



Climate-Smart Agriculture in Guinea-Bissau

Climate-smart agriculture (CSA) considerations

P The economic wealth of Guinea-Bissau is mainly in its natural capital with agriculture (crop, forestry, fishing and livestock farming) accounting for 49 percent of the country's GDP. Similar to most countries in West Africa, Guinea-Bissau's physical exposure and dependence on agriculture drive its vulnerability to climate change. Significant rises in temperature and droughts are projected especially for the eastern part of the country.

M Total annual greenhouse gas (GHG) emissions in Guinea-Bissau is estimated at about 3.5 MtCO₂eq. The livestock sub-sector contributes about 72 percent of total emissions mainly from enteric fermentation and emissions from manure left on pasturelands.

The nationally determined contributions of Guinea-Bissau indicates reforestation as the major action for mitigating GHG emissions. A new forestry policy and a legal framework for long-term low-carbon development particularly in the energy sector are proposed as innovative mitigation measures.

A Cereal production particularly rice forms the backbone of food security while cashew nut and groundnut are important cash crops. With rising climate uncertainties and increased vulnerability of production systems to climate change, the development and adoption of CSA practices such as agroforestry, organic manure, weather information, drip irrigation, crop rotation, rainwater harvesting

through zai techniques etc. is becoming obvious in both small and large scale production systems.

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I The enabling environment for CSA lies in the strength of both government and private sector (AgroSafim, AgroGeba, AgriMansoa) institutions whose activities aimed at supporting and increasing agriculture productivity and advancing CSA practices in Guinea-Bissau. National policies, plans and strategies such as the National Adaptation Programme of Action, National Good Governance Programme, Convention on Biological Diversity, National Plan of Environmental Management etc. outline measures to build adaptive capacity, improve resilience of agricultural systems and conserve biodiversity for sustainable development.

\$ Under the auspices of the United Nations Development programme (UNDP, Guinea-Bissau continues to benefit from the Global Environment Facility, Adaptation Fund and the Least Developed Countries Fund (LDCF) in support of its climate-related programmes. However, similar to most developing countries, government support for CSA is weak. Enhancing private sector financing to CSA is needed. This could be done through capacity building and sensitization of microfinance institutes, agro-dealers, outgrowers and multinational companies on the benefits of investing in climate-smart practices.

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 tradeoffs 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

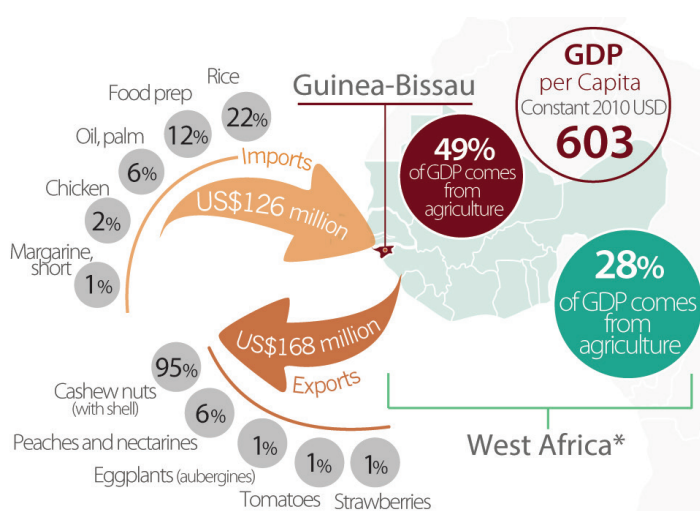
environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking 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.

National context

Economic relevance of agriculture

The agricultural sector is the mainstay of the economy of Guinea-Bissau. In the absence of other resources, the agricultural sector, despite being underdeveloped plays leading roles in supporting food security and job creation. Presently, the sector contributes about 49 percent of national gross domestic product (GDP) with 69 percent of the population actively employed in primary production agriculture [3,4]. The total agricultural imports and exports are valued at USD 126 million and USD 168 million respectively with agriculture contributing about 90 percent of total export earnings. The top five agricultural products exported include: cashew nuts with shells (94.8 percent); peaches and nectarines (6.3 percent), eggplants (aubergines) (1.5 percent), tomatoes (1.5 percent), strawberries (1.41 percent) [4]. Guinea-Bissau also imports a number of agricultural products to meet the demands of its growing population with rice having the largest percentage share (22 percent) of total agricultural products imported between 2012 and 2016. As at 2017, the population of Guinea-Bissau was

Economic relevance of agriculture in Guinea-Bissau



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

Source: [3, 4]

approximately 1.861 million (50.8 percent women) [3]. About 58 percent of the population live in rural areas. A 2010 data from the World Bank development indicators showed about 67.3 percent of the population live below the national poverty line (of USD 1.9/day). Increased poverty has been linked to limited employment opportunities, limited infrastructure development, illiteracy etc. In relation to basic needs, the country records about 60.4 percent youth literacy rate while a small proportion (14.7 percent) of the total population have access to electricity with 4.1 percent from rural areas.

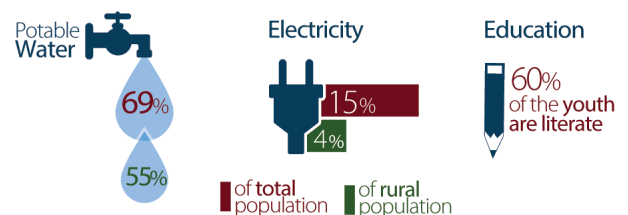
Meanwhile, about 69.2 percent of the total population have access to improved water resources comparable to data from rural areas (55 percent) [5]. Agriculture continues to be a major source of employment for most of the population (69 percent) with women farmers forming the larger proportion (65 percent) [4]. About 88 percent (of the agriculture population) are small scale farmers farming on less than two hectares.

People, agriculture and livelihoods in Guinea-Bissau

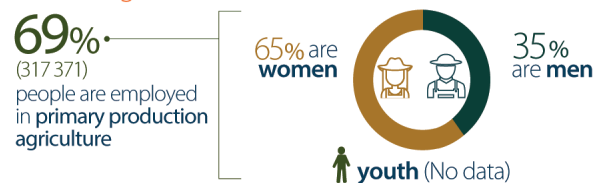
Demographics



Access to basic needs



Jobs in agriculture



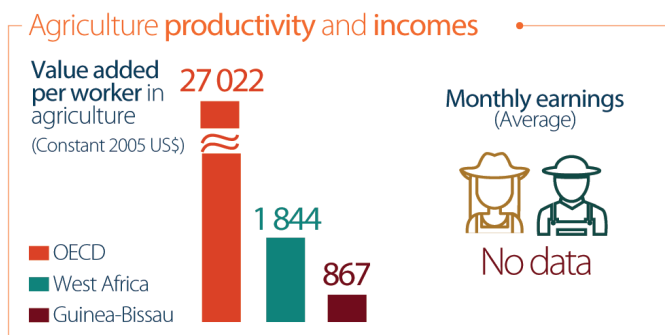
People living below



Gender inequality (Index)



Source: [3, 4, 5]

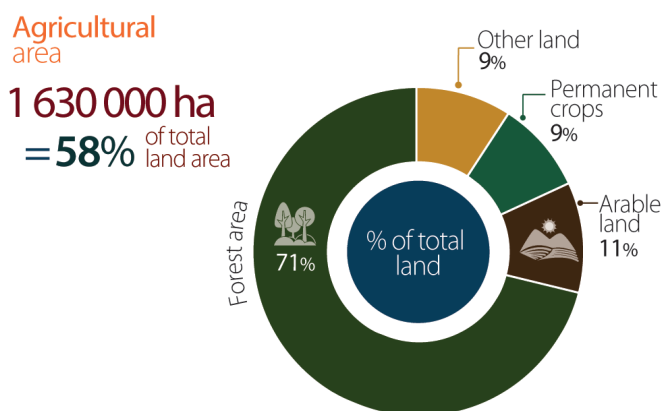


Source: [3, 4, 5]

Land use

Guinea-Bissau has a total land area of 2 812 000 ha of which approximately 58 percent is agricultural land (1 630 000 ha). About 71 percent of the land area is under forest while 38.4 percent is for permanent crops, arable land and other land. Whether from clearing for cultivation, local harvesting of wood, or for external commercial markets, the forest resources have been heavily degraded by rapid exploitation. The rate of deforestation has increased from about 2 percent per year between 1975 and 2000 to 3.9 percent over the 2000 to 2013 period. In June 2018, the Minister of Agriculture and Rural Development of Guinea-Bissau, Nicolau dos Santos indicated that between 60 000 and 80 000 hectares of Guinea-Bissau's forest is lost every year due to deforestation, illegal logging and uncontrolled forest fire [6]. However, the country continues to have huge agricultural and forestry potential, including arable land estimated at about 1.5 million hectares, of which 80 percent is on plateaus, 200 000 in freshwater valleys, 106 000 in salt water valleys and more than 100 000 square metres of areas with industrial wood [6].

