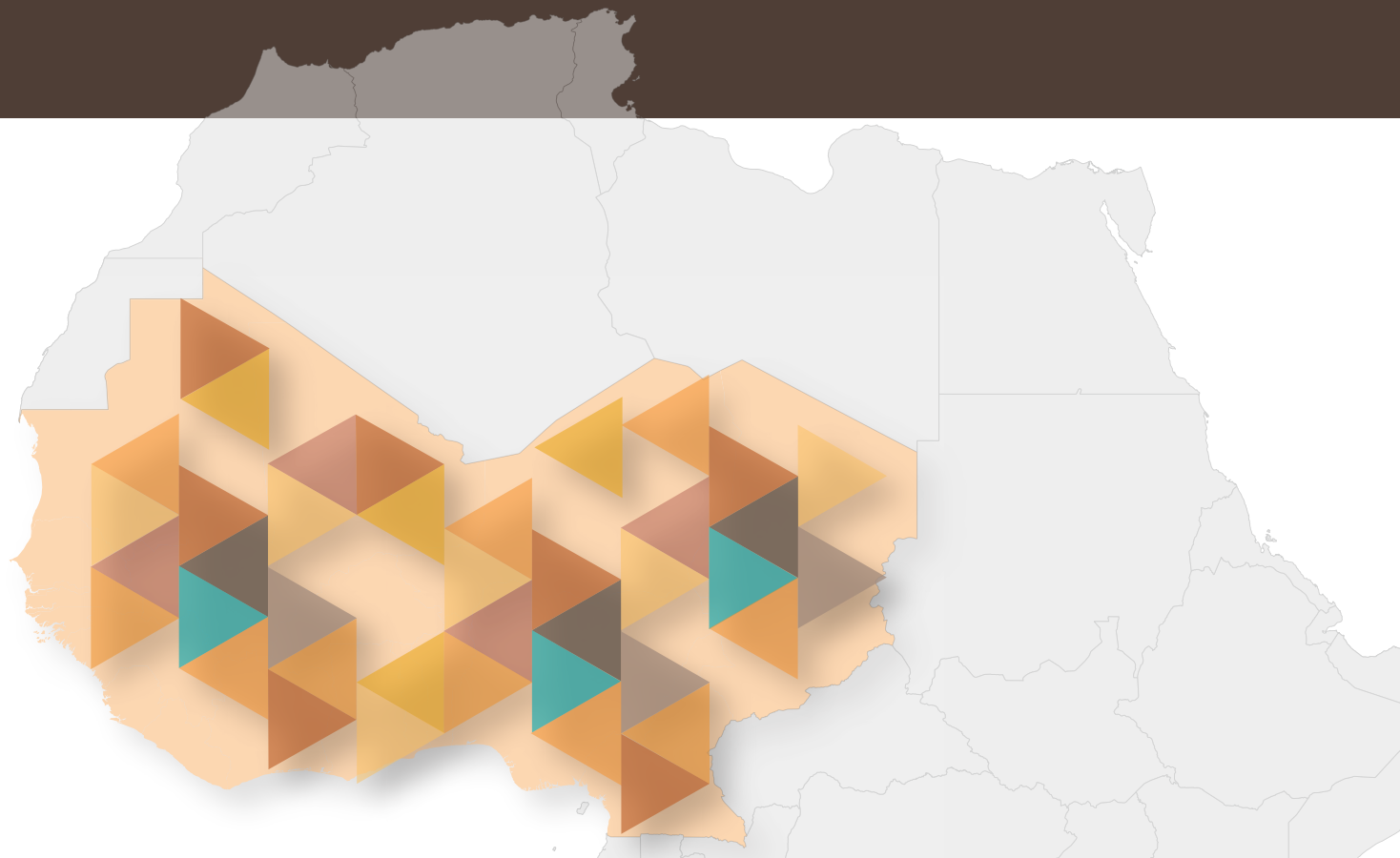
A Blueprint for Strengthening Food System Resilience in West Africa:

Regional Priority Intervention Areas



CORAF

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

Food and Agriculture Organization of the United Nations

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A Blueprint for Strengthening Food System Resilience in West Africa:

Regional Priority Intervention Areas

Economic Community of West African States • Permanent Interstate Committee for Drought Control in the Sahel • The West and Central African Council for Agricultural Research and Development • CGIAR Research Program on Climate Change, Agriculture and Food Security • Food and Agriculture Organization of the United Nations • World Bank

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FOREWORD

Since the 1970s, West Africa has been exposed to a growing diversity of shocks and stressors affecting regional food security. They include extreme weather events such as drought and flooding, market volatility and trade disruptions, pests and zoonoses as well as worsening insecurity, state fragility and conflict. In 2020, the region was hit by the COVID-19 pandemic, which has further compounded an already challenging situation. Thanks to regional and international cooperation, West Africa has been largely successful in mitigating the food crises that this continuous stream of shocks has caused. Despite this effective mitigation, the concentration of available human, institutional, and financial capital on short-term humanitarian response has often come at the expense of long-term investments to address the structural causes underlying the persistence of food insecurity in the region.

Recently accelerating trends related to climate change, growing populations, urbanisation, changing consumption habits and recent technological advances have created new challenges and opportunities, reaffirming the need for long-term investment. In parallel, the importance of taking a systemic food system perspective, which embraces multiple outcomes, sector contributions and value chain functions, is increasingly recognized. Based on a long history of successful collaboration, West African governments, regional institutions, and other food system stakeholders have developed the shared understanding that systematically addressing the above-mentioned trends requires strong collective action anchored at the regional level.

The World Bank, along with other technical and financial partners, has been a longstanding partner of West Africa's key regional institutions in advancing the regional food security agenda reflected in the ECOWAS Agricultural Policy (ECOWAP). To further increase its technical and strategic support to ECOWAS, CILSS, and CORAF, the World Bank has recently initiated the multi-partner West Africa Food System Resilience Facility (FSRF).

This report is the first output of FSRF. It was developed in collaboration with ECOWAS, CORAF, CILSS, CGIAR CCAFS, and the FAO Investment Centre to critically inform the preparation of large-scale, regional-level investment programs that aim to address some of the food system's structural long-term challenges. Focusing on three priority intervention areas, including i) Strengthening the Sustainability of the Food System's Productive Base – Climate-Smart Agriculture at Farm and Landscape Level; ii) Promoting an Enabling Environment for Intraregional Value Chain Development and Trade Facilitation; and iii) Improving Regional Risk Management Architecture and Farmer Decision Support Tools, the report reviews the region's most pressing food system issues (the 'what') and summarizes lessons from successful past approaches on which the region could build going forward (the 'how'). Based on this review, the report also identifies (i) knowledge gaps requiring further analytical work and (ii) possibilities for impactful key initiatives at regional level, several of which are already earmarked for further development and implementation through regional programs under preparation, most notably the West Africa Food System Resilience Program (FSRP).

The World Bank looks forward to collaborating with ECOWAS, CILSS, CORAF and the region's partners in the context of both future analytical work under FSRF and upcoming investment operations to bring some of the report's recommendations to life.

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ABBREVIATIONS

AAA	Adaptation of African Agriculture
ABEE	West Africa Breeding Networks and Extension Empowerment
ACMAD	African Centre of Meteorological Applications for Development
ACLED	Armed Conflict Location and Event Data project
ACP	African, Caribbean and Pacific Group of States
AFD	The French Development Agency
AfDB	African Development Bank
AFSLD	African Food Security Leadership Dialogue
AgGDP	agricultural GDP
AGRHYMET	Regional Training and Application Center in Agrometeorology and Operational Hydrology
AGIR	Global Alliance for Resilience Initiative-Sahel and West Africa
AGRA	Alliance for a Green Revolution for Africa
AICCRA	Accelerating Impacts of CGIAR Climate Research for Africa
AMU	Arab Maghreb Union
ANCAR	National Agency for Rural Agricultural Advice (Senegal)
ARAA	Regional Agency for Agriculture and Food
ARC	African Risk Capacity
ASECNA	Agency for the Safety of Air Navigation in Africa and Madagascar
ASDIA	Agricultural Services and Digital Inclusion in Africa
ASTI	Agricultural Science and Technology Indicators
AU	African Union
AVDP	Agricultural Value Chain Development Project
BCEAO	Central Bank of West African States
BOAD	West African Development Bank
BHA	Bureau for Humanitarian Assistance
CA	conservation agriculture
CAADP	Comprehensive Africa Agriculture Development Program
CARD	Coalition for African Rice Development
CARG	competitive agricultural research grant
CARI2	Competitive African Rice Initiative Phase 2
CBA	community-based actions
CCAFS	Climate Change, Agriculture and Food Security
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDCS	Centre de Crise et de Soutien
CERC	Contingency Emergency Response Component

CET	Common External Tariff
CEWARN	Conflict Early Warning and Response Mechanism
CEWERU	Conflict Early Warning and Response Units
CGIAR	Consultative Group on International Agricultural Research
CGS	competitive grant schemes
CH	Cadre Harmonisé
CHSAN	High-Level Committee on Food and Nutritional Security
CILSS	Permanent Inter-state Committee on Drought Control in the Sahel
CIMMYT	International Maize and Wheat Improvement Center
CIRAD	French Agricultural Research Centre for International Development
CIS	climate information services
CLCPRO	Commission for Controlling the Desert Locust in the Western Region
CNRA	National Center for Agricultural Research
COCOBOD	Ghana Cocoa Board
COMESA	Common Market for Eastern and Southern Africa
CORAF	West and Central African Council for Agricultural Research and Development
COVID-19	Corona Virus Disease-2019
CREWS	Climate Risk and Early Warning Systems
CRRP	climate-resilient rice production
CSA	Climate-Smart Agriculture
CSAIP	Climate-Smart Agriculture Investment Plans
CSIR	Council for Industrial and Scientific Research
CSV	Climate-Smart Villages
CSPM	Climate-Smart Pest and Disease Management
CTDC	Commodity Technology Delivery Compacts
DIAPER	Permanent Diagnosis project
DLIM	Desert Locust Information Service
DTTM	Drought Tolerant Maize for Africa
DRM	Disaster Risk Management
EAC	East African Community
EBID	ECOWAS Bank for Investment and Development
ECCAS	Economic Community of Central African States
ECDPM	European Centre for Development Policy Management
ECOAGRIS	ECOWAS Agriculture Regional Information System
ECOWADF	Regional Fund for Agriculture and Food
ECOWAP	ECOWAS Common Agricultural Policy
ECOWAS	Economic Community of West African States
ET	evapotranspiration
ETLS	ECOWAS Trade Liberalization Scheme

EU	European Union
EVD	Ebola virus disease
EWS	Early Warning System
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa
FARM-TRAC	Family Farming, Regional Markets, and Cross-border Trade Corridors
FAW	fall armyworm
FCV	fragility, conflict, and violence
FEWACCI	Federation of West African Chambers of Commerce and Industry
FEWS NET	Famine Early Warning Systems Network
FIRST	Food and Nutrition Security Impact, Resilience, Sustainability, and Transformation
FMD	foot and mouth disease
FMNR	farmer-managed natural regeneration
FOLOR	Food Systems, Land Use, and Restoration Impact Program
FSCCP	Food Security under Climate Change Program
FSRF	Food System Resilience Facility
FSRP	Food System Resilience Program
GEF	Green Environmental Fund
GFDRR	Global Facility for Disaster Reduction and Recovery
GGWI	Great Green Wall Initiative
GIEWS	Global Information and Early Warning System
GMet	Ghana Meteorological Agency
GRiF	Global Risk Financing Facility
GT	gestion de terroirs
HEA	Household Economy Analysis
HPAI	avian influenza
ICBT	informal cross-border trade
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
ICT	Information and communication technologies
IDA	International Development Association
IDB	Inter-American Development Bank
IDP	internally displaced people
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
IGAD	Intergovernmental Authority on Development
IITA	International Institute of Tropical Agriculture
IMF	International Monetary Fund
INSAH	Sahel Institute

IoT	Internet of Things
iSAT	Intelligent Agricultural Systems Advisory Tool
IPCC	Intergovernmental Panel on Climate Change
IPES-Food	International Panel of Experts on Sustainable Food Systems
IPPC	International Plant Protection Convention
IUCN	International Union for Conservation of Nature
LECZ	low-elevation coastal zones
LGB	larger grain borer
LSMS-ISA	Living Standard Measurement Study-Integrated Surveys on Agriculture
M&E	monitoring and evaluation
MAFAP	Monitoring and Analyzing Food and Agricultural Policies
MDTF	Multi-Donor Trust Fund
MERET	Managing Environmental Resources to Enable Transition
MIS	market information systems
MoFa	Ghanaian Ministry of Food and Agriculture
MOLOA	West African Coastal Observation Mission
MPA	Multiphase Programmatic Approach
MS	Member state
NAIP	National Agriculture Investment Plans
NAP	National Adaptation Plans
NARES	National Agricultural Research and Extension Services
NARS	National Agricultural Research Systems
NCA	National Committees on Accreditation
NCD	noncommunicable disease
NcoS	National Centers of Specialization
NEPAD	New Partnership for African Development
NGO	nongovernmental organization
NIBIO	Norwegian Institute of Bioeconomy Research
NMHS	national hydro-meteorological services
NRI	National Research Institutes
NSO	National Statistics Offices
NTM	non-tariff measures
OECD	Organisation for Economic Co-operation and Development
OECD/SWAC	Organisation for Economic Co-operation and Development/ Sahel and West Africa Club
ORFAO	Regional Land Observatory in West Africa
OSBP	One Stop Border Posts
OSS	Sahara and Sahel Observatory
PAEPARD	Platform for African-European Partnership on Agricultural Research for Development

PAIAD	Project for the Dissemination and Implementation of Good Practices for Sustainable Agricultural Intensification in West Africa
PAIRED	Partnership for Agricultural Research, Education, and Development in West Africa
PARIIS	Regional Support Initiative for Irrigation in the Sahel Project
PARM-SAFIN	Multistakeholder platform for agricultural risk management
PATAE	Support Project to the Agroecological Transition in West Africa
PAU	common agriculture policy
PEPISAO	Integrated and Secure Livestock and Pastoralism Project in West Africa
PES	payment for ecosystem services
PESCAO	Programme for the Improvement of Regional Fisheries Governance in West Africa
PFP	partial factor productivity
PHEIC	Public Health Emergency of International Concern
PHL	post-harvest losses
PoU	prevalence of undernourishment
PPR	peste des petits ruminants
PRAOP/ ECOWAP	Regional Support Programme for Professional and Farmers' Organizations within the Framework of the Implementation of the Regional Agricultural Policy
PRAPS (I and II)	Regional Pastoralism Support Project in the Sahel (I and II)
PREDIP	Regional Dialogue and Investment for Pastoralism and Transhumance in the Sahel and Coastal Countries of West Africa Project
PREGEC	Charter for Food Crisis Prevention and Management
PRESASS	Prévision Saisonnière en Afrique Soudano-Saharienne
PRTAD	Degraded Agricultural Land Restoration Program
PSNP	Ethiopian Productive Safety Net Program
PTAE	West Africa Agro Ecological Transition Support Project
R&D	Research and Development
RAHC	Regional Animal Health Center
RAIP	Regional Agriculture Investment Plan
RANIP	Regional Agriculture and Nutrition Investment Plans
RBO	River Basin Organizations
RCAP	Regional Economic Communities Agriculture Policies
RcoE	Regional Centers of Excellence
REC	Regional Economic Community
RESOGEST	Network of National Public Stocks
RFI	regional flagship initiative
ROPPA	Network of Peasant Organizations and Agricultural Producers of West Africa

RPCA	Regional Food Crisis Prevention Network
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SADC	Southern African Development Community
SAGI	Irrigation Development and Management Agencies
SAWAP	Sahel and West Africa Program in Support of the GGWI
SDGs	Sustainable Development Goals
SIGMAT	Interconnected Transit Freight Management System
SIIP	Sahel Irrigation Initiative Support Project
SLWM	Sustainable Land and Water Management
SPS	sanitary and phytosanitary standards
SME	small and medium enterprise
SNV	Netherlands Development Organization
SONAGESS	Société nationale de gestion du stock de sécurité alimentaire
TAAT	Technologies for African Agricultural Transformation
TAD	transboundary animal disease
TFP	total factor productivity
TFSP	West Africa Trade Facilitation Support Program
UEMOA	West African Economic and Monetary Union
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNIDO	United Nations Industrial Development Organizations
UN-OCHA	United Nations Office for Coordination of Humanitarian Affairs
WAAPP	West African Agricultural Productivity Program
WACIP	West Africa Common Industrial Policy
WACSAA	West Africa Alliance for Climate-Smart Agriculture
WACTAF	West African Association for Cross-Border Trade in Agro-Forestry Pastoral and Fisheries Products
WAFP	West African Fertilizer Program
WAICSA	West African Initiative for Climate-Smart Agriculture
WAMEU	West African Economic and Monetary Union
WAMIS-NET	West African Market Information System Network
WASCAL	West African Science Centre on Climate Change and Adapted Land Use
WB	The World Bank
WFP VAM	World Food Programme (WFP) Vulnerability Analysis and Mapping (VAM)
WAHO	West African Health Organization
WASP	West African Seed Program
WHO	World Health Organization
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

SYNOPSIS

This report provides an overview of food system resilience in West Africa,[1] examining three mutually reinforcing and interconnected priority areas for intervention at the regional level:

1. Strengthening the Sustainability of the Food System's Productive Base: Climate-Smart Agriculture (CSA) at Farm and Landscape Level and Related Approaches
2. Enabling Environment for Intraregional Value Chain Development and Trade Facilitation
3. Regional Risk Management Architecture and Farmer Decision Support Tools

For each intervention area, the report provides (a) a technical stocktake, (b) a mapping of existing regional initiatives, (c) potential entry points for intervention, and (d) identification of potential flagship initiatives in the region.

The report is the first output of the Food System Resilience Facility (FSRF), a multi-partner technical advisory facility that provides strategic, technical, and capacity-building support to the Economic Community of West African States (ECOWAS), the Permanent Inter-state Committee on Drought Control in the Sahel (CILSS), and the West and Central African Council for Agricultural Research and Development (CORAF).[2]

The results emerging from the report inform the programming of future activities (including multiple deep-dive studies) under FSRF. Linked to the West Africa Food System Resilience Program (FSRP) currently under preparation, the report also aims to serve a broad range of development partners and other actors in formulating policies and designing investment projects in West Africa.

This report was inspired by the 2019 Kigali African Food Security Leadership Dialogue (AFSLD) that called for joint action to tackle the African Food Security challenges. ECOWAS, CILSS, CORAF, Consultative Group on International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (CCAFS), and the World Bank provided overall leadership for the process and analysis that underpins this report. Wageningen University prepared a background paper as input to the report.

The information presented in this report represents a synthesis of the analysis of relevant secondary data and information as well as interviews with over fifty West African experts working on the food systems' issues presented in this document. Findings from the draft report were presented and discussed in a four-day virtual conference with over 300 West African actors working in diverse areas of the food system. The results of this conference, together with detailed comments from all the relevant partners associated with the report, guided the revision process and production of this final report.

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[1] For the purposes of this report, West Africa includes the combined membership of ECOWAS and CILSS, that is, Benin, Burkina Faso, Cabo Verde, Chad, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

[2] Formerly West and Central African Council for Agricultural Research and Development (CORAF/WECARD).

INTRODUCTION

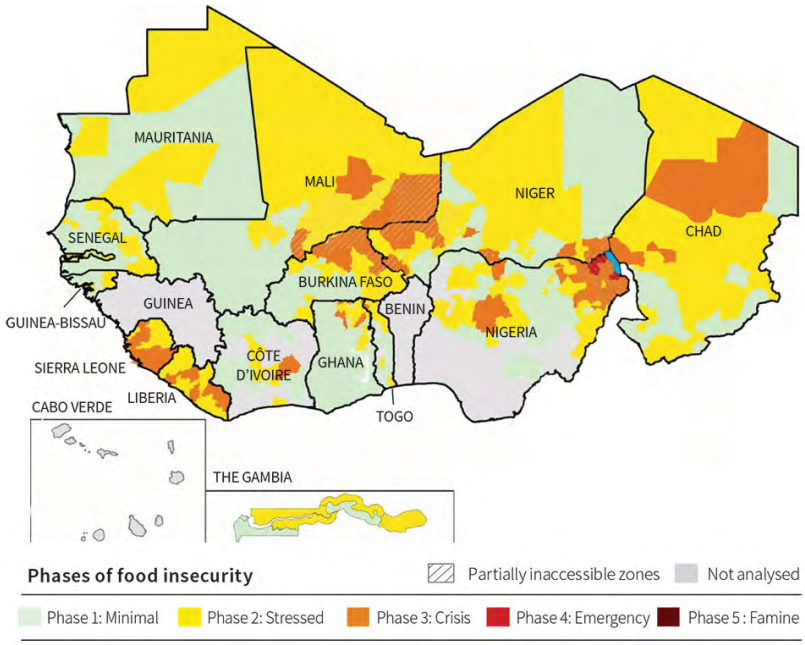
Agriculture and food systems are at the heart of both the opportunities and the challenges facing West African countries. Agriculture and food systems are the largest source of livelihoods and employment in West African economies. They have the potential to generate economic value added and job creation for inclusive growth and poverty reduction that could propel the region to capture its significant demographic dividend. The region's rich and diverse agriculture sector spans multiple production systems across coastal, savanna, and Sahelian zones. Together with rapidly evolving food systems, the sector is primed to meet changing consumer food demand through production of safe, nutritious, and convenient food products. Strong agricultural and food system performance is needed to meet the food needs of rapidly urbanizing countries and ensure food access for low-income consumers while also driving down the real cost of food. Developing more productive and competitive food systems is essential to reverse rising food imports. West Africa has both extensive experience and well-developed institutions at national and regional levels that are positioned to help the region address changing climates and fragile environments while preserving increasingly scarce natural resources. This strong foundation and expertise must be mobilized and enhanced to strengthen the sustainability and resilience of food systems.

Across food systems, vulnerability has increased since 2010 on the heels of increasing frequency of agroclimatic shocks, rising food insecurity, and declining and more volatile per capita food production. This situation reverses a trend of increasing per capita availability of calories, protein, and fat previously observed in almost all West African states between 1980 and 2009. In contrast, between 2010 and 2018, the absolute number of undernourished people in West Africa increased from 32 million to 56 million people, raising the prevalence of undernutrition from 10 percent in 2014 to 15.2 percent in 2019.[4] More recently, between March and May 2021, 19.6 million people across the region were estimated to require food assistance (CILSS and RPCA 2021); map ES.1 shows their geographic distribution. In addition, an estimated 52 million West Africans are overweight or obese and suffer from micronutrient deficiencies, representing 15 percent of the subregion's population. Over-nutrition fuels noncommunicable diseases (NCDs) such as Type 2 diabetes, high blood pressure, heart attacks, and some forms of cancer. Nearly half of all women of reproductive age in West Africa (49 percent) suffer from iron deficiency anaemia, and 47 percent of children aged 6–59 months have vitamin A deficiency (GNR 2018).

Climate change and environmental degradation driven by population growth and intensifying competition over natural resources, together with the increasing incidence and severity of conflict, are the main drivers of worsening food insecurity. Impacts from more frequent extreme weather events such as droughts and floods are already being felt across the region. Increasing precipitation variability may critically affect food system resilience. Near term projections suggest significant wetter conditions and increased flood risks (WMO 2020). In the medium term, regional climate models consistently predict both fewer days of rainfall and shorter wet spells over 70 percent of the region's land area coupled with higher precipitation intensity on wet days (Dosio et al. 2019). The overall water availability for food production and other uses is projected to decrease, and competition for resource access between different livelihood groups may further intensify. Without adaptation measures

[4] FAO 2020

MAP ES.1 Acute Food Insecurity Across West Africa, March-May 2021



Source: RPCA 2021, based on Cadre harmonise analysis, regional concertation meeting, Ouagadougou, Burkina Faso, March 2021; map: © CILSS

and excluding extreme weather events, climate models anticipate median yield decreases of 20 percent for irrigated rice, 14 percent for sorghum, and between 5 and 7 percent for maize, soybeans, and groundnut by 2050 (all of which are rainfed) (Jalloh et al. 2013). Further, high levels of land degradation also put downward pressure on yields. While current figures on the extent and severity of land degradation in West Africa are hard to obtain, it is widely acknowledged that land degradation ranks among the major threats to regional food security.[5] Finally, fragility and conflict have been proliferating across the Sahel, with rapid increases of armed conflicts and large and growing numbers of internally displaced people.

The ongoing COVID-19 pandemic is putting further strain on the food system, threatening to increase rates of undernutrition among vulnerable population segments. Although COVID-19 infection and mortality rates in West Africa have remained comparatively low to date, the pandemic has contributed to a rise in food insecurity. Restrictive measures, including government-imposed curfews, lockdowns, and border closures, have caused supply disruptions, rising food prices, and income losses. As a result, food availability and financial access to food have decreased, particularly for the poor. The cumulative effects of health, economic, and security crises will continue to affect food and nutrition security trends over the coming months. Without appropriate interventions, 23.6 million people might require immediate food and nutrition assistance during the next lean season in 2021 (SWAC/OECD 2020a).

[5] Earlier studies estimate that 90 percent of rangelands and almost 80 percent of farmlands in the Sahel are severely degraded (FAO 1995). A recent study covering Burkina Faso estimates that 34 percent (92,345 million ha) of cropland in the country is degraded. The same study also estimates an annual land degradation between 100,000 and 250,000 ha (Hien 2015).

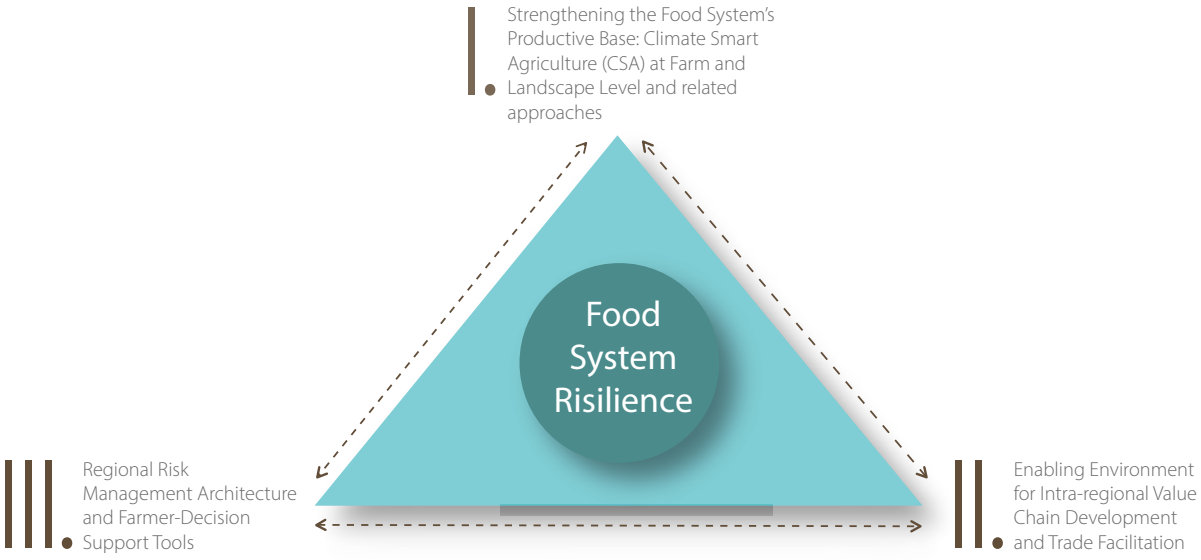
THREE PRIORITY INTERVENTION AREAS AT THE REGIONAL LEVEL

Food system resilience, or the ability to withstand adversity and continue to perform and deliver multiple economic, social, and environmental outcomes—jobs, accessibility, nutrition, health, biodiversity—has become increasingly important given the frequency and severity of agroclimatic, socioeconomic, zoonotic, and security-related shocks challenging West Africa. West Africa's history has shown that regional cooperation allowing countries to work together to achieve economies of scale, social solidarity, and reduced risks is critical to the region's ability to resist diverse threats and achieve interlinked food system goals.

To strengthen food system resilience, this report proposes three priority areas for intervention at the regional level in West Africa (see figure ES.1). The three areas are mutually reinforcing in that simultaneous investment promises to yield more than the sum of its parts. For instance, trade and the resulting business opportunities generate market incentives that farmers rely upon to invest in new resilience-strengthening technologies. Both farmers and traders require improved information and decision-support systems to reduce risks and maintain the viability of their activities under intensifying climate change. Risk management and related farmer advisory services require quality and frequently updated climate and market data to be effective.

Building on the ECOWAS Common Agricultural Policy (ECOWAP), ECOWAS, together with CILSS and CORAF and with input from extensive stakeholder consultations, has prioritized these three regional intervention areas. Further, the World Bank Africa Strategy, Africa: Food Security under Climate Change,[6] provides a technical foundation to complement this prioritization process.

FIGURE ES.1 Priority Areas for Regional Intervention



Source: World Bank

[6] The WB Africa strategy's three pillars are (1) to scale up CSA at farm and landscape level, (2) to enable the private sector to build more efficient value chains at national and regional levels, and (3) to create a more effective enabling environment at all levels of the food value chain, farm to fork.

For each intervention area, this report synthesizes the results of a stocktaking exercise of available knowledge and a mapping of existing initiatives. Based on this analysis and insights assembled from over 50 in-depth expert interviews in the region, the report suggests potential entry points for intervention. Priorities were chosen simultaneously with the priorities for the flagship FSRP. They are not exhaustive of other regional initiatives that could have a positive impact on food system resilience in areas outside the priority intervention areas that this report covers, for example, in those relating to forestry, infrastructure, health and social protection

PRIORITY REGIONAL INTERVENTION AREA

Strengthening the Sustainability of the Food System's Productive Base: CSA at Farm and Landscape Level and Related Approaches

TAKEAWAY #1: WIDEN FOCUS OF REGIONAL RESEARCH SYSTEM AND STRENGTHEN LINKAGES TO THE PRIVATE SECTOR

The agriculture research system should widen its focus beyond varietal development and give greater weight to technology dissemination through linkages with the private sector. To increase the region's ability to promote agricultural innovation, the West African Agricultural Productivity Program (WAAPP) achieved significant progress in establishing a regional agricultural research system that pools resources and allows for positive cross-border spillovers of agricultural innovations. The regional research agenda should add focus to other important issues such as natural resource management, efficient water use, locally adapted mechanization, and digital agriculture. Research institutions, however, cannot and should not act as the key distributor of technologies. This role is best filled by the private sector in collaboration with national extension services. Future interventions should thus aim to increase the private sector's ability to act as a catalyst for technology dissemination.

TAKEAWAY #2: ACCESS TO INPUT AND OUTPUT MARKETS IS CRUCIAL FOR CSA ADOPTION BUT CAN BE BOOSTED THROUGH DIGITAL TECHNOLOGIES

Resilience and mitigation gains, yield trends, and technology uptake have remained below expectations despite the availability of an increasing number of climate-smart technologies allowing for greater on-farm productivity. The principal barriers to technology uptake are the absence of financial incentives due to poor market access. This situation makes upfront investment costs prohibitive, contributes to risk aversion, and leads to poor availability of inputs and lack of awareness of CSA technologies (Bayala et al. 2016; Ouédraogo et al. 2015).

Increasing farmers' access to markets and providing commercial opportunities are the most promising ways to boost adoption of CSA practices. Without access to markets, farmers will remain unable to afford perceived riskier investments in high quality inputs and fertilizers. Without available marketing channels allowing farmers to reliably sell their produce, efforts in other fields (for example, increasing access to

finance and inputs) will be futile. Subsistence farming alone does not provide a sufficiently strong incentive for farmers to justify investment in high-yielding crop varieties or modification of farming practices, which may be perceived by some producers as too risky. CSA projects should also address other critical value chain segments (including aggregation, processing, and distribution) to achieve lasting impact. One pathway toward better market access is enabling producer associations to deliver aggregation, value addition (for example, cleaning, grading, and quality control), and commercialization services to their members.

Improving inputs and technology availability through strengthening both demand- and supply-side policies should be an urgent priority. Access to credit and improved inputs (both related to soil fertility management and seeds) to grow food crops remains low by global standards. To bring down the cost of credit to farmers and to confer more agency to farmers in choosing the inputs best suited to their conditions, governments should consider reorienting government resources toward CSA credit-subsidizing schemes or smart subsidies. Funding could be redirected from funds currently spent on input subsidies or other distortive forms of public support. Financial innovations could also play a central role. For example, the West African Initiative for Climate-Smart Agriculture (WAICSA), implemented by the ECOWAS Bank for Investment and Development (EBID), plans to provide subsidized loans or guarantees to 80,000 small farmers through a blended finance fund. On the supply side, the private sector is currently unable to provide inputs at affordable prices and required volumes. Input dealers and related service providers should be more strongly incentivized to deliver CSA inputs and technologies at scale. Options include capacity-building measures to improve local small and medium enterprises (SMEs) capacity to meet regional quality standards and loan guarantees and matching grants allowing firms to enhance production and distribution volumes.

Digital technologies offer an opportunity to overcome the longstanding structural issue of high transaction costs in farmer outreach for multiple actors and unlock new extension models. Given the already extensive penetration of mobile phones, digitally disseminated climate information combined with tailored agronomic advice can be a powerful tool in reaching more beneficiaries than traditional extension methods. Promising examples in the region include ESOKO, a Ghana-based public-private partnership with 300,000 subscribers. To inspire long-term behavioral changes, digital extension needs to be coupled with more interactive sensitization and follow-up training. As state-led extension services are often overburdened, producer organizations should play a bigger role. The agricultural research system should work more closely with farmer organizations to support farmers as diffusers and get technologies to scale.

TAKEAWAY #3: LANDSCAPE RESTORATION MEASURES ARE EFFECTIVE RESPONSES TO THE INCREASING DEGRADATION OF AGRICULTURE'S PRODUCTIVE BASE, BUT EFFORTS SHOULD BE MADE TO MANAGE AND LIMIT THEIR COMPLEXITY

Integrated approaches to natural resource management at landscape or watershed scales protect the ecological foundations of agricultural production and thus support medium- and long-term food system resilience. Landscape or watershed scale interventions can yield sustainability gains that cannot be achieved by focusing exclusively on the plot level. Although estimates of land degradation vary, low levels of soil organic matter and land cover need to be addressed to reduce sensitivity to climatic shocks. To maintain the viability of the regional food system in the long term, integrated approaches should particularly focus

on protecting the hydrological basis underlying food production. Safeguarding and rehabilitating the resource base in hotspot areas may lessen conflict over scarce resources and reduce negative spillovers resulting from forced migration and displacement. One promising entry point is promoting farmer-managed natural regeneration (FMNR), one of the few success stories at scale. Offering strong productivity and resilience gains while contributing to climate change mitigation, FMNR should be mainstreamed in CSA initiatives in all agroecologies where it achieves good results.

For lasting resilience gains, integrated landscape projects should be simplified and embedded in a favorable institutional and policy environment. Integrated approaches are complex by nature. Successful examples indicate that programs should start with a focus on low-hanging fruit and build toward more complex interventions in line with growing institutional capacity. To ensure resilience gains last beyond the duration of projects, resource users should be included in decision-making from the outset and should directly benefit from restoration efforts through guaranteed resource usage rights or secure land tenure rights. Also, supportive conflict-resolution institutions such as accepted grievance redress mechanisms are needed to sustain collaboration of resource users in the long run. In addition, combining project-driven rehabilitation efforts with a more systematic application of economic instruments, such as water pricing and payment for ecosystem services schemes, could have a positive impact on safeguarding the sustainability of the food system's productive base.

PRIORITY REGIONAL INTERVENTION AREA

Enabling Environment for Intraregional Value Chain Development and Trade Facilitation

TAKEAWAY #4: EXISTING REGIONAL POLICIES—EXCEPT FOR SANITARY AND PHYTOSANITARY STANDARDS (SPS)—PROVIDE A STRONG FRAMEWORK, BUT IMPLEMENTATION IS LAGGING

West African intraregional trade in food crops is low compared with other continents and below other Regional Economic Communities in Sub-Saharan Africa. Official figures likely underestimate trade volumes significantly due to under-recording linked to an estimated 75 percent of staple food trade transactions that take place informally (Torres and van Seters 2016). In 2018, intraregional trade of food crops was estimated at 12 percent of total production in the ECOWAS area, third within Africa behind the estimated 23 percent in the Southern African Development Community (SADC) and 17 percent in ECCAS (IFPRI 2020a). At present, regional policies promoting free trade among the region's states, such as the ECOWAS Trade Liberalization Scheme (ETLS), lag in implementation. This is reflected in excessive number of controls with high illegal fees charged to traders and time-consuming border crossings that decrease the competitiveness of regional products compared with international imports.

More consistent implementation of regional trade policy could contribute to increased food system resilience and contribute to jobs for economic transformation. Intraregional trade could smooth fluctuations in production across ECOWAS countries, increase the nutritional diversity of consumer choice and allow countries to focus on the production of crops where they have comparative advantage.

Expanding markets for agricultural value chains with proven regional comparative advantage through facilitating intraregional trade flows could be a powerful engine of growth and generate employment opportunities to spur economic transformation. The establishment of a regional accountability framework that monitors the implementation of regional policy (that is, benchmarking implementation against a regional standard) by national governments could improve transparency and increase incentives for implementation of regional trade policy. In addition, setting up conflict-resolution mechanisms allowing traders to seek recourse in case of border harassments may also contribute to ease regional trade flows.

Harmonizing SPS across member states could foster intraregional trade, increase business opportunities for the agrifood sector, and greatly contribute to limiting the spread of zoonotic diseases. At present, each country has its own criteria and norms complicating the circulation of both raw and processed foods. For example, some West African countries lack grades and standards for maize. Without regional standards, multinational companies and buyers in West Africa cannot ensure consistent and reliable quantity and quality of the products they wish to trade. SPS regulations and improving states' capacity to carry out quality control measures could dynamize both intraregional trade and food processing activities across the region. Finally, livestock are carriers of zoonotic diseases and SPS measures can play a role in avoiding future disease outbreaks such as COVID-19 and Ebola.

TAKEAWAY #5: REGIONAL VALUE CHAIN INTEGRATION BEGINS WITH THE INTEGRATION AND INCLUSIVE FORMALIZATION OF INFORMAL TRADERS

Achieving inclusive value chain development requires addressing widespread informal cross-border trade which approximately accounts for 75% of the region's food crop trade. Informal cross-border trade (ICBT) is a multifaceted response to the context in which trade takes place. On the one hand, from the traders' perspective, operating outside legal frameworks allows them to bypass inefficient and sometimes predatory public agencies, avoiding taxation, reacting dynamically to market opportunities, and taking advantage of low barriers to entry, especially in times of high price volatility, exchange rate misalignment, emergencies, and other shocks. On the other hand, traders involved in ICBT usually face difficulties in accessing credit and other services from formal financial institutions and are either denied credit or forced to access credit at high interest rates. This is particularly striking for women traders, who play a substantial role in the local economy but continually face stigmatization, violence, harassment, and poor working conditions.

Practical actions exist to better integrate informal traders and improve inclusive formalization processes. First, policies supporting small enterprises, such as One Stop Border Posts (OSBP) or trade facilitation desks at district levels within member countries, can be expanded to offer better quality services. A second action consists of strengthening partnership-based approaches that bring together formal private sector organizations, nongovernmental organizations (NGOs), development partners, and governments to develop joint value chain structuring strategies that take all actors' interests into account. Third, incentives and compliance-based approaches include measures at the national or regional level to encourage formalization through incentives tailored to the needs of informal traders.

TAKEAWAY #6: BARRIERS TO CROSS-BORDER VALUE CHAIN DEVELOPMENT ARE MOSTLY CUTTING ACROSS COMMODITIES AND REGIONAL INTERVENTIONS ARE WELL PLACED TO UNITE THE DIVERSE ACTORS REQUIRED TO ADDRESS THEM

A gap exists at the regional level for cross-border value chains since national value chain platforms coordinate and facilitate the flow of information between retailers, processors, and producers within national borders but not beyond. Many cross-border food value chains have poor communication and information flows as information gets lost or distorted across large numbers of intermediaries working in different countries. Also, bottlenecks are often multicausal and interdependent, their resolution stymied by the lack of functional mechanisms. ECOWAS recently created a department promoting cross-border investment, joint ventures to promote investment, and public-private partnerships. Other regional platforms to enable information exchange and network creation across borders have recently been put in place, such as the African Rice Advocacy Platform. These efforts could be pursued further. Other cross-border value chain development-related challenges concerning most value chains include the lack of adequate cold-chain infrastructure and storage facilities.

PRIORITY REGIONAL INTERVENTION AREA

Regional Risk Management Architecture and Farmer Decision Support Tools

TAKEAWAY #7: REGIONAL AND NATIONAL RISK MANAGEMENT SYSTEMS ARE OFTEN WELL ESTABLISHED BUT NEED INSTITUTIONAL REFORM

Managing and mitigating risks represents a major challenge for all food systems and actors and is a key feature of resilient food systems. Smallholder producers, largely operating in family enterprises, are responsible for the vast majority of agriculture production in West Africa. Given their low level of assets and access to productive resources, they are particularly vulnerable to the diverse shocks that threaten West African agriculture and food systems. Agriculture shocks that most affect food security in the region are production risks arising from erratic rainfall (droughts, floods), pest and disease outbreaks, and market shocks mainly related to unexpected changes in input/output prices and food price volatility.

Numerous risk management mechanisms and systems under CILSS and its specialized agency, AGRHYMET, aim to address food security-related challenges, yet they do not always efficiently and adequately address the region's needs in practice. AGRHYMET is the premier training and climate services institution in the region with a mandate to provide and collaborate on hydromet services and Early Warning System (EWS) with its national counterparts. The Cadre Harmonisé (CH) is a harmonized regional framework, coordinated by CILSS, for monitoring the region's food and nutrition insecurity. Despite the strong performance of AGRHYMET and the effective application of the CH in recent years, a variety of constraints complicates addressing the growing

threats and demands in the region. These include resource-challenged national data collection systems, limited technical capacity for information service delivery, lack of sustainable financing to strengthen existing systems, and more effective coordination and linkages between regional and national level institutions. Revitalizing and improving existing regional and national risk management systems is crucial going forward to better meet the needs of the region.

Regional and national hydromet agencies should strengthen institutional coordination and technical capacity for effective data generation, information service delivery, and access to information for timely decision-making. Weak linkages and coordination between institutions (such as global centers of excellence, AGRHYMET, and national agencies) at national and regional levels lead to inefficiencies and incomplete information on food security-related issues. Coordination could be improved along four major pathways. These encompass the following: (a) streamlining the "chain of information" across regional, national, and subnational levels to provide demand-driven information services by leveraging state-of-the-art technologies and new business models; (b) considering new delivery models; (c) reorganizing and structuring the system through focused support for critical modules relating to climate information services; and (d) upgrading and digitizing the system through modern database management applications. AGRHYMET performance could benefit from adopting a results-based operating model for service delivery and value addition of data collected through a transparent and collaborative approach.

Transforming the current technical frameworks and analytical tools for food insecurity assessments into a more agile, less costly system is needed to improve the efficiency and sustainability of EWS and the broader needs assessment process. Although the CH functions well as an analytical tool, the needs assessment is often perceived as a bulky process involving lengthy field missions and validation meetings. Transforming existing mechanisms into more agile systems and processes requires sustainable financial investments in technical institutions. At present, relying on short-term donor funding undercuts the regional institutions' ability to adequately sustain continuity of existing initiatives and retain their technical experts. The regional organizations and development partners need to work toward a system that secures and stabilizes funding directly for CILSS and AGRHYMET with a long-term view of capitalizing and strengthening these institutions. This challenge is equally present at the national level.

TAKEAWAY #8: THERE IS A NEED TO ENGAGE THE PRIVATE SECTOR TO ADD VALUE TO CLIMATE INFORMATION WITHIN AND BEYOND STATE-LED PUBLIC INFORMATION SERVICES

Private sector and local service provider delivery of hydro-meteorological and other relevant farmer-level information services that supplement regional and national institutions represent a major opportunity. Given the need for highly effective systems to provide the variety of services needed in countries, championing the private sector is critical to revitalizing data systems and increasing the availability of and access to information. Creating a conducive environment for the private sector by fostering innovative and collaborative technical-level partnerships with regional institutions that maximize the value and potential of farmer-level information and advisory services is important to improving performance. Removing barriers related to accessing data collected at the national level, such as the fees businesses are required to pay and availability of financing to provide services, are examples of how to foster a conducive environment.

Information services that specifically target

pastoralists should also be explored for the Sahel. Pastoralists have limited access to relevant climate information data such as water points, availability of pastures, and flood risks, all of which can negatively impact animal health. Pastoralists' mobility is often restricted due to border closures and insecurity in the region. Growing herd size, land degradation, and insecurity contribute to increasing conflicts between herders and farmers. Pastoralist-targeted climate information advisory services can assist herders and associated communities in resolving these challenges and contribute to a healthy and prosperous livestock sector in the Sahel.

TAKEAWAY #9: ENHANCE REGIONAL EWS RESPONSIVENESS TO USER NEEDS THROUGH BETTER LEVERAGING OF DIGITAL SOLUTIONS

Digital solutions for EWS should prioritize understanding user needs. The current systems at the country level are typically engaged in data collection and data analysis geared toward the provision of information to regional counterparts, development community partners, and other relevant government agencies, not to producer-level end users. Any entities involved in hydromet service provision should have regular interactions with users and feedback on services so that evolving user needs and user satisfaction are regularly tracked by service providers.

High quality weather, climate, and hydrological services, as used in global centers of excellence, underpin effective digital advisory services and farmer decision support systems. Traditional infrastructure-heavy investments in hydromet services have a poor track record in service delivery. Experience points to the development and delivery of services that meet user needs by widening the hydromet "ecosystem" to include the global centers of excellence, academia, private sector, and NGOs. The national meteorological and other relevant agencies could improve their services, including those geared toward farmer decision support systems, by effective use of products from global centers (for example, impact-based warning in conjunction with ensemble forecasts).

TAKEAWAY #10: NEW FINANCING INSTRUMENTS COULD COMPLEMENT EXISTING PROCEDURES FOR THE REGIONAL RESERVE TO REFORM CRISIS PREVENTION AND RESPONSE

The regional food reserve is well conceptualized but suffers from financing shortfalls and the suboptimal location of physical stocks; these features could be improved. The reserve rests on a subsidiarity based three-tier system from local, to national, to regional physical (minority) and financial (majority) stocks. To date, ECOWAS and member countries have been unable to mobilize sufficient financing to lift stocks to target levels. Physical stocks are often located at great distances from the populations most frequently in need of their services.

New risk financing instruments could place the reserve on a sustainable footing and enable it to become an effective regionally owned vehicle to replace ad hoc food crisis emergency response. The multilateral system is still weighed too heavily toward responding only after disasters hit. A suite of new instruments could be deployed to reverse this longstanding structural deficit. The African Risk Capacity (ARC) aims to play such a role. The experience of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) could offer important lessons for the region. The Global Risk Financing Facility (GriF), a new investment vehicle that focuses on improving financial resilience to climate and disaster risks, has agreed to explore opportunities for regional food insecurity risk mechanisms. The reserve would be a natural entry point to advance these agendas.

POTENTIAL REGIONAL FLAGSHIP INITIATIVES

This section proposes a set of potential regional flagship initiatives (RFIs) for each priority intervention area. Under the FSRF, it is envisaged to establish RFIs to mobilize innovative actions that address priority issues affecting food system resilience in West Africa. RFIs represent program concepts with the potential to strengthen food system resilience at regional scale by capturing economies of scale and regional spillovers and fostering collective action on common challenges and opportunities. This set of RFIs aims to enhance regional sectoral strategies by offering new ideas for their implementation.

RFIs were identified in two steps. A long list was initially compiled based on the analysis for each intervention area. A short list was subsequently established following an innovative large-scale virtual stakeholder conference, which mobilized 400 participants for four days of interactive group work (see box ES.1). Prioritization of this short list of RFIs is an ongoing process led by ECOWAS, CILSS, and CORAF. For example, several RFIs, including #1, #2, #4, #9, and #11 (see table ES.1), are already earmarked for implementation through regional programs under preparation such as the FSRP.

This set of potential RFIs, emanating from the analysis presented in this report and widely discussed with a large and diverse group of West African stakeholders, addresses many of the opportunities and challenges to enhance food systems resilience in the region. Cast

BOX ES.1 UNDER THE PALAVER TREE: UNPACKING FOOD SYSTEM RESILIENCE IN WEST AFRICA

The four-day interactive virtual conference "Under the Palaver Tree: Unpacking Food System Resilience in West Africa" was hosted by ECOWAS, CILSS, and CORAF in cooperation with CGIAR, UEMOA, FAO, and the World Bank between July 6–9, 2020 to inform this work. Evoking the image of the palaver tree under which community members gather to discuss shared issues, the bilingual, virtual stakeholder conference brought together 400 participants from West African countries, regional bodies, development partners and representatives from the private sector, academia, and civil society. Providing a virtual space to engage in times of travel restrictions and social distancing, the event's reach was far greater than that of a physical event at comparable cost. The virtual format allowed a high degree of interactivity. Up to 250 participants at a given moment spent 70 percent of the time in discussions in groups of 5–15 participants in up to 20 parallel virtual breakout rooms. Results were documented using online collaboration software. The discussions, participants' ideas, and proposals fed into this reports' recommendations and the preparation of several emerging regional initiatives, including the West Africa Food System Resilience Program (FSRP). Participant feedback on the conference was overwhelmingly positive, with an average participation of 160 people connected throughout all four days. The image links to a short video summarizing the event.

within this integrated, systemic food systems' framework, it allows diverse organizations, actors, and partners to prioritize and focus on a given priority area, while ensuring coherence with the broader regional vision and outcomes to which it will contribute. As described above, the World Bank, ECOWAS, CORAF, and CILSS will address several RFIs in the context of the FSRP. Given the magnitude of both present and future challenges affecting food systems in West Africa, other actors and partners must coordinate to support the implementation of other RFIs presented in this report.

TABLE ES.1 RFIs by Priority Intervention Area for Food System Resilience at Regional Level

Priority Areas	# RFI	Title
I. The food system's productive base: CSA at farm and landscape level	1	Accelerate evolution of regional research system
	2	Systematic targeting of hotspot areas with flexible integrated approach
	3	Leverage digital technologies
II. Enabling environment for intraregional value chain development and trade facilitation	4	Develop regional food trade monitoring scorecard for increased transparency and accountability
	5	Invest in private and public capacity to perform key enabling functions such as traceability systems, food safety and quality control, and standards
	6	Set up integrated market information systems across national and regional levels
	7	Harmonize agricultural support policies
III. Regional risk management architecture and farmer decision support tools	8	Enhance Regional Food Security Reserve
	9	Leverage rapid technological change to achieve near real-time EWS
	10	Regional pest- and disease-monitoring systems based on a One Health approach
	11	Establish innovative risk financing instruments for food crisis

Source: World Bank

NEXT STEPS

The FSRF will support ECOWAS, CILSS, and CORAF in the operationalization of several RFIs. Its support is organized across three pillars: (a) strategy and partnerships; (b) evidence, analytics, and delivery mechanisms; and (c) learning and capacity building, as shown in table ES.2.

TABLE ES.2 The FSRF is Organized Across Three Pillars

Structure	Pillar 1 Strategy and Partnerships	Pillar 2 Evidence, Analytics, and Delivery Mechanisms	Pillar 3 Learning and Capacity Building
Description	Support ECOWAS, CILSS and CORAF in design of regional flagship initiatives and related partner engagement	(Co-)Develop technical, policy and strategy notes to build the evidence base and close knowledge gaps in collaborative way with technical partners, led from World Bank side by relevant topic leaders	Continuous and needs-based convening of topical communities of practice, organization of south-south and north-south exchanges

Source: World Bank

The immediate next step for FSRF is to develop deep-dive technical studies under Pillar 2 to close knowledge gaps required for the design and implementation of RFIs. Some of the proposed technical work cuts across several RFIs as shown in table ES.3:

TABLE ES.3 RFIs and Corresponding Deep Dives

#RFI	Title	Corresponding technical work (Deep dives)
1	Accelerate evolution of regional research system	Covered through existing tech. work led by CORAF
2	Systematic targeting of hotspot areas with flexible integrated approach	Hotspots, Fragility, and Integrated Approaches
4	Develop regional food trade monitoring scorecard for increased transparency and accountability	Trade: Toward more data and a scorecard methodology
6	Set up integrated market information system across national and regional levels	
8	Harmonize agricultural support policies	
5	Invest in private and public capacity to perform key enabling functions such as traceability systems, food safety and quality control, standards	Food Safety: Priority Issues, Investments and Other Interventions
10	Regional Pest- and disease monitoring system based on a One Health approach	
7	Enhance regional food reserve system	Regional Risk Architecture and Financing Mechanisms
11	Establish innovative risk financing instruments for food crisis	
9	Leverage rapid technological change to achieve near real-time early warning systems	Digital Climate Information and Agriculture Advisory Delivery Mechanisms
3	Leverage digital technologies	

Source: World Bank

The deep dives seek to carry out a comprehensive investigation and analysis of these topics, seeking to achieve the following objectives presented in table ES.4.

TABLE ES.4 Overview of Proposed Deep-Dive Technical Studies

Deep Dive	Objective
Regional Risk Architecture and Financing Mechanisms	To increase knowledge of food system resilience risks and responses (early warning, risk financing)
Hotspots, Fragility, and Integrated Approaches	To increase knowledge on linkages between climate and agriculture production risks and conflict or fragility
Trade: Toward More Data and a Scorecard Methodology	To create a broadly owned methodology for a country scorecard on intraregional trade of food commodities
Food Safety: Priority Issues, Investments, and Other Interventions	To develop a consensus on priority foci and measures to address food safety risks in selected West African countries
Digital Climate Information and Agriculture Advisory Delivery Mechanisms	To identify viable delivery models for climate information and agriculture advisory to reach farmers at scale

Source: World Bank

1 PART ONE: AN OVERVIEW OF THE CURRENT STATE OF THE WEST AFRICAN FOOD SYSTEM

Part 1 begins by laying out the context of the West African food system before introducing the notion of food system resilience. This is followed by a description of five food subsystems of high regional relevance. Subsequently, this part discusses important drivers and emerging trends related to agriculture production and the food system. Part 1 closes with an overview of COVID-19 impacts on the region's food value chains and their implications for regional food security.

1.1 CONTEXT

The West African Economic Monetary Union (UEMOA)'s common agriculture policy (PAU) in 2001 and the ECOWAS Common Agricultural Policy (ECOWAP) in 2005 represent major policy landmarks for West Africa's agriculture sector. UEMOA's participatory formulation and approval of PAU and ECOWAP are based on a desire to build an integrated regional market as part of an economic diversification strategy. These policies helped move countries and the subregion away from project-driven approaches toward a coherent, sector-wide approach to agricultural development. Based on broad stakeholder consultation processes and incisive analyses, these policies established a systemic vision, priorities, and guidelines for actions and investment plans at national and regional levels supporting agriculture development. ECOWAP identified six priority fields of action: (a) improved water management; (b) improved natural resource management; (c) sustainable agriculture development; (d) agriculture supply chain and market development; (e) crisis prevention; and (f) institution building (ECOWAS 2016; Hollinger et al. 2015; UEMOA 2001).

ECOWAP made significant achievements in its first 10 years of implementation, including the sustainable rice production initiative, improving how information is produced and harmonized, establishing regional food reserves, adopting the 2011 Charter for Food Crisis Prevention and Management (PREGEC) and institutionalizing multiactor policy dialogue and multisector policy coherence. Building on this success, the Agriculture Commission of ECOWAS, together with UEMOA, CILSS, and CORAF, continues to work with their member states to address the evolving challenges confronting the region.

The agriculture sector in West Africa faces multiple challenges. In West Africa,[7] as in

much of the world, a changing climate, more extreme weather events, and insect infestations worsen agricultural production problems in environmentally fragile environments. Insecurity and protracted crises persist (particularly in cross-border zones), eclipsing the capacities of local governments, worsening poverty and food insecurity, displacing people, and requiring governments to reallocate budgets to peace and security. A weak business environment (in some countries) and inconsistent implementation of regional market policies increase costs to do business, constrain agriculture investment, and hinder inclusive growth in value addition and employment. In 2020, the SARS-CoV-2 virus and the COVID-19 disease present yet another shock to the region and the agriculture sector, disrupting supply chains by restricting movement of goods, people, and services, closing markets, infecting workers, and reducing consumer demand for food from the resulting economic downturn. Food security is threatened by loss of livelihoods and jobs and rising food prices.

Several trends bode well for the region's agriculture sector despite the seemingly endless exposure to these diverse agroclimatic, security, socioeconomic, and zoonotic shocks. The combination of population growth and a youthful population, broad-based urbanization (including small towns and cities), dietary diversification, and rising incomes in certain segments of the population provides unprecedented opportunities for the sustainable development and growth of West African agriculture (Hollinger et al. 2015; ECOWAS 2015b; OECD/SWAC 2016 UEMOA 2001).

These opportunities and diverse challenges shape the overall context for agriculture in West Africa and its rapid transformation. Agriculture has traditionally centered on producing staple foodstuffs to meet national food demands, with a focus on rural farms. Yet there is increasing regional awareness that the broader food system exerts an equally strong influence across the evolving rural-urban geography, influencing the industrial and service segments of the economy, affecting nutrition and health, livelihoods and jobs, and the sustainability of the planet (Tefft et al. 2020). Broadly speaking, food systems, or agrifood systems, include all activities, actors, and processes in primary production, industry (that is, processing), and services. In West Africa, the agrifood economy generates 36 percent of regional gross domestic product, with 40 percent of value addition occurring in non-agriculture activities (that is, in industry and services).

Resilient and sustainable food systems are a central pillar of the World Bank's Africa Strategy for 2019–23, "Supporting Africa's Transformation" (World Bank 2019). Food systems are equally fundamental to (1) achieving the vision and integrated goals in the African Union's (AU) Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods (AU 2014); and (2) the objectives of the 2016–25 ECOWAP/Comprehensive Africa Agriculture Development Program (CAADP) (ECOWAS 2015b). Food systems are a common thread linking all 17 Sustainable Development Goals (SDGs), given their far-reaching and interconnected economic, social, and environmental dimensions and their use as a powerful lever for sustainable development. The 2019 Kigali Call to Action reaffirms the commitment of the AU, African Development Bank (AFDB), International Fund for Agricultural Development (IFAD), Food and Agriculture Organization (FAO), and the World Bank to implementing the commitments on agriculture and food security in the Malabo Declaration, the CAADP results framework (2015–25), Agenda 2063, the 2030 Agenda for Sustainable Development, the Paris Agreement on Climate Change, and climate resilience and low-carbon development plans of AU member states.

[7] For the purposes of this report, West Africa includes the combined country membership of ECOWAS and CILSS, that is, Benin, Burkina Faso, Cabo Verde, Chad, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

1.2 FOOD SYSTEM RESILIENCE CONCEPT

FOOD SYSTEM APPROACH

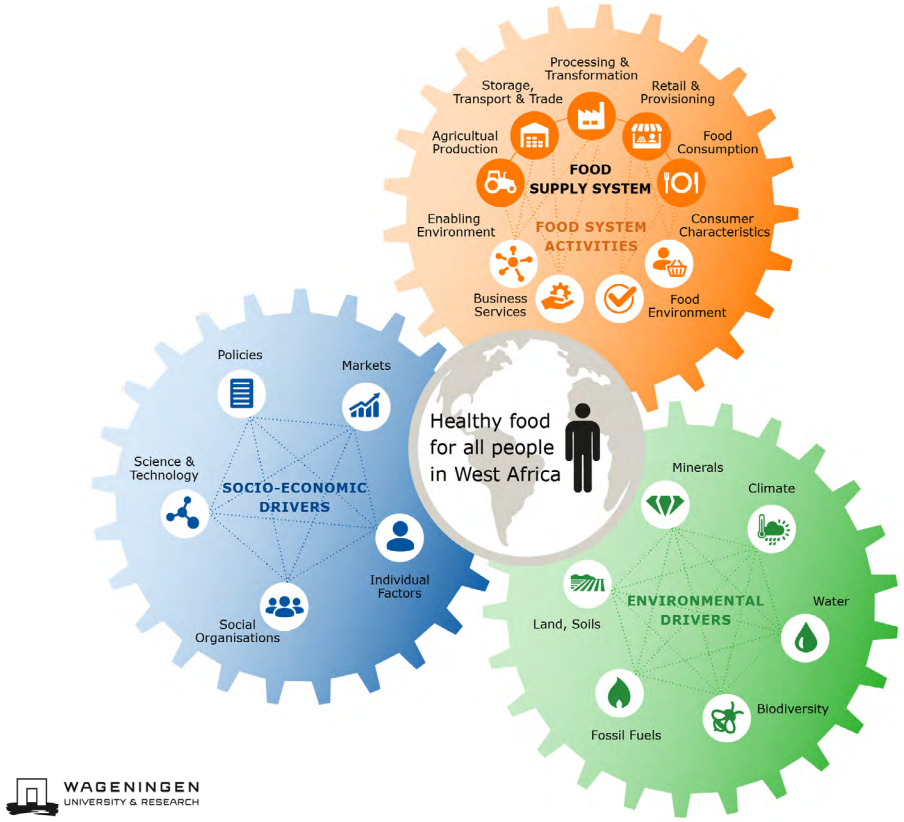
Food systems include the range of activities in producing, processing, distributing, marketing, preparing, consumption, and disposal of goods that originate from agriculture, forestry, or fisheries, including the ecosystem services impacted or generated. Composed of traditional, modern, and informal channels, food systems also involve the people and institutions that initiate or inhibit change in the systems as well as the sociocultural, political, economic, natural, and technological environments in which these activities take place. This definition includes food security and the wider set of systems in which food operates (FAO 2017; Global Panel 2020; HLPE 2014, 2017; Tefft et al. 2020; UNEP 2016). In line with Tendall et al. (2015), we prioritize the functional goal of food systems to ensure the provision of sufficient (in terms of nutritive value and quantity), accessible, and culturally appropriate food for all.

The food systems concept embraces a systemic approach to examine the diverse outcomes to which they contribute, including environmental sustainability and resilience; safety, nutrition, and health; accessibility; and incomes and employment (inclusiveness and equity). The concept's holistic nature and related approaches makes the interrelationships and trade-offs between outcomes, and the dynamic interactions between drivers, outcomes, and impacts—both positive and negative—explicit (David-Benz et al. 2020).

The concept also helps to identify important food systems drivers, whether exogenous to the sector (for example, urbanization and climate), or endogenous, such as policies and infrastructure, which shape its structure and performance. Diverse conceptual frameworks that underpin food systems approaches help elucidate how and where the food is produced and how it influences the broader economy, environment, and society (see figure 1.1). The food systems perspective contributes to the emergence of territorial approaches that embrace geographic specificities of subnational food systems. The COVID-19 crisis has underscored the importance of local food systems and their governance to resilient economies faced with diverse supply chain disruptions.

The holistic nature of the food systems concept and resulting frameworks naturally incorporates consideration of behavioral and governance issues that condition the public and private decisions that help shape it. In this context, governance perspectives may illuminate the effect of diverse stakeholder interests on policy and investment decision-making, or on relationships between different levels of government (that is, vertical), or across sector ministries or departments that intervene in food systems (that is, horizontal) (Tefft et al. 2020).

FIGURE 1.1 Food Systems Framework



Source: courtesy by Wageningen University & Research 2020

THE NOTION OF FOOD SYSTEM RESILIENCE

Resilient food systems are characterized by the ability to withstand and adapt to exogenous or endogenous shocks and stressors. The Intergovernmental Panel on Climate Change (IPCC) defines resilience as "the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity of self-organization, and the capacity to adapt to stress and change" (IPCC 2007). This definition applies to all subcomponents of food systems and thus encompasses climate resilience, economic resilience, sociopolitical resilience, and food access resilience, which mutually influence each other (Steenhuijsen Piters et al. 2021). Importantly, resilience is not a binary attribute but manifests in varying degrees and may differ across multiple levels and scales; for example, from the individual to the national level (Tendall et al. 2015). Even when food systems can be considered resilient at the macrolevel, the ability to absorb shocks and disruptions can be unevenly distributed within them. Specific societal segments within a region or a country may be more vulnerable than others (for example, lower-income households vs. well-endowed households) due to socioeconomic

disparities. In this work and in line with above definition, resilient food systems are understood as retaining their ability to deliver multiple economic and social outcomes—accessibility, nutrition, health, safety, and jobs—in a sustainable manner. Resilient food systems are of critical importance to meet United Nations (UN) SDGs, particularly SDG1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 5 (Gender Equality), and SDG 13 (Climate Action). In West Africa, core development objectives such as eliminating hunger, reducing poverty, and enhancing resilience to climate change cannot be achieved without strengthening the region's food systems.

West Africa is currently not on track to meet the resilience targets of the AU. According to the Second Biennial Review Report of the AU Commission on the Implementation of the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, only four countries in West Africa (Ghana, Mali, Mauritania, and Cabo Verde) are making progress toward implementing the Malabo Commitment on Enhancing Resilience of Livelihoods and Production Systems to Climate Variability and Other Related Risks. To meet the Malabo Commitment, signatories must ensure that by the year 2025, at least 30 percent of the farm, pastoral, and fisher households have improved their resilience capacity to climate and weather related risks; investments into resilience building initiatives, including social security for rural workers and other vulnerable social groups, as well as for vulnerable ecosystems, are enhanced; and resilience and risk management are mainstreamed into their policies, strategies, and investment programs.

1.3 FIVE PRINCIPAL FOOD SYSTEMS OF WEST AFRICA

To reflect the great diversity of food systems across West Africa, this report commissioned a background study completed through Wageningen University[8] to map the principal food systems and their interrelationships. Five archetypal West African food systems were selected based on the agro-ecological systems analysis following Garrity et al. (2017). These are the (a) agropastoralism-based food system; (b) mixed grains and legumes-based food system; (c) rice and horticulture food system; (d) coastal maritime fisheries-based food system; and (e) tropical mixed tree and food crop food systems. The complete food system mapping is available upon request. We summarize the findings below. Maps 1.1 – 1.6 show the geographical distribution of the subsystems.

[8] The development of the background study was led by Bart de Steenhuijsen Piters, Wageningen Economic Research (2021). The food subsystem summaries are based on the study and the contained references. The summary of the subsystems on the following pages is based on the food system mapping and the references therein.

TABLE 1.1 The Agropastoralism-based Food System

THE AGROPASTORALISM-BASED FOOD SYSTEM

OVERVIEW

- The agropastoralist food system is characterized by the involved households' reliance on livestock keeping with varying degrees of mobility and transhumance.
- In total, West Africa is home to between 17 and 25 million agropastoralists with strong demographic growth rates. Seventeen percent of the Sahelian countries' population can be considered part of the agropastoralist community (UNOWAS 2018; FAO 2018b).

ECONOMIC OUTCOMES

- Animal products account for 12–19 percent of the gross domestic product (GDP) in the Sahel countries and for less than 6 percent in coastal countries.Intraregional trade of livestock is estimated at nearly US$400 million per year for the 2013–15 period, which is six times higher than for cereals (Tondel 2019).
- Due to its high informality, the true extent of livestock trade is not captured by official statistics.
- Agropastoralists are the most important supplier of livestock products to consumers living in urban centers in West Africa.
- High transport, handling costs, and illegal taxes profoundly affect profit margins for both producers and traders.
- There is high market potential through income growth in urban centers.

NUTRITION OUTCOMES

- Around 24–30 percent of the pastoralist population is moderately to severely food insecure[9]
- One of the most important determinants of household malnutrition is access to forage, which accounts for half of agropastoralist household expenditures.
- Agropastoralist families in Sudanian areas combining livestock and cropping are less concerned by food insecurity than pastoralists.

