

Climate-Smart Agriculture in Adamawa state of Nigeria

Climate-smart agriculture (CSA) considerations

P Agriculture is the mainstay of about 80 percent of the inhabitants of Adamawa state and occupies an important position in the state's economy. The ecological condition of the state permits cultivation of root crops (e.g. sweet potatoes, yam and cassava), cereals (maize, sorghum, millet and rice), horticulture and rearing of livestock (cattle, goat, sheep, pig and poultry) in large numbers.

A P Declining soil fertility, climate change, low farm input lets, limited investment and poor infrastructure continue to hamper agricultural productivity and developments in the agricultural sector.

A I Adamawa state and indeed Nigeria has made efforts to enhance the resilience of the agriculture sector to climate change. The ongoing development of the Agricultural Promotion Policy (APP), the development of a National Policy on Climate Change and Response Strategy (NPCCRS) and the numerous plans, strategies and policy enabling environment are thought to set the state on the path towards sustainable development under the realities of a changing and varying climate.

A Some CSA practices (e.g. intercropping/multiple cropping, agroforestry, conservation agriculture etc.) are quite widespread and their proliferation has

been facilitated by ease of adoption, and multiple benefits such as food, income diversification and improved resilience.

P A M Although there are a wide range of organizations conducting CSA-related work, most have focused largely on food security, environmental management and adaptation. There is the need to also integrate mitigation into the State's climate-smart agriculture development efforts. In addition, off-farm services related to CSA need to be enhanced, including weather-smart and market-smart services.

\$ Funding for CSA is limited in the state and Nigeria in general, however there are opportunities to access and utilize international climate finance from sources such as the Green Climate Fund and Global Environment Facility and through readiness and capacity building programmes. At the national level, the National Agricultural Resilience in Nigeria, an arm of the Federal Ministry of Agriculture and Rural Development which targets reforestation, agriculture and livestock, is a useful mechanism for directing climate finance to CSA-related activities. Others are the fund set aside for the National Climate Change Adaptation Strategy and Action Plan for Climate Change in Nigeria (NASPA-CCN) which can benefit CSA-related activities the Adamawa state.

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

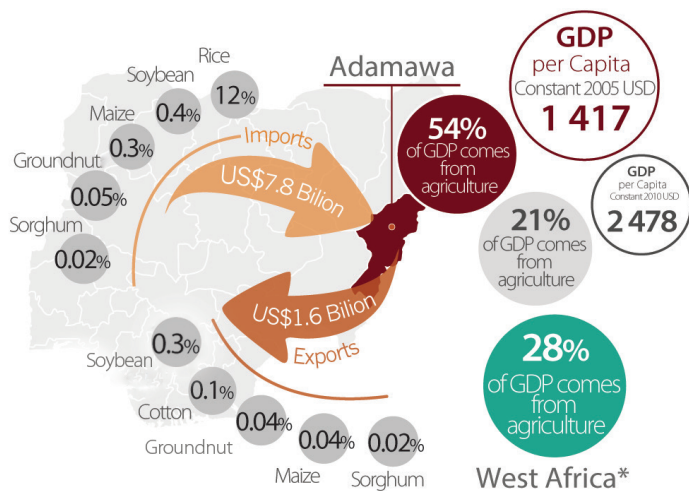
environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking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

State context

Economic relevance of agriculture

Adamawa state contributes just 0.43 percent to the gross domestic product (GDP) of Nigeria. Currently, the GDP is estimated at USD 4.58 billion with per capita GDP of USD 1 417 [3]. Adamawa's economy remains diversified across livestock (37.1 percent of state GDP), crop production (16.6 percent), wholesale and retail trade (6.6 percent), real estate (23.0 percent), and road transportation (6.8 percent). Therefore, agriculture contributes 53.7 percent of the state's GDP. Due to the activities of the insurgency, the estimated impacts on output and prices from 2011 to 2015 dropped by USD 1 570 million which raised the inflation on food items by 9.0 percent. The purchasing power parity (PPP) as at 2010 was 74.3 percent. Adamawa has a strong agricultural base, mineral deposits, fresh water resources and energy sources [4]. The major cash crops produced include groundnut, cotton, and onion. Groundnut is either sold in local markets or exported to other states. Although exportations figures are not currently available at state level, major agricultural export crops contributing to the national economy are sesame, cotton, groundnut, maize, sorghum.

Economic relevance of agriculture in Adamawa



*West Africa: Benin, Burkina Faso, Cape Verde, Ivory Coast, Ghana, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierre Leone, Togo, Liberia, Gambia

■ Adamawa ■ West Africa ■ Nigeria

Source: [5, 9, 10]

The top five agricultural products imported into Nigeria and for that matter the state are rice, soybean, maize groundnut and sorghum [5].

Adamawa state has an estimated population of about 4.2 million of which 80 percent are farmers. Agriculture offers the source of livelihood to majority of the population through subsistence traditional farming. In 2016, about 59.1 percent were estimated to be involved in crop production [11]. Majority of the farming population are male who engage in production processes while the females (46.7 percent) are mostly engaged in processing and value addition to the produce.

A recent survey revealed that from a total of 16 137 644 hectares under cultivation of export crops, Adamawa state accounted for a total of 485 348 hectares [6]. The size of the farm holding per family rarely exceed 5 hectares. The state is blessed with river Benue, Kiri, Kilange, Mayo Inne, Chouchi and Lake Geriyo, Tallum, Dwam, and Kiri in which dry season vegetable cultivation takes place [7].

A large number of farmers produce cereals (maize, rice, millet and sorghum), roots and tubers (sweet potatoes, cassava, and to a lesser extent, yams), legumes and pulses (cowpea, bambara nut, groundnut, and soya, cowpea) and horticulture crops (e.g. onions, lettuce, tomatoes, pepper, spinach, roselle, kenaf, etc.). Livestock produced include cattle, sheep, goats, pigs, and poultry. Poultry production is undertaken in every part of the state, as the practice is acceptable to all the ethno-religious groups in the state. The village communities living on the banks of the rivers engage in fishing while the Fulanis are cattle rearers [8].

People, agriculture and livelihoods in Adamawa

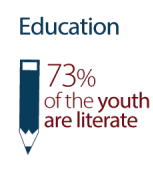
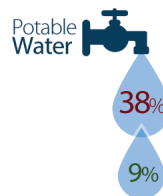
Demographics

4 million people live in Adamawa



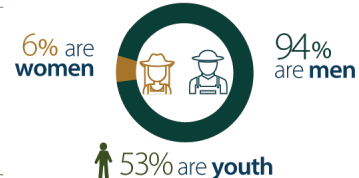
60% live in rural areas

Access to basic needs



Jobs in agriculture

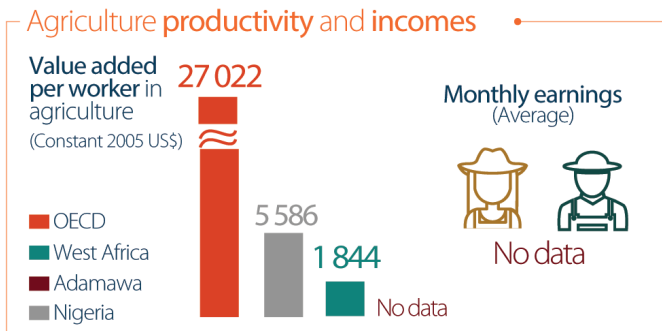
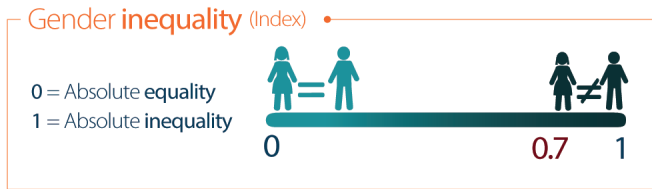
80% (153 252) people are employed in primary production agriculture



People living below



Source: [9, 11, 12, 13]

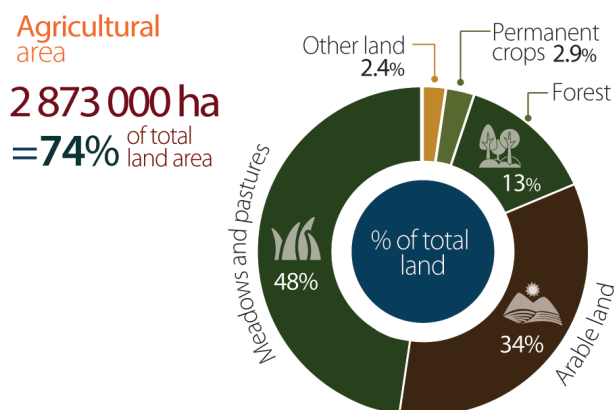


Source: [10, 16, 17]

Land use

Adamawa state has a total land mass of 38 823 square kilometer of which 28 730 square kilometer or 74 percent is arable. Adamawa state has a tropical wet and dry climate. Dry season lasts for a minimum of five months (november-march) while the wet season spans april to october. The major agro ecological formation of the state include, the guinea savannah, which is divided into southern and northern guinea savannah, and sudan savannas (annex 1). The southern guinea savannah comprises Toungo, Ganye, Jada, Mayo-Belwa and some parts of Fufore local government areas. Mean annual rainfall is about 1 600 mm in the extreme southern part of the state. The northern guinea savannah includes Lamurde, Numan, Guyuk, Shelleng, Song, Gombi, Maiha, Hong, Mubi and some parts of Fufore local government areas. The sudan savannah covers Madagali, Michika and some parts of Mubi and Hong local government areas [14]. The zone span from north to north-western part of the state. The mean annual rainfall ranges from 700 mm to 1 050 mm.