Land use in Guinea-Bissau



Source: [4, 6]

Agricultural production systems

Farmers in Guinea-Bissau produce diverse crops and livestock. The most produced crops in terms of harvested area are cashew, rice (the country's staple food), sorghum, maize, plantains, millet, sweet potatoes, oil palm, coconut, cassava and groundnut most of which are produced by subsistence farmers. Cashew nuts and groundnut are the main export crops. Horticulture production is mostly practiced by women and is very important activity in the urban area. The main horticulture crops are tomatoes, lettuce, carrot, kale and sweet potatoes. Livestock production is also important in Guinea-Bissau. The livestock sub-sector contributes more than 17 percent to GDP. Livestock production is one of the main economic activities supporting food security and thousands of livelihoods. The national livestock census in Guinea-Bissau conducted in 2009 indicated that the country has 1 121 555 cattle, 304 104 sheep and 646 183 goats.

Although recent data are not available, the country's herd is growing rapidly. Livestock production is mainly concentrated in the north and east of the country, particularly in Gabù, Bafatà and Oio regions, which are home to 86 percent of the livestock. Meanwhile, the coastline of Guinea-Bissau also offer important avenue for marine fisheries which engages quite a number of the coastal dwellers for economic and subsistence gains. Guinea-Bissau is divided into three agroecological zones (north, east and south) based on ecological, climatic and demographic characteristics (annex 1):

(1) Northern zone - this zone has a Guinean maritime climate with mean annual rainfall between 1 500 and 1 800 mm. The area has high population density and significant loss of vegetation cover. The main vegetation types include the mangrove forests on the Atlantic lowlands flooded by tides, and the savannah woodlands on the uplands [7]. The main farming systems are freshwater swamp rice (on gleysols in the savannah grasslands); upland cereals and peanuts (on ferralsols; in the savanna woodlands) and mangrove swamp rice (on fluvisols in the mangroves) [7].

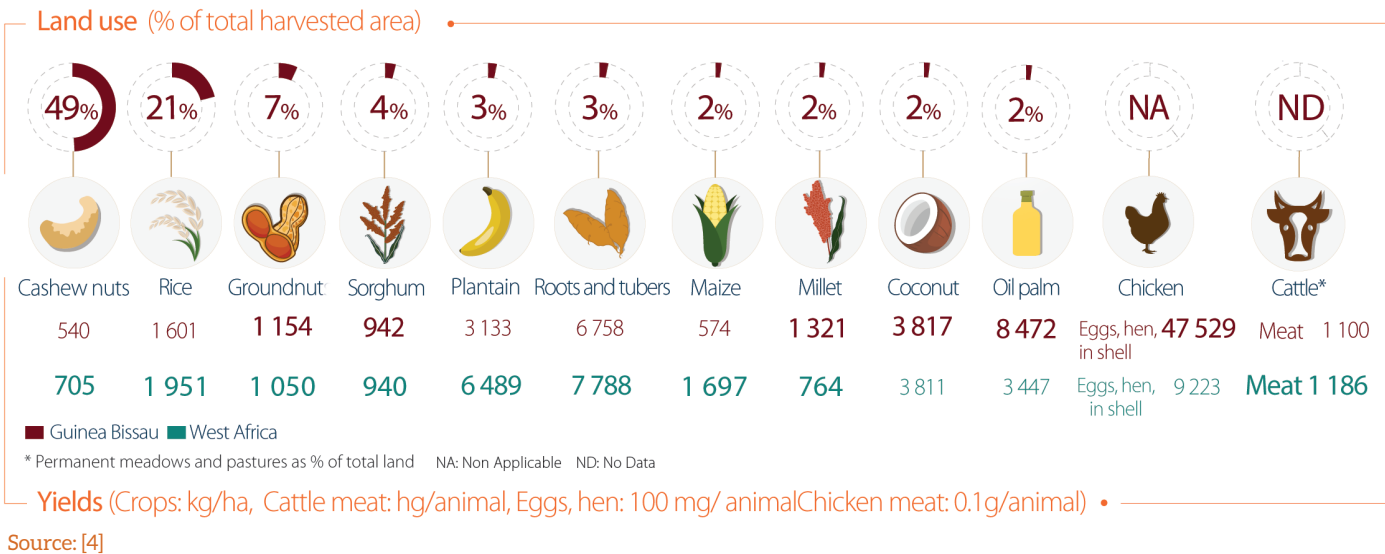
(2) Eastern zone - this area has a mean annual rainfall of 1200 mm. The main vegetation types are savannah woodlands in the uplands (where shifting cultivation of sorghum, millet, maize, peanuts and sometimes rice is practiced, using an average cultivation period of 3.6 years, and an average fallow of 8.2 years) and dry and wet grasslands in the lowlands [7]. Soils are generally poor and lateritic. Permanent cultivation of rice is practiced in the freshwater swamps and sorghum, millet, maize and peanuts are also produced without fallow in the highly fertile land [7].

(3) Southern zone - this zone has the highest annual mean annual rainfall (1 800 - 2 500 mm), the most fertile ferralsols and fluvisols, and the most dense dry forest patches and thick mangrove forests [7]. Major food crops in this zone include: rice paddies in coastal areas, rice on the plateau, livestock (mainly cattle, goats, pigs and chickens), cashew nuts, maize, sorghum, fonio, cola, banana, citrus and palms.

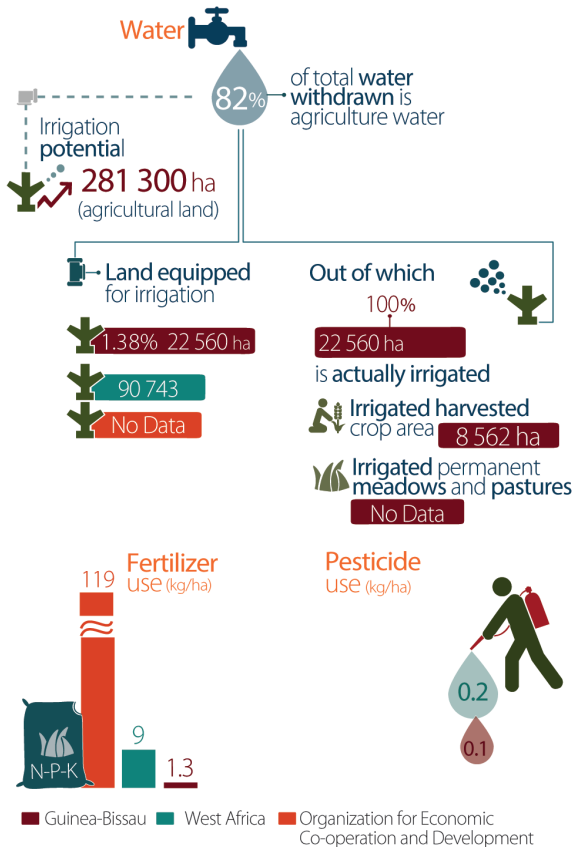
Rice cultivation dominates all food production systems with an annual production of 132 935 tonnes of non-processed paddy rice which constitute about 81.5 percent of total cereal production. Regarding the other dried cereals (maize, sorghum, millet, fonio), yields range from 0.5 to 1.0 tonne/ha.

The following infographic shows a selection of agriculture production systems key for Guinea-Bissau food security. The importance is based on the system's contribution to economic, productivity and nutrition quality indicators. For more information on the methodology for the production system selection, consult annex 2.

Production systems key for food security in Guinea-Bissau



Agriculture input use in Guinea-Bissau



Agriculture in Guinea-Bissau is mainly rainfed. Irrigated farming is very limited. As at 2013, irrigation potential of Guinea-Bissau was about 281 300 ha with about 1.38 percent of the total agricultural area equipped for irrigation. Meanwhile, 82.3 percent of water withdrawn is used for agricultural purposes which implies the necessity for huge investments in irrigation to support agricultural production. Majority of agricultural production in Guinea-Bissau is low-input with about 1.35 kg/ha fertilizer applied on 1000 hectares.

Food security and nutrition

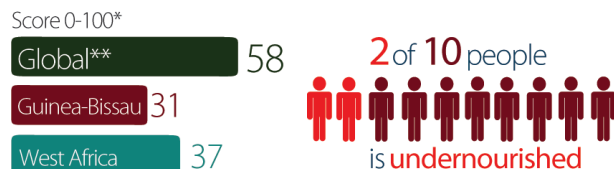
Despite the agro-forestry-pastoral potential and fisheries resources of Guinea-Bissau, numerous studies have shown that the current food situation in the country is very precarious. Poverty is the primary cause of food insecurity and is more prevalent in rural areas where about 58 percent of the population lives. The precarious situation of food insecurity is varies slight among the agroecological zones occurring during the months of july, august, and september. The regions of Gabu and Bafatá in the eastern part of the country and Oio in the northern part of Guinea-Bissau are particularly more vulnerable to food insecurity due to limited rainfall, poverty and inherently poor fertility of soils. Nationally, about 20 percent of the population are estimated to be undernourished with a global food security index score of 31. In terms of health, about 1.7 percent of children between 6 months to 5 years are underweight while 6 percent of children are wasted [4].