ENVIRONMENTAL OUTCOMES

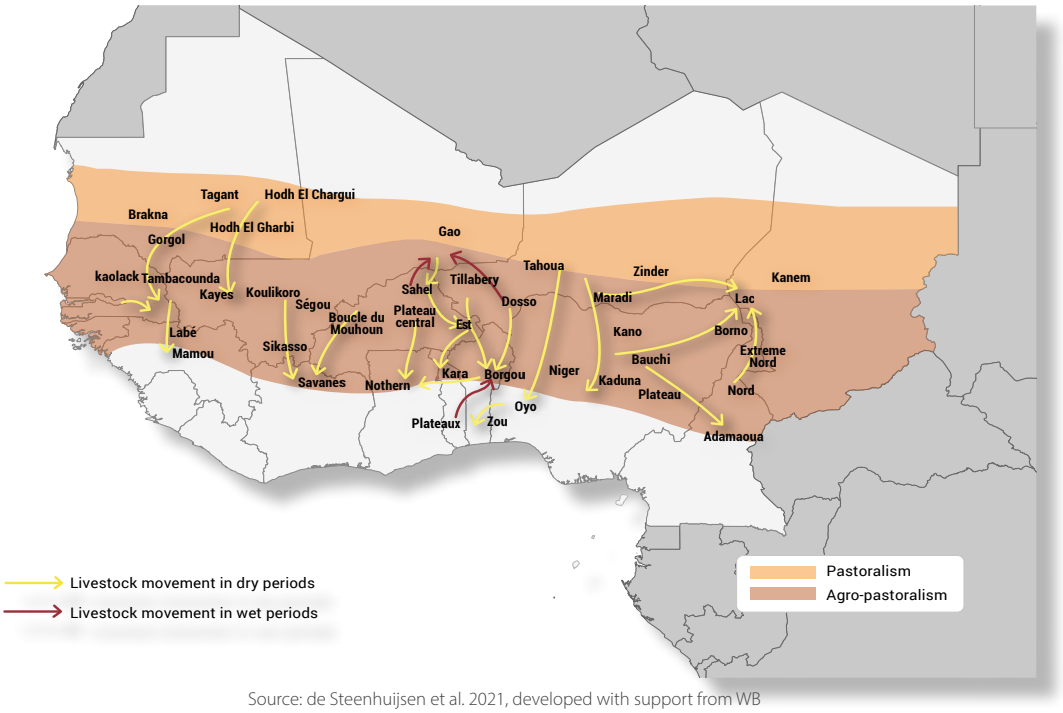
- Extensive pastoralism with unconstrained mobility has low environmental impact and causes comparatively little greenhouse gas emissions compared with other livestock production systems.
- In recent years, intensifying competition over resources and different mobility patterns have led to rising levels of land degradation.

RECENT TRENDS

- Agricultural encroachment onto rangelands through population growth and a lack of secure land access, rising incidence of animal and zoonotic diseases, and more extreme climate events increasingly affect the production system.
- Shifting herd routes have seen conflicts rise over water points and pastures.
- Due to natural resources constraints and natural reproduction cycles, herd growth is unable to match the pace of population increase.
- Intensifying agropastoral production systems through market orientation, secure access to water and feed resources, and improving animal health services could enhance the sector's resilience to climate change.
- Complementary adaptation strategies for responding to the above pressures include diversification of revenues and income sources, including farm, horticultural, and livestock products as well as salaried employment.

[9] Based on data from WFP VAM ENSAN 2018.

MAP 1.1 Agropastoralism-Based Food System



Source: de Steenhuijsen et al. 2021, developed with support from WB

Table 1.2 The Grains and Legumes-based Food System

THE GRAINS AND LEGUMES-BASED FOOD SYSTEM

OVERVIEW

- The grains and legumes-based food system is characterized both by highly market-oriented and subsistence-based farming households and is the typical agricultural production system in the Sudano-Sahelian zone.
- An estimated 32 million people are at the heart of this grains and legumes-based food system and represent about 15 percent of West Africa's total population, excluding Nigeria.

ECONOMIC OUTCOMES

- During the 2014–18 period, the regional production of cereals increased 5 percent annually: 3 percent increase for sorghum, 6 percent for millet, and 5 percent for maize
- West African traders in millet, sorghum, maize, and cowpea operate through a highly informal but well-coordinated international network that links countries to regional West African markets.
- In-country trade flows of millet and sorghum in Burkina Faso and Mali generally transfer surplus from areas in the south to deficit areas in the north, with urban centers in the north being hubs from where cereals are distributed to smaller markets.
- No reliable data exists on the volumes of the regional market and trade flows of coarse grains and legumes (cowpea) in West Africa because the vast majority of transactions are informal and involve small volumes, and unprocessed products are exempted from customs duties and are not captured by official statistics.

NUTRITION OUTCOMES

- According to the most recent household surveys in Burkina Faso (2012), Ghana (2012), Benin (2017), and Mali (2018), about 1 percent of the population (persons or households) were in a severe food security situation in Burkina Faso and Mali, and 3 percent and 8 percent in Ghana and Benin, respectively. Ninety-six percent in Mali, 84 percent in Burkina Faso, 81 percent in Benin and 79 percent in Ghana were in a limited food secure situation. Millet, sorghum, and maize represent 50 percent of the daily food intake (energy) in West Africa with root crops accounting for 20 percent[11].
- In the Sahel countries (Burkina Faso, Mali, Niger, and Senegal), cereals account for 60 percent of the daily food intake and root crops only for 2 percent. About 60 percent of the daily food intake through cereals is accounted for by millet, sorghum, and maize, and 30–40 percent by rice[12].
- In West Africa, vegetal products contribute to about 80 percent of the daily supply in proteins (quantity). Pulses represent 15 percent of this supply through vegetal products.

ENVIRONMENTAL OUTCOMES

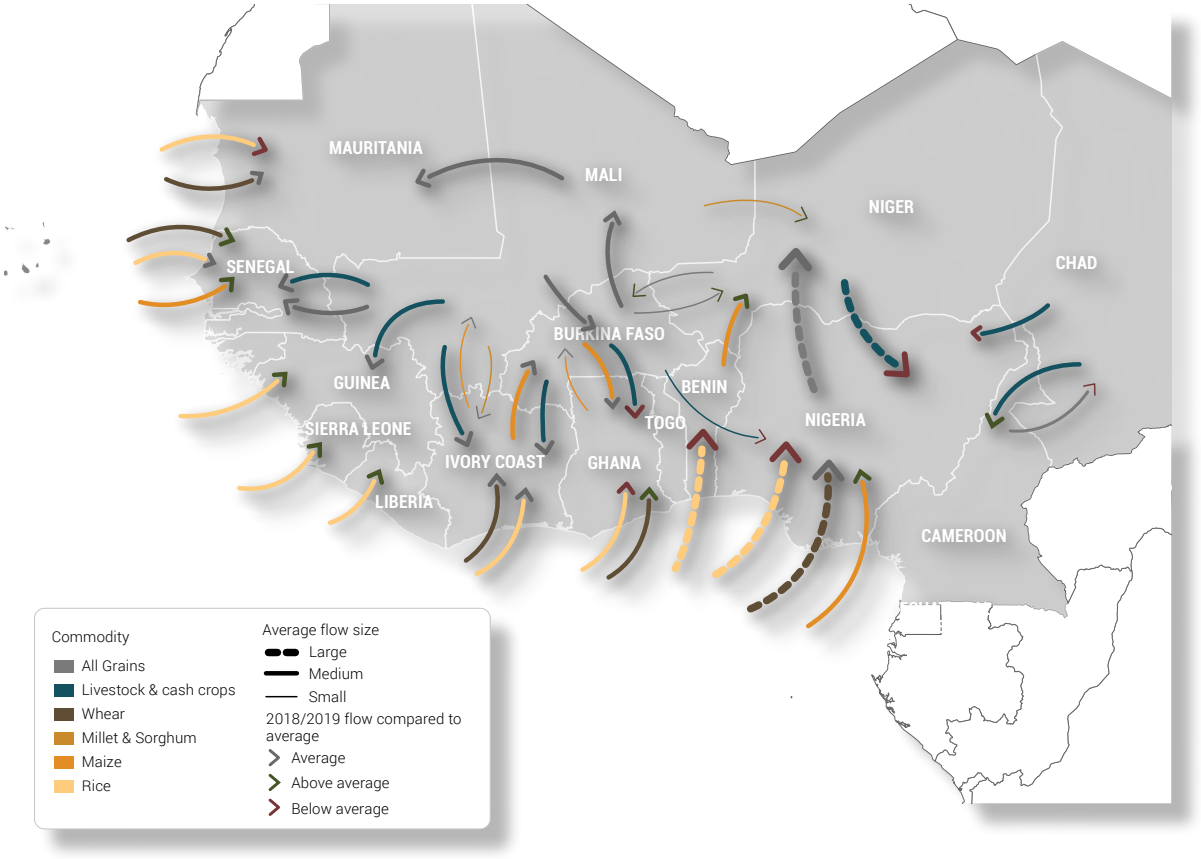
- Population growth remains the main driver for land use change, mainly for agricultural purposes, resulting in degradation, declining soil fertility, biodiversity loss, and fewer non-timber forest products.
- Land use change and forestry, energy, and agriculture are the main sources of greenhouse gas emissions, with 32 percent, 27 percent and 23 percent respectively for the enlarged West African region (USAID 2019).

RECENT TRENDS

- The last 20 years point to a greater variability of annual rainfall and a higher number and recurrence of localized climate extremes.
- Demand for unprocessed and processed coarse grains and legumes will increase as urbanization of the West African population continues.
- Trends over the last two decades show an increased production capacity of grains and pulses in response to the rising demand, although closing yield gaps remains a challenge.
- Since 2012, the security situation in Sahel countries has worsened in parts of Niger, Burkina Faso, and Mali, with spillover effects in other areas. For instance, farmers in Central Mali are not always able to cultivate their fields because of recurrent attacks and massacres.

[10] Based on FAOSTAT 2020.
[11] Based on data from WFP VAM 2014, 2017 and 2018; WFP 2012; FAOSTAT 2017.
[12] Food intake data based on FAOSTAT (2017).

MAP 1.2 Grains and Legumes-Based Food System



Source: de Steenhuijsen et al. 2021, developed with support from WB

TABLE 1.3 The Rice and Horticulture-based Food System

THE RICE AND HORTICULTURE-BASED FOOD SYSTEM

OVERVIEW

- The bulk of rice production in West Africa comes from numerous small- and medium-scale family farms.
- In West Africa, over three million (small-scale) family farms or 18–24 million people[13] are involved in rice and irrigated horticulture production.

ECONOMIC OUTCOMES

- Rice is staple food for almost all West African households, including poor urban and rural households, and is the most consumed cereal after sorghum-millet, accounting for more than a third of all grain consumption.
- In 2017, the consumption of rice in West Africa was 15.86 million metric tons and is projected to grow to 22 million metric tons by 2025 based on the trends in the last five years. This is close to a 50 percent increase between 2017 and 2025 with per capita consumption equally expected to rise from 43 kg in 2017 to 49 kg in 2025 (ECOWAS 2019c, p.8).
- Horticulture production has risen quickly in parallel to increasing rice production, at 5 percent per year in the past decade (6 percent per year in 2000–18). In 2018, West Africa produced around 26.4 million tons of primary vegetables (on estimated 4.43 million ha)[14].
- The overall vegetables production finds its destination in nearby markets. The gross value of primary vegetables (dry and shallot onions, pepper, tomatoes, sweet potatoes) was estimated at US$8.3 billion in 2016, with Niger representing US$1.8 billion and Mali US$1.4 billion[15]. Production is concentrated in the Sahel (Burkina Faso, Mali, Niger, Senegal) and near urban markets in coastal countries.
- The rice diet transition has stimulated local production and led to a rapid increase in rice imports (2017 imports of 9.2 million tons equal 40 percent of its total demand (ECOWAS 2019c).

NUTRITION OUTCOMES

- For caloric intake, rice has overtaken the individual coarse grains and can exceed 33 percent of calories for the urban poor (Soullier et al. 2020)
- Rainfed upland and lowland subsystems, and mangrove and floating rice, are part of broader systems, and we observe the same tendencies as described for households in the mixed grain-legumes and mixed tree-food crops systems.
- Households in lowland irrigated or horticulture areas consume fewer dairy products than those in adjacent agropastoral areas.

ENVIRONMENTAL OUTCOMES

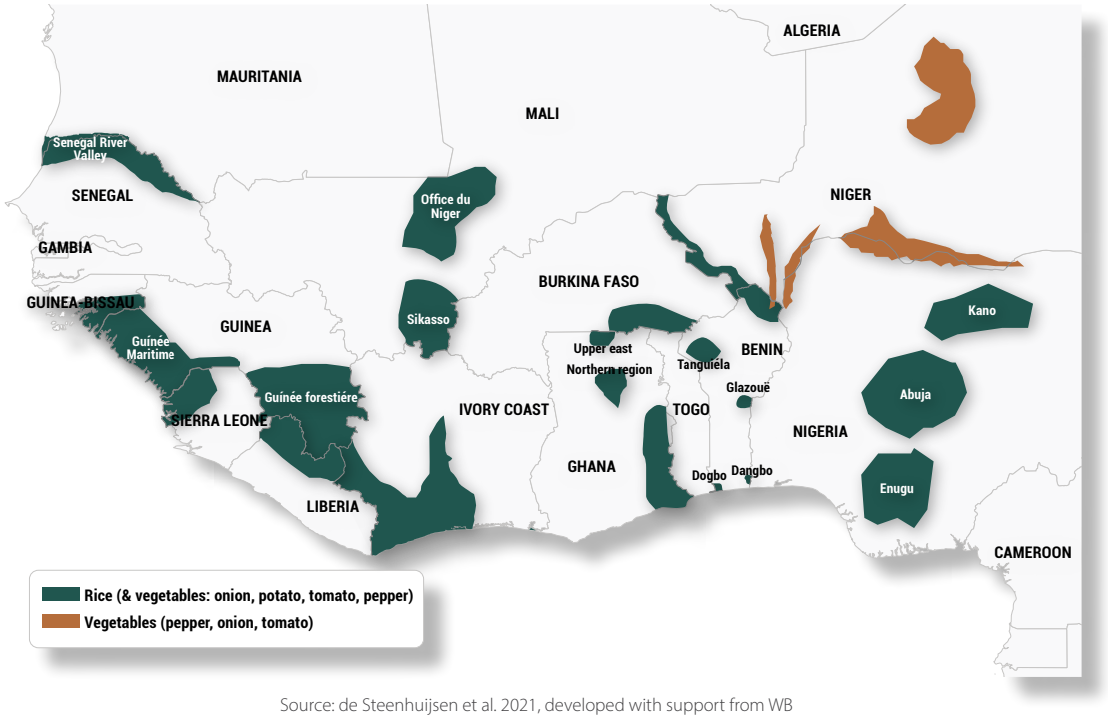
- Rice fields use total seasonal water inputs that are up to 2–3 times higher than those for other cereals.
- Rice affects the environment through releasing greenhouse gases and changing water composition
- Rice and horticulture have encroached on the region's wetlands, on grasslands for livestock, and on water plains and ponds, which play a key role in livestock and fishing systems. Encroachment has contributed to conflicts over land and water access.

[13] Estimates based on ECOWAS 2019 and FAOSTAT 2020
[14] Based on FAOSTAT 2020
[15] Ibid

RECENT TRENDS

- Farming households face increasing land fragmentation and smaller plots. They are also confronted by land pressure and tenure insecurity.
- Increases in rice production have been largely driven by increasing production areas and less by productivity gains.
- The lack of economic incentives constrains the adoption of innovations requiring capital investments.

MAP 1.3 Rice and Horticulture-Based Food System



Source: de Steenhuijsen et al. 2021, developed with support from WB

TABLE 1.4 The Coastal Maritime Fisheries-based Food System

THE COASTAL MARITIME FISHERIES-BASED FOOD SYSTEM

OVERVIEW

- Coastal communities' livelihoods are highly diverse, and households are often involved in both land and marine or freshwater-based activities.
- People in West African fishing communities rely on livelihood diversification but also use migration as a livelihood strategy, since fish migratory patterns lead to seasonal variation in West African fisheries.

ECONOMIC OUTCOMES

- Marine capture fisheries from the Eastern Central Atlantic fishing area (which covers West Africa) equalled 5.5 million tons in 2018 (FAO 2020d), and on average just over 4 million tonnes annually in the period 2005–14 (FAO 2018c).
- Marine capture fisheries are the most important, contributing 71 percent in volume, followed by inland fisheries (19 percent) and inland aquaculture (10 percent) in 2018 (FAO 2020e).
- Recent data on the contribution of fisheries to GDP in the West African region is lacking. Older estimates from before 2010 indicate a contribution of the sector of around 4 percent, including both production and post-harvest activities.

NUTRITION OUTCOMES

- Fish is of key importance to food and nutrition security in West Africa, serving as an important source of key micronutrients (especially vitamin A, calcium, iron, selenium, and zinc), essential fatty acids (especially omega 3), and protein.
- The availability of fish for human consumption depends on the fisheries resources and competing uses. When caught by the industrial fishing fleets, most small pelagic fish, which are rich in macro- and micronutrients, are converted into fishmeal and oil as ingredients for aquaculture, livestock, and chicken feed. This raises important questions for food and nutrition security, as aquaculture tends to convert wild fish into farmed fish, which is inefficient, particularly for the carnivorous species.

ENVIRONMENTAL OUTCOMES

- An (International Union for Conservation of Nature (IUCN) assessment of 1,288 species in marine waters from Mauritania to Angola showed that 51 were threatened or near threatened, with 39 of these species caught for both industrial and small-scale fisheries (IUCN 2016). Many of these species are staple food sources for West Africans. Overfishing is not the only concern for healthy fish stocks; pollution from activities such as oil drilling, coastal development, poor waste management, and agricultural runoff negatively affect coastal ecosystems.
- Fisheries subsidies (that is, financial payments from public entities to the fishing sector) have been widely identified as a major driver for overexploiting fisheries resources.

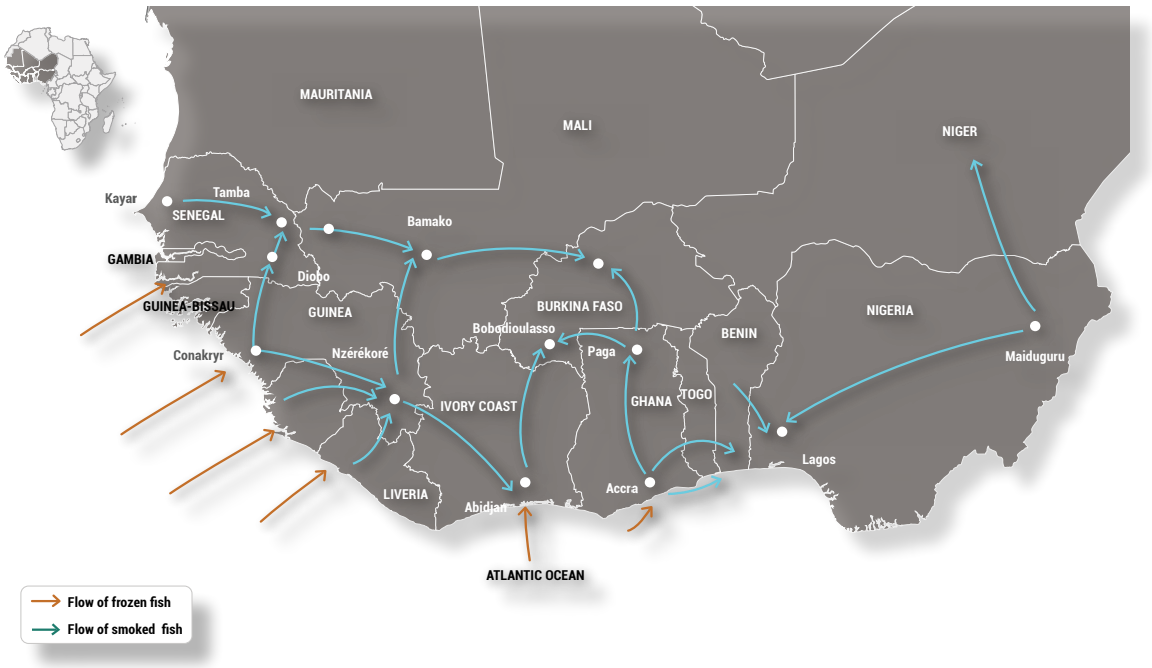
RECENT TRENDS

- The West African coastal marine fisheries are under pressure because of intense harvesting (legal and illegal) of marine resources, pollution, and degradation due to economic activities on land and at sea and because of climate change.
- Coastal and marine pollution affect the structure and function of phytoplankton, zooplankton, and benthic, and thereby have important effects on ecosystems and fisheries.
- Expected increase in demand for fish due to population growth, urbanization, and rising incomes in West Africa will put significant pressure on the marine fisheries food system.

MAP 1.4 Coastal Maritime Fisheries-Based Food System

Source: de Steenhuijsen et al. 2021, developed with support from WB

MAP 1.5 Coastal Maritime Fisheries-Based Food System II



Source: de Steenhuijsen et al. 2021, developed with support from WB

TABLE 1.5 The Tropical mixed Tree and Food Crop Food Systems

THE TROPICAL MIXED TREE AND FOOD CROP FOOD SYSTEMS

OVERVIEW

- In tropical West Africa, there are two broad mixed tree and food crop-based systems: lowland humid tree farming systems and highland forest perennial systems.
- An estimated 30 million farmers on 64 million ha practiced lowland humid tree farming systems in Sub-Saharan Africa in 2015, most in West Africa (Gockowski 2019).
- These systems generally consist of several plots with different, rotating mixes of annual/seasonal food crops (both subsistence and cash crops such as roots and tubers and vegetables) and perennial tree crops (cash crops such as cocoa, rubber and coffee).

ECONOMIC OUTCOMES

- On a national level, cash crops contribute to food security through generating export revenues that allow to import food or to invest in domestic production.
- Cocoa has consistently been the major export cash crop in West Africa. It has the largest land area coverage that spans West Africa and accounts for the largest share of exports. In Ghana, 800,000 people were active in the cocoa sector in 2014, accounting for 50 percent of national employment with a value of US$2 billion in 2017, equivalent to 10 percent of agricultural GDP (Marcella and Kolavalli 2017). Another country where cocoa is a key cash crop cultivated by smallholders is Côte d'Ivoire, where cocoa is estimated to account for 75 percent of national employment.
- For cash-crop cultivating households in Ghana and Côte d'Ivoire, cocoa is the most important source of income. For example, an estimated 78 percent of household income in Ghana comes from cocoa and even 90 percent in Côte d'Ivoire (Fountain and Hütz-Adams 2018).

NUTRITION OUTCOMES

- Around half of farmers studied in countries in the lowland humid zones had high risks of food and nutritional insecurity.
- Diets depend on production shares of subsistence and cash crops, as well as the overall share of purchases of local or imported foodstuffs. Poverty and distance from markets reduce food purchases.
- Fallows and forested areas have traditionally been an important source of animal protein in the form of bushmeat and fish. Yet supply has rapidly declined to crisis levels in the last 40 years due to over hunting, land use change, and changing agricultural practices such as shorter fallow rotation periods. Declines in traditional protein supply has not yet been offset by alternative protein sources.

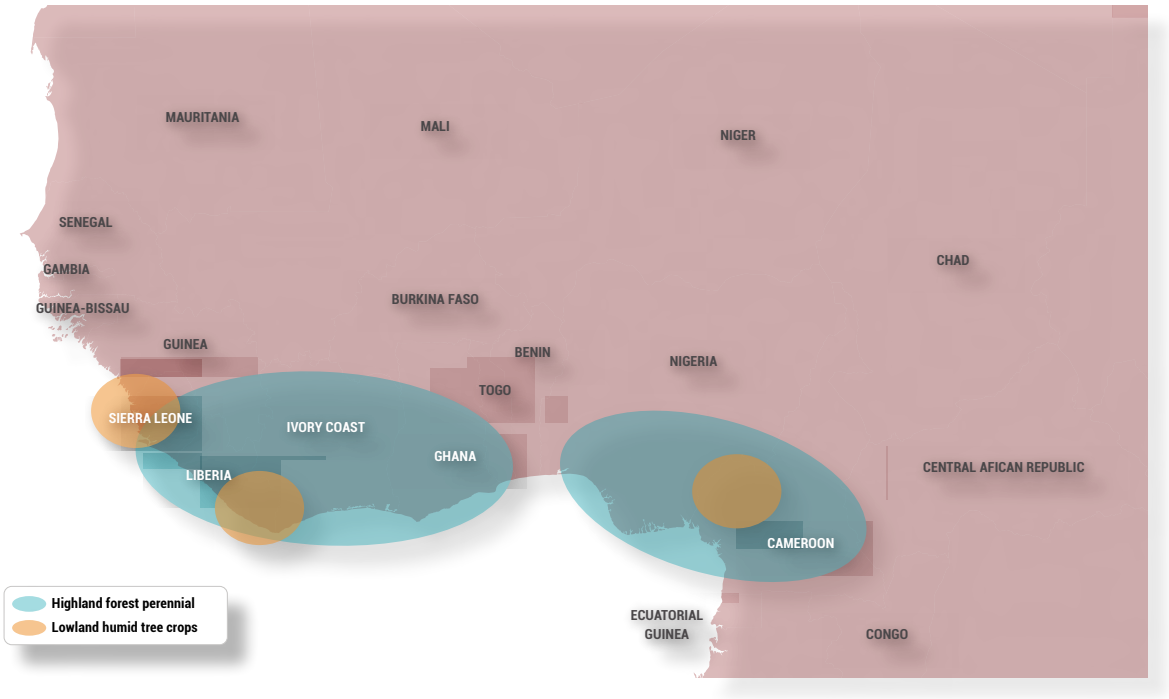
ENVIRONMENTAL OUTCOMES

- Farmer's expansion into secondary and primary forests to gain new land and overcome soil fertility issues leads to rapid land-use change
- Intensive cash crop systems requiring large amounts of inputs lead to soil degradation
- Overharvest of forest products results in decreased natural regeneration rates of native crop species such as baobab and shea trees and decreases biodiversity in both forests and fallows.

RECENT TRENDS

- Declining soil fertility and soil degradation pose a risk to the productivity of the main cash crops
- Trade-offs between cash crop intensification and ecosystem services present a risk to the long-term sustainability of this food subsystem.
- Increased climate variability is expected to impact the cocoa and coffee sector. The area suitable for cocoa production is predicted to decrease significantly.
- Agroforestry can be a promising option to increase food security and co-deliver a range of environmental benefits.

MAP 1.6 Tropical Mixed Tree and Food Crop-Based Food System



Source: de Steenhuijsen et al. 2021, developed with support from WB

1.4 FOOD SYSTEM DRIVERS AND SHOCKS

This section examines several key drivers that transcend the variation across local food systems and condition the opportunities and pose challenges to governments and actors in the food system of West Africa as a whole:

- income growth and distribution
- population growth, urbanization, and migration
- trade and public policy
- gender inequality, land rights, post-harvest losses
- climate change, zoonotic diseases, insecurity, conflict, and violence.

DRIVERS: INCOME GROWTH AND DISTRIBUTION

West Africa is comprised of a heterogeneous mix of countries, roughly divided by its bioclimatic subregions – Sahelian, Sudanian (middle belt), Guinean (or Coastal), and denser Guinean–Congolian. The region's countries have notable differences in physical size, population, natural endowment, resources, economic resources, social structure, education and health attributes, and linkages to the global economy.

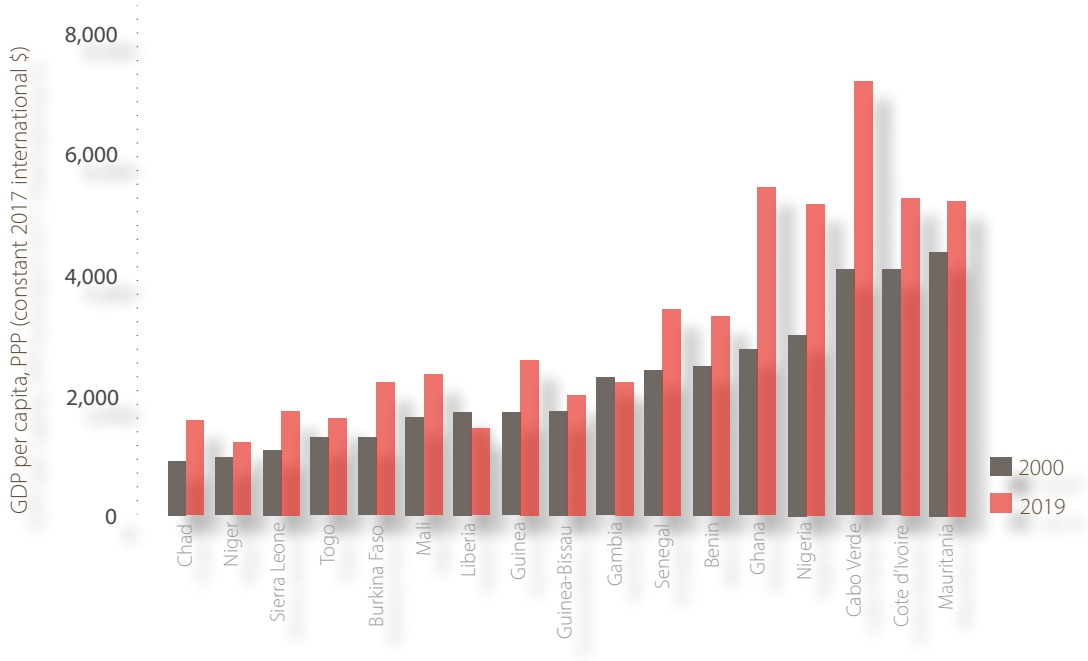
The agriculture sector is important in all countries as a key source of livelihoods and jobs. In some countries, a natural resource boom and extractive industries drive economic growth. In other countries, the agriculture

sector still predominates. The service sector has driven growth in many of the region's countries while the industrial sector has been relatively less important. Food systems are important to all three sectors (agriculture, industry, services), generating value addition, employment, and livelihoods. Between 2000 and 2015, the following employment trends by sector in West Africa have been observed: Agriculture from 58.8 percent to 52.3 percent; Industry from 10.4 percent to 12.5 percent; and Services from 30.8 percent to 35.2 percent (AfDB 2019). Macroeconomic statistics continue to minimize important contributions of the food system to agriculture, industry, and service sectors, both in terms of value addition and employment.

There is a large variation in all socioeconomic variables and trends among the 17 countries of the ECOWAS and CILSS zones. Yet regional averages obscure these large variations. Agricultural and economic growth rates have varied widely across the region, with star economic performers in stark contrast from those emerging or currently involved in protracted crises. Three countries—Nigeria, Côte d'Ivoire, and Ghana—account for three-fourths of West Africa's population and 80 percent of its GDP, so the health of these economies has a profound impact on the rest of the region.

The strong economic growth in much of West Africa has not been inclusive, whether within or across countries. The region, like much of the developing world, has shown economic progress since the mid-1980s (Radelet 2015). GDP per capita in the ECOWAS zone grew at an average annual rate of 3.8 percent over the period 2000–15, with all countries of the region except Liberia experiencing positive per capita GDP growth during that period (World Bank 2016). Most West African economies grew quickly in the past 20 years (see figure 1.2), yet their structural transformation is uneven. Large segments of the population are employed in low productivity jobs in the informal service sector.

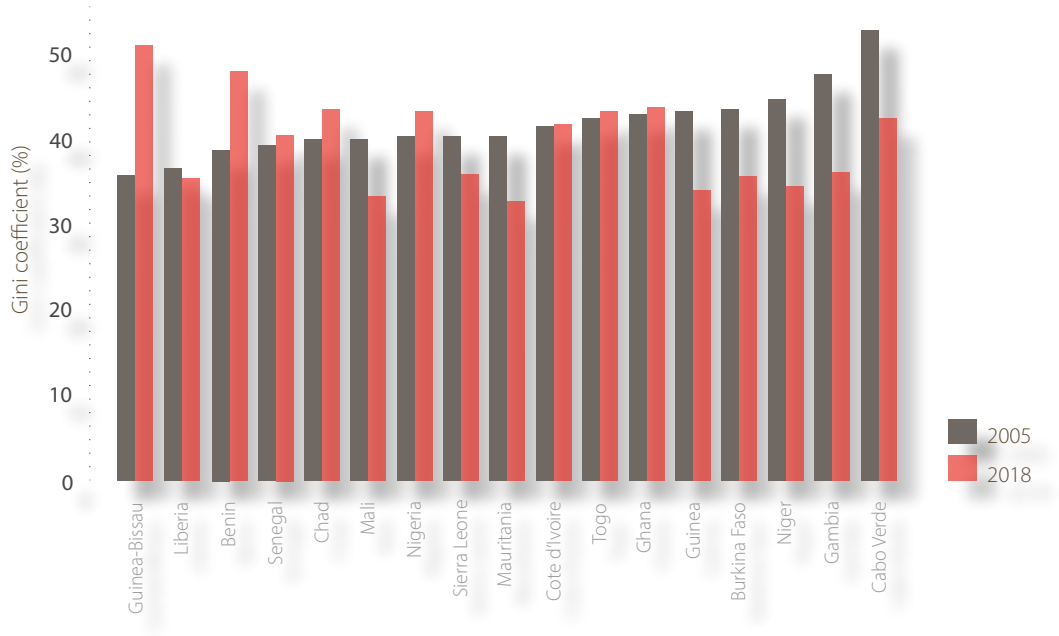
FIGURE 1.2 Per Capita Income (PPP, Constant 2017 International $) for West African Countries, 2000 and 2019



Source: World Development Indicators Database (WB 2020c)

Inequality, while high, did not change significantly in West Africa between 1985 and 2018. Guinea-Bissau, The Gambia, and Cabo Verde have the highest inequality, and Mali, Sierra Leone, Niger, and Guinea have the lowest, although the differences are not great (AfDB 2018). For the years 2005 and 2018, the Gini coefficient oscillated narrowly between 40 and 46 (figure 1.3). Persistent income inequality stems from reasons that include human capital, informality, education, nutrition, health, civil conflict, wasteful public expenditure, natural resource dependency, and inadequate secondary education.

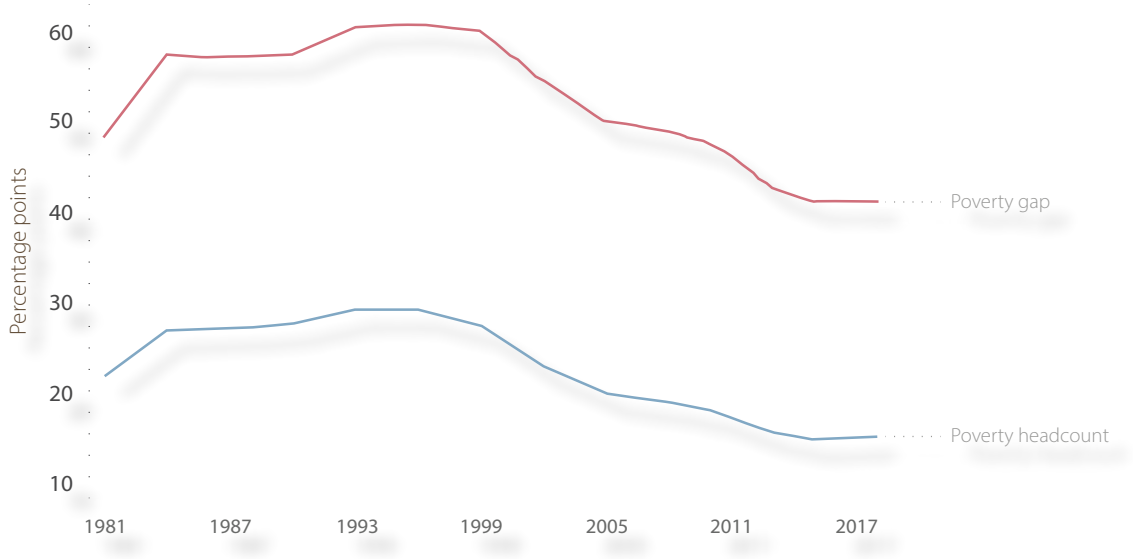
FIGURE 1.3 Gini Coefficient Across West African Countries, 2005 and 2018



Source: PovcalNet (WB 2020b)

While less widespread than two decades ago, poverty in West Africa persists at high levels and progress to reduce them has slowed recently. At present, approximately 43 percent of West Africans live below the international poverty line. After rising between 1981 and 1996, poverty fell consistently between 1997 and 2013 before plateauing at around 43 percent (see figure 1.4). While poverty declined in most of the region, there is considerable variation in poverty across West African states. As poverty rates fell, the poverty gap declined— poverty gap is the difference between the average income of the poor and the poverty line (see figure 1.4). Seventy-five percent of the West African population lives at under US$2 per day. Consequently, consumers spend a large proportion of their income on food, ranging on average from 39 percent in Côte d'Ivoire to 65 percent in Nigeria. The price of food is a critical determinant of the real incomes of the growing mass market of people still living under the poverty line, who are therefore highly sensitive to increases in food prices (Hollinger et al. 2015).

FIGURE 1.4 Headcount and Poverty Gap of West Africa, 1981–2018



Source: PovcalNet (WB 2020b)

In parallel, the middle class—those individuals or families earning more than US$2 per capita per day (in 2010 dollars)—has expanded as West African economies have grown (AfDB 2011). In 2010, 25 percent of West Africa's population met that definition, accounting for roughly 70 million people. Over half (53 percent) of these people fall into the "floating middle class"—people with per capita incomes between US$2 and US$4 per day (AfDB 2011). The middle class is concentrated in the three largest countries: 50 percent live in Nigeria, with an additional 27 percent in Côte d'Ivoire and Ghana. However, the countries with the highest share of their population in the middle class are Ghana (47 percent), Cabo Verde (46 percent), Côte d'Ivoire (37 percent) and Senegal (36) (Hollinger et al. 2015).

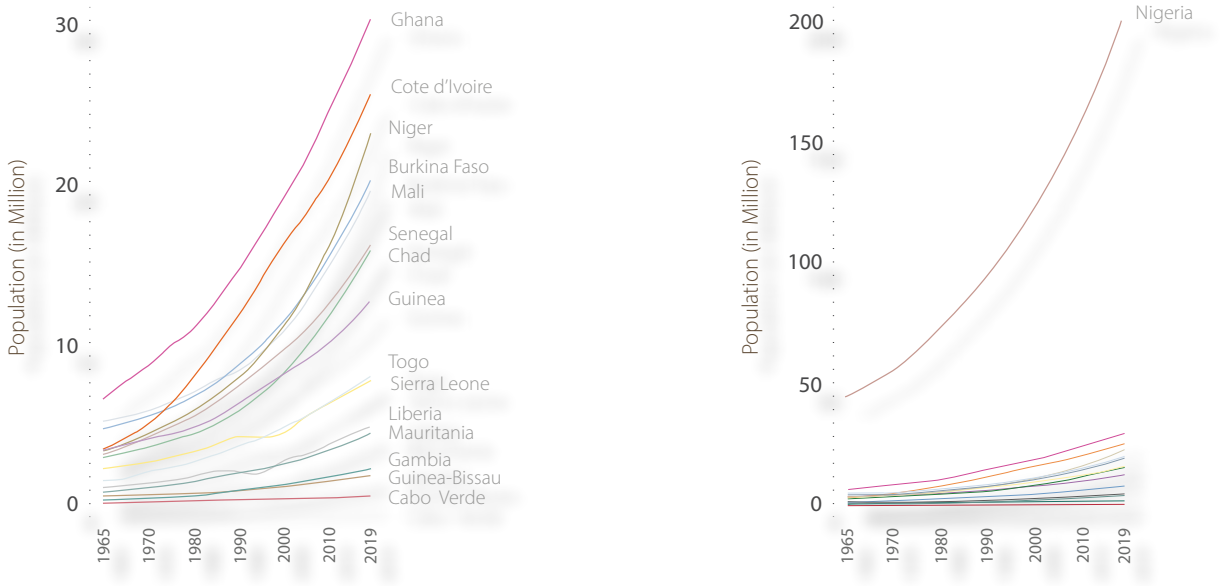
DRIVERS: INCOME GROWTH AND DISTRIBUTION

Three main demographic drivers are shaping food system structure and performance: the growth and composition of population, the rate and composition of urbanization, and migration. While these factors pose a challenge to agrifood systems to produce enough food with lower per capita endowments of natural resources (notably land and water), they also provide livelihood and job opportunities for young people in production, processing, and services in both rural and urban areas.

West African population growth is generally high, and millions of people enter the labor market each year, representing both a challenge and an opportunity. With the regional population growing annually at 2.75 percent, the current 400 million people in West Africa will be 500 million people by 2030 and reach 789 million in 2050 (see figure 1.5). Nigeria, with 200 million residents, is the most populated country in the region and will be the third most populous country in the world by 2050, after China and India. The region's coastal

countries will have the greatest population growth, with population densities 6 to 15 times higher than in the Sahelian states. The region's population is trending younger, with 44 percent under age 15 and 60 percent under age 25. West Africa may benefit from its demographic dividend, given the larger working-age population and millions of people entering the labor force every year, relative to the non-working-age share. This youthful population, increasingly urban and plugged into digital media, is adopting new lifestyles and changing food consumption patterns, spreading different modes of consumption from metropolitan areas into the hinterland. The youth bulge is also raising aspirations, fueling the demand for rewarding and adequate jobs.

FIGURE 1.5 West Africa Population Growth



Source: World Development Indicators Database (WB 2020c)

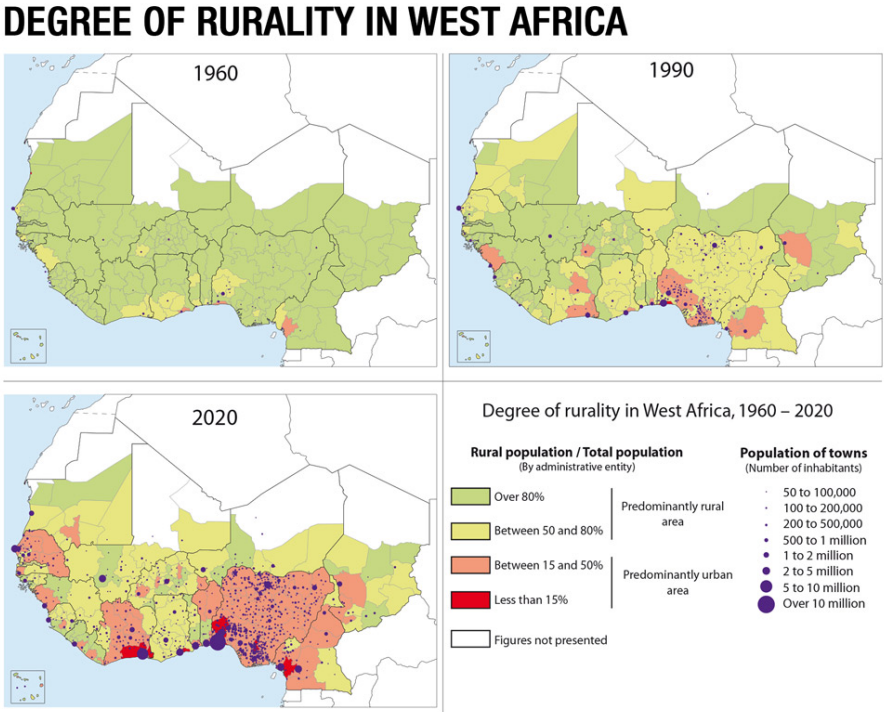
West Africa has experienced explosive urban growth with a 30-fold increase in the number of urban residents, from 5 to 150 million, between 1950 and 2015. This trend is expected to continue, with the percentage of urban residence projected to increase from 48 percent in 2018 to 64 percent in 2050, compared with 40 percent and 58 percent for all of Sub-Saharan Africa. Since the 1980s, the number of people born in cities has exceeded those arriving from rural areas. These metropolitan areas are the main interface with global markets. While strong population growth and urbanization create opportunities for job creation and economic growth, these factors also increase pressure on scarce natural resources and biodiversity which affects agro-ecological resilience of the food system, e.g., through driving agricultural expansion and deforestation.

West Africa's coastal countries are more urbanized, and populations in vulnerable coastal zones are increasing rapidly. Some coastal area increases reflect rapid migratory flows from the Sahelian areas (Moriconi-Ebrard, Harre, and Heinrigs 2016). For example, in Nigeria's low-elevation coastal zones (LECZ), or

areas located 10 meters or less above mean sea level), the population density is 491 inhabitants per km2 compared with 134 inhabitants per km2 nationally. By some estimates, Africa's populations in LECZs will rise at an annual rate of 3.3 percent between 2000 and 2030—more than double the world's average. For example, in Senegal, the share of the LECZ population may skyrocket to 50 percent by 2060, up from 20 percent in the early 2000s. LECZs are vulnerable to flooding and sea-level rise associated with climate change (Mbaye 2020).

Small towns and cities in Sub-Saharan Africa are among the fastest growing in the world. These areas are the main interface with the rural economy and serve as a means for spreading urban food habits into rural areas. Globally, 40 percent of people live in small towns and cities with less than 300,000 people, while in Sub-Saharan Africa the number is 44 percent. The flip side of urbanization is rurality—looking at how much, and what parts, of countries are rural. In 1960 almost all of West Africa was primarily rural (map 1.7), with over 80 percent of the population (shown in green). By 2020, the shift to less rural and more urban is visually evident; there is little green left on the map, and most of the region has shifted into less rural categories. Niger remains the most rural country, with only 16 percent of people living in urban areas. By 2050, only 28 percent of the population will reside in cities.

MAP 1.7 Rurality and Urbanization in West Africa



Source: Figures taken from the WALTPS Study, Club du Sahel/OECD
Extract: OECD/SWAC (2009), Regional Atlas on West Africa, OECD Publishing, Paris
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Source: © Sahel and West Africa Club Secretariat (SWAC/OECD)

West Africans mainly move within their country or the ECOWAS region. Approximately 7.5 million people are expatriates in another country in the region compared with 1.2 million immigrants (that is, 0.5 percent of the West African population) living in OECD countries (for example, Europe and North America). Ivory Coast and Nigeria represent the two main migratory poles, followed by Senegal and Mali. Coastal areas continue to attract most migrants, largely due to opportunities for employment in cash crop production, the development and growth in coastal cities, and the increasing environmental and livelihood challenges in the Sahel (Moriconi-Ebrard, Harre, and Heinrigs 2016). The effective implementation of the ECOWAS protocol on the Free Movement of Persons and Right of Residence and Establishment in the region should facilitate this mobility and the resettlement of migrants.

Regional migration and displacement will likely continue due to the combined effect of conflict and insecurity, climate change, and socioeconomic factors. In 2019, West Africa and the Sahel region hosted around 1.2 million refugees and 4.4 million internally displaced people (IDP). Driven by insecurity, the number of IDP in the Central Sahel countries grew at dramatic rates between late 2018 and the end of 2019. Increases over this period have reached 300 percent in Niger's regions of Tahoua and Tillabéry, 66 percent in Mali, and 1,270 percent in Burkina Faso (FSIN 2020). In the long term, climate change and environmental degradation may dramatically increase internal migration within West Africa. Assuming a pessimistic scenario low levels of economic growth and high global carbon emissions, recent projections suggest that the number of internal climate migrants may reach 54.4 million (6.87 percent of population) by 2050. The magnitude of climate migration will be determined by global efforts to reduce emissions and regional development outcomes. In a more optimistic scenario assuming more inclusive development and strong climate action, projections anticipate 17.9 million climate migrants (2.27% of population) (Kumari Rigaud et al. 2018).

DRIVERS: TRADE

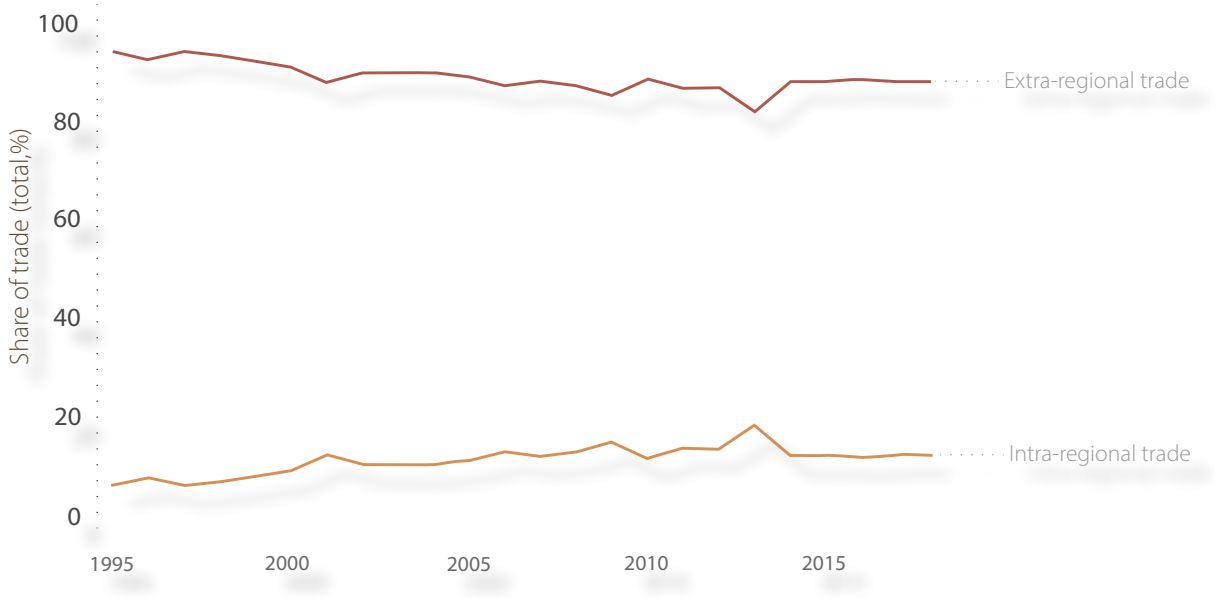
As markets provide two-thirds of food supply in West Africa, trade impacts each of the four dimensions of food security, including food availability, access, utilization and stability.

Trade impacts each of the four dimensions of food security as markets provide two-thirds of food supply in West Africa, the vast majority of which is imported from outside the region. Trade impacts incomes, prices and inequality, and stability of supply, linking food-deficit areas with food-surplus areas, food safety, variety, and quality of food products. These all help determine the food security and nutrition of individuals (Brooks and Matthews 2015; FAO 2015). With adequate policies in place, trade has a positive impact on food security. For example, trade, by increasing supply and competition, can lower staple food prices or dampen price rises and facilitate access to food (Dorosh, Dradri, and Haggblade 2009).

Most of West African trade in food commodities appears to be extraregional, with intraregional trade only representing about 10–20 percent of the total (UNCTAD 2020). The vast majority of food available on West African food markets is imported from outside the region. The share of intra-regional trade has grown only slowly over time as shown in figure 1.6. However, these figures are

highly imperfect representations because of the generally poor level of trade flow records in the region. Most importantly, most food trade in the region is informal in nature and almost completely unrecorded.

FIGURE 1.6 Share of Intra and Extraregional Trade of Food in West Africa



Source: based on UNCTADstat 2020

Intraregional trade is constrained by limits on the free movement of goods in West Africa posed by physical, infrastructural, and political barriers (Torres and Seters 2016). As a result, markets are fragmented and staple food shortages and price volatility are common. Poor infrastructure and governance of the transport sector has led to high costs of moving goods by road or rail within West Africa. This situation mainly affects producers in rural areas because transport cost per ton kilometer from farm to primary collection markets tends to be more expensive than that from secondary markets to wholesale markets located in the countries' capitals (FAO 2015). In addition, the bad quality of infrastructure reduces market access based on the geographic distance between producers and consumers and by the availability and quality of connecting infrastructure. Buyers face high transaction costs for product aggregation and quality control, especially of perishable products such as fruits, vegetables, and animal products (FAO 2015). Other important barriers to trade are tariffs and import and export restrictions through bans or quotas implemented by many West African countries (Roquefeuil et al. 2014; Engel and Jouanjean 2013; World Bank 2015).

Being largely dominated by livestock and staple crops, intraregional trade within the ECOWAS region is largely informal and poorly documented. According to official trade data, intraregional trade involving livestock products, including cattle and small ruminants, represents the most important product category in terms of value. According to Tondel (2019), official data from CILSS/USAID for the 2013–15 period estimates the total value of livestock trade at US$400 million, six times higher than for cereals. This data likely underestimates the true trade value as most of the livestock transactions are informal and thus remain unrecorded (Valerio et al. 2020). Sahelian

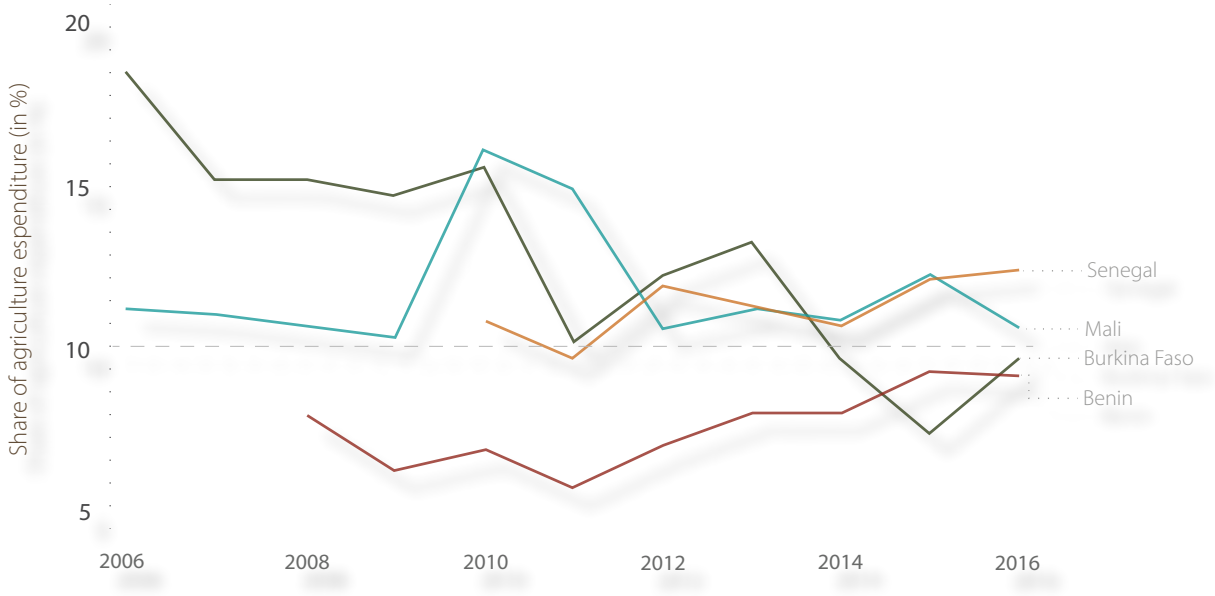
countries are the region's primary livestock producers, serving the coastal markets. The region's most commonly traded cereals include maize, millet, rice, and sorghum; the most frequently traded starchy roots are cassava, yam, and sweet potatoes. The largest sources of exports of maize are Côte d'Ivoire, Nigeria, and Burkina Faso (Maliki 2014). Burkina Faso, Mali, and Nigeria are the most important exporters of sorghum and millet. In contrast, coastal countries frequently export starchy roots such as cassava and yam to Sahelian countries. As in the case of livestock, intraregional trade concerning cereals and staples such as roots and tubers is often informal and thus not captured by official statistics. For example, it is estimated that 75 percent of regional trade in staples goes unrecorded (Nedelcovych and Mainville 2013).

DRIVERS: PUBLIC POLICY

To achieve maximum impact, public investments into agriculture are better spent on public rather than on private goods. While most activities within the food system such as agriculture and food production are private enterprises, their functioning relies critically on public goods that private actors are unable or unwilling to provide efficiently. Public spending can benefit food systems through productive investments into public goods that contribute to generating and disseminating technologies, reducing transaction costs, and attracting private capital (Goyal and Nash 2016). For example, investments in rural roads and market infrastructure can have significant effects on poverty and may boost trade. The resulting reduction in transport costs mean that farmers pay less for inputs while being able to retain a higher share of their product sales (Chamberlin et al. 2007; Khandker et al. 2006; Minten and Kyle 1999). Public investments in private goods are often inefficient and risk crowing out private sector investments (Goyle and Nash 2016).

Although mostly remaining below the CAADP Maputo target of 10 percent, ECOWAS member states have recently increased levels of public agricultural expenditure as a share in total expenditure. As part of the Monitoring and Analyzing Food and Agricultural Policies (MAFAP) program at FAO, data on these expenditures is available for four West African countries from 2006 onward (see figure 1.7 and figure 1.8). From 2006 to 2016, public agricultural expenditures are the highest in Mali and Burkina Faso in relative terms. For instance, Mali reached the 10 percent target over the entire period. Expenditures show strong yearly fluctuations, suggesting that macro developments have a large impact on the annual agriculture budget (figure 1.7).

FIGURE 1.7 Public Agriculture Expenditures Relative to Total Expenditures in Selected West African Countries

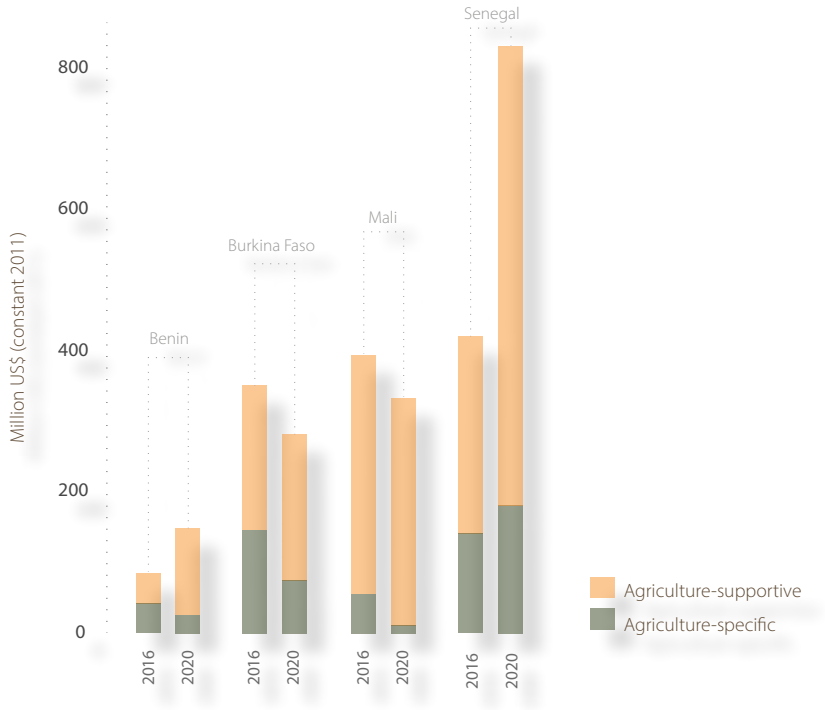


Source: based on FAO MAFAP 2020

Direct public support for agriculture has grown considerably between 2006 and 2016. MAFAP divides public expenditure in direct support (agriculture specific) and indirect support (agriculture supportive) to the sector. Agriculture-specific measures include producer support (for example, through fertilizer subsidies), other participants of the value chain such as suppliers, traders, or processors, and agriculture research. Agriculture-supportive measures include investments in rural infrastructure or general education. In the countries included in the MAFAP study, agriculture-specific expenditure has markedly grown between 2006 and 2016. For example, Senegal's agriculture-specific expenditure reached more than US$600 million in 2016, representing a more than twofold increase from levels seen in 2006 (see figure 1.8). Agriculture-supportive spending trends are more mixed in the examined countries with three in four countries reducing expenditure levels in these category over the reference period.

A large share of direct public support for agriculture is spent on input subsidies that frequently show limited effectiveness in raising agricultural yields. The majority of direct public support (agriculture-specific expenditure) is spent on fertilizer subsidies. In Mali, direct producer support accounts for almost all of the public expenditures in the agriculture sector. Estimates for Nigeria, Senegal, Ghana, Burkina Faso, and Mali suggest they spend US$425 million a year on input subsidies (Goyal and Nash 2016). For Nigeria, these estimates might even be conservative as state-level subsidies are not included (Searchinger 2020). While input subsidies are a popular tool among policymakers, a growing body of evidence from farm-level surveys strongly questions their effectiveness in sustainably raising agricultural productivity and reducing poverty (Goyal and Nash 2016; Jayne et al. 2018). Reasons why fertilizer subsidies often fail to significantly increase yields include weak fertilizer responses due to

FIGURE 1.8 Agriculture-Supportive and Agriculture-Specific Public Expenditures in Selected West African Countries (constant, 2011 US$)



Source: based on FAO MAFAP 2020

low soil organic matter, suboptimal agronomic practices, pest and disease infestations, inadequate formulations of subsidized fertilizer (Tittonell and Giller 2013; USAID 2019), and large inefficiencies in implementing support schemes (timing, quality, procurement, and so on). The ECOWAS Regional Agricultural Investment Program for Food Security and Nutrition (RAIPFSN, 2016–20) has called for harmonizing public support policies across member states to address the region's limited performance of fertilizer subsidy programs and the lack of cross-country coordination.

Higher returns to poverty alleviation and greater resilience to climate change could result from a shift in spending from private to public goods such as agricultural research and development (R&D) and improved extension services. High public expenditure on input subsidy programs reduces funds available for other, more impactful spending categories such as R&D (Goyal and Nash 2016). Despite evidence of high returns, estimated at 34 percent in Sub-Saharan Africa between 2000 and 2011, support to agricultural R&D in the region in Sub-Saharan Africa is generally low. Over the last decade, spending on agricultural research accounted for only 0.4 percent of agricultural GDP in Sub-Saharan Africa compared with 1.3 percent in Latin America and the Caribbean and 0.9 percent in South Asia. This also applies in large measure to the subregion of West Africa. Although agricultural spending has generally risen over the last decade in West Africa, agricultural research spending as a share of its agricultural GDP (AgGDP) has declined from 0.53 percent

to 0.33 percent, remaining far short of the New Partnership for African Development (NEPAD) target of 1 percent and falling considerably below levels seen in other Sub-Saharan African subregions (Stads and Beintema 2017a).

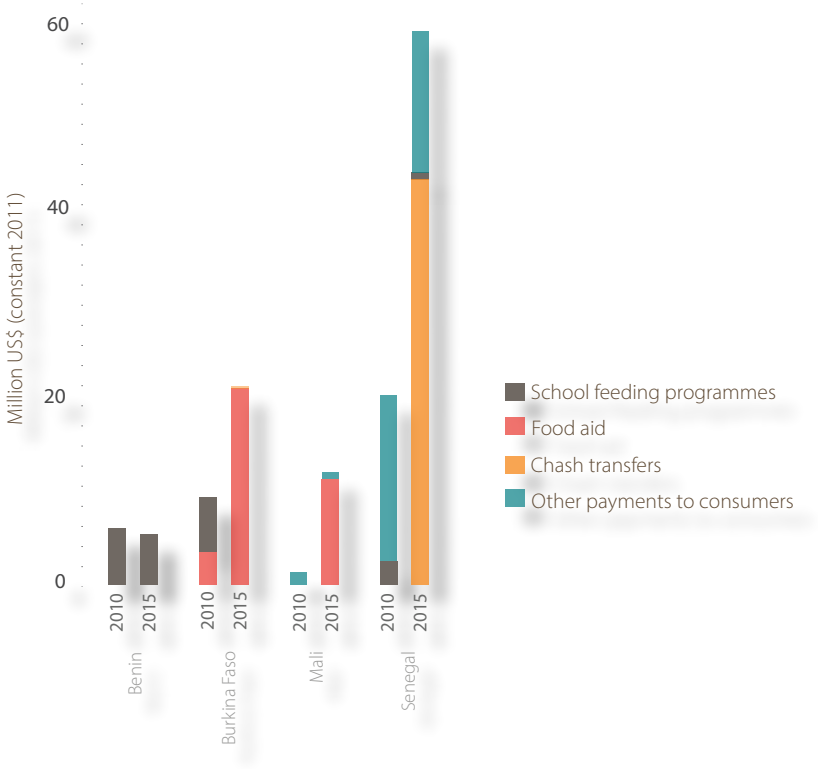
Investing in quality agricultural higher education is essential to ensure human capacity equal to the scale of regional food system challenges and opportunities. To inform research policy, the International Food Policy Research Institute's (IFPRI) Agricultural Science and Technology Indicators (ASTI) and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), a network of 105 universities in 37 African countries, have jointly initiated two online data portals. To support decision-making and the setting of priorities for agricultural training, the portals monitor trends related to student population, teaching staff, and available degrees. North-South collaboration can contribute to capacity building through facilitating knowledge transfers. For example, the Forum for Agricultural Research in Africa (FARA)-led Platform for African-European Partnership on Agricultural Research for Development (PAEPARD) facilitates African-European collaboration among farmer organizations, civil society groups, research and education institutes, and the private sector.

Public policies targeting demand side such as school feeding programs can play an important role in strengthening food security and improving nutrition outcomes, especially during crises. School feeding programs were one of the key responses to the growing food insecurity that followed the food crisis of 2008. In West Africa, school feeding systems exist in Cabo Verde, Côte d'Ivoire, Ghana, Mali, and Nigeria. These programs are a long-term social investment and contribute a productive safety net for children and their families (Bundy et al. 2009). There is no "one size fits all" approach for school feeding programs. They work best when addressing needs of the community, ensuring local ownership, and involving parents and the wider community (WB 2016).

Policies directly targeting consumers represent a small fraction of total agriculture expenditures. In Burkina Faso, Mali, and Senegal, public expenditures on demand side policies increased from 2010 to 2015, whereas in Benin they remained roughly the same. The largest increase took place in Senegal from US$20 million to around US$60 million (figure 1.9). These four countries differ in how much they spend on consumer policies; Benin, for instance, spends all its resources on school feeding programs. In Mali and Burkina Faso, transfers that reduce the cost of food, so-called food aid, play an important role. Senegal, however, transferred more than US$40 million in 2015 to consumers to raise their expenditure in food consumption (cash transfer). In Mali and Senegal, some consumer policy transfers cannot be sufficiently identified to allocate them to a specific category (other payments to consumers).

Other policy measures supporting consumers include temporary or permanent export bans, which have become relatively common in the region following the 2008 food crisis. Export restrictions are usually justified by those who implement them based on a national shortage, most often of basic foodstuffs. For example, Burkina Faso applies a large per capita tax on exported livestock and poultry; Nigeria has banned the export of certain staple foods such as rice and closed its border. In 2012, Burkina Faso's Ministry of Agriculture banned cereal exports, and in Mali, exports were subject to authorization. Liberia

FIGURE 1.9 Expenditures on Agricultural Consumer Policies in Selected West African Countries



Source: based on FAO MAFAP 2020

banned all food exports in 2008 in response to the crisis. Export restrictions create distortions in intraregional trade. In the countries where they are in place, export restrictions act as indirect consumer subsidies by keeping prices lower than they would be in case produce could be freely traded. On the other hand, export bans prevent trading partners from accessing competitive supplies. In importing countries, export bans create artificial scarcity and therefore negatively affect consumers prices.

Public policy should favor enhancing the long-term resilience of the wider food system, including agriculture production, and avoid discouraging private investments in the provision of subsidized goods. West African countries do not have enough financial resources to subsidize consumers and producers at the same time. Trade policy measures that aim to reduce price volatility through safeguards rather than protecting producers by permanently using fixed rates are also likely to be more achievable. Effective regional harmonization of regulations related to subsidies and other taxes could enhance competitiveness of West Africa's food sector and promote intraregional trade.

DRIVERS: GENDER INEQUALITIES

Persisting gender inequalities in terms of access to resources, education, and decision-making negatively affect food system outcomes. Women make critical contributions to West Africa's food system but continue to be seriously disadvantaged. While 75 percent of females are employed in the agriculture sector, they are less likely to head agricultural production units, have less access to higher value land, and usually own smaller farms (IPAR 2015). For example, household survey data for Niger suggests a 19 percent gender productivity gap associated with unequal access to resources and education, with negative implications for food security, undernutrition, and infant mortality (O'Sullivan et al. 2014). Due to low access to productive factors such as land and credit and to prevailing social norms, women dominate off-farm activities such as processing, where women's share (regional average) in employment amounts to 83 percent (Allen et al. 2018). Despite their high growth potential, public policies frequently overlook these downstream segments and rarely address gender-specific barriers (Staatz and Hollinger 2016). To enhance women's role in the food system, both issues relating to access to resources and entrenched power imbalances within and outside the household need to be addressed (O'Sullivan et al. 2014).

DRIVERS: LAND RIGHTS

Allocating and enforcing land rights mostly operates through a diverse and overlapping set of customary arrangements at the village or local level in rural West Africa. Increasing pressure on natural resources and the absence of written documentation regarding land use have given rise to land conflicts over inheritance and disputes among villages, farmers, and pastoralists. These elements, including lack of formal land rights, suggest that tenure insecurity may limit access to land, deter investment in agriculture, and lead to suboptimal yields (Goldstein et al. 2015). Other challenges associated with customary systems of land ownership are undefined boundaries, unclear rights and titles, and undocumented transactions (AUC-ECA-AfDB Consortium 2011).

While West African women generally have access to land, their decision-making in land management, control over the use of land, and ability to own land is virtually non-existent. This is especially true in the customary systems where land relations are largely informed by a patriarchal orientation where women are usually excluded in land management and inheritance. Women's rights to land are usually secondary and related to rights obtained through primary rights holders such as brothers, husband, fathers, or sons. There may also be shared rights that are vested in the community, such as access to wood fuel in the forest and non-timber forest products. Access to land and the uses to which the land can be put are also gender sensitive (AUC-ECA-AfDB Consortium 2011).

