# Info Note

# Climate Smart Cocoa in Côte d'Ivoire

*Towards climate resilient production at scale*

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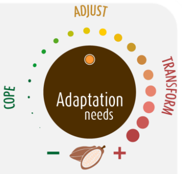
**Key messages**

- The expected cost of inaction to climate change will cause income losses to farmers of about USD$1.1 bn per year (about 3.9% of Ivory Coast's current real GDP)
- Recommendation domains with different degree of projected impact can guide interventions to scale-out adaptation.
- Climate Smart Practices for Cocoa simultaneously improve productivity and help to adapt to future climate risk.
- Current, low adoption rates of improved farming practices are a reflection of significant barriers.
- We recommend cocoa value chain actors mainstream interventions tailored to projected climate gradients regions of Côte d'Ivoire.

Three degrees of adaptation **effort**




1. **Incremental** adaptation where climate is most likely to remain suitable and adaption will be achieved by a change of practices and ideally improved strategies and enablers
2. **Systemic** adaptation where climate is most likely to remain suitable but with substantial stress, adaptation will be achieved through a comprehensive change of practices, but also requires a change of strategy and adequate enablers
3. **Transformational** adaptation where climate is likely to make cocoa production unfeasible, this will require a focus on a change of strategy and adequate enablers as practices alone may be uneconomical

Climate Smart Cocoa (CSC) furthers the objectives of Climate Smart Agriculture in cocoa production. These objectives are: increasing productivity and improving farmers livelihoods, adaptation to climate change, and mitigation of greenhouse gas emissions. Current cocoa production practices in Côte d'Ivoire still have a long way to improve toward greater resilience and achieving CSA goals.

Cocoa farms in Côte d'Ivoire are vulnerable to an array of climate-related risks: the Harmattan wind, droughts, storms, flooding. Climate change is projected to increase the occurrence of such extreme events, as well as induce more gradual changes to cocoa farming suitability via higher average temperatures and more erratic rainfall. Whether sudden or gradual, production needs to be resilient to these changes.

> This info note gives an overview of research to guide the implementation of CSC practices in Côte d'Ivoire.

To achieve adaptation at scale, stakeholders should consider impact gradient maps as well as the costs and benefits of potential CSC practices.

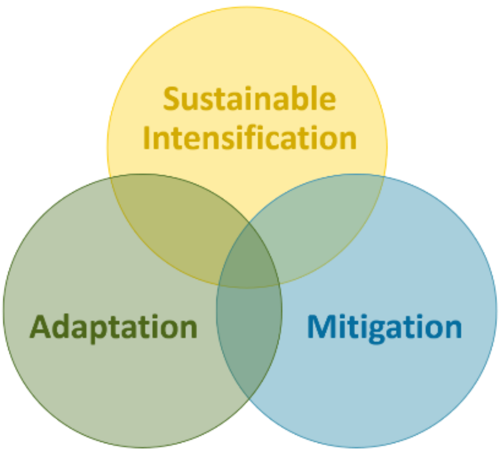
| *Practices* | *Strategies* | *Enablers* |
|---|---|---|
| implemented on-farm to adapt to current climate variability (and to a lesser extent, prepare for climate change) | implemented on- and off-farm, within the cooperative, community or supply chain, that adapt to current climate | supported by actors on- and off-farm to establish the conditions needed to implement CSA strategies and to adopt CSA practices |
| Cover crops<br>Shade management<br>Distancing<br>Trenches | Diversification<br>Choosing resilient varieties<br>Changing processing methods | Financing<br>Weather insurance<br>Weather stations |

## Climate-Smart Cocoa

Approximately 40% of the total production of raw cocoa comes from Côte d'Ivoire, however, multiple studies on the effects of climate change on cocoa production in Côte d'Ivoire have shown that the areas in which it is currently grown will become less suitable in the future (see, for example, Schroth, et al. 2016). 5 million people (21% of the population) are dependent on the 700000 smallholder farmers grow cocoa all across the southern half of the country. This crop is the lifeblood of the southern rural economy; farmers in Côte d'Ivoire depend on cocoa for 74% of their income. Most farmers are smallholders with just 1-2 ha planted with cocoa.

> Most cocoa farmers in Côte d'Ivoire live on less than USD $2 a day. Climate change is projected to have a negative impact on the Ivorian economy and rural development.

Without the necessary adaptive action, geographical shifts of suitable cocoa farming areas in Côte d'Ivoire caused by climate change appears likely and stakeholders increasingly demand decision support to direct adaptation. Climate smart cocoa (CSC) production sustainably increases productivity, enhances resilience to climate risk, and reduces or removes greenhouse gas emissions (GHGs). Many of the interventions that make up CSC already exist worldwide and are used by farmers to cope with various production risks. Interventions can take place at different technological, organizational, institutional and political levels.




Climate Smart Cocoa requires by definition a more nuanced approach to determining what constitutes a "good" agricultural practice by accounting for site- and time-specific variabilities such as climate, vulnerability, and capacities of producers to identify and adopt climate smart responses when needed. Traditional guidance such as national sustainability curriculums and GAP manuals may be insufficiently tailored to local variability, particularly under conditions of future climate uncertainty and volatility.

## Resilient production at scale

Training, enabling, and monitoring are not trivial tasks at any scale. Therefore, the importance of selecting no-regret adaptation practices and understanding barriers to implementation becomes crucial. No-regret practices are those which are designed to be beneficial for farmers under a wide array of possible future climate scenarios.To take a further step toward increasing the resiliency of production in the face of climate change, scaling must account not only for the current climate but also for the projected developments of the coming decades. Recommendation domains of future impacts, as displayed in the following pages, and the division of practices into incremental, systemic, and transformational are a touchstone of CSC for improving the resiliency of cocoa production.

Resiliency at the farm-level equates sustained productivity despite gradual climate change and a rapid and thorough recovery after extreme climate events. Resilient production at the national scale implies that the supply of cocoa beans from Ivorian farmers is far more secure and sector incomes become more stable.

> Scaling CSC practices provides a path to greater resilience and improved productivity, adaptation, and mitigation of GHG emissions in the production of Ivorian cocoa.

