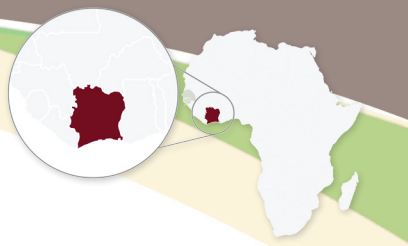
Food and Agriculture Organization of the United Nations



Climate-Smart Agriculture in Côte d'Ivoire

Climate-smart agriculture (CSA) considerations

P Agriculture is the main economic activity in Côte d'Ivoire contributing 21.2% to the country's gross domestic product (GDP) and employing 46% of the labour force. The country is at the forefront of Africa for many agricultural products such as cocoa, rubber, palm oil, banana, pineapple, cotton, coffee, coconut, and cola nut.

P A I Despite the importance of agriculture in Côte d'Ivoire, the sector is confronted by several challenges including high deforestation, soil erosion, land tenure insecurity, weather variability and climate change which has manifested in the form of declining rainfall amounts, shortening length of the rainy seasons; rising temperatures, increased duration and rigor of dry seasons, as well as increased incidences of floods.

I A M P While CSA practices exist in Cote d'Ivoire, most of the practices are not widely adopted. At present, banana-cocoa integration system seems to be the most adopted covering about 13% of the agricultural land. The wide spread adoption of this practice has been enabled by low technology needs, private sector engagement in the implementation and its' multiple benefits such as food, income diversification and contribution to improved resilience of the system as a whole.

I A M P Challenges to the adoption of CSA include lack of capacity building of farmers and limited access to information on available innovations and their provision in accessible and usable format so that small rural producers can understand and apply them.

M With livestock contributing 63% of total agricultural greenhouse gas (GHG) emissions, there is the need to conduct research on livestock-based CSA practices to support mitigation actions. At present, the livestock-based CSA practices focus largely on adaptation and resilience.

I Several policies, strategies, plans and programs are being implemented to fight climate change and promote CSA. Of relevance to CSA are the National Communication on Climate Smart Agriculture (NCCSA), National Strategy for Disaster Risk Management (NSDRM) and the National Programme on Climate Change (NPCC).

I CSA policies and actions are implemented mainly by the Ministry of Environment and Sustainable Development (MINEDD), the Ministry of Agriculture and Rural Development (MINADER), the Ministry of Animal Production and Fisheries Resources (MIRAH) and the Ministry of Water and Forest (MIREF). The Institution for Aeronautical and Meteorological Development (SODEXAM), plays a key role in monitoring and sharing climate and weather information. There is limited involvement of civil society on CSA in the country.

I $ Although the country is eligible for multiple international climate finance instruments, funding for CSA is limited. Greater effort needs to be placed on accessing international climate finance instruments while at the same time, ensuring availability of local level public and private financing instruments for investments in the agriculture sector.

A Adaptation **M** Mitigation **P** Productivity **I** Institutions **$** Finance

The climate-smart agriculture (CSA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address trade-offs and synergies between these three pillars: productivity, adaptation, and mitigation [1].

The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within countries and globally, about entry points for investing in CSA at scale.

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CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS
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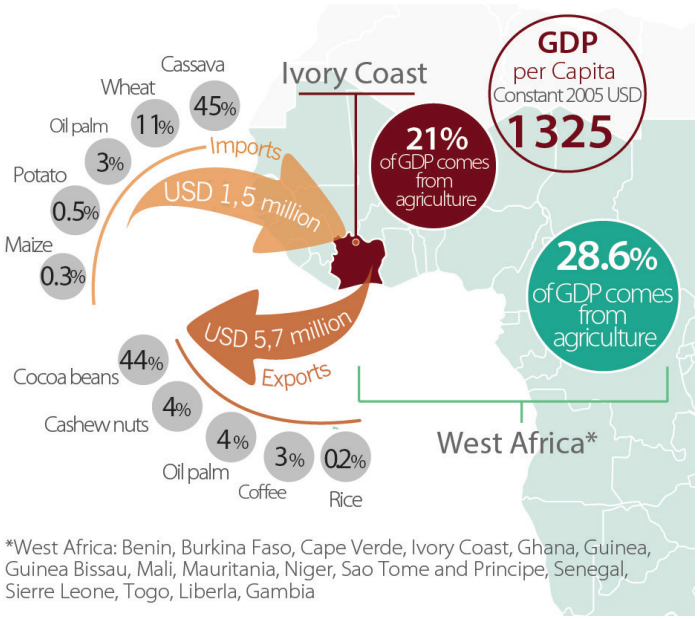
National context

Economic relevance of agriculture

The agricultural sector is the main engine of economic growth in Côte d'Ivoire [3]. Agriculture, including forestry, hunting, fishing and livestock production, contributes about 21.2% of GDP and accounts for 47% of total exports of the country. This sector employs 46% of the country's labor force and constitutes a source of income for two-thirds of the population. Export productions account for almost 40% of export earnings and support the agro-industrial development of the country. Côte d'Ivoire has natural agricultural potentialities (fertile land, important hydrological resources, and favorable climate) and a wide variety of agro-ecological conditions. These assets place the country at the forefront of Africa for many agricultural productions (rubber, palm oil, banana, pineapple, cotton, coconut, and cola nut). Indeed, Côte d'Ivoire is now the world's largest producer of cocoa and second largest producer of cashew nuts, with other expanding export productions, including rubber and mango.

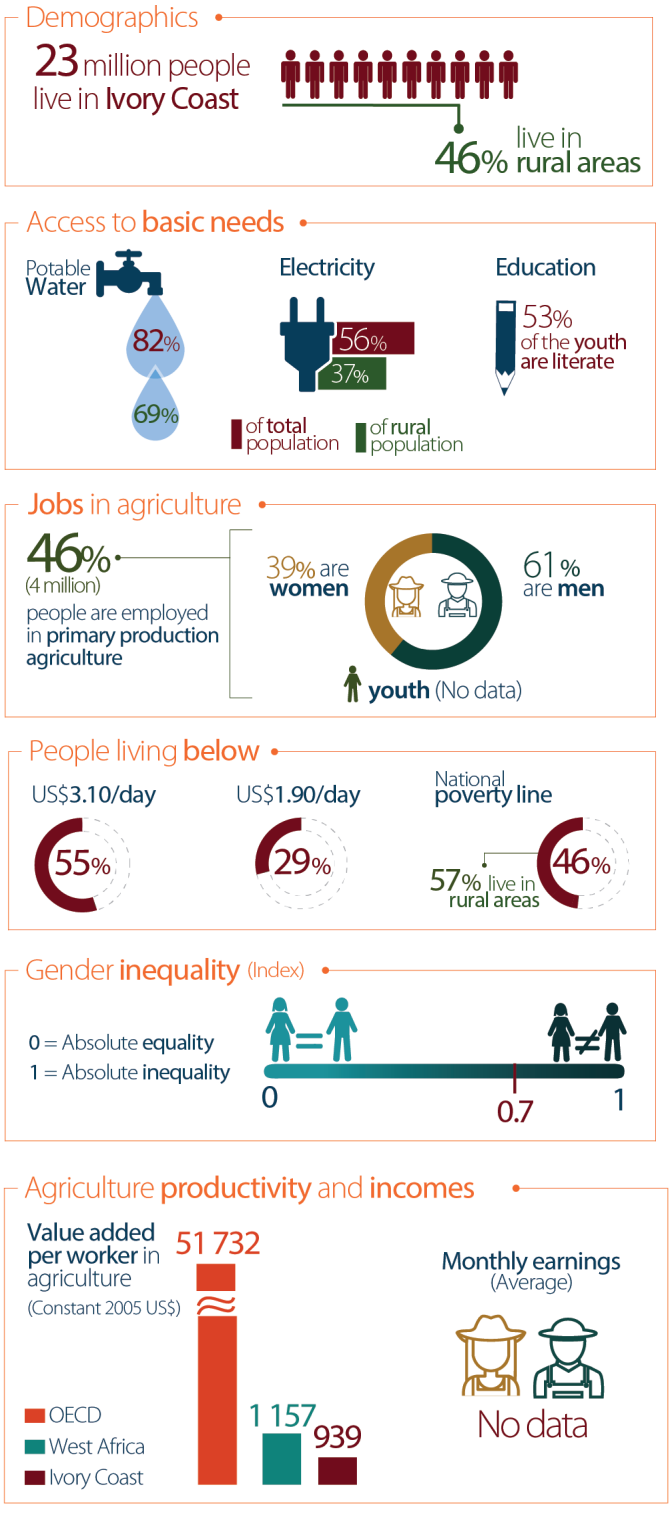
Economic relevance of agriculture in Côte d'Ivoire



*West Africa: Benin, Burkina Faso, Cape Verde, Ivory Coast, Ghana, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Sao Tome and Principe, Senegal, Sierre Leone, Togo, Liberla, Gambia

Source: [4, 5]

People, agriculture and livelihoods in Côte d'Ivoire



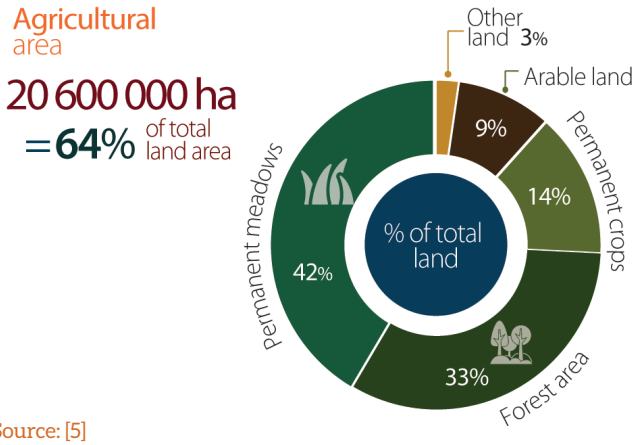
Source: [4, 5, 6]

[1] https://oxfordbusinessgroup.com/overview/return-form-after-challenging-period-country's-agriculture-sector-has-started-see-its-fortunes

Land use

In Côte d'Ivoire, arable land is estimated at 21 million hectares (ha) representing 64% of the total area of the country. In 2012, cultivated areas were estimated at 7.4 million ha, or 35% of arable land [5]. Young people and women have limited access to land mainly in areas where population pressure and environmental degradation make productive land [7]. Between the early 1960s and now, the forest cover of Côte d'Ivoire has declined from 16 million hectares to 2 million hectares. With the current rate of deforestation, Côte d'Ivoire is expected to lose all its national forest by 2034. The main factors of deforestation remain the exploitation of the forest for timber and wood energy (e.g. charcoal used by approximately 47% of the urban population), bush fires and agricultural expansion [8]. In addition, poor policy steering and poor governance, lack of coordination between forest policy and other sectoral policies, lack of land tenure security and demographic pressure have negatively impacted on the management of forest resources [8, 9].