Land use in Adamawa



Source: [16]

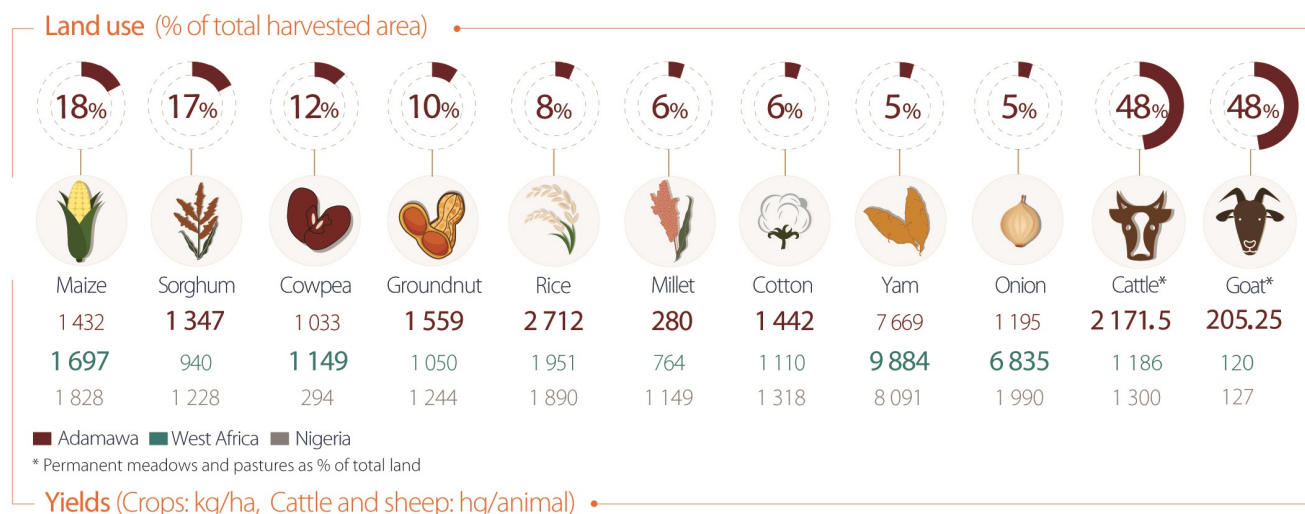
Agricultural production systems

In the Adamawa state, agriculture is characterized by small-scale and subsistence production systems. Agriculture is largely dependent on rainfall with less than 5 percent of land under cultivation equipped with irrigation. The state has irrigation potential of over 200 000 hectares and over 1 200 hectares are under irrigation during dry season. Production systems generally have low input of fertilizers and pesticides. Fertilizer consumption per unit of arable land is about 5.95 kg per hectare which is about two times lower than the West Africa regional average. Farmlands are generally small scale. By agroecology, major crops grown in the guinea and sudan savannah areas include groundnut, maize, sorghum, rice, cowpea, soyabeans, beniseed/sesame, yam, cotton, sweet potato and cassava. Vegetables like carrots, tomatoes, spinach, garden egg, onion, sorell/roselle and okra among other crops are also grown intensively in the area during the dry season. Fruit production are also common in these regions. In addition to crop farming, some farmers keep livestock such as cattle, sheep, goat, pigs and poultry. Village communities living on the banks of river Gongola and Benue in the state engage in fishing. There are few large scale farming in the rea such as Sebore farms. Livestock species are cattle, sheep and goats with poultry species reared all over the state. The farmers in this zone are mostly peasant farmers with farm size rarely exceeding 5 hectares per family.

Cereals (maize and millet) and legumes (cowpea and groundnut) are often grown in annual double-cropping systems in the sudan and guinea savanna zones, whereas sorghum is mainly grown in single-cropping systems. Typical double cropping systems in these zones include maize-cowpea, millet-maize, millet-cowpea and groundnut-maize. Intercropping is widely practiced in different parts of the state, particularly in the sudan savannah. Cereals are often intercropped with legumes or with other cereals for economic reason [15]. Cattle are used in land preparation; animal traction was reported as a common land preparation method across Adamawa states. Moreover, animal manure (organic manure) is widely used by many households to improve the soil fertility; especially for the poor households who could not afford the inorganic fertilizers. Animals and animal products are also used as food across the states and are among the most important sources of income especially during the lean seasons and during shocks.

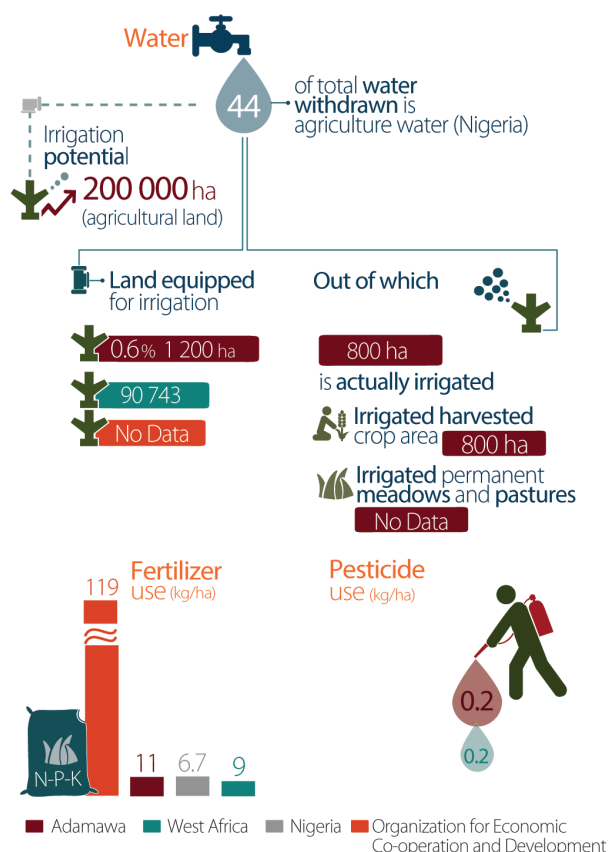
In 2015, the average yield for maize, sorghum, cowpea, rice and groundnut were 941 kg/ha, 348 kg/ha, 246 kg/ha 700 kg/ha, and 110 kg/ha, respectively. These were significantly lower than the standard expected yield for the respective crops [11]. According to FEWSNET, the below-average 2015 harvest in the entire northeast was attributed to the prolonged conflict (for the third consecutive year) which severely restricted cropping activities. The low yields could also be attributed to the predominant mixed cropping practice across the state as well as influence of climate change. For more information on the methodology for the production system selection, consult annex 2.

Production systems key for food security in Adamawa



Source: [5, 18]

Agriculture input use in Adamawa

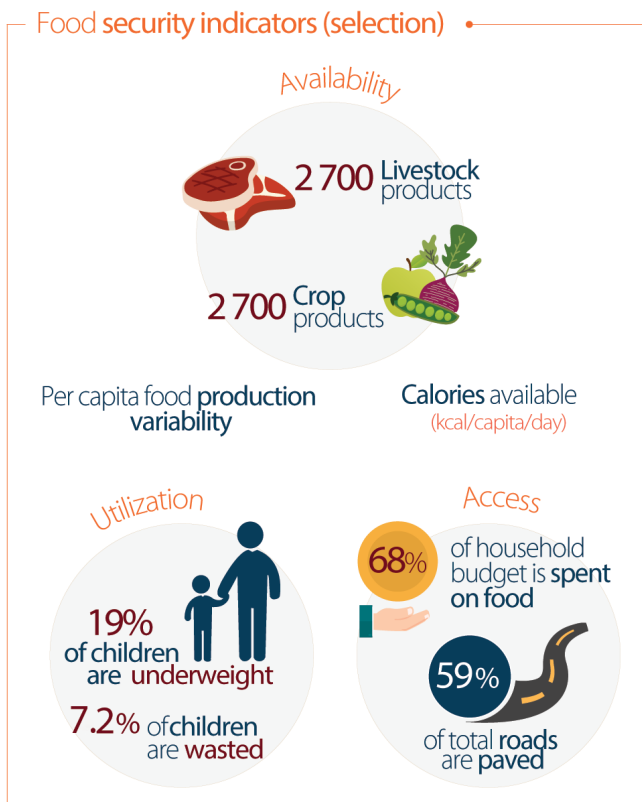
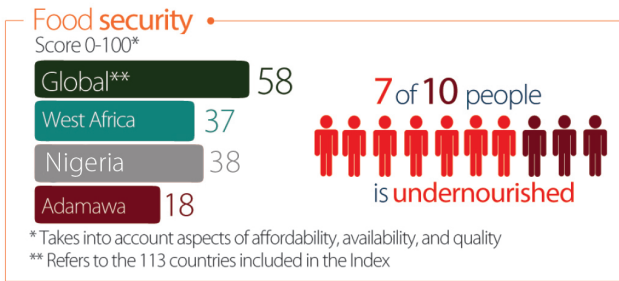