Adaptation to climate change is often understood as a change of production practices at farm level. Because climate models involve some uncertainty, we recommend no-regret CSC practices, i.e. practices that improve economic and social benefits regardless of the actual future climate. We were able to identify these suggested farm-level practices with the input from farmers and experts. This aims to make the adoption of these practices feasible for resource-constrained smallholders. With increasing degree of climate impacts, the importance of systems approaches to adaptation and the enabling environment increases. Value chain inclusive systems approaches to adaptation, therefore, include a wider range of actors or crops to manage risk from cocoa. Such systemic or transformational adaptation may require changes to the framework conditions, or enabling environment for CSC. The enabling environment includes policies, institutional arrangements, stakeholder involvement, gender considerations, infrastructure, credit, insurance schemes, and access to weather information and advisory services. The implementation of strategies and enablers by value chain actors beyond the farm gate is needed to help farmers adapt specific CSC practices. Climate change is a threat not only to cocoa production but to the entire cocoa value chain. Effective solutions require shared investments and greater collaboration among value chain actors both private and public.

## Observed and projected climate change

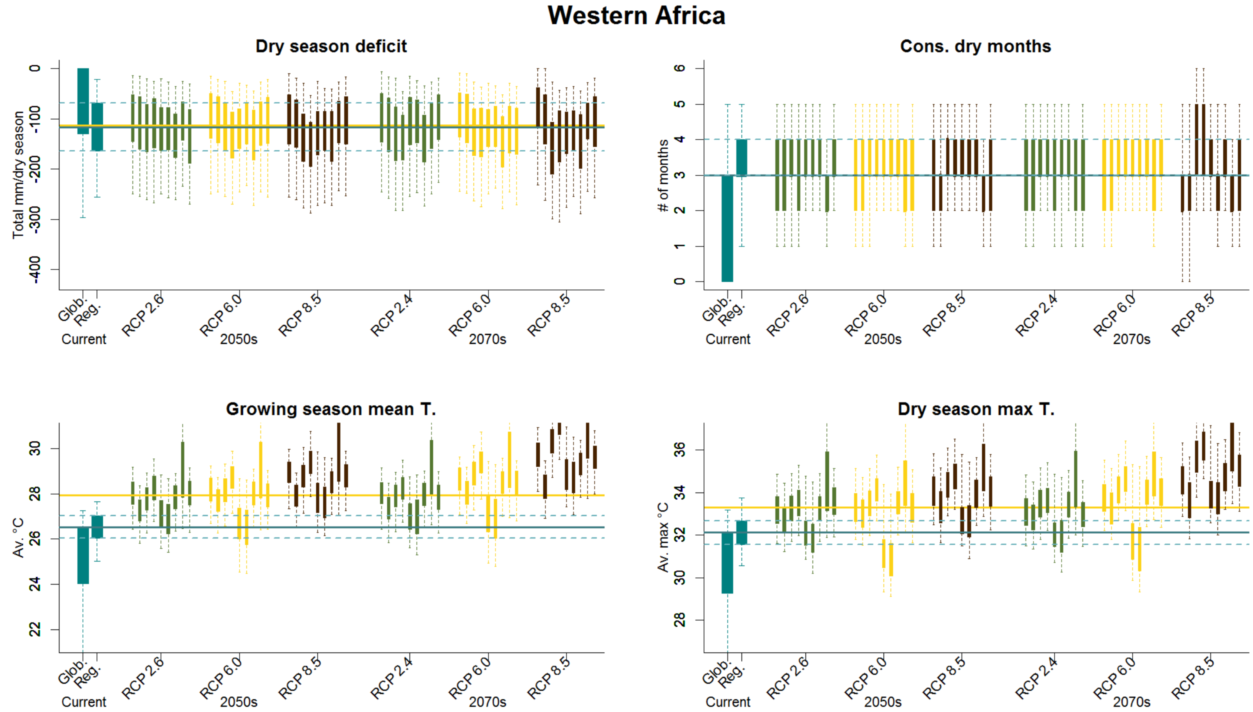



*Figure 2. Comparison of observed and simulated climate at cocoa occurrence locations in West Africa; teal colored bars show current climate conditions at global occurrence locations and only the locations in West Africa; green, yellow, and brown bars show the projections in the emission scenarios RCP's 2.6, 6.0, and 8.5 for the 2050ies and 2070ies. Bars represent the 1st and 3rd interquartile range, whiskers 5% and 95% percentiles. The yellow horizontal line represents median conditions at occurrence locations in the 2050s in the RCP 6.0 emissions scenario.*

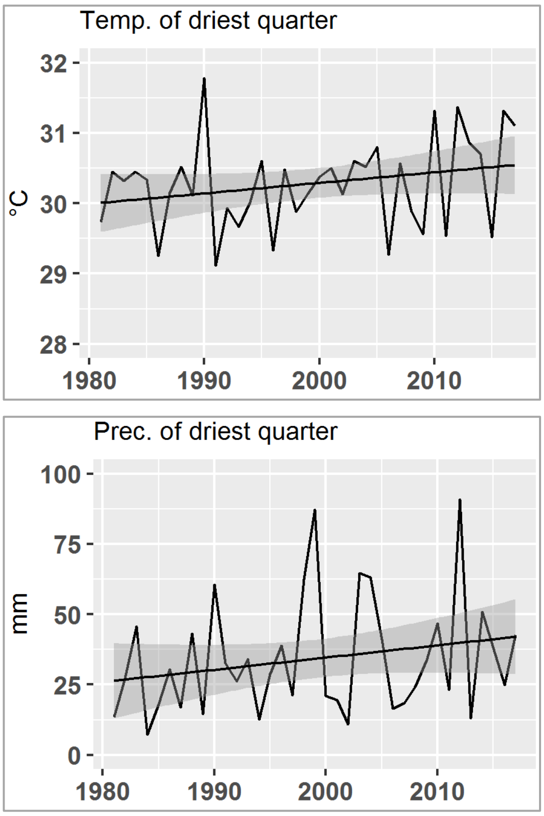



*Figure 1. Mean temperature and precipitation during the driest quarter of the year in Tiassalé from 1981 to 2017.*

Cocoa experts and stakeholders report a wide range of perceived climatic changes to date. Irregular or intermittent rainfall are among the most voiced complaints, yet others state that heat and drought are increasingly concerning. Observed climate data from interpolated weather observations confirmed some of these perceptions but not all. Across the cocoa zone in Ivory Coast, temperatures have risen in all seasons: For example, the driest quarter has become hotter everywhere by about 0.7°C over the last three decades. However, precipitation during the dry season has also increased on average between 1981 and 2017 with high variability between years (Figure 1). Increases in evapotranspiration are similar to the rise in temperatures but the precipitation increase is outpacing this so that the driest quarter is overall more humid. Precipitation of the wettest quarter has not changed. The data is inconclusive about the perceived irregularity of rainfalls.