Land use in Côte d'Ivoire



Source: [5]

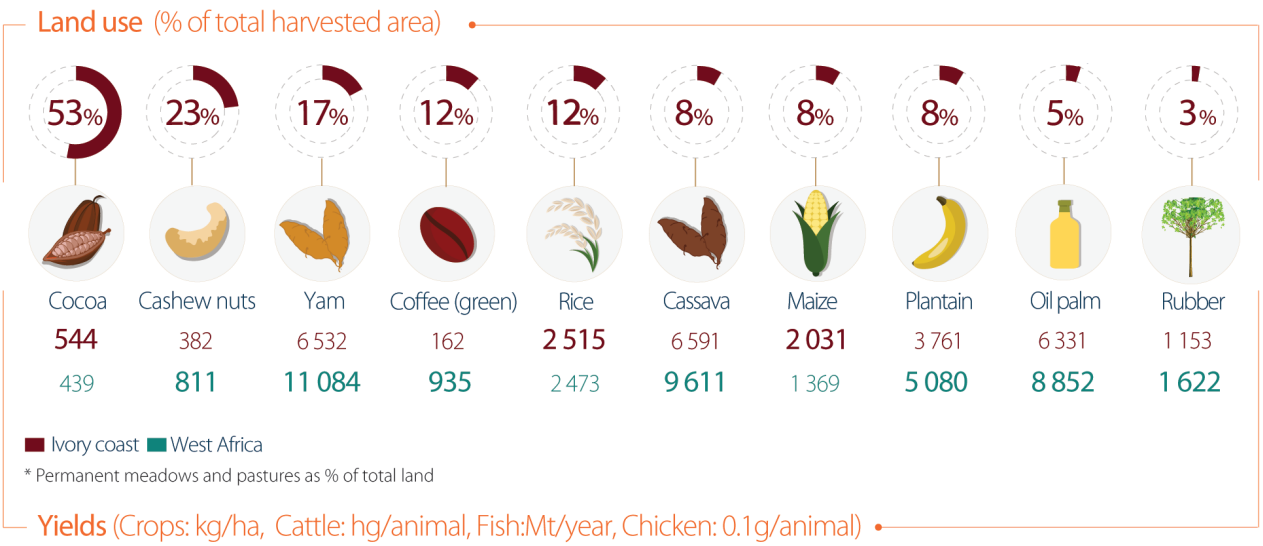
Agricultural production systems

Côte d'Ivoire is divided into four (4) large agro-climatic zones based on biophysical and socioeconomic characteristics. The agro-climatic zones include Sudan savannah (900-1 400 mm), Guinea savannah (1 000-1 500 mm), Western semi-mountainous forest zone (1 200 to more than 1 600 mm) and forest zone (from 1 200 to more than 1 600 mm) [10, 11, 38]. The main cropping systems include food crop-based systems and perennial crop-based systems. The food crop-based systems include yam, rice, plantain, cassava and maize. Yam is mainly produced in the northern part of the country and contributes about 4.7% of GDP. Yam also provides about 510 Kcal/day/inhabitant, making it the second energy source just after rice. Rice is produced in the country under three production systems (rainfed, lowland and irrigated) and contributes 1.72% of the agriculture GDP. Plantain is produced mainly for the domestic market and normally grown in association with coffee and cocoa. Cassava is grown on 4/5 of the national territory, but it is the forest region which provides most of the production. Maize is mainly grown in the Sudanian and Sudano Guinean regions [12].

Perennial crop-based systems include cocoa, cashew nut, coffee, rubber and palm tree-based systems. Cocoa is mainly produced in the forest zone. It constitutes the pillar of the Ivorian economy contributing about 5% of GDP in 2013 [13]. Cashew is mostly cultivated in the Sudan and Sudano Guinean zone of the country. It contributes 1.3% of GDP [13]. Cashew production in Côte d'Ivoire increased by 40% from 2009 to 2013 placing the country as the second largest producer in the world [13]. Livestock is still a secondary economic activity with a direct contribution of around 4.5% to agricultural GDP and 2% to total GDP. The 2001 national consumption coverage rate was 59% for meat and offal, 100% for eggs and 18% for milk and dairy products [10, 14]. Traditional cattle breeding is practiced in two extensive forms: sedentary breeding with small size of herd in the savanna zone and transhumant breeding. The improved traditional system results from a gradual intensification of the traditional system. It is found throughout the country but with a higher concentration in the Central and North-Central regions.

The following infographic shows a selection of agricultural production systems considered key for food security in Côte d'Ivoire. The selection is based on the production system's contribution to economic, productivity and nutrition quality indicators. For more information on the methodology for the production system selection, consult Annex 1.

Production systems key for food security in Côte d'Ivoire

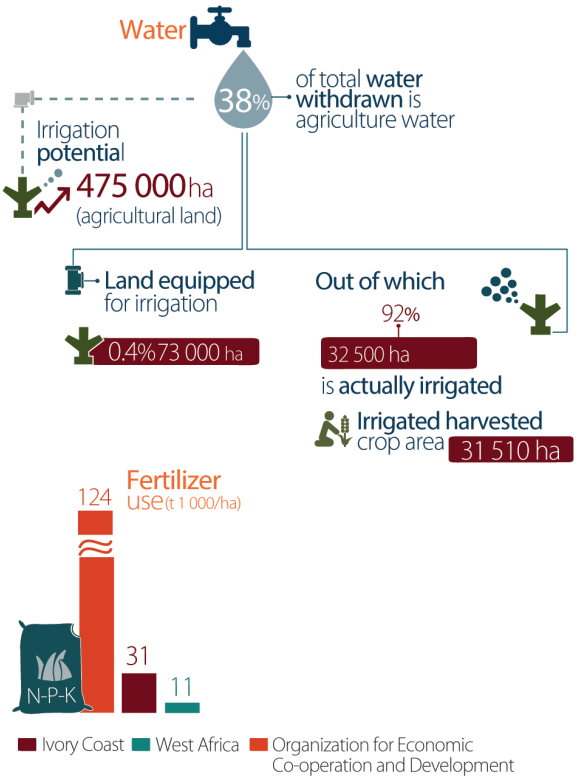


Source: [5]

The use of inputs is an important factor in modernizing agriculture in Côte d'Ivoire. A recent study has shown that, overall, fertilizer and herbicide[2] are the two best known and most commonly used agricultural inputs [15], followed by improved seed and insecticide for cereals (maize and rice) and vegetables. Domestic demand for inputs is increasing, given the growing demand for foodstuffs. But the use of fertilizers and pesticides is very low, especially among food producers, with the purchase price of food products not allowing increased use of inputs. In 2014, muriate of potash and urea were reportedly the most commonly consumed fertilizers constituting about 50% of total consumption [16].

At the level of seeds and seedlings, the Ivorian Agriculture uses the varieties created by the national research system, but also benefits from introductions from abroad, and in particular from the institutions of the international agricultural research system. Meanwhile, different socio-economic, institutional and political constraints limit producers' access to agricultural inputs, particularly for food crops. To improve producers' access to inputs, the government has put in place a number of policies including tax exemption or preferential taxation, moderate subsidies, liberalization of production, supply and distribution, establishment of support mechanisms for professional organizations, support for supply cooperatives, etc. Moreover, agriculture in Côte d'Ivoire is largely rainfed with less than 1% of land under cultivation equipped with irrigation facilities [17].

Agriculture input use in Côte d'Ivoire



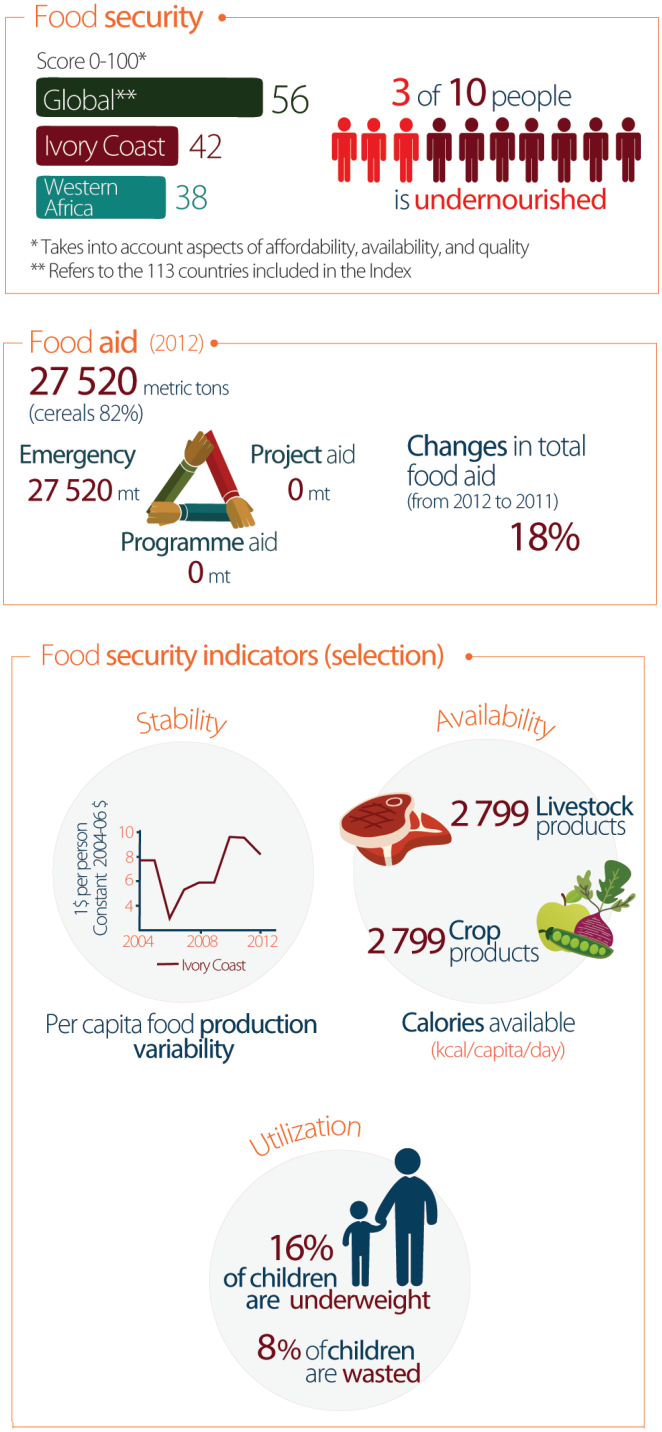
Source: [4, 5, 16, 17]