DRIVERS: POST-HARVEST LOSSES

Each year, a large share of food is lost during post-harvest handling, storage, and packaging. In Sub-Saharan Africa, post-harvest losses (PHL) for grains alone are estimated to range between 20 and 40 percent of total production, corresponding to the annual caloric requirement of at least 48 million people (Zorya et al. 2011). Rates of loss are even higher for horticultural crops, reaching 40 to 50 percent (Gustavsson et al. 2011). At present, West African countries are not on track for reaching the Malabo Declaration target of halving PHL by 2025 (AU 2018). Major reasons for PHL are poor infrastructure, harvesting methods, post-harvest handling procedures, and inadequate distribution policies. The COVID-19 pandemic has compounded structural causes for PHL. For example, Guinea, Senegal, and Nigeria are reported to have experienced potato harvest losses between 20 and 50 percent (Bancal and Kouamé 2020). Addressing PHL data constraints as well as improving both post-harvest handling techniques and market access could reduce PHL.

DRIVERS: CLIMATE CHANGE AND AGROCLIMATIC IMPACTS

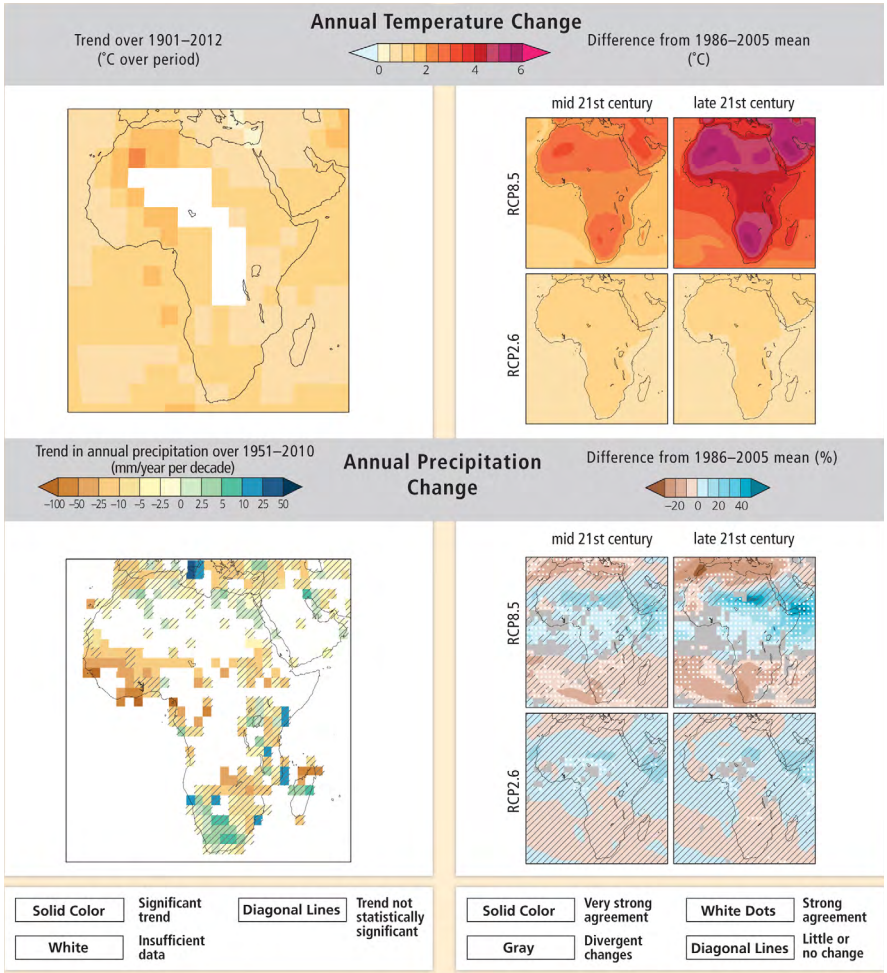
Climate change impacts are already evident globally, with changing weather patterns and extreme events among the many impacts affecting agriculture. In coming decades, climate change impacts on the stability of food supply will likely worsen dramatically. Climate change will challenge farmers with an array of climate risks, including lower and erratic rainfall, shorter rainy seasons, and a higher incidence of pests and diseases. The world is locked into warming of above 1.5°C given annual global emissions of about 37 gigatons (Gt) of CO2 equivalent (CO2e). If 580 Gt more of CO2e are emitted, the probability of exceeding warming of 1.5°C to rises above 50 percent (Hoegh-Guldberg et al. 2018). The IPCC projects that 1.5°C warming will cause periodic food shocks across regions and that warming beyond 2°C will cause sustained global food supply disruptions. Apart from food supply disruptions, rising atmospheric CO2 levels and more frequent climate shocks could also significantly decrease the availability of critical nutrients, further complicating the challenge of tackling food insecurity and malnourishment (Beach et al. 2019).

West Africa has experienced rising mean temperatures, decreasing precipitation, and more hydrological extremes such as drought and flooding. Average temperatures in West Africa have risen between 0.5°C and 0.8°C between 1970 and 2010 (Collins 2011; Field 2014). The recorded increase in average temperature varies across the region, with the lowest values over the Gulf of Guinea and the highest over the Sahel (Sylla et al. 2018). During the twentieth century, West Africa saw an overall decrease in rainfall, although annual precipitation rates have somewhat increased since the 1980s (Ibrahim et al. 2014; IPCC 2013). Yet recent studies point toward higher interannual variability, delayed monsoon onset, and early monsoon retreat (Diallo et al. 2012; Seth et al. 2013; Stocker et al. 2013). Variability observed on both annual and interdecadal time scales makes trends since 1960 difficult to categorize.

Trends of rising average temperatures and sea levels are expected to continue (see map 1.8). The rise in mean temperatures in the region is anticipated within a range of 1.5°C up

to 6.5°C by the end of the century, depending on the planet's future emission pathway (Sylla et al. 2018). In the medium term, Jalloh et al. (2013) simulate average temperature rises varying from 1.5° to 2.3° until 2050. Within the region, the Sahel is consistently projected to experience the strongest temperature increases (Sylla et al. 2018). Climate change brings about more violent cyclone activity by substantially increasing sea surface temperature and storm surges on coastlines, generating higher wind speeds and heavier precipitation, which makes disaster forecasting, preparedness, and management more challenging. An increase in the temperature of tropical sea surface by 1°C increases wind speed by three to five percent (Mbaye 2020). Sea levels are expected to rise between 40 and 80 cm, the increase dependent on tides and the strength of the wind or ocean swells triggered by storms off the coast. This causes sea level to rise and it leads to flooding, coastal erosion, and increased salinity of soils (USAID and USGS 2020).

MAP 1.8 Projected Temperature and Precipitation Changes



Observed and projected changes in annual average temperature and precipitation. (Top panel, left) Map of observed annual average temperature change from 1901–2012, derived from a linear trend. [WGI AR5 Figures SPM.1 and 2.21] (Bottom panel, left) Map of observed annual precipitation change from 1951–2010, derived from a linear trend. [WGI AR5 Figures SPM.2 and 2.29] For observed temperature and precipitation, trends have been calculated where sufficient data permit a robust estimate (i.e., only for grid boxes with greater than 70% complete records and more than 20% data availability in the first and last 10% of the time period). Other areas are white. Solid colors indicate areas where trends are significant at the 10% level. Diagonal lines indicate areas where trends are not significant. (Top and bottom panel, right) CMIP5 multi-model mean projections of annual average temperature changes and average percent changes in annual mean precipitation for 2046–2065 and 2081–2100 under RCP2.6 and 8.5, relative to 1986–2005. Solid colors indicate areas with very strong agreement, where the multi-model mean change is greater than twice the baseline variability (natural internal variability in 20-yr means) and ≥90% of models agree on sign of change. Colors with white dots indicate areas with strong agreement, where ≥66% of models show change greater than the baseline variability and ≥66% of models agree on sign of change. Gray indicates areas with divergent changes, where ≥66% of models show change greater than the baseline variability, but <66% agree on sign of change. Colors with diagonal lines indicate areas with little or no change, where <66% of models show change greater than the baseline variability, although there may be significant change at shorter timescales such as seasons, months, or days. Analysis uses model data and methods building from WGI AR5 Figure SPM.8. See also Annex I of WGI AR5. [Boxes 21-2 and CC-RC]. Source: Reprinted from "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change". IPCC 2014, p. 1207.

There is considerable uncertainty over future precipitation trends in West Africa. Long-term predictions of future precipitation are still highly uncertain given persisting discrepancies between global and regional climate models over both sign and magnitude of future precipitation changes (Dosio et al. 2019; Field 2014; Sylla et al. 2018). There has been high multidecadal variability in rainfall with prolonged dry periods over the last 50 years (Hollinger et al. 2015). The 1980s were very dry and are linked to the severe 1980s Sahel drought. Compared with the 1976–2005 reference period, recent regional modeling projects mean precipitation changes ranging between −10 percent and +10 percent by 2100. While climate predictions are relatively detailed for countries located north of The Gambia, temperature and rainfall data are less specific for countries further south.

There is a high likelihood of more frequent extreme weather events and a shift toward less frequent but more intense precipitation, along with more frequent drought. Extreme precipitation events affect human activities and natural systems to a much larger extent than slightly less rainfall overall (Parry et al. 2007). Regional climate models consistently predict fewer days with rainfall with longer dry spells and shorter wet spells over 70 percent of the land area. Drought frequency has dramatically increased, from an average of once every 12.5 years over 1982–2006 to once every 2.5 years over 2007–16. These droughts have also become more severe and prolonged, diminishing the productive capacity of the land. Modeling results also indicate more intense rainfall on wet days (Dosio et al. 2019; Field 2014; Sylla et al. 2016; Sylla et al. 2018). This suggests that both drought and widespread flooding may become more frequent in the coming decades (Sylla et al. 2018). Generally, projected changes in precipitation patterns are more pronounced under high-emission pathways, with the western Sahel likely to be most affected by the lengthening of dry spells (map 1.8) (Sylla et al. 2018). The region will likely witness a rise in torrid, arid, and semiarid climate conditions with the changing temporal distribution of rainfall and rising temperatures (Sylla et al. 2016a).

In the near term (2020–24), the Sahel might experience significantly wetter conditions than the recent past, leading to higher flood risks that may hurt agricultural production and displace large numbers of people. In line with the World Meteorological Organization's (WMO) seasonal forecasts, the Sahelian zones experienced a wetter-than-average rainy season in 2020. From Senegal to Ethiopia, record levels of flooding with extensive damages to fields and livestock have been reported. The overflowing of the Niger river has seen 226,000 persons displaced while 500,000 hectares of farmland have been severely damaged in northwestern Nigeria, triggering local price spikes (Smith 2020). According to the WMO's Global Annual to Decadal Climate Update (2020), wetter-than-usual conditions can be expected in the region through 2024. The latest WMO projection highlights the critically urgent need to review and adapt existing regional and national risk management arrangements and capacities.

Climate change in West Africa will reduce crop yields as well as labor productivity while the region's population grows, leading to less food availability per capita and rising food prices. Both the Sahel and West Africa are regarded as areas particularly sensitive to climate change. By some estimates, Africa could face a near double-digit reduction in crop yields and production volumes over

the next decade[16], as well as rising food prices by similar margins. Climate change will reduce suitability for major crops, especially beans, maize, and banana, and production will likely decline unless new cropping systems will be introduced (Rippke et al. 2016). A large body of existing studies consistently predicts decreases in crop yields and livestock productivity in West Africa (Palazzo et al. 2017 and references therein). For example, the IPCC (2014) projects that crop growing periods in West Africa may decline by an average of 20 percent by 2050, entailing a 40 percent drop in cereal yields and a fall in biomass production for livestock without adaptation. These decreases are mainly associated with expanding arid and semiarid agroecologies caused by longer and more frequent dry spells and slightly reduced overall precipitation. Comparing global climate models and assuming no productivity changes, that is, no changes in management, improved varieties, and so on, Jalloh et al. (2013) report median crop decreases of 20 percent for irrigated rice, 14 percent for sorghum, and between 5 and 7 percent in the case of maize, soybeans, and groundnuts. As the region's population is growing and expected to grow at a high rate, the projected yield reductions are estimated to result in rising food prices, complicating food access for resource-poor strata of the population and thus exacerbating food insecurity (Zougmoré et al. 2016).

Livestock is important in West Africa and climate change may negatively affect the sector. In the Sahelian countries, the livestock sector's share of GDP ranges from 12 to 29 percent, while in coastal countries it is around 6 percent.[17] Cross-border trade of animal products is the second source of export revenue for Niger and accounts for 30 percent of Chad's exports. According to CILSS and USAID estimates, intraregional livestock trade (75 percent cattle, 25 percent small ruminants) was worth approximately US$400 million per year in the 2013–15 period, six times more than intraregional cereal trade (Tondel 2019). Pastoralism provides growing urban populations with meat at competitive prices and secures livelihoods for millions of primary producers and also for tens of thousands of people employed in livestock value chains. Climate change poses significant threats to the sector. Livestock are most directly affected by heat stress and water scarcity and also by reducing the quality and quantity in forage resources, altered suitability of species and breeds of livestock, changing livestock mobility patterns, and rising incidence of disease (Thornton et al. 2014). Despite the significance of the livestock sector to West African economies, studies quantifying climate change impacts on the sector are limited (Thornton et al. 2014).

In the long term, transhumance may no longer serve as an effective climate hazard adaptation strategy for pastoralists. Pastoralists used an opportunistic operating system of grazing resources to face seasonal forage crisis by using the ecological diversity and the complementarity between the various agroclimatic areas. While widely seen as an effective way for ongoing climate change adaptation and sustainable natural resource management, climate change and farm expansion have made it challenging for traditional pastoralists to feed animals and provide them with water. Pastoralists are migrating sooner to the humid areas, staying longer, and sometimes not going back (CILSS, 2019). While this helps pastoralists and their

[16] Current projections likely underestimate yield/productivity reductions as possible impacts from declining labor productivity due to climate-change induced increases in heat stress are not yet considered (Hertel and Lima 2020).
[17] Dosio et al. 2019.

livestock, farmers are unhappy with the influx of people and livestock and the need to share scarce land and resources. Concern among farmers in the receiving areas in the Sudanian zone (400–600 mm) has increased. These new conflicts are related to climate change effects of depleting the quality and quantity of natural resources in the Sahelian belt (less than 300 mm per year). Without robust restoration programs and with harsher climatic conditions, the availability of forage biomass and the nutritional value of grazing are decreasing.

Artisanal fishing in both fresh and marine waters is negatively affected by climate change. West African fisheries are critical to the food and nutritional security of an estimated 200 million people and to the livelihoods of over 10 million people employed in the fisheries sector (Belhabib, Sumaila, and Pauly 2015). In Ghana alone, 2.2 million people depend on fishing for their livelihoods, including nearly 125,000 artisanal fisher folk. Rising water temperatures and acidification levels damage many fish species' physiology, including their size, value, and their reproductive capacity, leading to declining stocks. Changes in water temperature cause species to migrate and diminish the number and size of catches. Local fishers in West Africa report that that some previously abundant fish species are increasingly scarce and even disappearing. For example, the sardinella fish species, which used to be abundant in Senegalese seawaters, have now disappeared. From 2000 to 2050, fish landings of 14 West African countries are modelled to decline by about 8 percent and 26 percent depending on differing carbon emission scenario pathways (Lam et al. 2012). Reaching approximately 20 percent of the region's total fish production, inland fisheries make an important contribution to the region's food and nutrition security (Katikiro and Macusi 2012). Both increased demand for dam infrastructure and decreasing precipitation will affect production of inland fisheries by reducing floodplain zones used for seasonal inland fishing (Zougmoré et al. 2016).

SHOCKS: ZOONOTIC DISEASE AND OTHER PESTS—EBOLA, COVID-19, FALL ARMYWORM, LOCUSTS

West Africa, like many parts of the world, has been exposed to diverse types of zoonoses, insect infestations, and diverse crop and animal disease. These shocks disrupt food systems, damage crops or decrease yields, inhibit trade, and have devastating negative effects on livelihoods, food security, and the overall economy. These diseases and pests include the EVD, locusts, grasshoppers, fall army worm, and the SARS-CoV-2 virus and related COVID-19 disease. Outbreaks of transboundary animal diseases (TADs) such as foot-and-mouth disease, swine fever, rinderpest, avian influenza (HPAI), and peste des petits ruminants (PPR) have been equally damaging to different countries in the region. There are equally slow-onset agriculture-related illnesses affecting human health, such as aflatoxins and antimicrobial resistance.

The EVD periodically emerges in West Africa. Formerly called Ebola hemorrhagic fever, this zoonotic disease jumps from animal reservoirs to humans and is often fatal. Four of the five known Ebola viruses cause human illness. On August 8, 2014, the World Health Organization (WHO) declared a Public Health Emergency

of International Concern (PHEIC) for Ebola in West Africa, a designation signaling events with risk of potential international spread or requiring a coordinated international response. During this epidemic, EVD affected primarily Guinea, Liberia, and Sierra Leone and spread to Mali, Nigeria, and Senegal. The outbreak was fatal to many and also adversely affected agriculture, food security, and nutrition in Guinea, Liberia, and Sierra Leone. National agriculture production decreased by 8 percent and 5 percent respectively in Liberia and Sierra Leone. Guinea suffered PHL of 40 to 50 percent. Food system disruptions, reduced economic activity, and loss of livelihoods and jobs reduced household income, led to volatile food prices, and reduced purchasing power.

The desert locust *(Schistocerca gregaria)* is considered the most destructive migratory pest in the world, found in various parts of Africa, Asia, and the Middle East. Locusts are highly mobile and can form swarms containing millions of locusts, leading to devastating impacts on crops, pasture, and fodder. There have been six major plagues in the twentieth century, with a major upsurge in 2003–05. According to the FAO, this major locust crisis has affected the livelihoods of about eight million people and control campaigns have cost more than US$570 million, with nearly 13 million liters of pesticides used to contain the plague. The current outbreak in East Africa is one of the most serious in the last 25 years. As of Autumn, 2020, the risk of a locust invasion into the Sahel from eastern Africa remained low (FAO 2020b). Other grasshopper species (such as the Senegalese grasshopper) and bird species also significantly affect food crops in West Africa.

Intensifying cross-border trade and the effects of climate change are increasing biological invasions by crop pests and diseases unknown in the region, with unknown but likely negative impacts on food and cash crops. These are mainly the larger grain borer (LGB), fruit flies (that is, ***Bactrocera dorsalis***), tomato leafminer (***Tuta absoluta***), fall armyworm (***Spodoptera frugiperda***), papaya mealybug (***Paracoccus marginatus***), banana bunchy top virus, palm red weevil (***Rhynchophorus ferrugineus***), and potato downy mildew (***Phytophthora infestans***).

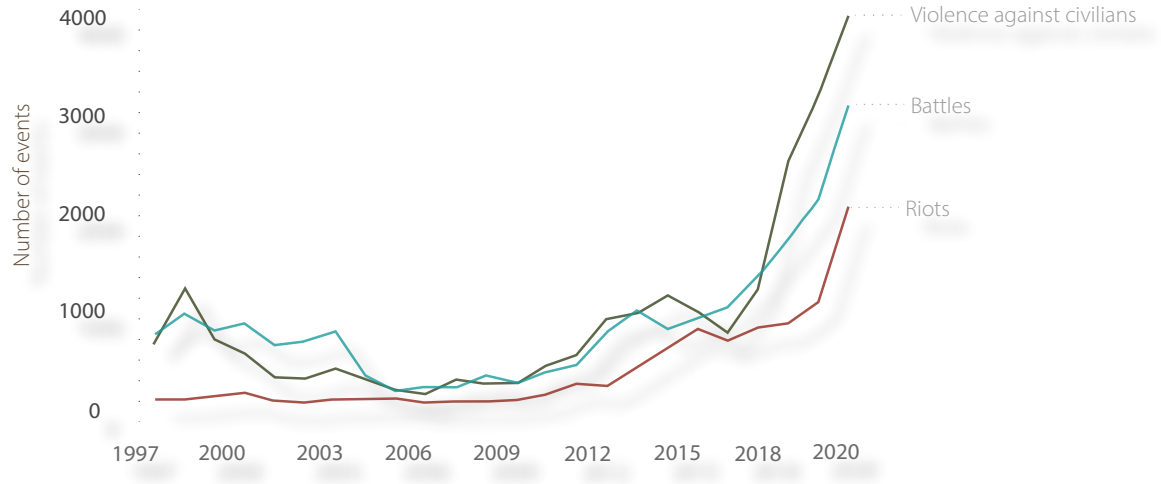
Aflatoxins are highly poisonous compounds that contaminate a range of crops, pose serious threats to human health, and reduce export earnings. Aflatoxins are produced by the Aspergillus fungus. After first infecting plant pod or cob, the toxin is produced in large quantities both before and after harvest depending on field and storage conditions. Contaminating maize, groundnut and peanut-based products along the entire value chain, aflatoxins affect both human health and trade in West Africa. At high doses, aflatoxins can cause acute poisoning (for example, liver cirrhosis) and death. Cumulative buildup can cause liver cancer and chronic immunosuppression. Aflatoxins also contribute to severe undernutrition in children. As of 2010, Aflatoxin contamination was estimated to contribute to an estimated 7,761 cases of liver cancer per year in Nigeria (Narayan et al. 2014). Recent studies estimate high levels of contamination of rice in West Africa. Aflatoxin-susceptible commodities that do not meet internationally accepted standards result in an estimated loss of export earnings of between €400 and €600 million a year (Okoth 2016).

SHOCKS: INSECURITY, VIOLENCE, AND CONFLICT

Several parts of West Africa have suffered from various types of insecurity, violence, and protracted conflict from insurgencies, illegal trafficking of drugs and arms, or conflict over access to natural resources (see figure 1.10 and map 1.9). Between 2011 and 2019, the number of violent events in the region jumped from 581 to 3,617 (OECD/SWAC 2020a). The number of associated fatalities rose from 3,361 recorded in 2011 to 11,911 in 2019. These trends in conflict and violence have taken place parallel to a globalized security environment where the boundaries between what is local and global, what is domestic and international, or what is military and civilian-related are increasingly blurred. Analysis of conflict and violence suggests several defining features in West Africa:

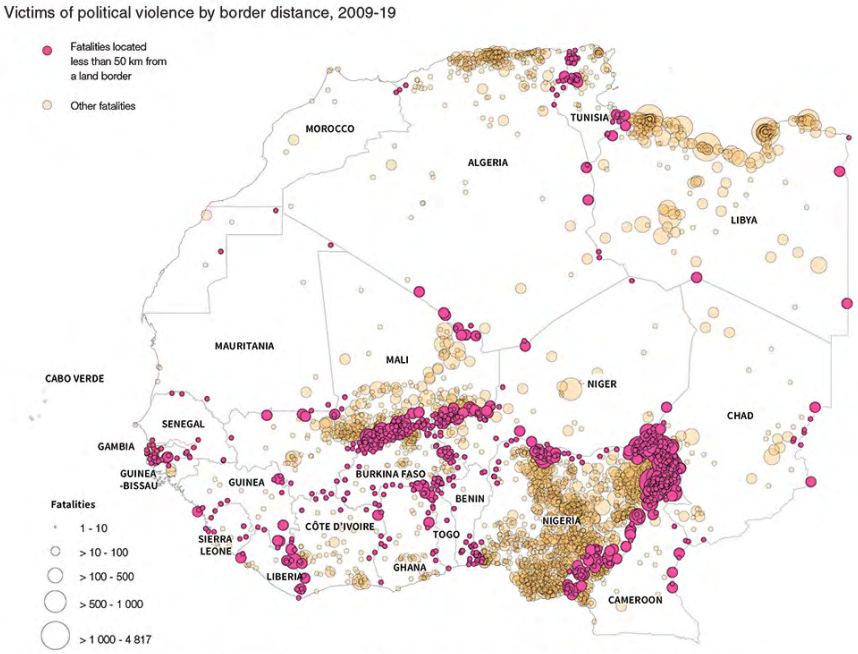
- Violence is increasingly targeting civilians
- Forty percent of violent events take place within 100 kilometers of borders
- Military intervention may not lead to long-term stability
- Most conflicts are local and do not spread
- One-half of the conflicts are low intensity, lingering, and spatially clustered; the other 50 percent are spatially clustered and high intensity
- Political systems are the primary reason for conflict, not natural resources
- Ethnicity and religion are used to further goals.

FIGURE 1.10 Evolution of Violent Events by Type in West Africa, 1997–2020



Source: based on ACLED 2020

MAP 1.9 The Geography of Conflict in North and West Africa



Source: © OECD/SWAC 2020a

Competition over land and other scarce resources is increasingly turning violent in Sahelian countries and may intensify with climate change. Dwindling resources, shifting livelihood patterns, the transformation of agropastoralist systems, and—perhaps most importantly—weak capacity and contested legitimacy of government institutions, together help explain the rising number of violent clashes. A main driver of conflict between farmers and herders in the Sahel has been policies that disrupted the relationships between pastoralists and farmers. Combined with increasingly scarce resources and high population growth, the support for agricultural lifestyles has led farmers to encroach on traditional pastureland. Diversification of economic activities and human and livestock mobility in quest for livelihoods (water, pasture, and financial resources through outmigration) are socioeconomic strategies adopted by agropastoralist families to face the challenges of natural resource scarcity and water deprived ecosystems. Sedentary farmers are investing in livestock to face risk while pastoralists are investing in lands to secure their livelihoods. More than 3,600 people died in conflicts between farmers and herders in Nigeria between January 2016 and October 2018, largely over land, water, and access to pastures.

Access to water is increasingly becoming a flash point due to climate change effects of longer dry spells and more frequent drought. Inter and intracommunity conflicts arise from discrepancies over access and management of pastures and water resources (seasonal water bodies and pastoral watering holes). Water shortages after the 1984 drought particularly reduced crop yields and led farmers to expand the total area under production—including into herder migration routes—and advance sowing dates. At the same time pastoralists, having more trouble finding grazing grounds during the dry season, also had to encroach on farmers' fields earlier and

for longer than normal, hurting farmer crops. Since the frequent droughts in the 1970s and 1980s, the dichotomy between pastoral and agricultural livelihoods within families and farming systems has become less marked.

Local government institutions are often unable to reconcile the competing interests and increasing intracommunal tensions with a dwindling resource base. While increasing pressure on land and other resources heightens intracommunal tensions, the inability of institutions—whether traditional or set up by the central state to mediate these tensions and regulate access to resources—is at the heart of the violent turn. In Chad, livestock population growth increased tremendously on the heels of the oil boom; 30 percent of Chad's 114 million head of cattle graze around Lake Chad.

Food insecurity and conflict are interlinked. There are three major hotspots in West Africa for food insecurity: the Lake Chad Basin which consists of subnational areas in Cameroon, Chad, Niger, and northern Nigeria; the Central Sahel (Liptako Gourma region) overlapping between Burkina Faso, Mali, and Niger; and eastern Mauritania. In these areas, the presence of armed groups led to massive displacement of people, destruction or closure of basic social services, and disruption of productive activities, markets, and trade flows. These hotspots have several common features. They are cross-border and located in remote areas with an isohyet of less than 300 millimeters and with harsh climatic conditions. Except for the region around Lake Chad, these areas have low population density a low level of basic services and weak presence and authority of states.

The increased incidence of conflict and fragility in West Africa is interacting with the food insecurity challenge in complex ways. Conflict, forced migration, and food insecurity can become interlinked and create a vicious cycle for rural populations. Preexisting land and water disputes among farmers, between farmers and herders, and between herders are more frequent. It is often thought that climate-conflict linkages result from different livelihood groups directly competing for natural resources such as land and water. Instead, one example from Lake Chad shows that uncertainty can be at the root of conflict. Uncertainty over who can access and use these natural resources at different times given changing weather patterns (or changes in population dynamics with incoming climate migrants). Because many conflicts occur in rural areas and target productive agricultural assets such as infrastructure, land, and livestock, the economic impacts often hit the agriculture sector, particularly women farmers, disproportionately hard.

Food security outcomes have worsened significantly in conflict-affected areas of Burkina Faso, Mali, Niger, Chad, and northeastern Nigeria. As a result of conflict, crops are often lost as farmers are forced off their fields and the provision of crucial services is interrupted. Border closures can restrict trade and worsen food insecurity as noted above. One underlying driver is increased uncertainty over access to natural resources, partly driven by population growth, as West Africa's labor-to-land and livestock-to-land ratios are rapidly deteriorating, leading to a vicious cycle as fallow periods are reduced, soil erosion and nutrient mining increase, and forests, vegetative cover, and biodiversity are lost—further increasing pressure on a diminished base.

The lack of presence of state systems and functional local government and security forces creates an institutional void, making access difficult for outsiders. This lack limits access to basic services, local participation in governance functions, control of borders, and providing essential security that is a prerequisite for socioeconomic development. These limitations are particularly acute for pastoralist

communities, who are underrepresented in local public institutions, which prevents both communities and local government from addressing the agriculture- and livelihood-related drivers of conflict and fragility and their consequences. Therefore, it is important to build capacity in local institutions to design and implement community-based approaches.

Regional institutions such as the ECOWAS have played a pivotal role in reducing insecurity and ending conflicts. The inclusion of civil society in peace deals and national dialogue enabled agreements to take hold, supported by strong post-conflict leadership and foreign assistance for reconstruction and development. Similar investments are required for today's problems, but at a more decentralized level of government.

1.5 EMERGING TRENDS IN AGRICULTURE PRODUCTION AND THE FOOD SYSTEM

This section summarizes important trends resulting from the food system drivers identified above:

- Land use changes and land degradation
- Stagnant agricultural productivity
- Worsening food insecurity
- High level of food prices and food price volatility
- Shifting demand patterns
- Agribusiness sector in transformation.

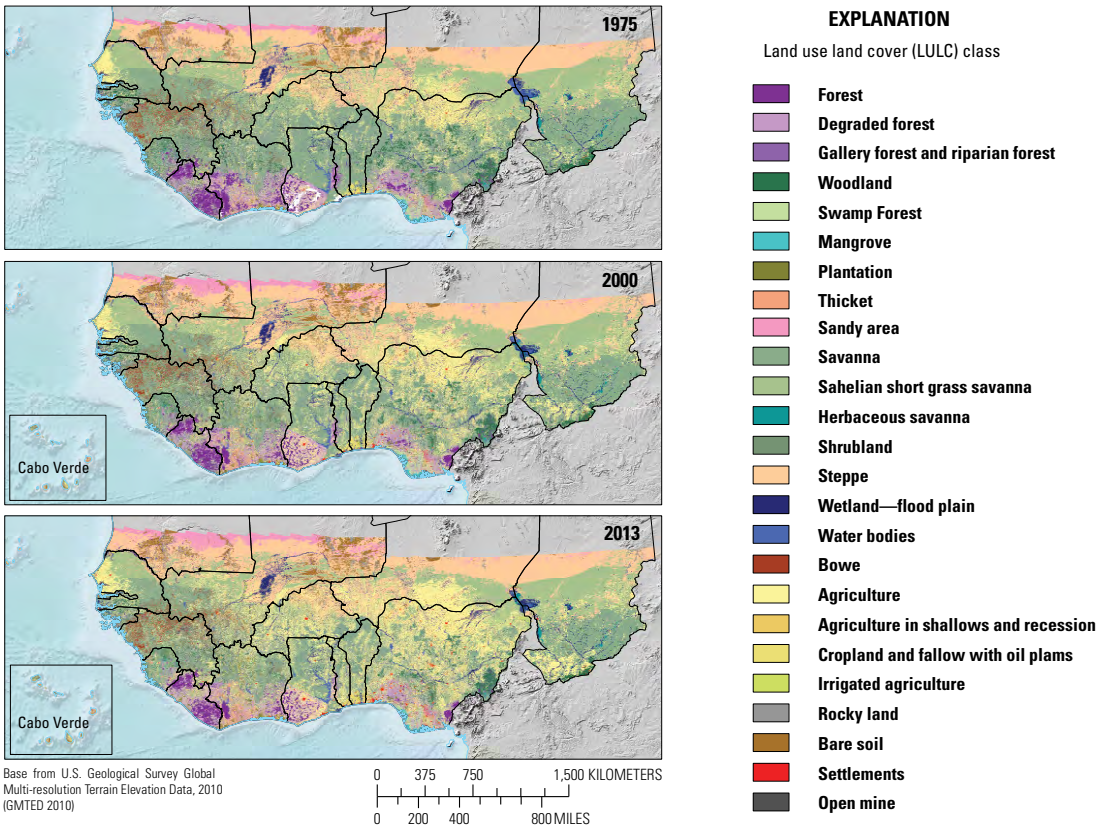
LAND USE EXPANSION AND SOIL EROSION

Changes in land cover have been significant over the last fifty years. Acreage expansion in West African farms doubled in area between 1975 and 2013. Vast areas of savanna, woodland, and forest landscape have been replaced or fragmented by cropland. Meanwhile, villages, towns, and cities have grown in area—taking up 140 percent as much land as they had in 1975. More than a third of the dense forest cover present in 1975 was cleared for farms and settlements. In savanna and steppe landscapes of West Africa, drought and unsustainable land use practices have degraded the vegetative cover, contributing to a 47 percent increase in sandy areas. Climate variability and change have and are impacting West African land cover by changing the amount and timing of water availability to vegetation (CILSS 2016).

Cropland has expanded rapidly, first along main transportation routes and now across the whole region. Between 1975 and 2013, the fastest average annual rates of cropland expansion were in Togo, Benin, Chad, Mauritania, and Burkina Faso (map 1.10). The area covered by crops doubled, reaching a total of 1,100,000 square kilometers, or 22.4 percent of the land surface during these 38 years. In every country, agriculture is exerting pressure on the natural landscapes, replacing and fragmenting savannas, woodlands, and forests. Only scattered protected areas remain and many are degraded and isolated within the

agricultural landscape. These protected areas are particularly visible in Burkina Faso, Ghana, Togo, Benin, and Nigeria. Chad and Liberia still maintain great expanses of unbroken wilderness. But change has also begun there (CILSS 2016).

MAP 1.10 Land Use Change in West Africa, 1975 – 2013



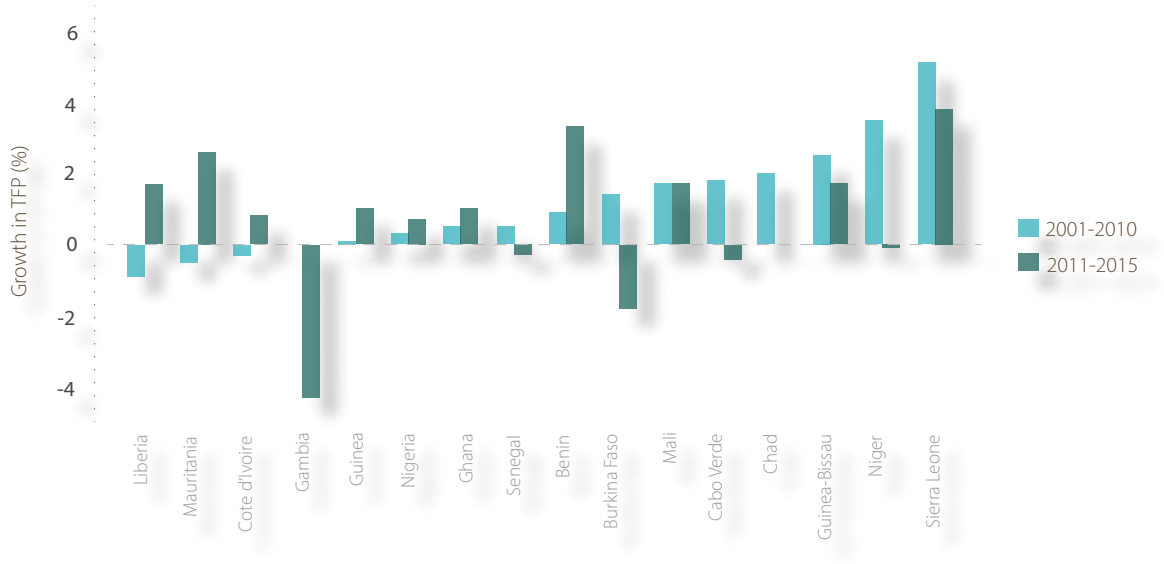
Source: Cotillon 2017

Widespread soil erosion causing declining levels of soil fertility is a major threat to West Africa's food security and a key production constraint. Falling soil fertility is frequently considered to be the single-most critical factor threatening food security in Sub-Saharan Africa. Nearly 90 percent of rangelands and 80 percent of farmlands in the West African Sahel are seriously affected by land degradation of which soil erosion is a major contributor. Senegal, Ghana, Mauritania, Nigeria, Niger are among the countries most heavily impacted on the continent. Soil erosion in the region is mainly caused by deforestation, removal of topsoil by water and wind, or unsustainable agricultural activities such as intensive tillage. Soil erosion is accelerated by the region's demography-driven land use changes such as rapid expansion of agricultural land, reduced length of fallow periods, and the increased use of firewood. Unless sustainable land management practices are deployed at a much larger scale than is presently the case, both the projected intensification of agricultural activities and the anticipated rise in extreme weather events are expected to further aggravate soil erosion (FAO 2015).

STAGNANT PRODUCTIVITY

Agricultural productivity varies considerably across West African countries. The measure of agricultural Total Factor Productivity (TFP) can be used to determine how efficiently the totality of agricultural inputs (for example, land, labor, capital, and material) are used to produce agricultural output. It is measured as the ratio of total agriculture output to total production inputs (IFPRI 2019). Thus, positive TFP growth implies that more output is produced from a given level of agricultural inputs. The growth rate of agricultural TFP varies strongly for West African countries over time (figure 1.11). In the recent period 2011–15, Burkina Faso, Cabo Verde, Chad, The Gambia, Niger, and Senegal have exhibited negative agricultural TFP growth rates. Over the time span, both Sierra Leone and Benin have shown more positive trends with more than 3 percent of agricultural TFP growth, respectively.

FIGURE 1.11 Agricultural Total Factor Productivity (TFP) Growth Rates for West African Countries

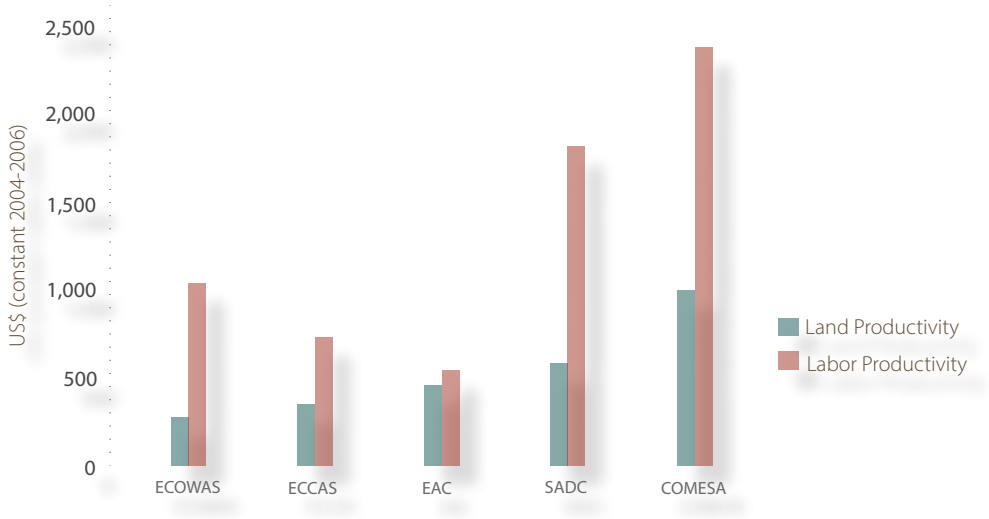


Source: based on IFPRI 2019

Agricultural land productivity in ECOWAS countries ranks lowest among African economic regions. Unlike TFP, partial factor productivity (PFP) measures such as land and labor productivity allow for comparisons of productivity related to these specific production factors. Land productivity is calculated as the ratio of total output to total area under cultivation and labor productivity as the ratio of total output to the number of economically active persons in the agriculture sector. PFP measures typically show larger growth rates than TFP. Growth in output per worker and output per hectare can result from more intensive use of other inputs such as fertilizers, while TFP nets out an increase in these inputs (Fuglie and Nin-Pratt, 2013). Compared with other African economic areas, only the

Southern African Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA) show higher levels of labor productivity than ECOWAS (figure 1.12). ECOWAS, however, lags behind all other economic areas on the continent in terms of land productivity.

FIGURE 1.12 Land and Labor Productivity for ECOWAS and Other Economic Regions, 2015



Source: based on IFPRI 2019

A**gricultural productivity remains low for reasons such as poor agricultural practices, lack of modern inputs, and limited market access.** In addition to low soil fertility, another crucial limiting factor is water availability with over 90 percent of agriculture in West Africa depending on rainfall alone. Soil cultivation techniques are still far behind what has been adopted in most of the world. Agricultural productivity also is inhibited by underdeveloped linkages between farmers and markets, limited access to affordable and reliable high quality seeds and fertilizer, and a lack of information on new agricultural technologies and best practices. As a result, the region has experienced some of the lowest per hectare crop yields in the world. Across Sub-Saharan Africa, yields of most important cereals still reach only 25 percent or less of potential, contributing to declining per capita food production (Mutegi and Zingore 2014). For example, cereal yields in West Africa average between 1 and 2 MT/ha compared with 7 and 9 MT/ha for wheat and maize in Western Europe (OECD/SWAC 2013). In the case of cassava, a major food staple in the region, smallholder farmers' yields vary between 5 and 10 t/ha on average. Better growing conditions and improved seeds have led to significantly higher yields reaching up to 35 t/ha (Adiele et al. 2020). The low productivity levels of agriculture in West Africa do not meet the growing demand for food from urban centers and the region is increasingly dependent on food imports.

WORSENING FOOD INSECURITY AND NUTRITION OUTCOMES

Food insecurity has recently worsened after improving for several years. The prevalence of undernourishment (PoU) is an estimate of the percentage of the population whose habitual food consumption is insufficient to provide the dietary energy levels required to maintain a normal active and healthy life. Undernourishment in West Africa exhibits the highest rise in Sub-Saharan Africa. The prevalence of undernourished people in West Africa has increased from 10.4 percent in 2012 to 15.2 percent in 2019. In 2019, 12 million people in West Africa and the Sahel comprising 15 countries were in crisis or worse (CH Phase 3 or above). The highest numbers were in northern Nigeria (5.0 million), Cameroon (1.4 million), Niger (1.4 million), and Burkina Faso (1.2 million). Around 48 million are "stressed" (CH Phase 2) with minimally adequate food consumption; they are unable to afford some essential non-food items without resorting to harmful coping strategies. They were likely to slip into a higher phase of acute food insecurity if they faced an additional shock or stressor (FSIN and GNAFC 2020).

Since 2010, malnutrition trends in West Africa are worsening again (table 1.6). Nigeria, with half of West Africa's population, has faced deteriorating commodity prices while Niger has faced population displacements and civil insecurity. In Mauritania, local food supplies are stretched by the influx of refugees, while Guinea has suffered localized production shortfalls as it recovered from the EVD. Food security in Nigeria has worsened by a depreciating currency, leading to high inflation, also reflected in food prices, especially rice, rising sharply in the second half of 2016 (FAO and ECA 2018). In addition, in northeastern Nigeria, civil conflict has left millions in need of urgent assistance. Based on the Cadre Harmonisé (CH) analysis of March 2018, 2.9 million people were deemed severely food insecure during the 2018 lean season (June to August), although the situation improved in 2017 (FAO and ECA 2018). While Ghana and Cabo Verde have relatively low prevalence of hunger and malnutrition, 12 percent of the total ECOWAS population is undernourished and there are alarmingly high figures for the Sahelian zone.

TABLE 1.6 Undernourishment in Africa and West Africa, 2005–19

	Prevalence (%)					Number (million)				
	2005	2010	2015	2017	2019	2005	2010	2015	2017	2019
Africa	21.0	18.9	18.3	18.6	19.1	192.6	196.1	216.9	231.7	250.3
West Africa	13.8	12.1	14.3	14.6	15.2	36.9	37.0	50.3	54.2	59.4

Source: based on FAO 2020a

Many different types of risks and shocks lead to food insecurity, and it is prevalent in diverse types of households. The growing intensity and severity of extreme weather events contributed to the increased number of people in food crises in 2019 relative to 2018. The level of acute food insecurity in the Sahel was 3 percent higher than in 2018, when pastoralist areas faced prolonged dry spells compounded by conflict and insecurity. Recurrent shocks, such as localized deficits in cereal and forage production arising from drought or floods, have eroded people's coping capacities. Food insecurity has historically been most common

in rural areas. Yet in low-income countries, 50 percent of urban residents are food insecure compared with 43 percent in rural areas (FAO's Food Insecurity Experience Scale) (Tefft et al. 2017).

Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation. Stunting in children under age five captures the effects of long-term deprivation and disease that often starts with maternal malnutrition. Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median (WHO 2014). While between 2000 and 2019, overall prevalence of malnutrition declined both on the African continent and the subregion of West Africa, the absolute number of stunted children increased over the same period (table 1.7). In 2019, the prevalence of stunting amounted to 27.7 percent in West Africa, which is slightly below levels recorded at the continental level.

TABLE 1.7 Prevalence and Number of Stunted Children under the Age of Five in Africa and West Africa, 2000–19

	Prevalence (%)		Number (million)	
	2000	2019	2000	2019
Africa	37.9	29.1	49.7	57.5
West Africa	36.6	27.7	14.8	17.8

Source: based on UNICEF, WHO and WB 2020

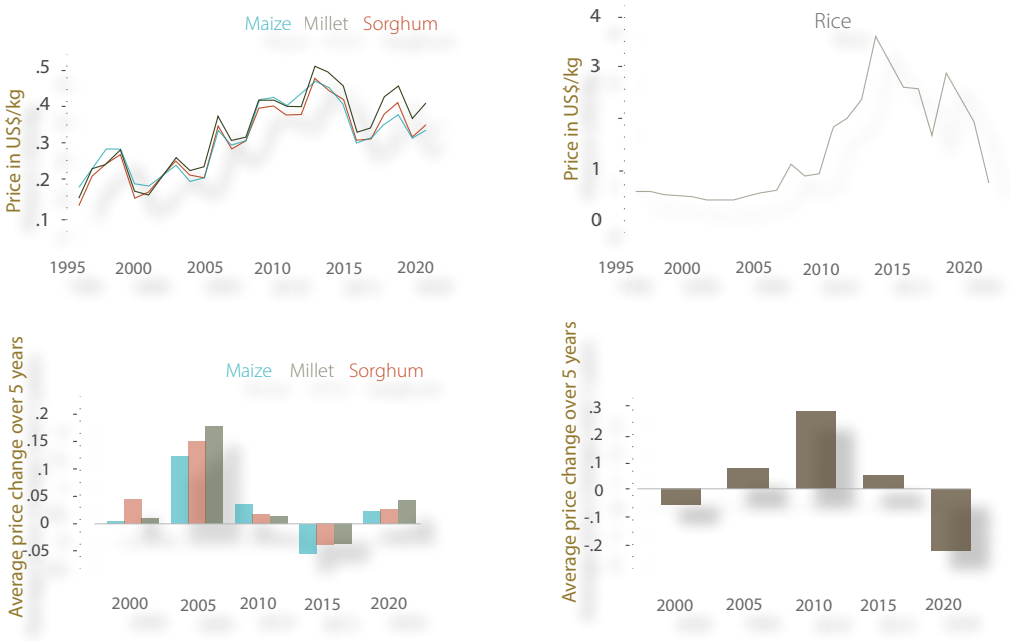
In West Africa, 25 percent of adults are overweight (17.6 percent) or obese (7.6 percent); incidence is higher in urban than rural areas and coexists with high rates of undernutrition. As elsewhere in the world, this situation reflects rapid shifts in diet and activity that take place as certain segments of the population become more prosperous (van Wesenbeeck 2018). Obesity in West Africa is most pronounced among women in urban areas, particularly in Burkina Faso, Ghana, Niger, and Togo, while rates are similar for men in rural and urban areas. These results differ from global trends that show that body-mass index is increasing equally in urban and rural areas (Jonas et al. 2019). The rising prevalence of overweight and obesity in the region, and increases in diabetes, hypertension, and other noncommunicable disease parallel trends in other parts of the world. They are strongly affected by changing consumption patterns discussed below.

HIGH LEVEL OF FOOD PRICES, HIGH SENSITIVITY TO PRICES, AND MARKET VOLATILITY

High and volatile food prices contribute to widespread food and nutrition insecurity by reducing purchasing power of large population segments. Food prices in Sub-Saharan Africa are 30 percent to 40 percent higher than in the rest of the world at comparable levels of per capita income (Allen 2017). Strong fluctuations in production, combined with weak spatial market integration and low volumes of marketed output, contribute

to high seasonal and interannual price volatility (see figure 1.13). Risks driving food price volatility include uncertain availability, timeliness, and quality of inputs, advisory services, and finance. Combined, these risks and uncertainties act as strong disincentives for producers to invest in productivity-enhancing technologies. They also discourage other private actors from investing in input supply, support services, marketing, and processing and other food businesses. The situation is compounded by the general lack of access to improved risk-management products and services by producers and other food supply chain actors. Higher food prices and strong food price volatility have a negative impact on purchasing power and result in a welfare loss for households. Given the strong reliance on food markets and the subsequent exposure and sensitivity to food prices, access to food and food prices are strong determinants of food insecurity.

FIGURE 1.13 Price Trends for Selected Food Staples in West Africa, 1995-2020



Source: based on WFP-VAM 2020 and IMF 2020

Price spikes are common when the multitude of agroclimatic, socioeconomic, security, and zoonotic shocks affect countries in the region. Erratic government interventions and spillovers of international price volatility further complicate the picture. The sharp price increase of imported rice in 2008 can be explained by export restrictions in Asian rice producing countries in the wake of the global 2008 food price crisis. Ad hoc policy decisions and reversals create an uncertain and risky business environment for market actors. Price volatility appears to be lower for processed and tradable food than for non-tradable food; prices vary more in secondary cities than major ones; and maize price volatility is actually higher in countries with the most active intervention to stabilize maize prices (Minot 2013). Favorable conditions for regional and international trade can arguably contribute to reducing food price volatility more effectively than traditional price stabilization efforts, e.g., through allowing food trade flows from areas with surplus production to areas with production deficits.

EVOLVING FOOD DEMAND AND RELATED OPPORTUNITIES

Agriculture is an engine for growth and poverty alleviation in West Africa and the wider continent. Africa as a whole has experienced faster agricultural growth (+4.6 percent from 2000–17) than the global average over the same period (+2.9 percent). There is further headroom as African agriculture could be two to three times more productive if it intensified further (Goedde et al. 2019). Increases in agricultural productivity have twice as much impact on reductions of extreme poverty than productivity gains in other sectors (Ivanic and Martin 2018).

Despite this strong output growth, agricultural production in West Africa has not kept pace with demand growth and shifts in consumer preferences. This is particularly pronounced with respect to many food staples such as rice, livestock products, and processed products. Productivity growth has been inconsistent and slow compared with other regions. As a result, West Africa's competitiveness has been declining for many tradable agricultural products. This is evident by its growing food imports and the region's declining share in several of its traditional export markets.

Feeding urban populations has always been a major political priority of governments in the region. This task is becoming harder as food preferences and consumption patterns are rapidly changing. Between 1980 and 2009, per capita availability of calories, protein, and fat increased, in some cases dramatically, in almost all of the 15 member states of ECOWAS. Diets diversified to a wider range of starchy staples, fruits, vegetables, and animal products. Improvements in grain processing have increased the willingness of consumers to substitute milled coarse grains, such as maize, millet, and sorghum, for rice during periods of price increases for the latter. The largest changes occurred in countries with the most robust economic growth, such as Cabo Verde and Ghana. Budget-consumption studies reveal that urbanization and per capita income growth are pushing demand strongly toward perishables and products that are more convenient to prepare and consume. In the next decades, there is is high projected demand growth for animal-based products, fruits and vegetables, and vegetable oil (Zhou and Straatz 2016).

In relative terms, imbalances between domestic production and demand will increase more quickly for foods with high income-elasticities of demand, such as meat, dairy products, seafood, fruits and vegetables and vegetable oils. Yet as income elasticities of demand across urban and rural areas are similar and high overall, rising consumption of perishable foodstuffs and diversification are essentially due to income growth in cities. Depending on the commodity, urban demand will grow two to four times faster than rural demand, putting increased pressure on already stressed urban food marketing systems. and substantial intraregional variation in supply and demand gaps suggest that fluid regional trade could help individual countries cope with these challenges (Zhou and Straatz 2016). The evolving pattern of food consumption implies that a clear understanding of the nature and dynamics of consumption is critical to designing demand-driven policies (Hollinger et al. 2015).

In urban areas, there is higher demand for convenience and a greater consumption of packaged, processed, and ultra-processed food, meals that are more frequent, snacking, and a greater percentage of meals eaten outside the home. These changes in demand and consumption result from greater disposable income, a youthful

population, changing lifestyles, exposure to digital media, and new consumer preferences. There is convincing evidence that globalization is shaping diets, leading to dramatic increases in the supply, availability, advertising, and promotion of high-calorie, nutrient-poor foods (especially processed food) in many countries (Hawkes, Chopra, and Friel 2009). It is equally due to the spatial concentration of consumers in cities who are further away from production areas, which increases the need to process foods for more convenient transportation and storage.

While income level affects overall consumer demand for food, purchasing choices are influenced by taste, price, convenience, and consumer perception of and trust in product quality. This involves notions of safety, appearance, cleanliness, and freshness. In middle- and higher-income segments of the market and among those who use digital media, greater importance is given to a set of value- and aspirational-driven preferences, including health and wellness, social impact, animal welfare, and shopping experience (Tefft et al. 2017).

AN AGRIBUSINESS SECTOR IN TRANSFORMATION

Taking advantage of opportunities related to changes in food demand requires a transformation across the agricultural sector, with strong implications for agribusiness across value chains, spanning production, processing, storage, transport, and marketing. With income growth and urbanization leading to the commercialization of agriculture, the shares of downstream agribusiness activities are growing rapidly (Africa Investment Forum 2018). There are many dimensions to reshaping the agribusiness sector to increase efficiencies and reduce waste, while also securing strong employment benefits. The expansion of mobile technologies is shaping how the sector can respond quickly in numerous ways, such as by improving logistics coordination, reducing information asymmetries for farmers, or improving storage with Internet of Things (IoT) technologies. Agribusiness expansion in food value chains and improving food safety will need to be mainly private sector driven but accompanied by a strengthening of related public functions and regulatory frameworks. For example, the problems related to aflatoxins in rice, noted earlier, leads to estimated export losses of €400 and €600 million a year (Okoth 2016). These and other food storage, processing, and safety issues need to be addressed as part of agribusiness expansion.

Growth in the agribusiness sector will have strong positive effects on employment, expanding jobs for women, and creating new jobs in both rural and urban areas. The food economy comprising all parts of the food value chain is the largest employer in West Africa, accounting for 66 percent of total employment. Of this total, 75 percent is in direct agricultural production; 15 percent in food marketing and services (transport, logistics, retail, and wholesale), and 5 percent in food processing. The food economy is critical for West African women; 68 percent of all employed women in West Africa work in the food economy, representing 88 percent of those employed in food service catering businesses (that is, food away from home), 83 percent in food processing, and 72 percent in marketing. Food economy jobs currently account for 35 percent of employment in urban areas, while 31 percent of total non-farm employment in West Africa is related to food processing and service jobs. The potential for agribusiness growth is demonstrated by Senegal, where food processing is the largest manufacturing sector (68 percent) and growing by 7.4 percent

per annum (2000–10). In Côte d'Ivoire, food processing is the largest contributor to formal sector value added and the second largest contributor to formal employment (14 percent) (Allen et al. 2018).

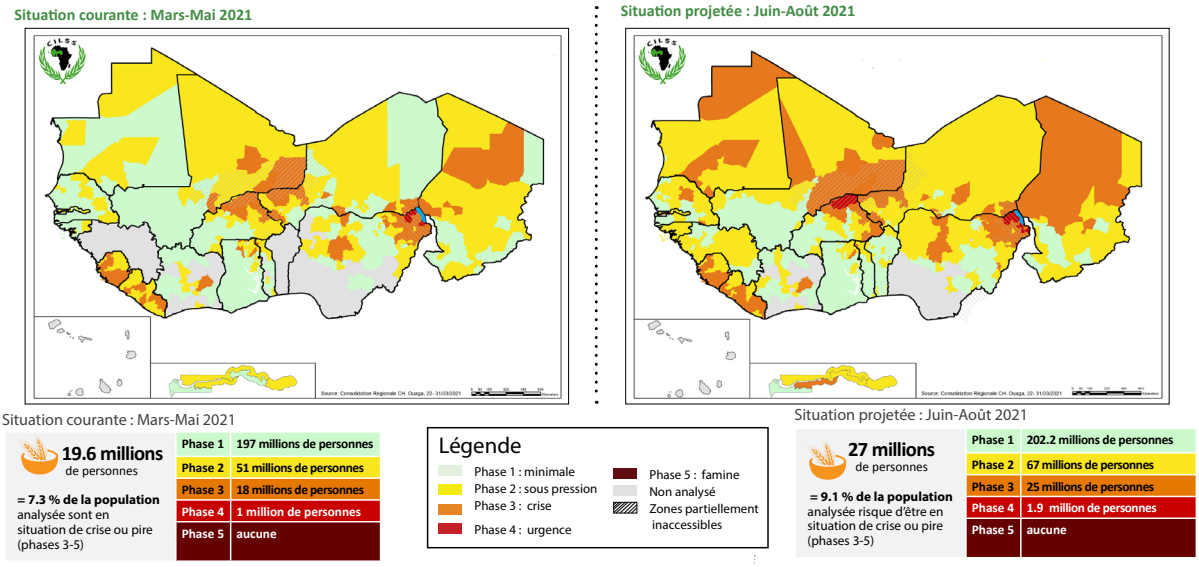
1.6 IMPACTS AND IMPLICATIONS OF COVID-19 ON WEST AFRICAN FOOD SYSTEM

Triggering a worldwide health and economic crisis, the COVID-19 pandemic is the most recent shock affecting the West African food system. In late February 2020, the first COVID-19 case was confirmed in Nigeria and within one month the virus spread to all West African countries (SAWC/OECD 2020c). The evolution of COVID-19 cases in West Africa has remained far below early predictions even when considering limited testing capacities and limited data quality. Despite comparatively low infection and mortality rates, the pandemic has severely affected the West African food system and will likely continue to do so (SWAC/OECD 2020a). This section outlines the impacts of the pandemic on food security, as well as its economic and social consequences in the region.

West Africa faces an unprecedented food and nutrition security situation due to the cumulative effects of a health, economic, and security crisis. In April 2020, members of the Food Crisis Prevention Network (RPCA) estimated that the combined effects of these crises might push 50 million people who are classified as food-stressed (Phase 2) into a food and nutrition crisis (Phase 3). To date, comparatively low infection and mortality rates as well as an effective rollout of social safety net programs have prevented such a steep rise in food insecurity. Nevertheless, the COVID-19-induced health and economic crisis has adversely affected regional food and nutrition security and will likely cause a long-term deterioration of vulnerable livelihoods (SWAC/OECD 2020a). During the lean season from June to August 2020, 17 million people were acutely food insecure - 5 million people more than the 5-year average of 12 million people. In the period from March to May 2021, 19.6 million people (7.3 % of the population analysed) required immediate food assistance, as shown in Map 1.11 (below). The situation is unlikely to improve in the near term. Without appropriate countermeasures, the number of people facing acute food insecurity is projected to reach a new record high of 27 million (9.1% of the population analysed) during the upcoming lean season from June to August 2021 (CILSS and RPCA 2021).

From March 2020 onwards, West African governments imposed public health measures to contain the spread of COVID-19. Governments in West Africa have imposed movement restrictions and social distancing measures from March 2020 onwards to prevent the spread of the virus. International borders were closed, and domestic movement was limited to a minimal level by imposing curfews, lockdowns and market closures. From May 2020 onwards, governments started easing restrictive measures including through extending curfew hours and partially suspending lockdowns. As of August 2020, governments had lifted most measures, including curfews (except in Chad, Sierra Leone, and Togo), lockdowns (except in Togo and Nigeria) and states of emergency (except in Niger, Togo, Chad and Sierra Leone) (CILSS

MAP 1.11 Food and Nutrition Situation in West Africa, Spring 2021 and lean season 2021



Source: CILSS and RPCA 2021, based on Cadre harmonisé analysis, regional concertation meeting, Ouagdougou, Burkina Faso, March 2021; maps: © CILSS.

and RPCA 2020). The measures have helped to contain the pandemic but contributed to increasing food insecurity in West Africa.

Governments as well as regional and international organisations implemented measures to mitigate COVID-19 impacts and secure the food and nutrition security of the West Africa population. West African countries launched public programs to i) support the most vulnerable parts of their populations, ii) ensure the functioning of the food system and iii) secure agricultural production. For example, Burkina Faso, Cabo Verde, Chad, Mali, Niger and Senegal have established national response plans with a total volume of CFA 400 billion (around USD 740 million). Both regional and international organizations including AU, ECOWAS, UEMOA, the Central Bank of West African States (BCEAO), the West African Development Bank (BOAD), West African Health Organization (WAHO), the European Union (EU), FAO, UN, the World Food Program (WFP), AfDB, IFAD, the International Monetary Fund (IMF) and the World Bank have provided humanitarian assistance, as well as technical and financial emergency support. In close cooperation with CILSS and UEMOA, ECOWAS launched a Regional Task Force to monitor COVID-19 impacts and support decision-making in member states. In Burkina Faso, Mali, Niger and Nigeria, ECOWAS provided humanitarian assistance by mobilising the Regional Food Security Reserve (see also section 2.3) (SWAC/OECD 2020a). Despite these efforts to reduce COVID-19 food security impacts, the pandemic affected the food system from farm to fork by creating both demand shocks and supply constraints.

To date, COVID-19 impacts on primary production have largely remained limited as farmers in rural areas could, in many cases, continue business-as-usual without major disruptions. While in some areas, mobility restrictions reduced productivity of farmers by lowering the availability of agricultural labor and agricultural inputs such as seeds and fertilizers, overall harvests proved to be decent (despite severe flooding in some areas as described in section 1.4). Estimates

for aggregate cereal output across West Africa during the 2020-2021 agro-pastoral campaign ranges from 71 million tons (FAO 2020f) to 74.4 million tons (SWAC/OECD 2020b), which is 4% to 9% higher than the previous five-year average. Thus, overall agricultural production trends at the regional level cannot explain the observed rise in food insecurity. Pastoralists and livestock herders, however, were affected to a larger extent than farmers as movement restrictions limited their ability to access grazing grounds (see Table 1.3). In the conflict-affected areas in Mali, Burkina Faso, Niger, Nigeria and Chad continues, insecurity continues to affect agricultural production due to reduced access to cropland.

Consumers' financial access to sufficient, safe, and nutritious food was reduced due to COVID-19-induced income shortages and rising unemployment. On an individual level, food insecurity is often not due to a lack of food availability but due to a lack of financial access to food (Sen 1983). COVID-19 and the restrictive measures taken to contain its spread, lead to income losses, e.g., through unemployment, reducing consumers' ability to pay for (high quality and nutritious) food. In a household survey implemented by WFP, ECOWAS, CERFAM and ECA in May and June 2020, 90 percent of households reported that restriction measures have had a negative impact on their income. Due to the relatively high percentage (55 percent on average) West African consumers spend on food products, pandemic-induced income losses negatively affected dietary choices. 60 percent of the households interviewed resorted to coping strategies such as eating less preferred foods, skipping meals or eating less than usual, or spending a whole day without eating (ECOWAS, WFP and UNECA 2020). The gradual repeal of measures from May 2020 onwards has led to a timid resumption of income-generating activities, especially for poor households (CILSS and RPCA 2020).

Supply disruptions caused by restrictive measures to halt propagation of COVID-19 triggered food price increases particularly during the first months of the pandemic. In April 2020, a decline in food availability led to rising food prices in Ghana, Mauritania, Niger, Nigeria, Senegal, and Sierra Leone. Transportation problems for both imported and domestic food products have contributed to higher food prices in Chad, Ghana, Mauritania, Niger, Nigeria, Senegal, and Sierra Leone. From September to October 2020, cereal food prices remained above average in most West African countries, although to differing degrees. While cereal prices remained almost flat in Mali and Mauritania, they increased by 50 percent compared to the 5-year average in Liberia, Nigeria and Sierra Leone. According to CILSS data, 9out of 17 West African countries experienced cereal price increases above 10 percent compared to the 5-year average (SWAC/OECD 2020a).

In 2020, West African food trade was under strain as COVID-19-related containment measures have reduced the availability of food on domestic markets. Despite the trade of food products being excluded from restrictions, containment measures have disrupted trading across West Africa and lowered volumes of informal trade, especially in the first months of the pandemic. Mobility restrictions complicated the transportation of agricultural outputs, with perishable products being particularly affected. This led in some cases to food loss and waste (IFPRI 2020b). West African traders of perishable products and livestock are reported to have losses of 10 to 30 percent due to disrupted transportation and illegal tax collection at checkpoints (Ross 2020). Transportation problems for imported food items and some domestic food products lead to difficulties in supplying food to domestic markets, particularly in Chad, Ghana, Mauritania, Niger, Nigeria, Senegal, and Sierra Leone, particularly affecting the food

availability of urban consumers. In most West African countries, traditional urban food retail markets were closed by governments for a limited time and reopened under strict health security measures to ensure food availability in urban areas. As of August 2020, internal and external trade of food was improving due to the continued relaxation of COVID-19 restrictions. Most food markets are operating again with adequate supply to meet demand at below-average levels. In some regions, however, markets remain disrupted, mostly due to persising insecurity (CILSS and RPCA 2020).

COVID-19-related lockdown measures disproportionately affect the food and nutrition security of the poor. The poor are most affected by income losses and unemployment due to COVID-19 measures as their principal productive asset, (physical) labor, is most affected by mobility restrictions and measures to control the pandemic's spread. As most of the poor work in the informal sector, the closure of informal markets and food stands cause significant income losses for vulnerable households. The same is true for mobility restrictions, which stop migrant workers from accessing their workplaces. As the poor generally spend a higher share or their income on food, their financial access to food is particularly vulnerable to income decreases. Furthermore, food security for the poor depends to a large extent on public support programs such as school feeding programs, which are common in West Africa (see section 1.4). In 2020, more than 20 million children were missing out on school meals due to school closures (SWAC/OECD 2020a). Due to the high vulnerability of the poorest population segments, many countries and regional and international organisations provided direct support including through free cereal distribution, subsidised cereal prices and cash transfers (SWAC/OECD 2020a).

As a result of the pandemic and the ensuing economic crisis, the number of people living in extreme poverty is expected to increase significantly. The West African economy was expected to expand by 4 percent in 2020 but is now projected to contract by –2 percent in 2020 (AfDB 2020). Rising unemployment in both the formal and informal sector will lead to a loss of income and reduced purchasing power for households. Worldwide extreme poverty, defined as people living under the poverty line of US$1.90 per day, is expected to rise with estimated ranging from an additional 119 to 124 million people in 2020 of which 32 to 34 million live in Sub-Saharan Africa (Mahler et al. 2021). The expected increase in poverty rates is likely to have a negative effect on food insecurity in the long-term.

COVID-19 impacts have varied across different food subsystems. Table 1.9 summarizes COVID-19 impacts on the five food systems[18] as of June 2020.

[18] The study on Covid-19 impacts on the five food subsystems was led by de Steenhuijsen Peters et al. (2021) and supported by the World Bank.