Source: [5, 18, 21, 22]

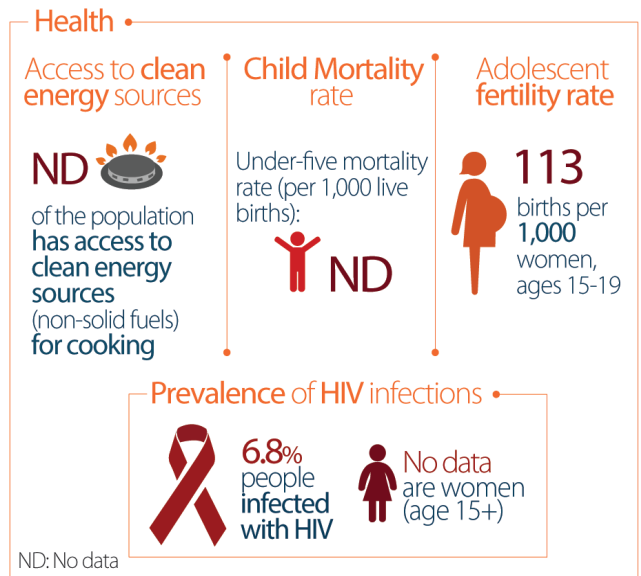
Food security and nutrition

Adamawa state faces huge food security challenges. About 74 percent of the population live on less than USD 1 per day [19], suffering hunger and poverty. The level of undernourishment also increased steadily from 6.1 percent of the population in 2010 to 7.0 percent in 2016. The variation of food prices in a given year (its volatility) ranged from about 2.6 percent to about 5 percent with prices of food items doubling. The incidence of underweight decreased from 23 percent in 2008 to 19 percent in 2015. The incidence of stunting decreased from 40.6 percent in 2008 to 32.9 percent in 2015. The incidence of wasting also decreased from 13.9 percent in 2008 to 7.2 percent in 2016. For stunting, Nigeria's target was to reduce it by 50 percent in 2015 and 75 percent in 2020. However, by 2015 only a 19 percent reduction in the 2008 level had been achieved. For underweight and wasting the Malabo targets are 5 percent in 2025 [20]. Efforts would have to be made to ensure that the Adamawa state and Nigeria as a whole is on track to achieve these targets by 2025. The driving factors of food insecurity are enormous. With declining soil fertility, climate change, degradation of vegetation, increasing incidences of terrorism and poverty the state's food production is no longer sufficient to feed the growing population [20]. The state has one of the lowest prevalence rate of HIV in Nigeria. According to the Nigerian National Bureau of Statistics, HIV prevalence is about 6.8 percent.

Food security, nutrition, and health in Adamawa



Source: [8, 16, 23]

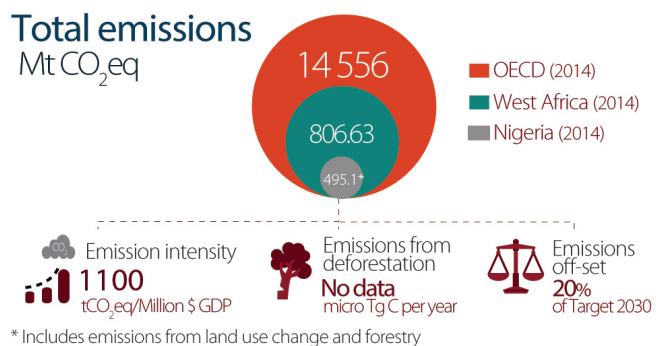


Source: [17, 24]

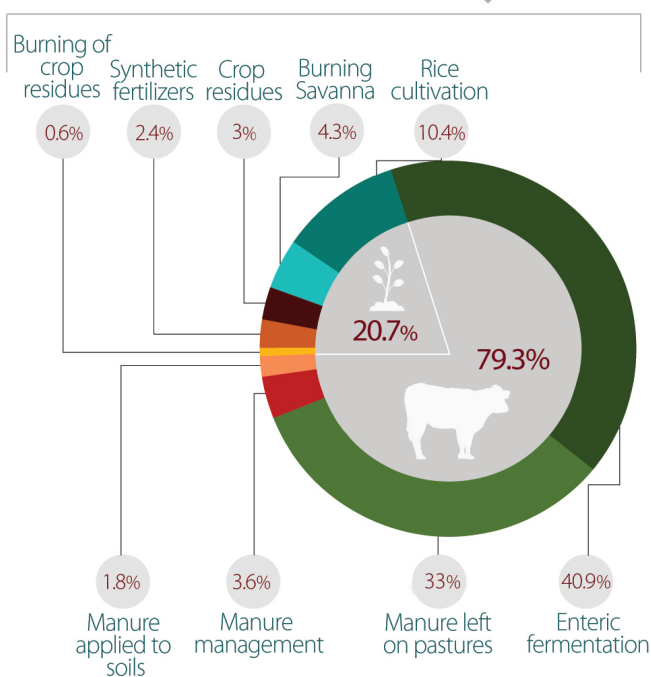
Agricultural greenhouse gas emissions

In Adamawa state, around 14 percent of human-generated greenhouse gases are estimated to come directly from agriculture; for example, almost half of all methane and nearly 60 percent of nitrous oxide emissions are generated by agricultural activities, including livestock production, and fertilizer and pesticide applications. A further 18 percent of greenhouse gases come from land use changes (e.g. clearance of forests for crops and pasture), soil erosion or machine intensive farming methods, which also contribute to increased carbon dioxide concentrations in the atmosphere. Reducing agriculture's carbon footprint is therefore an important consideration to limiting climate change [24].

Greenhouse gas emissions in Nigeria



Sectoral emissions (2014)



Source: [5, 25, 26]

Challenges for the agricultural sector

(a) Growth in population and food demand

Agriculture is the principal source of food and livelihood in Adamawa, making it a critical component of programs that seek to reduce poverty and attain food security. To meet the rapidly increasing demand for food by an ever-expanding human population, production from crop agriculture must expand by 4 percent annually while the production of food from animal agriculture must expand by more than 3 percent annually, between now and the year 2050. This will result in great pressure on land, leading to intensification of land use. Under these conditions, full integration of crop and livestock production offers the greatest potential for increasing agricultural productivity.

(b) Natural resource scarcity/depletion

Soil fertility depletion is a common phenomenon in Adamawa and regarded as the fundamental biophysical cause for declining per capita food production. This challenge will continue as population pressure increases and degradation of soil resources is aggravated. Overgrazing, constant bush burning, extensive tree felling for timber, fuel wood and continuous land cultivation have contributed negatively to soil fertility. Soil degradation due to inappropriate land use system is threatening the livelihood of thousands of people. Presently, large areas of land in Adamawa state have been abandoned due to soil fertility depletion as the result of continuous cultivation. In order to make sound decisions regarding land use, knowledge of specific properties related to soil functioning under different land use systems are necessary.

(c) Poverty and inequality

Majority of the Adamawa population lives in poverty, despite the wealth in Nigeria. Nigeria's inequality level was 0.45 in 2010 which is relatively high and indicates that income is held in the hands of relatively few. In the northeast where Adamawa state belongs, the poverty rate is 69.1 percent. With increased poverty, a large proportion of farmers are resource-poor to meet the agricultural input requirements on their farmlands. This poses threats to food production and challenges efforts to improve food and nutritional security in the Adamawa state.

(d) Poor Infrastructure and limited financing schemes

Agricultural performance in the Adamawa state is greatly impaired by the low level of development of social infrastructure. In the rural areas, where majority of the smallholders operate, inadequate infrastructure constitutes a major constraint to agricultural investment, production and trade. In addition, many farmers and value chain operators have no access to formal credit to finance their operations. With the scarcity and rising cost of farm inputs and processing, it is difficult for value chain actors to engage in commercial agriculture projects especially in view of their low level of income and savings, and access to credit challenges.

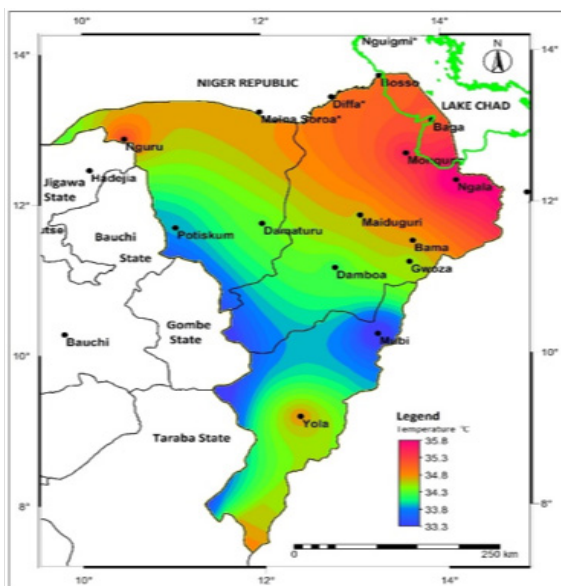
Agriculture and climate change

The earth's temperature is rising as a result of increased atmospheric concentrations of greenhouse gases. Northern Nigeria and indeed Adamawa is not an exception. As a semi-arid area, the Adamawa state is generally vulnerable to climate change. Figures 1 shows 30 years average rainfall and temperature across the state. State has experienced serious droughts, shortening rainfall and floods that have negatively impacted the state's agricultural productive capacity. During the rainy season, most crops are facing issues such as flower abortions, unusual flowering or fruiting time and generally low yields due to the effects of climate change [27]. For instance, 1 percent increase in minimum temperature leads to 3.7 percent reduction in rice production in Adamawa [28]. As rainfall becomes more variable, farmers are no longer able to rely on their traditional knowledge on the seasonality of climatic features. [2] has predicted that 11 percent of the arable land would be affected by climate change, with consecutive reduction in cereal production, and on 16 percent agricultural GDP reduction.