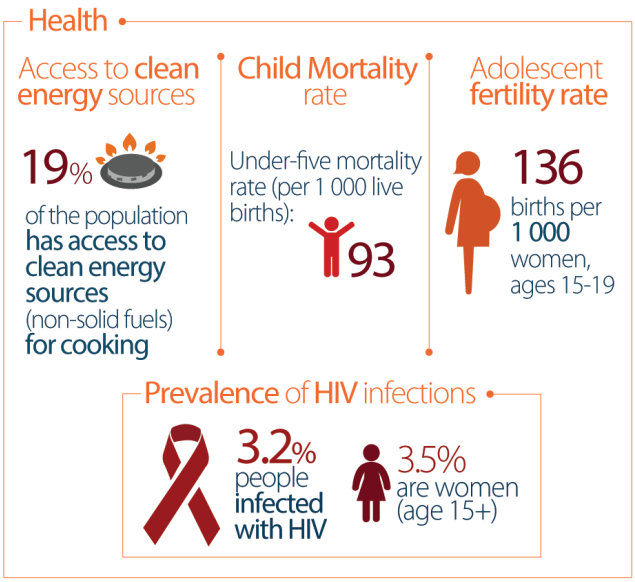
[2] Herbicides is in fact the most commonly used input.

Food security and nutrition

According to the comprehensive food security survey, 12.6% of rural households in Côte d'Ivoire are food insecure, of which 2.5% are severely food insecure and 10.1% are moderately food insecure. An analysis of household consumption patterns by quintile indicates that "wealthier" households account for a smaller share of their consumption expenditures on food compared with less affluent households. In 2008, wealthier households accounted for 40% of their consumer spending on food, compared with 55.3% for those in less affluent households. In 2002, the figures were respectively 25.5% and 58.7% [18, 11]. From the food balance sheets, it appears that the average number of calories consumed per person per day is 2 535 kcal / person / day over the period 2002-2008. This indicator varies between 2 587 kcal which is the highest level (in 2006) and 2 504 kcal in 2007. The average number of calories consumed per day per person in Côte d'Ivoire is close to the minimum threshold of 2 400 kcal/ person/day. In parallel with the change in per capita calorie consumption, the prevalence of undernourishment in the population is on average 28%, the minimum is 26.4% (in 2006) and the maximum is 29.1% (in 2007). An analysis of the contribution of products to the calorific availability per person per day at national level shows a predominance of products such as yam, rice and cassava with product rates higher than 10% of the total calorific availability per person per day. However, a segment of the Ivorian population remains vulnerable to food and nutrition insecurity due to: (i) climatic uncertainties; (ii) the socio-political crisis which led to massive displacement of populations and problems of access to land; (iii) the weakening or inadequacy of the distribution, processing and preservation network; (iv) the low purchasing power of households and; (v) poor nutritional practices. All these factors have contributed to altering all nutritional indicators. In children aged 0 to 59 months, the prevalence of chronic malnutrition increased from 25.4% in 2000 to 34% in 2006 with 16% of children currently underweight, particularly in the North and West of the country. With regards to micronutrient deficiencies, high deficiencies in iron and vitamin A are reported among children and women of reproductive ages. From 1996 to 2007, the prevalence of iron deficiency increased from 35% to 51.5% in children under 5 years and 16% to 58.9% in women of reproductive age. As part of the fight against Iodine Deficiency Disorders, about 84% of households in Côte d'Ivoire are now using iodized salt. Three percent of the population between 15 to 49 years old are estimated to be infected with HIV/AIDS as at 2015 [5].

Food security, nutrition, and health in Côte d'Ivoire





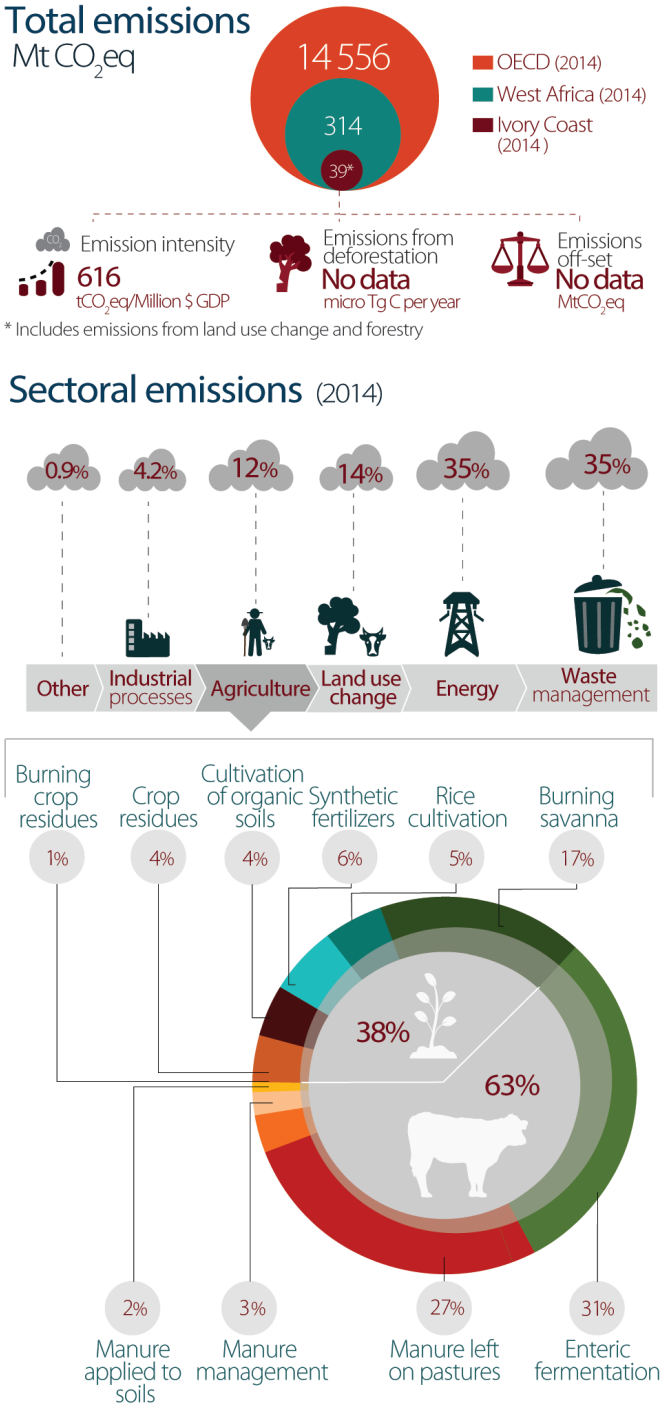
Source: [4, 5, 19, 20, 21]

Agricultural greenhouse gas emissions

Total annual greenhouse gas emissions (GHGs) in Côte d'Ivoire are estimated at about 39 Mt CO_2 equivalent (CO_2e) with the agriculture sector contributing 12% of the total emissions. The livestock sub-sector contributes 63% of the agricultural emissions mainly through enteric fermentation (31%) and manure left on pastures (27%). Savanna burning, rice cultivation and use of synthetic fertilisers contribute 17%, 5% and 6% respectively [22]. The UNFCCC Secretariat reported that Côte d'Ivoire was the 61st Party to formally submit its (Intended) Nationally Determined Contribution ((I)NDC), which announces two greenhouse gas (GHG) emissions reduction targets: the first, 28% below a business as usual (BAU) reference scenario by 2030, is based on the reduction efforts contained in the strategic sectoral development plans with the support of technical partners and financiers; the second containing an additional 8% reduction (36% reduction in total), is subject to capacity building, technology development and transfer, and financial support that is new, additional and easily accessible [23].

In the NDC, Côte d'Ivoire outlines mitigation actions in the agriculture and forestry, energy and transport, and waste sectors. In agriculture, actions to mitigate climate change include among others: promotion of agricultural practices such as agroforestry; mainstreaming strategies to limit deforestation (e.g. REDD+) into National Agricultural Investment Plans (NAIPs) [24]. The NDC emphasizes the need to decouple the link between agriculture and deforestation and land degradation, while ensuring that agriculture and forestry practices maintain ecosystem services. In addition practices related to domestic energy availability, such as improved cooking stoves are highlighted as a means of reducing deforestation. The NDC also identifies agriculture, forestry, water resources and coastal zones as priority areas for adaptation support.

Greenhouse gas emissions in Côte d'Ivoire



Source: [5, 22]

Challenges for the agricultural sector

Despite the enormous potential of agriculture in Côte d'Ivoire, the sector remains confronted with several challenges. Intensification of agriculture is far from being achieved and deforestation has worsened. Rural to urban migration has also continued, leaving a limited skilled rural population. Land tenure security is facing difficulties of application of the law adopted in 1999 [25]. Similarly, the objectives of the intensive diversification of agricultural production, productivity and competitiveness, self-sufficiency and food security could not be achieved in plant or animal production. Imports of food products have maintained an upward trend, which has even strengthened in recent years. Concerning the human capital, agriculture in Cote d'Ivoire, for the most part, is driven by an aging agricultural population, little trained in modern production techniques that use family work force and rudimentary tools. Moreover, the low level of conservation and processing of the main agricultural products generally results in relatively high post-harvest losses. These losses can range from 27% to 50% for tubers and bananas. For cereals, post-harvest losses sometimes reach 16%. The major problems identified in this area are inadequate technology for the processing and conservation of perishable foodstuffs and the high cost of existing technologies.

Forest degradation is continuing at an alarming rate, including (i) the misuse of forest resources for the production of timber, firewood and charcoal; (Ii) extensive agriculture and itinerant farming; (Iii) inadequate decommissioning and clandestine infiltration into classified forests, national parks and reserves; (Iv) the decline of reforestation; (V) uncontrolled urbanization; (Vi) bush fires and (vii) population pressure [25]. Funding for agriculture, livestock, fisheries and aquaculture is characterized by a low level of investment after a decade of crisis, although considerable efforts have been made since the end of the post-election crisis. The issue of land ownership remains a major concern in Côte d'Ivoire. Indeed, renewed land conflicts and problems of access to land are still factors of social tensions that undermine national reconciliation and the revival of economic activities in Côte d'Ivoire. Concerning gender, women who are at the center of agricultural activities are marginalized in terms of access and control of production assets [25].