Source: [4]

At present, the country records about 91 child deaths for every 1 000 live births which is among the medium levels in West Africa [3]. Meanwhile, Guinea-Bissau has a relatively low HIV prevalence rate. In 2017, the HIV prevalence rate is estimated at 3.4 percent (women = 4.1 percent; men = 2.6 percent) [3].

Food security, nutrition, and health in Guinea-Bissau

Food security



* Takes into account aspects of affordability, availability, and quality
 ** Refers to the 113 countries included in the Index

Food aid (2012)



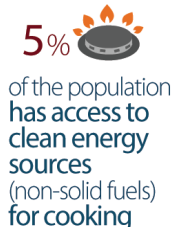
Food security indicators (selection)



Source: [3, 4, 8, 9]

Health

Access to clean energy sources



Child Mortality rate



Adolescent fertility rate



Prevalence of HIV infections



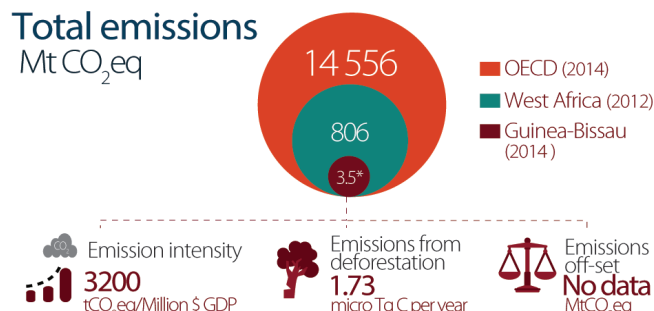
Source: [3, 4, 8, 9]

Agricultural greenhouse gas emissions

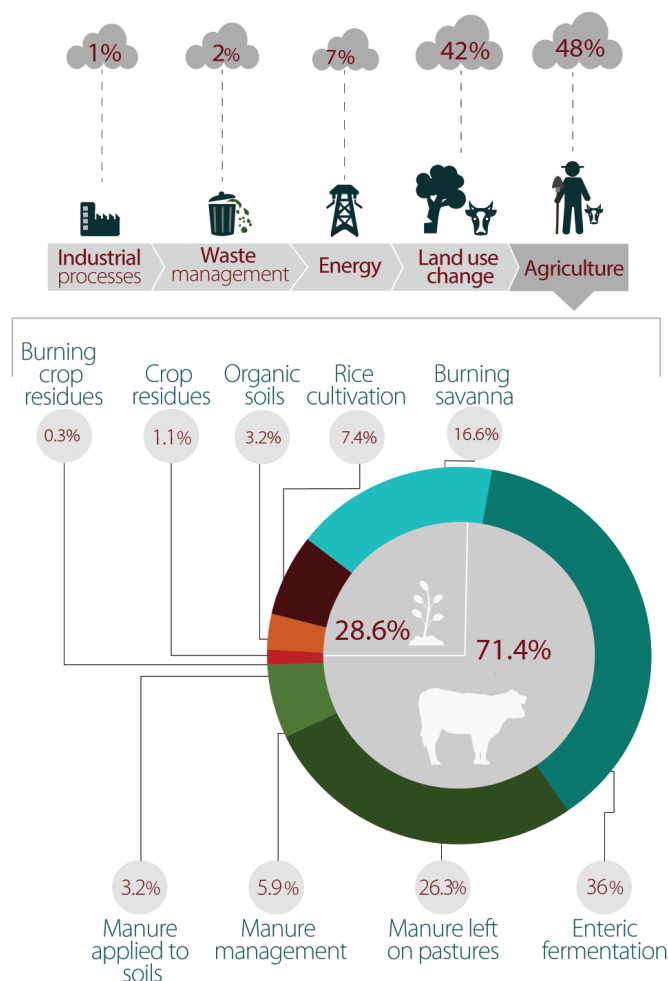
Total annual greenhouse gas (GHG) emissions in Guinea-Bissau is estimated at about 3.5 mtCO₂eq. Overall, the sectoral breakdown of the national GHG Emissions in 2014 indicate that the agricultural sector contributed the most (48.6 percent) to the total GHG emissions followed by land use change and forestry (42.9 percent of total emissions). Out of the total agricultural emissions, the livestock sub-sector contributed (71.47 percent) mainly from enteric fermentation (36.01 percent) and emissions from manure left on pasturelands (26.32 percent). The UNFCCC Secretariat reported that Guinea-Bissau was the 118th Party to formally submit its (Intended) Nationally Determined Contribution ((I)NDC). In the (I)NDC, Guinea-Bissau indicates reforestation as the major action for mitigating GHG emissions. Other measures planned by the country include: (1) the establishment of a new forestry policy for sustainable management of forest resources achievable through the conservation and restoration of forests; and (2) the development of a legal framework through a national strategy for long-term low-carbon development particularly in the energy sector.

Greenhouse gas emissions in Guinea-Bissau

Total emissions Mt CO₂eq



Sectoral emissions (2014)



Source: [4, 10]

Challenges for the agricultural sector

Agriculture in Guinea-Bissau is confronted with several challenges:

- Growth in population and food demand – the population of Guinea-Bissau is expected to double by 2050. This will have serious implications on food security. At present, food consumption per capita is about 2 304 kcal/day each for crop and livestock products. Rising populations will call for increased production to meet the demand for food in sustainable way. Failure to meet food security needs will increase malnutrition and the presently unacceptable levels of poverty and child mortality. At present, national cereal production has not been sufficient to meet the present population. Statistics from national reports shows annual consumption levels of 130 kg/person for rice, 8.47 kg/person for maize, and 36.63 kg/person for dry cereal. In 2016, the Government of Guinea-Bissau imported cereals worth USD 25.9 million to meet the deficits in cereal production. To augment production levels, agricultural systems have to be diversified with modification of the traditional shifting cultivation systems that are becoming unsustainable due to dwindling fallow periods. There should also be increased investments in irrigation and adoption of climate-smart innovations.
- Land use change and natural resource depletion - forest resources are subject to high levels of vulnerability to natural and human induced climate vagaries. With a significant number of the population directly or indirectly depending on forest resources for their livelihoods systems, there are obvious possibilities of over-exploitation in the form of rampant tree felling, logging and bush fire occurrences all of which can suppress growth (afforestation) and disrupt the ecosystem through loss of biodiversity among other things. Between 1975 and 2013 Guinea-Bissau lost about 77 percent of its forests [11]. The government intends to implement a new forest policy that will ensure sustainable forest resources management. Meanwhile the inherently poor soils without adequate nutrient replenishment particularly in the northern and eastern agroecological zones impede current efforts to boost food production.
- Limited marketing opportunities of agricultural commodities has long been a challenge in Guinea-Bissau. The agriculture sector is mainly subsistence-based except for cashew and groundnut production with a larger majority of smallholder farmers lacking knowledge and skills on aligning agricultural value chains to marketing and commercialisation. Thinking of a value chain as a business and understanding how to minimize costs, improve efficiencies, differentiate products, and overcome challenges to achieve profitability is critical to achieving sustainable livelihoods.

- Climate change and variability – like most small island developing states, climate change and variability continues to threaten efforts to increase per capita household food availability in Guinea-Bissau. Delays in rainfall onsets and shorting rainfall periods markedly affect cereal production. Rising temperatures also increase evaporation of water resources threatening the available of sufficient water for agriculture.

Agriculture and climate change

Guinea-Bissau has a typical hot, humid monsoon-like tropical climate, with two well-defined seasons. The rainy season is from mid-may to mid-november, with the dry season occupying the rest of the year. May and november are transition months between both seasons. Average temperatures in the rainy season range from 26 °C to 28 °C (30.5 °C in april and begin of may), but are lower at 1 800 mm in the country's southern provinces, but only <1 200 mm in the east [12].

Historical observations show july and august as the rainiest months in Guinea-Bissau. Major droughts occurred in 1977, 1979, 1980, 1983, 2002, 2004 and 2013. The drought of 2002 affected an estimated 100 000 people which is more than any other climate-related disaster (including epidemics) between 1980 and 2010. High tides and torrential rainfalls in 2003, 2004 and 2005 destroyed makeshift housing and bridges in east Guinea-Bissau, forcing family farmers to abandon their houses (some permanently) and causing severe harvest losses. Floods of Geba and Corubal rivers' tributaries are particularly relevant in this respect [13].

Agriculture in Guinea-Bissau as with the other small island developing states, is exposed to the effects of climate change. The country is vulnerable to droughts, floods and sea level rise. The new climate scenarios project significant changes in the climate of Guinea-Bissau. The scenarios systematically project increases in average daily temperature up to + 1.4 °C for the period 2016-2045 with the potential to reach up to + 2.2 °C between 2046 and 2075 per the low emissions scenario (CRP4.5).

