CCAFS Deep Dive Assessment of Climate-Smart Agriculture (CSA) in the Feed the Future Portfolio in Senegal

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1. Objective

The Climate Change, Agriculture and Food Security (CCAFS) program of the CGIAR system is working with USAID to identify opportunities for mainstreaming Climate Smart Agriculture (CSA) in its Feed the Future portfolio. While climate has always been a cross-cutting theme in Feed the Future, BFS is now interested in framing this cross cutting theme as CSA.

CSA is an integrative approach that aims to support efforts from the local to global levels for sustainably using agricultural systems to achieve food and nutrition security for all people at all times, integrating necessary adaptation and capturing potential mitigation (Lipper et al. 2014). It addresses the linked challenges of climate change and food security and refers to an improved agricultural system that is developed and implemented with three main objectives:

1. Sustainably increasing agricultural productivity and incomes;
2. Adapting and building resilience to climate change; and
3. Reducing and/or removing greenhouse gas emissions, where appropriate.

As part of a global effort that will inform how Feed the Future tracks CSA across the 19 focus countries (plus aligned) the CCAFS and USAID/BFS team selected 5 to carry out a deeper analysis of their portfolio. In July 2015, CCAFS' visit to the USAID Senegal mission provided an opportunity to identify and discuss CSA-related activities within the country and the USAID zone of influence (ZOI) highlighting the importance of addressing the effects of climate change in the agricultural sector and the current and potential benefits of Feed the Future's presence for climate resilience. The visit included meetings with USAID Mission staff, Feed the Future implementing partners, and three government agencies. The process also included the review of Feed the Future strategy and project documents, as well as a limited external literature review. This report outlines the key findings of the visit and highlights some ways in which CSA approaches can be further incorporated into the Mission's future programming.

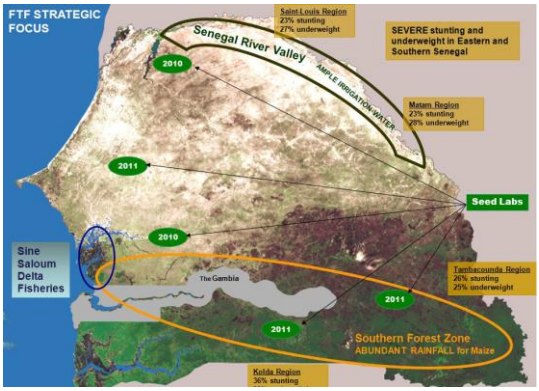

***Figure 1**. Feed the future zone of influence*

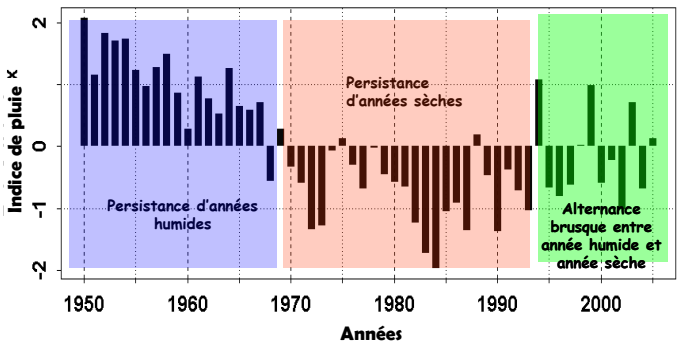

Figure 2. Rainfall Index evolution (provided by Senegalese Ministry of Agriculture and Rural Equipment. Original citation non available)

2. Senegalese Context

Covering 12% of the territory and employing 70% of the population[1], agriculture is a major

[1] Oxford business Group. The Report: Senegal 2009

contributor to Senegal's national economy and food. It contributes to 17% of the GDP[2] and absorbs ca. 1/10th of public investments[3].

A. Risk and Vulnerability

The country is characterized by a rainfall gradient ranging from as little as 300-500 mm in the north to 1,000-1,200mm in the south, making the essentially rain fed crop production (94%) already highly vulnerable and risky in much of the country. In addition to a diverse and complex range of agro-ecological (poor soils, water management, salinization soils, deforestation, variability of rainfall, erosion soils, underperforming and non-adapted technologies) and socio-economical (low intensification potential, low yields, and incomes of farmers) challenges, agriculture is highly vulnerable to climate related risks as it is by nature strongly exposed to the characterized high inter annual and inter-decadal Sahelian rainfall variability, which can make long-term trends difficult to identify (Figure 2).

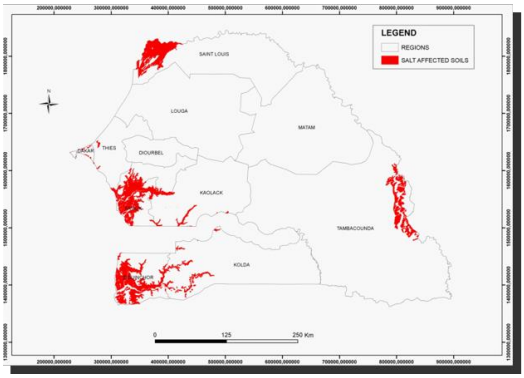

Figure 3: Salt-affected areas (Provided by ERA)

While the droughts of the 1970s and 1980s were devastating for farmers and livestock herders, the current pattern of unpredictability within and between seasons makes it especially difficult for farmers and the Government of Senegal to plan their activities and develop effective adaptation strategies. Currently, high variability and marginal rainfall levels for crop production, prolonged droughts and extreme temperatures; delayed onset and dry spells during rainy season; floods (as a result of heavy rainfall events); sea-level rise (which exacerbates the problem of saltwater intrusion and land salinization (Figure 3) and coastal erosion are having an impact on the crop, livestock and fisheries sectors and posing the greatest threat to the country's development goals (WorldBank, Senegal dashboard).