> In an intermediate emissions scenario, the median temperatures in the 2050s would be hotter than at 98% of global locations under current conditions.

Observed trends should not be extrapolated over several decades. Therefore, we used data from global climate models (GCMs) for long term projections. West African growing areas were found to have pronounced dry seasons both in length and in deficit compared to other global locations (Figure 2). Under current conditions, growing and dry season temperatures were above most other global locations. Precipitation projections in the climate change simulations were uncertain. In the RCP 6.0 and 8.5 emission scenarios, slightly more GCMs projected increasingly severe dry seasons but overall the humid conditions were projected to prevail.

## Recommendation domains for adaptation

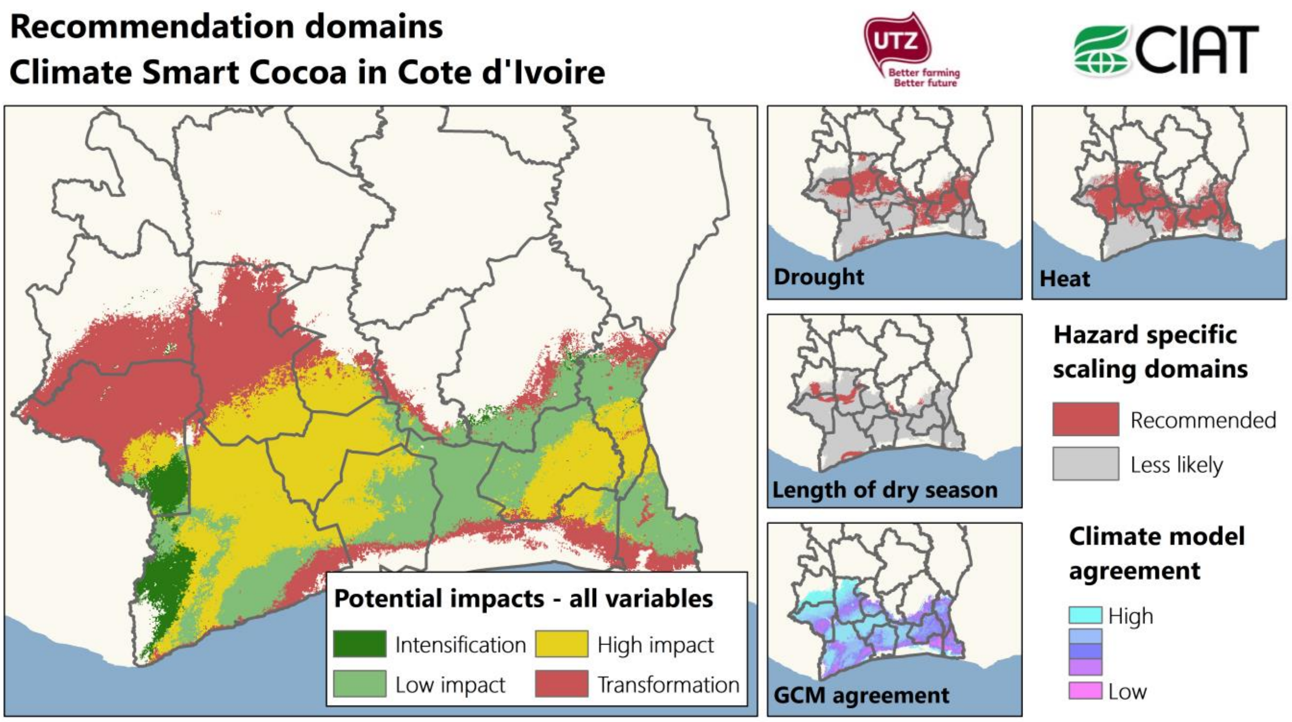
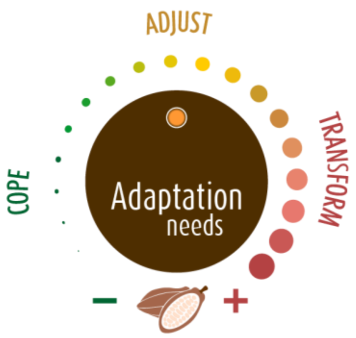



*Figure 3. Recommendation domains to scale adaptation strategies by degree of impact in the consensus across 19 GCMs in the RCP 6.0 scenario.*




To support efficient adaptation, we developed a gradient of climate change impacts. The gradient is a cocoa specific evaluation of the projected climatic changes described above. Otherwise identical climatic changes may result in severe or irrelevant impacts depending on the historic climate conditions. For example, a reduction of 50mm precipitation may be critical to the cocoa crop at locations with low water availability but would be irrelevant where rainfalls are abundant throughout the year.

> The gradient shows the most likely degree of necessary adaptation effort across several potential future climate developments.

Our method used an RF classification model to evaluate the degree of climate change impacts in Côte d'Ivoire by comparing future (2040-69) to present (1950-2000) bioclimatic suitability for cocoa. We considered 19 climate projections from GCMs in a moderate emissions scenario. For each climate scenario, we distinguished four impact zones: Cocoa production can either be sustained under low or high adaptation effort (incremental or systemic adaptation) or will become unprofitable such that it should be substituted or radically transformed (transformation). In previously unsuitable regions (opportunity) cocoa may become a new option for farmers.

The impact of climate change on cocoa producing areas in Côte d'Ivoire is far from homogenous. The area in and around Abidjan will stay relatively dry and with low suitability for farming cocoa productively. Conditions will worsen in the direction of the Savanah while central areas are projected to require adaptation to sustain current production levels. In the far southeast and southwest of the country (around Tai national park) climatological conditions will remain humid and suitable for cocoa. Although it is unclear which degree of adaptation will be necessary, sustained pressure on the national park by cocoa production will continue.

The gradient shows that central Montaignes and northern Sassandra-Marahoué will become transformation zones. Such transformation may require the development of alternative value chains or novel cocoa systems that are viable under conditions that would in the past be considered unsuitable for cocoa. The northern Góh-Djiboua and northern Comoé were classified as systemic adaptation zones. In these areas comprehensive adaptation efforts will be necessary to sustain and improve productivity in the face of climate change

State lines do not coincide with impact gradient areas. Bas-Sassandra, for example, has systemic adaptation areas in the northwest, incremental in the mid-east and transformation in the south.

