Defining Climate-Smart Cocoa in Ghana:

Contributions from the ESPA EcoLimits Research Experience

Key message

In defining climate-smart cocoa, research shows that priority should be given to use of fertilizer, incorporating rotting biomass in farms to improve soil moisture and pollinator habitat, conserving forests in the landscape, and promoting at least 40% canopy cover shade at landscape scales.

Understanding climate-smart agriculture

According to the FAO, **climate-smart agriculture (CSA)** reflects an approach for developing agricultural strategies that aim to achieve sustainable food security under climate change. Broadly, this translates to policies that are focused on **food security (sustainably increasing crop yields and improving farmer incomes)**, **improving adaptation**, **building farmer resilience to climate change**, and **improving mitigation** (reducing or removing greenhouse gas emissions). Thus, any CSA approach should strive to encompass these goals.

The process of defining climate-smart cocoa in Ghana

In 2012, Ghanaian cocoa and forestry sector stakeholders initiated a strategic dialogue on "climate-smart cocoa" (CSC), and by 2016 government, multilateral donors, private sector chocolate companies, civil society and traditional leaders had all made strong commitments to implementing a CSC approach to reducing deforestation and forest degradation across the cocoa landscape and improving farmers' yields and incomes.

The collective understanding in Ghana of the CSC concept has also evolved over this time period, with significant work having been completed that recommends CSC practices, discusses cocoa adaptation and resilience under climate-change, and outlines the potential for a Ghana CSC standard. However, much of this work is based upon common knowledge and policies, without benefitting from ecosystem-based research or field testing with farmers.

The importance of using research to test what should actually be promoted as "climate-smart" is critically important given the complexity of the socio-ecological relationships between livelihoods, yields, management practices, and environmental conditions and services, particularly in the context of a changing climate. Thus, this brief uses initial findings from the ESPA EcoLimits research, as well as other recent studies, to make some recommendations, based on research findings, towards how CSC is defined and the specific practices and strategies that are promoted.

The logic of these recommendations stems from their alignment with the concept that CSA practices and strategies should help to increase yields and incomes, enable adaptation and resilience, and promote mitigation; and that many practices can likely contribute to multiple goals.

Research-based recommendations for climate-smart cocoa

Ghana has clear recommendations for best cocoa practices. Many of these practices were measured under the EcoLimits research and modelling was used to assess the impact on yields.

1. **Apply fertilizer:** At the EcoLimits research site, cocoa yields were higher if fertilizer was used. In fact, application of fertilizer was the most important determinant of higher yields. Across all of the research plots, soils were deficient in some important nutrients, like nitrogen. Ensuring widespread access to fertilizer and its use by farmers should be a key part of a CSC strategy.

2. **Incorporate rotting biomass into the farm to create pollinator habitat:** Cocoa trees that were close to rotting vegetation, which provides habitat for pollinators and keeps the soil moist, had higher yields. Rotting vegetation may also provide benefits to soil fertility. Rotting biomass in the study included dead plantain and banana stalks, rotting palm fronds, empty cocoa pods, and rotting fruits, and occurred up to 100 meters from cocoa trees. This could be considered a *low-tech* method of helping farmers to improve their yields given that organic matter is common in the cocoa landscape.

3. **Maintain moist soils:** The research found that cocoa yields were higher when the soils were wetter. In farming systems, soil moisture can often be maintained or improved by adding mulch or rotting biomass near the base of trees. As demonstrated at CRIG sites, moist soils are not only important for yields, but also to improve the survival of cocoa seedlings and young cocoa trees. Increased cover from shade trees and some shade tree species can also have a positive effect on soil moisture—for example, many farmers cite Nyamedua (*Alstonia boonei)* as enhancing soil moisture. An important caveat to this recommendation is that the structure of soils can vary widely, which will in turn affect soil moisture. For example, the soils around Kakum were found to be naturally quite sandy and therefore prone to drying out more easily.
4. **Test the use of plantain stalk discs to increase cherelle production:** As an experiment, the project placed sliced discs of plantain stalks in a circle around the base of cocoa trees. Trees that received this treatment produced twice as many cherelles over a 7 month period. It is unclear whether the positive effect came from creating pollinator habitat or improved soil moisture from rotting biomass. This experiment should be replicated in different cocoa environments and further tested so as to guide CSC recommendations.

5. **Conserve forests in the landscape:** Cocoa farms located closer to Kakum forest had higher yields than farms located farther away[1]. This is the first time that research in Ghana has documented that forests have a positive effect on smallholder cocoa yields; likely due to the forest microclimate (e.g. lower temperatures, higher moisture levels in the air, and depositing dew which increases soil moisture). Thus, Ghana's definition of climate-smart cocoa should specifically incorporate measures to conserve intact forests and reduce deforestation and degradation where forests are already under threat.
6. **Promote at least 40% canopy cover of shade trees—cocoa agroforestry landscapes:** Under the research, shade (canopy cover) had neither a positive nor a negative impact on cocoa yields. This may be because there is very little variation in shade cover across cocoa farms in the Kakum landscape. EcoLimits farmers had an average of 16 shade trees per hectare (all naturally regenerated) and about 40% canopy cover. However, other new research focused on a range of shade canopies has shown a significant positive impact from increasing canopy cover on smallholder cocoa yields in Ghana[2], and CRIG recommends 16-18 shade trees per hectare and approximately 40% canopy cover. Further, mature shade trees store significant carbon stocks (CO^2). Therefore, CSC should promote at least 40% canopy cover (cocoa agroforestry) and maintain a strong focus on achieving this at a landscape scale—not only at the farm scale. This can only be achieved by harnessing natural regeneration, in addition to planting, and paying attention to shade tree species that may compete with cocoa for water or nutrients, particularly during drought periods.

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espa ecosystem services for poverty alleviation

1. This finding is based on one year of data, and may change following analysis of 3+ years of data, including the 2016 El Nino event.
2. Asare, R., Asare, R.A., Raebild, A., Anim-Kwapong, G.. (In Press). "On-farm cocoa yields increase with canopy cover of shade trees in two agro-ecological zones in Ghana", *Climate and Development*.