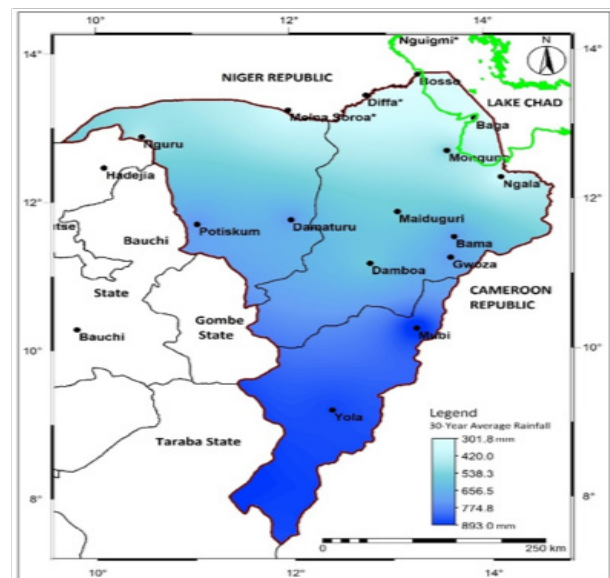
This may translate into substantial increase in poverty, hunger, and general food security challenges as a consequence of lower performance of rain-fed agricultural production systems. As a means of adaptation, it is recommended to capacitate farmers with up-to-date knowledge on climate-smart crop production technologies, such as the use of early maturing seeds, drought-tolerant varieties and more specifically the use of irrigation in order to boost crop production in the region. Weather forecast information should be made available to farmers through various relevant channels (e.g. SMS through mobile phone, radio broadcasts, TVs).

Mean temperature and precipitation in Adamawa state

Annual mean temperature (°C)



Mean precipitation (mm)



Source: [2, 27, 28, 29]

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. Evidence from the literature suggests that farmers are using several agricultural innovations developed from indigenous knowledge or introduced technologies to improve their adaptive capacity to climate change and variability. Some of these practices are *ex ante*, meaning they are based on pre-informed climatic events while others are *ex post* (measures adopted after a climatic event has been realised). Below, we used evidence from the literature to discuss some agricultural technologies and practices in the Adamawa state have been promising in achieving one or more of the three pillars of CSA: productivity, mitigation and adaptation:

a. Conservation agriculture – like most farming communities in Nigeria, conservation agriculture (CA) is a common practice in the Adamawa state with soil and water conservation attributes. Building on conventional slash-and-burn agricultural systems, CA approaches involve: (a) minimum or zero-tillage; (b) maintenance of soil cover through cover cropping or mulching; and (c) crop rotation [30]. CA delivers on one or more of the three pillars of climate-smart agriculture. The use of CA is driven by increased soil degradation throughout the dry areas of north-east Nigeria where crop yields are relatively low due to low soil organic matter, limited use of fertilizer inputs and recurrent droughts. In terms of productivity and adaptation, empirical evidence confirm CA increase the biological yield of major food crops such as maize, sorghum and millet even on poor soils and offer economic benefits from diversified crop rotation systems [30, 31]. Maintaining adequate soil cover through mulching offer multiple benefits to the farmer in dealing with climate-related risks. These include reduced run-off, increased water infiltration, improved soil organic matter and improved soil moisture retention. The encouragement of zero or minimum tillage in CA also minimizes labour costs in land preparation and enables early planting to synchronize the onset of rainfall.

b. Intercropping/crop diversification - with crop diversification and use of varying intercropping approaches in CA, there is significant reduction in the risks of crop failure providing farmers important safety nets in the event one crop fails to perform as expected. Cereals (maize and millet) and legumes (cowpea and groundnut) are often grown in annual double-cropping systems in the sudan and guinea savanna zones. Typical double cropping systems in these zones include maize-cowpea, millet-maize, millet-cowpea and groundnut-maize. Intercropping is widely practiced in different parts of the state, particularly in the sudan savannah. Cereals are often intercropped with legumes or with other cereals for economic reason [15].

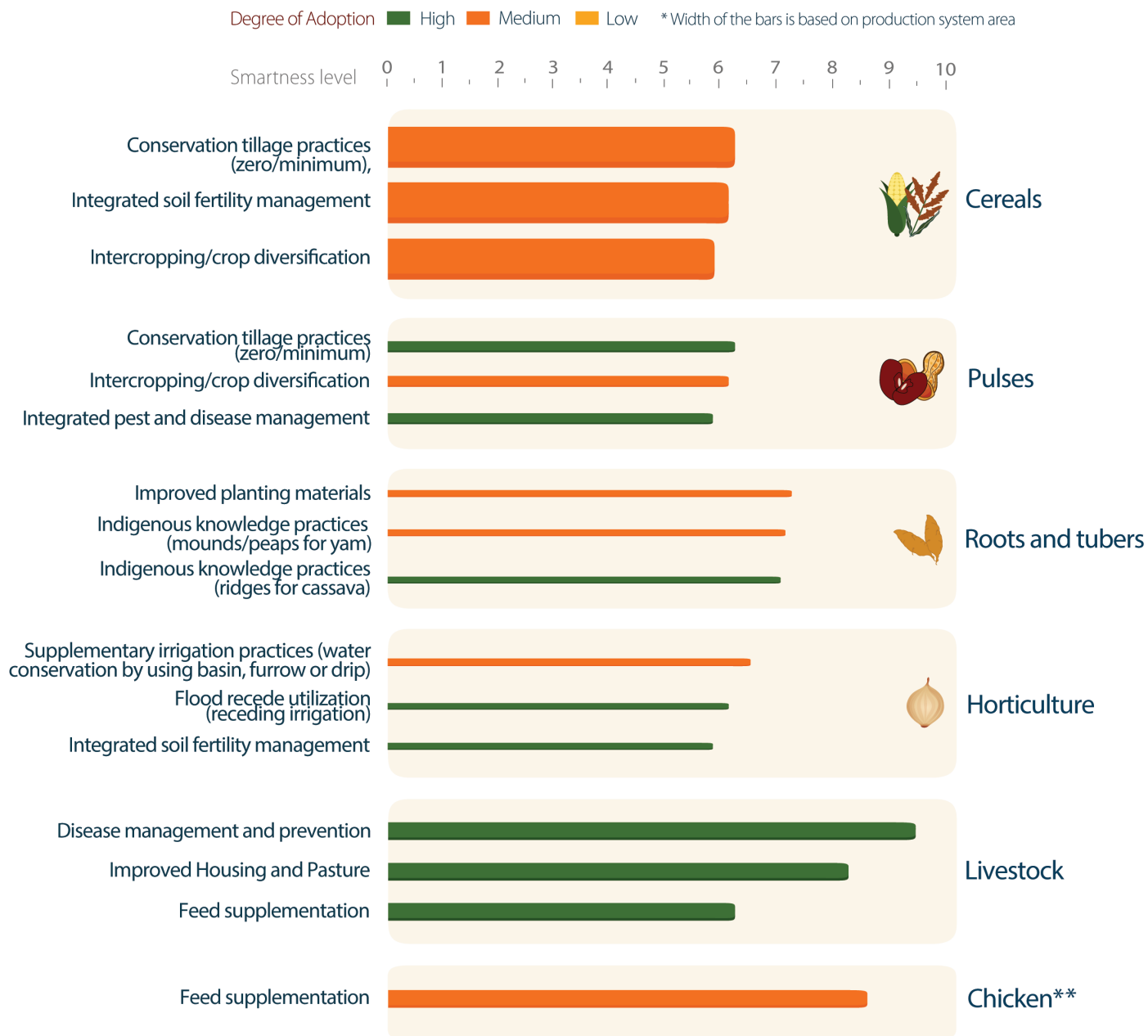
c. Improved seeds - over the past decades with increased temperatures and higher intensity of rain, many farmers have adopted the use of varieties that are resistant to extreme weather conditions. Some adopted seeds are also early maturing to evade consequences of reduction in amount of rainfall being experienced under varying and changing climate.

d. Integrated soil fertility management – farmers combine chemical fertilizers with other soil fertility improvement practices such as application of animal manure, compost, crop residues etc. Addition of organic manures to improve soil aggregate stability necessary and improve soil nourishment through decomposition and nitrogen mineralization. Using integrated soil fertility management practices markedly reduce the need of large quantities of synthetic fertilizers which, apart from their high costs contribute to GHG emissions [32].

e. In livestock production - common CSA practices for cattle, sheep and goats identified are seasonal migration, especially during dry period in search of pasture and water for pastoralists, improved housing for sedentary herders to create microclimate to shield the animals from excessive heat and rainfall and provision of quality water that helps in production. Others are conservation of feed for off season utilization and improved medication. In addition, for poultry production routine vaccination and feed formulation with locally available materials to reduce cost are common practices.