## Cost of inaction

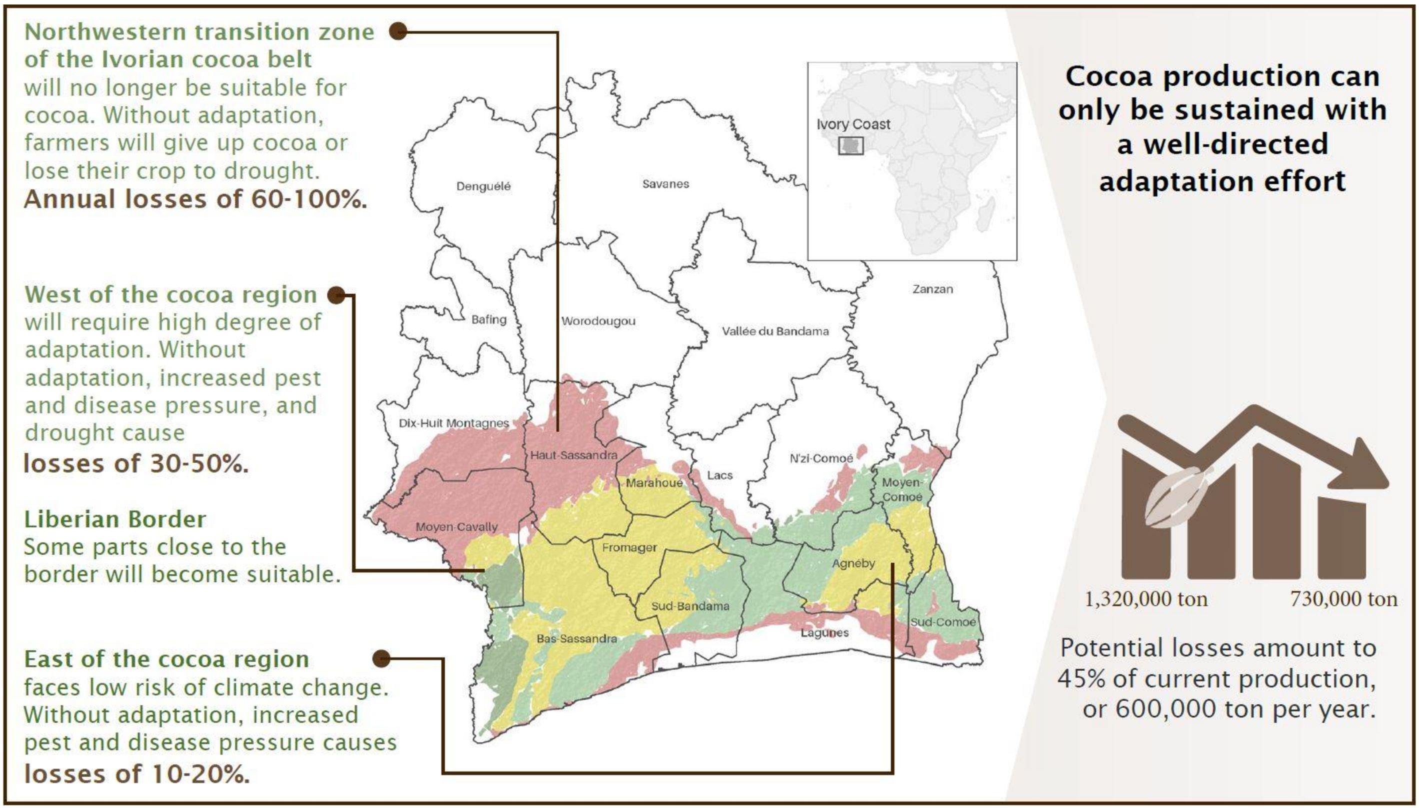
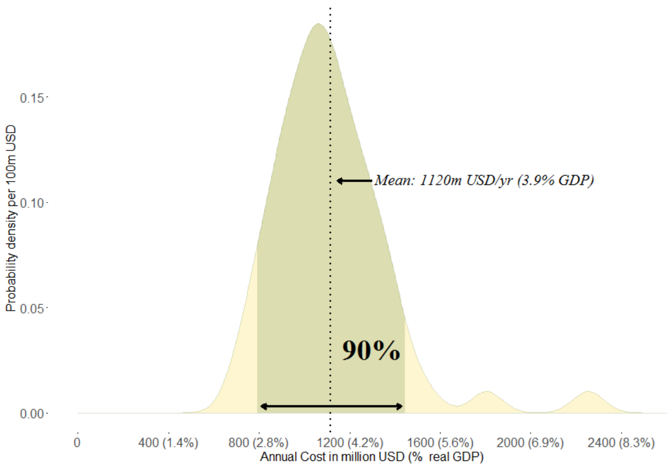



*Figure 4. Cost of inaction estimates in the different impact zones.*

To assess the importance of early adaptive action in the Ivorian cocoa sector, we estimated potential losses for a hypothetical scenario in which no action is taken against the negative effects of climate change on cocoa. To do this, we evaluated the loss of production under 171 impact scenarios that reflect potential climate change trajectories and empirically founded production losses. Benchmarking these costs should enable stakeholders to plead a more solid case in favor of investing in Climate Smart Cocoa. Our analyses revealed that if the climate conditions of the 2050s occurred today losses would amount to 1.1 bn USD per year.

> Stakeholders avoid investments that anticipate future climate change because the action would not have had positive returns with current (or past) climate conditions.




We recognize that there is a considerable degree of uncertainty with regard to future climate conditions and their effects on unadjusted cocoa farms. Therefore, we estimated a 90%-probability range of between 0.8 bn and 1.45 bn USD annually (equivalent to 2.8% to 5% of GDP)

> The expected cost of inaction on adaptation by the 2050s was estimated at 1.1 bn USD per year which is about 3.9% of current real GDP.

The probability distribution was not symmetric and indicated that the risk of extreme values, i.e. very low cost (e.g. less than 0.8 bn USD) are rather unlikely, while very high cost (higher than 1.45 bn USD correspondingly) are relatively more likely. Our cost of inaction must, therefore, be understood as an estimate of the degree of potential cost based on reasonable assumptions.

A full assessment of the benefits of adaptation by the 2050s would require knowledge of future cocoa production and prices. Demand will likely grow in the future and Cote d'Ivoire announced an effort to stabilize future prices. Under these conditions, the true cost of inaction could, therefore, be even higher. Decisive climate action is a smart investment.