Agriculture and climate change

The analysis of the evolution of climate parameters during the last 50 years (1960 to 2010) shows that climate change is already an undeniable reality for Cote d'Ivoire [26]. It is indicated that insolation increased in the Guinean forest zone of the south, but changed very little in the northern half of the country. Temperatures have risen by 1.6°C throughout the country in the period 1960-2010, and projections indicate that temperatures will continue to increase by as much as 1.8 °C and 2.1°C in 2050 and 2070 respectively, with the greatest increases being in the Northern parts of the country where malnutrition rates are already high.

In terms of rainfall, mean annual rainfall decreases from south to north, reaching 1 800 mm in high Abidjan in the south and reducing to 1 050 mm in Bondoukou in the northeast. While it is common for rainfall in the country to fluctuate, the general trend is a decline in total annual rainfall. Between 1940 and 2010, rainfall has reduced by 28.9% in Abidjan, 23.5% in Soubré, a barely noticeable decrease in Gagnoa in the forest zone and Abengourou, a decrease of 12.5% in Bondoukou and Bouaké and a decrease of 7.7% in Korhogo. The largest declines were observed in the moist forest area in the south of the coast, which could be partly related to the destruction of the forest cover by extensive agriculture and the uncontrolled exploitation of forests [26]. Projections indicate an average of 0.3% and 1.2% increase in total annual precipitation for 2050 and 2070 respectively. This increase in rainfall is expected to be greatest in the Northern and Western regions of Côte d'Ivoire. However, there are pockets in the south and east of the country, where rainfall is expected to reduce by as much as 3% from the current averages. Therefore adaptation efforts need to take consideration of these spatial differences in rainfall changes. Studies by SODEXAM show that the rainy season has been shortened by an average of 10 to 27 days on the littoral with an average start-up delay of two weeks. Inside the country, there is a reduction in the length of the season by between 10 to 20 days in the North, 20 to 30 days in the Inner South, and 10 to 28 days in the Center. Delays in season onset vary from one to two weeks depending on the location [27].

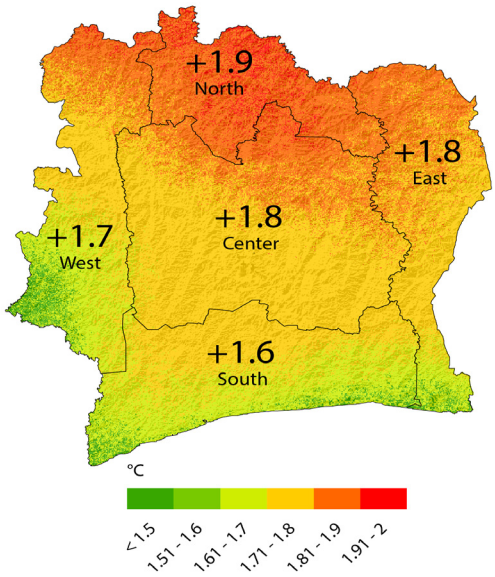
The analysis of the aridity index of de Budyko-Lettau (IABL) in 2010, indicates that changes are expected in the country's agro-ecological zones. Projections indicate that by 2100, only the Forest Zone around Gagnoa and Abengourou will remain in the Guinean zone while the Southern Forest Zone around Abidjan and Soubré will join the Sudano-Guinean zone when the Sudanese Zone around Korhogo and Ferké with its IABL> 2 would become a Sahelo-Sudanese zone, more arid and at risk.

The change in climatic parameters over the last three decades has led to a mismatch between timeliness of rainfall and traditional growing seasons. Rainfall disturbances have had significant impact on cocoa production in Cote d'Ivoire whose yield fell by more than 20% during El Niño episodes compared with previous campaigns [28]. The impacts of the changes also results in the loss of crops due to extreme climate events such as floods, drought and bush fires.

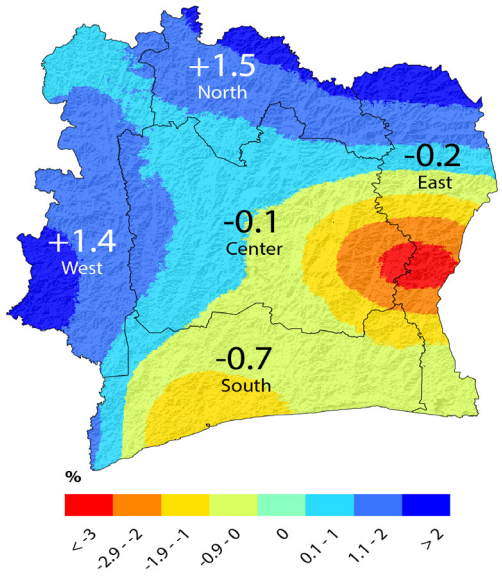
Other challenges related to climate change in the country include: the uncontrolled economic and social consequences of floods, land degradation, sea-level rise, coastal erosion, declining agricultural yields, endemic health vulnerability (meningitis, malaria, etc.); and increased occurrence of drought [27]. Most of all climate change has had a negative impact on the food security and livelihoods of Ivorian farmers.

Projected changes in temperature and precipitation in Côte d'Ivoire by 2050

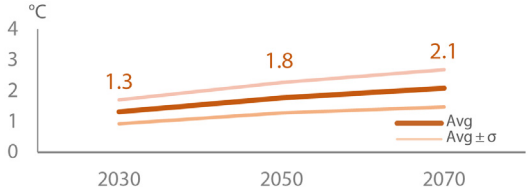
Changes in annual mean temperature (°C)



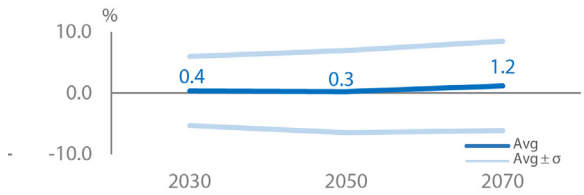
Changes in total precipitation (%)



Average temperature (°C)



Average precipitation (%)



Source: [29, 30, 31]

CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. For this profile, practices are considered CSA if they enhance food security and/or improve climate change adaptation and mitigation. Hundreds of technologies and approaches around the world fall under the heading of CSA.

In Côte d'Ivoire, several CSA practices exist. Some of these include:

1. Alley cropping – alley cropping is the cultivation of food, forage or specialty crops between rows of trees. In Côte d'Ivoire, is normally practiced at the guinea savannah zones where various crops such as groundnut, maize are planted within the rows of leguminous trees/shrubs such as *Gliricidia sepium* [32].
2. Use of organic manure – organic manure use (particularly from poultry) is common with cereal-based systems and cocoa plantations across the country.
3. Use of weather information – various projects in Côte d'Ivoire such as METAGRI launched by the World Meteorological Organization and the Spanish State Agency for Meteorology in 2008, has improved farmers' use of climate information for making planting decisions.
4. Water control through irrigation - various irrigation techniques are becoming prominent in Côte d'Ivoire to improve water availability on farmlands particularly during droughts. In the alluvial plains (noted for vegetables,

rice, pineapple and banana) and sugar producing areas, sprinkler schemes are commonly used. However the main irrigation technologies implemented in the country are the equipment of inland valley bottoms and drip irrigation for vegetable production. Drip irrigation for gardens is promoted in the country as a means to increase food security, diversify diets, generate incomes and increase resilience to climate change [33].

5. Anti-erosion arrangement – various erosion control measures are practiced in Côte d'Ivoire. For instance the use of methods such as the planting of grass at the outer of drains to control erosion on banana fields [34]. In addition, terraces, contour ridges and erosion control strips tried out on erosion plots at Adiopodoumé and Bouaké in Côte d'Ivoire, reduced soil loss to one-tenth and runoff to about one-third compared to the control plot.

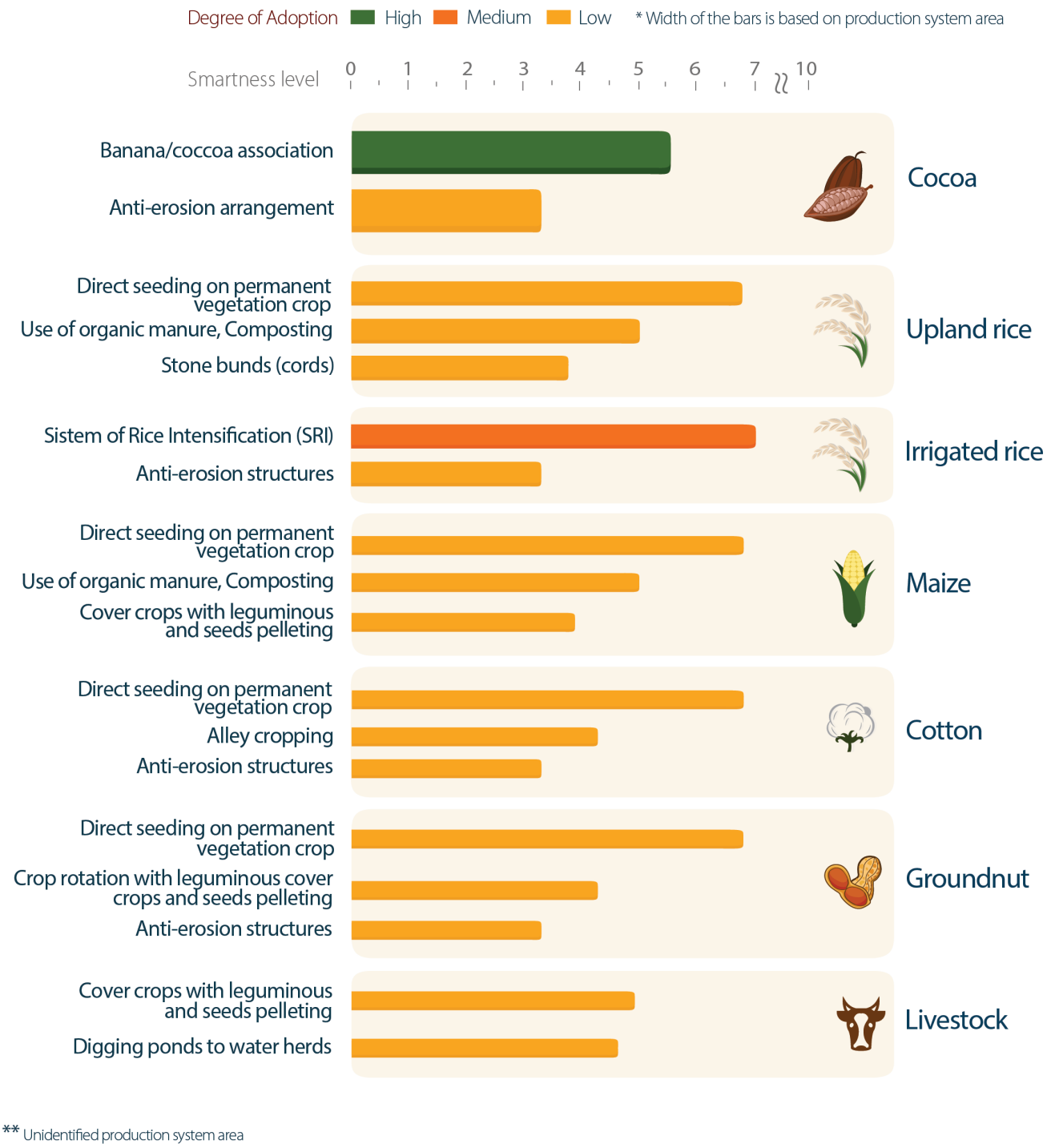
6. Cocoa-banana association - The association of cocoa with banana is a temporary association, where the cocoa benefit from the shade of banana to grow at the early time of its development. The technology has also shown to be productive even periods of long dry spells.