TABLE 1.8 COVID-19 Impacts on Different Food Subsystems

IMPACTS OF COVID-19
AGROPASTORALISM-BASED FOOD SYSTEM
• Pastoralists are dangerously affected by the preventive measures taken by the various governments of West Africa against the COVID-19 pandemic. The movement restrictions jeopardize the possibilities of providing feed and water to the herds with a direct effect on the productivity of the system, both in terms of traded meat and secondary milk. This results in an accumulation of animals in specific grazing areas and close to borders, inducing health risks both for humans and their animals. Thereby, the pandemic puts extra pressure on local natural resources, hampering the future production of these areas. To cope, farmers invest in animal feed and reduce the number of animals. A vast majority of households are put in a precarious situation by the COVID-19 crisis with an estimation of 81 percent vulnerable (agro)pastoralist households (daily income under US$1.90 per person per day; sample of eight countries and 1,935 households) (bulletin de veille APESS May 2020). To cope with the situation, individuals (61 percent men and 45 percent women) complement their incomes with non-farm jobs. In a context of current and potential conflict, tensions are rising between herders and between herders and farmers.
MIXED GRAINS AND LEGUMES-BASED FOOD SYSTEM
• In the mixed grains and legumes-based food system in the Sudano-Sahelian zone, the 2020 off-season crops are expected to reach markets and provide substantial income to farmers. However, the closure of borders and the restriction of internal and cross-border movements may limit people's access to markets (WFP 2020). The planting period extends between May–June 2020 for the 2020–21 agricultural season, while at the same time the COVID-19 pandemic forces governments to reduce agricultural spending and prioritize spending related to health. • In Burkina Faso and Mali, COVID-19-related restrictions, including closing down markets and evening curfew, have been related to decreasing household incomes in two ways: earnings from casual work and incomes from the sale of agricultural products decreased (WFP 2020). The restrictions have led to a drop in demand for cash crops such as cowpeas and peanuts, which are usually exported to Mali, Togo, and Benin. This drop in demand has, in the short term, led to a slight decrease in price and therefore a decrease in household income.
RICE AND HORTICULTURE FOOD SYSTEM
• There has only been a limited impact on the production of rice and vegetables. However, supply chains for farming inputs are directly impacted by COVID-19-related trade restrictions as shipments and trucks get stuck due to closed borders and health checks. This is especially problematic for countries that are largely depending on external markets for seeds, fertilizers, and the import of rice. • The Gambia, Ghana, and Senegal have rice self-sufficiency ratios of 60 percent or less due to COVID-19 impacts. Price shocks will therefore be more severe for these countries as they are still largely dependent on Asian exports to meet the gaps between production and consumption.
COASTAL MARITIME FISHERIES-BASED FOOD SYSTEM
• Globally, fisheries activities declined during the COVID-19 crisis because of restrictions on people's movement, curfews, and a ban of fisheries in some countries and because of closure of markets (FAO 2020e). The recommendations to prevent COVID-19 (for example, face masks, physical distancing) have been difficult to apply on fishing vessels and markets. • Negative impacts are felt by households that are dependent on artisanal fisheries, who are less resilient and have little financial buffers to bridge a period with reduced or no income. Industrial fisheries have been similarly affected and reduced their activities. A positive outcome of this decline in fishing pressure is a potential recovery of some over-exploited resources.

TROPICAL MIXED TREE AND FOOD CROP FOOD SYSTEMS

- Ghana and Côte d'Ivoire together represent over 60 percent of the total world cocoa production. In case COVID-19 further emerges in these countries and forces the national governments to upscale the measures (for example, stricter curfews or lockdown of ports), the cocoa production might be harmed by these measures, which could cause shortages on international markets (CBI 2020a).
- Tree and food crops that are sold on domestic markets could face challenges in transportation. The transportation of crops from the producing to consuming regions could be made difficult by travel bans, lockdowns, and curfews.

Due to West African high dependency on global food markets, its food system is particularly vulnerable to the risk of international supply chain disruptions and rising costs of trade. Covid-19 mitigation measures have imposed shocks on all segments of food supply chains on the global, regional, and national level and have increased transaction costs for trade (mostly due to higher transportation costs caused by border closures, additional inspections, and reduced hours of operations of check points). Due to West Africa's high import dependency on imported agricultural inputs and grains (rice and wheat) and animal products (poultry, dairy, and fish), it is vulnerable to global supply chain disruptions. They can affect the food availability in West Africa and can lead to price increases and raised price volatility and thereby increased food insecurity in the food importing countries. Global supply chain disruptions can be caused by exporting states restricting trade of agricultural products. The 2007–08 food crisis showed the impact such food export restrictions can have: the crisis, initially triggered by bad harvests of wheat and corn, was reinforced and multiplied by protectionist reactions of one-third of the world's governments. The WB estimates that globally, about 45 percent of the increase in rice prices and almost 30 percent increase in wheat prices was due to insulating behavior (WB 2011). As of July 2020, only 5 percent of food exports in terms of calories were restricted, compared with 19 percent in 2008. For West Africa, the restrictions on the export of rice from some of its major suppliers (India, Vietnam, and Cambodia) were particularly worrisome and impacted prices in some countries (Clingendael 2020). Overall, food global supply chain disruptions have been less extensive than in 2008. However, the risk reveals the systematic vulnerability of West Africa's dependency on food imports, especially combined with the concentration of supply of key crops by some countries. Countries with high levels of food insecurity and volatile export earnings are especially sensitive to the effects trade disruptions could have.

When dealing with food crises, a few lessons can be learned. CILSS (2020) highlights that the global community must ensure that the immediate food needs of poor and vulnerable populations are met with food aid programs where lockdowns shut down markets and cash transfers when a shock drastically reduced income opportunities and, in the long term, the support of social safety nets. Moreover, the global trading of food products must continue so that global food supply chains can keep running. In the long term, monitoring the food production, trade, and consumption trends with the help of local extension services or online surveying technologies can help to reduce negative impacts of shocks as responses can be planned pre-crisis and targeted.

This part summarized the most important drivers of the West African food system and their implications for food security.

On the demand side, these include fast demographic growth, urbanization, and changing consumption patterns, while climate change and increasing levels of conflict are significant factors affecting food supply. In part due to stagnant yields and weak intraregional trade output, growth was unable to keep pace with growing food demand, leading to rising levels of import dependence. In recent years, food security and nutrition trends have been deteriorating. In 2020, the implications of the COVID-19 outbreak has put additional pressure on the West African food system. Given the convergence of multiple drivers that will increasingly affect the food system, it will be critical to carefully balance immediate preparedness for rapid intervention with enhancing foresight and anticipation capacities that allow to build long-term resilience. The urgent need for increased investments to reverse the pandemic's adverse food security and economic impacts may provide a unique opportunity for addressing West Africa's structural food system vulnerabilities in a systematic and strategic way. Part 2 examines three key thematic areas for priority interventions at the regional level that future actions need to target for increasing the food system's resilience.

2 PART TWO: PRIORITY INTERVENTION AREAS AT THE REGIONAL LEVEL

The previous part has provided an overview of a selection of key drivers, constraints and trends cutting across a broad range of components relevant to West African food system, this part focuses on three priority areas for regional level intervention. For each intervention areas, this part provides:

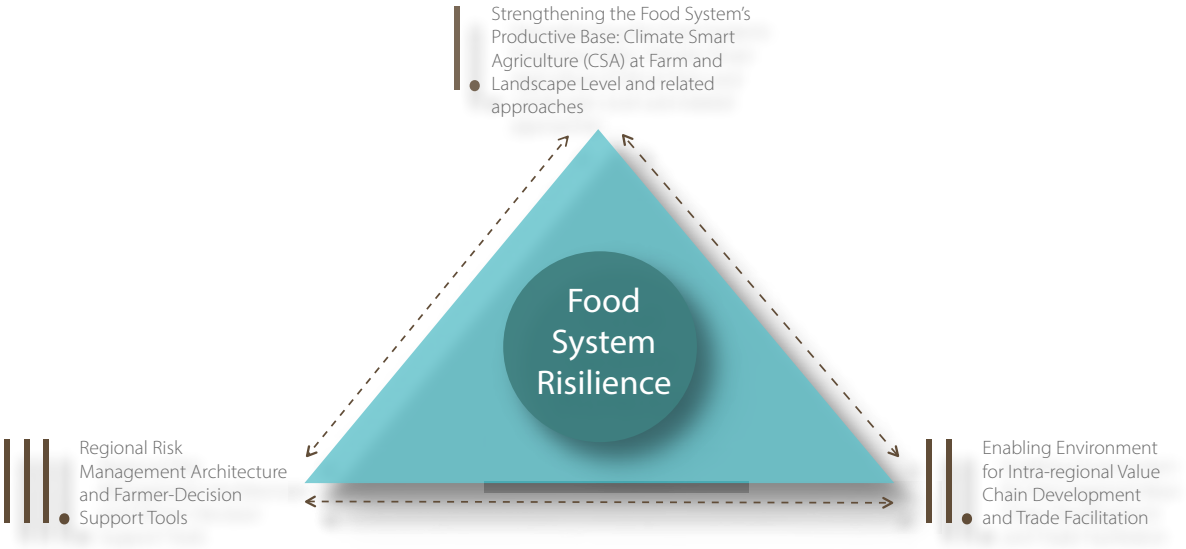
- A stocktake and summary of technical aspects and past experience
- A mapping of regional initiatives currently operating in this space
- Entry points for future interventions based on the stocktake and over 50 interviews with regional and international experts
- Potential regional flagship initiatives (RFIs) for further development
- Proposed technical work to close knowledge gaps of the identified RFIs

The three priority areas for regional intervention build on the ECOWAS Agricultural Policy (ECOWAP) and were identified in a process led by ECOWAS in consultation with CILSS and CORAF. ECOWAP priorities were adapted to focus on areas (1) where subsidiarity favors interventions at regional level and (2) that correspond to those priorities that are particularly urgent in the current context. The World Bank Africa Strategy ***Africa: Food Security under Climate Change***[19] provided a useful technical underpinning1. The three selected areas were chosen simultaneously with the priorities for the flagship Food System Resilience Program (FSRP) and are not exhaustive of the domains where regional initiatives could have and are having positive impact on food system resilience, such as fisheries, forestry, infrastructure, health, social protection, and other agendas and sectors. Linkages to these agendas were established throughout.

The proposed regional priorities are: (1) strengthening the sustainability of the food system's productive base: climate smart agriculture (CSA) at farm and landscape level and related approaches; (2) enabling environment for intra-regional value chain development and trade facilitation; (3) regional risk management architecture and farmer decision-support tools (see figure 2.1). The three priorities are mutually supportive. For instance, trade generates the market incentives farmers rely on to make the necessary investments to adopt new resilience strengthening technologies. Both farmers and traders require improved information to reduce risks and maintain the viability of their activities under intensifying climate change. Risk management and related farmer advisory services require quality and frequently updated data from traders to be effective.

[19] The strategy's three pillars are (1) To scale-up CSA across farm and landscape level, (2) to enable private sector to build more efficient value chains at national and regional levels and (3) to create a more effective enabling environment at all levels of the food value chain, farm to fork.

FIGURE 2.1 Priority Areas for Regional Interventions



Source: World Bank

Regional flagship initiatives (RFIs) are concepts for concrete intervention areas at a regional level to strengthen food system resilience. They seek to mobilize innovative action at regional levels in ways that capture economies of scale, regional spillovers and foster collective action on common challenges and opportunities. This report and the set of RFIs thus do not replace regional sectoral strategies such as ECOWAP/CAADP but rather aim to enhance the latter by offering new ideas. RFIs therefore avoid restating already existing programs or interventions and focus on influencing initiatives under preparation and on the incubation of potential new initiatives.

As a starting point, a longlist containing over 30 possible regional flagship initiatives (RFIs) was compiled based on a review of the literature by applying the following criteria:

- **Regional/subsidiarity:** Initiatives best approached at regional level (economies of scale, spillovers, benefits from coordination/harmonization, etc.) and/or of regional relevance.
- **Scalability:** Going beyond localized and scattered project impacts towards systemic change or with the potential to do so.
- **Actionability:** Aligned with client strategy frameworks (in particular the 2016-25 ECOWAS Agricultural Policy (ECOWAP/CAADP) & ECOWAS Regional Agriculture Investment Plan (RAIP) and priorities. Availability of requisite means to achieve objectives (domestic, regional, technical & financial partners).
- Immediate urgency: Potential to positively affect food security outcomes of a large number of beneficiaries at

[20] The overall objective of the ECOWAS 2025 Strategic Policy Framework is to "contribute in a sustainably way to meeting the food and nutritional needs of the population, economic and social development and poverty reduction in the Member States, and inequalities between territories, zones and countries" (ECOWAS 2017).

BOX 2.1 A STAKEHOLDER CONFERENCE CONTRIBUTED TO UNPACKING FOOD SYSTEM RESILIENCE IN WEST AFRICA

The four-day interactive virtual conference "Under the Palaver tree: Unpacking Food System Resilience in West Africa" was hosted by ECOWAS, CILSS and CORAF in cooperation with CGIAR, UEMOA, FAO and the World Bank in July 2020 to inform this work. Evoking the image of the palaver tree, the bilingual, virtual stakeholder conference brought together 400 participants from West African countries, regional bodies, development partners and representatives from the private sector, academia and the civil society and offered them a virtual space to engage in times of travel restrictions and social distancing. The event's reach was far greater than that of a physical event at comparable cost. The virtual format allowed a high degree of interactivity up to 250 participants at a given moment spending 70% of the time in discussions of groups of 5-15 participants held in up to 20 parallel virtual break-out rooms and documented using online co-working software. The discussions, participants ideas and proposals fed into this reports' recommendations and the preparation of several emerging regional initiatives including the West Africa Food System Resilience Program (FSRP). Participant feedback on the was overwhelmingly positive and participation strong with an average of 160 people connected throughout all four days. The image links to a short video summarizing the event.

regional level in the near term and particularly under COVID-19.

This long list was discussed during a four-day virtual stakeholder event 'Under the palaver tree' (see box 2.1) and RFIs were prioritized based on the outcomes of the conferences' interactive sessions. Participants' contributions were captured in google slides and inputs subsequently systematically harvested and synthesized into the shortlist presented below.

The prioritization of the identified RFIs for implementation through regional programs is an ongoing process led by ECOWAS, CILSS and CORAF. At the time of writing of this report, several major regional programs are under preparation (see box 2.2) that propose to tackle crucial aspects of food system resilience in West Africa. They offer important opportunities to implement several of the regional flagship initiatives identified in this report. A non-exhaustive selection:

BOX 2.2 REGIONAL PROGRAMS UNDER PREPARATION THAT OFFER OPPORTUNITIES TO IMPLEMENT RFIS

Food System Resilience Program (FSRP): FSRP is a 10-year regional investment program (~US$1.2 bn) under preparation to strengthen food system resilience in West Africa through a strategic regional approach. Under the leadership of ECOWAS, the program will finance investments in three mutually reinforcing components (1) Digital advisory services for agriculture and food crisis prevention & management; (2) Sustainability & adaptive capacity of the food system's productive base (sustainable land and watershed management, agro-ecological approaches); (3) Market integration & trade (value chain development of regional staple foods), with each component led by a mandated regional institution (AGRHYMET, CORAF, ECOWAS/UEMOA) to ensure coordination and build lasting capacity. At the time of writing, several RFIs or selected aspects thereof are undergoing further development for implementation under FSRP.

CGIAR Two Degree Initiative Sahel Grand Challenge: By adopting an R4D approach, the objective of the 'Sahel' grand challenge of the CCAFS led 'two-degree initiative' is to improve the capacity of agricultural producers, women & youth, and enhance institutional resilience to shocks and vulnerabilities to climate change. This includes increasing producers' access to climate services and agroecological technologies, sustainable management of productive assets, development of resilient agro-silvo-pastoral value chains linked to youth entrepreneurship, and enhanced governance of land and water resources to prevent and manage conflicts.

AICCRA: Implemented by the CIAT-led International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and International Livestock Research Institute (ILRI), AICCRA will aim to increase access for agriculture research and extension service providers in Mali, Ghana and Senegal to knowledge, technologies, and decision-making tools relevant to enhancing the resilience of agriculture and food systems in the face of climate change. AICCRA will fill a critical gap by making cutting-edge CGIAR research and innovation available to NARS and other key stakeholders in Africa.

PRAPS II: Pastoralists in West Africa rely on unimpeded mobility to move livestock across borders in search of pastures, water and markets. After decades of neglect, the role of pastoral societies in providing sustainable livelihood options and contributing to food security is increasingly acknowledged. The Regional Pastoralism Support Project in the Sahel (PRAPS II will support the objective of the Nouakchott declaration of "securing the lifestyle and means of production of pastoral populations and increasing the gross output of livestock production by at least 30% in the 6 concerned countries over the next 5 years with a view to significantly increasing the incomes of pastoralists within a period of 5 to 10 years". Proposed activities include scale up pastoral agreements; the rehabilitation of critical water infrastructure such as boreholes; restoration of degraded areas as well as to facilitate livestock mobility; improve animal health and the inclusion of women and youth in livestock value chains.

PRTAD: The ECOWAS-led Program for the Restoration of Degraded Agricultural Land for Food and Nutritional Security in West Africa will aim to increase the area under cultivation through the sustainable restoration of degraded agricultural land while promoting sustainable land management. Activities will

include knowledge-sharing on strategies for land restoration, the development of financial mechanisms to foster land restoration as well as the dissemination of seed varieties allowing farmers to adapt to negative effects caused by soil degradation.

WAISCA: Initiated by ECOWAS, the West African Initiative for Climate Smart Agriculture (WAISCA) intends to foster the uptake of CSA technologies through establishing a blended finance mechanism. WASICA comprises two components: a financing facility (implemented by the ECOWAS Bank for Investment and Development (EBID)) will provide grants for loans with subsidized rates, guarantees and equity investments for smallholder farmer organizations and agricultural businesses. A technical facility, to be implemented through the Regional Agency for Agriculture and Food (RAAF), will provide technical assistance to help farmers adopt CSA practices, and to support local finance institutions to integrate climate-smart metrics into their loan products.

2.1 STRENGTHENING THE SUSTAINABILITY OF THE FOOD SYSTEM'S PRODUCTIVE BASE: CLIMATE-SMART AGRICULTURE (CSA) AT FARM AND LANDSCAPE LEVEL AND RELATED APPROACHES

STOCKTAKE AND OVERVIEW

INTRODUCTION: SETTING THE SCENE FOR CLIMATE-SMART AGRICULTURE IN WEST AFRICAON

Promoting sustainable agricultural transformation to guarantee food system resilience under climate change is essential across the African continent in light of deteriorating food security trends. Climate-smart agriculture (CSA) is an integrated approach for climate-aware agricultural development simultaneously increasing agricultural productivity in a sustainable way, strengthening resilience, and, where possible, lowering carbon emissions. Encompassing a broad spectrum of both traditional and recently developed knowledge, practices, and technologies, CSA aims to systematically take advantage of synergetic relationships between productivity, adaptation, and mitigation while managing related trade-offs. These relationships will not always be field based; they can also include policies, institutions, and finance. The recent flagship report by the Global Commission on Adaptation (2019) indicated that all actions in the agricultural sector should consider climate-smartness given what we know are existing and inevitable climate impacts. The growing recognition of CSA among regional and national policymakers is increasingly reflected in the region's key policy frameworks.

Section 2.1 is centered on the main structural factors driving the generation, dissemination, and adoption of climate-smart technologies with the potential to enhance resilience of regional food production both on a farm and landscape level. After briefly sketching out recent political commitments for promoting CSA, the section outlines current CSA technologies relevant for food production on a farm and plot level. Given West Africa's high levels of land degradation, there is a strong need to safeguard the ecological health of the food system's productive base when increasing agricultural production. Therefore, this section continues by providing a summary of integrated resource management approaches and their implementation potential. The section then reviews recent developments in regional agricultural innovation systems

with an emphasis on the regional research landscape and agricultural extension, followed by a discussion on adoption drivers, including access to inputs and credits. The section closes by summarizing and reflecting on the most salient findings contained in the preceding subsections and suggests corresponding key priorities and related RFIs for future interventions.

OVERVIEW OF THE CURRENT ENABLING ENVIRONMENT FOR CSA

The Regional Agricultural Policy for West Africa (ECOWAP) remains the major framework for agricultural transformation and regional integration in West Africa. ECOWAS adopted ECOWAP in 2005 and it has emerged as a regionally owned policy framework in line with the Comprehensive Africa Agriculture Development Program (CAADP). African heads of state signed the 2003 Maputo declaration with the goal of enhancing food security and agricultural productivity. The New Partnership for African Development (NEPAD) established CAADP shortly after the 2003 declaration. Main CAADP objectives include raising public agricultural investment to at least 10 percent of national budgets and increasing agricultural productivity by at least 6 percent. On a continental level, the need for employing CSA was identified at the twenty-third summit of the African Union (AU) in Malabo in 2014, where African leaders decided to integrate CSA into the NEPAD program on agriculture and climate change.

ECOWAP/CAADP saw the elaboration of a Regional Agricultural Investment Plan (RAIP) promoting sustainable productivity increases in the agricultural sector. In 2015 during the High-Level Forum of Climate-Smart Agriculture Stakeholders in West Africa, ECOWAS adopted a new CSA intervention framework to respond to gaps that ECOWAS stakeholders identified in the first generation of RAIP, such as gaps between agriculture and climate change adaptation, resilience, and agricultural risk management (ECOWAS 2015a). In line with the ECOWAP/CAADP Intervention Framework for CSA, the ECOWAS 2025 Strategic Policy Framework[21] and the second generation RAIP 2016–2020 consider promoting CSA as a major challenge that the region needs to address. During the above-mentioned High-Level Forum of Climate-Smart Agriculture Stakeholders in West Africa, ECOWAS also initiated the establishment of the West Africa Alliance for Climate-Smart Agriculture (WACSAA) to support the member states in the implementation of the ECOWAP/CAADP Intervention Framework for CSA.

West African governments have started to make provisions for CSA in their national adaptation and agriculture strategies. On the national level, ECOWAP/CAADP requested that member countries develop National Agriculture Investment Plans (NAIP). Thanks to the Support of WACSAA and ECOWAS and in line with ECOWAP/CAADP recommendations,

[21] The overall objective of the ECOWAS 2025 Strategic Policy Framework is to "contribute in a sustainable way to meeting the food and nutritional needs of the population, economic and social development and poverty reduction in the Member States, and inequalities between territories, zones and countries." The overall objective of ECOWAP is further broken down into four specific objectives. The first objective is to "contribute to increased productivity and agro-sylvo-pastoral and fisheries production through diversified and sustainable production and reduce post-production losses" (ECOWAS Department Of Agriculture, Environment And Water Resources 2017).

countries including Burkina Faso, Mali, Ghana, and Senegal have recently made progress integrating CSA into their NAIPs. The process of mainstreaming climate change and CSA into agricultural development plans was further supported by establishing multistakeholder science-policy dialogue platforms at both national and subnational levels. These platforms have proven an effective mechanism for bringing academia, policymakers, and civil society together (Zougmoré et al. 2019).

CLIMATE-SMART AGRICULTURAL INVESTMENT PLANS (CSAIP)

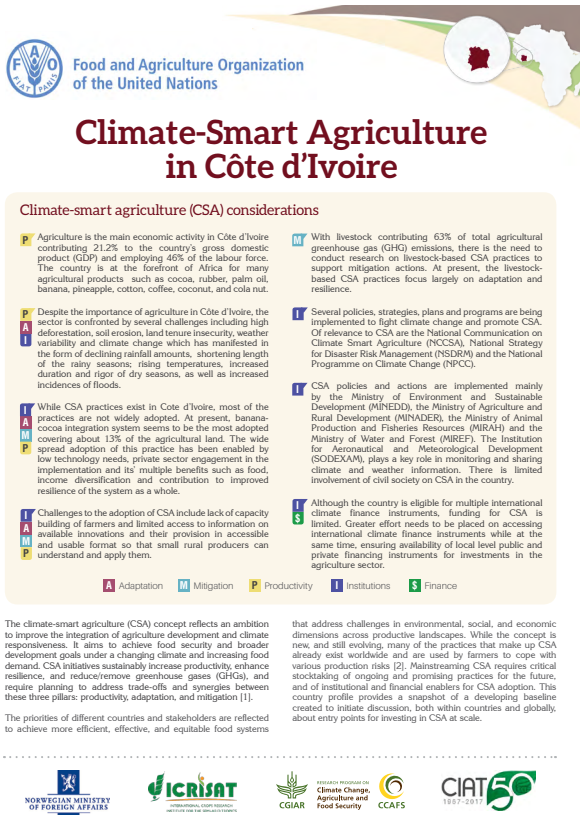
In close consultation with governments and other key in-country actors in the agriculture sector, the World Bank has developed Climate Smart Agriculture Investment Plans (CSAIPs) in four West African countries. CSAIPs are aligned with both national and regional policies and priorities. They propose concrete investment options that have the potential to scale up in-country adoption of promising CSA options. CSAIPs in ECOWAS and Permanent Inter-state Committee on Drought Control in the Sahel (CILSS) countries exist for Mali, Côte d'Ivoire, Burkina Faso, and Ghana.

Relying on participatory methods, CSAIPs identify concrete CSA investment opportunities and policy options with transformative potential for productivity, resilience, and mitigation in support of countries' national priorities and NDCs (Nationally Determined Contributions). The CSAIP approach was developed by the World Bank in collaboration with CIAT (The International Center for Tropical Agriculture), Consultative Group on International Agricultural Research (CGIAR), Climate Change, Agriculture and Food Security (CCAFS), the International Institute for Applied Systems Analysis, and others.[22] The choice of analytical tools used is adapted to each country and spans visioning exercises, robust decision-making under uncertainty, and quantitative modeling, which is explored in stakeholder consultations. Where available, CSAIPs are informed by CSA country profiles.

CSAIPs contain a suite of country-supported and evidence-based investment options that are most likely to achieve national food security and climate targets. They summarize (1) the need for CSA in the national context; (2) which investments would, if financially supported, be most suited to achieve the desired positive CSA outcomes; and (3) a general framework for monitoring and evaluation (M&E) for CSA that supports and reinforces other national monitoring frameworks. For example, Mali's national CSAIP2 prioritized a set of 12 investments to strengthen crop resilience and drive-up yields for over 1.8 million beneficiaries and their families. Large-scale initiatives at the national level propose investments in remote sensing-enabled monitoring of farm productivity and in ramping up provision of agroclimatic information through ICT (information and communication technologies). Priorities for crop-specific interventions include restoring degraded lands and promoting integrated millet-sorghum-legume cropping systems. Four CSAIPs have been completed for West African countries: Mali, Ghana, Burkina Faso, and Côte d'Ivoire (see figure 2.2).

[22] For example, the CSAIP Mali was developed with support of the AAA (Adaptation of African Agriculture) Initiative and the World Bank and with technical assistance from the International Center for Tropical Agriculture, the World Agroforestry Center, and the CGIAR Research Program on Agriculture, Climate Change and Food Security (CCAFS).

FIGURE 2.2 CSAIPs and CSA Profiles



Source: World Bank

CSA TECHNOLOGIES AT THE FARM- AND LANDSCAPE LEVEL IN WEST AFRICA

The Food and Agriculture Organization (FAO) Sourcebook for CSA lists water and soil management, climate-smart crop production systems, and climate-smart livestock systems as important CSA categories. Given its strong focus on outcomes that work for farmers means that CSA is just as inclusive of agroecological approaches leveraging natural processes for increased resilience as of recently developed agricultural innovations such as drought-resilient crop varietals and genetically improved livestock breeds. A brief overview of climate-smart technologies frequently mentioned in West African agroecologies is compiled below. Below, we summarize three of the five CSA categories included in the FAO sourcebook (based on Faurès et al. 2013), excluding forestry and genetic resource conservation.

WATER AND SOIL MANAGEMENT TECHNIQUES

Water management measures increase water availability for crops when water is scarce or prevent erosion of fertile topsoil by torrential downpours. Common examples of the region's soil and water management techniques include contour ridges, stone bunds, furrows, ditches, and terracing and rainwater harvesting. In the Western Sahel, zai- and half-moon-shaped pits are traditional techniques preserving soil moisture and restoring degraded lands (Lahmar et al. 2012). Another well-known and efficient water harvesting technique is boulies. These consist in "over-dug" ponds that are placed in an area where runoff water is concentrated during heavy rains.

West Africa only has 5 percent of agricultural land irrigated (Burney et al. 2010). Field studies point to high yield gains with solar-powered drip irrigation, especially for high-value horticultural crops (Wanvoeke et al. 2016), but structural barriers such as high upfront investment costs and low water supply generally complicate adoption (Partey et al. 2018). This said, the FAO reports substantial resilience gains of smallhold farmers through the implementation of small-scale solar drip irrigation systems in The Gambia, Mali, Burkina Faso, and Niger. A low-cost alternative to irrigation systems is to increase soil organic matter by enhancing on-farm tree cover, leading to better water retention.

Agroecological approaches including sustainable land management (SLM) or conservation agriculture (CA) foster natural biological processes to achieve high yields while preventing natural resource degradation. Examples encompass minimum or no tillage, crop rotation, mulching, intercropping, and permanent crop cove and crop diversification. CA practices increase soil organic matter, decrease erosion, improve water retention, and increase carbon sequestration. Studies show positive but limited effects of CA practices on crop yields for maize, millet, and sorghum in West Africa, moderated by biophysical context (Bayala et al. 2012). CA alone is unlikely to allow West African farmers to overcome low productivity and food insecurity. According to the most comprehensive study to date of CA yield impacts on crops yields in Sub-Saharan Africa based on a meta-analysis of 933 observations from 16 different countries, average yields under CA are only slightly higher than those of conventional tillage systems (3.7 percent for six major crop species and 4.0 percent for maize). Larger yield responses for maize result from mulching and crop rotations or intercropping. When CA principles (reduced or no tillage, crop rotation) are implemented in parallel, maize yield increases by 8.4 percent. The largest yield benefits from CA occur in combination with low rainfall and use of herbicides (Corbeels et al. 2020).

Integrated soil fertility management combines locally available organic matter (crop residues, green manure, and compost) with mineral fertilizers and N-fixing legumes such as soybeans to increase fertilizer efficiency. Integrated soil fertility management both increases and stabilizes yields under adverse rainfall conditions but uptake in Sub-Saharan Africa is still limited (Roobroeck et al. 2015).

CLIMATE-SMART CROP PRODUCTION SYSTEMS

Adaptation measures such as the cultivation of heat and drought-resilient varietals and improved management practices can offset climate change impacts. Breeding and disseminating drought and heat- resilient cultivars can contribute limit expected yield losses and even lead to yield gains despite climate change. For example, the Drought Tolerant Maize for Africa Project (DTTM), CIMMYT (The International Maize and Wheat Improvement Center) and IITA (International Institute of Tropical Agriculture) have developed 200 new high-yielding and drought-tolerant maize varieties. Millet is also frequently referred to as a climate-smart crop due to its drought resilience (Bandyopadhyay et al. 2017). In addition to the choice of cultivars, field management practices are pivotal. Studies have shown that agricultural practices may influence yields more than climate change-induced weather variability. For example, increased fertilizer application combined with increased plant populations has led to yield gains ranging from 20 percent to up to 256 percent (Adam et al. 2020). Existing germplasm also may contribute to climate resilience when management practices such as sowing dates are adapted. As Akinseye et al. (2020) have demonstrated using crop modeling studies, changes to the phenology of staple cereals such as sorghum, along with better management practices, can offset negative climate change impacts.

Climate-smart pest and disease management (CSPM) reduces crop susceptibility to pest and disease outbreaks by favoring agroecological practices such as crop diversification and habitat management and conserving indigenous natural enemies. It limits pest population buildup through preventive management practices such as using resistant varieties, timely planting and harvesting, and crop rotation. Preventive measures are flanked by reactive measures such as using biorationals (biopesticides, botanical pesticides, and biological control) and environmentally safer and low-risk synthetic pesticides.

Agroforestry systems incorporating trees in crop or livestock systems can be considered climate smart. Benefits comprise increases in soil organic matter and better water retention leading to higher soil fertility, less soil erosion, more biomass, and foliage-provided protection against extreme temperatures (Matocha et al. 2012; Verchot et al. 2007). Increasing tree density is observed to improve crop yields considerably. Yield gains linked to agroforestry are further enhanced when coupled with mineral fertilizer. Agroforestry practices are widely acknowledged to contribute to food security and climate resilience by diversifying sources of farmer income, increasing their resilience. The success of farmer-managed natural regeneration (FMNR) (see also correspondent subsection further below) in achieving higher crop yields, enhancing resilience, and carbon sequestration is a case in point.

CLIMATE-SMART LIVESTOCK SYSTEMS

Recent modeling demonstrates that there is scope for both increasing resilience and volume of livestock production across Africa's drylands. In the absence of adaptation measures under a business-as-usual scenario, more than 50 percent of both pastoralists and agropastoralists may not be able to subsist at 50 percent of the poverty line by 2030. By contrast, adaptation measures will allow pastoralist and agropastoralist producers to increase their contribution in meeting the rising demand in West Africa for animal-source products. Investments to, among other things, improve the quality of animal health services in parallel with measures to facilitate better access to feed resources (for example, through developing underexploited grazing areas or enhancing feed supply systems) could contribute to decreasing the share of households under pressure to exit the sector to below 7 percent by 2030[23] (Cervigni and Morris 2016).

Climate-smart livestock management approaches increasing resilience and productivity include "zero-grazing systems," using feed supplements, rotational grazing, planting fodder crops, and efficient manure management (Sova et al. 2018; Zougmoré et al. 2016). Climate-smart livestock strategies are site-specific, so they vary by agroecological zone. For example, in arid and semiarid zones where drought is the biggest risk, a shift toward small ruminants and camels and pasture management using the feed balance sheet approach could strengthen the adaptive capacity of livestock-based livelihoods. Where climate change will lead to a higher risk of flooding, thereby increasing exposure of livestock to vector-borne diseases, using endemic livestock breeds and improved fodder production could stabilize livelihoods (Zougmoré et al. 2016).

Future adaptation measures should (1) generally give priority to enable herders to rapidly adjust to climate or other shocks over productivity increases and (2) incentivize the development of alternative sources of income. Research shows high levels of productive efficiency of well-managed livestock systems in African drylands. In addition to the above-mentioned measures, creating enabling conditions for a resilient livestock sector requires guaranteeing livestock mobility to semiarid or subhumid zones when drought strikes, better market integration, and systems that allow for rapid and early destocking and restocking of herds (Cervigni and Morris 2016). In parallel to technically optimizing livestock management, the development of income sources, both within and outside the sector, should be an important component of any adaptation strategy (Cervigni and Morris 2016). Last, given the rising incidence of herder-farmer conflicts across the area, setting up accepted and inclusive conflict-resolution mechanisms is crucial.

Whether any given approach, practice, or technology is climate smart depends on the characteristics of the local biophysical environment. West African farming practices are highly heterogeneous due to the large diversity of agroecologies. A farming practice that would be climate smart in one area does not necessarily meet CSA criteria elsewhere in the region (Partey et al. 2018; Thornton et al. 2018; Williams et al. 2015). For example,

[23] The modeling results apply to all of Africa's dryland regions including West Africa.

CA might not be suitable for all soil types. Agronomic analysis suggests that CA practices such as mulching are more effective on loamy soils compared with sandy and clay soils. On poorly drained soils, by contrast, mulch can result in waterlogging and crop diseases (Corbeels et al. 2014). Despite the need for context-specific measures, scientific literature and expert solicitations point to recurring themes. Based on expert solicitation and CSA country profiles, the greatest gains in improving household resilience increases are likely from better water and soil fertility management, agroforestry, and drought-tolerant germplasm. Moreover, managing pests and diseases and genetic improvement of livestock breeds are other priorities that are frequently mentioned (Cervigni and Morris 2016; Sova et al. 2018).

LANDSCAPE-LEVEL CSA APPROACHES

Broader agricultural land use patterns and other sectors' activities on the landscape level have implications for both quality and quantity of available natural resources, influencing farm and livestock yields. Realizing the potential of climate-smart food production systems thus requires following a more holistic and integrated landscape management approach on multiple scales such as community or regional levels (Faurès et al. 2013). According to the FAO's CSA Sourcebook, adopting a landscape approach to CSA implies that the "management of production systems and natural resources covers an area large enough to produce vital ecosystem services and small enough so the action can be carried out by the people using the land and producing those services" (Faurès et al. 2013, 45).

International organizations and governments have moved to mainstream landscape management concepts into investments or development visions, policy frameworks, and climate adaptation plans. This is because the limitations and shortcomings of sectoral approaches in addressing the nexus of environmental degradation, poverty, and food security have grown more evident over recent years (Scherr, Shames, and Friedman 2013). Given the fuzziness and ambiguity of the notion of "landscape," different communities of practice and international research organizations have, depending on their main concerns (for example, biodiversity conservation, water management, or community-based resource governance), advanced many different landscape management concepts whose definitions, objectives, and operationalizations frequently overlap. For example, the integrated watershed management concept focuses on coordinating and planning natural resource use at a hydrological unit, while the main objective of sustainable land management (SLM) lies in scaling up landscape-level sustainable agricultural practices—for example, integrated soil and nutrient management to rehabilitate degraded land.

Integrated landscape management describes the variety of approaches where collective economic and ecological benefits are larger than the sum of plot- or farm-level gains accruing from individual land and water management interventions (Scherr, Shames, and Friedman 2013) (Gray et al. 2016). Scherr, Shames, and Friedman (2013) have identified several key principles underlying the integrated landscape management

approach: (a) promoting multiple objectives; (b) reducing negative trade-offs and fostering synergies associated with ecological, social, and economic interactions; (c) recognizing the role of local communities; (d) ensuring adaptiveness of interventions; and (e) institutionalizing collaborative action and broad stakeholder engagement. An example of integrated landscape management consists in mobilization of community members for collective action in managing surface and groundwater resources.

THE WEST AFRICAN CONTEXT

The path toward solutions needs rethinking given rapid climate change, depleting natural resources, and expansionary agricultural growth. Land and labor productivities, while increasing in recent years, remain well below global benchmarks. In West Africa, yield growth only contributed about 16 percent to overall growth in production, compared with 80 percent for developing countries. Consequently, the area of total agricultural land harvested in West Africa has grown by 17 percent from 2005–17. Projections show that increasing crop areas in eastern parts of West Africa would significantly deplete forest and grassland by 2050. Almost two thirds of West African countries will be facing water scarcity by 2025 and almost 80 percent of surface waters face eutrophication. Promoting landscape restoration, including through agroforestry, could significantly enhance both coping strategies of local communities and strengthen their resilience to weather shocks. If covering sufficiently large areas, improved tree, shrub, and forest cover in the Sahel region could increase water infiltration, groundwater recharge, and the potential for rainfall while providing land surface cooling (Ellison and Speranza 2020). Currently ongoing initiatives, as discussed further below and shown in more detail further in table 2.1, provide major opportunities to target restoration at landscape scales.

Adopting an integrated landscape management paradigm appears particularly relevant in the Sahel. In the semiarid and arid areas of West Africa, resources are scarce and dispersed and livestock are an integral part of agricultural production systems. In this context, introducing isolated technologies at the plot level are hardly ever successful (Bado and Bationo 2018; Birhanu et al. 2020). Employing SLM practices at the landscape scale is crucial to safeguard agricultural productivity and the region's food security given land and resource degradation (UNCCD 2019). The urgent need to halt land degradation to guarantee food security is well recognized in the region, with most of the region's countries adopting voluntary land neutrality targets. Apart from land- and watershed restoration, another important type of landscape-level intervention includes the restoration of floodplains and riverbanks to mitigate impacts from flooding and to improve natural habitats with attended benefits for biodiversity. Restoring floodplains frequently involves the reconnection of floodplains to main waterways and the reestablishment of a more natural hydrologic regime. In the Sahel, constructing water spreading weirs is widely considered a promising option to increase yields in rainy season (Amdede and Whitbreat 2020).

PAST EXPERIENCES AND LEARNINGS: GESTION DE TERROIRS (GT)

In francophone West African states, the gestion de terroirs (GT) approach became a widely promoted landscape approach for sustainable land use planning in the 1990s (Bernard 2014; Gray et al. 2016). This approach emerged as an innovative response to failures of preceding top-down rural development programs (for example, Community-Based Natural Resource Management) (Degnbol 1996). Due to its emphasis on bottom-up and decentralized management of natural resources at the village or community level that anchored decision-making at local-level institutions, GT is a pioneer of participatory landscape management approaches (Bernard 2014). The effectiveness of GT was generally constrained by unresponsive policy frameworks at higher administrative levels, the often purely informal decision-making authority of local village committees without legally conferred powers, insufficient local capacity, and the frequent failure of newly created community-level institutions to build on local cultural traditions (Bernard 2014; Cleary et al. 2003; Gray et al. 2016). Yet increasing local agency in decision-making has been associated with better food security outcomes. When promoting any climate-smart landscape approach, historic experience with the GT-approach forcefully demonstrates the importance of improving stakeholder capacity at local level and building strong institutions that are attuned to their respective cultural context (Bernard 2014). Communities must have the legal authority to select investments (for example, in irrigation) that are best suited to their specific conditions for effective, bottom-up management approach, making stringent political decentralization measures critical.

CLIMATE-SMART VILLAGE (CSV)

To ground research on context and location-specific enabling conditions for scaling CSA at landscape level, CGIAR CCAFS and local partners have developed the climate-smart village (CSV) approach. Based on the principles of participatory action research, the CSV approach aims to (a) generate actionable evidence on CSA effectiveness in real-life settings and social, biophysical, and gender constraints to adoption; and (b) facilitate codevelopment of proven mechanisms for CSA-scaling at landscape, subnational, and national levels. CSV AR4D (applied research for development) sites are clusters of villages within a local government jurisdiction (involving one or several villages). The selected climate-smart villages are in high-risk areas across a wide range of agroecological zones, climate risks, and farming patterns, allowing for site comparison, learning, climate analogue analysis, and extrapolation of research findings. Since project launch in 2011, CCAFS has established CSV in Burkina Faso, Ghana, Mali, Niger, Senegal. Other CSV can be found in East Africa, Latin America, and Southeast Asia.

[24] See also subsection on adoption barriers further below for findings on CSA adoption constraints based on CSV research.

PRODUCTIVE SAFETY NETS

Since the early 2000s, integrated landscape management has increasingly been promoted in the context of government-initiated safety net schemes. In these schemes, poor households receive food and cash payments for increased food security in exchange for rehabilitating land and water resources and working around community infrastructure. In India, for instance, farmers contributing their labor to SLM interventions were compensated with wages and agricultural loans (Gray and Srinidhi 2013). Widely known and analyzed examples on the African continent include the Ethiopian Productive Safety Net Program (PSNP) and the Managing Environmental Resources to Enable Transition (MERET) program (Gray et al. 2016). Applying lessons from earlier SLM interventions and other approaches, these programs successfully introduced participatory, decentralized implementation mechanisms, chose manageable scales (that is, watershed level), and were flanked by supportive land tenure policies (Gray et al. 2016). Cost-benefit analyses attested overall favorable results including long-term improvements in soil fertility and productivity on the farm level as well as increased groundwater levels and the prevention of soil erosion on the landscape level (WFP 2005). Major learnings from past experience with integrated landscape management efforts in Ethiopia and elsewhere indicate the importance of a long time-horizon to achieve positive returns as increased productivity is conditional on prior ecosystem restoration (Gray et al. 2016). In the case of Ethiopia, cash-for-work or cash-for-food projects have enabled scaled-up SLM interventions and strengthened farmer awareness of ecosystem restoration (Gray et al. 2016).

FARMER-MANAGED NATURAL REGENERATION (FMNR)

Farmer-managed natural regeneration (FMNR) is a SLM practice that has taken root in Sahelian countries through a largely bottom-up driven process with little coordination. Having contributed to transformative landscape changes in areas across the region, FMNR is widely seen as a prime example for successful large-scale rehabilitation of degraded lands based on community action. Originating in an integrated development project started in Niger in 1984 to halt desertification (Tougiani, Guero, and Rinaudo 2009), FMNR has been credited with both improving food security and increasing drought resilience for 4.5 million people (Cameron 2011). The practice has allowed around 200 million trees to grow on more than five million hectares (Reij, Tappan, and Smale 2009). FMNR, typically categorized as an agroforestry practice, mainly consists in letting remnant tree seeds remain in the soil to germinate naturally instead of clearing land for crop cultivation. Additional planting of trees or inputs is not required. Per hectare, farmers regenerate 20 to 60 trees and prune them on a yearly basis (World Future Council 2019). FMNR benefits include rising yields through soil fertilization and better water retention, firewood and fodder production, and biological pest control through increased biodiversity (Carey 2020). Overall household income gains from FMNR have been estimated at around US$1,000 per household and year (Pye-Smith 2013). In its early days in the mid-1980s, pioneering NGOs such as Serving-In-Mission (SIM) and an IFAD project (PPILDA) promoted FMNR dissemination through farmer-to-farmer visits and extension and communication activities.

FMNR helped farmers to develop a common understanding that tackling land degradation and declining soil fertility required action on farm, village, and intervillage levels, although no explicit landscape-level goals had been set in advance (Gray et al. 2016). While word-of-mouth exchanges of experience largely drove the dissemination of FMNR practices, widespread adoption was critically aided by an increasingly favorable policy environment. Beginning in the 1990s, the Nigerien government decentralized natural resource management, leading farmers to perceive that they could reap the full benefits from on-farm tree management (Gray et al. 2016; Reij and Winterbottom 2015). These developments significantly boosted farmers' motivation to invest in protecting and regenerating trees on their farms. Owing to a large degree the diffusion of FMNR, Niger is frequently referred to as the African country with the most positive landscape transformation over the last decades (Bilsky 2018). Thanks to its well-documented achievements and its perception as an easily scalable and cost-effective approach, community-based FMNR is now promoted by a variety of NGOs such as World Vision and other actors across the continent (World Future Council 2019). Yet despite this abundance of success stories surrounding FMNR, community-based regreening efforts have so far reached only a small proportion of the degraded lands in West Africa (Carey 2020; Bado et al. 2020).

ONGOING LARGE-SCALE LANDSCAPE INITIATIVES

Country commitments to halt and reverse land degradation and greater ambition on what can be achieved has been catalyzed by the SDG agenda, the Paris Agreement, and increased public attention. For example, 28 African countries have committed to restoring 113 million hectares of land by 2030. With a continental vision, the Great Green Wall Initiative (GGWI) may be the most frequently mentioned landscape-level initiative in West Africa. Launched in 2007 under the auspices of the AU, it was originally conceived as an almost 8,000 km-long and 15 km-wide band of trees leading from Senegal to the Horn of Africa to halt the Sahara desert expansion. Attracting large amounts of donor funding, its initial strategy consisted in tree-planting on a massive scale. Yet the GGWI was criticized for misconceptions about the Sahara's advancement, the GGWI's top-down driven mode of operation, and the high mortality of planted trees (Carey 2020; Wade et al. 2018). The GGWI has recently moved away from its original vision of erecting a literal "barrier of trees" toward a more nuanced approach drawing inspiration from bottom-up initiatives such as FMNR that are considered highly successful and cost-effective. GGWI now supports community-driven interventions that create a mosaic of diverse and adapted landscapes while relying on traditional land regeneration techniques (Carey 2020; Davies 2017; GEF 2019). While experts generally commend this change in orientation, reliable, transparent, and systematic information on GGWI's current status is surprisingly scarce. This is attributed to the lack of centralized M&E under one competent steering agency, the great number of actors, and the distribution of funds and projects over a multitude of countries absent a clearly established management mechanism (Vizcarra 2019).

The Sahel and West Africa Program in Support of the GGWI (SAWAP) is particularly relevant. SAWAP was launched in 2011 by the World Bank and the Green Environmental Fund (GEF) under the TerrAfrica partnership, a coalition to rapidly expand continent-wide adoption of SLM. SAWAP is a US$1.1 billion

multitrust fund to implement SLM practices in climate-vulnerable areas in the Sahel and West Africa. By 2016, US$231 million had been disbursed across one regional and 12 country projects (WB 2016). Running from 2013 to 2019, the regional project titled "Building Resilience through Innovation, Communications, and Knowledge Services" (BRICKS) under the auspices of the CILSS, the Sahara and Sahel Observatory, and the International Union for Conservation of Nature (IUCN) sought to improve accessibility of best SLM practices and monitoring information within SAWAP countries. The goal was facilitating South-South learning and scaling up innovations across the region. By 2019, SAWAP has contributed to SLM adoption of over 1.6 million ha of land, reaching in total 22 million direct beneficiaries while also leading to increased uptake of participatory approaches for natural resource management (GEF 2019).

The GEF-cofinanced Fostering Sustainability and Resilience for Food Security Sub-Saharan Africa (FS-IAP, 2017–2022) is another currently operational multicountry program involving Sahelian countries.[25] Covering 12 Sub-Saharan African countries, including Burkina Faso, Ghana, Niger, Nigeria, and Senegal, it aims to improve management on 10 million hectares of land and seeks to leverage US$900 million from various donors. Aside from continental programs, global large-scale programs that West African countries can tap into for scaling up SLM practices to restore productive landscapes include the recently launched World Bank-led Food Systems, Land Use, and Restoration Impact Program (FOLOR) and the FAO-led Dryland Sustainable Landscapes. Last, the World Bank's new PROGREEN multidonor trust fund will also represent a potentially abundant source of integrated resource management funding given its objective to assist countries in fulfilling their national targets such as the land neutrality targets.

CHALLENGES LINKED TO INTEGRATED RESOURCE MANAGEMENT IN WEST AFRICA

At present, a lack of both horizontal and vertical integration and capacity constraints complicate the sustainable implementation of integrated resource management. Relevant actors (for example, agriculture, water, and forestry agencies) still act too frequently in silos while the distribution of responsibility between state actors at the national, subnational, and local level often lacks coherence. As mentioned before, the effectiveness in implementing a participatory landscape management approach requires that communities have the legal authority to select investments that are best suited to their specific conditions. Institutional arrangements need to promote both adequate coordination mechanisms and empower different stakeholders according to their respective mandates and competencies. Closely related to this, limited staff capacity and financial resources, particularly in poor or isolated rural areas, make development interventions unsustainable in the long run as integrated approaches are not sufficiently

[25] For other relevant programs, including those led by ECOWAS and CILSS, such as the West Africa Agroecological Transition Support Project (PTAE), please see also the initiative mapping further below.

anchored locally. While projects often provide funding for local investments, funds are also required for establishing and sustaining the public administrative structures that provide technical and administrative support after the project ends.

Coordinated land restoration programs that have proven successful in other regions may not be fully transferrable to the West African drylands where both physical and social characteristics differ. The case of Ethiopia, where government-coordinated landscape programs are credited with having achieved considerable success, provides an illustrative example for the importance of context. It appears questionable whether similar programs could be successful in West Africa. In the hilly Tigray region in Ethiopia, it is straightforward to delineate water catchments, whereas this is not the case in the largely flat savannahs in West Africa. Furthermore, collective action in Ethiopia was mobilized by building on well-organized local governance structures at the village level. In contrast, in many West African countries, local government institutions are much less developed, if not practically absent. A more fundamental criticism of conventional landscape restoration programs relates to the use of integrated landscape management in development interventions. Farmers and resource users' perceptions of landscapes and priorities tend to differ considerably from those of scientists or development practitioners. Farmers will adopt a practice when they see an immediate benefit for doing so but not necessarily when it would be reasonable from a landscape perspective.

Integrated landscape management projects are often highly complex, which makes them difficult to achieve transformation on a large scale. The complexity of big landscape projects often complicates reaching long-term sustainability of project activities. A previous big-donor financed project with eight packages and 43 different activities provides an illustrative example. Subcomponents ran the gamut from development of catchment management plans to the development of agricultural value chains and the development of market information systems. With so much complexity, little can be achieved within two years and it is questionable whether activities would be continued after the external support for the project has ended. For long-term adoption of CSA, benefits should materialize within one or two years (Reij, Tappan, and Smale 2009). The Integrated Keita Project in Niger provides another example of the pitfalls of complexity. Started in the mid-1980s, it restored thousands of hectares of degraded land through Food-For-Work programs to mobilize labor and involved heavy machinery. While its achievements during implementation were obvious, restoration has all but ceased after the end of the project since techniques promoted by the project relied on external support (Reij 2018).

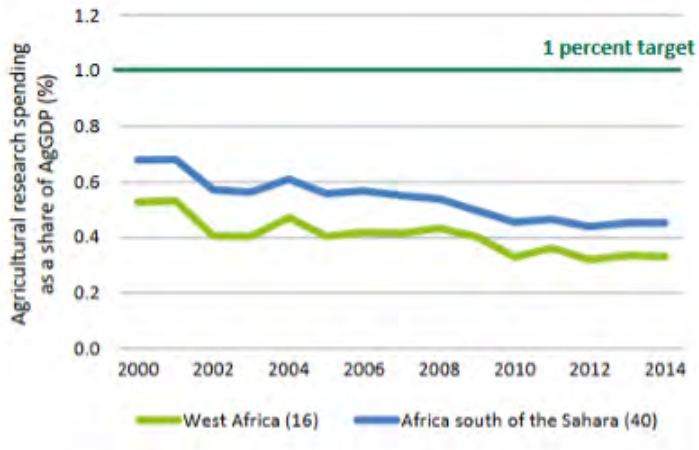
There is a need to clarify land tenure or resource usage rights in the areas where project activities are to be implemented. In West Africa, land governance is often based both on modern legal provisions (modern law) and traditional provisions (customary law). The overlap between two approaches is often conducive to disputes and a lack of tenure clarity. In many cases, land rights are not clearly defined and land rights of farmers are insufficiently protected. Women frequently face particularly severe constraints in accessing land. In the absence of clarifying tenure, farmers have little incentive to make long-term investments into their lands, which complicates achieving sustainable outcomes.

AGRICULTURAL INNOVATION SYSTEM

AGRICULTURAL RESEARCH TRENDS IN WEST AFRICA

Despite high expected returns on investment (ROI), support to agricultural R&D remains low. For Sub-Saharan Africa between 2000 and 2011, the ROI was estimated at 34 percent. Over the last decade, spending on agricultural research accounted for only 0.4 percent of agricultural GDP in Sub-Saharan Africa compared with 1.3 percent in Latin America and the Caribbean and 0.9 percent in South Asia (Goyal and Nash 2016). While the region has witnessed growing public investments into agriculture between 2000 and 2014, agriculture expenditure in total public expenditure in ECOWAS countries has remained well below the CAADP Maputo target of 10 percent (Stads and Beintema 2017b). Moreover, growth in investments in agricultural research lagged behind general agriculture-related spending growth. Consequently, agricultural research spending as a share of its agricultural gross domestic product (AgGDP) has declined from 0.53 percent to 0.33 percent, considerably falling below levels seen in other Sub-Saharan African subregions (see figure 2.3).

FIGURE 2.3 Agricultural Research Spending



Sources: Calculated by authors based on ASTI data and various secondary sources; data on AgGDP are from World Bank (2016).
Note: The numbers in brackets denote the number of countries included in each sample.

Source: © ASTI 2017

National Agricultural Research Systems (NARS) are underfunded in the region. While spending ratios should be interpreted with caution as they omit countries' differing socioeconomic and biophysical characteristics, they suggest that there is systematic underfunding. Public investments in agricultural research largely have been driven by unstable external donor support. Across the region, national governments often fund staff salaries while non-salary-related expenses are covered by external funding. Francophone countries exhibit particularly high levels of donor dependency. This excessive reliance on external aid has led to harmful fluctuations in sector funding and also to a lack of national

ownership and alignment of research priorities with national development plans (Stads and Beintema 2017a). While it is highly desirable for the region to decrease donor dependence by setting up sustainable funding mechanisms, achieving this in the near term will be unlikely. This applies especially to Sahelian countries where security and defense spending is consuming growing shares of the national budget due to worsening conflict.

The effectiveness of regional research systems has been constrained by fragmentated research capacity across countries, a lack of regional coordination, duplication of research agendas, and outdated research infrastructure. In the past decades, research capacity was highly fragmented, with scarce resources spread too thinly over a wide range of research themes. Moreover, many countries in the region have simultaneously pursued similar research agendas, leading to duplication of efforts. Considering that returns to research and development increase with scale (Goyal and Nash 2016), it is unsurprising that the overall research effectiveness has remained limited (Lynam et al. 2016). Also, the high dependence on external donors is not conducive for pursuing coherent mid- and long-term strategies. With donor support frequently tied to the addressing of specific research agendas, actual research efforts are occasionally at odds with national and regional mid- and long-term strategic research plans. Last, extended time periods of underfunding of National Agricultural Research Systems (NARS) are also reflected in outdated research equipment and facilities, a low number of female researchers, and rapidly aging staff, which all further impede performance (Stads and Beintema 2017b).

Since the 2000s, donors have increasingly turned toward promoting supranational collaboration to increase agricultural research effectiveness by funding of regional research programs (World Bank, USAID, EU, Japan, and others). The rationale has been to enable participating countries to follow a more ambitious research agenda by combining resources and talent. One approach has been to conduct agricultural research of regional interest through commissioned or competitive agricultural research grant (CARG) schemes administered by the West and Central African Council for Agricultural Research and Development (CORAF). Given the absence of regionally collected taxes or levies, however, CARG schemes are currently limited since they depend on external funding (Lynam et al. 2016). Yet efforts are underway to continue CARG schemes by mobilizing internal resources. Another recently pioneered approach to increase the regional clout of Sub-Saharan agricultural research has been promoting much-needed coordination and cross-country collaboration among NARS in the context of agriculture productivity programs facilitated by the World Bank.

The West African Agriculture Productivity Program (WAAPP) directed by CORAF is widely considered a game changer for the West African agricultural research landscape. From 2008 to 2019, WAAPP has made important strides in reforming the regional technology generation and dissemination regime for increased impact and effectiveness. By dividing up responsibilities for agricultural research between national, regional, and international research centers, the West African Agriculture Productivity Program (WAAPP) has sought to create a system of mutual interdependence that leverages resources and encourages technological spillovers. With extensive capacity-building and training measures, the five-year-long first phase of WAAPP established nine National (research) Centers of Specialization (NCoS) concentrating on national priority commodities aligned with the regional priorities as defined in ECOWAP. To scale up generation and dissemination of improved technologies under phase two, WAAPP foresaw the upgrading of eligible NCoS to Regional

(research) Centers of Excellence (RCoE) capable of undertaking world-class research in cooperation with international research institutions such as CGIAR research centers that bring global knowledge and expertise to the region. WAAPP also piloted successfully participatory innovation platforms facilitating the identification of value chain constraints as well as the selection and dissemination of technologies most relevant to producers and processors. Between 2011 and 2016, WAAPP was complemented by a Multi-Donor Trust Fund (MDTF) that strengthened the CORAF Executive Secretariat and funded projects of regional interest through Competitive Grant Schemes (CGS).

Much more needs to be done to enable the West African agricultural research system to overcome multiple challenges and meet critical needs. WAAPP has directly benefited around nine million producers and is credited with having improved food security for around 50 million people and has released over 200 improved technologies. Alongside upgrading research equipment, the program has enabled 1,000 young scientists (30 percent female) to receive scholarships for higher academic education and on the job training. This has maintained critical human resources in the face of the imminent retirement of senior researchers and generally improved the outlook of West African agricultural research. For West Africa to attain its ambitious agricultural growth and food security targets, however, the regional technology generation and dissemination structures need further strengthening. First, thus far two in nine countries with NCoS have successfully completed the second phase of WAAPP, meaning that presently only two RCoE exist that are capable of executing world-class programs. The other NCoS aspire to graduate into RCoE but currently face resource shortages. Moreover, responsibilities between national research systems and regional/international research institutions need to be defined more clearly based on subsidiarity and comparative advantage.

To guarantee long-term viability of an integrated and effective regional research system, sustainable endogenous funding mechanisms for both national and regional research must be established. For example, CGSs for multicountry research could be reformed following the FONTAGRO model, which has proven an effective instrument to multicountry research related to climate change adaptation, sustainable intensification, and food security in Latin America. FONTAGRO is a regional cooperation mechanism that relies on country contributions for its functioning. Established in 1998, 15 Latin American countries have contributed a total of US$100 million in capital to the Inter-American Development Bank (IDB)-administered cooperation mechanism.

The large-scale Technologies for African Agricultural Transformation (TAAT) Project was launched as part of the Feed Africa Strategy as a continental flagship program to accelerate technology uptake with high relevance for the region. It was launched in 2018 by the African Development Bank (AfDB). In contrast to the WAAPP research program, TAAT is an outreach campaign for boosting rates of varietal deployment. TAAT aims to rapidly diffuse already existing high-yielding cultivars while promoting diversification and processing around nine priority commodities. Managed by various CGIAR research centers through Commodity Technology Delivery Compacts (CTDC) organized by commodity, TAAT works closely with National Agricultural Research and Extension Services (NARES) as the main agents for technology delivery and scaleup. A major innovation compared with earlier approaches to scaling innovative technologies lies in the clearinghouse (C-house), TAAT's main decision-making body. Its core objective is selecting eligible technologies to disseminate and roll out across similar agroecological zones based on a

consultative peer review process. The C-house steers efforts to harmonize seed regulation and registration processes. At present, lengthy variety release procedures are replicated in each country and result in slow technology adoption and fragmented seed markets. To harmonize seed registration and release protocols across the region, TAAT is working with Sub-Regional Organizations (CORAF) and International Food Policy Research Institute (IFPRI) and its partners (Africa Technology Policy Studies ATPS Network). Of special regional relevance is the TAAT sorghum and millet compact launched in 2019. Managed by ICRISAT (International Crop Research Institute for the Semi-Arid Tropics), it focuses on transforming sorghum and millet value chains in Senegal, Mali, Niger, Nigeria, Sudan, Chad, and Burkina Faso. It is frequently argued that TAAT should collaborate more closely with the regional research system to improve technology dissemination.

ROLE OF PRIVATE SECTOR IN REGIONAL AGRICULTURAL INNOVATION SYSTEM

PRIVATE SECTOR INVOLVEMENT IN AGRICULTURAL RESEARCH IS STILL LACKING

Making the regional research system more impactful and raising more resources by better involving the private sector is a widely acknowledged need. West Africa's public sector has historically spearheaded investments in agricultural R&D. Information on research activities by the private sector in the region is scarce and rarely documented (Beintena and Stads 2011). Except for South Africa, private investments in R&D are generally still low in Sub-Saharan Africa, although there has been considerable growth. This applies especially for parts of the seed sector that are linked to commercially integrated value chains, such as maize (ibid). As a potential source for sustainable financing, the private sector remains underutilized in most countries (Beintema and Stads 2014). Increasing private sector interest requires "developing explicit market demand for the products of agricultural research" (Lynam et al. 2012). CORAF's current regional strategic plan "Catalysing Innovations 2020–2027" highlights the importance of better integrating the private sector in agricultural research. For example, as part of the IR4D approach, the plan calls for fostering a regional enabling environment for scaling technologies and innovations, including through mobilizing partnerships with the private sector.

Recent interventions encouraged private sector participation in research and dissemination, but more needs to be done. The USAID-financed WASP (West African Seed Program) attempted to increase private sector participation in seed breeding activities. A midterm review, however, stated that the current supply and production of breeder seeds lacks a business approach and still depends on project funding due to lack of support, capacity constraints, and the reluctance of some countries to allow private production of foundation seeds (USAID 2017b). Most countries continue to rely on public

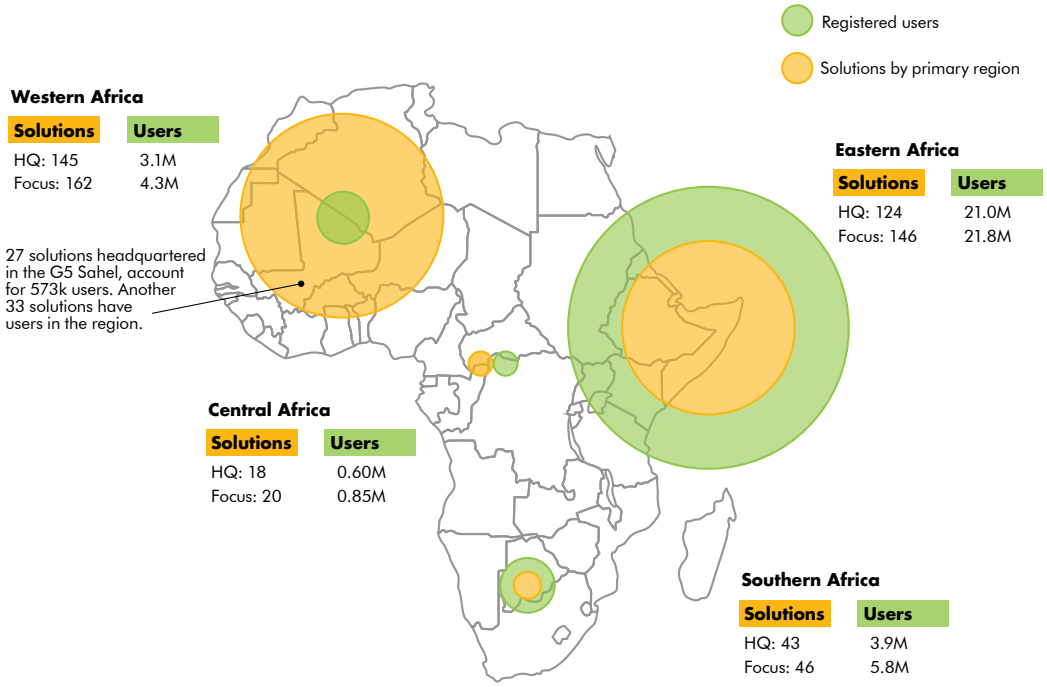
breeding. To encourage private investments in technologies and their dissemination, it is vital to allow local and foreign firms to enter while providing them with a stable policy and regulatory environment (Pray et al. 2014). Addressing issues around intellectual property is important. At present, research products from publicly funded research frequently cannot be taken up by the private sector due to licensing issues. As discussed elsewhere in this report, corresponding regional regulation exists, for example, in terms of free circulation of registered seeds, but implementation is still lagging and needs updating.

Public-private collaboration in the region may allow the raising of significant levels of private funding complementing public sources and boost innovation. Mistrust between private and public actors frequently complicates collaboration, for example, through Private-Public Partnerships. Yet positive examples exist. Farmers and related agribusinesses (such as formal associations) can generate additional resources for agricultural research through collective action. A unique example in the region is The National Center for Agricultural Research (CNRA) in Côte d'Ivoire. Established as a public-private entity, it obtains 40 percent of its funding from the public and 60 percent from the private sector. Private contributions come from membership subscription fees from commodity-specific producer organizations. At least 75 percent of funding raised in a subsector is assigned to programs responding to private sector needs (Beintema and Stads 2014).

DIGITAL AGRICULTURE PRESENTS NEW OPPORTUNITIES FOR INCREASING PRIVATE SECTOR INVOLVEMENT IN WORKING TOWARD INCREASING FOOD SYSTEM RESILIENCE

Although funding is still largely donor driven, West Africa has an active start-up scene developing digital solutions with potential resilience gains from farm to fork. Between 2016 and 2018, the number of tech hubs in Sub-Saharan Africa has almost doubled, from 239 to over 440 (GSMA 2018). Across Sub-Saharan Africa, the number of users that have registered to use one or more types of digital agriculture services is projected to rise from 33 million to 200 million users from 2019 to 2030 (Tsan et al. 2019). Tech companies such as Alphabet and Facebook have recently set up start-up incubators and agriculture and agribusiness-specific innovation hubs have been established. For instance, SmartHectar, an operator of innovation hubs backed by many multinational agribusinesses, and enpact, a nonprofit organization, launched an innovation hub for agriculture technology, food technology, and water technology in West Africa based in Ghana in 2019. At present, most registered users (over 20 million) are in East Africa (see map 2.1). Despite counting many emerging solutions, totaling 145 with headquarters in the region, the number of registered users, estimated at 3 million, is still small. With public contributions totaling US$207 million compared with US$55 million from private sources (2018), funding of agriculture tech start-ups remains largely donor driven.

MAP 2.1 Solutions and Registered Users (Millions) by Subregion of HQ and Subregion of Primary Focus, 2018



Source: © CTA 2019 EU Financing

Emerging digital solutions range from advisory and extension services to e-market places and applications enhancing financial access. In Mali and Senegal, MyAgro, a nonprofit, has become a successful mobile layaway platform, allowing at present around 50,0000 farmers to pay for seeds, fertilizer, and training via piecemeal instalments. Users of the application report 50–100 percent increases in harvest yields, corresponding to an additional income of US$128–390 per farmer (IFC 2018). A noteworthy example of a private-public partnership is Senegal-based agCelerant. Resulting from a partnership between CGIAR institutes and a private organization (Manobi) and EU- Horizon 2020 funding, this innovation program aims to connect smallholders with credit, insurance, and input and output markets. It aims to leverage both Internet of Things (IoT) and earth observation data for data ecosystems that allow an increase in smallholder access to credit and insurance and value chain orchestration. For example, combining dense networks of automated rain gauges with earth observation data enables banks to develop clearer risk profiles of farmers, decreasing the cost of agricultural credit and weather insurance (Traore 2020).