> Download the report here:
> https://hdl.handle.net/10568/100126

## Potential CSC practices

Climate Smart Cocoa recommends a series of agricultural practices that fulfill one or more of the key objectives of Climate Smart Agriculture. Because of the urgent need for high adoption, an obvious approach to CSC development is to promote the scaling of strategies that some farmers already use to cope with climate risks within suitable recommendation domains. These practices are beneficial for farmers under a wide array of possible future climate scenarios. The following list can serve as a starting point to develop portfolios for each of the risk zones in Côte d'Ivoire.

> These CSC practices are already used in the region and may increase the resilience of farmers.

Before fieldwork, a desktop review of existing literature on cocoa farming practices was conducted. Literature included peer-review studies but also technical reports and communications. These practices are informed by a series of surveys of farmers by World Agroforestry and the ICRAF West and Central Africa Regional Programme. At least 40 farmers from each impact zone were interviewed, additional validation and verification workshops were conducted at the community level. Participants at the workshops reviewed and discussed the merits of a provisional list of climate change impacts and CSC adaptation recommendations for cocoa systems in each climate impact zone and provided valuable input.

> See an example of practical implementation of CSC practices for training in Ghana here: https://hdl.handle.net/10568/93360

| Intervention | Incremental adaptation | Systemic adaptation | Transformation |
|---|---|---|---|
| Plant | Planting in troughs close to banana<br>Small bowls around seedlings to catch water<br>40cm holes for planting filled with organic matter<br>Nursery with compost | Direct sowing | Improved planting material<br>Spacing<br>Pruning |
| Plot | Temporary shade with banana<br>Permanent shade trees<br>Shade management<br>Rehabilitation and/or renovation of old plantations<br>Trenches for drainage<br>Improved harvest and post-harvest management<br>For new farms, preservation of shade trees already on the plot | Plot preparation in January<br>Renovation and rehabilitation of old plantations | Higher cocoa planting density<br>Choosing humid and fertile zones for planting |
| Diversification | Agroforestry combining food crops, fruit species, and timber trees. | Diversifying incomes with other agricultural practices | Diversifying with off-farm incomes |
| Soil | Manual weeding<br>Fertilizer use<br>Composting | Mulch | Irrigation and water management |
| Pest and disease | Integrated pest management<br>Phytosanitary measures | | Resistant varieties |
| Household | Join a farmer group or cooperative<br>Form credit unions<br>Provide financial management training and access to financial information to farmer groups<br>Enhance farmer access to input/credits<br>Provide financial/ credit support to farmers for the acquisition of basic farm assets and technologies which when these are needed for facilitation the adoption of CSA among farmers | | |
| Landscape and enabling environment | Climate Information system adapted to the needs of cocoa farmers should be developed<br>Farmer training and assistance should be adapted to the sociodemographic characteristics of producers, low literacy rates and migration background, for example.<br>Farmer field school approach and mass media campaigns should be adopted to raise awareness about the threat of climate change | | |

## Cost-Benefit Analysis of CSC

Farmers are resource-constrained, i.e. they lack the financial capacity and knowledge of expected returns to adopt new practices. Making an economic argument for investments in climate smart practices and the present value of future benefits can be a determining factor in increasing adoption rates of the practices and for obtaining the necessary credit to finance them. Although cost-benefit analyses (CBAs) are ex-ante assessments and involve some uncertainty, the comparison of incremental costs and benefits can aid farmers and extension agents in prioritizing the adoption of certain CSC practices over overs. From the above set of climate smart practices, we chose a few that are widely debated to be potential "Best bet" options for scaling out. We compared the costs and benefits of these practices to a conventional – well managed – reference system with some shade and intercropping.

The following overview of costs, benefits, and barriers to adoption may help design interventions to support the adoption of these practices. From our analysis, the barriers to adoption are high for each of these practices.

The Net Present Value NPV) is calculated as the sum of benefits minus costs of each year at discounted at a specified rate (14% in our case)  to find their equivalent value in the present period in the following way and it can be used to prioritize one investment over another, as a higher NPV is generally preferred. The Internal Rate of Return (IRR) is calculated in the following way and is a measure of the discount rate at which the NPV is zero, the higher the IRR the better the investment. Business As Usual (BAU) refers to results according to continued current production practices with no adaptation.

| Current state of cocoa farming | Climate Smart Practice | Cost | IRR/NPV Compared to BAU | Barriers to adoption |
|---|---|---|---|---|
| | | *Fertilizer application* | | |
| Insufficient quantity<br>Lack of knowledge of soil requirements | Correct quantity and timing of fertilizer application to avoid soil depletion. 130% higher yields | Very high fertilizer cost<br>More labor (+33 days per year) | +76%<br>+527% | Very high cost of fertilizer<br>Lack of knowledge of soils<br>Lack of knowledge on timing for application<br>Low cocoa prices |
| | | *Improved planting material* | | |
| Non-selected traditional varieties<br>High-density planting<br>Random planting | Improved varieties from verified sources with higher yields and greater resilience to climate and pest and disease pressures. 19% higher yields | Replanting<br>No seedling cost | +23%<br>+58% | Lack of access to verified seeds and extension services<br>Lack of varieties that are ready for the future climate<br>High replanting costs |
| | | *Shade tree planting and management* | | |
| No or light shade cover (Less than 30% canopy cover)<br>Natural regeneration | At least 18 shade trees per ha (spacing at 12mx12m). Between 30% and 40% canopy cover. 22% yield increase | Lower yields in the first years<br>More labor | +12%<br>0% | Fear of less water and nutrients for cocoa plants<br>High labor costs and preference for short-term gains. |
| | | *Irrigation* | | |
| No irrigation<br>No drainage | Better water management by rudimentary drip irrigation system can increase yields substantially (+73%) and trenches reduce soil erosion and flooding during intensive rainfall | USD $345 input costs in the first year<br>Higher annual labor costs (USD$48.40) | +160%<br>+25% | High upfront investment for irrigation and lack of training<br>Trenches and low-tech irrigation with plastic bottles require substantial labor but are more profitable |
| | | *Pest and disease management* | | |
| Pests control is insufficient and fungicides are not applied | Pesticides applied 4x a year and fungicide against black pod is applied. Integrated pest management raises yields by 25% | 8 labor days per ha,<br>Pesticides and fungicides cost | +33%<br>+3% | Misuse and mishandling of pesticides threaten health, environment, and effectiveness of agents. Lack of training. |

## Diversification options

Climate change will drive producers to seek alternative income sources. Diversifying production can be a measure to reduce climate risks to household income. Tree crops are often preferred over field crops because the latter don't offer the same income and ecosystem services benefits provided by cocoa. The development of alternative or complementary value chains that can replace lost cocoa income will require multi-stakeholder approaches that include public and private actors.