The majority of these practices are implemented in the savanna zone, except for the use of climate information which is implemented in mountainous forest areas and the practice of the banana-cocoa association, implemented in forest area. These practices are mainly targeting small scale producers.

Most of these practices are not widely practiced, and cover less than 1% of the agricultural area. Only the practice of the banana-cocoa association covers a significant portion (13%) of the agricultural area.

The following graphics present a selection of CSA practices with high climate-smartness scores according to expert evaluations. The average climate smartness score is calculated based on the practice's individual scores on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity); income, water, soil, risks (adaptation); energy, carbon and nitrogen (mitigation). A practice can have a negative, positive or zero impact on a selected CSA indicator, with ±10 indicating a 100% change (positive/negative) and 0 indicating no change. Practices in the graphics have been selected for each production system key for food security identified in the study. A detailed explanation of the methodology can be found in Annex 2.

Selected CSA practices and technologies for production systems key for food security in Côte d'Ivoire



** Unidentified production system area

Case study: Banana-cocoa association and intercropping as a climate-smart practice

Cocoa growing in Côte d'Ivoire faces many constraints, including the aging of the orchard, the high parasitic pressure (with the resurgence of the disease of the swollen shoot virus) and between four to five consecutive months of drought. Advances in agroforestry research with cocoa have led to the development of a cocoa-banana technology that reduces the impact of direct sunlight on the cocoa plants during and following long dry spells. The association of cocoa with banana is a temporary association, where the cocoa benefit from the shade of banana to grow at the early time of its development. In this association, the banana is planted at a high density (approximately one banana plant for each cocoa tree). Research has shown that for optimal results the density of a banana tree in a cocoa field is 1333 plants per ha, planted the same year between the cocoa crop interspacing.

The banana-cocoa combination is an agroforestry technique that is part of a broader program of sustainable production diversification in cocoa production areas. This program involves several stakeholders brought together through a public-private partnership platform. Stakeholders include the Cocoa Coffee Council with the 2QC Sustainability Program, the World Cocoa Foundation, the Sustainable Trade Initiative, the World Agroforestry Center (ICRAF) the National School of Statistics and Applied Economics (ENSEA), the Houphouet-Boigny National Polytechnic Institute (INPHB), the National Center for Agronomic Research (CNRA), the Public Universities of Côte d'Ivoire and the National Agency for Rural Development (ANADER). The first three structures mentioned above constitute the main sources of funding for the activities of the platform.

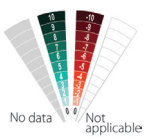
The economic (in addition to the environmental) value of this association is an essential asset of the system. The food crops associated with the cocoa tree provide the threefold function of providing shade to the young cocoa trees, food for the members of the farm and additional income. Cocoa litter also plays a critical role in soil water maintenance, soil fertility improvement and increase organic matter content which also contributes to soil carbon sequestration. These factors have resulted in the cocoa-banana association becoming increasingly prevalent in banana production areas of the country.

There are currently over 2 million small cocoa producers in Côte d'Ivoire using this agroforestry technique. Although the cocoa-banana association is widely practiced throughout much of the cocoa production areas in the country, there is renewed interest in the south-west of the country, which currently represents the new cocoa circle in Côte d'Ivoire. According to the Vision for Change (V4C) project, diversification through the association of other crops with cocoa allows increasing cocoa yields and overall income by about 50%. With rising interest in the practice and its effectiveness as a CSA technology more research and evidence on the economic implications to farmers will be crucial for accelerating adoption. Assessments of the GHG emissions reduction effects would also be important.

Source: [35, 36]

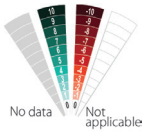
Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Côte d'Ivoire

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Cocoa (53% of total harvested area)				
Banana/cocoa association	Guinea savannah 60>	S		**Productivity** Enhances production per unit area. Diversifies income and food sources. **Adaptation** Promotes soil structure and moisture conservation. Minimizes erosion. Contributes to spread crop failure risk. **Mitigation** Maintains or improves above- and below-ground carbon stocks and organic matter content.
	Forest zone 60>	S		
Anti-erosion arrangement	Sudan savannah <30%	S M		**Productivity** Increased productivity per unit of land. **Adaptation** Medium- to long-term increases in soil fertility by improving physical and bio-chemical soil characteristics. Conserves soil moisture. **Mitigation** Increases in above- and below-ground biomass. Reduction in loss of biomass from soil.
	Sudan savannah <30%	S M		
Upland rice (12% of total harvested area)				
Agroforestry systems (fruit and timber trees along with rice and vegetables)	Sudan savannah <30%	S		**Productivity** Increases the yield and income as a result of enhanced soil health and fertility. Reduces use of external inputs hence reducing production costs. **Adaptation** Promotes soil and water conservation. Increases soil health and biodiversity upon decomposition of organic matter. Minimizes erosive processes. **Mitigation** Increases carbon storage in soils. Reduces use of synthetic fertilizers and related GHG emissions/carbon footprint. Reduces GHG emissions attributed to ploughing. Reduces soil disturbance.
	Sudan savannah <30%	S		



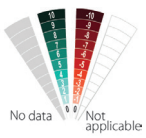
Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Use of organic manure, composting	Sudan savannah <30%	S		**Productivity** Increases productivity as a result of enhanced soil health and fertility. **Adaptation** Promotes soil structure conservation. Integrates crop residues and other on-farm waste. Minimizes erosion and enhances in-situ moisture conservation. **Mitigation** Allows long-term reduction in nitrogen-based fertilizers and related GHG emissions. Maintains or improves soil carbon stocks and organic matter content.
	Sudan savannah <30%	S		
Irrigated rice (12% of total harvested area)				
System of Rice Intensification (SRI)	Sudan savannah 30-60%	S		**Productivity** Enhances production per unit area due to the higher number of tillers, stronger stalks and better harvest quality. **Adaptation** Reduces seeds requirement and makes nursery management easier. Increases water use efficiency by intermittent water application (reducing permanent flood). Increases in use of organic fertilizers enhances soil fertility. **Mitigation** Increases above- and below- ground carbon capture and storage. Reduces GHG emissions/carbon footprint related to the use of synthetic fertilizers. Reduces methane emissions from permanent flooding.
	Guinea savannah & Sudan savannah 30-60%	S		
Anti-erosion structures	Sudan savannah <30%	S M		**Productivity** Overall agro-ecosystem productivity is maintained with minimal impact on the environment. **Adaptation** Promotes soil structure conservation therefore increases in soil microorganisms and fertility. Reduces erosion and enhances water-holding capacity of the soil. **Mitigation** Reduces GHG emissions from soil disturbance. Helps maintain both above and below ground biomass and hence carbon stocks.
	Sudan savannah <30%	S M		



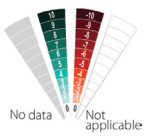
Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Maize (8% of total harvested area)				
Direct seeding on permanent vegetation crop	Guinea savannah <30%	S		**Productivity** Higher profits due to increased crop yield and reduced production costs. Overall agro-ecosystem productivity is maintained with minimal impact on the environment. **Adaptation** Promotes soil structure conservation hence reduces soil erosion and promotes moisture conservation and nutrient mobilization. **Mitigation** Increases above- and below- ground carbon capture and storage. Reduces soil disturbance and related GHG emissions.
	<30%	S		
Use of organic manure, Composting	Sudan savannah <30%	S		**Productivity** Overall agro-ecosystem productivity is maintained with minimal impact on the environment. **Adaptation** Promotes efficient use of local inputs. Enhances soil structure conservation. Reduces runoff and erosion. Increases in-situ moisture conservation. **Mitigation** Maintains or improves soil carbon stocks and organic matter content. Long-term reduction in nitrogen-based fertilizers and related GHG emissions when composting is managed correctly.
	Sudan savannah <30%	S		
Cotton (6 % of total harvested area)				
Alley cropping	Guinea savannah <30%	S		**Productivity** Increases in total production and productivity per unit area. Allows diversification of agricultural activities and income sources. **Adaptation** Promotes soil structure conservation. Use of native tree and shrub species favor local fauna. Reduces runoff and erosion, enhances in-situ moisture conservation. **Mitigation** Increases above- and below-ground carbon storage. Reduces use of synthetic fertilizers and related GHG emissions, especially when leguminous trees are included in the cropping system.
	<30%	S		