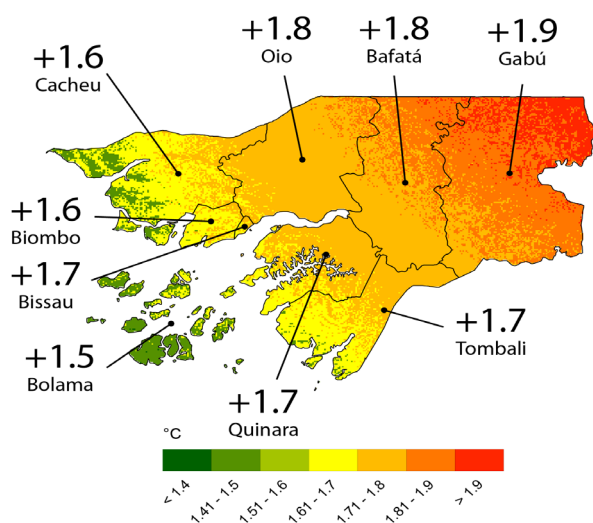
According to the RCP8.5 scenario (high emissions), the changes expected are still higher with temperature increases from + 1.6 °C to + 3.1 °C for the periods 2046 and 2075 respectively. All together, the models point to significant increases in the daily maximum and minimum temperatures in the order of +3.0 °C and +3.2 °C, respectively, particularly in the eastern part of the country.

With regards to precipitation, the average of fourteen models used in the simulations point at a slight increase in the average daily rainfall of + 3 percent [2 percent to + 5 percent] for almost the entire national territory per the RCP4.5 scenario (low emissions) for the period 2016-2045. For RCP8.5 scenario (high emissions), no significant changes are expected in relation to the reference period: 1961-1990. With the exception of the south-western part of the archipelago of Bijagós and part of the southern region of Tombali (cacine sector) where + 5 percent increase is expected, projections under this scenario are generally characterized by significant variability. Historically, there has been a linear decline in mean annual rainfall in Bissau from 1 750 mm in 1960 to ~1 450 mm in 2010 with the central northern and eastern portions of the country expected to experience more dryness in the future.

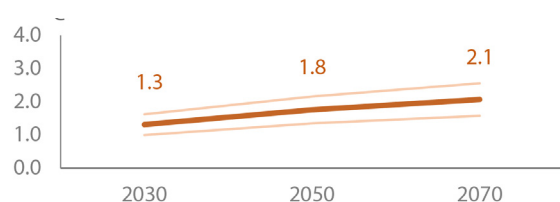
The projected changes in temperature and rainfall are expected to have substantial impact on water resources which are already limited in their capacity provide sufficient water for the agriculture sector. With predominance of rainfed agricultural production systems, yield of major food crops and livestock production are also expected to dwindle without appropriate climate-smart solutions.

Projected changes in temperature and precipitation in Guinea-Bissau by 2050

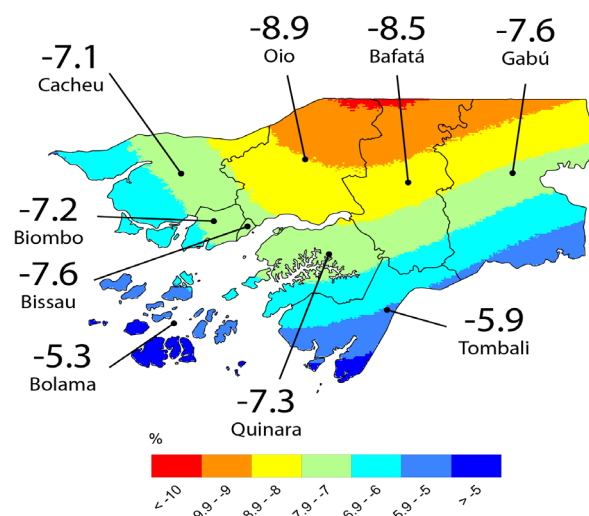
Changes in annual mean temperature (°C)



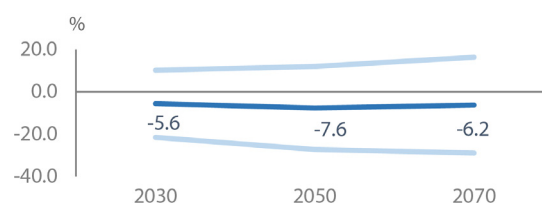
Average temperature (°C)



Changes in total precipitation (%)



Average precipitation (%)



Source: [25, 26]

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 as well as at least one of the other objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA.

In Guinea-Bissau, several CSA practices exist. Most of these practices are implemented in the north and east of the country, consisting essentially of savannas, very vulnerable and strongly impacted by high temperatures and rainfall variability. Some of CSA practices include:

1. Use of organic manure – organic manure use is common in the production of vegetables. In some places, compost is prepared from the decomposition of a mixture of plant residues (weeds, leaves, straw and peanut shells) and animal waste, cold ash, household waste or other to provide organic nutrients and increase the content of organic matter in the soil.

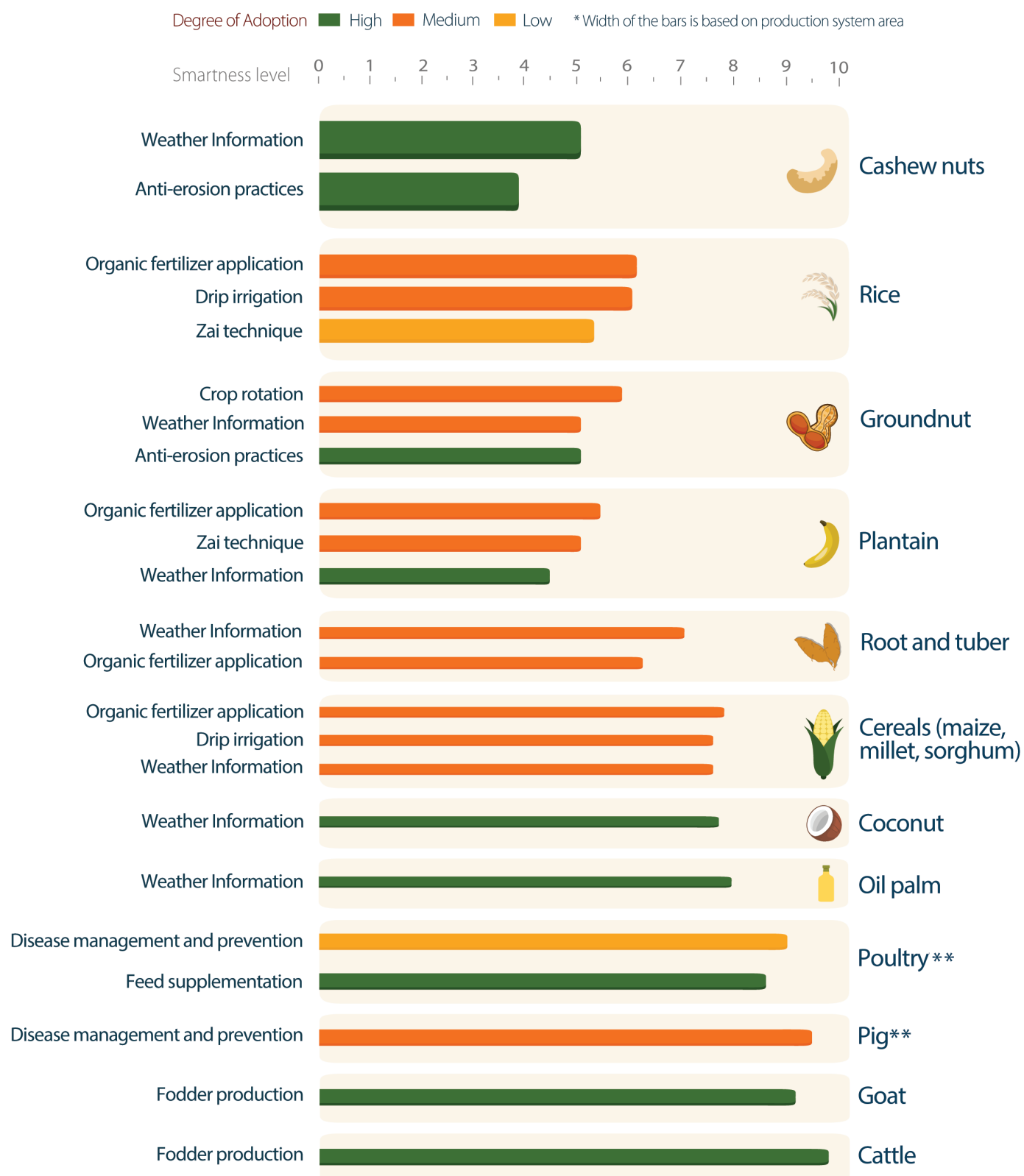
Using organic materials for soil fertility improvement reduces the use of synthetic fertilizers which emit GHGs. The compost also improves soil water retention to improve the adaptability of crops to water shortages at least in the short-term.