We evaluated the climatic suitability of frequently named companion crops for cocoa under current and future climate conditions. For the cocoa zone, we evaluated whether these companion crops can be considered resilient to climate change so that they can be recommended for on-farm diversification if a market for the produce exists locally.

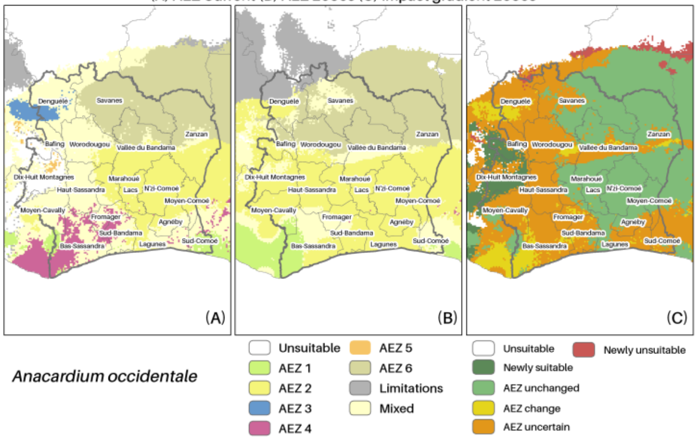
The methodology used was similar to the approach to evaluate climate impacts on cocoa. First, we evaluated the degree of climate change impacts in Côte d'Ivoire by comparing future (2040-69) to present (1950-2000) bioclimatic suitability for these crops. We then identified what the most likely future suitability in a certain region will be. A crop is recommended if cultivation can continue with only incremental adaptation. Some ot the results maps are shown on the following page.

**Companion tree crops for cocoa and adaptation needs**

| Crop | Scientific | North | West | Center-West | Center | East | South |
|---|---|---|---|---|---|---|---|
| **Cashew** | *Anacardium Occidentale* | Requires adaptation | Recommended | Requires adaptation | Recommended | Recommended | Requires adaptation |
| **Peanut** | *Arachis hypogaea* | Recommended | Not recommended | Not recommended | Requires adaptation | Requires adaptation | Not recommended |
| **Papaya** | *Carica papaya* | Not recommended | Recommended | Recommended | Recommended | Recommended | Recommended |
| **Coffee** | *Coffea arabica* | Not recommended | Not recommended | Not recommended | Not recommended | Not recommended | Recommended |
| **Orange** | *Citrus* | Mixed | Mixed | Recommended | Recommended | Recommended | Recommended |
| **African Walnut** | *Coula edulis* | Not recommended | Not recommended | Not recommended | Not recommended | Not recommended | Mixed |
| **Water yam** | *Dioscorea alata* | Recommended | Mixed | Recommended | Recommended | Recommended | Requires adaptation |
| **Avocado** | *Elaeis guineensis* | Not recommended | Not recommended | Not recommended | Not recommended | Not recommended | Mixed |
| **Bean** | *Fabaceae* | Not recommended | Not recommended | Not recommended | Not recommended | Not recommended | Not recommended |
| **Mango** | *Mangifera indica* | Mixed | Not recommended | Mixed | Recommended | Recommended | Mixed |
| **Banana** | *Musa paradisiaca* | Not recommended | Mixed | Recommended | Recommended | Recommended | Recommended |
| **Common-Guava** | *Psidium guajava* | Not recommended | Not recommended | Recommended | Recommended | Recommended | Recommended |
| **Njangsa** | *Ricinodendron heudelotii* | Mixed | Requires adaptation | Requires adaptation | Recommended | Recommended | Mixed |
| **Sugar cane** | *Saccharum officinarum* | Mixed | Mixed | Mixed | Recommended | Recommended | Mixed |
| **Elephant ear** | *Colocasia esculenta* | Mixed | Mixed | Requires adaptation | Recommended | Recommended | Mixed |