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 Adamawa state, Nigeria can be found in annexes 3 and 4 respectively.

Selected CSA practices and technologies for production systems key for food security in Adamawa



** Unidentified production system area

Case study: Packaging climate-smart agricultural actions to build the resilience of vulnerable households in the Adamawa state of Nigeria

With over 90 percent of its agricultural production rain-fed, Adamawa's smallholder agriculture is very vulnerable to the impacts of climate change. In this regard, Oxfam Nigeria and the European Union have embarked on a Pro Resilience Action (PROACT) project aimed at improving food security and helping farmers build resilient livelihoods. The project is being implemented by the Christian Rural and Urban Development Association of Nigeria (CRUDAN) in Adamawa. The project which started in 2016 is presently being implemented in four local governments of Adamawa state namely Mubi south, Fufore, Song, and Guyuk. This is a project through which, a certain number of climate-smart actions are combined to help farmers become more resilient. These include: (1) capacitation of farmers with farm inputs (e.g. fertilizers, water pumps, improved seeds etc.), (2) capacitation and training of farmers' groups and of government extension workers, establishment of cereal banks and of village savings and loan groups to facilitate access to flexible financing services. The project is expected to benefit a large number of farmers (at least 50 percent women) and build the capacities of 700 farmer groups. Through the project, rice farmers have witnessed a boost (almost 100 percent increase) in dry season rice production due to the distribution of farm inputs (e.g. fertilizers, water pumps, improved seeds etc.). In the first phase of support, a total of 625 farmers benefited from the distribution of 4 800 bags of fertilizer and over 400 water pumps of which 350 were women.

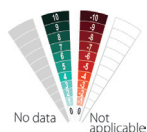
In addition to distribution of farm inputs, about 70 government extension workers in Kebbi and Adamawa states received training on good agricultural practices such as agroforestry, integrated crop management, basic agribusiness principles etc. for improved productivity of major crops such as rice, sorghum, millet, maize, livestock etc. Through the training, forty Farmer Training Field Schools (FTF) were established by the Extension workers in PROACT Communities in Adamawa state to help enhance farmers' capacity in adopting best agricultural practices that improve their yields and productivity. Field evidences suggest the FTF program has contributed to higher adoption of climate-smart agricultural practices leading to improved food security and income of farmers. At the end of the four-year term the project seeks to transfer farming techniques to farmers; plant 500 000 trees to combat desertification and climate change; establish 1 400 village savings and loan groups to facilitate access to flexible financing services, as well as establish 700 cereal banks to promote community-based food reserves.



(Source: <https://nigeria.oxfam.org/what-we-do/program-one/pro-resilience-action>;
<https://proactnigeria.com/kebbi-adamawa-states-extension-workers-trained-on-farm-field-school-programme/>)

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

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
Cereals (49 percent of total harvested area)				
Conservation tillage practices (zero/minimum),	Sudan savanna and guinea savanna 30-60%	S M L		<p>Productivity Enhances production per unit area; Diversifies income and food sources.</p> <p>Adaptation Improves and conserve soil fertility and improves yield; minimizes soil erosion</p> <p>Mitigation Maintains or improves above and below-ground carbon stocks and soil organic matter content; reduces soil disturbance.</p>
Integrated soil fertility management	Sudan savanna and guinea savanna 30-60%	S M L		<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 in situ 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>
Pulses (13 percent of total harvested area)				
Intercropping/ crop diversification	Sudan savanna and guinea savanna 60%	S M		<p>Productivity Enhances production per unit area; Diversifies food sources.</p> <p>Adaptation Provides important safety net climate-related risks and prospects for income diversification.</p> <p>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.</p>
Conservation tillage practices (zero/minimum),	Sudan savanna and guinea savanna 60%	S M L		<p>Productivity Enhances production per unit area; diversifies income and food sources.</p> <p>Adaptation Improves and conserve soil fertility and improves yield; minimizes soil erosion.</p> <p>Mitigation Maintains or improves above and below-ground carbon stocks and soil organic matter content; reduces soil disturbance.</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
--------------	------------------------------	---	-------------------	-----------------------

Roots and tubers (6 percent of total harvested area)

<p>Improved planting materials</p>	<p>Sudan savanna and guinea savanna</p> <p>30-60%</p>	<p>S M L</p>		<p>Productivity High-quality planting materials can improve yields by 30-40 percent.</p> <p>Adaptation Improved planting materials with drought-resistance improve the resilience of production systems.</p> <p>Mitigation Improves biomass, which may promote carbon sequestration.</p>
------------------------------------	--	--------------	--	---

<p>Indigenous knowledge practices (mounds/peaps for yam)</p>	<p>Sudan savanna and guinea savanna</p> <p>30-60%</p>	<p>S M L</p>		<p>Productivity Improve water use efficiency, minimizes climate-related shocks.</p> <p>Adaptation Minimizes production losses and enhances production per unit area.</p> <p>Mitigation Improved knowledge on best practices minimizes the use of large quantities of fertilizers and pesticides that significantly emit GHGs.</p>
--	--	--------------	--	--

Horticulture (6 percent of total harvested area)

<p>Supplementary irrigation practices (water conservation by using basin, furrow or drip)</p>	<p>Sudan savanna and guinea savanna</p> <p>30-60%</p>	<p>S</p>		<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 A reduction in energy required for irrigation can reduce emissions intensity per unit of output).</p>
---	--	----------	--	--

<p>Flood recede utilization (Receding irrigation)</p>	<p>Sudan savanna and guinea savanna</p> <p>60%</p>	<p>S</p>		<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 A reduction in energy required for irrigation can reduce emissions intensity per unit of output).</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>			

Livestock (48 percent)

Disease management and prevention

Sudan savanna and guinea savanna

60%



Productivity

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

Adaptation

Prevents diseases associated with livestock. Increases the potential to overcome climate shocks.

Mitigation

Has no use of synthetic fertilizers and related GHG emissions/carbon footprint.

Improved Housing and Pasture

Sudan savanna and guinea savanna

60%



Productivity

Enhances production per unit area.

Adaptation

Minimizes production losses and increases the potential to overcome climate shocks.

Mitigation

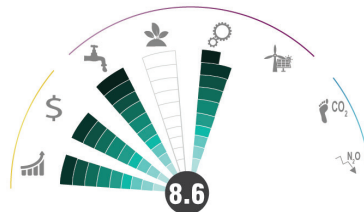
Reduces GHG emissions (carbon footprint) by reducing consumption of energy, synthetic fertilizers and other agricultural inputs

Chicken (NA)

Feed supplementation

Sudan savanna and guinea savanna

30-60%



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, and other agricultural inputs.



Yield

Income

Water

Soil

Risk/Information

Energy

Carbon

Nutrient

Institutions and policies for CSA

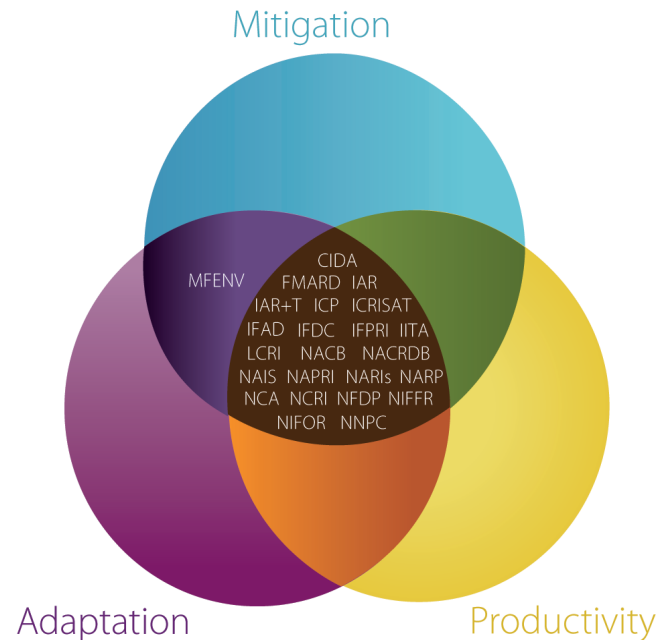
The Adamawa state has several key institutions and policies aimed at supporting and increasing agriculture productivity and advancing CSA practices. A number of institutions working on activities related to CSA operates at the Federal and state levels. Prominent among the institutions is the Federal Ministry of Agriculture and Rural Development (FMARD) the top rural development institution which is primarily responsible for agricultural policy formulation in Nigeria. State ministries of agriculture have the responsibility for agricultural policy implementation in their respective states, except agricultural research, which the federal government also funds. The Federal Ministry of Agriculture and Rural Development (FMARD) and other sectoral ministries such as the Federal Ministry of Environment and their state counterparts are responsible for the formulation, development and implementation of policies, programmes and strategies for addressing climate change activities.