2. Use of weather information – various projects in Guinea-Bissau such as NAPA (National Adaptation Programmes of Action) has strengthened the technical, institutional and systemic capacity of the National Institute of Meteorology (NMI) in collecting, processing, producing and disseminating weathering information to inform farmers about the weather. Peasant pluviometers were introduced to guide farmers in respecting the sowing season to prevent seed losses. Complementarily, there is a joint working group that collaborates with the NMI, the Ministry of Agriculture and the Ministry of the Environment in disseminating agro-hydro-meteorological information to farmers for good agricultural planning decisions. The use of weather information is common among cashew, cereal and groundnut producers.

3. Water supply through drip irrigation – solar-powered drip irrigation systems are becoming prominent in Guinea-Bissau to improve water availability on rice fields and on private farms particularly during droughts.
4. Anti-erosion arrangement – various erosion control measures are practiced in Guinea-Bissau. Windbreaks are particularly used in cereal production systems to minimize shocks/crop destructions from strong winds and wind erosion.
5. Forage/fodder production – in the eastern agroecological zone, forage plants such as the *brachiaria* sp., are planted to improve the diets of livestock. These practices are particularly useful during fodder scarcity periods or intense droughts where fodder of fair nutritive quality are limited in supply.
6. Crop rotation – cereal-legume rotations are practiced in Guinea-Bissau to mitigate low soil fertility resulting from intensive land use without adequate nutrient replenishment. Bean-corn crop rotations in Guinea-Bissau markedly improves yield of associated crops. About 10 percent increase in productivity are recorded for both cereals and legumes. In the Gabu region, crop rotations reportedly contributed to the reduction of fungal diseases and increased resilience against drought.
7. Rainwater harvesting through the zai technique – in the plateau areas, zai techniques are used for the production of corn, sorghum, fonio, among other cereals. Zai involves digging pits (at 20-40 cm diameter and 10-15 cm depth) to accumulate water before subsequent planting with or without the application of organic resources such as compost, plant residues and animal manure. Farmers use the techniques to maintain soil moisture, reduce soil erosion, and improve soil fertility.




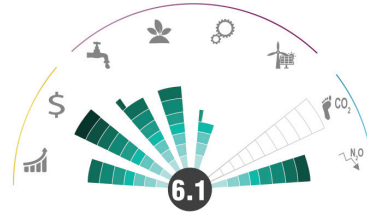
The following graphics present a selection of CSA practices with high climate smartness scores according to expert evaluations. The average climate smartness score is calculated based on the practice's individual scores on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity); income, water, soil, risks (adaptation); energy, carbon and nitrogen (mitigation). A practice can have a negative/ positive/ zero impact on a selected CSA indicator, with 10 (+/-) indicating a 100 percent 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 and a more comprehensive list of practices analyzed for Guinea-Bissau can be found in annexes 3 and 4, respectively."

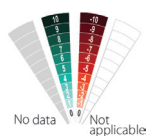
Selected CSA practices and technologies for production systems key for food security in Guinea-Bissau




** Unidentified production system area

Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Guinea Bissau

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
Cashew nuts (49 percent of total harvested area)				
Weather Information	60%	M L		<p>Productivity Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.</p> <p>Adaptation Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.</p> <p>Mitigation Climate-informed fertilizer application can reduce nitrous oxide emissions.</p>
Anti-erosion practices	60%	M L		<p>Productivity Increased productivity per unit of land.</p> <p>Adaptation Medium- to long-term increases in soil fertility by improving physical and biochemical soil characteristics. Conserves soil moisture.</p> <p>Mitigation Increases in above- and below-ground biomass. Reduction in loss of biomass from soil.</p>
Rice (21 percent of total harvested area)				
Organic fertilizer application	30-60%	S		<p>Productivity Increases productivity as a result of enhanced soil health and fertility.</p> <p>Adaptation Promotes soil structure conservation. Integrates crop residues and other on-farm waste. Minimizes erosion and enhances insitu moisture conservation.</p> <p>Mitigation Allows long-term reduction in nitrogen-based fertilizers and related GHG emissions. Maintains or improves soil carbon stocks and organic matter content.</p>
Drip irrigation	30-60%	M		<p>Productivity Improves crop yield and overall productivity</p> <p>Adaptation Improves water availability and utilization efficiency for increased resilience to drought</p> <p>Mitigation Some impact on nitrogen emissions by efficient fertilizer application. A reduction in energy required for irrigation can reduce emissions intensity per unit of output).</p>



 Yield


 Income

 Water

 Soil

 Risk/Information

 Energy

 CO₂ Carbon

 N₂O 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
Groundnuts (7 percent of total harvested area)				
Crop rotation	30-60%	M	5.9	<p>Productivity Enhances production per unit area. Diversifies income and food sources. Reduces use of external inputs hence reducing production costs.</p> <p>Adaptation Improves and conserve soil fertility; minimizes erosion; and contributes to reducing the risks of crop failure.</p> <p>Mitigation Allows long-term reduction in nitrogen-based fertilizers when leguminous crops are rotated with cereals. Maintains or improves above and below-ground carbon stocks and soil organic matter content.</p>
Weather Information	30-60%	S	5.1	<p>Productivity Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.</p> <p>Adaptation Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.</p> <p>Mitigation Climate-informed fertilizer application can reduce nitrous oxide emissions. Climate information reduces risk of crop failure therefore crop yields and the emission per unit production</p>
Plantains (3.11 percent of total harvested area)				
Organic fertilizer application	30-60%	M	5.5	<p>Productivity Increases productivity as a result of enhanced soil health and fertility.</p> <p>Adaptation Promotes soil structure conservation. Integrates crop residues and other on-farm waste. Minimizes erosion and enhances insitu moisture conservation.</p> <p>Mitigation Allows long-term reduction in nitrogen-based fertilizers and related GHG emissions. Maintains or improves soil carbon stocks and organic matter content.</p>
Zai technique	30-60%	M	5.1	<p>Productivity Increased productivity per unit of land.</p> <p>Adaptation Builds soil fertility by improving physical and bio-chemical soil characteristics. Reduces erosion and conserves moisture.</p> <p>Mitigation Promotes carbon storage in soil. Water retention increases, which in turn reduces energy needs for irrigation, therefore reductions in related GHG emissions.</p>

CSA practice	Region and adoption rate (%)	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
	<30 30-60 60>			

Roots and tubers (3 percent of total harvested area)

Weather Information

30-60%



Productivity

Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.

Adaptation

Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.

Mitigation

Climate information reduces risk of crop failure therefore crop yields and the emission per unit production.

Organic fertilizer application

30-60%



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 insitu moisture conservation.

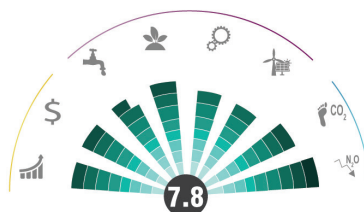
Mitigation

Allows long-term reduction in nitrogen-based fertilizers and related GHG emissions. Maintains or improves soil carbon stocks and organic matter content.

Cereals (maize, millet, sorghum) (2.16 percent, 2.06 percent, 3.85 percent of total harvested area)

Organic fertilizer application

30-60%



Productivity

Increases productivity as a result of enhanced soil health and fertility.

Adaptation

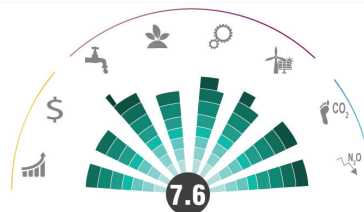
Promotes soil structure conservation. Integrates crop residues and other on-farm waste. Minimizes erosion and enhances insitu moisture conservation.

Mitigation

Allows long-term reduction in nitrogen-based fertilizers and related GHG emissions. Maintains or improves soil carbon stocks and organic matter content.

Drip irrigation

30-60%



Productivity

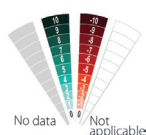
Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.

Adaptation

Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.

Mitigation

Climate-informed fertilizer application can reduce nitrous oxide emissions.



Yield

Income

Water

Soil

Risk/Information

Energy

CO₂ Carbon

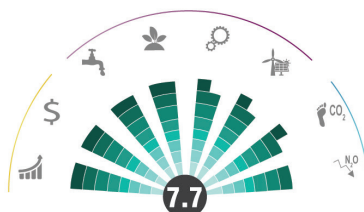
N₂O Nutrient

CSA practice	Region and adoption rate (%)	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
	<30 30-60 60>			

Coconut (2 percent of total harvested area)

Weather Information

60%



Productivity

Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.

Adaptation

Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.

Mitigation

Climate information reduces risk of crop failure therefore crop yields and the emission per unit production.

Oil palm (2 percent of total harvested area)

Weather Information

60%



Productivity

Reduces risks of crop failure through informed decision making, improves efficient use of farm inputs and increases yield.

Adaptation

Improves farmers awareness, preparedness and responsiveness to irregular weather conditions and extreme weather events.

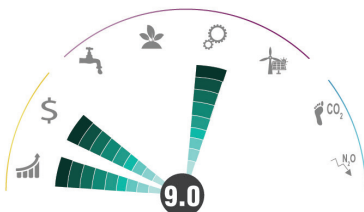
Mitigation

Climate information reduces risk of crop failure therefore crop yields and the emission per unit production.