"In Senegal, hypersalinity occurs upstream in tidal estuaries with salinization of groundwater in shallow aquifers up to 200 km inland. Recent studies on several aquifers (Senegal River Delta System, North Coast Littoral, Saloum Delta and the Casamance Delta) reveal high sensitivities to climate variability and climate change". And up to 1 700 000 Ha affected.

Mean annual temperatures have increased by 0.9°C since 1960, an average rate of 0.20°C per decade and are projected to increase for the foreseeable future (by 1.1 to 3.1°C by the 2060s, and 1.7 to 4.9°C by the 2090s), with projected rates of warming faster in the interior than in those areas closer to the coast. Rainfall variability is also likely to continue, with an increase in severe weather events. All these trends will have implications for the country's surface and groundwater resources. While the precise course and pace of climate change in Senegal cannot be predicted, the evidence for deteriorating conditions is strong,

[2] World Bank, 2015: http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

[3] Comprehensive Africa Agriculture Development Programme (CAADP): https://www.africaportal.org/dspace/articles/analyse-du-plan-national-dinvestissement-dans-le-secteur-agricole-du-senegal

and prudence dictates that the implications for the national economy and food and nutrition security be taken very seriously.

- *Cultivated areas of millet, maize, sorghum and peanut have decreased in the last years (important decreases in Millet related to its photoperiodism sensitivity) and are been substituted by shorter cycles crops such as: niebe, millet, peanut, watermelon (mainly in the peanut basin) and cassava (drought- resistant).*
- *The peanut cultivation area is moving southwards due to the occurrence of strong rains, salinization and erosion.*
- *Livestock is also moving from the north to the center of the country.*

Souce: MADR Presentation and Interview, July 2015

B. Government Agricultural Strategy and Policy

The Government of Senegal and other key stakeholders acknowledge that a major issue in the country is that despite the existence of an enabling policy framework (National Adaptation Plan, 2006) and the specific mandate of the National Committee on Climate Change (COMNACC) hosted by the Ministry of Environment and created by law in 2011, there is a lack of effective concerted planning of the climate change efforts.. Since 2012, efforts on this direction have been initiated by the multi-stakeholders/multisectoral National Science-Policy Dialogue platform for Climate Change Adaptation and Food Security (CCASA) coordinated by the Direction de Agriculture, acting as the agricultural arm of the COMNACC..

While some guiding strategic documents touching on agriculture and food security did not fully account for climate change impacts (e.g. National Agricultural Investment Plan (NAIP) launched by the Government of Senegal in 2011), more recent policy instruments clearly integrate climate into policies. This is the case of the *Programme de Relance et d'Accélération de la Cadence de l'Agriculture Sénégalaise* (PRACAS plan), agricultural component of the current government's guiding long-term vision known as Plan Senegal Emergent (PSE) developed in 2014. PRACAS plan aimed to profitable, competitive and sustainable agriculture, not only explicitly addresses climate risks, with a particular emphasis on water management as highlighted in the quote above, but also incorporates a number of adaptation strategies, including:

- ✓ In rainfed areas, adopting varieties adapted to climate variability and promoting practices that economize water;
- ✓ In irrigated areas, adopting short cycle and cold tolerant varieties
- ✓ Making use of the meteorological services to anticipate changes in rainfall patterns by agro-ecological zone and taking necessary measures regarding planting dates, crop and variety selection, etc.;
- ✓ Operationalizing early warning systems for floods based on rainfall forecasts and taking urgent actions to protect cultivated areas;
- ✓ Close follow-up on agricultural practices related to fertilization and use of pesticides for improved adaptation;
- ✓ Promoting index-based agricultural insurance for climate risk transfer

Similarly, interviews with key staff from the Ministry of Agriculture highlighted the progress made over the last years towards more proactively addressing climate variability through the use of seasonal forecast and timely provision of agricultural and crop management recommendations at the beginning of the

growing season; contrasting with the ex-post food emergency measures usually taken in the past to mitigate crop failure and food insecurity.

The next two years represent an important window of opportunity for Senegal to align its agriculture sector, and broader national development strategies, with a more climate-smart path. At global, continental and regional levels, the CSA "movement" is starting to gain momentum. At the same time, the push for a new global climate deal in Paris in late 2015 through the UNFCCC process is well underway, including some progress in the standing up and resourcing of new climate change adaptation funding mechanisms, such as the Green Climate Fund[4] (GCF). Coming out of the June 2015 West Africa Climate-Smart Agriculture Conference in Bamako, ECOWAS has committed to updating its regional agricultural development program (ECOWAP) by the end of the year to reflect the latest thinking on CSA. The new regional strategy will then serve as a basis for member states, including Senegal, to update their national agriculture investment plans (NAIPs) to make them climate-smart and to guide government and donor investments in the sector accordingly. In parallel, work is just getting underway at a sectoral level, including agriculture, fisheries and livestock, to develop Senegal's National Adaptation Plan (NAP), a process that is likely to take 2-3 years to complete. The importance of the new NAIP and NAP should not be under-estimated, and ongoing efforts could be strengthened to further include the evidence, lessons learnt and recommendations that come out of the Feed the Future projects and implementing partners to influence and facilitate future investments in CSA and climate change adaptation more broadly.