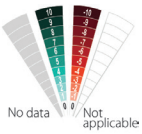
Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Direct seeding on permanent vegetation crop	Sudan savannah <30%	S		**Productivity** Higher profits due to increased crop yield and reduced production costs. Overall agro-ecosystem productivity is maintained with minimal impact on the environment. **Adaptation** Conserves physical and bio-chemical soil characteristics including water retention capacity and minimizes soil salinization process and nutrient leaching. **Mitigation** Reduces emission of methane and other GHG related with use of synthetic fertilizers and soil disturbance. When combined with organic fertilizers and leguminous cover crops, could present greater benefits.
	Sudan savannah <30%	S		
Groundnuts (1.6% of total harvested area)				
Direct seeding on permanent vegetation crop	Sudan savannah <30%	S		**Productivity** Increases total production and productivity per unit area. Harvests of multiple crops increase income stability. **Adaptation** Helps build a healthy soil structure, hence reduces runoff and erosion, enhances in-situ moisture conservation, and promotes wealth of microorganisms. **Mitigation** Reduction in ploughing and legume integration promotes reduction of synthetic Nitrogen-based fertilizers, hence reduce nitrous oxide emissions. Conserves Soil Organic Matter (SOM).
	Sudan savannah <30%	S		
Crop rotation with leguminous cover crops and seeds pelleting	Sudan savannah <30%	S		**Productivity** Increases total production and productivity per unit area. Increases in income stability and food security due to harvest of multiple crops. **Adaptation** Reduces the risk of total crop failure under adverse climatic conditions due to crop diversification and seeds protection. Minimizes the incidence of pests and diseases. **Mitigation** Reduces GHG emissions (carbon footprint) by reducing use of synthetic fertilizers. Enhances soil carbon stock.
	Sudan savannah <30%	S		



Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Livestock (N/A)				
Digging water ponds	Sudan savannah <30%	S		**Productivity** Increases total production. Rearing of different livestock species and crops expands the sources of income and food security. **Adaptation** Increases biodiversity on the farm as well as in the soil. Improves water availability enabling production during the dry season. Reduces soil runoff and erosion during the rainy season. **Mitigation** Promotes indirect reductions of GHG in the medium- and long-term per unit of output.
	Sudan savannah <30%	S		
Cover crops with leguminous and seeds pelleting	Sudan savannah <30%	S		**Productivity** Increases yield and quality of produce. Organic inputs can enhance long-term soil productivity and reduce production costs. **Adaptation** Increases farmers' capacity to limit the crop exposure to climate risks (drought). Reduces soil erosion. Increases water and nutrient use efficiency per unit of output. **Mitigation** Increases carbon storage in soils. Reduces use of synthetic fertilizers and related GHG emissions/carbon footprint.
	Sudan savannah <30%	S		



Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

Institutions and policies for CSA

Côte d'Ivoire has several key institutions and policies aimed at supporting and increasing agriculture productivity and advancing CSA practices. These include government ministries and trusteeship structures of ministries, firms operating in the agricultural sector, universities, specialized laboratories, agricultural research institutes and centers such as the Centre National de Recherche Agricole (CNRA). The majority of these institutions are national institutions, however a few international agricultural firms exist, such as CARGILL, Saco-Barry Callebaut and certain research organizations such as the Swiss Center for Scientific Research and AfricaRice. All these institutions are intervening in several sectors including agriculture, climate change, forestry, environment and natural resources management.

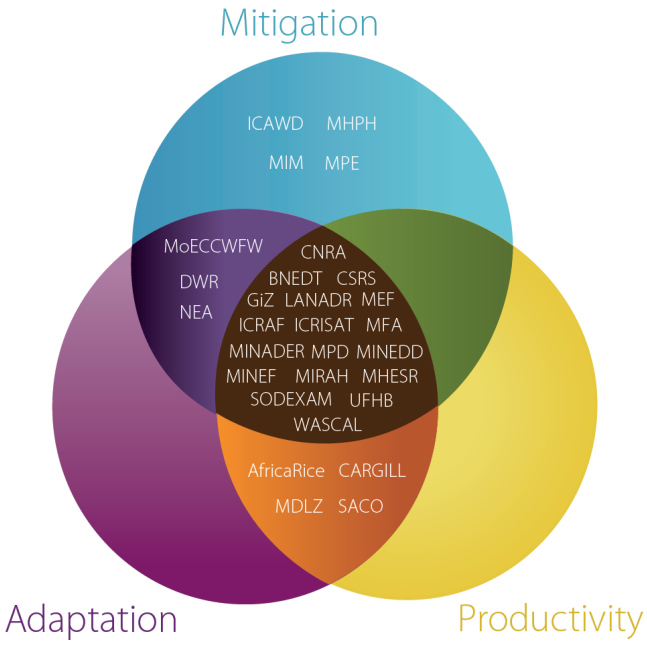
At the government level, the institution responsible for the country's climate change plans and policies is the Bureau of Climate Change in the Division of the Fight Against Climate Change of the Ministry of Environment and Sustainable Development (MINEDD), which also serves as the country's UNFCCC focal point and nationally designated Authority (NDA) to the Green Climate Fund (GCF). On the agriculture front, the Ministry of Agriculture and Rural development (MINADER) is the key government institution for partnerships for climate-smart agriculture work in the communities as well as for policy and investment related issues through the national Agricultural Investment Plan (PNIA, 2010) for example. Other key CSA-related government institutions include: Ministry of Water and Forest (MINEF); and the Ministry of Animal and Fish Resources (MIRAH). While the Institution for Aeronautical and Meteorological Development (SODEXAM), plays a key role in monitoring and sharing climate and weather information that is crucial to support farmer adaptation activities.

In terms of research, CNRA conducts various types of CSA-related agricultural research including research on improved practices for perennial crops (coffee, cocoa, oil palm, rubber tree, etc.), annual crops (rice, maize, roots and tubers, sugar cane, etc.), animal production (livestock and fisheries), forestry research, in-field production systems, and post-harvest research (food conservation and processing). International development agencies such as GIZ have contributed to the implementation of a climate change adaptation and population stabilization program which aimed to improve food security in the persistently affected Cavally, Gboklê, Nawa, Guémon and San Pedro regions, while building the adaptation capacity of populations to climate change. The support for the improvement and intensification of agricultural production through GIZ included the development of lowlands for the promotion of food crops (e.g. rice, maize, cassava, and plantain), vegetables and off-season. The project also promoted the use of improved seeds adapted to climate change (e.g. short cycle seeds and varieties resistant to water stress). In addition, GIZ collaborates with international agricultural organizations such as the Africa Rice Centre, ICRAF to implement the Innovation Transfer into Agriculture-Adaptation to Climate Change project which is rolling out many agricultural innovations such as ICT use for climate information, early warning and market alerts mainstreamed into projects such as the Africa Cashew Initiative implemented in Côte d'Ivoire and other African countries [37]. The World Agrofestry Centre (ICRAF) is also an important research organisation for the country's agroforestry efforts, and has conducted the "Land health surveillance system for smallholder cocoa in Ivory Coast" project which includes collection of key land health indicators such as vegetation health, pests and diseases and soil health; which could yield important data for designing and monitoring climate-smart agriculture interventions.

Most of the organisations identified are conducting work focused on agricultural productivity, although adaptation has become increasingly important in recent decades. Mitigation is often an unintended consequence of their work, hence mitigation efforts still need to be enhanced, possibly through awareness raising and capapcity building of all CSA-related stakeholders.

The following graphic highlights key institutions whose main activities relate to one, two or three CSA pillars (adaptation, productivity and mitigation). More information on the methodology and results from interviews, surveys and expert consultations is available in Annex 4.

Institutions for CSA in Côte d'Ivoire



AfricaRice The Rice Center for Africa **BNEDT** National Office for Technical Studies for Development **CNRA** National Center For Agronomic Research **CSRS** Swiss Center for Scientific Research **GIZ** German Development Cooperation Agency **ICAWD** International Committee of African Women for Development **ICRAF** World Agroforestry Centre **ICRISAT** International Crops Research Institute for the Semi-Arid Tropics **LANADR** National Laboratory for the support of Agricultural development **MEF** Ministry for Economy, Finance and Budget **MFA** Ministry of Foreign Affairs **MHESR** Ministry of Higher Education and Scientific Research **MHPH** Ministry of Health and Public Hygiene **MIM** Ministry of Industry and Mines **MINADER** Ministry of Agriculture and Rural Development **MINEDD** Ministry of the Environment and Sustainable Development **MINEF** Ministry of Water and Forest **MIRAH** Ministry of Animal and Fish Resources **MPD** Ministry of Planning and Development **MPE** Ministry of Petroleum and Energy **SODEXAM** Institution for Aeronautical and Meteorological Development **UFHB** University Félix HOUPHOUET-BOIGNY **WASCAL** West African Science Service Center on Climate Change and Adapted Land Use

Côte d'Ivoire, ratified the UNFCCC and Kyoto Protocol in 1994 and 2007 respectively, and submitted its NDC in 2015. These reaffirmed the country's commitment to both climate change adaptation and mitigation. The NDC, identifies agriculture and forestry as key areas for both adaptation and mitigation, especially in terms of reducing deforestation and land degradation as well as supporting farming households to access alternative sources of energy to fuel wood [24].

Of note is that the country has a National Communication on Climate Smart Agriculture[3] (NCCSA, 2014) which specifically mentions issues such as:

- Research on drought and flood resistant varieties.
- Reduced grazing and improved livestock management, with support to decentralized veterinary services as a key measure for improving animal health and hence resistance shocks and efficiency of meat and milk production.
- Research on improved animal breeds.
- Use of short cycle crop and vegetable varieties.
- Promotion of integrated soil fertility management.
- Promotion of maximum soil cover.
- Water storage (particularly in the north of the country).
- Weather risk insurance for farmers.
- Putting in place an inter-ministerial committee on climate-smart agriculture.

The NCCSA [38] also has a focus on gender issues and requires that women farmers get appropriate support to practice sustainable agriculture.

The National Agricultural Investment Plan (NAIP/ PNIA) under MINADER is the overall guiding investment plan for agriculture and aims to support agricultural growth for food security in the country. Although it includes issues such as forest rehabilitation, sustainable fisheries management and the need to improve agricultural productivity and competitiveness [39]; the Ivorian Government has indicated the need to integrate CSA into the plan based largely on the issues raised in the NCCSA.