Advisory Committee on Agricultural Resilience in Nigeria (ACARN) was set up as a platform on climate resilience in Nigeria. The committees make recommendations, based on informed expertise and research, to inform policies that will strengthen the capacity of small- and large-scale agricultural producers to increase productivity, grow wealth and thrive in the face of growing challenges from multiple environmental stressors and changing climate.

There are also several agricultural research institutions and universities/colleges working on CSA. These institutions and organizations are owned by the Federal Government and make up the National Agricultural Research System (NARS). They comprise 15 Commodity-based Research Institutes, 11 Federal colleges of agriculture, a specialized National Agricultural Extension Institute, over 50 Faculties of Agriculture in regular Federal Universities; and 3 specialized Universities of Agriculture. The activities of these institutions come under the purview of Agricultural Research Council of Nigeria (ARCN), which oversees their operations. In addition, Nigeria hosts a number of relevant international research and development organizations e.g. the International Agricultural Research Centre (IARC), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Food and Agriculture Organization of the United Nations (FAO) and the International Institute of Tropical Agriculture (IITA) whose activities also cover the North-East of Nigeria.

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 Adamawa



CIDA Canadian International Development Agency FMARD Federal Ministry of Agriculture and Rural Development IAR Institute for Agricultural Research IAR+T Institute for Agricultural Research and Training ICP Integrated cassava project ICRISAT International Crops Research Institute for the Semi-Arid Tropics IFAD International Fund for Agricultural Development IFDC International Fertilizer Development

There are no known policies on CSA in the Adamawa state of Nigeria. However, the development and promotion of CSA can be envisioned in Federal and national level policies on agricultural development and food. The government's long-term economic blueprint is expressed in the Nigerian Vision 20: 2020 (2009), which aims to transform agriculture into a sustainable and profitable sector with a focus on increasing agricultural productivity and production for direct consumption and processing for local market and export. To implement Vision 20: 2020, the National Planning Commission developed a new Medium-Term Plan for the period 2010–2013; meanwhile the Federal Ministry of Agriculture and Rural Development developed the National Agricultural Sector Strategy (NASS) and a five-point agricultural agenda, which is largely consistent with the four Comprehensive African Agricultural Development Plan (CAADP) pillars: water management, rural infrastructure, increasing food supply and technology transfer to the agricultural sector. Together with the Vision 20: 2020, the overarching framework that guides agriculture, food and nutrition security in Nigeria is the National Agriculture and Food Security Strategy (NAFSS, 2010–2020), which is now embedded in the Agriculture Transformation Agenda (2013–2015). The agenda was launched in 2011 to diversify the economy and enhance foreign exchange earnings, with the objective of achieving a hunger-free Nigeria through an agricultural sector that drives equitable income growth and distribution, accelerates the achievement of food

and nutrition security, generates decent employment and transforms Nigeria into a leading player in global food markets. These two strategic frameworks have provided the basis for the CAADP National Agricultural Investment Plan (NAIP, 2011–2014), which seeks to enhance agro-industrialization and employment; and the National Agriculture and Food Security Programme, which seeks to increase agricultural output and rural household incomes. In 2016, the government of Nigeria developed the Green Alternative: The Agriculture Promotion Policy (APP, 2016–2020), which considers the agricultural sector a key instrument to long-term economic growth. It aims to prioritize specific crops; assist agricultural growth through private sector-led business; strengthen commodity value chains; improve market orientation through infrastructure and commodity exchanges; mainstream climate change measures and environmental sustainability into agricultural development; and implement nutrition interventions for vulnerable groups.

In 2017, the Government of Nigeria launched the synthesis report of the Nigeria zero hunger strategic review, a strategic plan and road map to achieve Sustainable Development Goal 2 (end hunger, achieve food security and improved nutrition, and promote sustainable agriculture) by 2030. Furthermore, the government formulated the Economic Recovery and Growth Blueprint [33] as the new medium-term plan to tackle the economic crisis, restore growth, and ensure sustainable and inclusive growth. Concerning social protection, in 2015 the government drafted the National Social Protection Policy, which aims to reduce poverty; improve the management of social protection projects and programmes; ensure access to basic social services and infrastructure; enhance social welfare and improve food security and nutrition; support decent employment and sustainable livelihoods; protect households from shocks; and foster coordination among all social protection intervention agencies. With regard to nutrition, in 2016 the government developed the National Policy on Food and Nutrition, which aims at reducing hunger and malnutrition through a multi-sectoral and multidisciplinary approach encompassing various interventions at the community and national levels. By 2025, Nigeria expects to halve the proportion of people who suffer from hunger and malnutrition; decrease the stunting rate among under-five children; decrease the incidence of malnutrition among victims of emergencies; achieve universal access of all school children to school feeding programmes; and increase access to potable water. Few other policies, plans and strategies directly addressing one or more pillars of CSA at the Federal and state levels include:

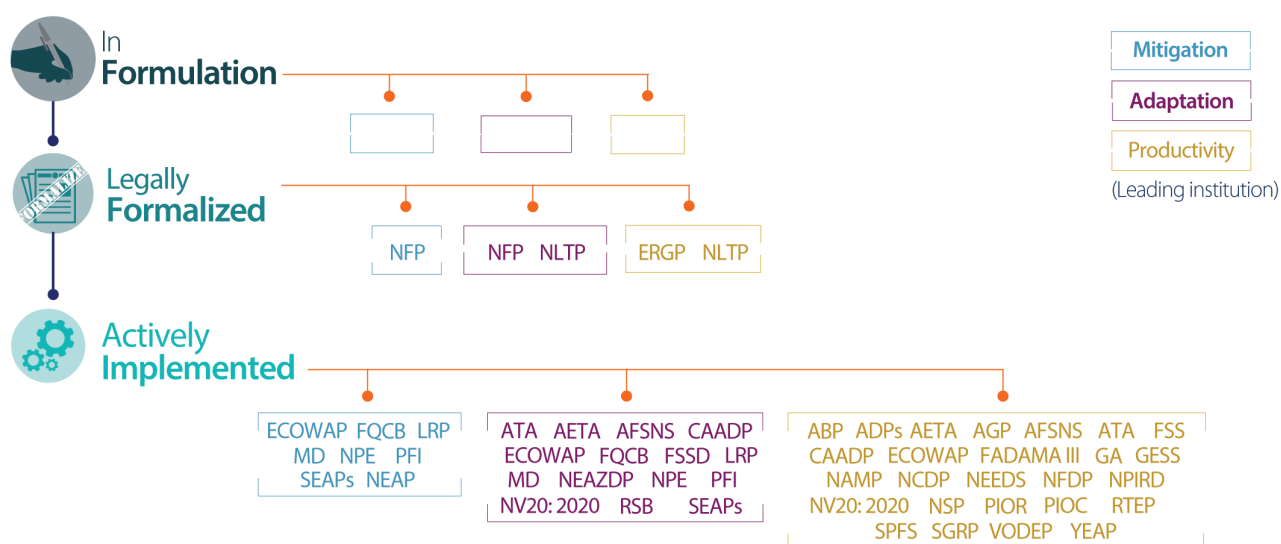
- The national adaptation strategy and plan of action on climate change for Nigeria (NASPA-CCN) prepared by the Building Nigeria's Response to Climate Change (BNRCC) project for the Special Climate Change Unit of the Federal Ministry of Environment in 2011 seeks to minimize risks, improve local and national adaptive capacity and resilience, leverage new opportunities, and facilitate collaboration with the global community.

- The Federal executive council of Nigeria in 2012 approved the adoption of a National Policy on Climate Change and Response Strategy (NPCCRS) as a national document for implementing climate activities in the country. The policy is meant to guide economic and social response of Nigerians to the global trend of climate change. The policy focuses on adaptation, mitigation, finance and technology [34].
- Nigeria is also a signatory to the Kyoto Protocol and ratified the United Nations Framework Convention on Climate Change (UNFCCC) 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).
- The National Forest Policy is geared towards ensuring sustainable forest management, promoting participatory process of development, facilitating private sector forestry development and adopting an integrated approach to forestry development. Government is currently embarking on a number of afforestation programmes. Under the guidance of the African Union Commission, Nigeria is keying into the project on the "Green Wall Initiative" in which a "green wall" of trees (40 million trees annually in the next 10 years) will be planted across the dry-land area of Nigeria to not only push back deforestation and secure agriculture and livelihoods across the sudano-Sahelian zone of the country, but also enhance the carbon sequestration of biological diversity resources in the region for climate change mitigation.
- The National Policy on Drought and Desertification, in particular, recognizes that climate change could intensify drought and desertification in the part of the country that are very prone to these environmental problems. Thus the policy emphasized the need to equip relevant agencies, institutions and citizens adequately to collect, analyze and use climate data effectively to ameliorate and combat drought and desertification. Specific implementation strategies for the policy include: (i) strengthening of agencies, institutions and facilities for the collection and analyses of meteorological and hydrological as well as for dissemination of information; (ii) upgrading the existing national early warning facilities for more efficient service delivery; (iii) developing appropriate awareness programmes for formal and informal education to enhance knowledge on climate and environment issues; and (iv) encouraging appropriate land use that enhances carbon dioxide sequestration, such as afforestation, reforestation and agro-forestry. This also reduces soil erosion and increase crop productivity for economic development.

