increase their yields—one of the underlying pillars of the concept. If yield increases are combined with serious land-use planning and the implementation of a multi-scale MRV/data management system, then mitigation through the adoption of CSC practices can be achieved. When the resulting yield increases and mitigation impacts are taken at a sector level it will also be possible to highlight economic, adaptation and food security benefits, and ultimately the production of a climate-smart cocoa bean.

## 3.2 Next Steps

- Having now clearly articulated the main elements and practices of CSC, further work will be needed to **determine a more precise carbon benefit directly associated with these practices and landscape level initiatives.** Preliminary work by the working group suggested that the climate mitigation benefit of CSC production is calculated at 18t $CO_2$ per ton of cocoa. This constitutes a decrease from the current BAU of 20t to a CSC scenario that emits 2t $CO_2$ per ton of cocoa produced. Sector emissions reductions are calculated at 14.4 million tons of $CO_2$. This conservative estimate is calculated based on a 110,000 ha landscape containing 60,000 ha of cocoa farms, under three shade regimes, and 50,000 ha of intact and degraded forest subject, to a 3% deforestation rate (FT and NCRC 2012).

- **Define a clear MRV strategy**— the success of a sector climate-smart initiative will require an MRV system that is robust, but can be monitored efficiently. The Working Group therefore envisions establishing clear correlations between adoption of specific farming practices and carbon benefits, coupled with landscape level monitoring (satellite imagery) and random farm-level monitoring. Through community-based platforms, like the CREMA, compliance with climate-smart practices can also be monitored through peer-check systems and community based reporting. This is similar in some respects to the MRV strategy proposed by Unique Forestry in land use for climate-smart coffee projects in Ethiopia, but it is not specifically linked to the Sustainable Agricultural Land Management (SALM) methodology approved last year by the Verified Carbon Standard.

- **Implement Climate-Smart Cocoa pilot(s)**—With the five gaps explained and CSC defined, the working group will have a clear picture of what it will take to implement and test climate-smart cocoa production in a cocoa landscape. Thus, the initiative will seek to begin testing pilot activities in the select project sites with government and private sector partners.

- **Facilitate private sector investment in Climate-Smart Cocoa**—The CSC initiative in Ghana has been designed to complement private sector interests and areas of investment, and to align such that cocoa companies can take the lead in piloting, in collaboration with government and NGOs, at the field level. Thus, pilots will aim to leverage co-funding from those companies already invested in the cocoa landscape. Further, the working group will seek to broker support from chocolate companies, whose investment could translate into quantifiable carbon benefits that they could use to off-set their carbon footprint.

## References


Afrane, G. and A. Ntiamoah. 2011. Use of Pesticides in the Cocoa Industry and Their Impact on the Environment and the Food Chain. In Pesticide in the Modern World—Risks and Benefits. ed. Margarita Stoytcheva. Rijeka, Croatia: InTech

African Development Bank. 2002. Government of Ghana: Cocoa Rehabilitation Project-Project Performance Evaluation Report. Operations Evaluation Department.

Amanor, K.S. 1996. Managing trees in the farming system: The perspective of farmers. ed. Ghana Forestry Department, Forest Farming Series. Kumasi, Ghana: Forestry Department Planning Branch.

Anim-Kwapong, G.J. and E.B. Frimpong, 2008. Climate Change on Cocoa Production. In Ghana Climate Change Impacts,Vulnerability and Adaptation Assessments, Environmental Protection Agency, pp.263-314.

Asare, R.A. 2010. Cocoa Establishment and Shade Management in Ghana's Ashanti Region: Understanding the Main Factors Driving Farmers' Decision Processes and Practices. Doctoral Dissertation, Yale University Graduate School. May 2010.

Asare, R. and S. David. 2011. Good agricultural practices for sustainable cocoa production: a guide for farmer trainers. Manual no. 1: Planting, replanting and tree diversification in cocoa systems. Sustainable Tree Crops Programme, International Institute of Tropical Agriculture: Accra, Ghana. July 2011 version.

Benhin, J.K.A. and E. B. Barbier. 2004. Structural Adjustment Programme, Deforestation and Biodiversity Loss in Ghana. Environment and Resource Economics 27:337-366.

Berry, S. 1992. Hegemony on a Shoestring: Indirect Rule and Access to Resources in Africa. Africa (62)3:327-355.

Cocoa Board. 2000. Ghana Cocoa Board Handbook. 8th edn. Accra: Ghana Cocoa Board.

Cocoa Board. 2013. About Us. Ghana Cocoa Board 2013. [cited September 6, 2013. Available from http://www.cocobod.gh/about.php]

Cocoa Swollen Shoot and Virus Disease (CSSVD) Control Unit. 2013. CSSVD Control History. Ghana Cocoa Board. [cited September 6, 2013. Available from http://www.cocobod.gh/control_history.php]

Cocoa Working Group. 2011. The Case and Pathway toward a Climate-Smart Cocoa Future for Ghana. Unpublished Technical Report. Nature Conservation Research Centre (NCRC) and Forest Trends. Accra, Ghana.