Finally, it should be noted that the Government of Senegal's engagement with CSA and broader response to climate change is challenged by the fragmented and siloed nature of the ministries (crop production – *Ministère de l'agriculture et de L'Equipement Rural*; fisheries - *Ministère de l'Economie maritime-* , livestock – *Ministère de Lélevage et des Productions Animales*; and water – *Ministère de L'Hydraulique)*, lack of budgetary resources/CSA funding streams and capacity of coordination mechanisms where the overall leadership for the country's climate change adaptation and mitigation efforts rests with the Ministry of the Environment.

3. Climate Smart Agriculture and USAID Senegal Feed the Future Strategy and Portfolio

Feed the Future works with partners to help local communities in Senegal increase productivity, incomes and nutritional status in a country where more than two-thirds of the population rely on agriculture for their livelihoods and nearly half of the population lives in poverty.[5] Feed the Future's efforts in Senegal focus on five areas of intervention in order to increase incomes and improve nutritional status: agriculture-driven economic growth (productivity increases through a value chain approach and promotion of sound land management); household behaviors that promote optimal nutrition; enhanced policy implementation; strengthened rural infrastructure and access to finance; and increased human resources and institutional capacity (agriculture and health sectors). USAID/Senegal's agricultural interventions have prioritized four key value chains: rice; maize; millet; and fisheries.

[4] Climate-smart agriculture is one of the prioritized program areas for funding. In Senegal, the Centre de Suivi Environmentale (CSE) is an accredited implementing partner.
[5] Per the World Bank, Senegal's poverty headcount ratio in 2011 was 46.7%. Source: http://data.worldbank.org/country/senegal

"The overall hypothesis is that if agricultural productivity is improved, if private sector trade is increased, if the management of natural resources and the ability to adapt to climate change are increased and if the nutritional status of women and children is improved then local populations will be more food secure and play a larger role in an expanding economy. Intermediate Result 3 specifically addressed increased Resilience of targeted communities and systems"
USAID Senegal Country Development Cooperation Strategy 2012-2016 (last version)

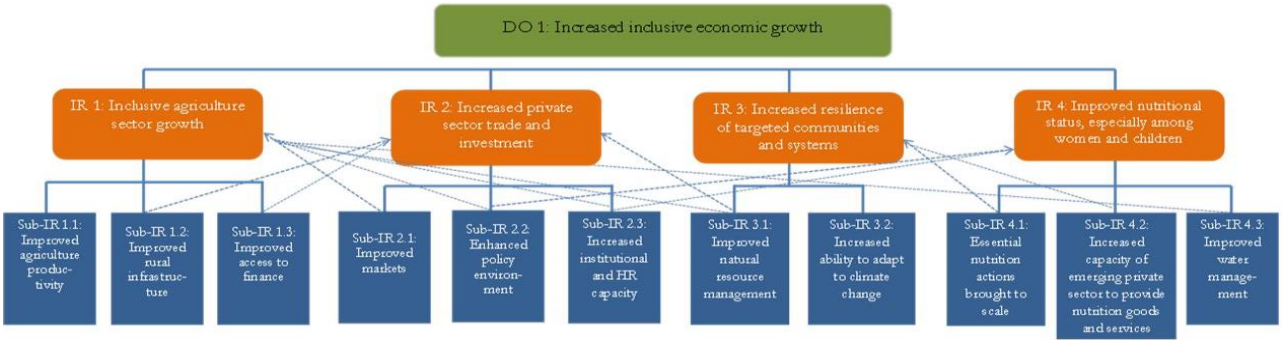

Figure 4: Results Framework for USAID Senegal Development Objective 1: Inclusive Economic Growth

The above hypothesis underlies the results framework for USAID's inclusive economic growth strategy in Senegal, of which climate change adaptation is described as a "core aspect,"[6] as a result of the fact that "[t]he recurring incidence of extreme weather, such as irregular rainfall or potential drought increases both farming business and food security risks." As a result, "increased ability to adapt to climate change" is one of two results areas identified under the improved natural resources management intermediate result, as can be seen in Figure 4 above.

Although climate change has been a strong cross-cutting theme since the development of the Feed the Future strategy in Senegal in 2010, conversations with both USAID staff and implementing partners reveal a continuing evolution of the approach to agriculture, based on a range of considerations, including Government priorities (e.g. to emphasize rice self-sufficiency), testing and refining intervention packages, and continuing assessment of the implications for agriculture and food security of climate variability and change. An interview with senior USAID foreign service nationals described how
USAID Sénégal's engagement in the agricultural sector since the inception of the Feed the Future program has matured from laying the groundwork for a commercial value chain approach to now having the capacity to incorporate a larger range of diverse activities.