Other CSA-related policies and strategies developed include the following:

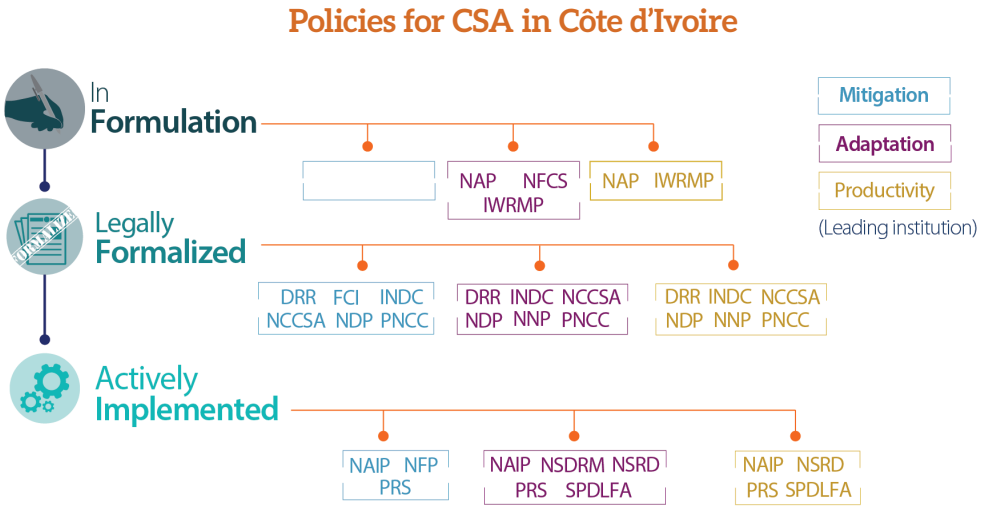
- National Programme on Climate Change (NPCC, 2015) – aims to put in place a national development strategy that integrates both climate change adaptation and mitigation, including in the agriculture sector.
- National Strategy for Disaster Risk Management (NSDRM, 2011) – focuses on reducing and managing risks and impacts from disasters, including floods and droughts. The strategy also has a National Action Plan for Capacity Building on Disaster Risk Reduction.

A national forest policy was first developed in the 1960s, and a draft revised forest policy was also developed in 2010, however the country has now taken steps to develop a National REDD+ Strategy and Investment Plan to support its zero-deforestation agriculture goals. The National Rice Development Strategy (NSRD) [40] and Strategic Plan for Livestock Development, Fisheries and Aquaculture are also important for CSA in the country; detailing the plans for improving the productivity and resilience in the sub-sectors but nor adequately capturing the mitigation issues.

The above policies are implemented mainly by the Ministry of Environment and Sustainable Development, the Ministry of Animal Production and Fisheries Resources, as well as Ministry-controlled structures such as Association for the Development of Forests (SODEFOR) and the National Office for Rice Development (ONDR).

[3] http://www.environnement.gouv.ci/pollutec/CTS3%20LD/CTS%203.2.pdf

The graphic shows a selection of policies, strategies and programs that relate to agriculture and climate change topics and are considered key entry points for CSA in the country.



DRR The National Action Plan for Capacity Building on Disaster Risk Reduction in Côte d'Ivoire (2016) (MINEDD) **FCI** Forest Conservation Initiative (MINEDD) **INDC** Intended Nationally Determined Contribution (2016) (MINEDD) **IWRMP** Integrated Water Resources Management Policy (MINEF) **NAIP** National Agricultural Investment Programme (2011) (MINADER) **NAP** National Adaptation Plan (MINEDD) **NCCSA** National Communication on Climate Smart Agriculture (2014) (MINEDD) **NDP** National Development Plan (2016) (GOCI) **NFCS** National Framework for Climate Services (SODEXAM) **NFP** National Forest Policy (1966) (SODEFOR) **NNP** National and Multisectoral Nutrition Plan (2016) (MHPH) **NSDRM** National Strategy for Disaster Risk Management (2011) (MINEDD) **NSRD** The National Strategy for Rice Development (2012) (ONDR) **PNCC** National Programme on Climate Change (2015) (MINEDD) **PRS** The Poverty Reduction Strategy (2009) (GOCI) **SPDLFA** The Strategic Plan for the Development of Livestock, Fsheries and Aquaculture (2014) (MIRAH)

Financing CSA

A number of projects that foster the development of knowledge and evidence on the effectiveness of climate-smart agriculture in improving food security, mitigating climate change and improving the adaptive capacities of production systems and populations in Côte d'Ivoire have received support from various donors and financing schemes. For instance, DFID and IDRC through the Climate Change Adaptation in Africa (CCAA) program funded an ecosystem system approach to managing water in the context of climate change in some West African countries including Côte d'Ivoire. This was deemed as a climate-smart drought intervention for communities whose conditions were also aggravated by floods. Another is the Global Index Insurance Facility (GIIF) - a dedicated World Bank Group's multi-donor trust fund program that facilitates access to finance for smallholder farmers through agricultural insurance. Like most countries in Sub-Saharan Africa, farmers in Côte d'Ivoire have benefited from the GIIF to adopting index-based insurance schemes that help reduce climate-related risks.

In July 2013, Côte d'Ivoire initiated the development of its national REDD+ strategy. In conjunction with the World Bank, UN-REDD (under a FAO/UNDP partnership), and the French Development Agency, Côte d'Ivoire partnered with the Climate Investment Fund to leverage Forest Investment Program funding for successful implementation of REDD+ field activities. REDD+ activities involve climate-smart practices such as agroforestry for mitigating climate change.

In addition IFAD has since 1984 invested hugely in several aspects of the agricultural sector of Côte d'Ivoire which also includes the development and promotion of CSA innovations. For instance IFAD provided USD 41.9 million to the Western Extension Support to Agricultural Production and Marketing Project (for implementation between 2014 to 2020) which will deliver on CSA goals - improved food security for 30 000 households by increasing smallholder farmers' access to services, technologies and markets while strengthening the resilience of their production systems to climate change.

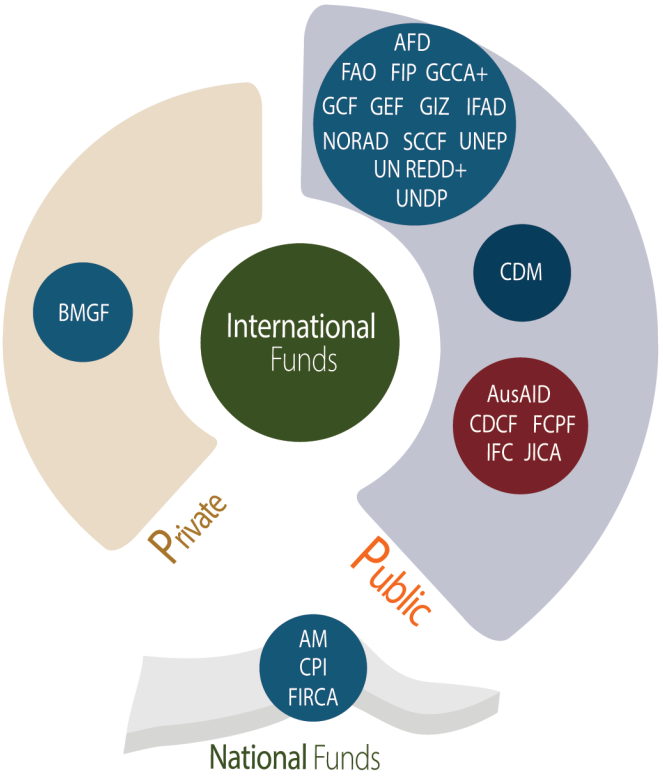
On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), GIZ is also helping to improve climate change adaptation in Côte d'Ivoire through a number of complementary projects such as the climate change adaptation and population stabilization program and the support for the improvement and intensification of agricultural production project which mainstream CSA principles in improving food security and enhancing the value chains for cocoa, cashew nuts and cotton.

In terms of access to UNFCCC funding mechanisms, the country has accessed approximately USD37 million worth

of funding from the Global Environment Fund (GEF) for 23 national projects focused on areas such as biodiversity and forest management; sustainable production and processing of cassava; and coastal areas management among others. The country has also been a part of 41 regional or global projects to the value of USD290 million.

Nationally, there are very few institutions financing CSA in Côte d'Ivoire. National opportunities for funding agriculture in Cote d'Ivoire include the support from the government (through the National Development Program and the National Investment Plan) and private sector.

Financing opportunities for CSA in Côte d'Ivoire



AFD French Development Agency **AM** Agricultural Mutual of Côte d'Ivoire **AusAID** Australian Agency for International Development **BMGF** Bill and Melinda Gates Foundation **CDCF** Community Development Carbon Fund **CDM** The Netherlands Clean Development Mechanism **CPI** Centre for the Promotion of Investments **FAO** Food and Agriculture Organization of the United Nations **FIP** Forest Investment Program **FIRCA** Interprofessional Fund for Agricultural Research and Council **GCCA+** Global Climate Change Alliance **GCF** Green Climate Fund **GEF** Global Environment Facility **GIZ** German Society for International Cooperation **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **JICA** Japan International Cooperation Agency **NORAD** Norwegian Agency for Development and Cooperation **SCCF** Special Climate Change Fund **UNDP** United Nations Development Programme **UNEP** United Nations Environmental Programme **UN REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation

Potential Finance

From the various sources of climate finance available internationally, Côte d'Ivoire is currently eligible for only a limited number of these and has not accessed major funding instruments such as the Green Climate Fund (GCF) and the Adaptation Fund (AF). There are however various UN agencies funding climate-smart agriculture related work in the country and continued partnership with these organisations could be a catalyst for access to larger CSA financing streams. These include the United Nations Environment Program (UNEP), United Nations Development Program (UNDP), and the Food and Agriculture Organization (FAO). There are also international cooperation funds such as the German Development Cooperation Agency (GIZ), the Norwegian Agency for Development and Cooperation (NORAD) and the French Development Agency (AFD) who support agriculture related efforts in the country. To support the country's access to climate finance, the Africa Climate Change Fund awarded Côte d'Ivoire (through MINEDD) a grant of USD 430 000 to enhancing the ability of the country to attract climate finance. Efforts to develop and implement high quality GCF projects could be a priority for the short term.

In addition, enhancing private sector financing to climate-smart agriculture is needed, as most of the funds currently available to the country are public funds. This could be done through capacity building and sensitisation of microfinance institutes, agrodealers, outgrowers and multinational companies on the benefits of investing in climate-smart practices.

Outlook

Côte d'Ivoire's commitment to CSA is relatively new, the institutions involved are still limited, and the sources of funding are essentially from public coffers as well as from international organisations such as FAO and GIZ. Although there are a wide range of organisations conducting CSA-related work, most have focused largely on productivity and adaptation, although environmental management, reduction of deforestation and sustainable energy are increasingly becoming important and could be integrated into the country's climate-smart agriculture efforts.

Some CSA practices such as the cocoa-banana association are quite widespread and their proliferation has been facilitated by ease of adoption, private sector engagement in their implementation and multiple benefits such as food, income diversification and improved resilience of the cocoa system.

However, other CSA practices such as anti-erosion structures, intercropping with legumes, direct seeding, manure management and water harvesting and irrigation are not as common and cover a very small proportion of the agricultural area and farmers. To enhance the adoption of these CSA practices there is need for:

- Increasing public awareness on agricultural climate

change adaptation and mitigation, and the CSA concept.