- **Agricultural Promotion Policy:** The main objectives of the Nigerian Agricultural Promotion Policy include:
 - (i) the achievement of self-sufficiency in basic food supply and the attainment of food security;
 - (ii) increased production of agricultural raw materials for industries;
 - (iii) increased production and processing of export crops, using improved production and processing technologies;
 - (iv) generating gainful employment;
 - (v) rational utilization of agricultural resources, improved protection of agricultural land resources from drought, desert encroachment, soil erosion and flood, and the general preservation of the environment for the sustainability of agricultural production;
 - (vi) promotion of the increased application of modern technology to agricultural production; and,
 - (vii) improvement in the quality of life of rural dwellers [35].

The following graphic highlights key policies 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 6.

Policies for CSA in Adamawa



ADPs Agricultural Development Programme (2008) **AETA** Agricultural Extension Transformation Agenda (2011) **AFSNS** Agriculture Food Security and Nutrition Strategy (2017) **AGP** Agricultural Promotion Policy (2016) **ATA** Agricultural Transformation Agenda (2011) **CAADP** Comprehensive Africa Agriculture Development Program (2014) **ECOWAP** ECOWAS Agriculture Policy (2014) **ERGP** Economic Recovery Growth Plan (2017) **FADAMA III** Fadama III Programme (2008) **FSS** Food Security Strategy (2009) **FSSD** Food Security Strategy Document (2009) **FQCB** Fertilizer Quality Control Bill (2019) **GA** Agriculture Promotion Policy (APP), Green Alternative (2016) **GESS** Growth Enhancement Support Scheme (2011) **LRP** Land Resources Policy (2009) **MD** Malabo declaration (2014) **NAMP** National Agricultural Mechanisation Policy (2009) **NCDP** National Cooperative Development Policy (2009) **NEAP** Nigerian National Environmental Action Plan (1995) **NEAZDP** North East Arid Zone Development Programme (1988) **NEEDS** National Economic Empowerment and Development Strategy (1999) **NFD** National Fadama Development Project (1990) **NFP** National Forest Policy (2018) **NLTP** National Livestock Transformation Plan (2019) **NPE** National Policy on Environment (1989) **NSP** National Seed Policy (2009) **NV20:2020** Nigerian Vision 20: 2020 (2009) **NPIRD** National Policy on Integrated Rural Development (2009) **PFI** Presidential Fertilizer Initiative (2016) **PIOC** Presidential Initiative on Cassava (2002) **PIOR** Presidential Initiative on Rice (2002) **RTEP** Root And Tuber Expansion Programme (2003) **RSB** Revised Seed Bill (2017) **SEAPs** States Environmental Action Plans (1995) **SGRP** Strategic Grains Reserve Programme (2015) **SPFS** Special Programme for Food Security (2008) **VODEP** Presidential Initiative on Vegetable Oil Development (2002) **YEAP** Youth Employment in Agriculture Programme (2014)

Financing CSA

Financing CSA activities in the Adamawa state is presently the prerogative of implementing agencies across the state. There are limited concrete linkages with funding organizations at the bilateral and multi-lateral levels in support of CSA. There are, however, donor-supported climate change projects at the Federal level that benefits the state. Presently, the United Nations Development Programme, United Nations Environment Programme, Food and Agriculture Organization of the United Nations, the World Bank and the African Development Bank have supported CSA-related initiatives and agricultural development projects that are geared towards rural livelihood improvement and food security in the Adamawa state. Nationally, the government of Nigeria is taking pragmatic measures to devote significant proportions of national budget to climate change especially in sectors of the economy like agriculture deemed highly vulnerable to climate change and variability. While Nigeria has been able to obtain funding from the Global Environment Facility Trust Fund for climate change-related projects in other states, very less can be said of the Adamawa states.

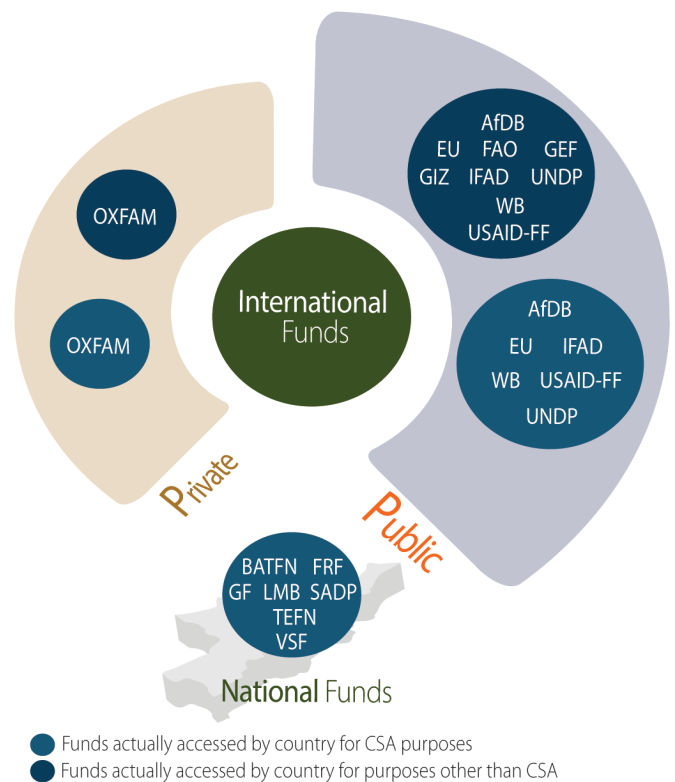
Potential finance

Adamawa state may not have sourced a lot of funding from climate finance initiatives like the Green Climate Fund and the Global Environment Facility. However, the vulnerability of the region to climate change and the rising need for the adoption of innovative agricultural technologies that avert the risks posed by climate change, makes projects seeking to improve climate change adaptation and rural livelihoods appealing to donors. At present, Federal Government support are not sufficient with the state counting mainly on local and international development agencies operating in the region. According to the Federal Ministry of Environment, the Federal Government is in the process of putting in place a Nationally Strategic Climate Change Trust Fund (NSCCTF) as a response to the need to broaden the scope of national interventions for impact at all levels of governance. The scope of the NSCCTF is said to be broad to cover many activities related to climate change and sustainable development in Nigeria. Agricultural stakeholders in the Adamawa state seeking to design projects that have the potential to strengthen agricultural production systems (crop and livestock) and improve their resilience to climate change-induced weather extremes such as drought are likely to benefit from this funding scheme. There have also been discussions on setting up an agricultural resilience fund that Adamawa state can benefit. The Bill to set up the National Climate Change Commission provides for “a fund into which all the monies accruable to the commission shall be paid and from which all the activities of the commission shall be funded”. This is the equivalent of a Climate Fund and would provide a pot from which the various economic sectors, including agriculture, could obtain their finances.

But there should also be a separate agricultural resilience fund to complement the National Climate Change Commission provision.

Indeed, the National Policy on Climate Change explicitly recognizes the need for individual sectors to pursue additional measures against climate change. Categorizing agriculture as a business invites greater involvement by the private sector in building finances to tackle climate change and develop climate-resilient agriculture. The private sector has many comparative advantages, including organized structures, experience, money and trained personnel, and will engage constructively in efforts to mitigate the shocks and stresses imposed by the changing climate. It understands the marketability and the profitability of climate-resilient agriculture and is willing to back that appreciation with the necessary level of investment. The graphic highlights existing and potential financing opportunities for CSA in the Adamawa state of Nigeria. The methodology and a more detailed list of funds can be found in annex 7.

Financing opportunities for CSA in Adamawa



AfDB African Development Bank BATFN British American Tobacco Foundation of Nigeria EU European Union FAO Food and Agriculture Organization of the United Nations FRF Fertilizer Revolving Fund GEF Global Environment Facility GF Guinness Foundation GIZ German Society for International Cooperation IFAD International Fund for Agricultural Development LMB LAPO Microfinance Bank NACRDB Nigerian Agricultural, Cooperative and Rural Development Bank SADP State Agricultural Development Programme TEFN The Tony Elumelu Foundation of Nigeria UNDP United Nations Development Programme USAID-FF United States Agency for International Development – Feed the Future VSF Victims Support Foundation WB The World Bank Group

Outlook

Agriculture is the mainstay for the Adamawa state employing over 80 percent of the population. Agricultural practices are mainly rain fed with few irrigated fields. Land holdings rarely exceed 5 hectares. Farming practices generally have low inputs with maize, sorghum, rice, cassava, yams, cowpea, soya bean, bambara nut and groundnut as major food crops and cotton, sugar-cane sesame and groundnut as major cash crops. Major livestock include cattle, sheep, goat, pig and poultry. Yet the agriculture sector is struggling to meet the food security needs of its growing population particularly in the face of highly variable weather and changes in climate. Factors such as declining soil fertility, poor financial services, land tenure complications, limited infrastructure and underdeveloped markets continue to hamper agricultural growth. This notwithstanding the Adamawa state and indeed Nigeria has made efforts to enhance the resilience of the agriculture sector to climate change. The ongoing development of the Agricultural Promotion Policy (APP), the development of a National Policy on Climate Change and Response Strategy (NPCCRS) and the numerous plans, strategies and policy enabling environment are thought to set the state on the path towards sustainable development under the realities of a changing and varying climate.