The section below provides a summary of the Feed the Future portfolio in Senegal with respect to CSA objectives and discusses current perceptions of CSA. A variety of efforts help agriculture adapt to a changing climate. These are categorized into three general approaches:

Approach 1: Farm technologies & practices. Development, dissemination and management activities that contribute to CSA outcomes, namely adaptation, mitigation and productivity/income generation;
Approach 2: Incentive mechanisms through improved performance of value chains, financial mechanisms, performance compensation, capacity building, data collection and analysis,

[6] USAID Senegal Country Development Cooperation Strategy 2012-2016

enhanced governance or other means that promote adoption of climate smart technologies and practices;

Approach 3: Multi-institutional participation and planning that foster integration and coordination of efforts across economic sectors (agriculture, forestry, fisheries, transportation, environment, and finance) at multiple political levels (community-based organizations (CBOs), producer organizations, businesses, agencies - national and international).[7]

A. Farm Technologies and Practices

An initial identification of CSA-related projects[8], which emphasizes **farm technologies and practices** within the current Feed the Future portfolio, is summarized in the Table below. Included are brief descriptions of the CSA relevant activities and associated types of CSA benefits (productivity & income, adaptation, mitigation). Further suggestions on CSA entry points and opportunities to be explored are highlighted later in this report.

Table1. CSA-relevant technologies and practices in projects and associated benefits

Feed the Future Project	CSA-relevant activities or potential	Sustainable productivity benefits	Adaptation benefits	Mitigation Benefits
Education and Research in Agriculture (ERA)	Strengthening institutional capacity in agricultural education, training and outreach assistance; Research on adapted varieties of upland rice (short-cycle, salt-tolerant); research on drought-tolerant millet; research on reclamation of saline agricultural soils; Implementation of a range of water management activities to reclaim degraded land and reduce saltwater intrusion.	Improved education of agriculture professionals, research on climate-adapted varieties of rice and millet, and strategies for reclaiming saline soils can all contribute to closing the yield gap.	Short-cycle and saline-tolerant crop varieties, along with improved water management, and soil amendments will better enable farmers to adapt to changing rainfall patterns.	Improved techniques for reclaiming large tracts of degraded lands could reduce pressure to open new land for cultivating.

[7] Example components of an enabling environment that facilitate CSA outcomes include climate information services, programmatic support for improved risk management, safety nets, or national policy frameworks such as national adaptation plans, NAMAs, etc.

[8] This matrix is represents only a very partial analysis of the CSA implications of the current Feed the Future portfolio in Senegal, but is indicative of the sort of more thorough analysis that might be undertaken by USAID as a next step to the initial "deep dive."

Feed the Future Senegal Yaajeende	"Zero-Risk" Package of Conservation Agriculture Practices (main components: land preparation services with tractor-pulled rippers; short-cycle seed variety selection; use of compost and manure; fertilizer micro-dosing; and crop insurance); Increased access to inputs through Community-Based Service Providers (CBSP); Crop and livestock diversification; Flood recession agriculture.	Pilot phase of "Zero-Risk Model resulted in more than three to four-fold increase of yields of sorghum and millet over baseline from use of tractor pulled-rippers (coping strategy against dry spells), short-cycle bio-fortified varieties, fertilizer micro-dosing, and increased soil organic matter.	Increased soil organic matter through use of compost and manure organic, adoption of short-cycle varieties, and transition from rainfed to flood recession agriculture in arid zones all have potential to increase resilience (possibility of 2d growing season); horticulture gardening; Pass on the Gift (Asset building); Diversification of herds	In addition to enhancing soil organic matter; minimum tillage, avoidance of residues burning, the project has also promoted the incorporation of agro-forestry and fruit tree species in local farming systems as well as intercropping.
Feed the Future Senegal Naatal Mbay	Introduction of organic manure; Promotion of good agronomic practices in cereal value chains and best practices to economize water; farmer-managed databases; integrated credit-contract growing-crop insurance package; selection of seed varieties best suited to evolving climate conditions; collection of local weather data	Production and incomes increased through application of good agronomic practices, access to credit and fertilizer, participatory seed variety selection (drought resistant rice varieties), market aggregation and linkages, mechanization, and reduced post-harvest losses.	Building adaptive capacity of farmer networks and associations to provide services to their members and make informed decisions based on self-managed database (incl. rainfall data to combine with local knowledge). Crop insurance for improving risk management.	Significant post-harvest loss reductions and more efficient fertilizer application due to better estimation of land; introduction of minimum tillage, manure organic, agrofo-restry and silvo-pasture introduced (lack of biomass, mulching not able)