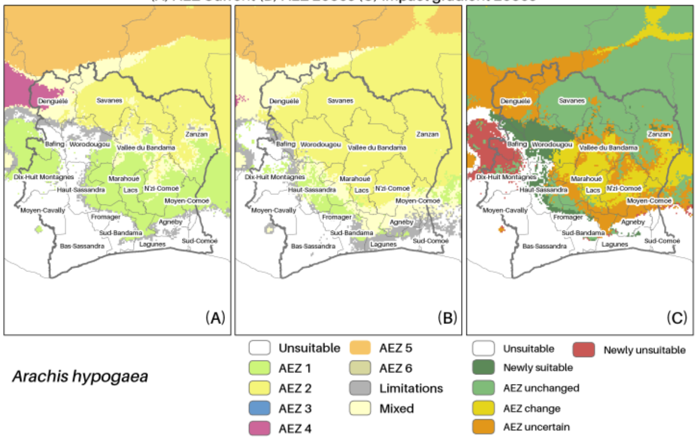
## Cashew

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



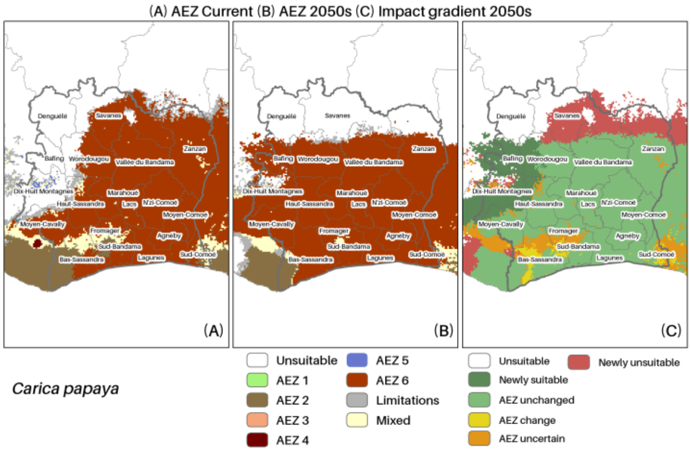

## Peanut

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



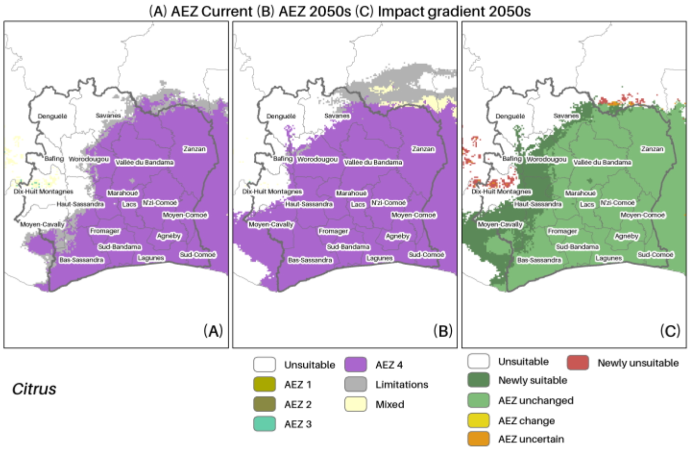

## Papaya

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



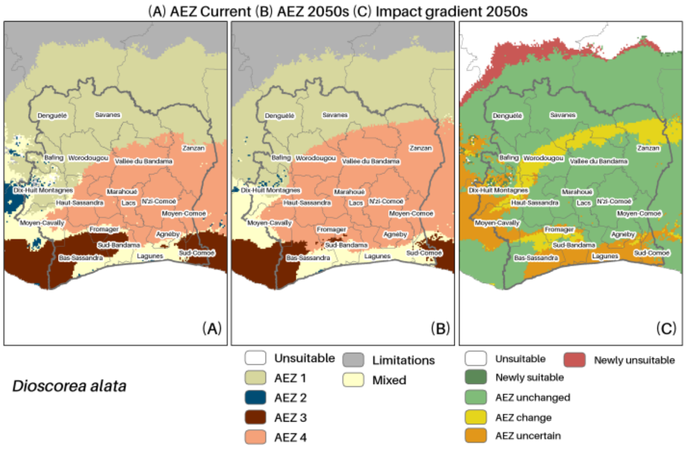

## Orange

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



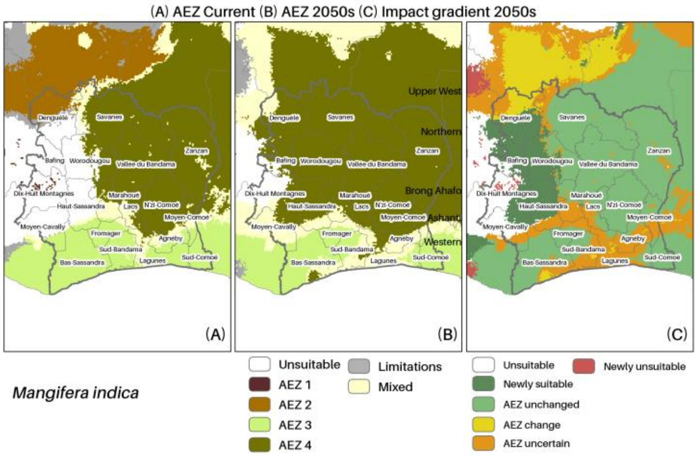

## Water yam

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



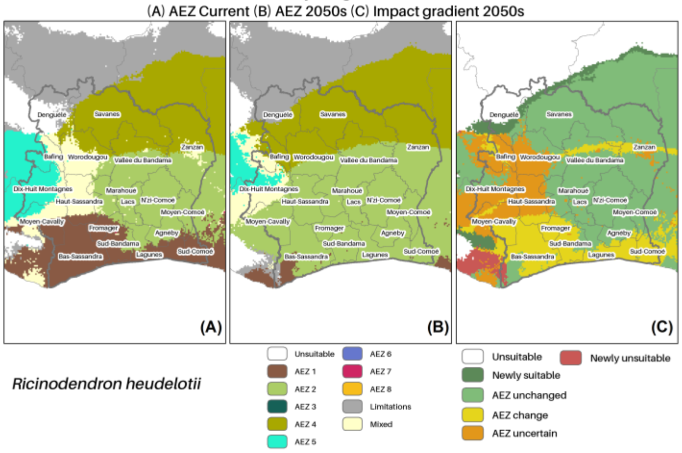

## Mango

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



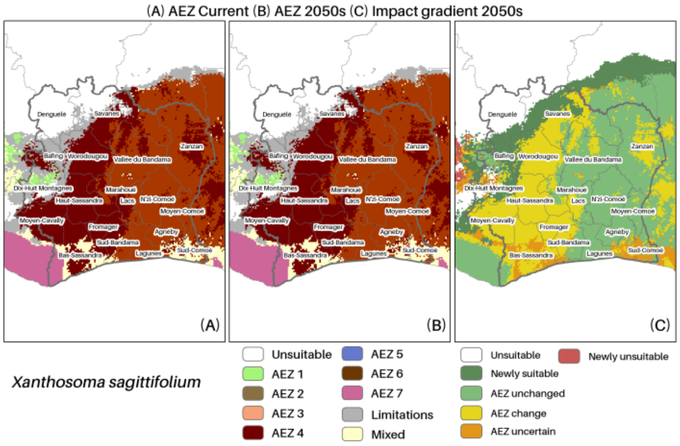

## Njangsa

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s




## Elephant ear

(A) AEZ Current (B) AEZ 2050s (C) Impact gradient 2050s



## Scaling strategies and enabling interventions

As climate change progresses in the coming decades, it will become increasingly challenging for farmers to sustain their production and livelihoods. The inclusion of a wider range of value chain actors is a necessary part of a systems approach to adaptation and the creating of enabling environments. In essence, this means that farmers are sharing the burdens and costs of increasing resilience with other stakeholders. Value chains can also be made more efficient and risk-proof through, for example, the diversification with farmers into alternative crops at the processing or transport stages. These types of comprehensive changes require adequate framework conditions (i.e. enabling environment) to unfold.

> Practice focused adaptation reaches a limit when the climate changes to a degree that makes alternative systems more attractive.

Changes in the enabling environment can reorient current practices toward Climate Smart Cocoa in a sustainable efficient way. They can promote institutional capacity and facilitate access and risk-reduction to the adoption of new technologies and practices. Comprehensive enabling environments have already been proven effective for climate-smart agriculture implementation.

> The enabling environment for climate-smart cocoa constitutes a set of framework conditions that encourage the adoption of climate-smart practices.