Dohmen, M.M., U. Helberg, and F. Asiedu. 2012. Certification Capacity Enhancement: Sustainable Cocoa Trainers' Manual. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Ghana Version 1.5, May 2012.

Edwin, J. and W.A. Masters. 2005. Genetic Improvement and Cocoa Yields in Ghana. Experimental Agriculture 41:491-503.

FAO. 2010. Climate-smart agriculture- policies, practices and financing for food security, adaptation, and mitigation. Rome, Italy. Retrieved from http://www.climatesmartagriculture.org/72611/en/

FAO. 2013. FAOSTAT Production. Rome, Italy. Available at: http://faostat3.fao.org/faostat-gateway/go/to/home/E

FAO. 2013b. Climate-Smart Agriculture Sourcebook. Rome, Italy. Available at: http://www.fao.org/docrep/018/i3325e/i3325e.pdf

Fairtrade Labeling Organization International (FLO). 2011. Fairtrade Standard for Cocoa for Small Producer Organizations. Current version 01.05.2011_v1.1.

Forest Trends (FT) and Nature Conservation Research Centre (NCRC). 2012. Climate-Smart Cocoa in Ghana: Achievements and a way forward. Accra, Ghana.

Fumey, M, 2013. Managing and linking cocoa sector data related to climate smart approaches in an integrated manner. Nature Conservation Research Centre (NCRC) and Forest Trends, Accra, Ghana.

Ghana Broadcasting Corporation (GBC). 2012. 300 Cocoa Extension Officers Trained. February 13, 2012. [cited September 6, 2013. Available from: http://www.gbcghana.com/index.php?id=1.781079]

Hainmueller, J., M.J. Hiscox, and M. Tampe. 2011. Baseline survey: preliminary report. Sustainable development for Cocoa Farmers in Ghana. Department of Political Science, Massachusetts Institute of Technology (MIT) and Department of Government, Harvard University.

Hill, P. 1963. The Migrant Cocoa-Farmers of Southern Ghana: A Study in Rural Capitalism. ed. M. Last, Classics in African Anthropology. Oxford: James Curry Publishers.

Hymer, S.H. 1971. The political economy of the Gold Coast and Ghana. In Government and Economic Development. Ed. G. Ranis. New Haven: Yale University Press.

International Bank for Reconstruction and Development. 1975. Report and Recommendation of the President to the Executive Directors on a Proposed Loan to the Republic of Ghana for a Second Cocoa Project. Report No. P-1687-GH

IPCC AR4. 2007. Climate Change 2007: Synthesis Report. IPCC, ISBN 92-9169-122-4.

Ruf, F. O. 2011. The Myth of Complex Cocoa Agroforests: The Case of Ghana. Human Ecology. 39:373-388.

Ruf, F. and A. Konan. 2001. Les difficulties de la replantation. Quel avenir pour le cacao en Cote d'Ivoire. Oleagineux Corps Gras Lipides. 8:6.

Ruf, F. and G. Schroth. 2004. Chocolate forests and monocultures: A historical review of cocoa growing and its conflicting role in tropical deforestation and forest conservation. In Agroforestry and biodiversity conservation in tropical landscapes. ed. G. Schroth, G. A. B. da Fonseca, C. A. Harvey, C. Gascon, H. L. Vasconcelos and A.-M. N. Izac. Washington: Island Press.

Sustainable Agriculture Network (SAN). 2010. Sustainable Agriculture Standard. July 2010, version 2.

Sustainable Agriculture Network (SAN). 2011. Criteria for Mitigation and Adaptation to Climate Change. February 2011.

UTZ CERTIFIED. 2009. UTZ Certified Good Inside Code of Conduct. For Cocoa. Version 1.0-April 2009.

World Bank. 1975. Appraisal of Ashanti Region Cocoa Project Ghana. Report No. 827a-GH. West Africa Regional Office.

FOREST TRENDS

## The Family of Forest Trends Initiatives

### Ecosystem Marketplace
A global platform for transparent information
on ecosystem service payments and markets

### Water Initiative
Protecting watershed services through markets and
incentives that complement conventional management

### Forest Trade & Finance
Bringing sustainability to trade and financial
investments in the global market for forest products

### BBOP
Business and Biodiversity Offsets Program, developing,
testing and supporting best practice in biodiversity offsets

### the katoomba group
Building capacity for local communities and governments
to engage in emerging environmental markets

### Communities and Markets
Supporting local communities to make informed decisions
regarding their participation in environmental markets,
strengthening their territorial rights

### Marine Ecosystem Services Program MARES
Using innovative financing to promote the
conservation of coastal and marine ecosystem services

### Public-Private Co-Finance Initiative
Creating innovative, integrated, and efficient financing
to support the transition to low emissions and zero
deforestation land use

Learn more about our programs at www.forest-trends.org