Collaborative Management for Sustainable Fisheries Future in Senegal (COMFISH)	Improvement of individual and institutional capacity for ecosystem management, strategies, policies and good practices; Technical studies on impacts of CC on fisheries; community-based vulnerability assessments and adaptation plans; improved access to weather information, diversification of livelihoods (processing, agriculture, aquaculture); support to fisheries component of National Adaptation Plan; national platform of weather warning system (free sms to fishermen).	Focus is on increasing resilience of coastal ecosystems and communities; sustainable fisheries practices and increasing socio-economical incomes (e.g. through processing and marketing).	Improved local governance through community-based adaptation plans, sustainable fishing practices, improved access to weather information, and livelihoods diversification (aquaculture) to increase resilience of HHs dependent on coastal fishing resources.	
Rural Resilience Initiative (R4)	Four integrated risk management strategies: risk reduction (asset creation); risk transfer through weather insurance; risk reserves through savings mobilization; prudent risk-taking and livelihood diversification (through credit)	Promotion of risk reducing activities: building stone bunds to prevent soil erosion, dredging and removing sand; Preserving natural resources e.g. through reforestation; Improving water management by building small dikes, and embankments; Diversifying livelihoods by initiating communal gardening activities; Creation and maintenance of nurseries for vetiver plants, compost pit making, and creation of vegetable gardens. Project seems to largely rely on linkages to other (USAID -Nataal Mbay and Yajeende IFAD projects: PAFA and PADAER)and BAD projects (PASA LOUMAKAF and PAPIL) for interventions aimed at increasing agricultural productivity sustainably.	As its name implies, the focus of this project is on a package of resilience-building activities, including access to savings, credit and rain index insurance. Diversification, horticultural gardening and livestock are also promoted.	By reducing risk and expanding investment horizons, there is potential for households to diversify, including into perennials that could offer mitigation gains

B. Incentive Mechanisms

Achieving widespread practice of CSA requires adequate incentives to make changes. This sub-section describes how Feed the Future projects provide four types of incentives that foster transformative processes: (i) improved performance of value chains, (ii) financial mechanisms, business skills and governance, (iii) data collection and analysis, and (iv) enhanced reach of communications.

(i) Value chain performance and mechanization

In addition the projects that emphasize input technologies and production practices highlighted above, three projects contain additional efforts that improve the production performance (including mechanization) valorization of products and farmer participation in post-harvest and marketing links of value chains. One is the **Naatal Mbay** project that aims to improve productivity through linking farmers to markets, increasing efficiencies across specific agricultural value chains (rain-fed and irrigated rice; maize and millet) and improving quality of products while consolidating smallholder producers. Focused on scaling-up proven technologies and approaches, the project ensures agronomical follow up from the planning to the marketing stages, leading to quality-certified products and reductions in post-harvest losses of more than 50%. It supports the efforts from seed producer associations involved in certified seed production and builds on research institutes and government technical offices (e.g ISRA and other research institutes) in charge of fundamental breeding processes.

The second is the nutrition-led **Yaajeende** project that aims to accelerate participation of the ultra-poor in local markets through private sector-led improvements in the provision of nutritious foods and demand creation. Its interventions include the scaling-up production and utilization of bio-fortified crops (such as orange sweet potato with vitamin A, iron bio-fortified millet, and zinc bio-fortified beans) promoted by a trained network of entrepreneurs that distribute these technologies on a commission basis; supporting 1000 Ha of commercial horticultural gardening which is becoming a year-round activity (through manual irrigation practices). Finally, the **COMFISH** project analyzed the *Sardinella* value chain and addresses improvement of female artisanal processing facilities to increase economic benefits and improve resilience. It is important to highlight that the interventions of these three projects include mechanization aspects: Naatal Mbay supports access to tractors though a credit-leasing system as well as to small mechanized post-harvest machines for women. Yaajeende's "Zero Risk" package and service provision model has successfully promoted the use of tractor-pulled rippers to improve water infiltration, a successful coping strategy against dry spells that has increased crop survival by more than 15 days in clayey soils and allowed diversification. Partial adoption rates, however, highlight remaining challenges related to a lack of competency, availability of tractors and return on investment (cost efficiency) at the farmer level. To another extent, COMFISH is supporting women's committees to improve artisanal techniques used for transformation, sustainable management, and marketing/labeling of fisheries products. At the Government level, the PSE plan through PRACAS and reflect the strategic place given to support mechanization.

(ii) Financial mechanisms and governance

The Government of Senegal is putting an emphasis on insurance as a risk management/transfer mechanism for farmers, and many such initiatives are underway, including in several projects in the Feed the Future portfolio that foster a variety support mechanisms, both community and externally managed, that facilitate the adoption of CSA practices. Four examples are highlighted:

Nataal Mbay's increased focus on climate change adaptation complements FTF's focus to scale up impacts by adding an element of long-term sustainability to Senegal's food security model[9]. Its interventions also focus on expanding access of small farmers to critical financial services including credit, equipment leasing, seasonal financing, and warehouse collateral. An innovation of the project is to package insurance with credit and market linkages (contract farming). The project is also partnering with private firms, farmer groups, and banks to invest in a grain-storage cost-share and with national institutions to develop both conventional (loss assessment-based) and index-based insurance products for irrigated and rainfed production zones. A successful extension/ technology outreach model is based on the consolidation of a network of farmers (each with 300 to 1000 producers) trained and involved with a lead farmer in the development and (agronomical and climatic) monitoring of the trial demo plots.

Yaajeende's success story behind the high adoption rates of new technologies promoted lies on the institutions created and strengthened by the project. The network of Community-Based Service Providers (CBSP) increased not only the supply of nutritious foods, low-cost water filtration and sanitation technologies, use of short-cycle seeds and quality agricultural inputs, but also provide access to rain-indexed insurance and credit/financing for off-farm income-generating activities, such as artisanal fortification of local cereals & salt iodization. CBSPs revenues have grown far beyond expectations and reached just shy of 1 million dollars in product/serve sales in Year 4. A key product designed by the project the "Risk Zero" package -a 400% increase over Year 3- resulted in an unprecedented $250,000 of private financing for smallholder rain-fed agriculture as well as greatly boosting subscriptions to crop insurance. Beyond this success, the project learned important lessons from an unsuccessful attempt for scaling up too rapidly and linked to a lack of competent/trained people, availability of tractors and certified seeds.