Involving farmers in the discussion of Climate Smart Practices and being aware of their average situation is crucial. For example, less than half of producers receive agricultural supervision and technical support for their cocoa farming activities. Members of producer cooperatives are more likely to receive support than non-members, therefore, expanding cooperative membership can be an approach to scaling agricultural extension services. Support can take many forms, including farmer field schools, technical plans, individual coaching, and training on good agricultural practices in cocoa. Even with training, however, less than 5% of those surveyed by World agroforestry had been informed of the importance of shade trees.  Links between producers and supervising organizations are weak, ANADER, the CCC, and  ICRAF are known by less than a third of farmers.

Moreover, farmers views on climate change are split. Just about half of those interviewed by World Agroforestry thought climate change would have increasingly negative effects on their farms. Two-thirds believe that the best way to combat climate change is reforestation, but just 4% thought improved farming practices could be of use. In this sense, mass media campaigns should be implemented to raise awareness of climate change and the potential for improving the resilience of farms.

Farmers aware of the risks of climate change still have to overcome significant barriers to implement practices that build the resilience of their production. Lack of credit is one of these barriers that, if overcome, could help farmers purchase inputs, pay for labor, plant trees (18% of farmers noted this possibility), and carry out other projects. 30% of producers don't even have access to inputs which are generally sold by cooperatives or private sellers. Just 14% of inputs are given to farmers by the Conseil de Café Cacao of the Government of Côte d'Ivoire.

Over 70% of surveyed farmers argue that climate information is very useful for cocoa production and helps them in decision making. Almost all mention that knowing when the first rains will come would help them make better cocoa farming decisions. Nonetheless, there are large differences between regions in access and use of climate information, while virtually all farmers in Bèkoinkro and Anaguié have used climate information to make farming decisions, in other areas the share is considerably lower (54%).

The following table presents the vision for a climate smart cocoa sector and the roles of sector participants.For each degree of impact, it presents a set of priority actions that should be developed towards 2030 with the objective of increasing the resilience of cocoa in Côte d'Ivoire. This vision was informed by individual farmer surveys, group discussions, and a desktop review of the literature.

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| Climate Smart Practice | Examples by degree of adaptation | Enabling actions | Relevant actors |
|---|---|---|---|
| Good agricultural practices | **Incremental**: larger holes for planting<br>**Systemic**: grafting with improved varieties on low productivity cocoa plants<br>**Transformation**: apply biostimulants to combat flower losses | • Providing farmers with training | • ANADER, Cooperatives, and NGOs |
| Good agricultural practices | | • Implementation of practices on-farm | • Producers and input suppliers |
| Establishment and management of shade trees. Shade trees should provide fertilization, fruits, medicine, or be forest species | **Incremental**: intercropping with Banana and *Gliricidia spp. for* temporary shade | • Develop adequate cocoa agroforestry models | • Research institutions (CNRA, ICRAF, CIRAD,…) |
| | **Incremental**: intercropping with Banana and *Gliricidia spp. for* temporary shade | • Provide information to producers about the benefits of shade trees on cocoa farms | • CCC, ANADER, NGOs, Cooperatives, Certification agencies, , MINEF, SODEFOR |
| | **Incremental** / **Systemic** | • Develop techniques to increase the number of shade trees on-farm and increase productivity | • Research institutions, ANADER, forestry stakeholders |
| | **Systemic**: plant productive shade trees for permanent shade (fruit and timber species) | • Develop production and distribution systems for planting and maintaining shade trees | • ANADER, Cooperatives, CCC, Producers, Chocolate producers, forestry stakeholders |
| | **Systemic** / **Transformation** | • Provide information to producers about forestry laws and the new forestry code regarding tree ownership | • MINEF, ANADER, NGOs, Cooperatives, Certifcation agencies, Chocolate producers |
| | **Transformation**: transition to different crops. Pruning tall trees | • Train farmers in the correct management of shade and shade trees | • ANADER, Cooperatives, NGOs |
| | **Transformation**: transition to different crops. Pruning tall trees | • Establishment of initiatives to increase the adoption of agroforestry systems based on cocoa (SAFc) | • CCC, Certification agencies, chocolate producers, Cooperatives |
| Measures for water and soil conservation | **Incremental**: apply organic matter<br>**Systemic**: apply compost and other sources of organic matter<br>**Transformation**: irrigation with bamboo pipes | • Provide information and training of farmers on the matter of soil and water conservation | • ANADER, Cooperatives, NGOs, microfinance organizations |
| Planting improved varieties with resistance to heat and prolongued dry periods | **Incremental**: use improved varieties<br>**Systemic**: use improved more resilient varieties<br>**Transformation**: planting improved varieties on soil enriched with compost for 6 to 8 months | • Development of adequate varieties with are resistante to prolongued dry periods heat, and other stressors | • Research institutions, CCC |
| Climate information services | | • Make available to farmers local climate information adapted to their cocoa farming needs | • Metereological services, Research institutions, ANADER, Cooperatives, NGOs, Chocolate producers (finance), Mobile phone and network companies, radio stations |

## Conclusions

The importance of Côte d'Ivoire as the largest supplier of cocoa in the world should be reflected in the use of improved farm management practices and resilience to climate change. However, most farmers are maladapted to sustain their production under climate change. This is especially worrisome in systemic adaptation and transformation areas where the negative effects on cocoa will be more severe. The analyses found in the previous pages of this document serve as a compass pointing toward greater resilience at scale of cocoa production in Côte d'Ivoire

The need to shift from current cocoa farming practices to CSC practices is ever more evident and urgent. Climate impact zones are useful tools to adapt recommended practices to the requirements of each area. The economic arguments for adopting these practices has been made and the resulting cost-benefit analysis should convince both farmers and lenders of the potential gains from CSC. However, interventions at any level (technological, organizational, institutional or political) must consider all possible barriers to adoption (e.g. access to inputs, lack of training). These approaches should be in the interest of all value chain stakeholders. No-regret adaptive practices, such as adequate fertilizer application and planting of improved seeds, are a stepping stone toward increasing the resilience at scale of cocoa farming in Côte d'Ivoire and achieving CSC objectives.

## Further Reading


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*The Feed the Future Learning Community for Private Investment in Climate Resilient Agriculture is a consortium of non-governmental organizations and research institutions working at the intersection of climate change and cocoa production. Our vision is to improve the livelihoods and resiliency of cocoa farmers and promote better environmental stewardship by having the private sector fully support and allocate resources to the implementation of climate-smart agriculture in cocoa landscapes globally.*

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