To fully harness the potential of digital solutions and expand business opportunities, the region needs to tackle a variety of barriers including but not limited to human capacity constraints, weak data infrastructure, and the absence of a regulatory framework related to data and privacy. The CTA Report "The Digitalisation of African Agriculture" coauthored by Tsan et al. (2019) concludes that access to mobile phones will unlikely pose major hurdles for the scaling of digital solutions in the medium term. Based on current trends, more than 80 percent of smallhold households will have access to at least one mobile phone with sufficient

connectivity. According to Tsan et al. (2019), the region should address the following stumbling blocks to allow digital technologies to play a transformative role: First, digital literacy among officials in the public sector and smallholder farmers needs to be improved. Related to that, the regional research system should increase investments to harness the potential of an increasingly tech-savvy and youthful population by supporting start-up ecosystems and encouraging youth involvement in incubators, university initiative and accelerators. Second, "the missing middleware infrastructure" needs strengthening. Digital solutions require availability of a wide range of data encompassing weather data, data on pests and diseases, soil mapping, market information and farmer-specific data. Individual operators are poorly placed for building data ecosystems by themselves. Much greater investments are needed in providing such data as public goods based on which digital providers can build their solutions and tailor them to the specific needs of their target groups. Third, related to the need for a publicly funded data infrastructure, is the necessity of an appropriate regulatory framework on data. At present, there is no dedicated digital policy at the ECOWAS or CILSS level. Apart from providing safe legal operating space for the creators of digital solutions, a core objective of a digital legal framework should be to safeguard the interests of producers and other value chain actors.

ADOPTION BARRIERS FOR CSA TECHNOLOGIES

Despite the multiple efforts to promote CSA scaleup, regional adoption of climate-resilient technologies both on a farm and landscape level remains unsatisfactory. Evidence suggests that context-specific biophysical, social, economic, and political factors inhibit farmer uptake of CSA practices such as sustainable resource management (Cordingley et al. 2015). Biophysical adoption determinants include soil fertility, pests, and unreliable rainfall (Sietz and Van Dijk 2015) while social factors run the gamut from low resource endowments, insecure land tenure, limited extension and infrastructure, unreliable market prices for agricultural products, and a lack of credit access (Adimassu, Kessler, and Hengsdijk 2012; Kassie et al. 2015). Frequently mentioned barriers to CSA adoption in West Africa include high upfront costs, lack of awareness of CSA, chronically low access to loans to make on-farm investments and purchase inputs, and an absence of financial incentives due to a poor market access (Bayala et al. 2016; Ouédraogo et al. 2015). A recent participatory study observing CSA uptake of approximately 900 households in CSVs across Niger, Ghana, and Mali identified poor technical capacity, limited availability of inputs and equipment for implementing CSA technologies and practices as well as low dissemination of information on CSA as the most important constraints to CSA uptake (Ouédraogo et al. 2018).

Past adoption of CSA and SLM innovations frequently failed to materialize as interventions focused too narrowly on biophysical problems while ignoring socioeconomic conditions both at household and landscape level. For example, low labor availability within households frequently prevents farmers from adopting labor-intensive soil and water conservation techniques such as zai pits or contour bunds (also referred to as "digues filtrantes"). The absence of land security disincentivizes farmers' long-term investments into soil health. Food system aspects such as processing, transport, and distribution of food products are also crucial adoption determinants but appear to be underresearched (Barnard et al. 2015). A meta-

analysis found that SLM adoption in West Africa is an emergent property of farming systems requiring the simultaneous occurrence and interaction of both socially and biophysically favorable conditions. Furthermore, adoption of CSA practices may not last if farmers abandon new techniques to respond to pressing short-term financing pressures (Barnard et al. 2015). A lack of knowledge and advisory through extension services often means that adoption of improved technologies is only partial, preventing farmers from achieving higher productivity gains. For example, an empirical investigation employing Living Standard Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) data to detect input use patterns in Africa found that only a fraction of Nigerien farmers pair modern agri-inputs such as inorganic fertilizer and improved seeds in a synergistic way, leading to forgone production benefits (Sheahan and Barrett 2017).

Gender-based constraints slow down CSA adoption by female farmers and need to be addressed to decrease the persisting productivity gap between men and women. As mentioned in Part One "An Overview of the Current State of West African Food System", evidence from Nigeria and Niger suggests a persisting productivity gap between male and female producers in the region. In addition to structural barriers such as less control over land, low access to resources, and limited agency in agricultural decision-making, ongoing socioeconomic changes may also contribute to the observed gender gap (O'Sullivan et al. 2014). This includes, for example, the gradual exiting of men from agricultural production, which frequently sees on-farm labor requirements for women rise. These gender-based constraints imply that women may benefit less from CSA technologies. A case study on uptake of drought-tolerant maize in Uganda concluded that women might be indeed more exposed to the identified adoption barriers than men (Mastenbroek et al. 2020). To ensure that CSA technologies benefit both genders equally, a gender-responsive approach needs to be adopted. This implies adequately recognizing and addressing the "specific realities, needs and priorities of women and men in the design and application of CSA" (WBG, FAO, and IFAD 2015). Accordingly, interventions promoting CSA must consider implications for labor distribution and labor impacts on all household members and adopt gender-sensitive indicators to measure progress in narrowing the agricultural gender gap (Huyer et al. 2015).

In sum, adoption barriers include a lack of market access, insufficient knowledge dissemination, poor access to inputs, and gender-based constraints. After a brief synthesis of the importance of lessons for scaling up CSA, this section continues with a more detailed discussion of extension and knowledge delivery services before turning to recent developments on farmers' access to input and credit.

LESSONS FOR SCALING UP CSA TECHNOLOGIES

Interventions should systematically incorporate scaling considerations during both design and implementation. Based on a review of evidence from across the developing world, the scaleup sourcebook proposes several lessons that should be applied when promoting CSA (Cooley et al. 2019). For example, CSA interventions should emphasize adaptive capacity over having the perfect plan at an early stage, as successful scaling normally involves repeated changes in strategy and intervention design during innovation rollout and must be supported by "theories of scaling" complementing technical theories

of change. To drive adoption, the whole value chain needs to be considered from the outset of any intervention through forming strong partnerships with value chain actors that can provide equipment leasing, input provision and aggregation services. Such partnerships could also encourage local agro-input dealers and service providers to offer extension and product verification services to farmers who are currently underserved by public extension services (Cooley et al. 2019).

Markets are needed to catalyze change and producer organizations can play a central role in better linking smallholders with markets. Existing output markets are core requirements for encouraging farmers to adopt new technologies (for example, seeds) with increased yield potential and practices. The prospect of generating income from selling surplus produce on domestic or regional markets is a key driver for CSA adoption. When farmers feel certain about market opportunities, they make efforts to adapt. Farmers in Burkina Faso have started growing tomatoes after learning from traders that city dwellers in Ghana and Togo would buy these at a higher margin than previously cultivated staple crops. According to anecdotal evidence, no extension agent had come to the village to educate them. The importance of available distribution channels is also underlined by a telling example of CSA disadoption. In the context of WAAPP, a high-yielding manioc cultivar developed by a regional research center and subsequently piloted with farmers in Ghana. Yet despite high yields, farmers abandoned the varietal in the following cropping season when they were unable to sell their harvest. In West Africa, producer organizations are frequently considered a key actor with the potential to facilitate farmers' market access and strengthening value chains. A promising avenue could thus be to improve the capacity of producer organizations in providing their members with adequate marketing, financial, and technical services for better market access.

The importance of functioning value chains cannot be understated. While a detailed discussion of requirements for functioning value chains is certainly beyond the scope of this section, it is essential to take them into account. It is widely acknowledged that West Africa had the lowest commodity transformation rate in the whole continent. A case in point is the success of (imported) rice progressively replacing millet in Mali and Senegal. Although certainly not the only reason, this development is at least in part due to the ease of preparing rice compared with millet, which requires a cumbersome and time-consuming cooking process. In the absence of transforming millet into a more convenient product, it is unlikely that it will present an attractive choice for farmers despite its good overall fit with climate conditions.

In essence, scaling CSA requires perceiving farmers as a business actor instead of beneficiaries of development interventions. Development assistance alone, while being able to make important contributions, cannot drive adoption rates to the levels needed for agricultural transformation. As described in the paragraph above, commercial markets and a conducive policy environment shaping producers' incentives are vital scaling forces with the potential to catalyze positive change for more farmers and value chain actors than projects ever could. Commercial scaling up requires a perception change toward viewing farms as businesses and customers rather than as beneficiaries. This said, given the importance of the enabling environment as a driver for scaleup, future initiatives and programs should focus more on facilitating policy change as opposed to simply taking the policy environment as a given (Cooley et al. 2019).

EXTENSION SERVICES AND DELIVERY MECHANISMS

A major problem hindering the dissemination and uptake of CSA practices lies in the generally low awareness of farmers. This is in part due to patchy and outdated national agricultural extension services across the region. With few exceptions, extension services in the region are understaffed, insufficiently resourced, and aging. In Ghana, for example, extension agent to farmer ratio is 1 to over 1000 (Opare and Wrigley-Asante 2008). In Mali, the average age of extensionists is 50 years (Simpson and Dembélé 2011). Moreover, extension agents lack both up-to-date knowledge to address new demand and the skills to assist farmers with adopting innovative CSA practices. Furthermore, traditional state-led top-down technology transfer approaches excluding farmers from technology development and dissemination have rarely proven effective in responding to the highly variable individual needs of farmers. Also, extension services have adopted an overly one-sided emphasis on technology that failed to address adoption barriers emanating from cultural and gender dimensions. More broadly speaking, a modern extension system should be geared toward creating a favorable environment for encouraging behavioral and organizational change instead of mechanically promoting new technologies coming fresh out of the laboratory.[26]

Developing participatory pluralistic extension systems comprised of a wide range of actors is important for ensuring widespread and inclusive CSA scale-up. The need for including actors such as farmer and civil society organizations, agribusiness, and research is now widely acknowledged by policymakers, academia, and development practitioners. Examples of pluralistic extension delivery mechanisms consist in farmer or community-led extension services which promote peer-to-peer learnings, public-private partnerships, and initiatives by the private sector. So far, however, existing "de-facto pluralistic extension systems" have been often unsystematic, weak, uncoordinated, and dependent on short-term project funding (Sala, Rossi, and David 2016). In recent years, new approaches such as participatory innovation platforms (for example, under WAAPP), and climate-smart villages (for example, under CCAFS) bringing together research, producers, and extension workers, have emerged as a new instrument to accelerate the diffusion of uptake and adoption of improved technologies and practices.

DIGITAL FARMER ADVISORY

New digital extension tools have the potential to enable widespread access to information given recent breakthroughs in information technology and increasing penetration of mobile phones (see box 2.3 and figure 2.4). For example, via telecommunications (for example, through text messages) it has become possible to disseminate agronomic, climatic, and market information to a greater number of farmers than ever before. Digital climate information advisory services draw on intraseasonal

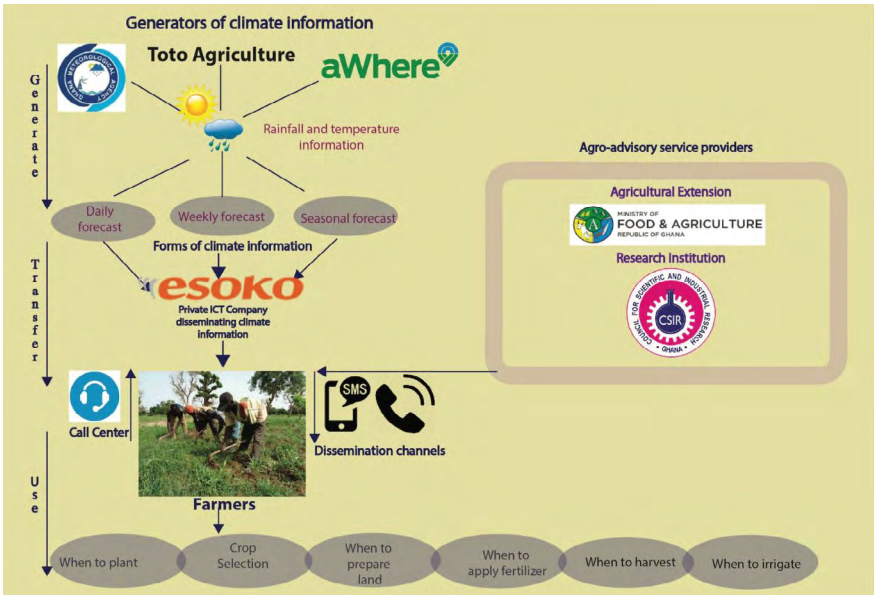
[26] In addition, extension services should be responsive to farmers' differing abilities to adopt new technologies. For example, extension information should be adjusted to local conditions by considering resource constraints, land holding modalities, risk perils, and so on.

weather and seasonal climate outlook to inform farmers on farm decision-making, for example, for informing farmers on suitable crops and planting dates (Partey et al. 2018; Zougmoré et al. 2016). For instance, in Senegal, intraseasonal weather and seasonal climate outlooks reach approximately 740,000 households via a large number of rural community-based radio stations (CCAFS 2016). Although scientific findings on costs and benefits of such technologies are still scarce (Partey et al. 2018), some studies indicate that profitability of farmers using climate advisory services is higher thanks to a reduced and more targeted use of inputs (CCAFS 2016). Digitally disseminated advice can involve a broad range of thematic areas spanning correct land preparation techniques, pest and disease management, and timely market price information. Agricultural Services and Digital Inclusion in Africa (ASDIA), an initiative launched in 2020 by the FAO in Senegal, is another example of recent efforts to tap into the potential of digital farmer advisory. This service provides seasonal and daily weather forecasts along with information on best practices spanning land preparation, optimal harvest times, market prices, animal and human health, and nutrition information to initially around 100,000 rural producers. Including an application dedicated to preventing and mitigating the spread of COVID-19, the advisory tool is available via mobile applications, websites, and SMS broadcasting. To disseminate the application, ASDIA collaborates with Senegal's national agency for rural agricultural advice (ANCAR), whose extension agents will train producer networks that will then sensitize their members to the application's benefits.

BOX 2.3 A PROMISING DELIVERY MODEL FOR PROVIDING CLIMATE INFORMATION SERVICES

New promising agricultural service delivery models have recently emerged. Between 2011 and 2017, CCAFS West Africa successfully piloted a public-private partnership (PPP) model centered on delivering climate information services (CIS) to farmers though a mobile phone platform. The ICT-based delivery model includes ASOKO, a Ghanaian agricultural profiling and messaging service and private ICT firms such as Toto Agriculture, aWhere, and Vodafone Ghana. The public institutions involved in the PPP include the Ghanaian Ministry of Food and Agriculture (MoFa), the Ghana Meteorological Agency (GMet), and the Council for Industrial and Scientific Research (CSIR). Toto Agriculture, aWhere, and GMet provide daily, weekly, and seasonal weather information to ESOKO. The company then processes and delivers this information via Vodafone-supplied mobile services such as text messages and a hotline to the farmers. CSIR and MoFA advise farmers on the suitable CSA-options based on the received information and assist farmers navigating reception and handling of the information. Within two years, this ongoing public-private partnership now reaches over 300,000 paying subscribers (21 percent women) and might constitute a model that could be rolled out across the region (Partey et al. 2019).

FIGURE 2.4 Scaling Up Climate Information Services (CIS) Through Public-Private Partnership Business Models
Partnership Business Models



Source: S. T. Partey, G. K. Nikoi, M. Ouédraogo, and R. B. Zougmoré 2019

Relying on a light-touch information dissemination strategy without putting boots on the ground is not enough. To achieve lasting impact and the desired behavioral changes, digital extension needs to be coupled with more interactive follow-up training through traditional state-led extension services or community-led engagement. Technology adoption is much more likely if field staff sensitizes farmers to the value of digitally provided advice and subsequently supports the farmer in choosing and applying the information most relevant to their individual needs. It is widely understood that farmers learn best from farmers. Thus, producer organizations should be systematically strengthened and relied upon for delivering extension services. One example is the USAID-led Nataal Mbay project, where producer networks were trained to enhance the capacity of their own members through training in best agricultural, quality control, and postharvest practices. The project also trained farmers in basic data literacy to measure their fields and help them to make more informed decisions on seeds and fertilizer use. The project worked with 123 producer networks that integrated farmer-owned and farmer-led extension systems comprising 771 network field agents and is credited with having reached over 150,000 beneficiaries and average household income gains in the order of US$1,000 (Poublanc 2019).

ACCESS TO INPUTS

Poor access to inputs including improved seeds, fertilizers, and machinery have constrained yield growth over the last few decades. In the last 30 years, a large part of agricultural production increases was achieved through expansion of cultivated land instead of yield growth (Keyser et al. 2015). Average staple crop yields in West Africa, which amount to less

than 1.5 tons per hectare for key cereals (millet, sorghum maize, and rice) remain among the lowest in the world and have shown little improvement in recent years (Nin-Pratt et al. 2011). Providing access to inputs including improved seeds and fertilizers is crucial to enable producers to improve yields. Using high quality seeds and fertilizer could allow farmers to double or triple yields of major cereals with relative ease (Nin-Pratt et al. 2011). While inputs for industrial cash crops such as cotton are often supplied to farmers by processors in more integrated value chains, food staples remain underserved.

Major factors inhibiting widespread input use include the long distances to reach distribution points of improved seed and fertilizer, high prices, uncertain quality, and a lack of technical capacity for proper input usage due to low availability of extension services (AfDB 2019; Maur and Shepherd 2015). Moreover, prices of agri-inputs vary excessively from country to country, which complicates economies of scale. Both anecdotal and empirical evidence (see, for example, Dillon and Barrett 2014) indicate that agricultural factor markets remain dysfunctional, constraining the ability of smallholder farmers to achieve higher productivity. It is important to note that higher input usage appears to be strongly correlated with market integration. Levels of mechanization remain low in West Africa. The picture related to adoption of machinery and mechanized tools replacing manual labor is little different. Although investments have risen over time, they remain inferior to those of other countries on the continent. For example, in 2012, Morocco, Kenya, and South Africa all featured higher levels of investments in tractors per hectare than any of the West African nations. Land tenure insecurity constitutes a key issue discouraging investment into mechanization (Zhou 2016).

Most farmers still rely on unimproved seeds such as traditional landraces or improved seeds that no longer provide yield advantages due to over-recycling. Estimates related to the uptake of improved varietals found in scientific and gray literature vary considerable but generally point to low levels of adoption. Compared with other African subregions, West Africa has the lowest adoption rates of improved seed varietals and a low supply of open pollinated varieties and hybrid seeds (Keyser et al. 2015). According to adoption estimates by CGIAR (2018), across West and Central Africa the average area planted with improved varieties of the nine dryland cereals and legumes amounts to 27 percent. In Nigeria, a recent peer-reviewed study asserts that improved varieties are sown on only 5–10 percent of land under acreage by about 10 percent of rural farmers (Uduji and Okolo-Obasi 2018). Cultivated area shares planted with optimized varietals of sorghum, a key staple crop for food security of poor households, is estimated at 3 percent in Burkina Faso, 15 percent in Niger, and 20 percent in Nigeria (Ndjeunga, Mausch, and Simtowe 2015). Past and major stumbling blocks slowing adoption rates of improved food crop cultivars include underdeveloped commercial seed distribution channels and an understandable risk aversion of resource-poor farmers to pay cash for varietals with dubious advantages (Smale et al. 2018).

Market integration seems to play an important role in the adoption of improved seeds. Market incentives are a significant driver in encouraging farmers to adopt improved varietals or diversify to higher-value crops. For vertically integrated value chains such as rice grown in the river valley of Senegal or cotton, adoption rates of improved varietals approach 100 percent. Commercial seed producers have little incentive to enhance production capacities for improved staple crop varietals given the lack of integrated value chains for key staples including sorghum and millet.

Low usage rates also apply to fertilizers, severely limiting the ability of West African

farmers to achieve high crop yields. Signed in 2006 by the African heads of state, the Abuja Declaration set the objective of reaching fertilizer application levels of 50kg of nutrients per hectare of cultivated land. Recent estimates suggest that fertilizer use in West Africa remains the lowest in the world, remaining well below 20kg/ha (AfDB 2019). The naturally low availability of nitrogen and phosphorus in West African soils (Bationo, Egulu, and Vargas 2013) makes the application of fertilizers particularly important. Without adding nutrients, continued cropping results in soil nutrient depletion and thus lower yields. Applying inorganic fertilizer also is required to realize the full potential of improved varietals. Poor soil health across Africa has been estimated to limit yield increases from genetically improved plant material to only 28 percent in Africa as compared with 88 percent in Asia (Evenson and Gollin 2003). Fertilizer usage has been constrained by high costs at farm gate, often linked to logistics, and a lack of timely access (Liverpool-Tasie et al. 2015). Recent estimates suggest that half of the fertilizer costs are related to its distribution (CRU Consulting 2017). To increase fertilizer use, many West African countries have various fertilizer subsidy programs which vary widely in design. At present, however, the cost-effectiveness, performance, and sustainability of these programs has been called into question (Goyal and Nash 2016; USAID 2019). From a food security standpoint, it appears suboptimal that fertilizers are mainly used for cash crops (AfDB 2019). As with seeds, market linkage is a powerful driver of adoption. For example, anecdotal evidence suggests that cotton growers are prepared to pay high prices and receive the loans for fertilizer as they can be sure of selling their produce year after year.

ECOWAS and UEMOA are trying to increase the availability of improved inputs by promoting the harmonization of seed and fertilizer policy and regulations across West Africa. They are also supporting the emergence of a strong private sector. With agroecological zones cutting across country borders, West African governments have regarded regional collaboration as a key lever for increasing input availability, including through achieving economies of scale, technology spillover, and trade facilitation. In 2012, ECOWAS, in coordination with UEMOA, adopted harmonized procedures for variety release and seed certification aimed at improving quality and facilitate regional transactions. An analogous regulatory harmonization process for fertilizer established, among other things, truth in labeling and harmonized quality control standards. To benefit from harmonized trade of inputs, countries were asked to undertake several specific steps such as establishing national bodies for seed and fertilizer control and publishing regional regulation in national gazettes (Maur and Shepherd 2015).

Recent regional projects including WASP, West African Fertilizer Program (WAFP), and WAAPP have sought to support regional organizations in increasing input availability with respect to both seeds and fertilizer. As mentioned before, WAAPP has developed many new seed varietals. Between 2012 and 2017, the USAID-funded WASP and West African Fertilizer Program (WAFP), respectively implemented by CORAF and the International Fertilizer Development Center (IFDC), who were given a mandate to facilitate implementation of regional regulation in member countries and promote better private sector involvement and organization in both seed and fertilizer industries. Apart from providing technical assistance for the implementation of regional seed policy, WASP activities included, for example, facilitating links among research institutions, seed producers, certifiers, and farmers by creating a multiactor regional-level seed alliance and support to the private sector to increase its ability to produce certified seeds. WAFP featured analogous components to enhance fertilizer availability by improving private sector capacity for supply and distribution by forming a private sector-

led Fertilizer Trade Association and technical assistance for implementing regional fertilizer regulation. Furthermore, WAFP developed up-to-date fertilizer recommendations to suppliers and users and facilitated recommendations for national subsidy programs. Building on WAFP, the follow-up project EnGRAIS, again led by CORAF and financed by USAID (2018–2023), seeks to promote effective private sector-led fertilizer markets, for example, by supporting private sector associations such as WAFA. The objectives of "PAIRED," a CORAF-managed project that will follow WASP and is currently being prepared, include improving seed registration procedures, addressing persisting trade barriers, and fostering private sector involvement.

WAAPP, WASP, and WAFP have made progress in increasing input availability, but the private sector is still unable to ensure producers' broad-based access to high quality inputs and regional trade of seeds continues to face barriers.[27] According to a midterm evaluation of WASP, 12 out of 17 ECOWAS, UEMOA, and CILSS member countries have published the ECOWAS regional seed regulation in their national gazettes. Furthermore, 17 countries established a National Seed Committee and high implementation rates at the national level have been observed. But challenges remain.

Control, certification, and quality assurance services do not yet allow for an efficient and viable seed system in West Africa. In many countries, the seed sector still faces a lack of political support (for example, access to loans and prerogative to produce foundation seeds) and incentives to step up production (USAID 2017b). In the fertilizer sector, a recently organized West African Financing Fertilizer Forum named limited access to finance, underdeveloped logistics, and an absence of quality control as key stumbling blocks weighing on the dynamism of the sector (AfDB 2019). Furthermore, member states still lack necessary technical, human, equipment, and financial resources for effective implementation of the harmonized regional legal framework concerning quality control (Diagana et al. 2018).

Input production should be based on comparative advantage. Inputs should be produced in areas with a proven comparative advantage and freely traded across the whole region. Some countries may have comparative advantages over certain inputs and have facilities that are well placed to supply the whole region. Such champions should be systematically identified, strengthened, and valued. Although this may be politically challenging since every country aspires to a maximum degree of autonomy, strengthening existing production units with high potential would be a more cost-effective approach than attempting to set up input factories in every country.

[27] At the time of writing, the development of a regional agri-input strategy is ongoing. Led by ECOWAS and coordinated by CORAF, its specific objective is to "Enhance the availability, accessibility and use of quality agri-inputs (seed and fertilizers) for priority crops in West Africa." The draft strategy has been validated by national stakeholders and is now ready for presentation and adoption by the council of ministers.

THE POTENTIAL OF DIGITAL TECHNOLOGIES TO IMPROVE TARGETING OF PUBLIC SUPPORT FOR PRODUCERS

The World Bank report "Future of Food: Harnessing Digital Technologies to Improve Food System Outcomes" (Townsend et al. 2019) details opportunities for how public services can be improved using digital technologies such as e-wallets. Nigeria provides a case in point as for how e-wallet programs for subsidized fertilizers can improve coverage of beneficiaries while reducing leakages and costs. In 2011, the government spent approximately US$180 million for 600,000–800,000 smallholders. Few of the intended beneficiaries received the funds. In 2013, an innovative e-wallet digital payment system allowed to support 4.3 million smallholders at a cost of approximately US$96 million. The system also created opportunities for the private sector while facilitating financial inclusion of farmers. A review of pilot e-voucher programs for subsidized farm inputs covering Guinea, Mali, and Niger that is cited in the report highlights several success factors. For e-wallet programs to be impactful, mobile phone coverage, actual mobile phone possession by intended beneficiaries, especially women, program literacy, and knowledge and availability of farm inputs at right time of season through well-organized agro-dealers with functioning procurement channels are key (Townsend et al. 2019 and references therein).

ACCESS TO CREDIT

Access to credit for smallhold farmers continues to be low for a variety of reasons, including insecure land tenure, unknown or high-risk profiles, and a lack of market integration (see box 2.4). General use of agricultural credit to purchase inputs is low. For example, according to the recently collected LSMS-ISA, less than 1 percent of agricultural households in Niger indicated that they received credit to purchase agrochemicals or inorganic fertilizers (Sheahan and Barrett 2017). Based on a survey of 15,850 farms in Ghana, Côte d'Ivoire, Nigeria, and Senegal, only 11 percent of smallhold producers have regular access to agricultural loans. The difficulty of accessing loans is a major constraint hindering the adoption of climate-smart agricultural technologies. One big hindrance consists in unclear land tenure and usage modalities; these often mean that producers cannot provide enough collateral to qualify for loans.

BOX 2.4 LAND TENURE AND RIGHTS TO RESOURCE USAGE

Land tenure security plays a key role in encouraging on-farm investments, from improving soil health to adopting climate-smart agricultural technologies and practices. Empirical evidence finds that land tenure security drives productive and environmentally beneficial agricultural investments and may empower women under certain circumstances (Higgins et al. 2018). A regional study conducted in West Africa found that secure land tenure encourages farmers to plant trees and take measures that increase soil fertility (Fenske 2011). Generally, West African women are disadvantaged, and their lack of land access holds back productivity increases (Gnisci 2016). Studies also suggest gender-specific effects. For example, women with land security were more committed than men to long-term soil fertility investments by letting land lie fallow (Goldstein et al. 2015).

Conferring land rights and use rights to producers, including the right to benefit from natural resources such as trees, is thus very important. When farmers lack these rights, they also lack incentives to improve or restore lands and resources, actions with long-term benefits such as natural tree regeneration. Securing land and resource rights are thus key to promoting investments into soil health and inputs. There is also potential in combining the decentralization of decision-making authority with measures to ensure land tenure. When municipalities can freely decide how to use land, they are more likely to invest in productive infrastructure such as dams for irrigation. A Burkinabe expert cited an example of a village where rain-fed rice fields were upgraded to irrigated rice when land rights were transferred to the village and a cooperative management structure put in place.

It is hard to establish equitable and effective land tenure arrangements given high demographic growth rates, increasing conflicts between herders and farmers, emerging and sometimes predatory land markets, and traditional land customs that are sometimes at odds with formal land titles. WAMEU (West African Economic and Monetary Union) is in the process of setting up a Regional Land Observatory in West Africa (ORFAO) to advise decision-makers on land tenure policy questions. Once operational, the observatory will monitor land tenure policies and log lessons learned and best practices to inform policymakers. ECOWAS has signaled interest in expanding the observatory to anglophone countries.

Commercial banks are reluctant to lend to producers with unknown risk profiles. These typically result in prohibitive interest rates that small-scale producers are unable to bear. Recent technological advances might provide an avenue to ease up credit flows to producers. For example, establishing a dense data ecosystem based on the combining satellite imagery and mobile field data could lead to more precise risk profiles, allowing banks to cost-effectively verify whether CSA practices for production increases are duly implemented. Preventing adverse selection and moral hazard, such a data-driven approach might bring down the cost of credit considerably and accordingly expand credit coverage of smallholders. At present, the WAICSA, currently scheduled for implementation in 2020 through the ECOWAS Bank for Investment and Development in collaboration with ARAA (Regional Agency for Agriculture and Food), is the most recent initiative at regional level aiming at facilitating

access to agricultural credit by providing subsidized low interest loans to both farmers and agribusiness through mobilizing public and concessional capital.

Digital agriculture may have the potential to make credit access, and thus access to inputs, more widespread. In the USAID-financed Naatal Mbay project in Senegal, farmer organizations were trained to engage in systematic gathering of data at different scales and leverage the former to obtain better access to credits, and, by extension, agricultural inputs. Farmer organizations collect and aggregate data both on a plot and farmer organization level. While farmers receive information on their farm's performance (cultivated area, yields/ha, and profitability), farm data is aggregated at the producer organization level, giving an overview of overall quantities produced and marketed. Accurate data about their operations enables producer organizations to apply for bank loans. Farmer organizations also use this data to negotiate better deals with input providers and processors (USAID 2017a).

INITIATIVE MAPPING

Table 2.1 (below) provides an overview of selected initiatives and projects, either ongoing or under preparation, that relate to the priority intervention area of strengthening the sustainability of the food system's productive base. Building on an initiative mapping contained in the ECOWAS RAIP, the overview is not intended as a complete collection of all existing initiatives but focuses on programs which are (a) regional in scope and (b) considered most relevant and impactful at regional level

TABLE 2.1 Initiative Mapping for Strengthening the Sustainability of the Food System's Productive Base

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
TECHNOLOGIES FOR AFRICAN AGRICULTURAL TRANSFORMATION (TAAT)					
Harness proven technologies to raise agricultural productivity in Africa; mitigate risks and promote diversification and processing in 18 agricultural value chains within eight priority intervention areas	(1) Selecting promising technologies around eight priority intervention areas for dissemination and scale up through TAAT clearing house (2) Harmonizing crop variety regulation across countries to fast-track release and adoption of new technologies	SSA including ECOWAS/ CILSS Member States	CGIAR centers, NARES, FARA	AfDB	Grant; 2018–25

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
ENGRAIS					
Develop well-functioning private sector-led fertilizer markets at regional and national levels	(1) Provide input recommendations and packages for key crops and agroecological zones (2) Facilitate implementation of fertilizer recommendation (3) Mobilize and engage key stakeholders at national and subnational levels	ECOWAS Member States	IFDC	USAID	2018–23; Grant; Base funding US$10 million
PAIRED (PARTNERSHIP FOR AGRICULTURAL RESEARCH, EDUCATION, AND DEVELOPMENT IN WEST AFRICA)					
To strengthen CORAF and increase the production, technological upscaling, and availability of quality agri-inputs	1) Strengthen stakeholder capacity of stakeholders within the agri-input value chains (2) Link the agri-input system to crop management practices as a package (3) Improve and harmonize regional input regulation	ECOWAS Member States	CORAF	USAID	2017–22; Grant; US$15 million
WEST AFRICA BREEDING NETWORKS AND EXTENSION EMPOWERMENT (ABEE)					
Fostering breeding networks and institutional breeding capacity in West Africa to develop climate-resilient crops for African smallholder farmers	Dryland crop varietal improvement. Support to breeding networks and modernized breeding capacity in West Africa to develop climate-resilient crops and delivery of improved varieties to smallholders	Burkina Faso, Mali, Niger, Senegal	CORAF, CIRAD, AfricaRice/ Integrated Breeding Platform National Institutes of Agronomic Research	EU	Grant; 2020–25 US$8.8 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
AICCRA (ACCELERATING IMPACTS OF CGIAR CLIMATE RESEARCH FOR AFRICA)					
Increase access for agriculture research and extension service providers in Africa to knowledge, technologies, and decision-making tools relevant to enhancing the resilience of agriculture and food systems in the face of climate change	(1) Development of ag-data hubs, design of climate service and visualization tools and dissemination systems, and strengthening of partnerships for the delivery of early warnings, climate services, and climate-informed digital agroadvisory to support agricultural decision-making (2) Identify tailored CIS and digital agroadvisory packages for use in building new extension systems or strengthening existing extension systems	Mali, Ghana, Senegal	CGIAR	World Bank	2020–23; Grant; US$60 million (across all of SSA)
SUPPORT PROJECT TO THE AGROECOLOGICAL TRANSITION IN WEST AFRICA (PATAE) AND ADDITIONAL SUPPORT					
Improve the performance and resilience of family farming to climate changes	(1) Support for the agroecological transition of family farms through support to producer organizations to promote sustainable collective management of natural resources at the village level (village lands, watersheds, and irrigated perimeters) 2) Support for capacity building in contribution to policy formulation in ECOWAS member countries	Burkina Faso, Côte d'Ivoire, Mali, Senegal, Togo, to be extended to all ECOWAS countries	ARAA (mandated by ECOWAS)	AFD	2018–24; Grant; € 8,96 million + € 8 million additional financing

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
PAN-AFRICAN GREAT GREEN WALL INITIATIVE (GGWI)					
To restore 100 million hectares of currently degraded land, sequester 250 million tons of carbon, and create 10 million jobs in rural areas	Specific activities are depend on location and contributing projects and programs.	20 African countries, including Mali, Niger, Chad, Ghana, Mauritania, Benin, Senegal, Nigeria, The Gambia	Decentralized implementation: AU provides leadership	Multiple technical partners and donors	2007–30
REGIONAL PASTORALISM SUPPORT PROGRAM IN THE SAHEL (PRAPS I + II)					
Improve access to productive assets, services, and markets for pastoralists and agropastoralists in transborder areas and along transhumance corridors and strengthen country capacities to respond to pastoral crises or emergencies	(1) Animal health improvement and veterinary medicines control (2) Sustainable landscape management and governance (3) Livestock value chains improvement (4) Improving social and economic inclusion of women and youth	Burkina Faso, Chad, Mali, Mauritania, Niger, Senegal	CILSS; FAO could make important logistical contributions given comparative advantage in epidemiological monitoring, transboundary pest management	World Bank	2015–21 (PRAPS I), Grant/Loan; Indicative US$335 million (US$20 million earmarked for CILSS)
REGIONAL DIALOGUE AND INVESTMENT FOR PASTORALISM AND TRANSHUMANCE IN THE SAHEL AND COASTAL COUNTRIES OF WEST AFRICA PROJECT (PREDIP)					
Strengthen the contribution of pastoralism to food security, socioeconomic development, and regional integration	(1) Improve knowledge management of pastoralism and transhumance (2) Facilitate peaceful transborder transhumance (3) Secure herd movement and and provide herders with market and resource access (4) Control transborder animal diseases	Mali, Burkina Faso, Niger, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria	CILSS (coordination)	EU	2018–23; Grant; US$27.5 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
ONE MILLION CISTERNS FOR THE SAHEL INITIATIVE					
Enable widespread access to drinking water and enhance agricultural production through promotion of rainwater harvesting and storage systems for vulnerable communities, especially women	(1) Ensure better access to clean water during the dry season through the construction of rainwater harvesting and storage systems (cisterns) (2) Support climate-resilient agricultural production by providing agroecological inputs (3) introduction of social safety nets mainly through cash-for-work activities (4) Capacity-building through cistern construction, use and maintenance of cisterns; good water management techniques; and adaptation to climate change in agriculture and agroecology	Burkina Faso, Chad, The Gambia, Mali, Niger, Senegal	FAO (Sub-Regional Office for West Africa)	Resource mobilization ongoing	Program currently under preparation
WEST AFRICAN INITIATIVE FOR CSA (WAICSA)					
Scaleup adoption of CSA through blended finance fund providing technical assistance and accessible credit to smallhold farmers and subsidized loans or guarantees to small-scale farmers	1) Mobilize public and concessional capital to provide subsidized low interest loans to smallholders (90,000 households) and agribusinesses in collaboration with local financial institutions (2) provide technical guidance on CSA implementation to facilitate adoption and increase loan compliance	ECOWAS region (instrument will be piloted in six countries within the next two years)	ECOWAS Bank for Investment and Development (EBID)	Not yet determined	2020–27; Loans; US$80 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
SCALING UP AGROECOLOGY INITIATIVE					
Dissemination of agroecological practices (both for uptake by farmers and consideration by research system)	Not yet defined	ECOWAS Member States	FAO (Sub-Regional Office for West Africa)	Possible partners include IFAD, AFD, EU, WB	Program currently under preparation
PROMOTING CSA					
Reduce farmers' and pastoralists' vulnerability to climate change	(1) Dissemination of climate-resilient practices related at local level (2) Integration of climate-resilient practices into national strategies, policies, and projects (3) Knowledge management related to climate-resilient agricultural practices	Benin, Burkina Faso, Ghana, Niger, and Togo	West African Development Bank/ARAA	Adapta-tion Fund	2018–22; Grant; US$14 million
REGIONAL PROGRAM FOR THE RESTORATION OF DEGRADED AGRICULTURAL LAND IN WEST AFRICA (IN PLANNING)					
Generate and disseminate technological and organizational innovations and strengthen the enabling environment for the establishment of an investment fund for the restoration of degraded agricultural land	TBD - Outcome of validation workshop held from March 11–13, 2020 in Lome not yet publicly available. Programme will be based on the learnings of the Regional Programme for SLM and Adaptation to Climate Change in the Sahel and West Africa (PRGDT) funded by the EU between 2011–2017.	ECOWAS region	TBD	TBD	TBD

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
REGIONAL SUPPORT INITIATIVE FOR IRRIGATION IN THE SAHEL PROJECT (PARIIS-SIIP)					
Generate and disseminate technological and organizational innovations and strengthen the enabling environment for the establishment of an Investment Fund for the restoration of degraded agricultural land	(TBD - Outcome of validation workshop held from March 11 to 13 2020 in Lome not yet publicly available at time of writing. Program will be based on the learnings of the Regional Programme for SLM and Adaptation to Climate Change in the Sahel and West Africa (PRGDT) funded by the EU between 2011–2017.	ECOWAS region	TBD	TBD	TBD
REGIONAL PROGRAM TO SUPPORT RESILIENCE IN WEST AFRICA AND THE SAHEL FOCUSING ON WATER RESOURCES					
Integrated water resource management to increase resilience of rural populations	n.a.	ECOWAS Member States	FAO (Sub-Regional Office for West Africa)	Not yet defined	Program currently under preparation
RICOWAS PROJECT					
Scaling up climate-resilient rice production in West Africa	(1) Strengthen human and institutional capacity in climate-resilient rice production (CRRP) (2) Assist farmers to scale up climate-resilient rice production (CRRP) (3) Strengthen communication, advocacy, and partnerships to scale up CRRP	ECOWAS countries	Sahara and Sahel Observatory (OSS)	Adapta-tion Fund	2021–25; US$14 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
COMPETITIVE AFRICAN RICE INITIATIVE PHASE 2 (CARI2)					
Increase the competitiveness of West African small-scale rice producers, millers, and other actors in the value chain and achieve long lasting reduction in poverty in Nigeria, Ghana, Burkina Faso, and Tanzania	Create better linkages among value chain actors	Burkina Faso, Ghana, Nigeria	GiZ, JAF-K, Kilimo Trust	BMZ; B&MG Foundation	US$11.25 million; Grant; 2018–21
INTEGRATED AND SECURE LIVESTOCK AND PASTORALISM PROJECT IN WEST AFRICA (PEPISAO)					
To ease conflict among farmers and herders by building a shared regional view of the different forms of livestock farming	Create knowledge base and dialogue platforms that lead to better public policies	ECOWAS Member States, Chad, Mauritania	ECOWAS, CILSS	AFD	US$6 million; Grant
WEST AFRICA CSA ALLIANCE (WACSAA)					
Coordination platform to support implementation of the ECOWAP/CAADP Intervention Framework for CSA and provide a coordination platform for alliance members	Four working groups: (1) Investments for CSA (2) Institutions for CSA (3) Resources for CSA (4) Partnerships for CSA	ECOWAS Member States, Mauritania, Chad; many international organizations, donors, NGOs, and farm organizations active in the region	ECOWAS Regional Agency for Agriculture and Food	n.a.	n.a.
PROGRAMME FOR THE IMPROVEMENT OF REGIONAL FISHERIES GOVERNANCE IN WEST AFRICA (PESCAO)					
Enhance the contribution of fisheries to sustainable development, food security, and poverty alleviation in West Africa	Improve regional fisheries governance in West Africa through better coordination of national fisheries policies	ECOWAS Member States; Chad; Mauritania	ECOWAS, FAO, CRSP, FCWC, EFCA	EU	Grant; 2017–21; US$16.5 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
FOOD AND NUTRITION SECURITY IMPACT, RESILIENCE, SUSTAINABILITY AND TRANSFORMATION (FIRST) IN THE ECOWAS REGION					
Facilitate the creation of an enabling environment for the development and implementation of the ECOWAS integrated and coordinated regional fisheries and aquaculture policy and its implementation strategy to enhance the contribution of the sector to food and nutrition security and poverty reduction in West Africa	(1) Modernize and protect artisanal and coastal (maritime and inland) fisheries with a strong focus on food and nutrition security and the fight against poverty (2) Support small and medium-sized aquaculture enterprises (Aqua-Business) (3) Mobilize and strengthen public and private investment in fisheries and aquaculture for food and nutrition security in West Africa (4) Improve the collection of information on food security and the nutritional status of populations at the national and regional levels (5) Strengthen weak and insufficient human capacity at the regional and national levels in terms of integrating food and nutrition security concerns into the sustainable development of fisheries and aquaculture, and vice versa	ECOWAS Member States	FAO, ECOWAS	EU	Grant, 2020–24

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
LAND POLICY SUPPORT PROJECT PHASE 3					
Support to West African countries for strengthening land policy	n.a.	Mali, Niger, Burkina Faso, Senegal, Côte d'Ivoire, Benin, Guinea	AFD	AFD	US$6 million; Grant
THREE-BORDER PROJECT					
Support Burkina Faso, Mali, and Niger in efforts to achieve stabilization, development, and peace of cross-border territories	(1) Increased resilience (reduction of food insecurity) (2) Prevention of conflicts	Burkina Faso, Mali, Niger (Liptako Gourma)	Concerned ECOWAS countries, NGO Consortium (IRAM, GRET, AVSF, CIEDEL)	AFD, Centre de Crise et de Soutien (CDCS)	US$60 million; Grant; 2019–24
CGIAR TWO-DEGREE INITIATIVE: FOOD SYSTEM RESILIENCE IN THE SAHEL					
SImprove the capacity of agricultural producers, women, and youth and enhance institutional resilience to shocks and vulnerabilities to climate change	(1) Increase farmer uptake of agroecological technologies and access to climate services (2) Develop climate-resilient communal development plans and resilient agro-silvo-pastoral value chains (3) Enhance countries' capacity to implement National Adaptation Plans (NAP) and NDCs	ECOWAS/ UEMOA/CILSS member states	ICRISAT (together with consortium of regional partners including ECOWAS, CILSS, UEMOA, CORAF, and other partners such as the World Bank)	n.a.	2020–30
AGRICULTURAL SERVICES AND DIGITAL INCLUSION IN AFRICA (ASDIA)					
Strengthen West African Farmers' resilience with access to comprehensive, critical information about agricultural production from preparation to postharvest activities, animal health and nutrition, market prices, human nutrition and health including COVID-19 prevention and mitigation information	1) Farmer training on use of digital tools (2)Deployment of applications throughout countries (3)Inform farmers about best practices in agriculture, livestock, and human nutrition; provide financial education for farmers including access to credit	Senegal, Niger, to be extended to other ECOWAS countries	FAO, ANCAR (Senegal) and other partners	Resource mobili-zation ongoing	Program currently under preparation

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
ALLIANCE FOR AGROECOLOGY IN WEST AFRICA (3AO)					
3AO is a coordination and information platform composed of farmers' organizations, research institutes and universities, international NGOs, and social movements to promote agroecological approaches in West Africa	Develop a joint strategy for 31 regional and national organizations and outline a concrete action plan to support the development of agroecology and sustainable food systems In West Africa	ECOWAS/ CILSS countries	ROPPA, IBES-Food	n.a.	n.a.

ENTRY POINTS AND REFLECTIONS

KNOWLEDGE AND TECHNOLOGIES FOR BOOSTING PRODUCTIVITY EXIST IN THE REGION BUT ADOPTION LEVELS ARE STILL LOW

While recent regional initiatives such as WAAPP raised the capacity of the West African agricultural research system and increased decision-makers' awareness of CSA, adoption of emerging technologies and improved practices remains limited. Experts almost unanimously agree that the WAAPP has greatly strengthened the capacity of the regional agricultural research system by pooling resources, promoting a regionally coordinated research agenda with RCoE, and facilitating technology spillovers. Through the establishment of innovation platforms bringing together a more comprehensive set of value chain stakeholders, WAAPP also marked the start of a much-needed paradigm shift away from supply-driven research toward a more demand-oriented approach that responds to farmer needs. In parallel, both international high-level platforms such as the WACSAA[28] and national level science-policy platforms have advanced the mainstreaming of CSA into agricultural investment plans and generally sensitized decision-makers to the importance of agricultural policies that promote climate-

[28] See also introduction of section 2.1

smart agricultural practices on both a field- and landscape level to achieve resilience and productivity gains in the face of climate change. These developments, however, have thus far failed to translate into high levels of farmer uptake of CSA and agricultural productivity trends have consistently failed to come up to expectations.

Many innovative CSA technologies and practices supporting on-farm productivity growth and increased resilience are available. The large number of climate-resilient varietals of core commodities released over the past years, a well-documented catalog of adapted agricultural practices, and recent breakthroughs in climate information and supporting communication technologies suggest the possibility of considerably higher food production levels than what is currently observed. Both expert conversations and a review of the relevant literature suggest, however, that CSA adoption will likely remain subdued unless longstanding structural impediments and non-technical adoption barriers are addressed:

- **To boost CSA adoption, increasing farmers' access to markets and commercialization is key.** Without access to markets, farmers will remain unable to afford high quality inputs and fertilizers in the absence of strong support measures. Without available marketing channels allowing farmers to reliably sell their produce, efforts in other fields (for example, access to finance and fertilizers) will be unsustainable. Subsistence farming alone does simply not provide farmers with an incentive strong enough to justify risky investments into new varieties or efforts to modify farming patterns. The importance of market access for improving uptake of new technologies and improved CSA practices also means that CSA projects should include other critical value chain segments including aggregation, processing, and distribution to achieve lasting impact. Promoting the professionalization of producer associations and cooperatives would also benefit farmers' market access. By supporting their members with aggregation and extension services and by enabling farmers to negotiate binding contracts with processors, producer organizations organized by value chain have the potential to greatly facilitate the commercialization process and with it access to high quality seeds, fertilizers, and credit that farmers would be otherwise unable to afford. This said, academic research points out (for example, Smale et al. 2018) that a large share of poor smallhold farmers in remote areas growing staple crops will unlikely generate sufficient commercial interest in the foreseeable future to allow for their inclusion in vertically integrated value chains. Strengthening farmers' market linkages in remote rural areas poorly served by road infrastructure thus need structural transformation before value chain integration can be successful.

- **Improve input availability through demand-side measures such as strengthening farmers' access to credit.** Governments should consider re-orienting government resources toward credit-subsidizing schemes that bring down the coast of credit to farmers and that confer more agency to farmers in choosing the kind of input best suited to their conditions. Funding can come from funds currently spent ineffectively on input subsidies. At present, the WAICSA, currently scheduled to launch in 2020, is the most important regional initiative aiming to facilitate access to agricultural credit by providing subsidized low interest loans to both farmers and agribusiness through mobilizing public

and concessional capital. Donors should consider strengthening WAICSA or examine how to complement this initiative. Other promising measures include fostering the phased and incremental use of fertilizers via smaller and hence more affordable bags, and implementing laws enabling farmers to use risk-free collaterals and investments in rural education by supporting producer organizations that can train their members in organizational management skills (see Agwe et al. 2007) for a more detailed discussion).

• **On the supply side, it is critical to facilitate private sector development and intraregional trade to bring down costs.** Agribusinesses that produce and distribute improved varietals and fertilizers should receive both logistical and financial support. Innovative service providers (for example, start-ups) targeting value chains or commodities creating employment opportunities for young experts (graduates from universities and start-ups) should also be included. Private sector promotion could take the form of capacity-building measures to improve SME capacity to meet quality standards and tailor input packages to local conditions, while loan guarantees and matching grants could be deployed on a large scale to enhance production and distribution volumes. This would address the widely lamented scarcity of inputs in West African countries. The CORAF Integrated Strategy for Sustainable Management of Agri-inputs in West Africa and the Sahel (2020) lists strengthening local capacity for private production and rational use of agri-inputs, promotion of intraregional trade in quality agri-inputs, and the creation of an enabling environment for the promotion of quality agri-inputs as priority intervention areas.

WITH SOME TARGETED REFORMS, THE REGIONAL AGRICULTURAL INNOVATION SYSTEM COULD CONTRIBUTE TO REDUCING ADOPTION BARRIERS AND BECOME MORE SUSTAINABLE

Shifting the focus from generating to disseminating technologies. All interviewed experts talked very highly of WAAPP, arguing that any future project should make efforts to support more National Centers of Specialization to graduate to RCoEs while promoting synergies between national and regional institutions. The focus of any new project building upon WAAPP, however, should shift from technology generation to technology dissemination. New technologies need to be disseminated to farmers and made accessible at affordable cost. Tools seen as promising for technology dissemination are the establishment of regional technology platforms that complement national and regional research centers by making proven innovations known to a wider audience and accelerating their dissemination. Existing devices include the WAAPP-established regional seed catalogue and TAAT, which is a platform promoting rapid diffusion of improved varietals. The last phase of WAAPP saw the establishment of the Marketplace of Agricultural Technologies and

Innovations (MITA), which at present remains underexploited. Regional technology diffusion platforms should be further strengthened and analogously established for inputs other than seeds such as fertilizers and mechanical tools.

While continued innovation around crop varietals tolerant to a rise in weather extremes is critical, the scope of regional research should be widened. The regional research agenda should also include other important issues, such as natural resources, water use, and mobilization and mechanization of digital agriculture. RCoE reflecting this expanded focus should be created, such as one for digital agriculture, bio-risks or a RCoE on Land and Water Management. Plans for establishing a RCoE for mechanization already exist.

Increase collaboration and trust between different research actors. The upward potential for collaboration between CGIAR centers and NCoS, with a shared focus on specific commodities, is widely acknowledged. Deepening collaboration between CGIAR commodity-based research centers and WAAPP-established research centers would allow better awareness of CGIAR-generated innovations and allow for better coordination of research themes between CORAF-established and CGIAR-run research units. Furthermore, the coordination between the TAAT Project and the WAAPP-established regional and specialized national research centers and the CGIAR research centers should also be improved. Measures could include financial support to TAAT to publicize technologies developed under WAAP that are ready for rollout on regional dissemination platforms. Discussions of better coordination and collaboration among actors has gone for a long time with few results. Collaboration between different actors should be more rigorously monitored and made subject to accountability mechanisms to evaluate its effectiveness, for example through regular and transparent reporting.

Make regional research more impactful and increase its financial sustainability by reforming current funding mechanisms for regional-level research. Research activities that need to be conducted at regional level, such as multicountry trials of new technologies or practices, are currently underfunded and highly dependent on donor funding. Setting up a research grant scheme based on country contributions to finance research with cross-boundary relevance could provide an avenue to increase both impact and sustainability of the regional research system. The FONTAGRO cooperation mechanism (see also subsection "Agricultural Innovation System"), which is based on financial contributions of 15 Latin American countries, could provide a promising model the region could use for inspiration.

Increase NARS awareness and understanding of benefits resulting from regional cooperation. Some national research systems appear to still question the value of sharing information and data with RCoE or other research units in other countries. This lack of collaboration detracts from the effectiveness and sustainability of a regional research architecture that aims to mutualize research advances and pool resources for the greater benefit of the whole region. To promote openness to sharing knowledge and data, more outreach, advocacy, and sensitization efforts are warranted. Increasing the willingness of NARS to collaborate with RCoE may also require the latter to find ways to better relate and share their knowledge with NARS.

Further strengthen the R4D-paradigm. Under WAAPP, important steps toward application and demand-oriented research were made. For example, on a subnational level, the innovation platforms pioneered by WAAPP are bringing together relevant value chain actors to exchange learnings and best practices. Many of these platforms still lack strong private sector buy-in, making them unsustainable. While they often represent

interesting social setups, they need solid financial sustainability and technology scaleup. Research for development (R4D) generally implies stronger private sector participation in the research process. At present, most funding is still targeted at public actors and the region should actively explore the potential of technology scaleup through awarding grants and funds to the private sector-led initiatives through public-private partnership schemes (for example, similar to the EU H2020 Initiative).

National research still places too much emphasis on developing technologies purely based on optimal agronomic properties without factoring in market considerations or engaging in market research. Without strong market demand, adopting new technologies will continue to be disappointing. Therefore, stronger encouragement is needed for research into seeds with favorable properties that also provide higher-value products and proven market potential. The region's research institutions need to move from a fixation on productivity and agronomic considerations, for example, by strengthening the role of social scientists. Both capacity-building measures and adding fresh expertise knowledgeable about the region's food markets and consumer trends would be useful. Future research should also prioritize innovative ways to process and transform commodities for better storage and value added.

The agricultural innovation system needs to better involve the private sector in disseminating innovations and new technologies. Knowing what fertilizer formulas work in which agroecological zone is of little use when seeds and fertilizer blends are not available in sufficient quantity. Producers need to have information on new technologies, but these inputs and technologies must be also readily available for subsequent adoption at an affordable price. One expert illustrated this point with an anecdote of a farmer who traveled all the way from Nigeria to Senegal to purchase a new type of fonio husking machine that was developed by the CERAAS center in Dakar. Yet the husking machines were not available in the needed volume. In general, research institutions cannot and should not act as the key distributor of technologies. This is a role best filled by the private sector. Against this backdrop, future interventions should increase the private sector's ability to act as a catalyst for technology dissemination. The need to better involve the private sector in technology especially applies to the seed sector. RCoE established under WAAPP have generated many seed varietals, but it is incumbent on the private sector to make these available to producers in sufficient quantity.

To enable the private sector to fulfill its role, both political support and capacity-building is required. National research systems often continue to hold the prerogative of producing and diffusing seeds, although some countries have created a better enabling environment. In Senegal, for example, the national agricultural credit union shows strong commitment to support agribusiness with loan guarantees for seed producers. Private business and start-ups could be supported in producing new and sought-after technologies at scale through a mix of measures, including technical capacity-building measures such as supporting SME to develop bankable business plans, loan guarantees, and matching grants. New interventions should support capacity-building and training measures so that the private sector can produce seeds and fertilizer at the required scale and quality in line with regional standards. Sufficiently high quality of both seeds and fertilizer are a must to inspire trust and create demand growth. To this end, improving lab testing capacities for better quality assurance was mentioned as a key priority going forward. Related to that, strengthening seed and fertilizer certification facilities and establishing cost-effective certification procedures would also have a positive impact.

Continue supporting regional harmonization processes and capacity building around ECOWAS regional policies and regulations. The wider policy environment modulates the probability of technology spillovers, independent of the quality of innovations emerging from research. One high-ranking official based in Guinea-Bissau noted that even though it is now possible to locate high-potential varietals existing within the region thanks to the regional seed catalog established under WAAPP, cross-country transfer of new seed technology still poses challenges. One expert detailed a case where it was unclear how a new cassava seed varietal could be procured from Ghana and shipped to Guinea-Bissau. To fully take advantage of regional achievements such as the regional seed catalogue, every effort should be made to allow uninterrupted flow of seeds across borders by private actors. To further remove impediments to fertilizer trade, efforts to assist member states in implementing the regional seed or fertilizer regulations like phytosanitary regulations should be continued by building upon achievements made under WAAPP, WAFP, and WASP. There also needs to be better capacity-building and sensitizing measures for actors such as border officials and policymakers, who are unaware of existing regional regulations and thus slow intra-regional trade. The same applies also to private traders who are frequently ignorant of regional seed trade provisions, too.

DIFFUSE CSA KNOWLEDGE BY INCREASING INVOLVEMENT OF FARMERS IN RESEARCH AND EXTENSION

Farmer organizations should be generally better included in knowledge generation at an earlier stage given the importance of achieving behavior change at the field level. How could collaboration between producers' and the region's regional and national research centers be improved and operationalized? How could producers be more systematically involved in the propagation of new technologies and best practices? Jointly with the region's regional and national research centers, farmer organizations could develop extension packages adapted to the respective conditions of the agroecological region. This would ensure a better fit with farmer needs. The Alliance for Agroecology in West Africa (3AO) provides an example of more systematically involving farmers in extension and knowledge exchange around agricultural practices. Launched in 2018 by ROPPA (Network of Peasant Organizations and Agricultural Producers of West Africa) and IPES-Food (International Panel of Experts on Sustainable Food Systems), 3AO provides a coordination and information platform composed of farmers' organizations, research institutes, universities, and international NGOs to promote agroecological approaches in the region, including through strengthening farmer-to-farmer training systems.

Many national agricultural technology fairs organized by the national research systems are still much too technical in nature and are not sufficiently adapted to producers' needs and knowledge. Thus far, these fairs and technologies are not sufficiently inclusive and do not provide an optimal space for discussions between producers and other field-level actors. Including farmers at an earlier stage of organizing such outreach events might enhance their effectiveness. Generally, both NCoS and RCoEs and CORAF should work more closely with farmer organizations such as ROPPA to improve outreach to farmers and to rely more on farmers as diffusors and multiplicators of technology.

Many farmers remain underserved by extension services, leading to low awareness of improved CSA technologies. There is a lack of readily available information and knowledge on CSA that hinders adoption. This is compounded by a low technical capacity to use agronomic information provided by technical agencies. To support underfunded public extension services struggling to keep abreast with both demography and the emergence of disruptive technologies, the following avenues might hold promise to sensitize and train farmers on new CSA technologies.

UTILIZE POTENTIAL OF EMERGING DIGITAL EXTENSION SOLUTIONS

The region holds many promising examples of ICT-powered extension solutions. Given the growing penetration of mobile phones, digitally disseminating climate information with tailored agronomic advice can more easily reach a large number of beneficiaries, considering the importance of both input and output markets. At present, however, a systematic analysis of all models implemented and piloted in the region still seems to be lacking.

Collect best practices and guidance for how digitally enhanced extension models supplying agronomic and climate information to farmers (and other value chain actors such as traders) could serve as a first step in rolling out promising and scalable models more widely across the region. Examples of these include the following:

- **E-extension and digital decision-support systems should provide farmers with up-to-date market-related information and tools facilitating contract farming,** in addition to agronomic advice
- **Explore alternatives to directly sending information to producers,** such as introducing new technologies via online videos and radio programs.

The positive effects of knowledge delivery through digital technologies alone will likely remain limited if not complemented by field-level person-to-person advice and sensitization. Outreach campaigns to educate farmers on how to use digitally transmitted information are thus still needed. Farmers learn best from farmers, meaning that farmers should be much more involved in the technology dissemination process. An extension agent from afar is much less able to convince and train farmers on new production methods than a trusted community member living nearby.

Farmer knowledge can be increased through field-based action and farmer-led extension. Producer organizations themselves can select lead farmers, paid by the producer organization, who then set up demonstration plots and organize physical field schools for community members. Well-structured value chains with aggregation services provide an environment allowing producer organizations to operate farmer extension services sustainably. The USAID-financed Naatal Mbay project in Senegal is a case in point, enabling producer organizations to use digital technology to monitor productivity and cultivation techniques. Employing a data-driven approach has allowed farmers to make evidence-based decisions on how to improve yields. Farmer-led extension services supported by Naatal Mbay are currently on track to reach self-sufficiency.

LEVERAGE POTENTIAL OF INTEGRATED APPROACHES FOR INITIATIVES AT LANDSCAPE LEVEL

Considering both near- and midterm climate projections, strengthening the hydrological basis of resilience in agriculture and food systems will be increasingly important. Climate change is likely to increase the severity of both drought and flood events, affecting food production potential. In the midterm, severe freshwater shortages will likely affect West African river basins (Sylla et al. 2018). In the near term, however, production risks from an overabundance of water seem just as acute. In its Global Annual to Decadal Climate Update, the WMO (2020) projects wetter-than-usual conditions over the Sahael in the 2020–2024 period, which is, absent swift adaptation measures, likely to give rise to both large-scale population displacements and significant damages to agricultural production. Reviewing and adapting existing regional and national risk management arrangements is thus an urgent priority. In addition, strengthening local capacity for water management and investing in complementary land conservation measures at the watershed level could both improve rainwater productivity, decrease soil erosion and siltation, and reduce flood risks. Such measures could include regreening of peripheral areas around small reservoirs and establishing buffer strips in riparian areas (see, for example, Cecchi et al. 2020).

A landscape approach to natural resource management greatly enhances the effectiveness of CSA by protecting the ecological foundations of agricultural production in the medium term. While estimates of the exact extent of West African land degradation vary, there is an urgent need of reversing the current soil degradation trends and halt soil widespread soil erosion to guarantee food security and build resilience against climate change. Allowing the regeneration of trees on fields leads to a wide range of benefits including increased crop yields and should therefore be, where possible, mainstreamed in CSA initiatives in all agroecologies where it achieves good results. The GGWI is large, albeit fragmented, and critics point out that the program's larger stakeholders have not yet incorporated the learnings of community-based regreening measures such as FMNR for achieving lasting sustainable impact. Many global and regional initiatives on landscape restoration are already underway, and Sahelian countries generally qualify.[29] Except for transboundary watershed governance and remote-sensing based landscape monitoring, most activities are subnational level in nature. There are, however, some activities that appear underexploited by current projects.

Map areas where land restoration was successful for complementary action. Doing a stocktaking in each West African country to examine where SLM techniques had impact at scale and determine complementary actions to further increase productivity would be a cost-effective no regrets option with significant potential for improving agriculture-based livelihoods. For example, where FMNR has successfully built up soil organic matter,

[29] This includes, for example, the GGWI and related initiatives as well as ECOWAS-led Support Project to the PTAE (see also initiative mapping of section 2.1)

applying mineral fertilizer becomes much more rational and effective (Reij 2018). Land restoration mapping allows for tailoring extension and input packages so yields could be cost-effectively enhanced and food security strengthened.

M&E is essential to track progress and measure the impact of land restoration activities on the ground. For example, the FAO program Action Against Desertification[30] has developed an innovative monitoring system using remote sensing imagery to observe all land under restoration in the areas where it operates systematically and continuously. Collect Earth is a free, open source and user-friendly tool to understand the dynamics of the landscape. This and other innovative technologies for measuring the progress of restoration efforts are key to the long-term success of such programs.

Seeing is believing: expand cross-border regional peer-to-peer learning so that farmers can listen to farmers who have achieved positive change under similar conditions. This would call for organizing many more exchanges of farmers and public officials between farmers that live under similar climatic conditions but have not yet done FMNR, with farmers in other regions where FMNR is already practiced. Analogously, field-level exchanges should also take place at the level of government and administrative staff. While the CSA has been increasingly mainstreamed in key regions as well as national policy documents over the recent years, there is still significant potential to improve awareness at the level of local government in terms of how CSA can be implemented and what benefits may result from adoption of CSA practices and technologies. It would be thus useful to organize and institutionalize exchange visits of resource management personnel from different Sahelian countries to improve the cross-border flow of learnings and experiences related to the reversal of land degradation. For example, Senegalese foresters and land management specialists should visit areas in Niger, where large-scale land restoration has taken place, to draw lessons for policy and practice in their own country.

Explore the use of economic instruments to build resilience such as water pricing, water quotas, and payments for ecosystem services. For example, in the Sahel, many Irrigation Development and Management Agencies (SAGI) only charge a portion of the operating and maintenance costs related to irrigation and drainage systems and rarely readjust their prices (CILSS 2017). This mispricing both disincentivizes rational use of water resources and contributes to the deterioration of public water infrastructure. Setting water services at appropriate levels that allow recovery of actual operating and maintenance costs through appropriate pricing of the water service could increase both water use productivity and long-term water availability through better maintained facilities. Another pathway toward enhancing the resilience of the food system's productive base could be promoting payment for ecosystem services (PES) schemes. Appropriate payments have been shown to motivate farmers to take up sustainable land practices while having the potential to encourage diverse livelihood strategies (Innis 2015; Ola and Benjamin 2019). In the context of the Sahel

[30] Action Against Desertification is an initiative of the African, Caribbean and Pacific Group of States (ACP) to restore drylands and degraded lands in Africa, the Caribbean, and the Pacific to tackle the detrimental social, economic, and environmental impact of land degradation and desertification (FAO 2020c).

and West Africa Program in Support of the GGWI, ecosystem payments mechanisms have been piloted. At present only a small fraction of Voluntary Carbon projects or projects under the Clean Development Mechanism are in Africa (Bernard et al. 2017), so upward potential exists. Furthermore, technological advances around soil carbon monitoring, reporting and verification, and remote sensing could expand opportunities for scaling up deployment of PES-schemes across the region.

Two findings on best results are that they often are achieved when combining different practices that complement one another, and that projects need to start off simple, remain adaptive, and add complexity responding to emergent needs. In dryland areas where soil degradation has been successfully reversed through agroforestry or water management techniques, adding high quality mineral fertilizer is much more effective in raising crop yields than in areas where soil organic matter is low. Using natural regeneration techniques such as FMNR to restore soil organic matters thus strengthens the rationale for using mineral fertilizer. Regions where increasing access to fertilizer could have a huge impact include, for example, the Maradi and Tahoua regions in Niger and the Bam and Yatenga regions in Burkina Faso (Reij 2018). This is a good example of where gradually adding complexity instead of starting with an all-encompassing list of activities could yield real benefits. While transforming agricultural systems to CSA may be a goal, trying to apply all possible actions in an area will likely result in a complex project. Greater success is likely through starting with simple actions that produce gains, and that can be combined with other actions that move toward complexity, if needed to adapt to greater challenges.

PROMOTE SOUND LAND TENURE POLICY

A focus for the regional level could be encouraging countries to improve their policies and regulations related to the natural resources use rights usage. At present, restrictive or poorly interpreted forestry laws frequently discourage farmers in many West African countries from regreening their fields. If trees are (perceived to be) in the formal ownership of state agencies with limiting farmers' rights to benefit from the resource, effectiveness of land restoration efforts are likely to be limited. Finally, while the sustainability of cash-for-work programs can be questioned, they might still represent an impactful entry point for the scaling of integrated landscape management in or near conflict-affected areas. Implementing productive safety nets might help some regions to deal with the combined pressures of a large influx of refugees, reduce conflict potential between new arrivals and the existing populations, and contribute to reining in soil and landscape degradation in a timely manner with positive effects for social stability and food security.