Rural Resilience Initiative (R4) implemented by UN World Food Programme (WFP) and Oxfam America in strategic partnership with the National Agricultural Insurance Company (CNAAS), encourages farmers to implement *risk reduction* to receive food assistance, either in food or food coupons in exchange for their labor. By working additional days, they can access insurance. Food assistance is supporting communities during the lean season, when the food gap is most severe and assets built increase communities' resilience by improving the productivity of rain-fed rice and starting up vegetable food production for self-consumption. Insurance complements the risk reduction strategy, by protecting farmers' investments. The *risk reserves* component of R4 which builds on the *Saving for Change* program is supporting local savings and credit activities through group participation and leadership, promoting income generating activities. The *prudent risk taking* component of the program is connecting village-level cereal banks to inventory credit schemes and local microfinance institutions (MFIs). This system, called warrantage, enables farmers to take out low interest rate loans using their cereal stocks as collateral. By using savings and surplus cereal production as collateral, households can invest in remunerative enterprises, including improved seeds and fertilizers, to increase their agricultural productivity.

Another example is provided by the **COMFISH** project that is supporting the Government to reform the country's fisheries sector to sustain productivity and enhance the participation of artisanal fishermen and women in the artisanal fishery value chains. The project is strengthening institutional capacity at all levels of governance (from local Artisanal Fisheries Councils to National level platform on weather warning systems), providing them with tools to be self-reliant so that they are better able to co-manage the fisheries and enforce rules and regulations to decrease overfishing. Activities include the elaboration of participatory local adaptation plans, the implementation of the Fisheries and Aquaculture Sector Policy Letter and the development of a national adaptation and sectorial strategy that integrates climate change.

[9] "One of USAID/PCE's objectives is to promote the integration of financing within a broader value chain strengthening approach that supports production, risk management, marketing, and building management capacities. It is within this context that the USAID/PCE project has sought to develop and expand agricultural risk transfer mechanisms, particularly for agricultural credit." For more details, see "Agricultural Insurance for Cereal Value Chains: Integrating Conventional and Index-Based Insurance Models into Value Chain Strengthening Activities in Senegal, April 2015.

(iii) Data collection and analysis

Besides the M&E efforts of all the projects, the portfolio contained two highlight efforts on data collection and analysis. At the center of **Naatal Mbay's** efforts to build adaptive capacity are the databases the project has developed (covering farming activities, technology adoption, plot areas, quality control, rainfall) that are now being managed by local farmer organization to make informed decisions about what to plant and when, taking into account locally gathered weather data. The centralized database is informing the regional extension offices (DRDR) and the national statistics agency (DAPSA) regarding CSA-related decisions, including that of the most promising varieties of rainfed rice for local conditions. At another level, the **baseline study** implemented at the end of 2014 by the Université Gaston Berger aiming to allow the future impact of the FTF portfolio constitutes, despite the very limited inclusion of climate related vulnerability aspects, a valuable effort to address the effects of the different range of interventions on vulnerability, food security, child nutrition, women autonomy, farmers organization, environmental status. It covers the Yaajeendé (agriculture component), Comfish (fisheries component) Wula Nafa (forestry), ERA (education and research) and PCE projects (economic growth program); 13 regions and 250 villages (120 are beneficiaries of the programme and 130 are « controls » - with similar characteristics at the beginning but non beneficiaries).

(vi) Communication

In addition to personal communication via extensionists and local project leaders, broader audiences are being reached with free *sms* messages and through community radio (COMFISH). However, there is much room for improvement in the use of these ICT channels.

C. Multi-Institutional Participation and Planning

Multi-institutional participation and planning also occurs in communities. Although many projects work with individual farmers and households, collective action is needed to achieve behavioral changes with respect to reducing crop residue burning, livestock management and forest use. **Naatal Mbay and COMFISH** interventions have a very strong component focused on building the capacity of local communities and farmer organizations to make informed decisions to manage risk, which is important to increase resilience in crop, livestock and fisheries systems. They include: consolidation of a network of farmers, training network of entrepreneurs, work with local Artisanal Fisheries Councils and supporting the multi-stakeholder national level platform focused on the development of fisheries management and community-based climate change adaptation strategies.

4. Discussion and Recommendations

This section provide a commentary on current perception on CSA, highlight comments that arose during conversations with implementing partners, and documents future opportunities and challenges for Feed the Future programming in Senegal.

Highlight comments

- From the inception of the Feed the Future Program in Senegal, climate change has been a strong cross-cutting theme in USAID Mission's economic growth strategy as reflected in its results framework;
- USAID Senegal's engagement in the agricultural sector since the inception of the Feed the Future program has evolved from a narrow commercial value chain approach to a more diversified and holistic approach.

A. Emerging Messages

Current perceptions of CSA

- The current Feed the Future Senegal portfolio has many CSA elements, particularly as regards the pillars of sustainable increases in productivity and increase resilience/adaptive capacity. This was apparent in discussions with both USAID Senegal staff and implementing partners when the assessment team was questioned on its use of the term "CSA entry points." From the USAID mission perspective, they are well past the phase of "entry points" and, instead, looking to broaden and deepen their work on sustainable agriculture under climate change and take promising practices to scale.
- However, if activities in the portfolio definitively include the climate component there is not full awareness of the meaning and potentials of the systemic Climate-Smart approach among most of the implementing partners.