Chicken (NA)

Disease management and prevention

<30%



Productivity

Reduces costs of production through reduction in external input use. Increases in income through high quality food.

Adaptation

Prevents crop losses caused by diseases. Increases the potential to overcome climate shocks.

Mitigation

Disease management and prevention reduces risk of crop failure therefore crop yields and the emission per unit production.

Feed supplementation

60%



Productivity

Reduces costs of production through reduction in external input use. Increases in income through high quality food.

Adaptation

Provides alternative food source, increasing adaptive capacity to dry season.

Mitigation

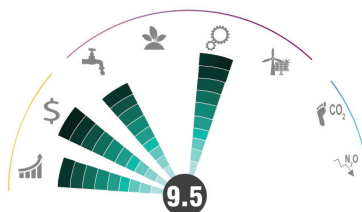
Reduces GHG emissions (carbon footprint) by reducing consumption of energy, synthetic fertilizers and other agricultural inputs.

CSA practice	Region and adoption rate (%)	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
	<30 30-60 60>			

Pig (NA)

Disease management and prevention

30-60%



Productivity

Improves animal production and quality, hence potential increases in income.

Adaptation

Prevents animal losses caused by diseases. Increases the potential to overcome climate shocks.

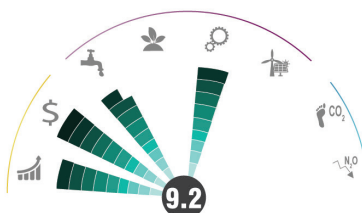
Mitigation

Disease management and prevention reduces risk of crop failure therefore crop yields and the emission per unit production.

Goat (No data)

Fodder production

60%



Productivity

Reduces costs of production through reduction in external input use. Increases in income through high quality food.

Adaptation

Builds soil fertility by improving physical and bio-chemical soil characteristics. Promotes biodiversity conservation. Provides alternative food source, increasing adaptive capacity to dry season. Reduces soil erosion.

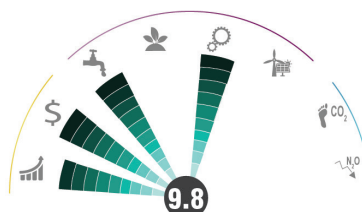
Mitigation

Reduces GHG emissions (carbon footprint) by reducing consumption of energy, synthetic fertilizers and other agricultural inputs. High-quality feed reduces methane emissions from ruminants.

Cattle (No data)

Fodder production

60%



Productivity

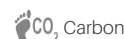
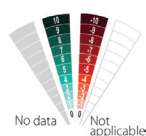
Reduces costs of production through reduction in external input use. Increases in income through high quality food."

Adaptation

Builds soil fertility by improving physical and bio-chemical soil characteristics. Promotes biodiversity conservation. Provides alternative food source, increasing adaptive capacity to dry season. Reduces soil erosion.

Mitigation

"Reduces GHG emissions (carbon footprint) by reducing consumption of energy, synthetic fertilizers and other agricultural inputs. High-quality feed reduces methane emissions from ruminants".



Institutions and policies for CSA

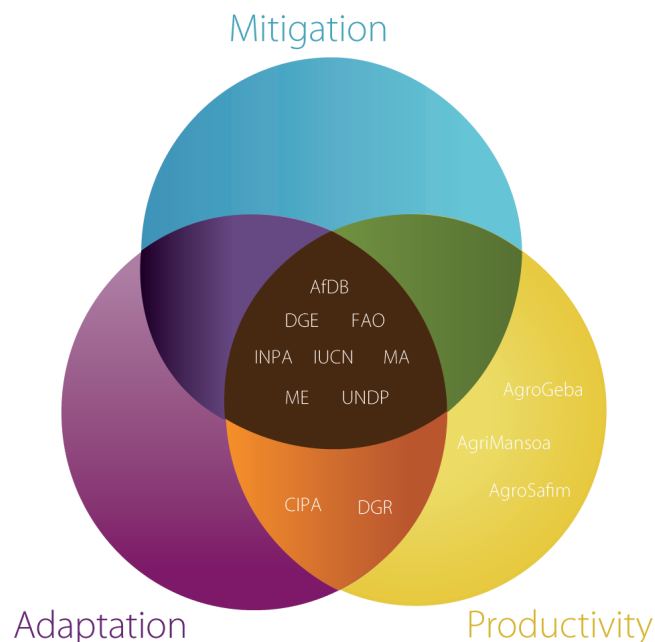
There are several institutions and policies aimed at supporting and increasing agriculture productivity and advancing CSA practices in Guinea-Bissau. These include government, private sector (AgroSafim, AgroGeba, AgriMansoa), National Institute for Agrarian Research (INPA), General Directorate of Rural Engineering.

From the survey, it was evident that most (62 percent) of the institutions identified in Guinea-Bissau have CSA-related activities that deliver on all the three pillars (productivity, adaptation and mitigation) of CSA. The survey identified 15 percent and 23 percent of the institutions as more productivity-focused and productivity + adaptation-focused respectively. At the government level, the institution responsible for the country's climate change plans and policies is the Ministry of Environment, which also serves as the country's UNFCCC focal point and Nationally Designated Authority (NDA) to the Green Climate Fund (GCF), Adaptation Fund (AF), Climate Investment Fund (CIF) and Global Environment Facility (GEF). As the head of the agrarian sector, the Ministry of Agriculture plays a large role in the implementation of actions on the ground linked to climate-smart agriculture. The Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP) and the International Union for Conservation of Nature (IUCN) play instrumental roles in the promotion of sustainable agriculture and environmental sustainability. Specifically, FAO has contributed tremendously in supporting the government of Guinea-Bissau to integrate climate change dimensions into the National Agricultural Investment Plan - program. UNDP and FAO have also contributed to the implementation of a climate change adaptation and population stabilization program with the aim of improving food security.

In terms of research, INPA conducts various types of CSA-related agricultural research including research on improved practices for annual crops (rice, maize, roots and tubers, etc.). The General Directorate of Livestock (DGP) and Center for Applied Fisheries Research (CIPA) also conduct research on animal production (livestock and fisheries). In the new organizational structure of the government of the Republic of Guinea-Bissau the Ministry of Environment and Sustainable Development (MADS), is the government entity entrusted with the overall responsibility for the development of environmental Policies, including those on Climate Change.

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 5.

Institutions for CSA in Guinea-Bissau



AfDB African Development Bank CIPA Center of Applied Fisheries Research DGE General Directorate of Livestock DGR General Directorate of Rural Engineering FAO Food and Agriculture Organization of the United Nations INPA National Institute for Agricultural Research MA Ministry of Agriculture IUCN International Union for Conservation of Nature ME Ministry of Environment UNDP United Nations Development Programme

In Guinea-Bissau, different strategies and programs are implemented in the field of agriculture and climate change. Key policies dealing with CSA are either under formulation (in phase of designing - writing/ consulting), legally formalized (enacted) or actively implemented (if implemented policies and evidences are already visible).

Guinea-Bissau ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 27 October 1995 and ratified also the Kyoto Protocol on 18 November 2005 [17] thus becoming a contracting Party to the Convention, committed to develop, update, publish the National Communications on Climate Change and other strategic documents on the same theme and participate in the Conferences of the Parties (COP). In order to meet its reporting obligations, Guinea-Bissau has already prepared and submitted systematically: i) the First Inventory and the Initial National Communication in 1996, the reference year 1994; ii) the Second Inventory and subsequent Second

National Communication in 2011, the base year 2000; iii) the Third Inventory and consequently, within this framework, the reporting guidelines, adopted during COP 8 for the preparation of national communications from Parties not included in annex-I to the Convention; and v) the third National Communication (reference year is 2010) steered by the guidelines and/or good practice guidance for land use, land use change and forestry (2003) of the Intergovernmental Panel on Climate Change (IPCC) for the preparation of national communications from Parties not included in annex-I of the Convention. In 2015 the country submitted the INDC serving as the basis for the Paris Agreement.

To cope with the challenges of economic development, poverty, food security and climate change, a number of political instruments have been put into place. Some of these include:

- Guinea-Bissau: National Adaptation Programme of Action - the preparation and finalization of the National Programme of Action of Adaptation to Negative Effects of Climate Changes (NAPA), financed by the Global Environment Facility (GEF) and under the country's joining of the framework convention on climate changes and the Kyoto Protocol, aims to assess the country's vulnerability to the above-mentioned phenomena. It proposes steps and priority activities aimed at reducing and/or mitigating the negative effects of climate changes and implementing early warning and forecasting measures to enable response to future catastrophes.
- National Good Governance Programme – had the aim of strengthening governance capacity at different levels. For instance, it assisted in the formulation of the Environmental Management National Plan (PNGA).
- Convention on Biological Diversity - with the objective of conserving its biodiversity, to guarantee the sustainable use of its elements and to promote the fair and equal share of the benefits and advantages that result from it, Guinea-Bissau, signed, in 1992, and ratified, in October of 1995, the Convention on Biological Diversity. The outcomes of this convention have been related to all the three pillars of CSA.
- National Plan of Environmental Management (PNGA) - this was institutionalized and legitimated as a principal document of the national global policies of the environment. Generally, this plan seeks the optimization of existing environmental resources for economic growth and sustainable livelihood improvement. Besides sustainable natural resources management, it also seeks to support the search of solutions that can improve food safety, eradicate poverty, control pollution, improve sanitation and mitigate climate change.