POTENTIAL REGIONAL FLAGSHIP INITIATIVES TO BUILD THE SUSTAINABILITY OF THE FOOD SYSTEM'S PRODUCTIVE BASE

RFI #1: ACCELERATE EVOLUTION OF REGIONAL RESEARCH SYSTEM

TABLE 2.2 Regional Flagship Initiative #1

Type	**Investment**
Objective	**Consolidate and expand regional agricultural research systems and identify sustainable finance mechanisms for future growth**
Context and rationale	The WAAPP established a regional agricultural research system. It aimed to pool scarce resources, facilitate cross-boundary knowledge spillovers, and avoid duplication of research agendas. The regional research system, however, still lacks a sustainable financing mechanism and many national research centers set up under WAAPP continue to require support to meet the requirements for operating effectively at regional level. In addition, cross-cutting agendas relevant to the food system such as mechanization, and natural resource management and the leveraging of digital technologies are not yet sufficiently considered. Last, private sector involvement in technology generation and dissemination is still below expectations.
Activities	(1) Reinforce and grow regional network of NCoS and RCoE: • Continue process of maturing NCoS into RCoE • Explore establishment of new research centers on relevant agendas (for example, natural resources, including production of detailed soil maps); digitalization of agriculture (linkage to RFI #3); bio-risks (linked to RFI #4); and mechanization. • Establish partnerships with regional and international tech companies and the African Institute for Mathematical Sciences (AIMS). (2) Develop sustainable funding model for regional-level research: • Strengthen linkages between R&D and private sector through setting up incubation platforms at regional level • Move toward grant schemes based on country contributions (for example, by adopting the FONTAGRO model) • Create innovative financing models for regional-level research centers (for example, core funding plus project-based funding with competitive research grant schemes); collaboration with private sector through innovation competitions (3) Accelerate diffusion of innovative technologies and cross-border technology exchange: • Strengthen digital technology dissemination platforms (MITA, WASIX) • Promote suite of technologies targeting integrated soil fertility management (soil mapping, targeted fertilizer blending, promotion of soil testing, complimentary packages of seed and fertilizer) • Strengthening the role of social science in agricultural research to move away from one-sided focus on agronomical properties toward a value chain approach

Activities	• Support agribusinesses and service providers that aim to distribute improved seeds and other research innovations through capacity building, matching grant, and loan guarantees • Promote demand-led research by enhancing the role of farmer organizations and other value chain actors in technology development and dissemination (for example, by better including producers in selecting criteria for varietal development) • Strengthen capacity of producer organizations to provide extension services to farmers • Strengthen capacity of other value chain actors including processors, aggregators, and distributors to diffuse and adopt technologies • Systematic use of ICT campaigns and e-extension (for example, radio and TV, social media) to raise technological awareness of farmers using local languages (4) Foster linkages of NARS system to CGIAR research system through collaborative research projects
RFI coordination and potential partners	CORAF; CGIAR Research Centers; USAID; WASCAL (West African Science Centre on Climate Change and adapted land use); CILSS and ECOWAS (particularly regarding the use of digital technologies); and financial partners
Past or existing initiatives with potential for collaboration	Initiative will build upon WAAPP; opportunities to collaborate with Partnership for Agricultural Research, Education and Development in West Africa (PAIRED) and EnGRAIS; CGIAR AICCRA on climate-informed digital agro-advisory packages; CGIAR Two-Degree Initiative; IFPRI Akademiya2063; AfDB TAAT to leverage proven technologies for scaleup
Knowledge gaps and areas for deep dive	• Scoping studies for additional regional research centers (listed above) in terms of mandate and mode of operation • Explore models for sustainable financing mechanisms for agricultural and food research of regional relevance and related convening processes • Develop concept for innovation competitions to increase involvement of private sector in agricultural research

RFI #2: SYSTEMATIC TARGETING OF HOTSPOT AREAS WITH FLEXIBLE INTEGRATED APPROACH

TABLE 2.3 Regional Flagship Initiative #2

Type	**Investment**
Objective	**Enhance vulnerable populations' food security and resilience to climate change in hotspot areas in the medium term through targeted interventions that (a) scale up integrated landscape management and (b) strengthen conflict-resolution mechanisms**
Context and rationale	An increasing number of West African countries is confronted with a complex, multidimensional crisis caused by a nexus of interrelated drivers including climate change, land degradation, and fragility, conflict and violence. By some estimates, Africa could face a near double-digit reduction in crop yields and production volumes over the next decade, as well as rising food prices by similar margins. Between 1975 and 2013, the area of land under cultivation has doubled severe land degradation and water shortages are threatening the sustainability of agriculture's productive base. Nearly 90 percent of rangelands and 80 percent of farmlands in the West Africa

Context and rationale	An increasing number of West African countries is confronted with a complex, multidimensional crisis caused by a nexus of interrelated drivers including climate change, land degradation, and fragility, conflict and violence. By some estimates, Africa could face a near double-digit reduction in crop yields and production volumes over the next decade, as well as rising food prices by similar margins. Between 1975 and 2013, the area of land under cultivation has doubled severe land degradation and water shortages are threatening the sustainability of agriculture's productive base. Nearly 90 percent of rangelands and 80 percent of farmlands in the West African Sahel are seriously affected by land degradation, including soil erosion. Almost 3 million hectares of forest are lost. Exacerbated by climate change and poor management, forest degradation threatens water supplies and ecological functions that are essential for the productive basis of the food system. In parallel, West Africa has witnessed a substantial rise in the incidence of political violence. According to the OECD (2020), the past five years have been the most violent on record, with over 12,000 conflict events and 50,000 fatalities through June 2019. This multidimensional food and security crisis is most acute in areas where large population growth, an influx of migrants, and competing claims by different groups (herders and farmers) on the right to use natural resources occur simultaneously. Adopting a regional approach to addressing land, forest, and water resource issues in hotspot areas could short-circuit this vicious cycle of vulnerability to climate shocks, landscape degradation, and FCV risks. First, landscape restoration measures and watershed management may reduce negative or enhance positive cross-border spillovers, particularly with respect to water resources quality, quantity, and variability, as well as air- or waterborne soil transport. Complementary investments in agroforestry and improved forest management can also increase community resilience by reducing soil erosion and promoting infiltration, groundwater recharge, and land surface cooling. Both approaches will safeguard and rebuild the foundation of agricultural productivity in the midterm. If flanked by accompanying measures to strengthen local governance and conflict-resolution devices (for example, through the establishment of grievance redress mechanisms), adopting an integrated approach at the landscape and watershed level will also contribute to reducing migratory pressures and the probability for conflict between different livelihood groups such as herders and farmers. The choice of targeted areas will be based on vulnerability to climate change; natural resource degradation or depletion (deforestation, erosion and land degradation, water depletion); extreme poverty; prevention of or recovery from FCV outcomes (for example, cross-border refugees fleeing terrorist violence, migration from degraded areas); and potential to improve regional food security needs. Where possible, this initiative could rely on existing projects (those co-financed by the World Bank and by other donors) as implementation vehicles.
Activities	(1) Interventions to restore the productive base in hotspot areas of regional relevance with high levels of land and forest degradation and FCV risks: • Watershed restoration on the slopes and flood plain restoration in valleys through integrated and participatory planning at the community level • Promotion of CSA on restored lands (for example, adoption of improved seeds and fertilizers, CA) and systems, including for livestock activities, irrigation, and water mobilization (for example, water harvesting and monitoring surface water and underground water table for sustainable use) • Promotion of agroforestry and sustainable management of forests (2) To reduce FCV risks, strengthen or establish local institutions and governance mechanisms related to conflict resolution (for example, grievance redress mechanisms): • Identification and implementation of community-based actions (CBA) • Capacity building for community-based adaptation • Build capacity for digitizing landscape at communal level to support integration of sustainable agriculture into local development planning (assessment and monitoring of natural resources, land cover and land use, and land surface climatology)

Activities	• Policy facilitation and dialogue for creating enabling environment for community-based initiatives, including through the NAP (3) Link social protection (adaptative safety nets) programs with science-powered (for example, remote-sensing based) information on the natural resource and productive base for efficient and timely intervention to reduce target populations' vulnerability in hotspot areas (4) Establish regional knowledge hub on the analysis, design, and implementation related to integrated approaches: • Dedicated training courses for senior staff of relevant development projects and government programs around the region including demonstration visits • Promote (COVID-19 situation permitting) cross-boundary farmer-to-farmer exchanges to scale up adoption of proven practices such as FMNR • Robust monitoring and impact assessment of CBA activities
RFI coordination and potential partners	CILSS AGRHYMET, CORAF, ECOWAS, technical and financial partners including EU, AFD, FAO, CGIAR, OECD, UN organizations (for collaboration on peacebuilding and conflict-resolution initiatives)
Past or existing initiatives with potential for collaboration	Build on existing regional and country projects targeting natural resource base such as PRAPS II, PREDIP, RFP-GDT/FFEM-FAO; collaborate with WB Analytics Sahel Adaptive Social Protection to link adaptive social safety nets with data-driven monitoring mechanisms of productive base; establish linkages to the Project for the Agroecological Transition in West Africa (PATAE); the Project for the Dissemination and Implementation of Good Practices for Sustainable Agricultural Intensification in West Africa (PAIAD); the Degraded Agricultural Land Restoration Program (PRTAD); explore linkages to the Regional Fund for Agriculture and Food (ECOWADF) and WAICSA
Knowledge gaps and areas for deep dive	• Development of hotspot diagnostic methodology (for example, through remote-sensing-derived data and geospatial information) and regularly renewed updates to improve targeting of interventions • Assessment and mapping of climate-security risks and potential remedies • Best practices and past learnings of landscape restoration and management interventions in volatile FCV environment; accelerate mitigation and adaptation actions through strengthening national adaptation processes and community-based adaptation

RFI #3 LEVERAGE DIGITAL TECHNOLOGIES TO ENHANCE FOOD SYSTEM RESILIENCE

TABLE 2.4 Regional Flagship Initiative #3

Type	**Integrated analytics, policy, and investment**
Objective	**To enhance the use of digital technologies including big data, artificial intelligence, and IoT-approaches in West Africa in areas relevant to food system resilience**
Context and rationale	Digital technologies may provide manifold opportunities for increasing West African food system resilience in a multitude of areas, for example, through connecting different value chain actors for decreased transaction costs; improving pest and disease monitoring and crisis

Context and rationale	times; and facilitating farmers' access to loans. At present, however, innovative technologies such as big data or AI (for example, to process remote-sensing and GIS data) are not widely used in the region. A regional approach could pool scarce resources to increase digital literacy of regional decision-makers, scientists, and producers; identify and promote promising digital applications and best practices as well as generate positive knowledge spillovers. Furthermore, a harmonized digital legal framework related to data issues and privacy across ECOWAS member states is still absent. A harmonized ECOWAS Digital Policy could spur development of agriculture-related e-infrastructure by facilitating private sector-led innovation and avoid regulatory fragmentation preventing economies of scale. This RFI would have linkages to both the regional research system and RFIs listed under priority intervention area " Regional Risk Management Architecture and Farmer-Decision Support Tools" as detailed in section 2.3.
Activities	(1) Assess potential of digital technologies such as remote sensing, digital mapping, and IoT solutions to improve farmers' market linkages and financial inclusion and to deliver tailored climate information to a both farmers and private sector actors; assess infrastructure constraints hampering the development of digital agriculture; facilitate creation of data-driven ecosystems for climate, agriculture, and market information to develop granular level farmer risk profiles and reliable climate information allowing to broaden access to finance (for example, credit and agricultural insurance) (2) Identify and design promising big data and AI applications (drawing on global experience) that could be integrated into operations of regional programs under preparation (for example, early warning; agriculture R&D; digital services for producers and food system actors; supply chains and regional commerce); explore partnerships with leading tech companies (Microsoft, Alphabet, and others) (3) Increase digital awareness and capacity of regional actors; set up a platform or regional-level repository for digital solutions and services (for example, CIS, agronomic advisory, e-vouchers) ready for sharing best practices; develop adapted curricula on digital technologies for various types of value chain actors and build regional capacity of NARS and decision-makers related to digital agriculture; organize hackathons with data-savvy West African youth and start-ups to catalyze development of home-grown digital solutions (for example, in collaboration with African Academy for Mathematical Sciences) (4) Determine regulatory needs and develop a region-wide digital regulatory framework
RFI coordination and potential partners	ECOWAS, CORAF, CILSS/AGRHYMET, FAO, IFPRI, African Academy for Mathematical Sciences, OECD Club de Sahel, global technology companies
Past or existing initiatives with potential for collaboration	Potential initiatives that could be built upon include FAO Geospatial data platform; IFPRI AI Predictive Tool; World Bank SD Geospatial Group; and others
Knowledge gaps and areas for deep dives	• Delivery mechanisms of digital climate information and agriculture advisory • Feasibility of digital monitoring emerging risks including GIS enabled conflict early warning and monitoring systems on natural resource conflicts • Regulatory needs

PROPOSED TECHNICAL WORK TO CLOSE KNOWLEDGE GAPS OF THE IDENTIFIED RFIS

The West Africa Food System Resilience Facility (FSRF)[31] will support ECOWAS, CILSS, and CORAF in the operationalization of RFIs in the context of regional programs that are currently under preparation. RFI #1, #2, and selected aspects related to #3 are earmarked for implementation through regional bodies in the context of the Food System Resilience Program (FSRP) and other regional programs. FSRF) support to develop RFIs is organized across three pillars: (1) strategy and partnerships; (2) evidence, analytics, and delivery mechanisms; and (3) learning and capacity building. The immediate next step for FSRF is to develop deep dive technical studies under pillar 2 to close knowledge gaps preventing the implementation of RFIs.

Table 2.5 (below) provides an overview of the RFIs aimed at improving the sustainability of the food system's productive base and the proposed analytical work that will contribute to further develop them. RFI #1, "Accelerate evolution of regional research system," is already well-covered by past and ongoing work led by CORAF. To address knowledge gaps related to RFI #2, technical work titled "Hotspots, fragility, and integrated approaches" is proposed to establish what climate-conflict hotspots exist in West Africa and what kind of interventions are best suited to short-circuit the emergence of vicious cycles of climate change, resource degradation, and conflict risks. The deliverable "Digital Climate Information and Agriculture Advisory Delivery Mechanisms" will explore in more detail most promising modalities related to the transmission of digital climate information and agriculture advisory to farmers. In addition, the core rationale pertaining to RFI #3 of how digital technologies can be utilized for making West Africa's food system more resilient will be mainstreamed across all follow-up analytical work. Last, it is important to note that the proposed enquiry on "Digital Climate Information and Agriculture Advisory Delivery Mechanisms" also responds to knowledge needs of other RFIs that are related to priority intervention areas (see sections 2.2 and 2.3) as set out in this report.

TABLE 2.5 Regional Flagship Initiative #3

RFI #	RELEVANCE AT REGIONAL LEVEL	POTENTIAL PROGRAMS FOR IMPLEMENTATION	PROPOSED TECHNICAL DEEP DIVES TO ADDRESS KNOWLEDGE GAPS
#1 Accelerate evolution of regional research system	Cross-border spillover of knowledge and research innovations, pooling of scarce resources, avoidance of duplication of research agendas	FSRP, AICCRA	Building on WAAPP, CORAF; its partners have already completed several preparatory studies covering a wide range of aspects relevant to RFI #1

[31] See executive summary for more information on FSRF.

RFI #	RELEVANCE AT REGIONAL LEVEL	POTENTIAL PROGRAMS FOR IMPLEMENTATION	PROPOSED TECHNICAL DEEP DIVES TO ADDRESS KNOWLEDGE GAPS
#2 Systematic targeting of hotspot areas with flexible integrated approach	Conflict risks exacerbated by climate change and resource degradation may spill over into neighboring countries	FSRP, PRAPS II, Social Safety Net Programs, PREDIP	Hotspots, fragility, and integrated approaches
#3 Leverage digital technologies	Pooling of scarce resources to generate cross-border spillovers of knowledge and best practices while avoiding duplication of efforts	FSRP, AICCRA, PRAPS II	Digital Climate Information and Agriculture Advisory Delivery Mechanisms Usage of digital technologies to be investigated across all analytical work

2.2 ENABLING ENVIRONMENT FOR INTRAREGIONAL VALUE CHAIN DEVELOPMENT AND TRADE FACILITATION

This section begins by outlining the current state of intraregional food trade before outlining main reasons for low trade volumes. This is followed by an overview of a selection of major challenges currently complicating regional value chain development. Last, the section also touches on policy areas that are relevant for regional integration.

STOCKTAKE AND OVERVIEW

STATE OF INTRAREGIONAL TRADE

The Economic Community of West African States (ECOWAS) Treaty of 1975 established a regional free trade area stipulating free movement of persons, goods, and vehicles within the 15 ECOWAS member states. Under the ECOWAS Trade Liberalization Scheme (ETLS), goods are traded and transported through the region duty free. Effective implementation of this ETLS was supposed to eliminate tariffs on regionally sourced goods (inputs, agriculture products, and so on), reduce the time and cost of moving products throughout the region, and harmonize tariff levels for goods of non-ECOWAS origin, promoting transparent and consistent application of tariffs across the region.

ECOWAS is now one of the regional economic communities in Africa with the

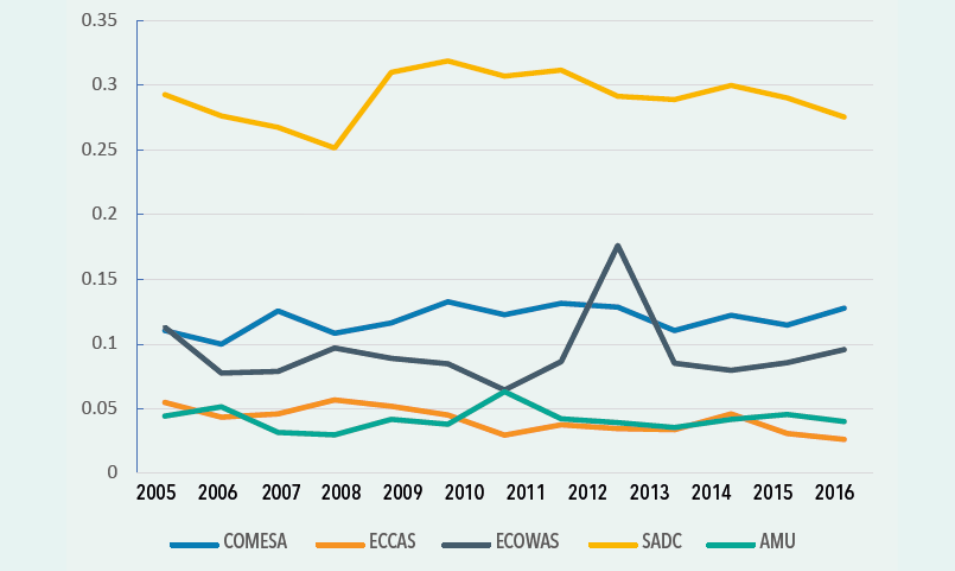
highest intraregional trade shares for both total trade and agricultural trade (Bouët et al. 2019). Unfortunately, the ECOWAS intraregional trade is largely underreported because trade data are fragmented and of uncertain quality. In 2008, the African Development Bank (AfDB) estimated the value of intraregional trade at US$8.6 billion. In 2010, the volume of intraregional trade of all commodities was estimated at 16 percent of the total value of commercial trade of the region. The intra-ECOWAS imports decreased, however, from 13.2 percent in 2000 to 10.4 percent in 2009, with an average of 12 percent over the decade (see figure 1.6 above). This suggests that member countries import more from the rest of the world than from neighboring countries. For example, 35 percent of the rice consumed in ECOWAS in 2017 comes from Thailand and other Asian countries (for example, Benin then reexports rice from Thailand). Regional demand and trade of local cereals such as maize, millet, and sorghum is strong as consumers prefer local over foreign varieties. The regional trade volume is estimated at 20 percent of production. Trade of fruits such as mangoes, plantains, and avocado, is well developed between coastal and Sahelian countries. Livestock trade is also a pillar of regional integration as trade volume and value are relatively high, and around 60 percent of all livestock products consumed in the ECOWAS area are produced locally. For roots and tubers, no extraregional import exists, as the ECOWAS region is self-sufficient with a production of around 200 million tons per year. Potential exists to further enhance these internal trade flows in the ECOWAS region.

REGIONAL TRADE AND FOOD SECURITY

Regional trade is one of the main contributors to food security of West African countries. Regional trade enables countries to benefit from their local comparative advantages and regional consumer demand, access a broader range of food products, and balance fluctuations in national production and prices with imports and exports. However, the level of agricultural trade in the ECOWAS region is volatile from year to year and is still low compared with other economic regions in Africa such as the Common Market for Eastern and Southern Africa (COMESA) and Southern African Development Community (SADC) (see

The top five intraregional food importing countries are Nigeria, Burkina Faso, Ghana, Mali, and Niger, which absorb 77 percent of intraregional food imports. The largest exporters of livestock are Burkina Faso, Mali, and Niger; the main exporter of cereals and cassava is Nigeria. The largest importers for livestock are Nigeria, Ghana, Côte d'Ivoire and Senegal; for maize Niger, Senegal, and Burkina Faso; and for sorghum and millet, Benin, Ghana, and Niger (Elbehri et al. 2013). Map 2.2 below presents the intraregional trade flows of cereals, root crops, livestock, fish, fruit, pepper, and colas. This map shows that the main exporters of cereals are Burkina Faso, Mali, and Nigeria. Nigeria exports its cereals mainly to Niger. ECOWAS and the Permanent Inter-state Committee on Drought Control in the Sahel (CILSS) aim to expand the number of monitored corridors to improve knowledge of trade levels and promote better circulation of goods and services.

FIGURE 2.5 Share of Intraregional Trade for Agricultural Products, 2005–17



Source: Bouët et al. 2019

MAP 2.2 Intraregional Trade Flows, 2017

Source: CILSS 2017

INTRAREGIONAL TRADE VALUE

The value of intraregional food export and import was estimated at US$2,149 million and US$2,328 million, respectively, in 2019 (UNCTAD 2020). Soule et al. (2010) identified five principal market areas: (a) a western area centered on Senegal, trading mainly in local rice, millet, and sorghum; (b) a central area comprising Côte d'Ivoire, Ghana, Togo, Mali, and Burkina Faso, trading mainly in maize; (c) an eastern area comprising Nigeria and its neighbors Benin, Niger, and Chad, which accounts for 60 percent of total intraregional flows of millet, sorghum, maize, cowpeas, and reexported rice (from Benin to Nigeria); (d) the Ibadan-Lagos-Accra conurbation, comprising agglomerations in Nigeria, Benin, Togo, and Ghana with flows of maize and reexports of rice; and (e) the Sahelian belt spanning Mauritania, Mali, Burkina Faso, Niger, and Nigeria (millet and sorghum). The top five food exporting and importing countries have a market share of around 70 percent of the total intraregional trade. The most imported and exported food products are tobacco, vegetables, edible food preparations, and live animals. The top five intraregional food exporters are Côte d'Ivoire, Senegal, Niger, Nigeria, and Ghana, with a market share of 76 percent.

THE REASONS FOR LOW INTRAREGIONAL TRADE

The ECOWAS intraregional trade is growing but flows remains weak compared with imports from the world. West Africa's low intraregional trade is mainly due to inadequate internal transport infrastructure (roads and rail networks) and to road harassment, leading to higher transport and transaction costs and weak competitiveness of regional products. Terms of trade are biased, favoring food imports from outside ECOWAS to the coastal cities because of low shipping and transaction costs. Sourcing them from hinterlands imposes high domestic transport and transaction costs. Between 1996–2000 and 2006–10, imports of most basic food commodities from outside the ECOWAS region grew at an accelerating rate: rice and wheat, palm oil, dairy products, poultry and other meats, tomato (paste and peeled), carrots and turnips, potatoes, green onions, and various processed vegetables. Among fruits, accelerating net imports include apples (16 percent), grapes (14 percent), oranges (14 percent), dates (23 percent), and all kinds of fruit juices (Hollinger et al. 2015).

Regional transport infrastructure linkages are also deficient (see figure 2.6). In West Africa, road transport accounts for 80–90 percent of total interurban and interstate transport of goods and is often the only option for accessing rural areas. The regional road network is insufficiently developed, and its quality remains highly variable given irregular maintenance. Road infrastructure provides the link between countries in the ECOWAS region and its periphery. The regional road network comprises two main highways: (1) the Trans-Sahel Highway, from Dakar to Niamey via Bamako and Ouagadougou; and (2) the Trans-Coastal Highway, from Port Harcourt in Nigeria to San Pedro in Côte d'Ivoire, via Cotonou, Lomé, Tema, Accra, and Abidjan. The interlinks between the two highways originate from the main seaports. The Trans-Coastal Highway links Abidjan to Port Harcourt over nearly 2,000 km and accounts for two-thirds of trade volume between ECOWAS countries. Two key future challenges are constructing the missing links to interconnect the main capitals and secondary cities in West Africa and ensuring fluidity of

traffic on the existing network. This will require removing border stops and other barriers to traffic, maintaining and improving roads, and developing alternative modes of transport—for example, railways for heavy or bulky materials (livestock, cotton, onions, and so on). Figure 2.6 compares the level of infrastructure quality in 2018 by economic region. In addition to ECOWAS, COMESA and SADC, the figure includes data for ECCAS (Economic Community of Central African States), AMU (Arab Maghreb Union) as well as EAC (East African Community). This shows that the quality of infrastructure in Africa as a whole and specifically in West Africa is low; the index ranges from 1 (low) to 5 (high).

FIGURE 2.6 Quality of Infrastructure, 2018

Source: based on Bouët et al. 2019

GATEWAY AND INTRAREGIONAL CORRIDORS

Gateway and intraregional corridors are the two main types of corridors in the ECOWAS area. Gateway corridors link the hinterland to the main seaports, primarily supporting overseas trade of the region and marginally supporting intraregional trade. Intraregional corridors provide key transport infrastructure and services constituting a pipeline for a mix of regional trade flows. Several gateway corridors share common ports. The main corridors link the seaports of Dakar, Abidjan, Tema, Lomé, and Cotonou to the landlocked countries of Burkina Faso, Mali, and Niger. As a transit country, Burkina Faso plays a key role in several corridors. The nine gateway corridors are (1) Cotonou–Niger; (2) Cotonou–Burkina Faso, extending to Mali; (3) Lomé–Niger; (4) Lomé–Burkina Faso, extending to Mali; (5) Tema or Takoradi–Burkina Faso, branching either to Niger or to Mali; (6) Abidjan–Burkina Faso, extending to Niger; (7) Abidjan–Mali; (8) Conakry–Mali; and (9) Dakar–Mali. The only example of a pure intraregional corridor is the Abidjan–Lagos Corridor.

INFORMAL CROSS-BORDER TRADE

West Africa has a high level (75 percent) of informal cross-border trade (ICBT). ICBT largely involves basic food products, cereals, livestock products, vegetables, low quality consumer goods, and so on. Informal traders often trade across borders with small volumes, at irregular intervals, to benefit from price differences and local market opportunities. However, at an aggregated level, these numerous small transactions represent large volumes. Informal trade linkages also extend across national territories. For example, ICBT in petrol, cereals, and fertilizers from Nigeria has expanded from the border areas of Niger into Mali, Burkina Faso, and Ghana. ICBT presents major regulatory challenges since the transactions and the details of the businesses or traders involved are rarely recorded or included in official statistics. For example, informal exchanges between Nigeria and Benin are hard to trace along the very porous 800 km land and sea border. Weak enforcement of regulations creates loopholes for trade in substandard or illegal products that negatively affect consumer welfare through health and safety risks and undermines efforts to develop efficient value chains.

Informal trade is grouped into passive smuggling and informal trading with low transaction volumes. Causes of ICBT in West Africa are as follows:

- Difficulties and high transaction costs associated with meeting all formal documentary requirements motivates traders, especially women, to engage in ICBT.
- Inadequate policy coherence and lackluster political will to implement regional regulation in some member states
- Weak capacity of public institutions (e.g., border authorities) in member countries
- High market response of ICBT to market signals and market imperfections, especially in times of high price volatility, exchange rate misalignment, emergencies, and other shocks
- Weak formal employment opportunities while ICBT offers jobs and revenues to millions of unskilled and semiskilled traders and workers

The traders involved in ICBT usually face difficulties in accessing credit and other services from formal financial institutions and are either denied credit or forced to access credit at high interest rates. While women engaged in informal trade play a substantial role in the local economy, they continually face stigmatization, violence, harassment, and poor working conditions.

ICBT can be formalized in three main ways: first, by reducing bureaucratic obstacles and transaction costs traders face when trying to access the formal market. This approach relies on policies and legislative approaches that directly promote professionalization; improve the business environment and border infrastructure; and address power imbalances between traders and border staff. Examples of policy and legislative interventions include expanding ongoing initiatives of One Stop Border Posts (OSBP) and establishing Trade Facilitation Desks at district levels within member countries to facilitate the completion of border formalities and reduce opportunities for harassment. Second, partnership-based approaches involve establishing partnerships that encompass formal private sector organizations, nongovernmental organizations

(NGO), development partners, and governments to develop joint formalization strategies. Third, incentives and compliance-based approaches include taking measures at national or regional levels to facilitate formalization through incentives tailored to the needs of informal traders:

- Implementing measures eliminating barriers to technology, credit, and market access and actions promoting compliance with formal business requirements, such as registration and needed permits
- Make trade policies more gender responsive and promote women's trade associations in policy formulation processes
- Create incentives for formalization aligned to the needs of informal traders, that is, providing technical support through, for instance, incubation services and capacity-building initiatives; financial support through initiatives such as establishing national and regional business development funds for informal traders; and promoting contractual agreements between producers and distribution companies through short circuits and product standardization.

CONTROLS AND ROAD HARASSMENT

Both the excessive number of controls with high illegal fees charged to traders and time loss decrease the competitiveness of regional production compared with international imports. The time to export for border and documentary compliances (176.6 hours) and to import (229.5 hours) is higher in ECOWAS compared with other regions such as COMESA or SADC (see table 2.6). Therefore, if exported products are perishable or have a seasonal nature, losses will be more important since such products will not be sold at an appropriate time to allow consumption.

TABLE 2.6 Border-Related Measures (by region), 2018

REGION	DAYS NEEDED TO CLEAR EXPORTS	HOURS NEEDED FOR BORDER COMPLIANCE (EXPORT)	HOURS NEEDED FOR DOCUMENTARY COMPLIANCE (EXPORT)	HOURS NEEDED FOR BORDER COMPLIANCE (IMPORT)	HOURS NEEDED FOR DOCUMENTARY COMPLIANCE (IMPORT)	LOGISTIC PERFORMANCE INDEX SHIPMENTS
COMESA	6.3	71.7	69.1	115.7	90	2.9
SADC	4.7	81.8	64.4	94.7	58.8	3.0
AMU	n/a	57.2	60.6	127.1	85.2	2.9
ECCAS	6.7	145.3	89.1	197.8	142.7	2.7
EAC	n/a	68.0	65.0	204.6	133.5	3.3
ECOWAS	12.8	100.6	76.0	120.7	108.8	2.8

Source: Bouët et al. 2019

Existing restrictions of intraregional trade in ECOWAS can worsen dependencies on imports from extra-regional markets. A typical example is the trade of local onions that have to compete with imported onions arriving by boat from other countries such as the Netherlands. Routing local onions between Burkina Faso and Côte d'Ivoire costs about one million CFAF per truckload. With traders unable to cross borders between countries, large stocks and underperforming markets are reported at the borders, which impacts market prices and leads to local surpluses and shortages. For example, large quantities of rotten fresh fruits and vegetables have been reported in border markets in Benin. The result is that prices of perishable, fresh food items dropped to abnormally low levels. According to the Ministry of Agriculture of Benin, in September 2019, the price of tomatoes in Comè, Benin dropped by 40 percent compared with September 2018 levels and 47 percent compared with the five-year average.

Options exist to reduce negative trade impacts of widespread road harassment. A reduction of harassment (see map 2.3 for location of documented road harassment points) could be achieved by (a) sensitization and capacity building of actors involved in trade (border inspections, customs) and growing the number of controls; and (b) the strengthening of the regional reserve, as most regional producers do not have the possibility of storing their products (West African Economic and Monetary Union (UEMOA) is currently creating additional storage facilities).

MAP 2.3 Mapping of Road Harassment, March 2015

Source: CILSS 2015

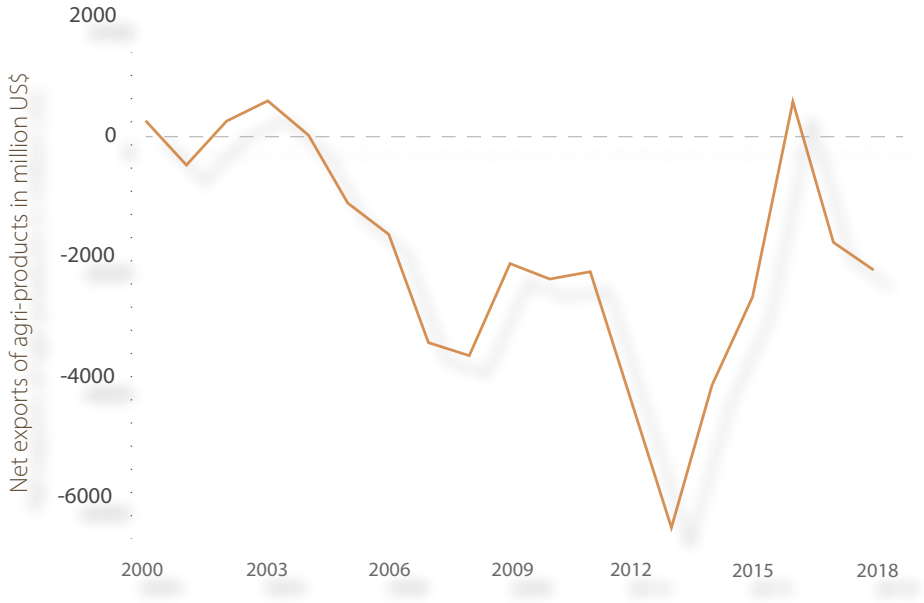
Several firms in West Africa report that they face more non-tariff measures (NTM) within ECOWAS member states than in third countries. NTM are defined as any measures (public or private) other than tariffs that influence international trade flows. While NTM may serve to protect public goods including public health or the environment, they often constitute politically motivated impediments to favor domestic over international suppliers. NTM frequently act as impediments to international trade by obliging importers and foreign exporters to charge higher prices or limit import volumes. For instance, firms in Guinea report that 65.9 percent of NTM are imposed by ECOWAS countries, while only 18.3 percent are imposed by Organization for Economic Co-operation and Development (OECD) countries and 15.9 percent are imposed by other developing countries. High prevalence of NTM within ECOWAS may partly explain regional trade patterns (shares of extra-regional trade in overall trade volume: 84.5 percent for OECD and 5 percent for other developing countries; share of intraregional trade within ECOWAS: 10.5 percent). Also, many West African countries have longer export timescales than other countries, mainly Asian counterparts (WB 2020a). The firms, which are monitored in the World Bank Enterprise survey, indicate that customs, where NTM are typically enforced, and trade regulations are a major constraint to trade (51 percent in Mali; 45 percent in Côte d'Ivoire).

Policies for the free movement of goods and people exist yet are not implemented or are impeded. Regional trade policy seems to be a policy of "convenience" that is implemented only if aligned with short-term political considerations. For example, in 2015, Nigeria banned imports of a range of commodities, including rice, as a response to the trade practices of neighboring countries and to promote local production. This was also a reaction to Benin's imports of cheap rice from the international market to repackage and re-export to Nigeria to profit through favorable exchange rates and price differentials. Potential solutions could be (a) strengthening the tools for auditing good trade practices; (b) strengthening the formal aspects of trade through better mechanism to verify product origin; or (c) adopting a list of strategic and sensitive products (rice, grain) that border services would inspect more closely. At present, no concrete examples of these measure exist in Africa, but there is a system of regular controls of dairy products between Mercosur countries that West Africa could turn to for inspiration.

REGIONAL VALUE CHAIN DEVELOPMENT

The aggregated net exports of agriculture products are mostly negative for ECOWAS between 2000 to 2018 (figure 2.7). This deficit was particularly severe in the years 2012–14, when annual imports surpassed exports by more than US$4 billion. Developing sustainable value chains for food staples and strengthening agribusinesses in the region are key to achieving a more balanced long-term trade balance.

FIGURE 2.7 Net Exports of Agricultural Production by ECOWAS Region (total, in US$, millions), 2000–18



Source: based on FAOSTAT 2020

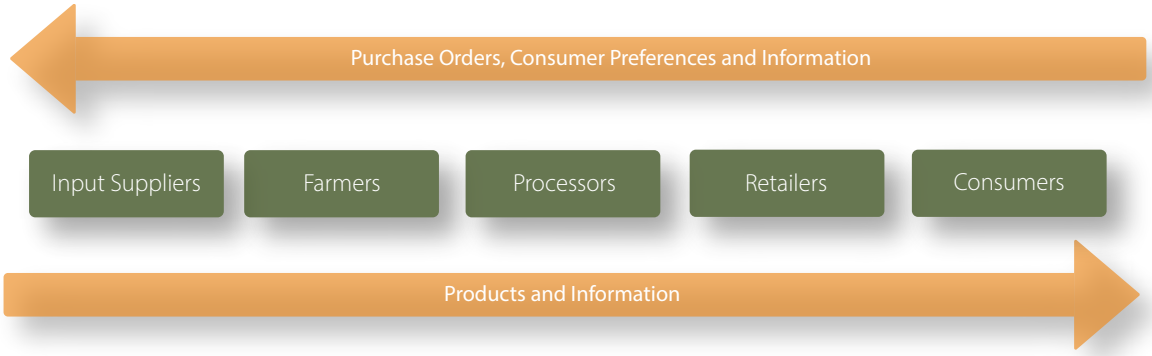
West Africa has an export profile that is dominated by extractive products (crude petroleum, natural gas) and a few agricultural commodities (for example, cocoa, rubber, cotton). Processed food products (rice, wheat, poultry, milk and dairy products, edible products and preparations) are prevalent in imports. The region has a negative food trade balance that is expected to further deteriorate given fast-growing populations, urbanization, and lagging food production. Key policy frameworks at regional and national levels put great emphasis on sustainable and inclusive agricultural value chain development (including processing for value addition) as well as enhancing intraregional trade. This includes the ECOWAS Common Agricultural Policy (ECOWAP), the West Africa Common Industrial Policy (WACIP), and the continental 2014 African Union (AU) Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, in which African heads of state and government committed to strengthening agricultural value chains and tripling intra-African agricultural trade by 2025. Intraregional trade is believed to create opportunities for economies of scale and allow food to flow from food surplus to food deficit areas.

STATUS OF VALUE CHAIN DEVELOPMENT AND AGRIBUSINESS IN THE REGION

The scarcity of data on value chains and agribusiness in West Africa complicates obtaining a clear overview of the sector, including the overall size, structure, and performance. While many agricultural products are consumed locally, there is a vast network of both formal and informal sector enterprises that transport, process, store,

package, and sell the region's products in urban areas and across borders. Official data either undervalues or does not count these thriving businesses in West Africa because many operate as part of the informal economy. Broad scale information, such as the composition of different enterprises in the sector, for example, in agroprocessing, is largely absent. Also lacking is solid data on the size, scale, value, and value added of businesses involved in agriculture along the supply chain. Where data exist, they are largely focused on specific value chains, such as cocoa, cotton, or livestock, that have high regional importance. Figure 2.8 provides a schematic overview of all relevant food value chain segments that need to be considered when collecting data on value chains.

FIGURE 2.8 Schematic Overview of a Food Value Chain—From Farm to Fork



Source: World Bank

Employment data for agriculture and value chains (the food economy) provide a proxy measure for the economic importance of agribusiness. These off-farm activities account for 31 percent of total non-farm employment across the region (Allen et al. 2018). Over 70 percent of all non-agricultural food economy jobs are in food marketing, which includes transport, storage, wholesale, and retail. Overall, these jobs represent 27 percent of the West African service-sector employment. Jobs created by agricultural value chains are increasingly important within the urban sector and represent 35 percent of West African urban employment (Allen et al. 2018). The food economy is vital to women; 68 percent of all employed women work in the food economy, and they dominate off-farm employment.

The agroprocessing sector is highly segmented and marked by a strong dichotomy (FAO 2015). Generally, the more important commodities are within an economy, (for example, cocoa in Ghana), the more likely that the value chains are more vertically integrated and have larger firms operating with more capital (FAO 2015). Small and medium-sized enterprises are often focused on a specific commodity and are often tied to larger domestic or multinational enterprises that are focused on exports. The "missing middle," a lack of medium-sized agribusiness enterprises, follows a pattern that exists across Africa in manufacturing (Dinh et al. 2012). There are relatively few formal-sector agribusinesses; most micro- to small-scale enterprises are dominated by the informal sector, with little regulation or information on their numbers, value, or value added. Yet this vast informal sector, linked to small producers, forms most of the agribusiness sector in West Africa.

While the number of medium-size farms is rising, increased smallholder productivity will be the biggest growth driver. This increase in smallholder productivity will necessarily increase the agribusiness sector as a whole. There are several trends that are working to boost smallholder productivity. First, there is increased attention to closing yield gaps and increasing resilient production, for example, climate-smart agriculture, and boosting agriculture by supporting agroclimatic, advisory, and financial services (see also section 2.1). Second, rural youth are increasingly engaging in agribusiness, and they use ICT (information and communication technology) more often than older farmers (Yami et al. 2019). The expanding use of ICT offers a range of new possibilities for the services farmers and small agribusiness ventures can access, from extension information to microcredit to transport services for products. A third potential trend will be toward larger-scale farms, where ICT and other changes in practices offer the potential for improving economies of scale and productivity for farmers. Production increases will require an equivalent increase in agribusiness, fully incorporating all elements of value chains, from farm to fork.

There are an increasing number of start-ups emerging across West Africa targeting small producers and enhancing value chains, largely driven by improving use of ICT. These start-ups aim to provide farmers with the tools and technology to boost their activities and deal with increased demand. Examples include:

- Farmcrowdy focuses on providing farmers and agribusinesses with the necessary tools and technology to increase yields, lower costs, and improve marketing. It uses a tech-powered network of agricultural commodity aggregation centers to aggregate fresh produce directly from farming communities, giving buyers, processors, and service providers access to markets across the entire fresh produce value chain. It helps farmers purchase the best seeds and inputs, identify yield and profit opportunities, optimize production decisions, and map their farmlands.
- Wefly is an Ivorian start-up comprising three products. It promotes administration, storage, processing, analysis, and providing automatically collected data using spatial locations to help farmers establish new farms; they manage, monitor, and optimize farming and harvest, package, and store agriproducts.
- INVESTIV specializes in using precision agriculture to improve conditions for farmers throughout Côte d'Ivoire and West Africa. As a pioneer of drone applications in agriculture, INVESTIV provides partners with technical and innovative solutions that reduce losses, increase outputs, and save time.

Formal-sector agroprocessing is most closely linked to specific commodities and countries, notably the "big three" countries of Nigeria, Côte d'Ivoire, and Ghana. Table 2.7 presents a ranking of 13 of the 15 ECOWAS countries for which data are available; the table ranks the countries in terms of their volumes of production of raw material and primary processed products for several major crops (FAO 2015).

Both urban consumers and export markets demand improvements in food safety and packaging, while urban consumers also need improved and expanded retail markets. There is strong potential for expanding agribusiness to meet these demands. The preferences urban consumers

have for a wider variety of products, improved packaging, nutritional information, quality and safety assurances, branded products, and convenient foods opens the way for increasing formal-sector agribusiness operations for both domestic and international markets. More modern retail outlets, including supermarkets, hypermarkets, and convenience stores are increasingly demanded by urban consumers. There is potential for substantial increases in

TABLE 2.7 Ranking of Countries by the Size of Their Agroprocessing Sectors

COUNTRY	ALL CROPS(INCLUDE FOOTNOTE TO BELOW TEXT)	RICE	CASSAVA	PALM NUT OIL	SUGAR CANE	COCOA	COTTON	RUBBER
Nigeria	16	1	1	3	4	3	1	3
Côte d'Ivoire	25	5	4	1	8	1	5	1
Ghana	28	7	2	2	2	2	8	5
Guinea	43	3	5	6	13	6	6	4
Benin	49	10	3	8	3	8	4	13
Liberia	57	8	7	7	13	7	13	2
Mali	60	2	11	13	5	13	3	13
Togo	60	13	6	4	13	4	7	13
Sierra Leone	61	4	8	5	13	5	13	13
Senegal	64	6	9	13	1	13	9	13
Burkina Faso	71	9	14	13	7	13	2	13
Niger	79	14	10	13	6	13	10	13
Guinea Bissau	86	11	12	13	13	13	11	13

Source: AGWA background research based on FAOSTAT data

The "all crops" figure represents the sum of the individual rankings for the crops listed in this table. The lower this score, the larger (in volume, compared to the other countries in the region) a national processing subsector industry is deemed to be. While the aggregate score implies comparisons across different subsectors solely on the basis of the volume of raw material processed, which varies greatly between subsectors, it provides a rough guide to the relative size of the entire agro processing sector in each country. On the other hand, the subsector scores allow direct comparisons between countries on a like-for-like basis. The ranking does not include the processing of imported raw materials such as sugar, wheat and dried milk, but since Nigeria leads the regions in all three commodities, followed by Côte d'Ivoire and Ghana, the overall rankings of the leading countries would not change if these products were included in the calculation.

small- and medium-sized agribusinesses to work closely with supermarkets to developed domestically processed, packaged, and branded foods. While this expansion of supermarkets is relatively small in West Africa, it is more significant in Ghana and Nigeria. Yet if the trajectory follows that of other regions, agribusinesses will likely emerge as a growing sector with a substantial influence on agribusiness development.

CONSTRAINTS TO VALUE CHAIN DEVELOPMENT

Most farms and producers in West Africa are small and their integration into value chains faces significant barriers: lack of access to information on the rapidly changing food regulations and quality standards in global markets, technical knowledge to comply with complex food safety and hygiene requirements, and financial means to make the necessary investments. Moreover, labeling, certification, and hazard control systems typically require large investments that are only feasible on a large scale. All these reasons contribute to reducing the participation of farmers and producers in food related value chains. To increase the benefits for small farmers through their participation in value chains, it is necessary to improve their capacity to respond quickly to emerging food safety issues; enhance administrative, infrastructure, technical, scientific, and judicial capacity; support farmer and business assistance programs; stimulate investment in the agrofood industry; reduce transaction costs; favor investment in infrastructure and farmers' associations; and strengthen the bargaining power of farmers.

Constraints for downstream value chain development are highly specific to the relevant commodity and location. For food staples and traditional exports, high transport costs, border logistics, and erratic government interventions are more important than other constraints, whereas for high-value products for domestic and export markets, major challenges are high food safety, other standards and financial issues. In the following, these key constraints are demonstrated for rice in Senegal and Ghana and cocoa in Ghana (see also table 2.8 further below).

Rice is one of the largest food staples imported in West Africa, substituting for traditional staples as urban consumers seek more storable and easily prepared foods. Consumers also show a distinct preference for higher-priced imported rice with aromatic qualities. During the food crisis of 2008, when several rice-exporting countries implemented export bans, world prices temporarily tripled, and price volatility increased (Baharom et al. 2009); several West African countries decided to stimulate domestic rice production. With improved policy incentives and higher world prices, local production has risen sharply in some countries:

- Senegal River Valley rice is irrigated and partially mechanized at costs only slightly higher than in Thailand, the main source of Senegal's imports. Local rice can be quite competitive with relatively efficient milling and transportation. Demand will grow if the aromatic rice varieties now being tested can be produced commercially. While Senegal has made major progress in increasing yields, its competitiveness is restrained by the difficulty of accessing secured, tradable land rights, which discourages significant private investments in irrigation systems.
- Ghana produces rice at a higher cost and faces a greater competitiveness challenge, even though tariffs and other charges add 40 percent to the price of imported rice. High production costs are partly caused by low yields and low levels of mechanization. Low milling ratios and high transport costs further disadvantage local rice, especially rice from the main producing area in the north. As in Senegal, more flexible and strong seed systems are needed in Ghana to provide

a wider range of high-yielding varieties to meet diverse growing conditions and consumers' preferences. Hence, as grain quality, cleanliness, and packaging are main determinants of consumers' preference for imported rice, Senegal and Ghana domestic value chains need to focus on these characteristics.

Cocoa is one of the most important agricultural exports in Sub-Saharan Africa, valued at about US$6.9 billion in 2018 and providing livelihoods for about 20 million people. Ghana, Côte d'Ivoire, and Nigeria have been the star performers in cocoa exports in recent decades. Ghana's performance is aided by a reduction in export taxes, a program to upgrade technology and management, and close attention to quality, spearheaded by a reformed parastatal institution, COCOBOD (The Ghana Cocoa Board). However, productivity is still far below potential, so concerted strategies will be needed to maintain competitiveness and ensure sustainability by reducing deforestation. With the aging of farmers and the aging of trees, substantial investments will be needed to modernize plantations and engage a new generation of more professional farmers. More promising ways to add value could include improving quality and branding and implementing certification programs, although these are expensive to run in a small, largely unorganized industry such as cocoa in Ghana and Côte d'Ivoire.

Public sector policies and programs play an important role in private investment both at regional and national levels. Both within countries and in the region, national policies impact regional outcomes. For example, the elements identified earlier, such as cross-border and transport issues and a lack of harmonization of standards, cause significant regional challenges. Subsidies and pricing policies (or a lack thereof) can serve as barriers to small and medium enterprises (SMEs) and prevent producers from reaching new and more resilient markets. These are national policy decisions with regional implications. Policies that give priority to national products or that limit imports can boost demand and prices but can limit competitiveness and access to regional-scale markets. Unfortunately, there are many national policies in different sectors that can impact regional policies. These in turn create seriously barriers to private investment.

ECOWAP developed a strategic framework to reduce these barriers and support private investment across the region. Among the key findings were that domestic trade barriers (formal and informal, tariff and non-tariff barriers) were discouraging investment in regional markets and slowing intraregional trade flows. Other studies show that these barriers have reduced trade performance within the region, especially by limiting access to finance (Ekpo et al. 2019). The same study found improved integration of value chains would increase income levels. To address these value chain constraints, ECOWAS created a department promoting cross-border investment, joint ventures to promote investment, and public-private partnerships. Other regional platforms to enable information exchange and network creation across borders have recently been put in place, such as the African Rice Advocacy Platform. This platform works across 11 countries on issues such as cross-border trade, tariffs, and the creation of an intra-Africa Rice Network supporting interprofessional bodies.

The 2019 Enabling the Business of Agriculture (EBA) (WB 2019b) revealed low scores overall for the 12 West African countries, but there is substantial cross-country variation. The EBA indicators comprise a unique data collection that helps to evaluate whether governments support farmers to conduct their businesses. The EBA score ranges from 0 to 100 and is a composite of eight sub-indicators: supplying seed, registering

TABLE 2.8 Summary of Major Constraints for Key Commodities

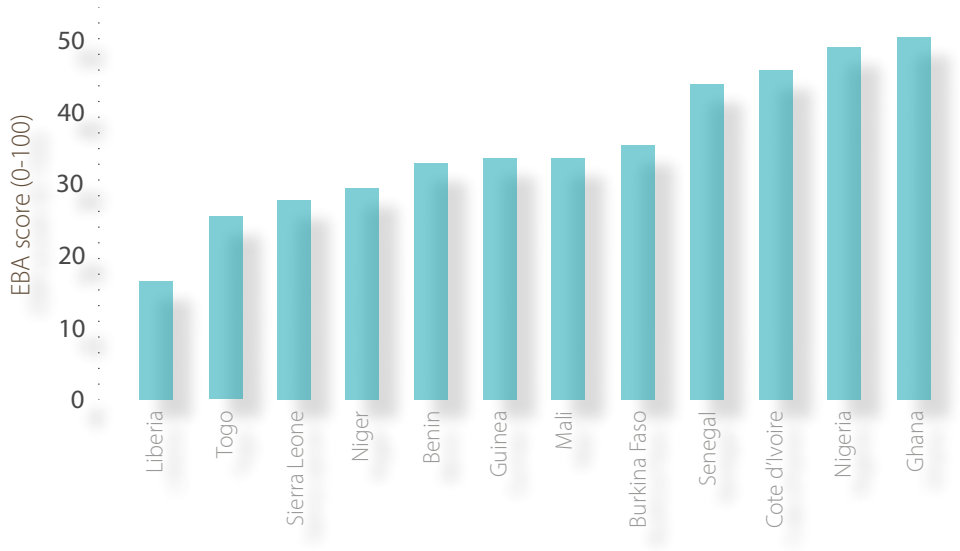
CONSTRAINTS	RICE: GHANA	RICE: SENEGAL	COCOA: GHANA
Output markets			
Policies distorting markets	*	*	*
Quality issues	**	**	*
Food safety			*
Social and environmental issues			**
Regional integration issues	**	**	
Price risk	**	**	**
Inputs and technology			
Policies distorting markets	**	**	*
Access issues	***	***	***
Land access issues	***	***	**
Infrastructure issues			
Transport	**	**	**
Other	***(irrigation)	***(irrigation)	*(energy for grinding)
Access to finance issues	**	**	***
Skill issues	*	*	**

Note: Number of asterisks denotes relative importance as a constraint, with *** as the highest priority.
Source: World Bank 2013

fertilizer, securing water, registering machinery, sustaining livestock, protecting plant health, trading food, and accessing finance. Ghana and Nigeria (see figure 2.9) were the best performing countries with EBA scores of 50, whereas Liberia—at the lower boundary—has an EBA score of 16. Ghana, Liberia, Benin, and Mali have particularly weak scores in the subcategory supplying seed. Scores for registering machinery or fertilizer are scarce due to lack of data. The data reveal large disparities in the strength of agribusiness regulations and the efficiency of their implementation within West Africa. For regional policies to be most effective, it is crucial to account for the heterogeneous constraints that agribusinesses face.

Some West African countries have recently implemented reforms to improve the agribusiness climate. In Benin, the fertilizer quality control system was improved by making it legally mandatory for all fertilizer containers to be labeled in the country's official language. In Burkina Faso, the government increased the safety controls for feed manufacturing as it now requires the approval and inspection of manufacturing facilities before the start of operations. In Côte d'Ivoire, the trade of agricultural products was simplified as the government introduced an online application for phytosanitary certificates. In Ghana, the regulatory system for plant protection improved through the introduction of a list of regulated quarantine pests and making it available on

FIGURE 2.9 Enabling the Business of Agriculture for West African Countries, 2019



Source: EBA report 2019 (WB 2019b)

the International Plant Protection Convention (IPPC) website. In Liberia, the government ameliorated the access to finance by introducing laws on agent banking. Nigeria introduced several incentives geared toward encouraging investment in the agricultural sector, including no duty on agricultural machinery; unrestricted capital allowance for agribusinesses; and up to 50 percent of the capital for agriculture-related plants and equipment. Ghana allows foreign ownership in local companies and joint start-ups and corporate tax rebates of 40–75 percent. Moreover, foreign investors are, among others things, permitted to lease land for a period of up to 50 years, and they are exempt from customs import duties on plant and machinery, equipment, and accessories imported exclusively for establishing enterprises (FAO 2010). While policy reforms in individual countries can undoubtedly set attractive incentives, greater private sector involvement would, as touched upon in the previous paragraphs, benefit from more regional consistency and reduced barriers for companies to operate across markets and countries.

INITIATIVE MAPPING

Table 2.9 (below) provides an overview of selected initiatives and projects, either ongoing or under preparation, that relate to the priority intervention area II—Enabling Environment for Intraregional Value Chain Development and Trade Facilitation. Building on an initiative mapping contained in the ECOWAS RAIP (2016–20), the overview is not intended to be a complete collection of existing initiatives but focuses on programs which are (a) regional in scope and (b) considered most relevant and impactful at regional level.

TABLE 2.9 Initiative Mapping for Enabling Environment for Intraregional Value Chain Development and Trade Facilitation

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
NETWORK OF MARKET INFORMATION SYSTEMS IN WEST AFRICA (WAMIS-NET)					
Inform farmers, agrodealers, and other stakeholders in the agriculture sector of the prices and availability of agricultural products and inputs via web-based platform to ECOWAS countries	Data collection and dissemination of market information through multiple channels including internet, radio, print, email, and SMS	Benin, Burkina Faso, Côte d'Ivoire, Guinea, Niger, Nigeria, Mali, Senegal, and Togo	CILSS, ECOWAS-UEMOA	Various partners since establishment including USAID, EU, DGIS	Since 2000; market information system
WEST AFRICA TRADE FACILITATION SUPPORT PROGRAM (TFSP) PROMOTING TRADE IN WEST AFRICA (WATIP II)					
Implement regional resolutions on trade and customs policy at national level, in dialogue with government, civil society, and private sector stakeholders	(1) Develop and implement regional policies and instruments for trade facilitation, such as the ECOWAS Common External Tariff and the ECOWAS Trade Liberalization Scheme 2) Promote the efficient transport of goods in selected trade corridors (3) Coordinate with the private sector to address trade-specific concerns and promote the role of private actors in the trade facilitation process	ECOWAS countries	World Bank, GIZ	Multidonor consortium including USAID, EU, Netherlands, Germany	2018–22; Grant; US$20 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
REGIONAL FOOD TRADE AND RESILIENCE					
Increase food trade in Sub-Saharan Africa to fulfill the anticipated increase and shifts in food demand	(1) Improve predictability of policies and public-private dialogue to incentivize private sector to increase investment and trade across borders (2) Improve coordination between regional investments in production, processing, and trade to improve the flow of finance to the sector and generate more income and resilience for smallholder farmers	East Africa, Southern Africa, and West Africa	Alliance for a Green Revolution for Africa (AGRA) and IDH—Sustainable Trade Initiative	Government of the United Kingdom's Department for International Development (DFID)	2018–23; Grant; US$ 48 million (not limited to West Africa)
FAMILY FARMING, REGIONAL MARKETS, AND CROSS-BORDER TRADE CORRIDORS (FARM-TRAC) IN THE SAHEL					
To develop at regional level a sustainable model of operational and policy stakeholders' platforms supporting the development of a family farming model that optimizes economic and social opportunities of cross-border regional trade	(1) At operational/ground level (that is, economic clusters/markets/trade corridors), support a better knowledge and evidence-based understanding of the role of a sustainable and climate-resilient family farming model able to diversify regional agricultural production while addressing better integration of markets and consumers' needs (2) At policy and institutional level (that is, UEMOA, AU, bilateral commissions, and so on), favor a more efficient coordination, concertation, and harmonization of relevant institutions/ organizations concerned by the development and management of agricultural markets and cross-border trade corridors generating and implementing more adequate sectoral strategies and policies reforms	Burkina Faso, Cabo Verde, Chad, The Gambia, Guinea-Bissau, Mali, Mauritania, Niger, and Senegal	International Food Policy Research Institute (IFPRI)	IFAD	2020-22 Grant; US$3.5 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
AGRICULTURAL VALUE CHAINS SUPPORT PROJECT IN THE SOUTHWEST, HAUTS-BASSINS, CASCADES, AND BOUCLE DU MOUHOUN REGIONS (PAFA-4R)					
Contribute to poverty reduction and stimulate economic growth in the Cascades, Hauts-Bassins, Boucle du Mouhoun, and Southwest regions	(1) Support to agricultural productivity and production (2) Support to the increase in value addition and marketing of agricultural products, including through civil society engagement	Burkina Faso	IFAD	IFAD	2020-25; Grant; US$ 124 million
FEED THE FUTURE WEST AFRICAN TRADE AND INVESTMENT HUB					
Attract finance and investment, build links among businesses and supporting institutions, and strengthen the agricultural and trade sectors	Data collection and dissemination of market information through multiple channels including internet, radio, print, email, and SMS	Nigeria, Senegal, Côte d'Ivoire, Ghana, and other West African countries	USAID	USAID	2019–25; Co-financing grant to leverage private capital; US$60 million
WEST AFRICAN QUALITY SYSTEM					
Support the implementation of the regional quality policy of ECOWAS aiming at "establishing a framework for the development and operation of suitable, relevant, efficient, and effective quality infrastructures to facilitate intraregional and international trade, protect the consumer and the environment, and promote sustainable economic development"	(1) Encourage the use of the regional quality infrastructure and harmonized legal framework (2) Favor private sector to get access to standards (3) Allow private sector to get access to a network of accredited and competitive conformity assessment services provided in the region (4) Strengthen quality culture in private sector	ECOWAS countries	United Nations Industrial Development Organization (UNIDO)	EU	2014–20; Grant; €12.9 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
THE WEST AFRICAN TRADE AND INVESTMENT HUB					
Reduce the cost and risk of doing business in Africa, leveling the playing field and cutting through red tape to make investment and trade freer and fairer for everyone	(1) Serve as leaders in adopting improved practices (2) Attract buyers and investors (3) Promote implementation of regional trade agreements	East Africa, Southern Africa, and West Africa	USAID	USAID, Creative Associates	2014-19; Grant; US$ 49 million
ECOWAS INFORMAL TRADE REGULATION SUPPORT PROGRAMME					
Increase intra-regional trade as part of the construction of the common market and poverty reduction in the ECOWAS region	(1) Implement of an independent mechanism for data verification and validation (2) Extend product coverage and standardize customs coding (3) Involve National Statistics Offices (NSOs) in data verification and validation activities (4) Conduct capacity building activities of apex organizations with the NSOs (5) Conduct advocacy activities for the removal of barriers to cross-border trade	ECOWAS countries	CILSS and ECOWAS; funding to be mobilized through programs by international donors	West African Association for Cross-Border Trade, in Agro-forestry-pastoral and Fisheries Products (WACTAF)	2019-22; n.a.
REGIONAL RICE DEVELOPMENT PROGRAM					
Supporting ECOWAS in achieving ECOWAP objective of rice self-sufficiency in 2025 (Regional Rice Offensive).	n.a.	ECOWAS countries	FAO (Sub-Regional Office for West Africa), ECOWAS, ECOWAS member states, Coalition for African Rice Development (CARD)	n.a.	Program under development at the time of writing.

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
MARKET ACCESS SUPPORT PROJECT FOR AFRICAN, CARIBBEAN AND PACIFIC GROUP OF STATES (ACP) FRUIT AND VEGETABLE PRODUCERS AND EXPORTERS ("FIT FOR MARKET" - F4M)					
Facilitate exports of vegetable and fruit producers to international markets	Enable smallholders, producer groups, farmer organisations, and micro, small and medium enterprises, to access international and domestic fruit and vegetable markets by complying with SPS issues and market requirements	ECOWAS countries, Chad, Mauritania	Europe-Africa-Caribbean-Pacific Liaison Committee (COLECAP)	EU/ French Development Agency (AFD)	2017–22; Grant; US$25 million
MOBILIZING SAHELIAN ENTERPRISES FOR INNOVATIVE AND LARGE-SCALE RESPONSES AGAINST MALNUTRITION (MERIEM - NUTRITION SAHEL)					
Decrease prevalence of malnutrition in West Africa	Support to agrifood SMEs specialized in the production of nutritional products	Mali, Burkina Faso, Niger	GRET	AFD/B&MG Foundation	2018–21; Grant; US$11 million
COMPETITIVE AFRICAN RICE INITIATIVE PHASE 2 (CARI2)					
Increase the competitiveness of West African small-scale rice producers, millers and other actors in the value chain and achieve long-lasting reduction in poverty in Nigeria, Ghana, Burkina Faso, Tanzania	(1) Knowledge management and cooperation support (2) Inclusive business models and productivity development (3)Financial services (4) Policy advice	Burkina Faso, Ghana, Nigeria	GiZ, JAF-K, Kilimo Trust	BMZ; B&MG Foundation	US$11.25 million
PROGRAM TO BUILD RESILIENCE TO FOOD AND NUTRITION INSECURITY IN THE SAHEL (P2RS) - PHASE 1					
Build resilience to food and nutrition insecurity in the Sahel	(1) Rural infrastructure development (2) Value chains and regional markets development	Burkina Faso, Chad, The Gambia, Mali, Mauritania, Niger, and Senegal	CILSS	AfDB	Loan/Grant; 2015–19 US$191.7 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
SUPPORT PROJECT OF MEAT AND LIVESTOCK MARKETING IN WEST AFRICA					
Develop competitive, regional, and inclusive livestock-meat value chains	(1) Improve functioning of live cattle trade along transnational corridors, especially cross-border areas (2) Strengthen organization of private stakeholders for the livestock sector in West Africa (COFENABVI-AO) (3) Stimulate innovative investments by entrepreneurs or producer groups in the livestock-meat sector	ECOWAS Member States, Chad, Mauritania	n.a.	Swiss Agency for Development and Cooperation	Grant; 2017–21; US$8.3 million
AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (AVDP)					
To increase the income of smallholder farmers through the promotion of agriculture as a business	(1) Support for smallholder rice production and productivity (2) Support for tree crop production and productivity (3) Strengthening the business skills of agribusiness centers, farmers' organizations; farmer field schools; facilitating value chain organizations; and deal making through the establishment of provincial multistakeholder platforms (4) Strengthen climate-resilient rural infrastructure	Sierra Leone	IFAD	IFAD; OPEC Fund for International Development, National Government, Beneficiaries, private sector local	Grant (insert it above 2018-25); US$86.93 million
FARM-TRAC SAHEL PROJECT					
Enhance food security, economic growth, resilience, and poverty reduction in the Sahel and West Africa through an integrated common market	(1) Contribute to an improved knowledge of the functioning of trade in agricultural and food products in West Africa (2) Ensure progress on the free movement of agricultural products in West Africa (3) Contribute to the formulation and implementation of regional policies and strategies for promoting trade agricultural and food products	ECOWAS MS, G5 Sahel countries	CILSS, IFPRI, West African Association for Cross-border Trade in Agro-Pastoral and Fisheries Products WACTAF	IFAD	Grant; 2020–23; US$3.5 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
AFRICAN SUSTAINABLE LIVESTOCK 2050 (ASL 2050)					
Anticipate and predict opportunities and challenges for society that will emerge in the years ahead due to fast-changing African livestock systems; identify actions to be taken now for tapping into coming opportunities and dealing with the emerging challenges associated with growing and changing livestock systems	(1) Facilitate multistakeholder dialogue and partnering with ongoing livestock initiatives (2) Build upon available data, information, and tools to examine livestock systems and generate long-term projections (3) Build a series of livestock scenarios to identify alternative policy options and capacity requirements for a sustainable livestock sector	Burkina Faso, Nigeria	FAO	USAID	2017-2021; Implemented in the framework of the Emerging Pandemic Threats (EPT-2) program

ENTRY POINTS AND REFLECTIONS

RECOMMENDATIONS TO FACILITATE INTRAREGIONAL TRADE FLOWS

The degree of private sector dynamism can be considered a measure of regional integration. The flow of people is intricately linked to private sector commercial activities under the ETLS, allowing measures of the level of integration in West Africa. Strengthening professional associations, such as herder organizations or trading associations, could play an important part in facilitating commercial activities and thus supporting regional integration. At present, these are not yet well organized at the regional level. For example, most activities of such organizations in the rice and livestock sectors remain limited to the country level. Promoting both financial inclusion of farmer's organizations that work in cross-border trade and technical support and capacity-building measures that enable professional organizations to better organize should be priorities. Traders often move with large amounts of money and are often robbed. Therefore, they should be enabled to deposit

their money at the point of sale and recover it upon return to their country of origin.

At the regional level, harassment and other trade issues resolution systems should be strengthened, and an online complaint system should be put in place. ECOWAS staff and member state representatives meet regularly to discuss the status of implementation of regional regulation and challenges such as road harassment. These meetings, however, have thus far failed to lead to significant reduction in border harassment of traders. To improve their effectiveness, there is need for systematically involving famers' organizations in these exchanges to find solutions adapted to traders' circumstances. Furthermore, professional organizations should be given a more prominent role in facilitating trade flows by more closely collaborating with existing cross-border trade facilitation centers. When traders arrive at the border, these centers could then more effectively assist them to prevent agricultural products from being subjected to unlawful harassment. In the medium and long term, professional organizations should be assisted in creating remote support centers that collect complaints and can assist traders at border crossings without trade facilitation centers through mediation and advisory services.

A number of measures taken at both the national and the regional level could help to effectively address impediments complicating intraregional trade. There is widespread agreement that the main issues holding back intraregional trade consist in harassment and infrastructure deficiencies. Key actions with the potential to promote trade flows include the following:

- Setting up traceability systems at the regional level through certification, standardized border controls, and formalities; make investments in storage facilities and improvement of the warehouse management system for better aggregation around strategic value chains. These could also be a starting point for promoting contract farming and thus better traceability.
- Creating one-stop shops at national levels to conduct transactions and obtain export and import certificates that are not too expensive and would simplify border formalities and reduce opportunities for corruption
- Implementing a system where each country declares the origin of its products before reexporting them to neighbor countries. Such measures should be accompanied by building awareness on regional regulation of ground-level actors. For example, both customs staff and producers could be handed cards informing them of the commodities that are authorized for free movement.
- Implementing a regional mechanism allowing representatives from involved in transport and logistics to receive information on inspections and trade formalities in their respective trade corridor and to lodge complaints about cross-border harassment to the competent authorities (ECOWAS).

REDUCING THE IMPLEMENTATION GAP OF REGIONAL POLICY

Reducing the current gap between regional trade regulation and their implementation at national level, strengthening national-level policy incentives and increasing monitoring capacity of regional organizations. Increasing compliance and awareness of ground-level actors related regional policy requires both stronger accountability mechanisms relying on peer effects and improving monitoring capacity of ECOWAS to more precisely measure outcomes against policy ambition (e.g., agreed policy commitments). More specific suggestions include:

- A regionally owned accountability mechanism (such as a country scorecard) with strong country buy-in could reduce the widespread noncompliance with ECOWAS regulation within member states, e.g., through rewarding those that are working toward common objectives.
- Increase involvement of private sector organizations, civil society, professional, and farmer's organizations in policy formulation, implementation, and monitoring and evaluation of regional market policies at both regional and national level.
- Strengthen dialogue with trade and transport departments in ECOWAS. Monitoring and Evaluation (M&E) related to implementation of regional policy cannot be done by ECOWAS alone as its M&E department is presently overburdened. M&E should be done through a multi-actor mechanism (two-tiered mechanism with technical committee and broader evaluation board including state representatives, ECOWAS/CILSS/UEMOA/CORAF, interprofessional organizations, agricultural commerce chambers, and technical committee). Recommendations could be made by all to an evaluation board.
- Strengthen regional (ECOWAS commission) technical capacity for collecting and analyzing trade data related to agricultural products.
- Strengthen national (ministries of agriculture, port authorities) trade monitoring capacity through capacity building for border personnel and customs staff to internalize relevant regulation (e.g., CET (Common External Tariff) and ETLS).