Government

- The Government of Senegal's awareness of and engagement in climate-smart agriculture (CSA) is growing, and that is increasingly reflected in new programs and strategies, such as the Plan Senegal Emergent (PSE) thought the Program for the Acceleration of Senegalese Agriculture (PRACAS);
- More efficient concerted (and inter-sectorial) planning is required under the leadership of the National Committee on Climate Change (COMNACC) to articulate current climate change related efforts and capitalize on the favorable institutional and policy frameworks in place.

B. Future opportunities & challenges

Government Policy and Strategy

CSA has yet to be fully integrated into Government of Senegal plans, strategies and budgets at the national level, however important opportunities exist over the coming years. Of particular importance are the updating of the country's National Agriculture Investment Plan (NAIP), the development of the National Adaptation Plan (NAP), and engagement in the ECOWAS-led West Africa Climate Smart Agriculture Alliance.

Feed the Future support

Numerous avenues are available for USAID and its implementing partners to support these processes. At least one Feed the Future Project, **COMFISH**, is already engaged in supporting the Government to develop the fisheries component of the NAP.

Given the low level of coordination in the Government of Senegal on issues related to climate change, agriculture and food security, USAID should use its influence to strengthen existing coordination mechanisms related to CSA (National Science-Policy Dialogue Platform for Climate Change Adaptation in Agriculture and Food security— Plateforme CCASA Senegal) and climate change adaptation more broadly (National Climate Change Commission— COMNACC). It is also worth pointing out that a new Feed the Future project focused on policy, **Feed the Future Senegal Agricultural Policy Support Program** (Programme d'Appui aux Politiques Agricoles - in French)[10]**,** has recently been approved and should add significantly to the opportunities for USAID Feed the Future efforts to enhance the enabling environment

[10] Documentation on this new project was not reviewed as part of the current assessment.

for CSA in Senegal.

Program prioritization considerations[11]

- *Value Chain Selection*

Priority Feed the Future value chains (VCs) in Senegal are rice, maize, millet and fisheries. The Yaajeende project incorporates a much more diverse mix of crops and livestock by virtue of its focus on nutrition outcomes. A more rigorous **application of the climate-smart lens** to the selection of VCs in the future might lead to consideration of including new VCs (e.g. small livestock, cowpea) and call into question the long-term suitability of others (e.g. maize) in the Senegal context. A sharper focus on women's empowerment and nutrition might lead to greater emphasis on other VCs (vegetables, OFSP, small livestock).[12]

- *Variety Selection and Quality Seeds*

The **availability of high quality seeds** of varieties best adapted to current and future growing conditions is critical to CSA, and this has been a significant component of multiple Feed the Future projects in Senegal (ERA, Naatal Mbay, Yaajeende), as regards both research and extension. Such efforts should continue. Rising temperatures, rainfall variability and salinization will put a premium on the development of a national seed system to produce and disseminate drought-tolerant, heat-tolerant, and salt-tolerant short-cycle varieties of major crops.

- *Sound Land Management Practices*

Low and variable rainfall and fragile soils dictate that any agriculture intervention in Senegal put "sound land management" at the center of its approach. Both the Yaajende and Naatal Mbay projects thus promote a range of sustainable land management practices, including conservation agriculture (CA) and agro-forestry systems. Upon deeper exploration, the systems of CA being promoted by neither project incorporate the three pillar approaches of minimal tillage, continuous soil cover, and inter-cropping and crop rotation. Instead they focus primarily on tillage using rippers, with limited crop rotation and some integration of trees. Adoption barriers to wide scale adoption of both the **use of green manure/cover crops and inter-cropping should be explored more systematically** to determine adapted solutions for the Senegalese context. The Yaajeende project also promotes the production and use of compost and micro-dosing of fertilizer as part of its "Zero Risk" package; these practices can be seen as the foundation for a **more holistic approach to integrated soil fertility management** (ISFM).

- *Water management*

For agriculture to become "at least a 10-month activity per year" a transition from subsistence production is required [13] and this cannot be accomplished without major improvements in water management practices, including significant investments in large- and small-scale irrigation infrastructure. **Expanding the area under irrigation, improving the efficiency of irrigation infrastructure and practices, reclamation of saline soils, and expansion of the area under flood recession agriculture** are all avenues already being

[11] This list is illustrative. Entry points should be evaluated based on their potential contributions (i.e. relative return on investment) to sustainable increases in productivity, increased resilience to climate variability/ change, and reduced emissions intensity.

[12] This has to be balanced with other factors, notably the existing mission targets, input from the partner country, and, importantly, what farm communities in the ZOI are actively investing in. Senegal also had a very high number of value chains before FTF (close to 20) but the ability to show impacts was limited—so there will be some resistance to going broad. My sense is that the millet and maize were targeting different parts of the ZOI. Another option to consider in the future is to add a value chain (e.g., small ruminants). Also note that there is a centrally-funded scaling activity in the country on cowpea intended to complement the Mission's cereal investments.