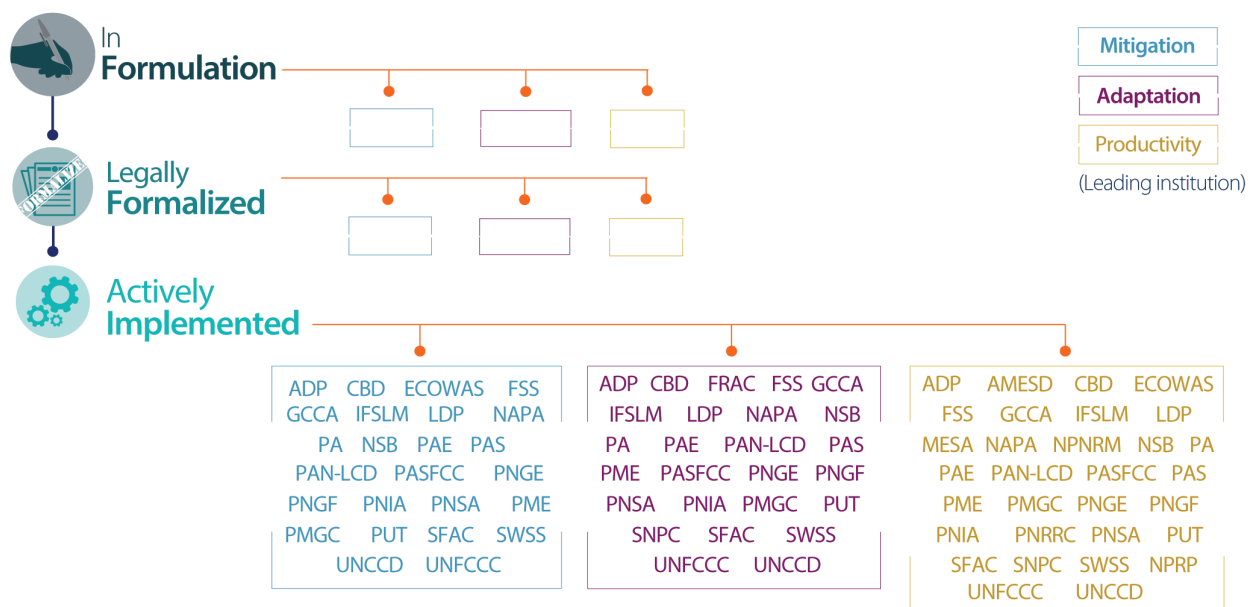
The mainstreaming of climate change into policy documents is still incipient; the African Development Bank (AfDB) and IUCN has been supportive of this. At present, climate change issues have been prioritized and included in the national poverty reduction paper (PRSP II) by integrating climate change themes into policies, strategies and development plans at national and sub-national levels. Through a GEF-supported project called “Strengthening of resilience and adaptability of the agricultural and water sectors to climate change in Guinea-Bissau” climate change considerations are being mainstreamed into the following policies: (i) Letter of Agricultural Development Policy; (ii) Letter of the Livestock Development Policy; (iii) Water and Sanitation Master Plan, and (iv) Gabu Regional Development Plan (Development Plans of Pitche and Pirada Sectors).

The graphic shows a selection of policies, strategies and programs that relate to agriculture and climate change topics and are considered key enablers of CSA in the country. The policy cycle classification aims to show gaps and opportunities in policy-making, referring to the three main stages: policy formulation (referring to a policy that is in an initial formulation stage/consultation process), policy formalization (to indicate the presence of mechanisms for the policy to process at national level) and policy in active implementation (to indicate visible progress/outcomes toward achieving larger policy goals, through concrete strategies and action plans). For more information on the methodology and results from interviews, surveys and expert consultations, see annex 6.

Financing CSA

Guinea-Bissau is part of annex I of the UNFCCC, part of the Kyoto Protocol, and is a least developed country (LDC). Major sources of financing are intended mainly for adaptation, mitigation and REDD+ actions. From reviews and confirmation from CSA experts, most of the climate-change and CSA-related funding have come from international sources with the United Nations Development Programme (UNDP) being great support. Most of the funds have come from UNDP's signature programmes, the Global Environment Facility, Adaptation Fund and the Least Developed Countries Fund (LDCF). Under UNDP's Supporting integrated climate change strategies signature programme, Guinea-Bissau was supported with USD 200 000 and USD 10 000 co-funding from the government to support the development process of the Guinea-Bissau National Adaptation Programmes of Action (NAPAs). The NAPAs provide a process for Least Developed Countries (LDCs) to identify priority activities that respond to their immediate needs to adapt to climate change, ultimately leading to the implementation of projects aimed at reducing the economic and social costs of climate change.

Policies for CSA in Guinea-Bissau



ADP Letter of Agricultural Development Policy (2002) (Ministry of Agriculture) **AMESD** AU-EU African Monitoring of the Environment for Sustainable Development (2009) (Ministry of Environment/Agency of Meteorology) **CBD** Convention on Biological Diversity (1994) (Ministry of Environment / IBAP) **ECOWAS** Economic Community of West African States (Government of the Republic of Guinea-Bissau) **FSS** Food Security Strategy (Ministry of Agriculture) **FRAC** Rural Forum on Climate Change (2011) (Multi-Sectoral) **GCCA** Support to the Global Climate Change Alliance (2013) (Multi-Sectoral) **IFSLM** Integrated Financing Strategy for Sustainable Land Management (2013) (Multi-Sectoral) **LDP** Letter of Livestock Development Policy (2009) (Ministry of Agriculture) **MESA** Monitoring for Environment and Security in Africa (2015) (Ministry of Environment/Ministry of Fisheries) **NAPA** National Action Plan for Adaptation to Climate Change (1996) (Ministry of Environment) **NPNRM** National Plan for Natural Resource Management (Ministry of Energy, Industry and Natural Resources) **NPRP** National Poverty Reduction Paper (Ministry of Finance) **NSB** National Biodiversity Strategy (2003) (Ministry of Environment / IBAP) **PA** Agricultural Policy (Ministry of Agriculture) **PAE** Policy for Environment Improvement (Ministry of Environment) **PAN-LCD** National Action Programme to Combat Drought and Desertification (2007) (Ministry of Agriculture) **PAS** Protected Areas Strategy (2009) (Ministry of Environment / IBAP) **PASFCC** Plan of Action on Sustainable Financing of Climate Changes (2013) (Multi-Sectoral) **PME** Water Master Plan (Ministry of Energy, Industry and Natural Resources) **PMGC** Coastal Zone Master Plan (Ministry of Security/Ministry of Transportation) **PNGE** National Environmental Management Plan (Ministry of Environment) **PNGF** Forestry Master Plan (Ministry of Agriculture) **PNIA** National Plan for Agricultural Investment (2015) (Ministry of Agriculture) **PNRR** National Platform for Reducing Disaster Risk (2012) (Agency of Meteorology/Ministry of Security) **PNSA** National Food Security Plan (Ministry of Agriculture) **PUT** Policy on Land Use (Ministry of Public Infrastructure) **SFAC** Strategy of Sustainable Financing of Adaptation to Climate Change (2013) (Multi-Sectoral) **SNPC** National Civil Protection Service (2012) (Ministry of Security) **SWSS** Strategy for Water Supply and Sanitation (Ministry of Energy, Industry and Natural Resources) **UNCCD** United Nations Convention to Combat Drought and Desertification (1994) (Ministry of Agriculture) **UNFCCC** United Nations Framework Convention on Climate Change (1994) (Ministry of Environment)

Through the LDCF, Guinea-Bissau obtained USD 5 150 000 as of November 2009 for a project on “Increased Resilience and Adaptation to Adverse Impacts of Climate Change in Guinea’s Vulnerable Coastal Zones”. In relation to this, a new project “Strengthening the resilience of vulnerable coastal areas and communities to climate change in Guinea-Bissau” is expected to leverage a proposed USD 12 million Global Environment Facility Least Developed Country Fund Grant to develop the strong institutions and policies needed to improve risk management in coastal zones, protect investments in coastal infrastructure and diffuse new technologies to strengthen resilience within coastal communities.

In the context of extreme vulnerability of family farmers to climate change in the dry lands of East Guinea-Bissau, the country received USD 9 979 000 from the Adaptation Fund for a five-year (2017-2022) project implemented by the Banque Ouest Africaine de Developpement (West African Development Bank).