MEASURES FOR INCREASING THE COMPETITIVENESS OF THE WEST AFRICAN AGRIFOOD SECTOR

Regional-scale coordination of agricultural value chains is necessary for a balanced development of the sector. Coordination at regional level is needed both for exchanging best practices and research results, and for each member country to focus on the products in which they have a comparative advantage, rather than watching each country try to produce all types of food commodities to ensure its self-sufficiency. Intra-regional trade based on comparative advantage could improve food system resilience in the

region through boosting food trade between countries with food surpluses and deficits. The promotion of intraregional agricultural value chains requires the support of regional institutions tasked with advancing regional integration, that is, ECOWAS and UEMOA. Specific ECOWAS/UEMOA-led measures could include the following points: (a) Adopt a resolution recommending that all member countries integrate the value chain approach in their agricultural sector development strategy with a special emphasis on food crops; (b) Ask community financing organs to integrate into their action programs a component for structuring and financing agricultural value chains; and (c) Recommend the ECOWAS and UEMOA Commissions to create an organ for the promotion of agricultural value chains and for facilitating the access of small producers to regional and international markets.

West African agriculture needs to achieve more economies of scale to become more competitive. This requires strengthening all segments of the food value chain:

- Increase production through a more efficient use of inputs and enable farmer groups to sell surpluses to markets. Where possible, contract farming should be promoted to increase farmers' production incentives.
- A regional agricultural-inputs market could be organized to avoid differentiation of input prices across countries, which is currently the case, and to cut down the price of most basic inputs for farmers.
- Encourage agribusiness to operate at each value-chain segment. Studying models of functioning value chains for key commodities such as sorghum, maize, millet, and livestock could help to promote value chains.
- Improve transport and communication infrastructures, both regional roads and links between the main production areas and main regional markets
- Improve access to international market information systems.
- Support the development of public-private partnership initiatives along the value chains for the improvement of production and services infrastructures including markets and phytosanitary and veterinary borders control points.

There are tools available to improve market access for producers and help stabilize agricultural prices. Problems in value chains functioning could be overcome by strengthening marketing channels and partnerships with the private sector to address problems of scale. There is also a need to strengthen financing mechanisms for agribusiness and incentives targeting both producers and consumers. More specifically, measures could include:

- Establishing mechanisms at the regional level to promote producers' access to technical and financial support.

- Foster regular consultations between the private and public sectors to put policies in place that support developing value chains, e.g., by following the examples of Côte d'Ivoire and Nigeria.

- Promote local consumption and the market prospects of regional products. Apart from making products more attractive through better packaging, it is important to promote local products through media campaigns that emphasize local products' superior quality compared with imported products.

Regional market information systems need to be upgraded and harmonized to reduce market price volatility and facilitate cross-border trade. Market information systems (MIS) provide publicly available data on prices and traded volumes to market actors to enhance decision-making. With EU support, AGRHYMET developed a market information system (West African Market Information System Network – WAMIS-NET, see also section 2.3) that is operational since 2000. Between 2000 and 2010, USAID supported CILSS in developing a market information monitoring program. Capacity (only two or three full-time staff in the market unit) and financial limitations affected the program's effectiveness. In the recent decade, in the ECOAGRIS project, led by ECOWAS and supported through EU-funding, aimed at strengthening WAMIS-NET. However, limited capacity to monitor market information and low uptake by users continue to hold back system effectiveness at the regional level. At the national level, certain countries including Mali, Burkina Faso, Niger, Mauritania, Chad, and Senegal have developed MIS that work very well. Going forward, the challenge is how to harmonize existing systems across countries (for example, information on stock levels) through an integrated market information system and beef up monitoring capacity at the regional level. One entry point for intervention could be dispatching innovators from the regional start-up landscape to regional bodies to make existing market information systems more attuned to user needs.

Advance harmonization of processed product standards and support SMEs that create high value addition in agricultural production to capture economies of scale. It is necessary to advance regional-level harmonization of standards related to processed product. At present each country has its own criteria and norms complicating the circulation of processed products. It is also important to support innovative start-ups specializing in local products distribution. For instance, technical support to SME could be add value to agricultural raw products, but also consist in support for producers' organizations by mobilizing and involving private sector players and creating supportive networks. Finally, improving domestic competitiveness of food production and food supply by improving transport links between inland and coastal cities is needed. Accompanying policy measures could include mandatory quotas for regional produce, e.g., by requiring grocery stores to include in its offer at least 30 percent of local products.

Future investments should address sanitary and phytosanitary (SPS) issues for maize and other important value chains. Recommendations include:

- Conducting national testing on biopesticides.
- Supporting the development of private commercial seed markets. This requires conditional licensing of multiplication and distribution rights of public domain seed to firms with the capacity to meet conditions.
- Further harmonizing national seed policies with the ECOWAS framework.
- Building processor awareness of mycotoxin hazards and facilitate commercial distribution of mycotoxin test kits.
- Training farmers and aggregators in the proper use and disposal of pesticides, aflatoxin controls, and grain-storage fumigants.
- Foster the extensive use of e-certification to facilitate agricultural product trade in the region.

COVID-19—AN OPPORTUNITY TO STRENGTHEN INTRAREGIONAL TRADE

COVID-19 aggravates food security challenges, but there may be ways to seize new opportunities from this crisis to foster intraregional trade. In a context characterized by high illiteracy, the negative influence of social media (fake news), and a lack of trust in relation to state authorities, countering COVID-19 impacts is challenging. However, COVID-19 may be ushering in a new era that may offer new opportunities for West Africa to decrease import dependence. Strategies to increase food security should focus on increasing local production since relying on imports poses considerable risks as international trade flows might continue to suffer disruptions in the near- and midterm. West Africa extends over two main geo-agricultural zones that both have added-value agricultural products to share and that are complementary. To counter COVID-19 impacts on food insecurity, future interventions contribute through

- Creating social conditions and political will that catalyze a new spirit of West Africa feeding West Africa.
- Facilitating and strengthening commercial exchanges within the region.
- Identifying the main products to be traded within the region (for example, meat, cowpeas, vegetable products, and oilseeds in the hinterland countries and rice, maize, tubers, and fish from the coastal countries). The closure of the borders due to COVID-19 has negatively affected the cross-border trade of some products that require physical border crossings of traders (for example, livestock and perishables). For traders circulating such goods, exemptions should be made, and additional sanitary measures introduced. To guarantee policy coherence across different countries, decision-makers should negotiate a regional consensus regarding when and how such exemptions apply.

POTENTIAL REGIONAL FLAGSHIP INITIATIVES TO PROMOTE INTRAREGIONAL VALUE CHAIN DEVELOPMENT AND TRADE FACILITATION

RFI #4 DEVELOP REGIONAL FOOD TRADE MONITORING SCORECARD FOR INCREASED TRANSPARENCY AND ACCOUNTABILITY

TABLE 2.10 Regional Flagship Initiative #4

Type	**Policy/analytics**
Objective	**To facilitate intraregional trade by promoting the implementation of regional policies**
Context and rationale	Despite ongoing efforts, the current levels of implementation of policies related to agricultural trade fall far short of the defined targets. Although the ETLS was adopted to promote free trade, its implementation by ECOWAS member states is lagging behind. This has resulted in various intraregional trade constraints including border and road harassments (often referred to as tracasseries). Moreover, border crossings are reported to be very time-consuming, leading to high trade costs. Border staff misconduct, including the collection of illegal fees and customs, results from the complexity of administrative rules and low levels of stakeholder awareness of regional trade regulations. New mechanisms are needed to improve implementation of existing policies such as ELTS and to increase compliance of border and customs staff with regional regulation. In addition, facilitating intraregional trade in agrifood commodities also requires strengthening both awareness and capacity of ground-level actors such as traders (for example, through supporting them to organize and coordinate under the umbrella of interprofessional organizations) and customs staff.
Activities	(1) Update and harmonize critical regional policies and regulations • Diagnose reasons for lack of implementation of regional regulation • Update regional regulation related to cross-border trade • Disseminate regulatory information through digital platforms and other ICT to increase information access (2) Foster implementation of regional policy • Establish and strengthen ECOWAS capacity to monitor and evaluate the implementation of regional policy • Strengthen awareness of farmers' organizations, interprofessional bodies, and private sector • Set up traceability systems and one-stop shops to fast-track completion of border formalities • Establish monitoring committees on issues related to cross-boundary agrifood trade led by civil societies and interprofessional bodies

Activities	(3) Establish scorecard monitoring mechanism and improve transparency at government level • Design, validate, and implement regional trade scorecard mechanism including improved trade data collection • Enhance regional conflict resolution system (including online or remote complaint system to facilitate border-crossing for trade purposes) • Support private sector and farmer's organizations through setting up cross-border trade facilitation centers • Promote high-level policy advocacy through mutual reviews and agreed-on reporting mechanisms
RFI coordination and potential partners	ECOWAS; UEMOA, CILSS, USAID, UNIDO, Federation of West African Chamber of Commerce and Industry (FEWACCI), Borderless Alliance, farmers' organizations, ROPPA, financial partners, AGRA, FAO, AfCFTA/AU
Past or existing initiatives with potential for collaboration	West Africa TFSP, WACTAF, Feed the Future West African Trade and Investment Hub, Regional Food Trade and Resilience, Regional Support Program for Professional and Farmers' Organizations within the Framework of the Implementation of the Regional Agricultural Policy (PRAOP/ECOWAP)
Knowledge gaps and areas for deep dives	• Bridging the gap of policy implementation • Design and data-gathering related to scorecard implementation • Cost-effective solutions to strengthening dialogue between stakeholders • Capitalize on past experiences of regional institutions

RFI #5 INVEST IN PRIVATE AND PUBLIC CAPACITY TO PERFORM KEY ENABLING FUNCTIONS SUCH AS TRACEABILITY SYSTEMS, FOOD SAFETY AND QUALITY CONTROL, AND STANDARDS

TABLE 2.11 Regional Flagship Initiative #5

Type	**Investment and policy**
Objective	**Identify and develop more efficient intraregional value chains and promote value chain innovations (quality control, contracting, standards, and traceability)**
Context and rationale	West African food value chains remain less developed than those in other parts of the developing world. Most of the agricultural products exported within and outside the region are raw materials. This is mainly due to the lack of processing and transport infrastructures as well as the lack of financial resources to support the private sector in their activities. In addition, there are weaknesses and disparities between ECOWAS member states relating to SPS regulations and state capacity to complete accredited and certifiable quality controls. Last, producers and other value chain actors, including producer organizations, frequently lack organizational capacity.

Activities	(1) Strengthen and harmonize SPS regulations, awareness, and capacity for testing and verification • Harmonize SPS within the region to build trust between countries; for example, through using blockchain technology for traceability of imported agricultural inputs and exported agricultural products • Support quality approach linked to the geographical origin of products through producer structuration, quality control committees • Establish and disseminate regional quality standards aligned with national quality standards • Support digitalization of certificate of origin and dissemination to countries through SIGMAT (Interconnected Transit Freight Management System) (2) Strengthen private sector organizations (farmers, traders, and processors) • Improve capacity of interprofessional bodies to offer logistical and organizational support to traders • Enhance farmers' organizations organizational capacity to manage logistic and transport needs in order to improve market linkages • Promote smallholders' inclusion in contract farming agreements • Improve the legal framework and access to finance (3) Support soft and hard infrastructure of regional key value chains • Promote certification of origin systems and their digitalization • Enhance regional commodity coordination covering aspects such as marketing, production, aggregation, quality, contracting, traceability • Identify the side streams of the value chain that could provide valuable inputs for other value chains and make them more circular • Consolidate and invest in critical infrastructure including markets, storage, and aggregation facilities
RFI coordination and potential partners	ECOWAS; UEMOA, AfDB, IFAD, IFPRI, WACTAF, CILSS, IFDC, FAO, European Center for Development Policy Management (ECDPM), SNV (Netherland Development Organization)
Past or existing initiatives with potential for collaboration	West African Quality system, F4M SPS, PRAPS II-livestock value chain improvement and inclusion of women and youth, AVDP, FARM-TRAC Sahel Project, CARI2, Regional youth employment program in the agriculture, agroforestry, livestock, and aquaculture value chains
Knowledge gaps and areas for deep dive	• Learnings from farmers' organizations involvement in value chain development across Africa • Sustainable financial value chain best practices across Africa • Value chain specific constraints for private sector investments

RFI #6 SET UP INTEGRATED MARKET INFORMATION SYSTEMS ACROSS NATIONAL AND REGIONAL LEVELS

TABLE 2.12 Regional Flagship Initiative #6

Type	**Investment**
Objective	**To improve and promote access to market information**
Context and rationale	The performance of markets critically depends on the quality of and access to information of the various actors involved in the agricultural value chains. Limited usage of information and communication technologies in West Africa complicate fast and convenient access to market information. Farmers frequently have incomplete and faulty information on input, output, and other agricultural products prices. Apart from access to information, weak data collection systems and low collection frequency result in generally low availability of reliable market information, which acts as another constraint to the intraregional trade.
Activities	(1) Strengthen and consolidate existing information systems (for example, ECO-AGRIS) along the value chain • Improve data collection mechanisms and systems • Capitalize data and information and build capacity of actors • Support digital regional agriculture market information systems • Support platforms that connect buyers and sellers for strategic agricultural commodities (regional seed market, commodity exchange) • Promote public-private partnerships around cross-border market information platforms and systems • Enhance integrated market monitoring systems at the regional level • Support the process of choice and decision-making for producers by providing elements to decide on the dates, market outlets, and the places for the sales of agricultural products (2) Enhance market access • Support regional market to expand national production for priority products • Strengthen farmer and processor organizations and cooperatives to favor market access
RFI coordination and potential partners	ECOWAS, UEMOA, FAO, USAID, CILSS, UNCTAD, WTO, WFP VAM (World Food Programme (WFP) Vulnerability Analysis and Mapping (VAM), private sector
Past or existing initiatives with potential for collaboration	Market Access Support Project for ACP Fruit and Vegetable Producers and Exporters ("Fit for Market" or F4M), WAMIS-NET, CommodAfrica, AfDB market information project, SONAGESS MIS in Burkina Faso
Knowledge gaps and areas for deep dive	Potential of differing data sources to ensure a better transparency on the market of agricultural products and improve negotiation capacity of producers

RFI #7 HARMONIZE AGRICULTURAL SUPPORT POLICIES

TABLE 2.13 Regional Flagship Initiative #7

Type	**Integrated analytics and policy**
Objective	**Promote more effective, ECOWAP-based public agricultural support policies across the region through (a) facilitating farmers' access to credit, (b) harmonization of producer support regimes, and (c) realigning public spending toward incentivizing the adoption of sustainable, climate-smart practices**
Context and rationale	Over the past decades, ECOWAS member states have increased levels of public agricultural expenditure. Most of this rise in agriculture-related public spending can be attributed to input subsidies, especially for fertilizers. Nigeria, Senegal, Ghana, Burkina Faso, and Mali alone spend US$425 million on input subsidies, excluding Nigerian state-level expenditures that have been estimated as high as US$800 million. In addition to high opportunity costs caused by underspending on higher-return public goods, frequently mentioned limitations of existing input subsidy regimes include a mismatch between targeted groups and programs' main beneficiaries, crowding out commercial market purchases, and low yield responses to single-fix solutions such as synthetic fertilizer application in the absence of other inputs as well as in carbon-depleted soils. Promoting more effective support policies through further developing ECOWAP could strengthen food system resilience via two pathways. In the past, inconsistent input subsidy regimes across ECOWAS countries have encouraged rent seeking by entrepreneurial traders engaging in cross-border arbitrage at a net cost to taxpayers. Considering the unsatisfactory performance of fertilizer subsidy programs in the region and the lack of cross-country coordination, harmonizing public support regimes across member states and replacing ineffective subsidies with measures to enhance producers' credit access would contribute to (a) functioning regional input markets and (b) diffusing best practices on the retargeting of public support (increasing producers' credit access, smart subsidies). Second, ECOWAP could also explore promoting the replacement of input subsidy schemes through other less distortionary forms of producer support in targeted areas. For example, by tying income support to the fulfillment of a set of environmental criteria, pillar one of the European Common Agricultural Policy aims to enhance the provision of public environmental goods while reducing market distortions. Applied to the context of West Africa, targeted support to producers' incomes in conflict-prone and environmentally degraded hotspot areas conditional on landscape restoration measures with long-term benefits both in terms of agricultural productivity and the sustainability of the productive base (for example, reforesting slopes and increasing soil carbon and the soils' water retention capacity). The necessary means for such highly targeted income support measures with regional benefits could stem from repurposing existing, nationally funded input subsidies that could be potentially supplemented by regional funds raised through a more stringent application of the ECOWAS CET (Common External Tariff).
Activities	(1) Establishing ECOWAP-based regional framework for harmonized and more effective public support regimes • Establish regional public support monitoring and accountability mechanism • Encourage countries' implementation of harmonized support regimes (for example, by relying on a stick-and-carrot approach) (2) Promote implementation of credit schemes and smart subsidies that allow producers to access inputs adapted to their conditions • Increase producers' access to loans (for example, through loan guarantees or matching grants)

Activities	• Map regional soils in terms of organic matter content to better target fertilizer subsidies (and to identify areas where producer support for increasing soil organic matter is more useful) • Develop guidelines for targeted smart input subsidies drawing on international best practice (3) Support income of producers (both sedentary farmers and agropastoralists) in hotspot areas conditional on landscape restoration and soil rehabilitation measures that safeguard agriculture's productive base • Identify hotspot areas with high levels of conflict and fragility risk and natural resource degradation with regional relevance • Explore technological possibilities (for example, remote sensing) of verifying site-specific landscape restoration measures with minimal ground-truthing requirements • Support income of farmers in return for landscape restoration measures (4) Strengthen ECOWAP/RAIP through establishing viable fundraising mechanisms for example, through application of CET
RFI coordination and potential partners	ECOWAS, CORAF, CILSS, IFRPI (for M&E); FAO; EU; USAID-Servir, USAID-EnGRAIS, UN organizations, OECD CSAO
Past or existing initiatives with potential for collaboration	IFRPI RESAKKS, AKADEMIYA 2063, USAID-EnGRAIS and precursors
Knowledge gaps and areas for deep dives	• Review of current input subsidy regime and cross-country comparison • Pathways to implementing CET and political economy of subsidy harmonization

PROPOSED TECHNICAL WORK TO CLOSE KNOWLEDGE GAPS OF THE IDENTIFIED RFIS

The West Africa Food System Resilience Facility (FSRF)[32] will support ECOWAS, CILSS, and CORAF in the development and operationalization of regional flagship initiatives in the context of regional programs that are currently under preparation. At the time of writing, selected RFIs are earmarked for implementation through regional bodies in the context of regional programs under preparation. For example, both RFI #4 and #5 will likely be pursued under Food System Resilience Program (FSRP). Going forward, FSRF will support regional organizations by developing deep dive technical studies to close knowledge gaps preventing the implementation of RFIs.

Table 2.14 (below) provides an overview of the RFIs related to the priority intervention

[32] Please see executive summary for more information on FSRF.

area of regional integration and value chain development as well as the corresponding analytical work proposed to further develop them. RFI #4 will be refined through analytical work with the objective of establishing a robust and broadly owned methodology to benchmark countries' implementation performance of regional trade regulations to facilitate intraregional trade flows. At the time of writing, regional organizations are currently deliberating how RFI #5 could contribute to the regional food system resilience agenda when pursued under FSRP. To fill related knowledge gaps, a deep dive on regional food safety priority issues will determine food security capacity building needs within selected West African countries and assess regulatory needs to harmonize food security standards on both national and regional levels. An ongoing technical study on regional risk management architecture will contribute knowledge to RFI #6, which is considered for implementation under several regional programs, including FSRP. Last, selected aspects of RFI #7, especially those related to the implementation of regional regulation aimed at facilitating commercial exchanges of food products between ECOWAS/CILSS member states, are elaborated on under the proposed deep dive on developing a broadly owned scorecard methodology. In addition, aspects related to policy harmonization across member states will be mainstreamed across the entirety of technical pieces that are proposed to inform RFIs.

TABLE 2.14 RFIs relating to Priority Intervention Area II and Proposed Technical Work

RFI #	RELEVANCE AT REGIONAL LEVEL	POTENTIAL PROGRAMS FOR IMPLEMENTATION	PROPOSED TECHNICAL DEEP DIVES TO ADDRESS KNOWLEDGE GAPS
#4 Develop regional food trade monitoring scorecard for increased transparency and accountability	Increased accountability and transparency related to the implementation of regional regulations may reduce barriers to intraregional trade	FSRP	Trade: toward more data and a scorecard methodology
#5 Invest in private and public capacity to perform key enabling functions such as traceability systems, food safety and quality control, and standards	Harmonized food safety standards and improved capacity to implement quality control protocols may facilitate intraregional trade flows	FSRP, PRAPS II	Food Safety: priority issues, investments and other interventions
#6 Set up integrated market information system across national and regional levels	Strengthening integrated market integration systems may encourage cross-border trade through enhanced market access	FSRP, PRAPS II	Regional Risk Architecture and Financing Mechanisms: market information systems are explored in the context of risk mitigation; RFI also being developed as part of preparatory work for FSRP
#7 Harmonize agricultural support policies	Harmonized agricultural support policies may increase opportunities for intraregional trade and improve regional input markets	ECOWAP, WAICSA, FSRP	Trade: toward more data and a scorecard methodology; to be mainstreamed across other deliverables, governance, and coordination mechanisms

2.3 REGIONAL RISK MANAGEMENT ARCHITECTURE AND FARMER DECISION SUPPORT TOOLS

The West Africa region is vulnerable to episodic weather-related shocks, security risks, pests and diseases, and volatile markets affecting productivity, food security, and the agriculture sector. Especially in the dry regions, recurring weather-related risks cause food crises resulting in loss of lives and livelihoods. As of October 2020, 16.7 million people in West Africa are severely food insecure, a number which may further rise to 23.6 million by August 2021 (see also box 2.5). The impact of COVID-19 pandemic and related restrictions to control its spread have further compounded the food security situation. The World Meteorological Organization (WMO)'s latest Global Annual to Decadal Climate Update indicated that from 2020–24, the Sahel region is likely to be wetter than the recent past (WMO July 2020) and is expected to worsen displacement of vulnerable populations due to floods. A sharp uptake in violence starting in 2012 has metastasized and localized into diverse forms of conflict across the subregion, encompassing violent extremism, armed rebellion, and banditry, among other things. As a region that produces at least 30 percent of the African continent's food requirements, increasing the resilience of West Africa's food system is critical to achieving food security and building a strong food system (Zougmoré et al. 2016).

BOX 2.5 FOOD AND NUTRITION SECURITY SITUATION IN WEST AFRICA, MARCH - MAY 2021

Some 19.6 million people (9.1 percent of the population) in 17 countries across West Africa and the Sahel were severely food insecure (CH Phase 3 or worse), requiring immediate food assistance in the Sahel and West Africa between May 2021. Despite the humanitarian and food assistance provided to vulnerable populations, some 1.1 million people were estimated to be in an emergency situation (CH phase 4) with significant numbers in Nigeria (493,345), Burkina Faso (177,364), Niger (101,871), Liberia (100,272), Mali (29,847), and Senegal (3,797). In five countries, the number of people in crisis or worse exceeds one million (CH phase 3): 8.7 million in Nigeria, 1.9 million in Burkina Faso (corresponding to approx. 1 in 10 people), 1.5 million in Sierra Leone, 1.5 million in Niger, and 1.2 million in Chad. In addition, at least 51 million people were deemed at risk of falling into a crisis situation (CH Phase 2).

In the absence of adequate countermeasures, the number of severely food-insecure people could reach 27 million, or 9.1 percent of the total population in the June to August 2021 lean season in the 17 Sahelian and West African countries. In northern Burkina Faso, eastern and western Chad, most regions of Niger, and central and northern Mali, acute malnutrition touches 10 percent of the population, which the World Health Organization (WHO) considers to be "high." The combined impact of simultaneously occurring health, economic, and security shocks is driving this unprecedented food and nutrition crisis.

Source: RPCA 2021, based on CH Analysis (February-March 2021 assessment period) and OECD SWAC 2020

This section discusses how West Africa and the Sahel region might improve its regional- and national-level risk management and farmer decision support systems to build resilience against food and agriculture-related risks. First, this section will discuss prevalent agriculture-related risks before reviewing region's existing risk management systems and mechanisms. As section 2.1 and 2.2, 2.3 closes with a discussion of possible entry points for future interventions and identifies a set of RFIs that can be taken up by future regional programs.

The growing multitude of food and agriculture-related threats is a significant challenge for the region. While short-term measures are needed to address immediate needs, the recurring nature and severity of these risks require a more structural response in the medium term. Much has happened in the region, from developing regional food security-related policy frameworks to establishing both national and regional institutional mechanisms and initiatives to support food and agriculture risk management. Yet, challenges remain and more needs to be done to strengthen the resilience of the region's producers. Producers will need regular access and use of high-quality weather and climate information as well as early warning, market, and other relevant information to make informed decisions, along with the ability to understand the information. This requires the existence of well-functioning farmer decision support systems that work in tandem with national and regional food and agriculture risk management institutions. This calls for addressing the capacity, institutional, and technical constraints hindering these agrifood risk management systems.

STOCKTAKE AND OVERVIEW

PREVALENT RISKS IN THE WEST AFRICA AND SAHEL REGION

Agrifood sector risks are uncertain events that negatively impact agricultural production, trade, markets, and consumption. For agriculture-based countries, or in countries where a large share of the population still depends on agriculture, risks impacting the agriculture sector adversely affect sector growth, poverty reduction, and national gross domestic product (GDP). Agrifood sector risks also can compromise food and nutrition security among poor producers and consumers in both urban and rural areas.

The World Bank's Agriculture Risk Management framework distinguishes three types of risks: (a) production risks, (b) market risks, and (c) enabling environment risks (figure 2.10). These risks can be either manmade or natural, and exogenous (caused by external factors) or endogenous (caused by domestic factors) (WB 2016). Risks often are interlinked; for example, production risks often cause price fluctuations due to production volatility, or erratic policy changes may cause the exchange rate to fluctuate. To effectively manage a risk, it is thus important to identify its root cause.

BOX 2.6 OVERVIEW OF FOOD SECURITY-RELATED REGIONAL POLICY FRAMEWORKS

- The "Strategic Framework for Sustainable Food Security in the Fight Against the Poverty" (CSSA) of CILSS. CSSA helped develop the national food security strategies and agricultural information and early warning systems. The Regional Food Crisis Prevention Network (RPCA) was created in 1984, the PREGEC Charter adopted in 2011, and the Harmonized Framework, which are relevant tools of this framework that needs to be strengthened and improved. Additional details on these tools are found in later sections (European Development Fund 2017).
- The "Agricultural Policy of the Union" (PAU) of WAEMU, adopted by additional act in 2001 (with eight countries) is considered the first agricultural policy for the whole region. The PAU has concrete actions within the framework of a 10-year Community Program of Agricultural Transformation for Food and Nutritional Security (PCD-TASAN) 2016–25.
- The ECOWAS "West African Regional Agricultural Policy" (ECOWAP) adopted in 2005 by the ECOWAS Heads of State (with 15 countries). ECOWAP is implemented through National and Regional Agricultural Investment Plans (NAIPs and RAIPs). The PRAISAN 2025 (second generation of the RAIP), validated in December 2016, refines the 2025 vision of the ECOWAS/ECOWAP and integrates food security, nutrition, and resilience dimensions. (ECOWAP/CAADP Process 2025).

FIGURE 2.10 Three Types of Risk

Source: World Bank

Production risks are often the most visible risks in the agriculture sector. They include weather-related events (such as droughts, floods, and cyclones), outbreaks of agricultural pests and diseases, and damage caused by animals, windstorms, or fire (WB 2016c). Production risks are mostly associated with yield reductions but can also affect product quality.

Market risks affect the price and availability of outputs and inputs. Commodity markets can have a high degree of volatility caused by changing local and global supply and demand. Producers worry about low prices (reducing their income); consumers are worried by high prices (raising their expenditure). Another market risk is exchange rate volatility, which can affect the price of outputs and inputs (WB 2016c).

Enabling environment risks also affect the agriculture sector. Enabling environment risks cover unexpected changes in the broad economic environment affecting agriculture. They can include changes in government or business regulations, fiscal and monetary policy settings, agricultural or tenure polices, external trade restrictions, political instability, corruption, regional conflict, and domestic unrest (WB 2016c).

The food security and agriculture sector in West Africa and the Sahel are mainly exposed to production, market, and macrolevel risks. A recent agriculture sector risk assessment in the region found that the agriculture shocks that most affect food security are production risks arising from erratic rainfall, dryness (droughts, floods), pests and diseases, and market shocks mainly from unexpected changes in input and output prices and food price volatility (Mbaye, Atta, and Tedesco 2019). Other enabling environment shocks related to political instability and conflict have also affected the sector, including high-intensity violence, that have reduced farmers' access to fertile farming areas. Climate change will likely worsen many of these risks, especially production risks, leading to food supply instabilities.

PRODUCTION RISKS

Production risks pose a serious threat to agricultural productivity and food availability in Sub-Saharan Africa, where several regions are already food and nutrition insecure. In the Sahel, weather-related events have been characterized by significant variations in temperature and rainfall, with an increasing trend in temperature levels. The rise in temperature contributes to more extreme weather events (such as extreme temperature, higher intensity of rainfall leading to flooding, and unevenly spaced rainfall patterns leading to longer dry spells) and also increases the risk of water stress for agriculture (Mbaye, Atta, and Tedesco 2019).

One of the most significant risks in West Africa and the Sahel region are related to extreme weather events (see table 2.15 and figure 2.11 below). Between 1950 and 2019, all West African and Sahelian countries recorded 803 natural disasters, with 52 percent related to extreme weather and hydrometeorological events, accounting for 98 percent of affected populations (or 126.5 million people) and 99 percent of damages (US$2.21 billion). The

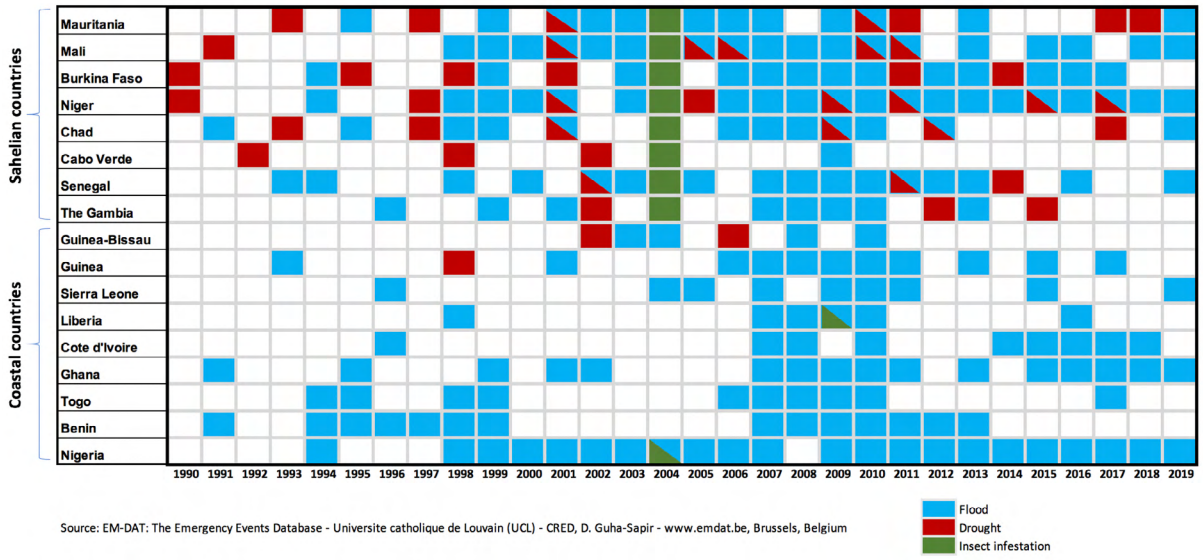
high variability and unpredictable duration of rainfall disrupts the crop calendar and reduces crop yields. Erratic rainfalls also result in high incidence of flooding (292 events in the last 70 years affecting 28.4 million people) that is widespread across the region, highlighting the transboundary nature of these risks (Mbaye, Atta, and Tedesco 2019).

TABLE 2.15 Natural Disasters Reported in 17 West African and Sahelian countries, 1950–2019

Disaster Type	Count of Event	Total Damages ('000 US$)	Total Affected Populations
Drought	89	590,354	96,900,659
Earthquake	1	-	21,436
Epidemic	325	-	1,389,580
Extreme temperature	3	47,000	1,000,000
Flood	292	1,570,587	28,431,692
Insect infestation	38	-	500,000
Landslide	8	30,000	24,256
Storm	37	9,057	192,305
Volcanic activity	2	-	8,806
Wildfire	8	-	20,993
Total	803	2,246,998	128,489,727
Hydrometeorological disasters	421	2,216,998	126,524,656
Hydrometeorological (% of total)	52%	99%	98%
Insect infestations (% of total)	5%	-	0.4%

Source: based on EM-DAT 2020

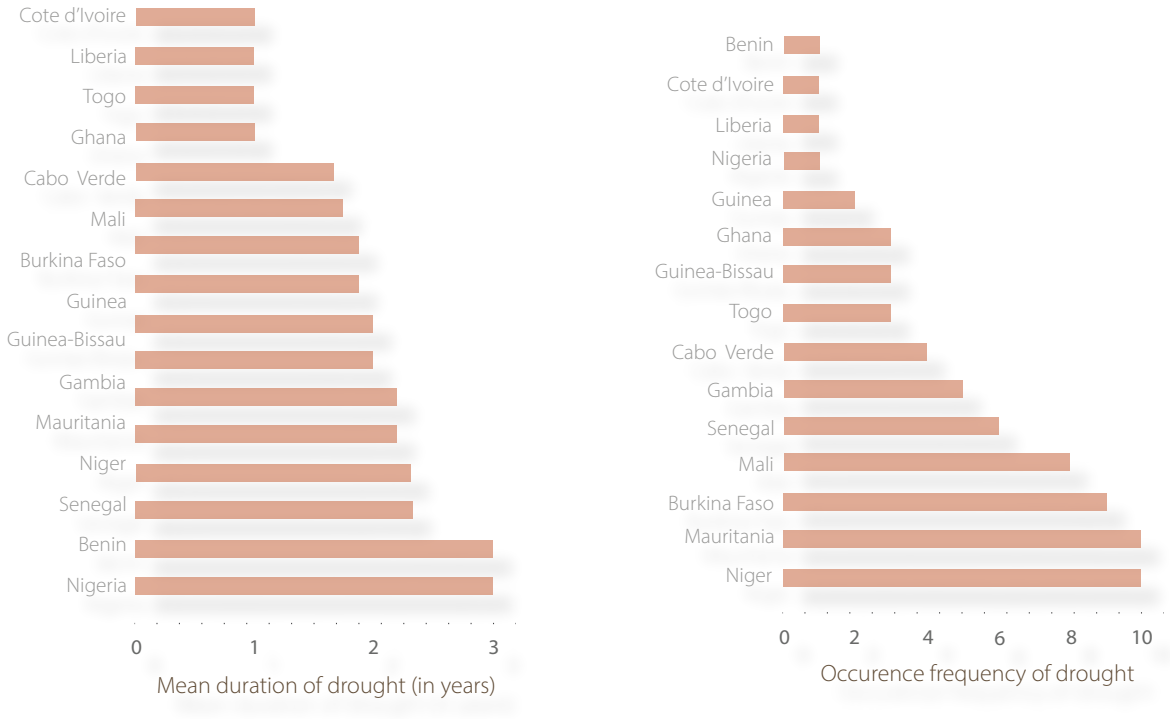
FIGURE 2.11 Natural Disaster Occurrence Trends in West Africa and the Sahel, 1990–2019



Source: based on EM-DAT 2020

Droughts are a common phenomenon in West Africa and the Sahel region. According to EM-DAT data (see figure 2.13), the region's countries experienced drought one-third of the time over the last 50 years. Each country encounters seven droughts on average and each drought lasted for over two years. Niger and Mauritania face ten droughts each, followed by Burkina Faso with nine droughts and Mali with eight droughts over the same period of time. Durations of drought range from one to three years. Considering both occurrence frequency and mean duration of drought across West African countries, it is found that over the last 50 years, drought occurred in Niger for 23 years, Mauritania for 22 years, and Mali for around 19 years.

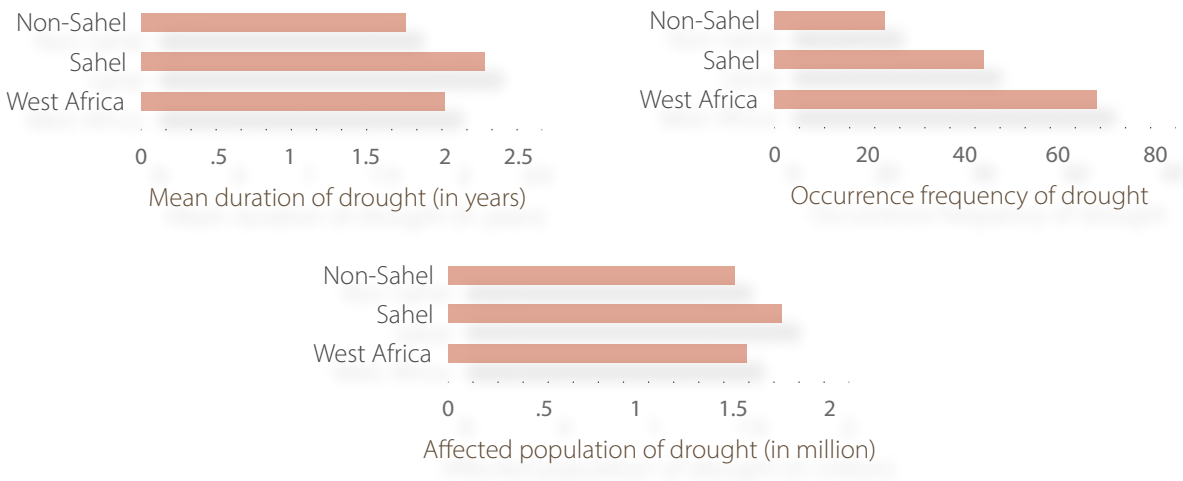
FIGURE 2.12 Occurrence Frequency and Mean Duration of Drought Across West African Countries, 1970–2018



Source: based on EM-DAT 2020

Sahelian countries experienced a higher number of droughts compared with non-Sahel countries over the last 50 years. Each drought in West African countries lasted around two years on average, and the average drought length is longer for Sahel countries (2.27 years) than the non-Sahel countries (1.74 years). Each drought affected 1.57 million people on average in the region. Droughts of Sahel countries are more pervasive compared with the non-Sahel countries in terms of the number of affected people. Figure 2.13 shows that one drought impacted 1.77 million people on average in the countries located in the Sahel areas, while for non-Sahel countries this number goes down to 1.51 million.

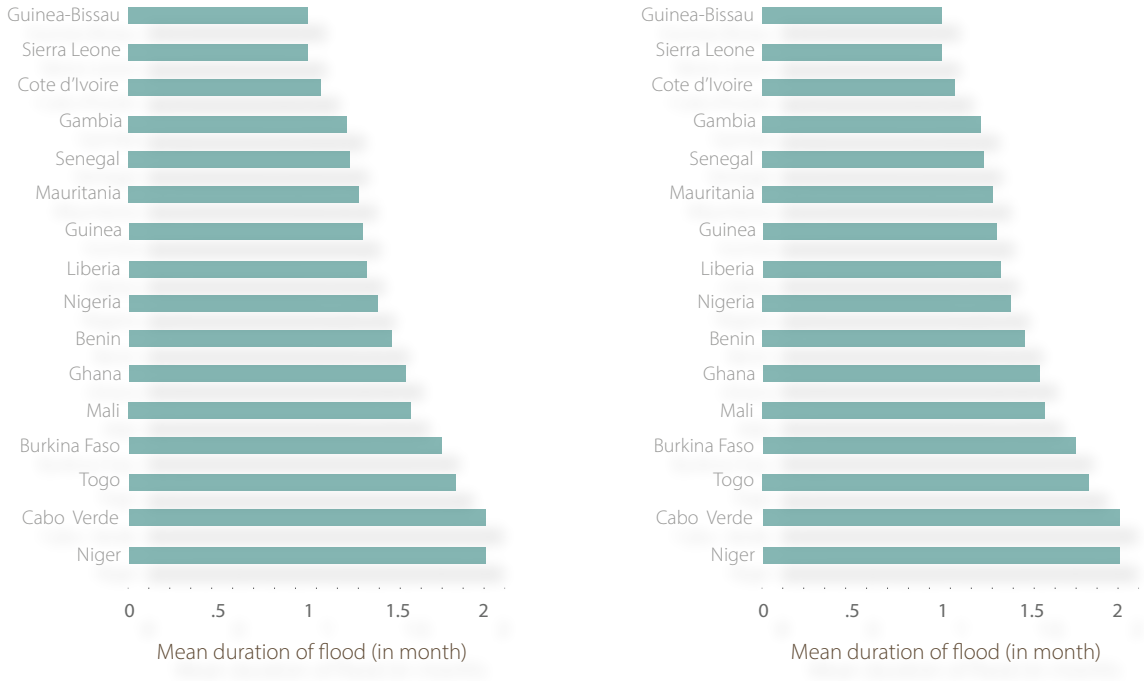
FIGURE 2.13 Occurrence Frequency, Duration of Drought and Average Affected Population in Sahel vs. Non-Sahel Countries of West Africa, 1970–2018



Source: based on EM-DAT 2020

Floods are another major shock that endangers food security in West Africa (see figure 2.14). Over the last 50 years, an average of 25 floods affected each West African country. Nigeria ranks first with 51 floods, followed by Niger with 29 floods and Mali with 26 floods. Floods lasted for a shorter period of time compared with the length of droughts. The average duration of floods in the West African countries is one and a half months while the average duration among the countries ranges between one and two months.

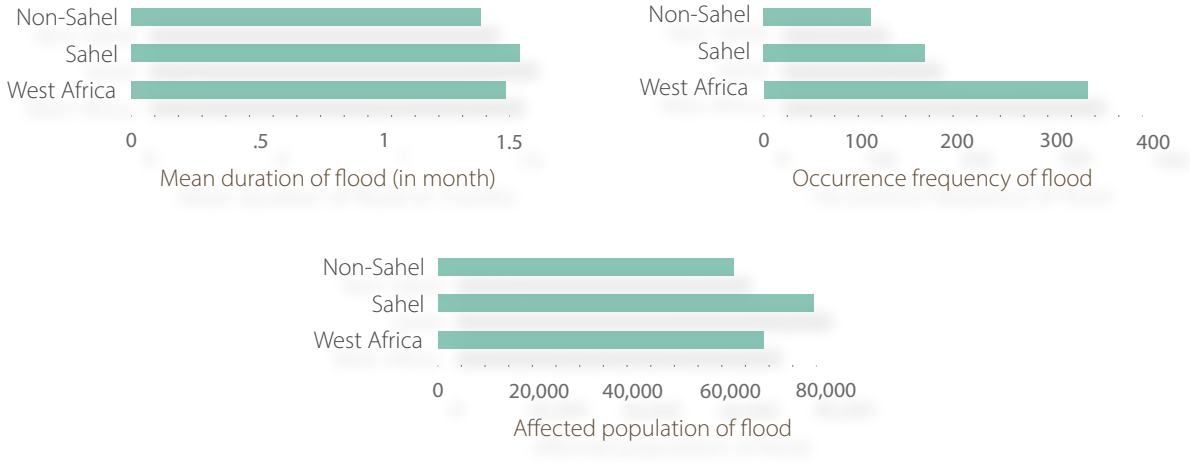
FIGURE 2.14 Occurrence Frequency and Mean Duration of Flood (Months) Across West African Countries, 1970–2018



Source: based on EM-DAT 2020

Over the last 50 years, a total of 330 floods occurred in West African countries. As with drought, Sahelian countries experienced a higher number of floods compared with the non-Sahel countries over the same period. Each flood lasted around one and half months on average in the countries of West Africa, while lasting longer for Sahel countries (1.54 months) compared with the non-Sahel countries (1.38 months). But the floods of Sahel countries are more destructive than the non-Sahel countries in terms of the number of affected people. Figure 2.15 below shows that one flood impacted around 77,000 people on average in the Sahel countries while for non-Sahel countries, this number came down to 60,000.

FIGURE 2.15 Occurrence Frequency, Duration of Flood and Average Affected Population in Sahel vs. Non-Sahel Countries of West Africa, 1970–2018



Source: based on EM-DAT 2020

Source: Emergency Database (EM-DAT) - Université Catholique de Louvain (UCL)

Increasing frequency of extreme weather and hydrometeorological events leads to the pest and disease outbreaks that negatively affect yields and can also affect product quality. Desert locust invasions severely affect producers' livelihoods, including their livestock, if nothing is done upstream to stop or limit the locusts' spread and to strengthen household resilience. In the last 70 years, the West Africa and Sahel region has experienced insect infestations that accounted for 5 percent of total natural disasters in 1978, 1985–88, 2004, and 2009. In 2003–05, West Africa and Sahel already faced a major desert locust invasion. More than 12 million hectares have been destroyed and more than 8 million people have been affected, leading to higher food insecurity across the region (Chad, Niger, Mali, Mauritania, Burkina Faso, and Senegal). Vulnerable communities took years to recover from the impact of the 2003–05 locust crisis, which cost an estimated US$2.5 billion in harvest losses. In March 2020, the FAO Desert Locust Information Service (DLIS) forecast a risk of a desert locust invasion of the western region of the Horn of Africa, starting in July and August 2020 during the summer breeding period and/or from October 2020 during the autumn period. Yet contrary to these projections, West Africa has fortunately not been significantly affected by the infestation seen in Eastern Africa and the situation is expected to remain calm through early 2021 (FAO 2021).

Regional efforts are underway to promote the use of innovative digital tools and approaches to strengthen national capacity to respond to locusts. FAO works with the technical expertise of the Commission for Controlling the Desert Locust in the Western Region (Commission de lutte contre le Criquet pèlerin, CLCPRO) to promote tools such the (a) mobile application 'eLocust3g' using GPS, mobile application 'eLocust3m' using smartphones, and the web version 'eLocust3w' using the smartphone web browser to increase surveillance capacities and collect field information about the locust populations, location, and movement; (b) the use of drones for desert locust surveillance; (c) the promotion of biopesticide and insect growth regulators; and (d) the import of pesticides from existing stocks in Morocco and Algeria to Chad, Niger, Mauritania, and Mali. This South-South cooperation will allow the recycling of old but still functional pesticide stocks before their expiration date, moving them from countries where they are not needed to countries that lack such products. Before use, the pesticides are analyzed by an international laboratory to confirm that they are still usable. Environmental and health assessments are also foreseen to ensure the strict respect of international standards.

A concerning development is the emergence of other pests as the fall armyworm (FAW), which was detected for the first time in West Africa at the beginning of 2016. In the Sahel, FAW mainly attacks maize, but it can also attack rice, sorghum, cotton, and some market vegetables. In a 2018 Nigerian survey, fall armyworm was present in all 12 surveyed states such as Abuja (87.1 percent), Jigawa (57.8 percent), Kano (59.3 percent), and Kastina (56.3 percent). Over half of cultivated land area in Ondo (70.1 percent) was infested by the crop pest (FAO 2018a). While the FAW severity level was observed to be low under steady rainfall, significant yield loss of more than 50–70 percent was reported in the 2018 cropping season across surveyed locations (FAO 2018a). In Cameroon, FAW resulted in yield losses ranging from 25–75 percent (Ndzana Abanda 2019).

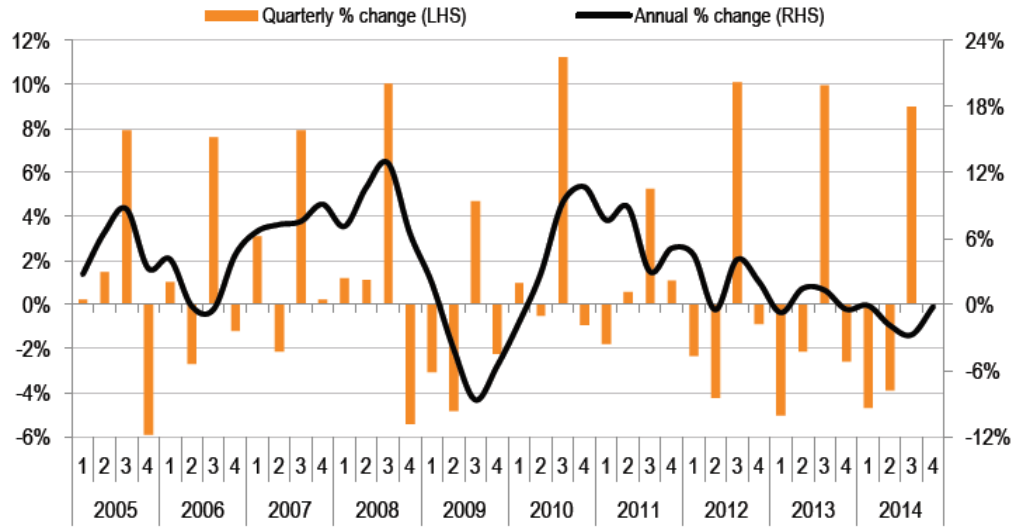
In addition to desert locusts and the fall armyworm, other pests such as fruit flies also threaten agricultural production, product quality and livelihoods. Fruit flies negatively impact 50–80 percent of the horticultural sector (that is, fruit production) in the region, particularly targeting mangoes (AFD 2019). According to ECOWAS, in 2006, fruit flies caused the interception of shipments at EU borders worth 9 million euros of mango exports, representing more than one-third of the total value of that year's shipments (ECOWAS 2019). Therefore, preparedness and anticipatory action are key to safeguard and diversify producers' livelihoods for their early recovery.

MARKET RISKS

The sharp increase in international food prices from late 2006 to late 2008 raised major concerns within West Africa. The consequences of this international price spike for West African food security were a function of the region's high dependence on imports from the international market and the extent that this rise was passed on to domestic consumer and producer prices. In 2008, maize and rice prices in Côte d'Ivoire, Guinea, Mali, and Niger reached their highest levels in the previous 10 years. West African urban

consumers and net cereal buyers in rural areas were the hardest hit by the food crisis. Many city dwellers and the poorest farming families end up consuming cheaper foods or even skipping meals because the cost of food usually takes up half or more of their income. In some countries, consumers turned to locally grown foods such as cassava. Even these, however, end up being more expensive, in part because of increased fuel prices needed to transport and process local foods (Staatz, Diallo, and Me-Nsope 2017).

FIGURE 2.16 Food Price Volatility in Senegal, 2005–14



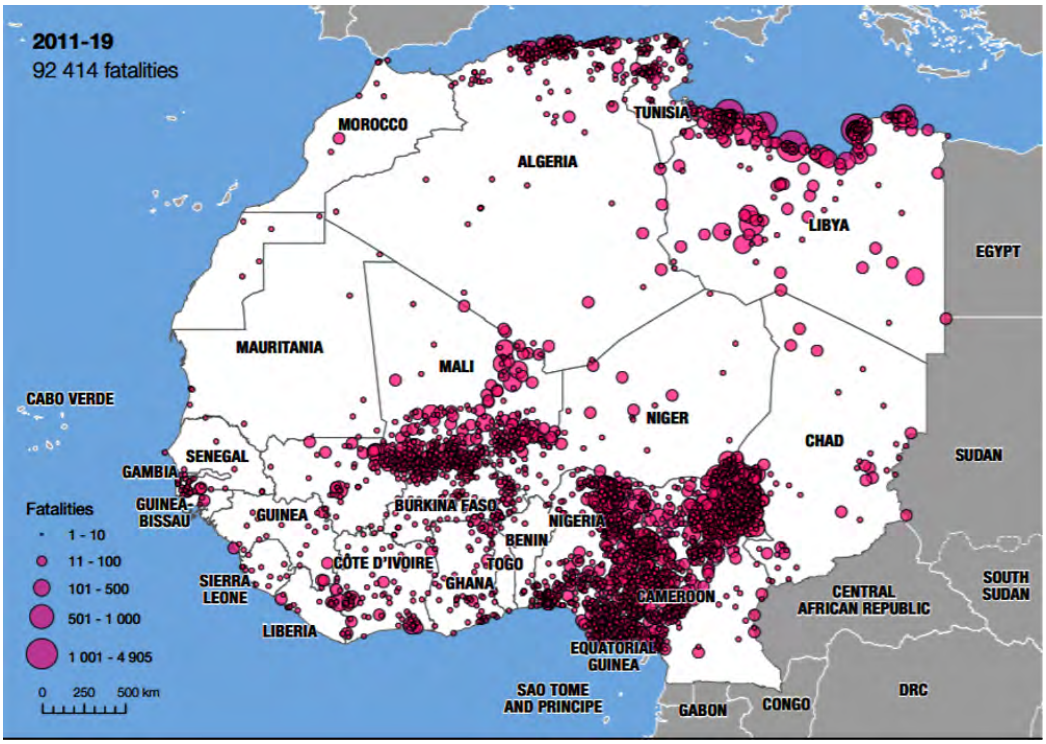
Source: © PARM and IFAD 2016b

For example, food prices in Senegal increased by 3 percent on average annually between 2005–14 (as observed from the food component of the consumer price index; see figure 2.16 above). The highest annual rate of 13 percent was recorded in September 2008 (PARM and IFAD 2016b). According to the Cadre Harmonisé (CH) results for the March–May 2020 assessment period, prices of food products in Senegal are rising compared with other Sahelian countries. Senegalese farmers also face some input price risks as seen by the variation in annual average import prices for fertilizers and pesticides. The import price for fertilizer increased by 300 percent between 2003 and 2008 and, in contrast, average pesticide prices halved between 1999 and 2010 (PARM and IFAD 2016b). In Niger, certain vegetable crops, sesame seed, and rice were most affected by output price risks over the period 1993–2012, with an average annual price loss due to price volatility of greater than 5 percent and an average loss of 40 percent once every four years for cabbages. Input import prices have risen by 15 percent or more at least once every three years for farmers in Niger since 1995 (PARM and IFAD 2016a). In addition, market risks can be induced by variable trade policies related to border closures. (The impact of trade restrictions due to border closures and the presence of ICBT has been addressed in section 1.4 Food System Drivers and Shocks and section 2.2 Enabling Environment for Intraregional Value Chain Development and Trade Facilitation, respectively).

CONFLICT AND SECURITY RISKS

In West Africa and the Sahel region, conflict and security risks are among the leading drivers of challenges affecting the enabling environment at the macro level. The Sahel region continues to be destabilized by terrorist groups and intercommunal violence often exacerbated by these groups. The last five years have been the most violent recorded in the region, with more than 12,000 events and 50,000 fatalities through June 2019 (Trémolières, Walther, and Radil 2020; map 2.4). Conflicts tend to involve numerous nonstate actors with diverging agendas, and they target civilians more systematically than before. Border regions attract a disproportionate and concentrated number of violent events and casualties—more than 40 percent of violent events and fatalities occur within 100 kilometers of a land border. Moreover, the number of regions experiencing local intensification of political violence are higher than 20 years ago and violent events are more likely to occur near one another. Multiple clusters of high-intensity violence have formed in the Sahel, where they are spilling over into neighboring regions and countries. High intensity violence reduces access to fertile farming areas, triggers fierce competition for land in safe areas and drives the forced displacement of persons. The result is a drastic reduction in agricultural production and a decrease in food security in conflict areas.

MAP 2.4 Victims of Violent Political Events, 2011–19



Source:© OECD/SWAC 2020

The security situation remains precarious in many parts of the region. The results of CH analysis for the March–May 2020 assessment period indicate particular tension in the border area between Burkina Faso, Mali, and Niger, around the Lake Chad Basin (Cameroon, Nigeria, Niger, and Chad), and in the two English-speaking regions of Cameroon. According to UN-OCHA (United Nations Office for the Coordination of Humanitarian Affairs), as of February 24, 2020, the violence had led to large population movements, with 3.7 million internally displaced persons and 804,000 refugees. Box 2.7 below presents a selection of conflict early warning and response mechanisms set up within and outside the region.

Political instability can further exacerbate both market and production risks as violence continues to disrupt the functioning and accessibility of markets, the conduct of income-generating activities, and access to land and grazing areas in the region. The emergence of new threats such as the pandemic linked to the COVID-19 virus also led to unexpected policy disruptions that contribute to enabling environment risk. The policies and prevention measures put in place by countries in the context of COVID-19 may disrupt markets, trade, and income-generating activities.

BOX 2.7 CONFLICT EARLY WARNING AND RESPONSE MECHANISMS

The G5 Sahel Joint Force is a partnership among Burkina Faso, Mali, Mauritania, Niger, and Chad in Africa's Sahel region to improve security along their shared borders. The partnership works to improve cooperation and deployment of joint patrols to interdict the flow of terror groups and traffickers that easily cross these porous national borders. The force comprises up to 5,000 military and police personnel drawn from national battalions and incorporates the existing Liptako Gourma task force established earlier this year by Burkina Faso, Mali, and Niger to secure their shared border region (CSIS 2017). The G5 Force also supports regional responses to shared crises through initiatives such as building agrohydraulic projects as part of its mandate to support the development and continuity of regional security activities. It also aims to "contribute to the sustainable improvement of the food and nutritional situation, to the development of natural resources and to the increase of the resilience of vulnerable populations to the effects of climate change." In 2018, the G5 formed a partnership with FAO and WFP for strengthening regional food and nutritional security. The G5 could benefit from exploring the feasibility and potential collaboration with regional early warning institutions to develop a conflict early warning system to reduce the incidence of security risks and intercommunal violence that negatively affects livelihoods and food security in the region.

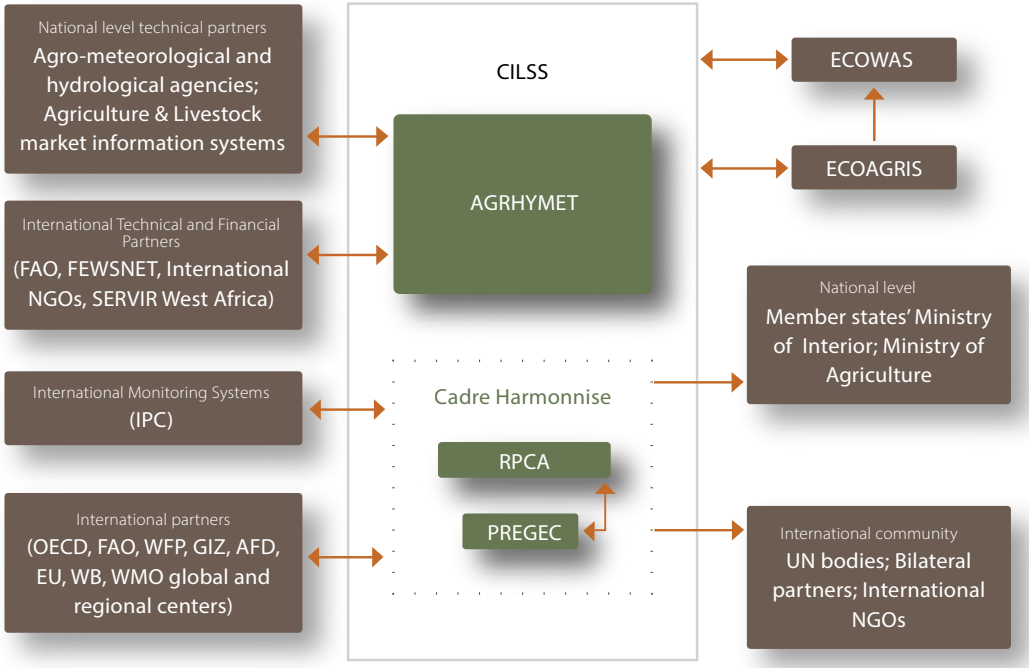
CEWARN is a collaborative effort of eight Intergovernmental Authority on Development (IGAD) member states in East Africa. These member states established CEWARN to fully utilize early warning and early response to prevent violent conflict. It supports peoples' desire for shared prosperity and a sustained, just peace. CEWARN's mandate is to receive and share information concerning potentially violent conflicts and their outbreak and escalation in the IGAD region; undertake and share analyses of that information; develop case scenarios and formulate options for response; share and communicate information, analyses, and response options; and carry out studies on specific types and areas of conflict in the IGAD region. Successful implementation of the conflict early warning program in pastoral areas will improve sustainable management of natural resources and food security in those areas. CEWARN presently undertakes its conflict early warning and response function through its national network of governmental and NGO stakeholders, Conflict Early Warning and Response Units (CEWERUs), National Research Institutes (NRIs), Field Monitors (FMs), and Local Peace Committees. They work in three clusters or pilot areas: the Karamoja Cluster (covering the cross-border areas of Ethiopia, Kenya, Sudan, and Uganda); the Somali Cluster (covering the cross-border areas of Ethiopia, Kenya, and Somalia) and the Dikhil Cluster (covering the cross-border areas of Djibouti and Ethiopia). The case of IGAD's CEWARN can offer important best practices and lessons learned (IGAD 2016).

EXISTING REGIONAL RISK MANAGEMENT SYSTEMS, INFORMATION SERVICES, AND MECHANISMS IN WEST AFRICA

Risk management strategies need to be context specific and may vary from one region to another. Many high and middle-income countries, including most Latin American and Caribbean countries, employ market-based instruments such as commodity exchange, contract farming, and food and agricultural market information systems to address food and agriculture-related risks. Asian countries rely on irrigated agriculture and government-based buffer stocks and strategic grain reserve for price stabilization and supporting producers (FAO 2016). The regional agencies at the forefront have established a set of policy and institutional mechanisms and initiatives to support food and agriculture risk management. These contribute significantly to food system resilience and are supported by the development community in West Africa and the Sahel.

This section outlines the main regional-level risk management institutions and instruments in West Africa and the Sahel region. In the following, the institutions and initiatives involved (CILSS, AGRHYMET Regional Center, ECOWAS Agriculture Regional Information System (ECOAGRIS), Regional Food Security Reserve, and WAMIS-NET) shall be briefly described. Figure 2.17 below illustrates the main actors in the region, although it is not an exhaustive list.

FIGURE 2.17 Regional Architecture Supporting Agriculture and Food Risk Monitoring, Hydromet Services, and Early Warning Systems



Source: World Bank

REGIONAL INSTITUTIONS

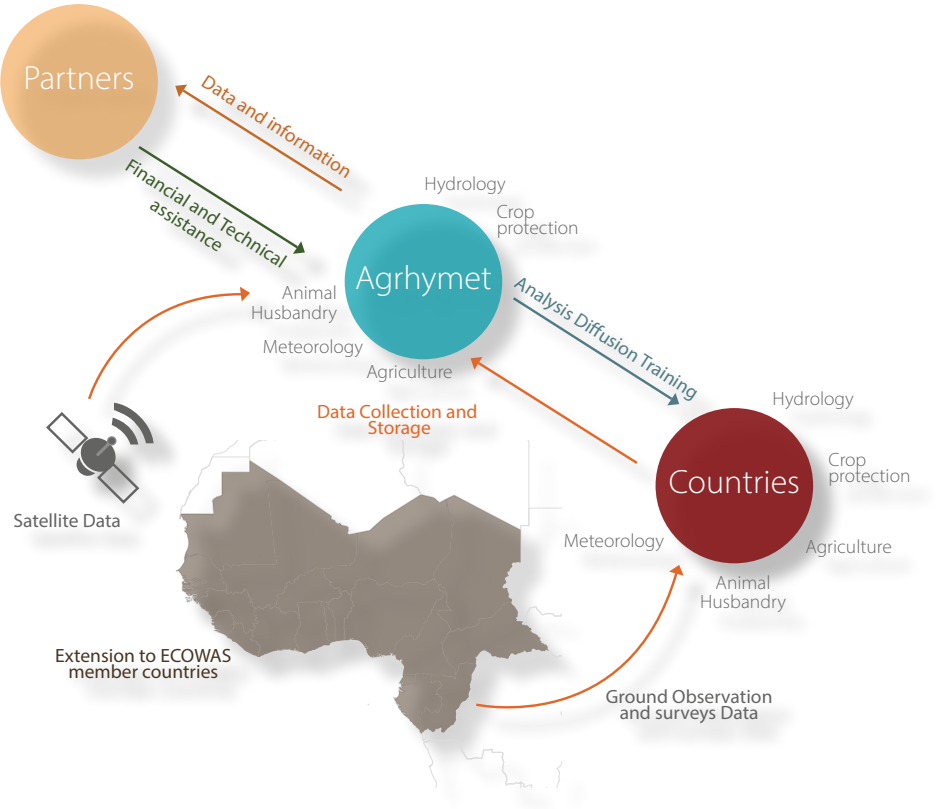
ECOWAS, headquartered in Abuja, Nigeria, is a regional political and economic union of fifteen countries located in West Africa with the objective of advancing regional integration notably through a trading union with a common market.

Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) is a regional entity that leverages political support and helps improve policies mostly related to drought management and agriculture in the Sahel. Through its subsidiary technical agencies, it provides technical expertise to its member states for sharing information, preventing drought, and increasing resilience in the water resources and agricultural sectors. CILSS has three main sites: the Executive Secretariat in Ouagadougou that deals with policy related issues, the AGRHYMET Regional Center in Niamey that provides training and information services, and the Sahel Institute (INSAH) in Bamako that provides research coordination. CILSS has successfully put in place a set of integrated early warning and food and nutritional security analysis information systems set up for monitoring and evaluating areas including the agro-sylvo-pastoral campaign (production, phytosanitary situation, markets, food balance sheets, and so on), risks, and vulnerable and food-insecure populations. These systems use multidimensional tools that are designed and implemented by states, technical partners, NGOs, the private sector, and universities.

AGRHYMET Regional Center, a subsidiary of CILSS, is the regional technical and training center focused on meteorology, hydrology, and specialized knowledge in climatology, agrometeorology, and operational hydrology. The center provides climate and agromet information services at the regional level (for example, seasonal climate outlook), technical assistance, and capacity building services to member countries including consultations, trainings, and applied research. It also gathers and processes regional data, issuing regional forecasts on agrometeorology and hydrological alerts—essential services that benefit farmers for better decision-making and help generate more value.

AGRHYMET is going to be a WMO-accredited Regional Climate Center for West Africa and the Sahel. Their services include seasonal rainfall monitoring and forecasts to inform countries on planting season preparation; 10-day forecasts to monitor and adapt planting and harvest seasons; and market monitoring of agricultural balance sheet in all 17 countries. At the global level, it is estimated for several countries that the benefit-cost ratios from improved weather, climate, and water services is in the order of 10 to 1 (Anderson et al. 2015). AGRHYMET's hydromet and climate information services are widely viewed as crucial in adapting to climate change and improving food security outcomes. Yet its capacity to deliver and provide access to information remains severely constrained by limited data collection capacity. Its organization is shown in Figure 2.18. AGRHYMET also has been a WMO Regional Training Center for years and has provided training for several technical experts from West Africa and other parts of the continent.

FIGURE 2.18 AGRHYMET Operating Scheme



Source: Traore et al. 2014

Limited capability of regional institutions to process, harmonize, and add value to data collected limits the potential to develop innovative information products and systems. At present, AGRHYMET is not effectively collecting, processing, and sharing data with partners. In addition, AGRHYMET as an institution has faced challenges in collecting data (for example, rainfall and climate data) from partner national institutions in the region—using, analyzing, and disseminating analyzed data as services—due to low capacity in analyzing and adding value to the data at the regional level. These challenges showcase the need to strengthen the capacity of CILSS-based information systems to enhance their data analysis, mapping, communications, and administration functions.