[13] Per interview with USAID mission staff on July 22,2015.

explored by Feed the Future implementing partners. Yet to be fully assessed are the future climate change impacts on Senegal's surface and groundwater resources.

- *Good Production and Post-Harvest Practices*

The systematic approach of the PCE/Naatal Mbay project to training rice farmers in every phase of the production cycle from land and seed preparation to post-harvest handling ("Le bon Chemin du Riz") is a good model, contributing to all three CSA pillars (sustainable, productivity, adaptation and mitigation). Given that the Government of Senegal is giving highest priority to rice self-sufficiency, **more attention to water management practices** in both rainfed and irrigated rice (e.g. system of rice intensification, other enhanced sustainable rice management practices, alternated wetting and drying) will be important, both to maximize adaptation and minimize greenhouse gas emissions.

- *Livelihood Diversification*

While diversification does not automatically lead to reduced risks, it is a good principle to apply in the context of Senegal's harsh and highly variable climate. This applies to both diversification in agriculture and the development of alternative livelihood strategies. As seen in the Yaajende project, agricultural diversification (e.g. inter-cropping with legumes and more systematic crop rotation to promote soil fertility) can also be more systematically promoted through a more "nutrition-sensitive" approach to agriculture. Diversification is also a strategy being explored by COMFISH in coastal fishing communities where incomes are low and rates of malnutrition are relatively high. Given challenges to the sustainability of the fishing resources, efforts to increase incomes have focused on **increased value-addition/processing and diversifying livelihood activities** (including agriculture and aquaculture).

- *Crop insurance*

Given the inherent, and likely growing, risks inherent in rainfed agriculture in Senegal, USAID should encourage the Government of Senegal to accord highest priority to risk reduction strategies (e.g. crop and variety selection, integrated soil fertility management and other sound land management practices, irrigation/integrated water resource management, etc.). While crop insurance is a promising risk transfer strategy, caution is in order as regards its place in a broader risk management strategy. A particular challenge, worth exploring in the coming years, is the feasibility of pricing agricultural insurance products in Senegal at rates that are both affordable to poor farmers and profitable to insurance providers, without the need for large, on-going subsidies by the Government or external donors.

- *Climate Information Services*

USAID/Senegal has identified **climate information services as a priority** addition to its Feed the Future portfolio, building on small initiatives within existing Feed the Future projects and drawing on the experience of other institutions. At the center of efforts to build national climate information services capacity is ANACIM (the national civil aviation and meteorology agency), with which USAID implementing partners are already collaborating. The multi-disciplinary working groups (Groupe de Travail Pluridisciplinaire—GTP) that ANACIM has pioneered at national and local levels (in six locations) to develop agro-met advisories/seasonal forecasts is a good model on which to build. Although progress in the art and science of seasonal forecasting and other climate information services is being made, ANACIM acknowledges that the approximately 70% accuracy[14] of its seasonal forecasts leave considerable room for improvement.

[14] ANACIM makes its initial seasonal forecast in May, followed by updates in June and July. Updates are more accurate that initial forecasts, and the accuracy of forecasts are evaluated at the end of each season. Down-scaled forecasts are provided in six locations where GTPs exist.

- *Agricultural Education and Research Capacity*

USAID Senegal is unusual in having a project in its portfolio exclusively dedicated to strengthening national agricultural education and research institutions. While a number of the research initiatives selected for support under the **ERA** project address climate risks, such as drought and salinization, the project also could use its involvement in the development of updated national agriculture curricula to integrate "climate smart awareness" and climate change adaptation strategies into the education of the next generation of Senegalese agriculture professionals (scientists and extension workers).

5. Conclusions

The CCAFS CSA deep dive assessment in Senegal resulted in a number of conclusions relevant to USAID's strategy and program portfolio under Feed the Future, including:

- ➢ Climate risk is large and likely to grow in terms of crop, livestock and fisheries production in Senegal, with significant implications for food security and the national economy if not aggressively addressed;
- ➢ Government of Senegal awareness of climate risks and efforts to address these risks systematically in national flagship strategies and programs are growing;
- ➢ Several planning processes are underway at national, regional and continental/global scale that offer opportunities for expanded support by the U.S. Government to the Government of Senegal to embrace CSA as a basis for securing national food security in a warming world.
- ➢ USAID's Feed the Future portfolio in Senegal is already on a climate-smart path with rich example of "climate-smart" elements, and there are many avenues for building on these elements and adding others as part of a more comprehensive approach.

The current Feed the Future strategy and portfolio in Senegal already provides a solid platform for CSA, but several possible pathways for building on that success can be pursued, including:

a) Further documenting CSA practices in current portfolio and sharing good practices among implementing partners and with government counterparts;

b) It is very positive that the Mission has already begun to identify and fill some initial critical gaps related to the context-specific climate change risks in Senegal in its Feed the Future portfolio (e.g. climate information services capacity-building, water management, and soil health. Such efforts should be continued, as climate risks, and our scientific understanding thereof, will continue to rapidly evolve.

c) the Mission could consider maintaining some flexibility to organically adapt/adjust the mix of interventions and value chains promoted (e.g. include small livestock, cowpeas, horticulture) along its program cycle, based on a number of criteria, including Senegalese Government priorities the application of a CSA lens to assess climate risks and vulnerabilities, in addition to income generation, women's empowerment and nutrition).