- Mobilizing private funds at the local and international levels to finance activities related to CSA.
- Encouraging participatory research and development to develop locally appropriate CSA practices for farmers.
- Mainstreaming climate change into country agriculture and economic development policies and programmes.
- Encouraging a multi-stakeholder approach to identifying and prioritizing the most applicable CSA practices for large scale promotion.

In terms of CSA finance, the mainstreaming of climate-smart agriculture into the country's National Agricultural Investment Plan (PNIA) as well as into other sector plans and policies could represent an important step in ensuring national budget allocation for climate-smart agriculture practices. Such developments could also play a key role in catalyzing international and private finance for the large scale implementation of key climate-smart agriculture initiatives.

Lastly, CSA stakeholders in Côte d'Ivoire will require technical capacity building, technology transfer and financial resources to be able to design, implement, monitor and evaluate CSA-related projects and programmes in line with its INDC and other national strategies and policies. Effort must be made to ensure that the country receives this support in a well-coordinated manner, within the framework of existing CSA-related plans and policies such as the PNIA and NPCC.

Works cited

[01] FAO. 2010. "Climate-Smart" Agriculture. Policies, practices and financing for food security, adaptation and mitigation. Rome: Food and Agriculture Organization of the United Nations (FAO).

[02] FAO. 2013. Climate-smart agriculture sourcebook. Rome: FAO. Available at: http://www.fao.org

[03] MINAGRI. 2004 : Recensement national de l'agriculture. Analyse des données, niveau national Septembre 2004, 37p+annexes

[04] World Bank. 2017. World Development Indicators. Washington, D.C: World Bank. Available at: http://data.worldbank.org/

[05] FAO. 2016. FAOSTAT Database. Available at: http://faostat3.fao.org/download/Q/QV/E

[06] UNDP. 2015. Human Development Report. United Nations Development Programme (UNDP). Available at: http://bit.ly/1nwKJGt

[07] Touré M. 2009. Evaluation approfondie de la sécurité alimentaire des ménages ruraux en Côte d'Ivoire. Ministère de l'Agriculture, Côte d'Ivoire. Rapport d'étude, 79p

[08] BNEDT. 2015. Gestion durable des ressources forestières. Rapport pour les Etats généraux de la forêt, de la faune et des ressources en eau, 31 Juillet 2015 ; 89p

[09] BROU Y. T. 2010. Variabilité climatique, déforestation et dynamique agro démographique en Côte d'Ivoire. Sécheresse 2010 ; 21 (1e) : 1-6.

[10] SARA. 1999. L'agriculture ivoirienne à l'aube du xxi ème siècle. Une publication du salon de l'agriculture et des ressources animals (SARA) d'Abidjan ; république de côte d'ivoire, ministère d'état, ministère de l'agriculture et des ressources animales ; ministère de l'environnement et de la forêt ; ministère de l'enseignement supérieur et de la recherche scientifique, 242p.

[11] MINAGRI, MPARH. 2008. Mission de suivi de la saison agricole et de la sécurité alimentaire de l'année 2007. Ministère de l'agriculture (MINAGRI), Ministère de la production animale et des ressources halieutiques (MPARH). Rapport d'étude, 65p.

[12] RONGEAD. 2015. Etude de la filière Banane plantain en Côte d'Ivoire en Côte d'Ivoire. Projet « Promotion et commercialisation de la banane plantain et du Manioc en Côte d'Ivoire » financé par le Comité Français pour la Solidarité Internationale (CFSI).

[13] FAO. 2013. Cote d'Ivoire FAO STAT-Economic Indicators; http://cotedivoire.opendataforafrica.org

[14] MPARH. 2003. Rapport national sur l'état des ressources zoo génétiques. Ministère de la production animale et des ressources halieutiques (MPARH) ; République de Côte d'ivoire, 80p

[15] DOUMBIA, S. 2014. Evaluation des systèmes de production agricole dans la zone du projet « Propacom » et valoristaion des innovations technologiques. 34 p.

[16] AfricaFertilizer.Org. 2015. Fertilizer statistics overview Côte d'Ivoire 2011 – 2014. Available at http://www.africafertilizer.org/wp-content/uploads/2017/05/CIV-Fertilizer-Statistics-Overview-2014.pdf. Accessed 9th November 2017

[17] FAO. 2016. AQUASTAT. Available at: http://www.fao.org/nr/water/aquastat/data/glossary/search.html

[18] MINAGRI. 2011. Rapport sur la dynamique de la consommation alimentaire en Côte d'Ivoire. 98 pages + Annexes.

[19] EIU. 2015. Food Security Index. The Economist Intelligence Unit (EIU). Available at: http://bit.ly/1U3NT2C

[20] WFP. 2016. Food Aid Information System. World Food Programme (WFP). Available at: http://bit.ly/1nwKY4r

[21] IEA. 2010. Global Tracking Framework. International Energy Agency (IEA). Available at: http://bit.ly/1RA9dH2

[22] World Resource Institute. 2016. Climate Data Explorer (CAIT). Available at: http://cait.wri.org/

[23] Wiseman, V. 2015. Côte d'Ivoire Submits INDC. Available at http://sdg.iisd.org/news/cote-divoire-submits-indc/. Accessed 10th November 2017.

[24] Government of Côte d'Ivoire. 2015: CONTRIBUTIONS PREVUES DETERMINEES AU NIVEAU NATIONAL DE LA COTE D'IVOIRE. Available at http://www4.unfccc.int/ndcregistry/PublishedDocuments/C%C3%B4te%20d%27Ivoire%20First/INDC_CI_22092015.pdf. Accessed 10th November 2015

[25] FAO. 2012. Cadre de programmation pays (2012-2015). Côte d'Ivoire. 30 pages.

[26] YAO.N.R; Oule.A.F; Kouadio.N.B. 2013. Etude de la vulnérabilité du secteur agricole face aux changements climatiques en Côte d'Ivoire. 105 pages

[27] DJE. K.B. 2014. Document de stratégie du Programme National Changement Climatique (201-2020). 84 pages + Annexes

[28] DJE.K.B. 2007. Impact des phénomènes ENSO sur la pluviométrie et leurs incidences sur la production cacaoyère. Conférence Internationale pour la réduction de la vulnérabilité des systèmes naturels économiques et sociaux en Afrique de l'Ouest face aux changements climatiques. Ouagadougou du 24 au 27 janvier 2007/

[29] Collins M; Knutti R; Arblaster J; Dufresne JL; Fichefet T; Friedlingstein P; Gao X; Gutowski WJ; Johns T; Krinner G; Shongwe M; Tebaldi C; Weaver AJ; Wehner M. 2013. Longterm climate change: Projections, commitments and irreversibility. In: Climate change. The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker TF; Qin D; Plattner GK; Tignor M; Allen SK; Boschung J; Nauels A; Xia Y; Bex V; Midgley PM. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Pp. 1029–1036. DOI: 10.1017/CBO9781107415324.024

[30] Ramírez J; Jarvis A. 2008. High-resolution statistically downscaled future climate surfaces. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Cali, Colombia.

[31] Ramírez-Villegas J; Thornton PK. 2015. Climate change impacts on African crop production. Working Paper No. 119. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen, Denmark. Available at: http://hdl.handle.net/10568/66560

[32] Schroth, G., Balle, P. and Peltier, R. 1995. Alley cropping groundnut with Gliricidia sepium in Côte d'Ivoire: effects on yields, microclimate and crop diseases. Agroforestry Systems, 29(2), pp.147-163.

[33] FAO. 2017. Adapting irrigation to climate change (AICCA) - Irrigation technologies in Côte d'Ivoire. Available at http://www.fao.org/in-action/aicca/country-activities/cote-divoire/irrigation-technologies/en/

[34] Prosper, K.Y., Maxime, B.N.T.K., Marie-Solange, T., Ouattara, D. and N'guessan, E.K. 2016. Biological Control of Erosion of Banana Drains in Côte D'Ivoire. Agricultural Sciences, 7(07), p.493.

[35] Kouame. C; Kahia J; Diby L; Kouakou T; Yeboi B; Bredou G; Kouassi A; Kouassi J-L; and Adjehi C; 2015. Quelle diversification pour une production durable du cacao? Expérience du projet V4C. 22 pages. World Agroforestry Centre; MARS; Sustainable Cocoa Initiative.

[36] Kebe I; Koffi N; Ahoutou K; N'guessan F; N'goran K.J; and Zahouli Bi.I. 2005. Bien cultiver le cacaoyer en Côte d'Ivoire. 4 pages. CNRA-CTA.

[37] GIZ. 2016. Use of ICT for Agriculture in GIZ projects – Status quo, opportunities and challenges. Available at: https://www.snrd-asia.org/download/sector_programme_rural_development/Use-of-ICT-for-Agriculture-in-GIZ-projects_Laureys-F..pdf. Accessed 22 November 2017 +Annexes.

[38] MINAGRI. 2014. L'agriculture Intelligente face au Climat en Côte d'Ivoire: état des lieux et besoins d'appui pour mieux intégrer l'Agriculture Intelligente face au Climat (AIC) dans le Programme National d'Investissement Agricole (PNIA). Communication-Pays, Côte d'Ivoire, 15p.

[39] PNIA. 2010. Programme National d'Investissement Agricole (2010-2015): Présentation des programmes, 48p

[40] ONDR. 2012. Rapport sur la Stratégie Nationale du Développement de la filière riz: plan stratégique 2012-2020, Abidjan, Côte d'Ivoire. 40p

For further information and online versions of the Annexes

Annex 1: Selection of agriculture production systems key for food security in Côte d'Ivoire (methodology and results)
Annex 2: Methodology for assessing climate smartness of ongoing practices
Annex 3: Long list of CSA practices adopted in Côte d'Ivoire
Annex 4: Institutions for CSA in Côte d'Ivoire (methodology and results)
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This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – , The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and The Food and Agriculture Organization of the United Nations (FAO) to identify country-specific baselines on CSA in West Africa (Benin, the Gambia, Niger and Côte d'Ivoire). The publication is based on data collected by FAO in collaboration with CSA stakeholders and partners in Cote d'Ivoire and on previous work commissioned and led by the World Bank Group to identify country-specific baselines and entry points for scaling out CSA, through data analysis and series of dialogues with national stakeholders. The work complements the CSA Profiles series developed since 2014 by the World Bank, CIAT and CCAFS for countries in Latin America, Asia, Eastern and Central Europe, and Africa (https://ccafs.cgiar.org/publications/csa-country-profiles).

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