Low capacity of national data systems at the country level is a key bottleneck for building an effective and innovative early warning system at the regional level. In the 2000s, AGRHYMET published regular monthly early warning bulletins (for example, rainfall and crop development) on a decadal basis with partners such as FEWS NET, FAO, and WFP. AGRHYMET would channel funding received from partners such as EU, USAID, AFD, AfDB and multilateral development banks down to individual countries' national services to undertake data collection at subnational and district levels. Countries would, in turn, feed the data collected back to AGRHYMET, which aggregates at the regional level. In recent years, due to limited funds from AGRHYMET, the capacity of national data systems has declined,

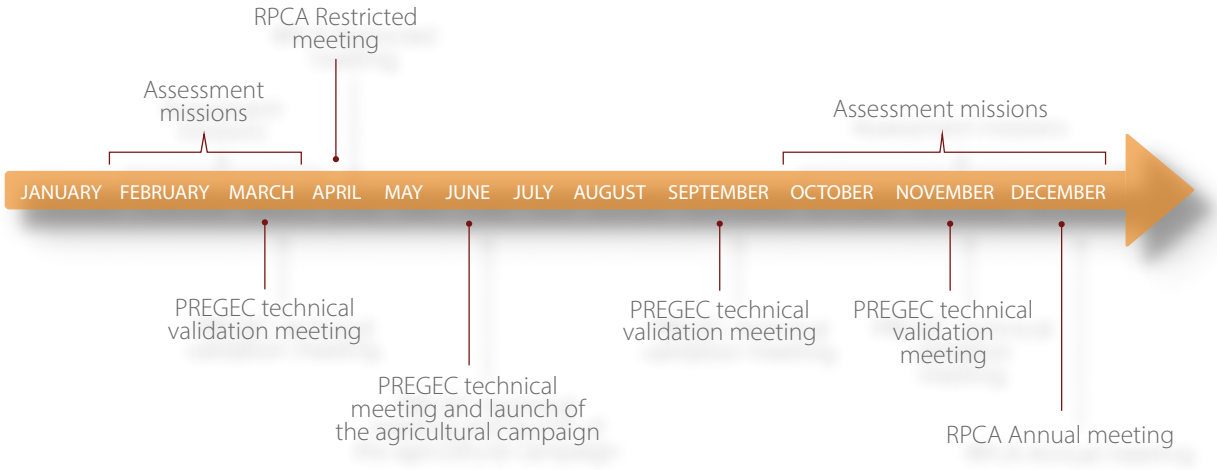
resulting in discrepancies in data aggregated at the regional level. While AGRHYMET also employs remote sensing techniques to collect data, the bulk of the institution's data comes from the countries' national data systems. Thus, the low capacity and financial constraints of national data systems have hampered AGRHYMET's ability to provide early warning information. At present, only a handful of countries—namely Mali, Burkina Faso, Niger, and Chad—consistently contribute data to AGRHYMET.

RISK MANAGEMENT INSTRUMENTS AND TOOLS

CH is a harmonized regional framework under the leadership of ECOWAS, UEMOA, and CILSS that aims to prevent food crisis by quickly identifying affected populations and identifying appropriate measures to improve their food and nutritional security. Initiated in 1999, the CH process is aligned with the global classification standard IPC (Integrated Food Security Phase Classification) in West Africa and serves as the major process to assess and classify the severity and magnitude of food insecurity in the region (bringing together Regional Food Crisis Prevention Network (RPCA) members and other stakeholders) similar to IPC is role at the international level. The CH has provided the reference tool for food and nutrition security analysis in West Africa and the Sahel under the coordination of CILSS and the leadership of the Technical Committee of the Harmonized Framework. At its core, the CH is an analytical process involving field missions and validation meetings with two different bodies—the RPCA and The Charter for Food Crisis Prevention and Management (PREGEC)—that meet six times every year. The current assessment missions are conducted by sending teams of experts to the field two times every year for a duration of two to three months—one before the Annual RPCA meeting in December and another before the Restricted RPCA meeting in April (see figure 2.19 below). The process relies on the input and cooperation of hundreds of experts and support staff throughout the year as well as national data collected by national early warning system (EWS), meteorological, and agricultural institutions across all ECOWAS and CILSS countries. The common assessment tool determines five phases of vulnerability using outcome results for food consumption, livelihood change, nutritional status, and mortality, enabling country stakeholders to jointly decide on emergency status and accurately analyze regional vulnerability to better target their aid efforts. The framework's vulnerability phase classification is used for triggering food aid distribution by the ECOWAS Regional Food Security Reserve and assists in decision-making for the High-Level Committee on Food and Nutritional Security (CHSAN) of UEMOA.

The limitations on the national-level data systems also adversely affect the CH process. The CH, as an analytical tool for monitoring food insecurity levels in the region, relies on countries' national data collection capability to provide quality data that is complete and accurate. As only rural populations are covered, urban areas are presently not taken into account for the assessment. Concerted efforts in the past have tried to maximize the coverage of the CH analyses across the region. In 2013, the regional institutions developed an enumerators' manual and provided trainings to data collectors with the goal of maximizing the

FIGURE 2.19 Cadre Harmonisé (CH) process



Source:World Bank

coverage of the CH analyses across the countries in the region. By 2018, the CH analyses country coverage doubled, covering 16 countries in the Sahel and West Africa region in addition to almost half of the states in Nigeria. The level of coverage has reduced in recent years due to low capacity of and financing for national data systems and countries' low priority to support data collection efforts (it has been suggested that in conflict-prone countries, government funds for data collection and research may be reallocated to address security-related risks). The process for the CH is static, relying on two data collection "missions" annually. This is not conducive in an emergency or crisis where the situation may change quickly in between the data collection missions. In addition, each country has its own method for collecting and aggregating data, leading to inadequate levels of harmonization. The systems also lack the capacity to conduct real-time evaluation of data on production systems, value chains, and pests and diseases such as locust outbreaks.

PREGEC (Charter for Food Crisis Prevention and Management): The PREGEC platform is where all the numerous data collection, analysis, and information tools available in the region come together. The data collected at national and regional levels by the Early Warning Systems, Market Information Systems, and Permanent Agricultural Surveys are validated through six regional consultations held throughout the year by the PREGEC and RPCA (as seen in above figure 2.20). PREGEC is presided over by ECOWAS and UEMOA but coordinated under CILSS in collaboration with its national, regional, and international partners.

RPCA: This platform, jointly organized with OECD, is a forum for exchange and analysis of information on food and nutrition security and a space for consultation on actions to prevent and control possible crises. The network aims to build a coherent and shared understanding of the region's food and nutrition situation and inform decision-making. Network members convene to validate and make recommendations based on the results of the assessments emerging from the CH process. RPCA is the political validation body, while PREGEC is its technical body that meets four times a year for technical validation of the assessments.

Permanent Annual Agriculture Surveys: The objective of the surveys is to estimate the areas cultivated in the rainy season, the water balance, agricultural production, and product use. The surveys form the basis for drawing up the forecast and ex-post cereal and food balances and are also used to establish the agricultural and food situation, provide data for national accounts, and define and evaluate agricultural policies (crop forecasts and estimates of residual farmer stocks). Since the end of the Permanent Diagnosis project (DIAPER) financed by the EU, the West African states have taken charge of their implementation or received support of a partner. Of the 17 countries of West Africa and the Sahel, only eight (Burkina Faso, Senegal, Mali, Mauritania, Niger, Chad, Togo, and Benin) regularly carry out the survey based on the DIAPER project methodology. These surveys are financed with the national budget. The other countries (Nigeria, Ghana, Sierra Leone, Liberia, Côte d'Ivoire, The Gambia, Cabo Verde, Guinea, and Guinea-Bissau) do not carry out the survey but they do an estimate. Their methods still need to be verified (PAGR-SANAD 2019).

Joint Crop Assessment Missions: Annual assessment missions are organized every year between October and November in all the countries of the region to assess the physical condition of the crops, estimate the harvest forecasts, and engage with actors on the ground regarding the reality and objective situation of the current agricultural season and the food prospects. The missions are organized jointly involving CILSS, FAO, Famine Early Warning Systems Network (FEWS NET), WFP, and country governments.

Ad Hoc Rapid Assessments: These are country-level assessments and are generally conducted by the government and its partners (CILSS, FEWS NET, FAO, and WFP). They take place in the countries most threatened by one or more shocks identified during the November PREGEC and recommended by the December RPCA. In some countries such as Liberia, Sierra Leone, Guinea-Bissau, and Ghana, these assessments are not regularly conducted. After several years of conducting these surveys, some countries are in the process of making them sustainable with the support of technical and financial partners (Mali, Niger, Mauritania, Senegal, Chad, Burkina Faso, and northeast Nigeria). For others, these surveys are carried out on a case-by-case basis and according to the needs of local partners based on the cycles of analysis of the CH (PAGR-SANAD 2019).

National market monitoring and information systems: market information systems (MIS) that are focused on cereals and livestock aim to collect data regularly on the number and types of products traded, price recording (producers, consumers), demand, market supply, stock monitoring (traders, institutions), monitoring of quantities sold on domestic and export markets, and factors influencing traders' behavior. MIS exist in all countries but face difficulties in providing services. In recent years, MIS have been financed by the ECOAGRIS project. In some countries, MIS are supported through the government's budget and by financing from the Food Security Reserve Stock Management Agencies—for instance, SONAGESS (Société nationale de gestion du stock de sécurité alimentaire) in Burkina Faso, OPVN (Office des Produits Vivriers du Niger) in Niger, Commissariat à la Sécurité alimentaire in Senegal, and so on. Partners such as CILSS and WAMIS-NET occasionally provide support to national-level MIS.

The Household Economy Analysis (HEA) is an early warning tool for analyzing food and nutrition security across livelihood zones but it is not a method for collecting information. It is often funded by the national government and occasionally by CILSS projects or partners (ECHO, Save the Children, and so on). The HEA tool is used during workshops conducted by the national mechanisms using official data

(agricultural production, prices), data collected in the field (surveys, sentinel sites, and so on), and assumptions for certain parameters, such as prices. The HEA results are used as indirect evidence of changes in livelihood assets and provide information on the potential outlook for households. HEA results also highlight the timing of possible production deficits. HEA information is used in the CH to inform the food consumption outcome through the livelihood protection gap and the survival gap. The method can provide important insights into chronic malnutrition.

West African Market Information System Network (WAMIS-NET): is a regional market information system launched in 2000 aiming to support food security and promoting regional trade. WAMIS-Net aims to facilitate better commercial decision-making by all stakeholders. The network is made up of national MIS organized around a regional coordination. It intends to pull data from Benin, Burkina Faso, Côte d'Ivoire, Guinea, Niger, Mali, Senegal, Togo, and Nigeria to provide up-to-date and accurate information on 400 rural and urban agricultural commodity markets via different media. WAMIS-NET is one of the building blocks of the ECOAGRIS project. The network lacks capacity and needs further support.

REGIONAL FOOD SECURITY RESERVE (RFSR)

Supply disruptions in international markets and a price surge in 2008 convinced the region and the international community (G-8 and G-20) to implement a region-wide food reserve framework. After 2008, ECOWAS developed a comprehensive strategy to respond to food crises through an emergency reserve system. The Regional Food Storage Strategy is based on three lines of defense based on the principle of subsidiarity. The first line consists of local stocks, held by producer groups, farmer organizations, village or community associations, or at the local community level. The second consists of national security stocks held by states, often with the help of aid agencies. As the main component of the strategy, the RFSR constitutes the third line of defense for crises exceeding the national capacity of member countries. Adopted in 2013 by ECOWAS heads of state, the RFSR[33] has potential to significantly increase food security across West Africa through complementing international aid and national policies while acting as a mechanism to foster regional solidarity. An EU-funded support project has contributed to advancing the implementation of the RFSR.

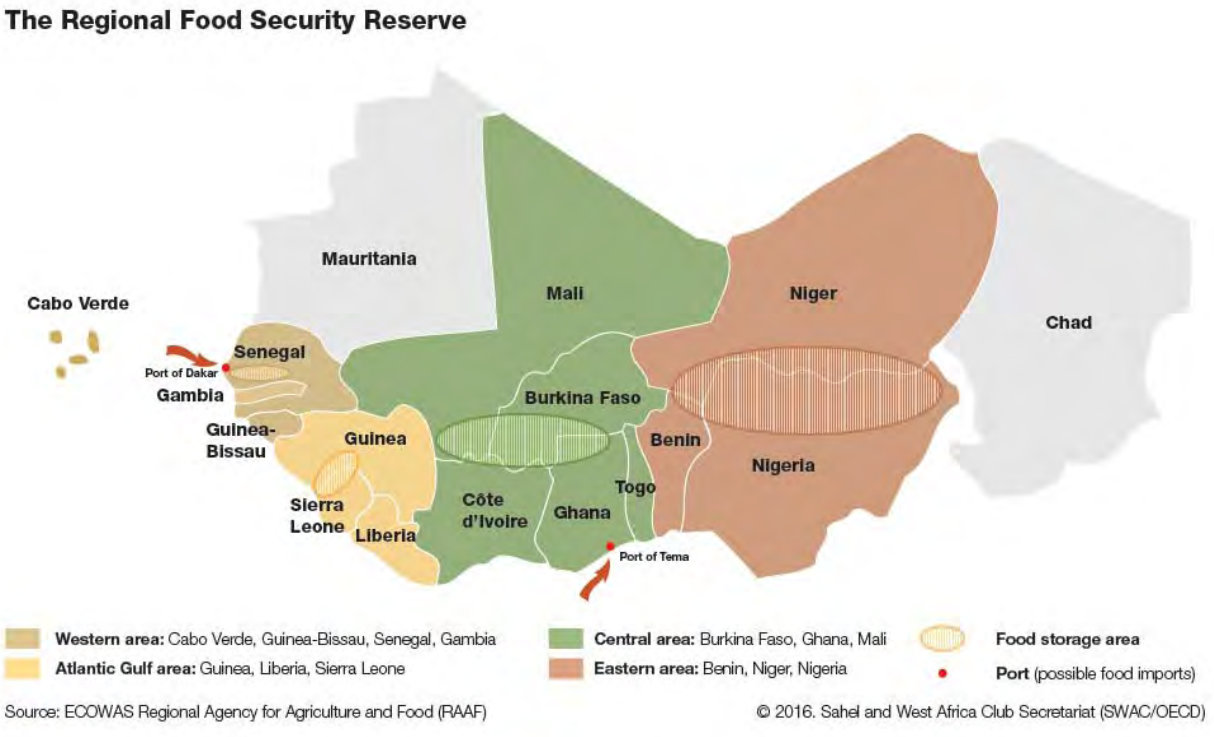
The RFSR is based on one physical and one financial component. The physical component (accounting for one-third of the reserve) consists mainly of cereals, tubers, and other food products that are stored for rapid supply. The financial component (two-thirds) serves to mobilize the stocked foodstuffs and to support affected populations through purchasing food supplies for emergency operations if physical stocks are insufficient and offering cash transfers and food vouchers. As agreed by the ECOWAS Council of Ministers in 2018, modalities governing the mobilization of

[33] The general objective of the ECOWAS Regional Reserve Project is "to effectively respond to food crises alongside State governments and stakeholders whilst contributing to the implementation of ECOWAP/CAADP with a regional food security and sovereignty perspective" (ECOWAS 2012, 34).

the RFSR to support a country in the region are based on objective criteria and are informed by the CH analysis and recommendations by RPCA.

Country needs are determined by using the share of population affected by a major crisis in previous years and estimating future population size of countries. Based on a retrospective and prospective analysis of risks and needs, the regional reserve's optimal intervention capacity was evaluated at 411,000 tons in 2012. Currently, the physical capital of the regional reserve is over 32,000 tons and is expected to increase to 40,000 tons by March 2021 (ECOWAS and ARAA 2020). The reserve also plans to have 5 percent of its stock made of enriched flours to address severe acute malnutrition. Map 2.5 shows the food stock capacity at different locations, especially four subregions: Eastern area composed of Benin, Niger, and Nigeria (56.5 percent); Central area composed of Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo (39.6 percent); West Atlantic area that includes Cabo Verde, Guinea-Bissau, The Gambia, and Senegal (2.3 percent); and Atlantic Gulf area composed of Guinea, Liberia, and Sierra Leone (1.6 percent). As part of their response to the 2020 food security crisis, with an estimated 17 million people in crisis or worse situation, ECOWAS and the EU have provided US$3.6 million to mobilize the RFSR. Between July and November 2020, approximately 6,219 tons of cereals were released to support vulnerable populations in Burkina Faso, Mali, Niger, and Nigeria (SWAC/OECD 2020).

MAP 2.5 Food Stock Capacities in the Sahel and West Africa



Source:© SWAC/OECD 2016

Although implementation of the RFSR has made significant progress over the past years, several challenges, including the lack of a viable financing mechanism, still constrain its full implementation. According to the proposed financing structure, two-thirds of the funding requirements should be covered by regional resources and one third by technical and financial partners. However, until now the Regional Reserve has been largely reliant on funding by the technical and financial partners, most notably the EU. The intended regional funding mechanism is not yet operational. The proposed funding components include a) financial contributions of the regional economic communities including ECOWAS and UEMOA, to be raised through a new regional tax (proposed rate of 0.5%) on extra-regional imports (also referred to as a "Zero Hunger tax"), and (b) country contributions in the form of grains (ECOWAS, UEMOA, CILSS and The Rural Hub 2012). However, to date, the Zero Hunger tax has not yet been created; financial contributions by the region's economic communities are still pending, and member states have not yet delivered the agreed quantity of staples earmarked for the reserve (Galtier 2019). Another factor limiting the reserve's performance is a mismatch between the location of physical stocks and that of the populations that are most likely affected by food security crises. Further challenges that presently reduce the effectiveness of the RFSR include the absence of a single reserve management scheme, differing objectives for the use of stock categories across member states, and lack of coordination between national-level and local-level stocks. Last, persistent gaps in technical capacity and insufficient linkages to local or regional food value chains still affect the functioning of local stocks (ECOWAS and ARAA 2019).

WEATHER, CLIMATE, AND HYDROLOGICAL (HYDROMET) SERVICES

Weather, climate, and hydrological services underpin various information services to support agriculture and the food security sector. Basic weather and climate information such as temperature and precipitation observation and forecasts can be further tailored and provided to assist users' decisions (see table 2.16 below).

TABLE 2.16 Hydromet Services Benefits by Groups of Beneficiaries

BENEFICIARIES	CLIMATE SENSITIVITY	BENEFITS OF HYDROMET PRODUCTS AND SERVICES	TYPE OF PRODUCTS AND SERVICES REQUIRED
Rain fed crop producers	Crop yields and pests are sensitive to variations in precipitation, evapotranspiration, and temperature	More targeted (date and quantities) application of pesticides, use of enhanced crop varieties, decisions related to the date of sowing and harvesting and post-harvest processing, market, and prices of assets or terms of trade, management of productiWon and market risks	Seasonal climate outlooks; intra-seasonal climate outlooks; weather forecasts guiding sowing, application of pesticides, harvest, and post-harvest

BENEFICIARIES	CLIMATE SENSITIVITY	BENEFITS OF HYDROMET PRODUCTS AND SERVICES	TYPE OF PRODUCTS AND SERVICES REQUIRED
Irrigated crop producers	Availability of surface water resources for irrigation (surface and groundwater); irrigation management depends highly on precipitation, evapotranspiration (ET), and temperature forecasts	Water efficient irrigation management based on accurate forecast of precipitation, ET, and temperature and water levels; assets or terms of trade, management of production and market risks	Seasonal climate outlooks; hydrological forecasts (for flood prevention to avoid damage to infrastructure and pumps, water-level modeling to optimize irrigation); advisory services to water user associations
Livestock herders	Climate sensitive fodder and water supply; weather and climate-related: livestock diseases	Stocking of fodder reserves; provision of additional water supply; efficient vaccination campaigns	Livestock sector-targeted weather and climate forecasts and climate-health outlooks
Fishing (inland)	Dependency on water quality; fish stock impacted by droughts (low water levels, low oxygen) and floods (siltation)	Fishing operations and day-to-day management of stocks; water quality improvement	Relevant information on water levels; flood and low water-level forecasting; siltation information; relevant information on water quality
Fishing (marine)	Increased level of storm surges in coastal waters	Safer fishing operations and improved day-to-day operations of fishing boats in coastal waters	Marine and coastal weather forecasts and storm warnings
Micro insurance	Small enterprises at risk of extreme weather events	Payouts to farmers based on weather indices	Forecasts for insurance
Civil protection	Extreme weather and climate events impacting communities and leading to increased uncertainties and need for civil protection	Early warning information and increased lead time to provide more efficiently early warning information	Early warning information (rivers, and urban Lomé) and short to medium-term forecasts (storm surge)

Source:ECOWAS and World Bank, forthcoming

There are a numer of regional entities collaborating to provide weather, climate, and hydrological services. West Africa has two main regional climate institutions: the African Centre of Meteorological Applications for Development (ACMAD) has already been certified by WMO as the continental regional climate center, while AGRHYMET is in the process of being endorsed by ECOWAS as regional climate center for West Africa. In addition, The Agency for the Safety of Air Navigation in Africa and Madagascar (ASECNA), West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), West African Coastal Observation Mission (MOLOA), and River Basin Organizations (RBO) all play certain roles in developing and providing hydromet-related services. Among those services, AGRHYMET and ACMAD regularly organize a Regional Climate Outlook Forum, Prévision Saisonnière en Afrique Soudano-Saharienne (PRESASS), to update seasonal

climate conditions and their outlook for the next few months. While regional services have been steadily improved over the years, there are gaps to fill: (a) technical limitations in seasonal forecast and provision of subseasonal forecast; (b) absence of an archiving database system and technical and user guides on forecasting and verification; (c) absence of data sharing mechanisms across ECOWAS; (d) lack of ICT infrastructure; (e) unsustainable funding mechanism of regional hydromet bodies; (f) lack of technical capacity at AGRHYMET; (g) absence of an integrated hydrometeorological forecasting system in the region; and (h) lack of calibration capacity for observation equipment (ECOWAS and World Bank, forthcoming).

National capacity providing hydromet services in West Africa varies from country to country. A recent report (ECOWAS and WB, forthcoming) highlighted that the national capacity providing such services in the region varies greatly from country to country. However there are common gaps identified across the region: (a) lack of accurate, timely, and actionable climate information to national institutions, decision-makers, and local communities; (b) limited observation network and weak data sharing mechanisms; (c) inadequate number of qualified personnel; (d) limited influence of the National Hydro-meteorological services (NMHS) at the decision-making level; (e) low access of climate and water vulnerable communities to actionable weather, climate, and water information; (f) lack of effectiveness for integrated national and regional platforms in climate and hydrology information and multihazards early warning; and (g) limited capacity of NMHS to set a sustainable business model and proactive use of public-private engagement in strengthening hydromet services.

FARMER DECISION SUPPORT SYSTEMS AND SERVICES

Two examples of needed systems for supporting farmers that deliver context-specific, real-time climate information using ICT and decision support systems are as follows:

- Intelligent Agricultural Systems Advisory Tool (iSAT): ICRISAT and partners have developed and piloted the iSAT system, which initially started as a sowing app in 2016. Using a decision tree approach, a structured and systematic approach to decision-making, considers the insights from analyzing historical climatic conditions, climate and weather forecasts, and prevailing environmental conditions. Microsoft India developed a platform to access real-time data from various public sources, perform data analytics, implement the decision tree, and generate and disseminate SMS messages to farmers and associated actors. iSAT was piloted between 2017 and 2019 with 2,100 farmers in Anantapur, India. The system generates a weekly decision tree integrating forecasts, crop and soil scenarios, and systems information (Rao et al. 2019)
- YeZaRe Market Information System: This platform was developed by an Ethiopian social enterprise called Echnoserve and provides information on weather patterns and market conditions to smallholder farmers through an accessible platform. YeZaRe provides information via text messages directly to farmers´ mobile phones, customized in their own languages. To develop the YeZaRe app,

Echnoserve conducted a preliminary assessment of both the current climate information dissemination channel in Ethiopia and market information. Using an agile software development system, the Echnoserve team developed system requirements, including information flow charts, and then an IT application that was tested and presented to different stakeholders, cooperatives, unions, farmers, development agents, and local NGOs (YeZaRe, www.yezare.info).

RISK FINANCING SYSTEM

More governments are moving toward a proactive (and more cost-effective) approach to financial planning to protect national budgets and the lives and livelihoods of their citizens from the impacts of disasters. Under this approach, governments consider climate and other shocks as part of their fiscal risk management strategies and develop dedicated risk financing systems and mechanisms. The approach complements other elements of a comprehensive disaster and agricultural risk management strategy, ranging from investments in strengthening early warning systems and agroadvisory services to irrigation, improved farming practices and innovations, and social safety nets.

The region lacks a dedicated regional institutional mechanism or system for risk financing. Food security-related risks lead to huge economic losses and governments often incur the costs of those risks, straining national budgets. (For context, natural disasters cost African countries approximately US$1billion every few years, with the highest economic loss of US$7 billion reported in 2003, according to the EM-DAT database). When faced with such shocks, countries have limited avenues for accessing risk financing at the regional level. Aside from having to rely on the international community to finance the response to these risks, it would benefit the region to have an institutional mechanism to respond to financial constraints caused by such shocks. African Risk Capacity (ARC) is active in some countries in the region; exploring the feasibility and potential for collaboration between ARC and the existing risk management institutions and systems, including the ECOWAS RFSR, could be a starting point.

INITIATIVE MAPPING

Table 2.17 (below) provides an overview of selected initiatives and projects, either ongoing or under preparation, that relate to the priority intervention area III Regional Risk Management Architecture and Farmer Decision Support Tools. Building on an initiative mapping contained in the ECOWAS RAIP (2016–20), the overview is not intended as a complete collection of all existing initiatives but focuses on programs which are (a) regional in scope and (b) considered most relevant and impactful at the regional level.

TABLE 2.17 Initiative Mapping for Regional Risk Management Architecture and Farmer Decision Support Tools

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
WEST AFRICAN FOOD SECURITY STORAGE SUPPORT PROJECT					
Contribute effectively to respond to food crises and build household resilience by promoting emergency food systems at different scales	(1) Support the implementation of the regional storage security strategy through three different levels of defense (local, national, and regional) (2) Strengthen information systems on food security and vulnerability for rapid decision support	ECOWAS member states, Chad, Mauritania	ARAA/AFD/ACEID Technical Partners: CILSS/ AGRHYMET RESOGEST, Regional Professional Organizations (ROPPA, ROAC, APESS, RBM)	EU	2014–20; Grant; US$64.7 million
ECOWAS AGRICULTURE REGIONAL INFORMATION SYSTEM (ECOAGRIS)					
Strengthen information systems at different local, national, and regional scales to address information needs for food and nutrition monitoring, vulnerability analysis, and decision support in order to anticipate food and nutrition crises and to select and target interventions	1) Improving capacities of national technical services in terms of equipment, database management systems, tools, analysis and training (2) Development of an integrated and centralized database in three centers access points located in HQ of CRA, UEMOA, and ECOWAS (3) Operationalization of the committees and countries of quality control statistical methods (4) Updating integrated country databases in a secure and accessible manner (5) Support for primary data collection and standardization of methods of data collection and data analysis (6) Specialized training for managers and technicians of national technical services (7) Strengthening the analytical and intervention capacities of regional actors on a common source of reliable indicators and data	17 member states of ECOWAS and CILSS regions	ECOAGRIS mechanism is implemented through collaboration of different sectoral data providers in 17 CILSS and ECOWAS countries and institutions in accordance with their specific competences: CORAF on research data base; WAMIS-NET; AFRICARICE	EU	2014–19; Grant; €18 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
IMPROVING GOVERNANCE FOR RESILIENCE AND FOOD AND NUTRITION SECURITY AND SUSTAINABLE AGRICULTURE IN WEST AFRICA PROJECT (PAGAR-SANAD)					
Strengthen the governance of Food and Nutrition Security and Sustainable Agriculture in West Africa and the Sahel	Strengthening of information, analysis and monitoring, and evaluation systems of agricultural policies and programs; capacity building of regional and national stakeholders to implement CH, RPCA, and PREGEC mechanisms and their review.	ECOWAS member states; Chad; Mauritania	ECOWAS, UEMOA, CILSS	EU	2018–22; Grant; US$22.6 million
SERVIR WEST AFRICA					
Improve the capacity of regional institutions in applying satellite data, ground-based data, and advanced geospatial analytical techniques to strengthen the region's resilience to climate change impacts	Strengthening the capacity of AGRHYMET to integrate earth observations information and geospatial technologies into development decision-making.	CILSS/ ECOWAS countries	Implemented by AGRHYMET	NASA and USAID	2016–21; US$14.9 million
CAPACITATING AFRICAN STAKEHOLDERS WITH CLIMATE ADVISORIES AND INSURANCE DEVELOPMENT I (CASCAID-I)					
Reduce agricultural investment risk from smallholder farm to whole value chains to improve agricultural productivity and food security together with the profitability of agricultural enterprises, in a context of increasing smallholder integration in urban-driven markets	(1) Improve service relevance through embeddedness in phygital data infrastructures that continuously improve stakeholder performance through user feedback loops (2) Target climate services and CSA options more efficiently through advanced socioeconomic and agroecological segmentation (3) Enhance stakeholder preparedness and decision-making through real-time, multiscale yield forecasting.	West Africa	Implemented by ICRISAT in West Africa; partners are University of Florida, AGRHYMET	CCAFS	2015-18; grant; n.a.

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
THE AFRICAN RISK CAPACITY (ARC) AGENCY					
The AU Specialised Agency on Disaster Risk Management and Financing, ARC promotes harmonized resilience solutions for protecting African lives and livelihoods vulnerable to natural disasters caused by climate change and other perils of importance to the continent. Member states are better equipped to manage the impacts of natural disasters on the livelihoods of vulnerable populations in a timely manner and build resilience to climate-related shocks.	(1) Collaborating with CILSS/ AGRHYMET to create an indicator based on the CH for a regional insurance coverage against food insecurity (2) Offering drought risk insurance coverage to several countries in the region (3) Providing Capacity Building on Disaster Risk Management and Financing as well as customizing ARC's premiere Drought Risk Tool—Africa RiskView—to country contexts	West Africa	EU/AFD, possibly KfW and AfDB, AGRHYMET, ARAA, ECOWAS	AfDB; Rockefeller Foundation	Since 2012; Technical support; US$5.5 million
FAO PEST CONTROL PROGRAM					
Control FAW and desert locust threats through integrated global pest control program	Support 17 Sahelian and West African countries' workplans, regional coordination	ECOWAS countries	FAO (West Africa Sub-Regional Office) in support to 17 countries and ECOWAS	Possibly IFAD; AfDB, EU, USAID, Arab funds	Program under development at the time of writing

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
FAMINE EARLY WARNING SYSTEMS NETWORK (FEWS NET)					
Provide unbiased, evidence-based early warning and analysis on acute food insecurity to governments and relief agencies who plan for and respond to humanitarian crises	Monthly reports and maps detailing current and projected food insecurity; alerts on emerging or likely crises; special reports on factors that contribute to or mitigate food insecurity, including weather and climate, markets and trade, agricultural production, conflict, livelihoods, nutrition, and humanitarian assistance; access to data, learning, and analysis of the underlying dynamics of recurrent and chronic food insecurity and poor nutritional outcomes, to improve early warning and better inform response and program design	West Africa	Managed by USAID's Bureau for Humanitarian Assistance (BHA)	USAID	Since 1985; Technical support; n.a.
CLIMATE RISK AND EARLY WARNING SYSTEMS (CREWS) INITIATIVE					
Increase the availability of, and access to, early warning systems	Improve delivery of hydro meteorological services; improve risk information to guide EWS development; strengthen application of ICT; strengthen EWS awareness; strengthen preparedness/ response plans	SSA LDCs	World Bank/ Global Facility for Disaster Reduction and Recovery (GFDRR), WMO, and UNDRR	CREWS Trust Fund (Multi-Donor Trust Fund)	Since 2018; Grant/ technical support; US$ 5.3 million
SUPPORT PROJECT FOR THE REGIONAL FRUIT FLY MANAGEMENT AND CONTROL PLAN IN WEST AFRICA (PLMF/FFCP)					
Increase fruit and vegetable producers' incomes, particularly small producers, to contribute to food security and poverty reduction	Improve regional and national fruit fly infestation monitoring and early warning and response capacities including through applied research and regional coordination.	Burkina Faso, Senegal, Benin, Mali, Ghana, The Gambia, Guinea, Côte d'Ivoire, Nigeria, Togo, Guinea-Bissau	CORAF, NARES, National Committees for Fruit Fly Control	AFD, EU, ECOWAS	2015–19 Grant US$26.1 million

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
DESERT LOCUST OPERATIONAL RESEARCH IN THE WESTERN REGION (CLCPRO-RESEARCH) PHASE 3					
Improve locust prevention and treatment	Operational research	Burkina Faso, Mali, Niger, Senegal, Chad, Mauritania	FAO, French Agricultural Research Centre for International Development (CIRAD)	AFD	Grant; US$2.2 million
MULTISTAKEHOLDER PLATFORM FOR AGRICULTURAL RISK MANAGEMENT (PARM-SAFIN)					
The Platform for Agricultural Risk Management (PARM) focuses on making risk management an integral part of policy planning and implementation in the agricultural sector in developing countries.	Strengthen agricultural risk management (ARM) in developing countries	Senegal, Niger, Cabo Verde, Liberia, and other Sub-Saharan Africa countries	IFAD	Donor consor-tium including AFD, BMZ, KfW and others	Since 2013; Grant; Share earmarked for West African countries > US$7 million
ANTICIPATING AND MANAGING BIO RISKS TO BOOST FARMERS' RESILIENCE TO CLIMATE CHANGE IN WEST AND CENTRAL AFRICA					
To help farmers anticipate and manage biological risks	Develop a robust system for early detection and effective containment of phytosanitary threats to cassava-based cropping systems in the face of environmental constraints exacerbated by climate change	ECOWAS member states	CORAF, WAVE Program (Central and West African Virus Epidemiology for food security), of Félix Houphouët-Boigny University of Abidjan.	EU	2020 – 25; Grant; US$5.5 million
CGIAR TWO-DEGREE INITIATIVE: ONE HEALTH PLATFORM FOR CLIMATE-DRIVEN PESTS AND DISEASES IN WEST AFRICA					
Enhance capacity of food producers to manage bio risks and institutionalize capabilities for early detection of emerging threats and rapid response.	1) Increase producer's adoption of new biocontrol technologies (2) Mainstream pest and disease issues into national adaptation plans (NAP)	ECOWAS/ CILSS/ UEMOA member states	ICRISAT, IITA, ICRISAT (partners include Norwegian Institute of Bioeconomy Research (NIBIO)	Broad coalition of donors	2020–30; Research Program

OBJECTIVE	ACTIVITIES	FOCUS COUNTRIES	IMPLEMENTATION	FUNDING SOURCE	DURATION, TYPE, AND VOLUME
GLOBAL FRAMEWORK FOR THE PROGRESSIVE CONTROL OF TRANSBOUNDARY ANIMAL DISEASES (GF-TADS)					
Reduce the threat posed by emerging, transboundary, and endemic pathogens through enhanced capabilities for preparedness, early detection, risk mitigation strategies, and control of transboundary animal diseases (TADs) of high security concern in target countries across Africa, South East Asia, Eastern Europe, and Eurasia	Strengthen laboratory diagnostic competencies and strengthen biosafety and biosecurity training on safe and secure outbreak investigations, sample collection, shipment, and characterization of foot and mouth disease (FMD); support qualitative risk analysis and risk mapping planning at country and regional levels to identify hot spots to help inform surveillance activities; conduct socioeconomic impact studies to inform surveillance activities and decision-makers for FMD at the national and the regional level	Liberia, Senegal, Nigeria	FAO	US DTRA	2020-22; Grant; US$ 5.1 million

ENTRY POINTS AND REFLECTIONS

This section outlines the key gaps and recommendations for improving the region's risk management and farmer decision support systems both nationally and regionally. It is informed by a large number of consultations and interviews with technical experts working in West Africa and the Sahel. The reflections focus on (a) policy and institutional aspects and (b) capacity and technical aspects. The first grouping highlights institutional coordination, the needs assessment process, and sustainable financing. The second grouping highlights issues data systems limitations, information accessibility at the farmer level, private sector involvement, and harmonizing information systems.

ENHANCING THE REGIONAL FOOD SECURITY RESERVE (RFSR)

The RFSR system faces challenges linked to insufficient financing, inadequate stock levels, and weak management at both country and regional levels. ECOWAS has aimed for stock level targets at the regional level that it is currently unable to finance and, as mentioned before, member states have not delivered on their commitments to provide the reserve with the agreed volume of staples. Establishing viable and sustainable financing is thus key if the reserve is to reach its full potential. Furthermore, the location of the reserves is one of the main issues because the chosen locations are not near highly food-insecure or fragile areas of the region where the need for food aid is high. A significant portion of the region's vulnerable populations live in landlocked rural areas far away from stock locations. Due to their limited access to public services, rural populations are most likely to rely on fast access to the reserves in emergency situations. In addition, collaboration between the regional vulnerability analyses and food security assessments and the food security reserve could be further improved.

New risk financing instruments could place the reserve on a sustainable footing and enable it to become an effective regionally owned vehicle to replace ad hoc food crisis emergency response. The multilateral system is still weighed too heavily toward responding only after disasters hit. A suite of new instruments could be deployed to reverse this longstanding structural deficit. The ARC aims to play such a role. The experience of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) could offer important lessons for the region. The Global Risk Financing Facility (GRiF), a new investment vehicle that focuses on improving financial resilience to climate and disaster risks, has agreed to explore opportunities for regional food insecurity risk mechanisms. The reserve would be a natural entry point to advance these agendas.

Enhancing the RFSR may also boost intraregional value chain development. A fully operationalized and sustainably funded regional food reserve would offer significantly increase targeted purchasing of food stocks. This could stimulate demand for certain key cereals including millet, corn, and sorghum. If accompanied by technical advisory and strategic investments in relevant infrastructure, smallhold farmers and other value chain actors could benefit from improved market access in the medium term.

POLICY AND INSTITUTIONAL CHALLENGES RELATED TO THE REGION'S EARLY WARNING AND CLIMATE INFORMATION SYSTEMS

Weak institutional coordination hinders effective data generation, information service delivery, and easy access to information necessary for timely decision-making on food security-related issues. A number of national and regional meteorological and hydrological agencies are engaged in seasonal forecasting and monitoring activities across West Africa and the Sahel. Agrometeorology information is sometimes generated by those agencies or in collaboration with agriculture stakeholders. However, the linkage and coordination between institutions (such as global centers of excellence, AGRHYMET, ACMAD, national meteorological agencies, and other information generating institutions) at the national and regional levels remain weak, leading to inefficiencies and potential duplication of effort. A lack of synergy and coordination issues act as bottlenecks for the easy access to information necessary for making timely decisions on food security-related responses. These issues are also prevalent among international development, private sector, and NGO partners of the regional institutions. Partners of the CH and AGRHYMET, such as FAO, OXFAM, and Action Against Hunger, have difficulty accessing information on food security collected at the national, subnational, and regional levels given inconvenient communication formats and platforms. AGRHYMET, for instance, publishes its forecasts and assessments on a webpage with an inaccessible and poor format.

- Streamline the "chain of information" across regional, national, and subnational levels to provide demand-driven information services by leveraging state-of-the-art technologies and new business models, revamping communication and a knowledge exchange format that goes beyond publishing bulletins on a website.
- Prioritize services and consider the mode of development and delivery. Defining public good services and non-public good services is important as it has implication for private sector involvement and financial models (GFDRR 2020).
- A potential entry point could be to reorganize and structure the system in a modular way and provide support to critical modules, where public intervention is critical, while other modules can be strengthened in partnership with different partners, including the private sector. Upgraded and digitized systems through a modern database management application would consolidate agroclimatic and food security information and should incentivize innovative and sustainable delivery models.

The food security outlook is sometimes incomplete due to the bulky needs assessment process. The CH analysis of the food security outlook and needs assessment is often perceived as a "heavy" and bulky process involving field missions and validation meetings that occur six times every year. Yet the CH functions well as an analytical tool and the RPCA consultations serve as major regional convenings where stakeholders validate the food security outlook and are well-regarded among partners. There is, however, a clear need to upgrade existing CH tools and processes toward a more agile, "lighter," and less costly

system. The current lengthy process of validating findings is a bottleneck that impedes timely decision-making when effective coordination and distribution of resources is needed in food-insecure areas. Some cite that country-level bottlenecks and national data collection and sharing capacities are weak. The national-level data that feeds into the CH can be incomplete or delayed, resulting in an inaccurate assessment. A review that aims to improve the format and frequency of the technical validation meetings and improve engagement with national systems in the data collection process would be useful. Furthermore, validating the food security outlook results at the national level, with oversight and safeguards in place, rather than at the regional level, can accelerate the speed of the validation process (for example, validating national results along with relevant country-level UN bodies to ensure accuracy).

Reliance on short-term donor funding undercuts regional institutions' ability to sustain continuity of initiatives and retain technical experts within its institutions. In the past five years, AGRHYMET has lost approximately 70 percent of its human resource capacity across its various units, including climate, markets, and data. Experts who are typically hired for specific donor-funded projects leave the organization once projects are concluded. This issue highlights the institution's inability to retain expertise for the long term. Moreover, the fragmented nature of donor financing leads to technical experts being shuffled from one project to another instead of continuing to further develop existing initiatives. (It should be noted that the issue of sustainability of financing is also a challenge at the national level where data collection and analysis is concerned). A case in point is the five-year-long ECOAGRIS project financed by the EU. During the duration of the project, experts had piloted a set of tools and products for the ECOAGRIS platform. When the project concluded, however, ECOAGRIS was not continued or taken up by another partner to be further developed, and the technical experts who worked on the products moved on to another project. This highlights the need to

- Improve the financial sustainability and resources of technical institutions such as AGRHYMET to retain expertise (including local experts' know-how) within the organization in the long term. AGRHYMET can follow the example of UEMOA by establishing fixed budget for permanent staff of sufficient seniority. The organization may also request regular payments of contributions by member countries to ensure consistency of AGRHYMET initiatives.
- Institutions (such as AGRHYMET) should explore ways to transition from donor financing toward generating their own financing. One avenue is to privatize certain units within these institutions as a separate stream for revenue generation. For instance, the training center within AGRHYMET could charge fees for the trainings it provides instead of having to mobilize external financing sources; or the trainees could pay for the service enabling AGRHYMET to generate its own resources instead of providing trainings at no or limited cost.
- Regional organizations and development partners can work to establish a system that secures and stabilizes funding directly for CILSS and AGRHYMET with a long-term view of capitalizing and strengthening these institutions.
- Prioritize information services development by considering the demand of users and comparative advantage of respective regional institutions. Systems to deliver such information services should be designed in a cost-effective manner, taking into consideration various types of partnerships.

ENHANCING THE REGIONAL INFORMATION SYSTEM'S RESPONSIVENESS TO USER NEEDS SHOULD BE A PRIORITY

Understanding user needs is a starting point. It is important that improved systems can provide information services that meet user needs most effectively. The current systems at the country level are typically engaged in data collection and data analysis geared toward providing information to regional counterparts, development community partners, and other relevant government agencies. These systems, typically housed within the Meteorological Agencies and Disaster Risk Management Agencies of countries, do not usually publish hydromet and early warning information with the producers in mind. Any entities involved in hydromet service provision should have regular interactions with users and feedback on services so that evolving user needs and user satisfaction for the current service portfolio are regularly tracked by service providers.

High-quality weather, climate, and hydrological services underpin digital advisory services for agriculture and food security. Transforming how hydromet services are developed and delivered in the region is needed. Traditional infrastructure-heavy investments in hydromet services have a poor track record. Instead, the focus should be on the development and delivery of services that meet the need of users by enhancing the entire hydromet "ecosystem," which consists of not only regional and national entities, but also global centers, academic and private sectors, and NGOs and CSOs.

The national meteorological and other relevant agencies could improve their services by making use of products from global centers effectively. In recent years, greater emphasis is placed on moving toward impact-based warning along with the use of ensemble forecasts, which enables making decisions while taking into consideration the inherent uncertainty of weather systems and impacts of hazards (GFDRR 2019). At the same time, numerical weather prediction outputs provided by global centers have high resolution, making most of the national-level efforts to run limited area models irrelevant (GFDRR 2019). Such shift in thinking should be duly considered in designing the system.

Holistic approach is needed to address both country-level systems and their linkages to regional-level systems first. The data collected at the national level feeds into the CH framework and regional institutions such as AGRHYMET. Building the capacity of countries' national services will thus have significant positive spillover effects. This calls for revitalizing data collection at national levels by building capacity of national statistical agencies, meteorological agencies, and other relevant government institutions to develop robust data systems and streamlining the CH process.

National-level monitoring and data collection systems face different problems across the region. As noted before, one common issue is the need to improve national data collection systems feeding into the CH process and hydromet information services. Coastal countries including Benin, Côte d'Ivoire, Ghana, Liberia, Sierra Leone, and Togo have significant needs given the current state of their national data collection systems. In Nigeria, there is no institutionalized and formal EWS at the national and state levels. While the Sahelian countries' national food crisis and disaster prevention and management systems are relatively functional, the systems are beginning to experience difficulties in financing

their activities from national budgets. These countries are making major efforts to mobilize state resources to carry out data collection with the support of their partners. However, the economic slump that is currently affecting almost all Sahelian countries means that state funding is limited, which also hinders the data collection process. At the technical level, these countries also need methodological support to ensure the adoption of new methods of data collection and analysis that feed the CH process.

AREAS FOR STRENGTHENING THE TECHNICAL CAPACITY AND VALUE PROPOSITION OF CILSS, AGRHYMET, AND NATIONAL ENTITIES

Numerous mechanisms and systems under CILSS aim to address a myriad of food security-related challenges and needs in the region. In practice, most of these tools, if they exist, do not work fully to the satisfaction of clients. The main challenges are dysfunctional collection systems, lack of primary and secondary data, insufficient analytical capacity, lack of coordination and linkage between early warning and response, lack of transparency, and even trust between states and other actors.

AGRHYMET is the premier training and climate services institution in the region, but its capacity to deliver and provide access to information remains severely constrained at the national levels. Currently, AGRHYMET is focusing its services at the regional level. In the past, AGRHYMET had a national component (in countries such as Mali and Burkina Faso) where a dedicated unit would meet with farmers every 10 days. While it is primarily the national agencies' responsibility to provide services to farmers, feedback from farmers on services can also inform how AGRHYMET can support national entities better. When it comes to AGRHYMET's data analysis capabilities, global data, such as satellite-based remote sensing and numerical weather prediction outputs, are used. Nonetheless, it can be questioned to what extent such data is being productively used in analyses. It needs more streamlined use of data from various sources in developing products.

AGRHYMET could benefit from revamping its model for a results-based orientation for delivery and value addition of data collected. By developing useful information products, AGRHYMET could add greater value and secure sufficient funding for its activities. Promoting an open data, open science co-development approach should be encouraged. Adopting a long-term vision and looking beyond the short-term cycle of donor projects and funding when designing the regional information systems can enhance creative out-of-the-box thinking for developing innovative information products. For information dissemination, the current system of communicating climate services and CH survey results through bulletins posted on websites is not necessarily adequate. The regional institutions can develop platforms like a dashboard, similar to FEWS NET, with readily available and up-to-date data and information. Linking such a platform with MIS in partnership with visual media and radio networks also assists with disseminating data and pushing information out to the grassroots. This may also imply properly implementing and maintaining already developed market information platforms such as ECOAGRIS.

AGRHYMET could add value by closely monitoring conflict caused by tensions related to use of natural resources, a

capacity it currently lacks. This is an important dimension for stability and food security in the region. Experts suggest that AGRHYMET can learn from or partner with NGOs actively working in this space in West Africa. One in particular—Action Against Hunger—has developed a GIS remote sensing tool that monitors biomass of good pasture lands to predict pastoralist tension and movement. Since AGRHYMET tools can be brought to scale, the institution has the advantage of being able to incorporate conflict monitoring in its existing systems at scale.

Hydromet services in the region currently lack sufficient reach to provide tailored information at the producer level. The most appropriate way for providing regular and reliable tailored services for the agriculture sector needs to be considered. There would be variation from country to country given various factors, including existing stakeholders and partners, legal and regulatory frameworks, and so on. One option is to consider how to broaden the scope of partnership including that with the private sector. Important prerequisites to enable such partnership include provision of reliable basic data from public sector and clarifying roles and responsibilities of public entities vis-à-vis the private sector. It should be highly encouraged to consider arrangements that allow more flexibility and to quickly develop market-responsive technologies that meet emerging needs of farmers. Further, information can be disseminated via multiple channels involving both newer and traditional channels such as apps, SMS, and radio. One example from Niger could be scaled up, where the Agriculture Chamber transforms AGRHYMET website bulletins into digestible messages for farmers and disseminated via radio. This calls for strengthening collaboration between institutions such as AGRHYMET and partners that are able to reach end-user farmers and pastoralists (including private sector organizations, NGOs, and farmer associations such as ROPPA).

Services for pastoralists are also needed. Pastoralists have limited access to relevant and available climate information data such as water points, availability of pastures, and flood risks, which can negatively impact animal health. The current system of availing of climate information website bulletins does not meet the needs of many potential users. Furthermore, with pastoralists' mobility restricted due to border closures and political conflict and terrorism in the region, communal conflicts between farmers and herders are rising. This calls for more pastoralist-targeted climate information advisory services to better support herders in choosing locations for livestock raising.

The national meteorological and other relevant agencies could improve their services by making their models more sophisticated. In general, it remains challenging for meteorological forecast models to accurately provide forecasts of the cropping season. Furthermore, many models are designed for large-scale homogenous cropping systems, which leads to suboptimal results in a region where small-scale mixed cropping systems are dominant. According to experts, the crop maps used by countries in the region for crop monitoring are outdated and too coarse-grained, lacking customization by agroecology. Likewise, MIS are not sufficiently accurate and spatially representative. One suggestion is to modify or develop customized models that cover the entire region with high resolution, quality satellite imagery. Generating quality information will increase demand for data in the decision-making process. A secondary concern is that national meteorological services charge fees to access their data, particularly for non-government entities. Contrary to current practice, making the data easily and freely available enables the creation of robust data ecosystems that allow for cross-fertilization of innovative products and services. Experts have also pointed out the potential to scale up a promising pilot initiative in Senegal, working on developing crop maps using machine learning.

BRINGING IN THE PRIVATE SECTOR TO ADD VALUE TO CLIMATE INFORMATION WITHIN AND BEYOND STATE-LED PUBLIC INFORMATION SERVICES AND EARLY WARNING SYSTEMS

Create a conducive environment for the private sector by fostering innovative and collaborative partnerships that maximize the value and potential of farmer-level information and advisory services. Given the need for highly effective systems to provide the variety of services within countries, championing the private sector is critical to revitalize data systems and increase accessibility of information at the national, subnational, and district levels. ESOKO, operating in Ghana, is one example, while another example from Mali involving cotton farmers and a private financial institution also highlights this point. When cotton producers requested tailored information services and advisory, the Mali Development Bank partnered with the meteorological agency to provide and disseminate the necessary climate information, including through sponsoring advisory information to be broadcast on national TV. This initiative involving the private sector to provide climate advisory services to farmers was well received when shared with partners at a regional donor meeting in Bamako. Removing barriers for private sector actors to easily access data collected at national level can help develop creative solutions (for example, while national agencies make data available to government actors and farmers' associations for free, private sector actors often have to pay a fee to access the same information) and modernize national and subnational hydromet systems to add value to already existing data.

Making early warning information available should not be the end goal; it is important to innovate to further add value to such information by collaborating with private sector actors and local service providers to supplement regional and national entities. Past investments in digitization and data-rich ecosystems were rarely built for long-term sustainability, adoption, or uptake by local private sector actors (financial institutions and commercial actors) connected to markets due to dependency on donor funds. These investments operated with the limited assumption that simply providing and disseminating general information (for example, plowing and sowing dates) is the end goal, cementing the reliance on one-off donor funding. However, substantial value is derived from a more long-term vision, such as creating relevant data ecosystems to monitor activities across the value chain and provide information to connect farmers with intermediate private actors (shifting focus to intermediate structures of decision-making). Through its Africa Hydromet Program launched in 2015, the World Bank has supported such local capacity building that can be rapidly deployed for decision support from local to national levels.

Apart from serving to improve on-farm decision-making, climate information could also be used to broaden access to credit and agricultural insurance. Recent technological advances in remote sensing and the Internet of Things (IoT) offer the potential to add value to climate information beyond improving advisory services for better on-farm decision-making. For example, creating a dense network of low-cost weather stations connected to the internet allows the creation of an industry-linked and granular IoT-enabled data ecosystem—an

approach pioneered by the firm Manobi in Senegal. By collecting fine-meshed weather (and by extension risk) information and data, financial institutions could develop better farmer risk profiles. This, in turn, could reduce the cost of credit and allow insurers to provide cheaper agricultural insurance premiums.

POTENTIAL REGIONAL FLAGSHIP INITIATIVES TO IMPROVE THE REGIONAL RISK MANAGEMENT ARCHITECTURE AND STRENGTHEN DECISION SUPPORT TOOLS AVAILABLE TO FARMERS

RFI #8 ENHANCE REGIONAL FOOD SECURITY RESERVE (RFSR)

TABLE 2.18 Regional Flagship Initiative #8

Type	**Investment**
Objective	**To improve the functioning of the RFSR through strengthening physical and financial instruments**
Context and rationale	After the 2008 food crisis, sharp price increases of imported food led to a drop of confidence in international markets and triggered efforts to create a three-tiered regional emergency reserve system consisting of local stocks, national-level stocks, and regional-level stocks whose mobilization is governed by the principle of subsidiarity. The RFSR aims to cushion temporary import difficulties and reduce reliance on international aid during food crises of regional extent while promoting regional production and regional solidarity. In 2013, the RFSR was adopted by ECOWAS, and an EU-funded support project has subsequently advanced its implementation. The implementation of the RFSR has made considerable progress over the past years, as demonstrated through its successful mobilization to supply vulnerable populations in Burkina Faso, Mali, Niger, and Nigeria during the 2020 food crisis. Overall, however, the RFSR is not yet fully functional for a variety of reasons, including a lack of financial resources and disparities between member states' national storage strategies.
Activities	(1) Establish viable and sustainable regional financing mechanism (2) Strengthen capacity of RFSR • Optimize location of physical stocks • Support partnerships with the private sector (millers, processors, and producers) • Support the implementation of harmonized national storage strategies in ECOWAS 15 members states • Raise capacity of member states in managing public food security stocks and engage cross-border coordination through sharing or lending stocks • Build linkages with safety net programs

Activities	(3) Strengthen local-level storage systems • Support training and capacity building to improve local storage management • Improve ties of local storage systems with value chains to improve food supply • Support strengthening staff capacity, governance, coordination, and monitoring of the regional food reserve
RFI coordination and potential partners	ECOWAS, CILSS, UEMOA, AFD, EU, other financial and technical partners
Past or existing initiatives with potential for collaboration	ECOWAS Food Security Storage Support Project in West Africa (EU-funded and AFD executed), Regional Agricultural Investment Plan (RAIP)
Knowledge gaps and areas for deep dive	Sustainable financing mechanisms of RFSR, best practices related to management of the physical reserve (losses, monitoring sanitary quality, associated costs, and so on)

RFI #9 LEVERAGE RAPID TECHNOLOGICAL CHANGE TO ACHIEVE NEAR REAL-TIME EWS

TABLE 2.19 Regional Flagship Initiative #9

Type	**Investment**
Objective	**Strengthen regional institutional capacity to provide climate and agriculture information services to manage risks, to ensure rapid early warning, and to catalyze the development and accountable delivery of digital climate and agriculture data, information, and advice to food system actors**
Context and rationale	West Africa and the Sahel region is one of the most fragile subregions globally and is highly vulnerable to climate variability. Climate variability is driving high levels of vulnerability of communities throughout the subregion, worsening food insecurity. The region incurs large losses annually due to various shocks in the form of production risks, market risks, and enabling environment risks. This highlights the need for robust risk management mechanisms in the region. While AGRHYMET's hydromet and climate information services are widely agreed to be a crucial element in tackling climate change and improving food security outcomes, the capacity to deliver and provide access to information remains severely constrained in the countries of the region. Strengthening region-wide EWS and climate advisory services hinges on i) improving of national-level data collection, and ii) the institutional capacity of the AGRHYMET Center - West Africa's key regional technical institution. In addition, there is a need to explore new avenues in developing and delivering effective and user-oriented EWS and climate information products, e.g. through increasing the involvement of the private sector and encouraging an open data paradigm.

Activities	(1) Improve data collection systems and enhance information/data sharing • Develop regional communication platform version 2.0 to streamline information chains across regional, national, and subnational levels • Upgrade the Cadre Harmonisé (CH), national meteorological and climate data by optimizing technical validation processes and improving engagement with national data systems • Digitize and streamline the production of information services, including through the application modern database management • Encourage national-level adoption of harmonized data collection methods to improve regional products including CH and weather /climate services • Explore adoption of open-data paradigm to facilitate development of innovative climate information and agriculture advisory products (2) Upgrade technical capacity of early warning and climate information services • Increase accuracy of seasonal forecasts; spatial resolution of cropping models and vulnerability data and the use of probabilistic forecasts • Strengthen the linkages between early warning and early action including early financing for emergency measures and adaptive social safety nets • Foster cross-boundary knowledge exchange related to EWS/Climate-information best practices (3) Strengthen institutional capacity • Revamp AGRHYMET operating model toward results-based orientation for delivery and value addition of data collected, including more systematically collected user feedback • Explore opportunities for public-private engagement to tap into private-sector expertise for developing more effective services • Assess lessons from ECOAGRIS to determine institutional settings for future work and to identify approaches to address current encountered in past actions • Increase collaboration with the West Africa Regional Climate Center and WMO technical programs (WCRP-WWRP, WIGOS, GFCS) • Provide support for graduate programs in food security and nutrition, climate change, and sustainable development to enhance the capacity of national technical services
RFI coordination and potential partners	CILSS/AGRHYMET; WMO, FAO Global Information and Early Warning System (GIEWS), WFP, USAID
Past or existing initiatives with potential for collaboration	Activities under this RFI would build on the significant investment, capacity development, and support in these areas provided by multiple partners over the last three decades, most notably by the OECD, EU, and European bilateral donors, AFD, and diverse technical partners including FAO, WFP, and FEWS NET. The RFI would continue to collaborate extensively with all active financial and technical partners in West Africa.

Knowledge gaps and areas for deep dives	• Financing models for EWS-initiatives reducing donor dependence • Feasibility of developing public-private delivery models involving private sector and bundling of climate, agricultural, and MIS • Assess collaboration opportunities between governments, donors, and technical actors in regional and national risk management • Detailed and spatially disaggregated assessment of latest WMO "wetter than normal" projections on the agriculture and food systems in the region (with considerations of the value chain logistics, infrastructure, social disruptions and displacements, and the risks of FCV) • Potential of open data paradigm, artificial intelligence solutions (AI) and big data in developing innovative EWS/climate information systems

RFI #10 INTEGRATED REGIONAL PEST AND DISEASE MONITORING SYSTEM BASED ON A ONE HEALTH APPROACH

TABLE 2.20 Regional Flagship Initiative #10

Type	**Investment**
Objective	**Enhance pest and disease monitoring and early warning technical capability by adopting a One Health approach[34]**
Context and rationale	Diverse plant pests and animal diseases, including zoonoses, do not respect borders. Collective action across sectors at the regional level represents the most effective means to address growing exposure to risks of outbreaks of diverse pests and diseases, many of which occur concurrently. With cross-border trade intensification and climate change effects, there is also an increase in biological invasions by crop pests and diseases hitherto unknown in the region and whose impact on food and cash crops is becoming more and more worrying. The recent COVID-19 pandemic, the fall armyworm invasion and the desert locust outbreak further highlight the need to focus efforts on preventative approaches for dealing with zoonotic diseases and transboundary pests. Based on its experience in pest management at the regional level and the established partnership, AGRHYMET can play a significant role in this regard in relationship with the two health related bodies of ECOWAS (West African Health Organization (WAHO) and the Regional Animal Health Center (RAHC).
Activities	• Upgrade to integrated national and regional monitoring capacities using innovative big data, AI, and geospatial approaches, which are not widely used in the region • Set up an integrated system for collecting, storing, and processing data and disseminating phytosanitary and zoonotic sanitary information • Conduct operation research to promote best practices and effective control methods preserving human and animal health and the environment

[34] The One Health approach consists of multisectoral collaboration, communication, and concerted action to mitigate or prevent health threats or challenges that emerge at the human-animal-environment interface.

Activities	• Operationalize and strengthen the regional harmonization of pesticides regulation and registration • Incorporate plant pests and animal diseases early warning in existing regional EWS • Adopt One Health approach management, including focus on zoonotic diseases and linkages to food safety and trade facilitation • Provide support for graduate programs in crop pest and disease control to enhance the capacity of national technical services
RFI coordination and potential partners	CILSS/AGRHYMET; FAO, WHO, CGIAR centers (ICIPE, CYMMIT, IITA), CIRAD
Past or existing initiatives with potential for collaboration	The RFI activities will build on the significant investment, capacity development, and support in these areas provided by multiple partners over the last three decades, most notably by the OECD, EU, and European bilateral donors, AFD, and diverse technical partners, including FAO, WHO, OIE, WFP, and FEWS NET. Programs include, for example, FAO Emergency Center for Transboundary Animal Diseases (ECTAD), FAO Pest Control Program, WHO, CGIAR ILRI One Health Institute WAHO, CGIAR centers (ICIPE, CYMMIT, IITA), and Global Locust Initiative (GLI) of Arizona State University.
Knowledge gaps and areas for deep dive	• Mapping of plant pests and animal diseases hotspots as well as assessment of past damages, losses, and economic costs of pests and disease infestation • Modeling future incidence of pest and disease shocks to West Africa's agrifood systems in relation to climate change, including focus on zoonotic risks and antimicrobial resistance (AMR), with the objective of ramping up preparedness capability • Monitoring of drivers for new, emerging, and reemerging risks within the agriculture sectors

RFI #11 ESTABLISH INNOVATIVE RISK FINANCING INSTRUMENT FOR FOOD CRISES

TABLE 2.21 Regional Flagship Initiative #11

Type	**Investment**
Objective	**Establish a regionally coordinated risk financing instrument for ex-post response interventions during agriculture and food security shocks in West Africa**
Context and rationale	Unlike other parts of the world, West Africa has not yet developed robust innovative mechanisms for timely risk financing in times of agriculture and food security shocks. Despite the presence of risk management initiatives in the region, a fully reliable financial instrument for responding to food security shocks that meets the different needs of the participating countries in the region has yet to be developed. In addition, there are no clear modalities for how regional risk management mechanisms (notably the RFSR) can collaborate with existing risk financing instruments including the African Risk Facility (ARC) to respond to shocks..

Activities	This will first require conducting analytical and scoping studies to assess innovative risk financing mechanisms used in other parts of Sub-Saharan Africa and throughout the world to identify potential opportunities for application in West Africa. (1) Develop food security responsive risk management and finance layering that considers the probability of occurrence and the intensity of different type of risks. (2) Assess feasibility of partnerships between risk management institutions and instruments, including the potential for collaboration between ARC and ECOWAS RFSR, with a focus on financial sustainability (3) Explore and implement virtual options for the RFSR. Instead of storing physical stocks, virtual options could include country commitments, or transfer instruments to mobilize funds for intervention in grain markets if needed.
RFI coordination and potential partners	ECOWAS; WFP, ARC initiative, FAO, AFD, AFRACA, USAID, and other non-African partners
Past or existing initiatives with potential for collaboration	Potential projects for collaboration include FSRP, ARC, and the AFD ECOWAS Strategic Food Reserve Project
Knowledge gaps and areas for deep dives	• Forward-looking analysis of diverse risks affecting the agrifood system in West Africa • Modelling impacts from the main production risk perils and correlating them with potential triggers such as measures of precipitation to define threshold values • Assess effectiveness of current efforts to mitigate risks • Review evaluations of other risk management instruments used in other regions of the world

PROPOSED TECHNICAL WORK TO CLOSE KNOWLEDGE GAPS OF THE IDENTIFIED RFIS

The West Africa Food System Resilience Facility (FSRF)[35] will support ECOWAS, CILSS, and CORAF in the further prioritization, development, and operationalization of RFIs in the context of regional programs that are currently under preparation. As in the two other priority intervention areas, prioritization of RFIs is ongoing. Several activities proposed by RFI #8, RFI#9 and #11 are currently being considered for implementation in the context of FSRP. Various aspects of RFI #10 will be implemented through FSRP and PRAPS II. To fill knowledge gaps and facilitate future implementation of the prioritized RFIs, FSRF will commission additional analytical work (deep dives).

Table 2.22 (below) provides an overview of the analytical work proposed under FSRF to further develop the RFIs related to the

[35] Please see also executive summary for more information on FSRF.

priority intervention area of Regional Risk Management Architecture and Farmer Decision Support Tools. Regarding RFI#8, a detailed study financed by the European Commission (See Galtier 2019) has already been completed. In addition, recently launched technical work on the regional risk architecture will inform RFI #8 by exploring supplementary financing options in support of the RFSR. To refine RFI #9 and generate relevant insights for designing impactful climate information system-related interventions under FSRP, detailed analytical work on digital climate information and agriculture advisory delivery mechanisms is currently under preparation. RFI #10 covering regional pest and disease monitoring will benefit from findings which will result from the two above-mentioned pieces on regional risk architecture and agriculture advisory delivery mechanisms. Moreover, strengthening regional pest and disease monitoring systems will be pursued under regional programs which are currently under preparation, including PRAPS II and the CGIAR 2DI Initiative. Knowledge gaps related to RFI #11 (Establish innovative risk financing instruments for food crisis) will be addressed by corresponding technical work on regional risk architecture and financing mechanisms.

TABLE 2.22 RFIs Relating to Priority Intervention Area III and Proposed Technical Work

RFI #	RELEVANCE AT REGIONAL LEVEL	POTENTIAL PROGRAMS FOR IMPLEMENTATION	PROPOSED TECHNICAL DEEP DIVES TO ADDRESS KNOWLEDGE GAPS
#8 Enhance regional food reserve system	Regional food reserve may lead to economies of scale and higher regional capacity to avert food crises	ECOWAS Strategic Food Reserve Project	Regional Risk Management Architecture and Financing Mechanisms for food system reserves, assess storage and buffer capacity
#9 Leverage rapid technological change to achieve near real-time EWS	Effective regional climate information systems require harmonized data collection and pooling of resources across country borders	FSRP, AICCRA	Digital Climate Information and Agriculture Advisory Delivery Mechanisms
#10 Regional pest- and disease-monitoring systems based on a One Health approach	Zoonotic diseases such as COVID-19 and pests (for example, locusts) pose important transboundary risks	CGIAR 2 DI, PRAPS II, FSRP	Regional Risk Architecture Financing Mechanisms and Digital Climate Information and Agriculture Advisory Delivery Mechanisms
#11 Establish innovative risk financing instruments for food crisis	West Africa is lacking mechanisms for pooled risk financing which affects systemic resilience to severe shocks	ARC, ECOWAS Strategic Food Reserve Project, FSRP	Regional Risk Architecture and Financing Mechanisms

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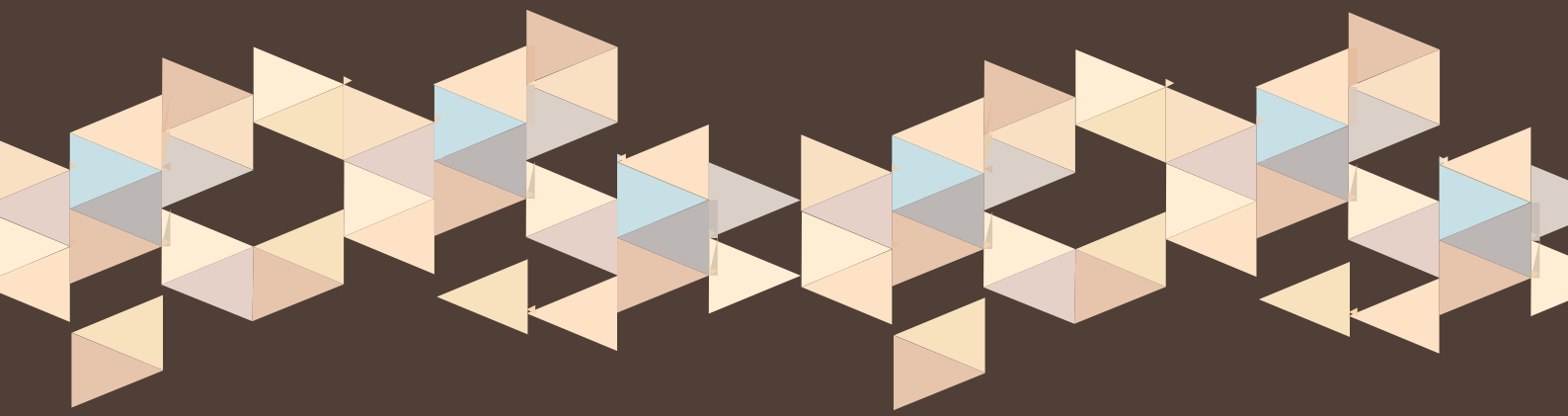

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