Some CSA practices (e.g. intercropping/multiple cropping, agroforestry, conservation agriculture etc.) are quite widespread and their proliferation has been facilitated by ease of adoption, and multiple benefits such as food, income diversification and improved resilience. Although there are a wide range of organizations conducting CSA-related work, most have focused largely on food security, environmental management and adaptation. There is the need to also integrate mitigation into the State's climate-smart agriculture development efforts. In addition, off-farm services related to CSA need to be enhanced, including weather-smart and market-smart services. While funding for CSA is limited in the state and Nigeria in general, efforts are underway to ensure that the country access and utilize international climate finance from sources such as the Green Climate Fund and Global Environment Facility and through readiness and capacity building programmes. At the national level, the National Agricultural Resilience in Nigeria, an arm of the Federal Ministry of Agriculture and Rural Development which targets reforestation, agriculture and livestock, is a useful mechanism for directing climate finance to CSA-related activities. Others are the fund set aside for the National Climate Change Adaptation Strategy and Action Plan for Climate Change in Nigeria (NASPA-CCN) which can benefit CSA-related activities the Adamawa state.

Works cited

- [1] **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).
- [2] **FAO.** 2013. Climate-smart agriculture sourcebook. Rome:FAO.
- [3] **C-GIDD.** 2008. Canback Global Income Distribution Database. Canback Dangel. Archived from the original. <https://www.cgidd.com>.
- [4] **Recovery and Peace Building Assessment.** 2016. North-eastern Nigeria Vol. III. State Reports. The World bank group. Washington D.C.
- [5] **FAO.** 2018. FAOSTAT Database. Available at: <http://faostat3.fao.org/download/Q/QV/E>
- [6] **CCAIECS.** 2005. Report on National Survey of Agricultural Export Commodities in Nigeria. CBN/NBS/FMA&RD/FMC 2004.2005. 52Pp.
- [7] **Osprey Limited.** 2012. Agriculture Master plan Adamawa State. Osprey Investments Group. www.ospreyinvestmentsgroup.com/our-work/case-studies/agriculture-master-plan-adamawa-state/
- [8] **AgroBusiness Times.** 2017. Agro Opportunities in Adamawa State. www.agrobusinessngr.com.
- [9] **Nigeria Data Portal.** Available at: <http://nigeria.opendataforafrica.org/apps/atlas/Adamawa>
- [10] **World Bank.** 2018. World Development Indicators. Washington, D.C: World Bank. Available at: <http://data.worldbank.org/>
- [11] **FAO.** 2016. Seed Security assessment in northeastern states of Nigeria. Food and Agriculture Organization,Rome. 64Pp.
- [12] **Amurtiya and Tashikalma.** 2018. Analysis of poverty level among some selected households in Girei local Government area of Adamawa state, Nigeria. Available at : https://www.academia.edu/29727115/ANALYSIS_OF_POVERTY_LEVEL_AMONG_SOME_SELECTED_HOUSEHOLDS_IN_GIREI_LOCAL_GOVERNMENT_AREA_OF_ADAMAWA_STATE_NIGERIA
- [13] **UNPD.** 2016. Available at: https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/assessments/undp_report_update_livelihoods_economic_reovery_assessment_final.pdf
- [14] **Jamala, G., and Oke, D. O.** 2013. Soil profile characteristics as affected by land use system in southeastern Adamawa state, Nigeria. Journal of agriculture and veterinary Science. 6(4): 4-11.

- [15] **Bala, A.** 2018. Nigeria: Global Yield Gap Atlas. Available at: <http://www.teildgaps/web/guest/yieldgaps>
- [16] **NBS.** 2019. Nigerian Bureau of Statistics. Demographic statistics Bulletin, 26p
- [17] **UNDP.** 2018. http://hdr.undp.org/sites/default/files/hdr_2018_nigeria_finalfinalx3.pdf
- [18] **CountryStat.** 2018. Available at : <http://countrystat.org/home.aspx?c=NGA&tr=21>
- [19] **Nwajiuba, C.** 2012. Nigeria's Agriculture and Food Security Challenges By chinedum.nwajiuba@imsuni.edu.ng Pp 45-58.
- [20] **Olomola, A. S. and Nwafor, M.** 2018. Nigeria Agriculture Sector Performance Review. A background report for the Nigeria 2017 Agriculture joint sector review.80pp.
- [21] **FAO/AQUASTAT.** 2019. Available at: <http://www.fao.org/nr/water/aquastat/data/query/results.html>
- [22] **FoodSecurity.** 2019. Available at : <http://www.foodsecurityportal.org/api/countries/calorie-supply-per-c?page=2>
- [23] **ACAPS.** 2017. Northeast Nigeria: Adamawa state crises profile. Available at: <https://reliefweb.int/report/nigeria/acaps-crisis-profile-northeast-nigeria-adamawa-state-crisis-profile-2017>
- [24] **Spore.** 2015. Climate change challenges and opportunities. Towards 2050: No time to waste. Spore magazine special issue, October, 2015. <http://spore.cta.int>
- [25] **ClimateWatch.** 2014. Available at: <https://www.climatewatchdata.org/countries/CPV>
- [26] **FAO.** 2019. Available at: <http://www.fao.org/faostat/en/#data/GT>
- [27] **Mohammed, T., Hassan Tanko, H.** 2018. The effects of climate change on food crop production in northern nigeria. 10.528/Zendo.1464995
- [28] **Adedeji, I. A., Tiku, N. E., Waziri-Ugwu P. R., Sanusi. S. O.** 2017. The effect of climate change on rice production in Adamawa State, Nigeria
- [29] **NIMET.** 2017. Available at: <https://www.worldweatheronline.com/potiskum-weather-averages/yobe/ng.aspx>
- [30] **Giller, K. E., Witter, E., Corbeels, M., & Tittonell, P.** 2009. Conservation agriculture and smallholder farming in Africa: the heretics' view. *Field crops research*, 114(1), 23-34.
- [31] **Bayala, J., Sileshi, G. W., Coe, R., Kalinganire, A., Tchoundjeu, Z., Sinclair, F., & Garrity, D.** 2012. Cereal yield response to conservation agriculture practices in drylands of West Africa: a quantitative synthesis. *Journal of arid environments*, 78, 13-25.
- [32] **Tubiello, F. N., Salvatore, M., Rossi, S., Ferrara, A., Fitton, N., & Smith, P.** 2013. The FAOSTAT database of greenhouse gas emissions from agriculture. *Environmental Research Letters*, 8(1), 015009.
- [33] **ERGP.** 2017. Economic Recovery and Growth Blueprint. Available at: <https://loudng.files.wordpress.com/2017/03/nigeria-ergplan.pdf>
- [34] **NNPC.** 2014. Nigeria unveils new global climate policy. Nigerian National Petroleum Corporation News and update. www.nnpc.com.
- [35] **FMARD.** 2016. Agriculture Promotion Policy (2016-2020): Building on the successes of ATA, closing key gaps. Policy and Strategy Document, Federal Ministry of Agriculture and Rural development, Nigeria. 59 Pp.

For further information and online versions of the annexes

Annex 1: Adamawa's agro-ecological zones

Annex 2: Selection of agriculture production systems key for food security in the Adamawa state of Nigeria (methodology and results)

Annex 3: Methodology for assessing climate smartness of ongoing practices

Annex 4: Long list of CSA practices adopted in the Adamawa state of Nigeria

Annex 5: Institutions for CSA in the Adamawa state of Nigeria (methodology and results)

Annex 6: Policies for CSA in the Adamawa state of Nigeria (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 State-specific baselines on CSA in North-East Nigeria (Adamawa, Borno and Yobe States). The publication is based on data collected by FAO in collaboration with CSA stakeholders and partners in Adamawa State 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), Jonas Bervoets (FAONG), Aminu Zakari (FAONG), Samuel Tetteh Partey (ICRISAT/CCAFS), Prosper Houessionon (ICRISAT/CCAFS), Mathieu Ouedraogo (ICRISAT/CCAFS) and Robert Zougmore (ICRISAT/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 Ramirez, 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 Adam Lawan Ngala (National Consultant)

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

Original figures and graphics: Fernanda Rubiano (independent consultant)

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

This document should be cited as:

FAO and ICRISAT. 2019 . Climate-Smart Agriculture in the Adamawa State of Nigeria. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Food and Agriculture Organization of the United Nations (FAO). Rome, Italy. 22p.

Acknowledgement

The fieldwork that supported the preparation of the CSA country profile for the Adamawa state of Nigeria was funded by the Government of Norway. We acknowledge the contribution of the stakeholders from Adamawa state as well as experts from Federal Ministries and NGOs for the validation of the profile content.



Some rights reserved. This work is available under a [CC BY-NC-SA 3.0 IGO](https://creativecommons.org/licenses/by-nc-sa/3.0/igo/) licence