The project titled: “Scaling up climate-smart agriculture in east Guinea-Bissau” seeks to strengthen practices and capacities in climate-smart agriculture in the project region and at institutional level. Through the project’s activities, food security and livelihoods are expected to be strengthened at household level while simultaneously increasing capacities in climate risk management and adaptation planning at all levels of governance [18]. Prior to this, Guinea-Bissau obtained a USD 4 million funding from the Global Environment Facility (GEF) through the support of the United Nations Development Programme (UNDP) to implement the project: “Strengthening adaptive capacity & resilience to climate change in the agrarian & water sectors in Guinea-Bissau”. This UNDP-supported, GEF-LDCF funded project in Guinea-Bissau was designed to transform the country’s policy responses to climate change from that of ‘reactive’ measures, towards achieving more ‘anticipatory’ and ‘deliberate’ policy responses.

An expected impact of this project is that the agrarian and water sectors will become more 'resilient' and thus more resistant to climatic pressures [18].

Potential finance

Based on funding history and donor interests, Guinea-Bissau has the potential to continue obtaining funding from climate finance initiatives such as the GEF. There is already high amount of funding received so far with the support of UNDP. Presently, UNDP is working with the Government of Guinea-Bissau to ensure a new tranche of USD 6 million from the Global Environment Facility's Least Developed Countries Fund is used to improve climate services and early warning systems in this West African nation. The "Strengthening climate information and early warning systems for climate resilient development and adaptation to climate change in Guinea-Bissau" project will work to enhance the capacity of the National Hydro-Meteorological Services (NHMS) in Guinea-Bissau, ensure the effective use of weather and water information to make early warnings, mainstream climate change information into long-term development plans, and work toward ensuring the sustainability of investments in new climate services. Similar to most developing countries, government support for CSA is weak. Enhancing private sector financing to CSA is needed. This could be done through capacity building and sensitization of microfinance institutes, agro-dealers, outgrowers and multinational companies on the benefits of investing in climate-smart practices.

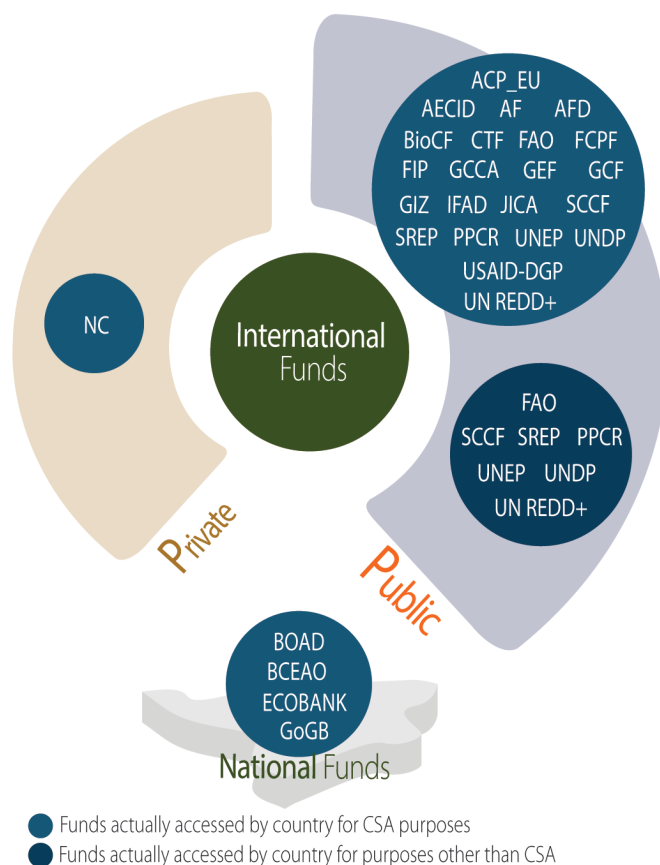
The graphic highlights existing and potential financing opportunities for CSA in Guinea-Bissau. The methodology and a more detailed list of funds can be found in annex 7.

Outlook

Guinea-Bissau consistently ranks among the most vulnerable countries in West Africa to climate change. The primary drivers of Guinea-Bissau's climate vulnerability are physical exposure, dependence on agriculture and fishing. With agriculture (crop, forestry, fishing and livestock farming) accounting for 49 percent GDP the economic wealth of Guinea-Bissau bases essentially in its natural capital.

The livestock sub-sector contributes about 71 percent of total emissions mainly from enteric fermentation and emissions from manure left on pasturelands. In the nationally determined contributions of Guinea-Bissau submitted to the UNFCCC, the country indicates reforestation as the major action for mitigating GHG emissions.

Financing opportunities for CSA in Guinea-Bissau



ACP-EU African, Caribbean and Pacific-European Union Energy Facility AECID Spanish Agency for International Development AF Adaptation Fund AFD French Development Agency BCEAO Central Bank of West African States BioCF World Bank BioCarbon Fund BOAD West African Development Bank BU Bank of Union CTF Clean Technology Fund ECOBANK Ecobank - The Pan African Bank FAO Food and Agriculture Organization of the United Nations FCPF Forest Carbon Partnership Facility FIP Forest Investment Program GCCA+ Global Climate Change Alliance GCF Green Climate Fund GEF Global Environment Facility GIZ German Society for International Cooperation GoGB Government of the Republic of Guinea-Bissau IFAD International Fund for Agricultural Development JICA Japan International Cooperation Agency NC The Nature Conservancy PPCR Pilot Program for Climate Resilience SCCF Special Climate Change Fund SREP Scaling Up Renewable Energy in Low Income Countries Program UNDP United Nations Development Programme UNEP United Nations Environmental Programme USAID-DGP United States Agency for International Development – Development Grants Program UN REDD United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation

The establishment of a new forestry policy for sustainable management of forest resources achievable through the conservation and restoration of forests; and the development of a legal framework through a national strategy for long-term low-carbon development particularly in the energy sector are viewed as mainstream opportunities for meeting climate change mitigation goals.

With high dependence on cereals for food security and cashew for foreign exchange, the development and adoption of CSA practices such as agroforestry, organic manure, weather information, drip irrigation, crop rotation, rainwater harvesting through zai techniques etc., offer support for the food security, climate change adaptation and economic goals of Guinea-Bissau.

There are several institutions and policies aimed at supporting and increasing agriculture productivity and advancing CSA practices in Guinea-Bissau. Both government and private sector (AgroSafim, AgroGeba, AgriMansoa) have placed significant roles in providing the enabling environment for CSA development and promotion.

National policies, plans and strategies such as the National Adaptation Programme of Action, National Good Governance Programme, Convention on Biological Diversity, National Plan of Environmental Management etc. outline measures to build adaptive capacity, improve resilience of agricultural systems and conserve biodiversity for sustainable development.

Guinea-Bissau continues to benefit from UNDP's signature programmes, the Global Environment Facility, Adaptation Fund and the Least Developed Countries Fund (LDCF) in support of its climate-related programmes. Similar to most developing countries, government support for CSA is weak. Enhancing private sector financing to CSA is needed. This could be done through capacity building and sensitization of microfinance institutes, agro-dealers, outgrowers and multinational companies on the benefits of investing in climate-smart practices.

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For further information and online versions of the annexes

Annex 1: Guinea-Bissau's agro-ecological zones

Annex 2: Selection of agriculture production systems key for food security in Guinea-Bissau (methodology and results)

Annex 3: Methodology for assessing climate smartness of ongoing practices

Annex 4: Long list of CSA practices adopted in Guinea-Bissau

Annex 5: Institutions for CSA in Guinea-Bissau (methodology and results)

Annex 6: Policies for CSA in Guinea-Bissau (methodology and results)

Annex 7: Assessing CSA finances

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 the Africa Small Island Developing States (Cabo Verde, Guinea-Bissau and Seychelles). The publication is based on data collected by FAO in collaboration with CSA stakeholders and partners in Guinea-Bissau 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>).

The document was prepared under the co-leadership of Albert Nikiema (FAORAF), Aste Yapi (FAORAF), Samuel Tetteh Partey (ICRISAT/CCAFS), Prosper Houessionon (ICRISAT/CCAFS), Mathieu Ouedraogo (ICRISAT/CCAFS), Robert Zougmore (ICRISAT/CCAFS), Evan Girvetz (CIAT) and Andrew Jarvis (CIAT/CCAFS). It is based on a methodology prepared by CIAT, the World Bank and the Tropical Agricultural Research and Higher Education Center (CATIE) in 2014 and revisited in 2015 by Andreea Nowak, Caitlin Corner-Dolloff, Miguel Lizarazo, Andy Jarvis, Evan Girvetz, Jennifer Twyman, Julian Ramírez, Carlos Navarro, Jaime Tarapues (CIAT/CCAFS), Charles Spillane, Colm Duffy and Una Murray (National University Ireland Galway).

Main authors: Samuel Tetteh Partey (ICRISAT/CCAFS), Prosper Houessionon (ICRISAT/CCAFS), and Viriato Cassama (Consultant/Ministry of Environment and Sustainable Development, Guinea-Bissau)

Editors: Robert Zougmore (ICRISAT/CCAFS), Albert Nikiema (FAORAF)

Original figures and graphics: Fernanda Rubiano (independent consultant)

Design and layout: CIAT and Fernanda Rubiano (independent consultant)

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