POLICY BRIEF

NOVEMBER 2021

AgMIP The Agricultural Model Intercomparison and Improvement Project

National agricultural development pathways influence climate change impacts on smallholders' livelihoods in Navrongo, Ghana

KEY MESSAGES

- Agricultural development can enhance the overall livelihood of farmers by 2035 by improving income and reducing poverty and food insecurity. The magnitude of benefit depends on selected agricultural pathways.
- A *Sustainable Development (SD)* pathway may result in a **greater** improvement of farmers' livelihoods compared to a *Business as Usual (BAU)* or a *Fossil Fuel Development (FFD)* - based pathway.

Context

Ghana's National Adaptation Plan (NAP) framework emphasizes the need to assess the vulnerabilities of key economic sectors to climate change in order to identify appropriate adaptation options. The Agricultural Sector, which is highly exposed and vulnerable to adverse climate and environmental impacts, significantly contributes to livelihoods of the majority of the rural population.

A study was carried out under the **AgMIP-CLARE Project**[1] in Navrongo - a semi-arid agro-ecology in Ghana - using the framework of the AgMIP's *Regional Integrated Assessment* (RIA; Antle et al. 2015).

This policy brief summarizes the study, describing the vulnerability of the agricultural sector and adaptation strategies for **three** plausible agricultural development pathways, co-generated by stakeholders (including scientists):

- Business as Usual (BAU)
- Sustainable Development (SD)
- Fossil Fuel Development (FFD)

Maize farms in Tamale in 2012

The AgMIP RIA has key features that makes it appropriate for climate change impact and adaptation assessments:

1. Driven by iterative stakeholder interactions;
2. Analysis of farming *systems* (not just crops);
3. Trans-disciplinary, bio-physical and socio-economic;
4. Multi-scale level (using field, farm, region, and global data and models);
5. Linked, multi-model methods, with
6. Distributional results such as impacts on poverty rates.

[1]AgMIP-CLARE is research aimed at investigating climate change impacts and adaptation options in smallholder farming systems. The work expands and extends previous AgMIP work to contribute to adaptation and resilience decision-making at the national scale. The result is evidence-based and thus more effective for National Adaptation Planning for climate change, with methods that better link Ghana's national and sub-national adaptation efforts. CLARE is the IDRC/FCDO Climate Adaptation and Resilience program.

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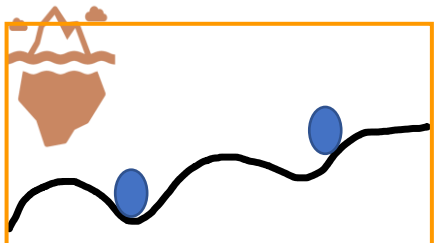
Three Co-Identified Plausible Development Pathways

Under the *current* production system, small-holder farmers in Navrongo have low levels of farm income, resulting in high levels of poverty and food insecurity. Stakeholder interactions identified **three** plausible *future* development pathways:

Business As Usual (BAU), Sustainable Development (SD) and Fossil Fuel (FFD) driven pathways



National RAPs

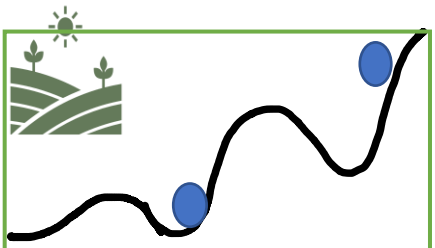
Business as usual

Agricultural development

Agricultural system is characterized by slow and inconsistent productivity growth as well as low adaptive capacity due to inadequate commitment of resources to implement appropriate policies.

Climate policies

Inadequate resource allocation coupled with leakages lead to marginal and erratic investments and low diffusion of climate smart agricultural technologies.



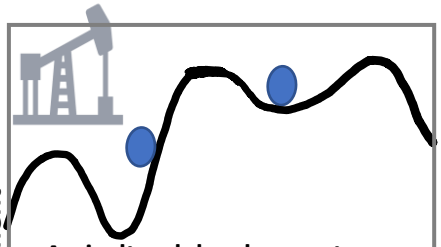
Sustainable development

Agricultural development

Agricultural system is modernized and characterized by continuous growth and resilience through private sector-led investments into appropriate technologies that balance economic growth and ensure environmental sustainability.

Climate policies

Massive investments in environmentally friendly infrastructure and climate-smart agricultural technologies through efficient private sector-led mobilisation of resources from green climate funds.



Fossil Fuel driven development

Agricultural development

Agricultural system is vigorously intensified and up-scaled with gross disregard for environmental sustainability resulting in rapid short-term economic growth.

Climate policies

Massive industrialization with carbon intensive energy and technologies as the backbone, with little regard and commitment to environmental sustainability.

Regional Implementation

Business as usual

Implementation of national agricultural policies at the sub-national level challenged by inadequate resources due to competing short term needs**.**

Thus, subsistence farming persists with limited use of appropriate external inputs due to weak institutional support structures leading to inefficient use of resources and low enforcement of environmental standards.

The design and implementation of climate change adaptation strategies are challenged by low and adhoc investments.

Sustainable development

Implementation of national agricultural policies at the regional level spurred by adequate investment led by private sector participation.

Thus, strong institutional coordination results in efficient dissemination and utilization of resilient agricultural technologies with effective enforcement of environmental standards.

Climate policies and investments enable effective design and implementation of appropriate strategies that promote resilient production system.

Fossil Fuel driven development

Implementation of national agricultural policies at the regional level spurred by massive investments led by private sector participation.

Large scale farms dominate the landscape supported by investments into technologies that support aggressive intensification. Low priority for enforcing environmental standards.

The design and implementation of climate change adaptation strategies disregards the mitigation pillar, thus reducing the adaptive capacity of the production system.

The response of the farming system to each of the development pathways on smallholder farms in Navrongo was assessed.

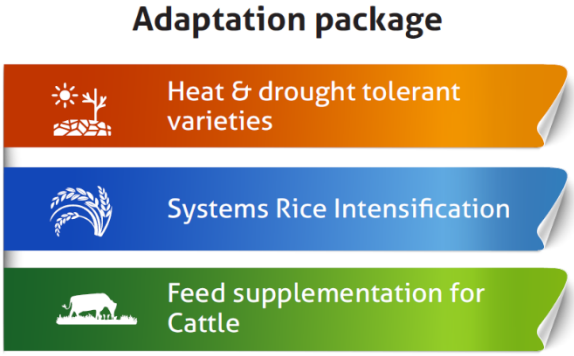
The regional Representative Agricultural Pathways (RAPs) provided parameters for bio-physical and economic models to simulate the impacts of climate change and adaptation on farmers' livelihoods using the AgMIP RIA methodology.

Co-Developed Adaptation Strategies

The government provides subsidies on improved, climate resilient seeds to enable the uptake of existing adaptation strategies.

Groundnut (peanut) remains a very important crop in the farming system within the study area as it benefits from climate change owing to CO_2 fertilization, lessening the impact of climate change on net farm returns, poverty rate and food insecurity of smallholders in Navrongo.

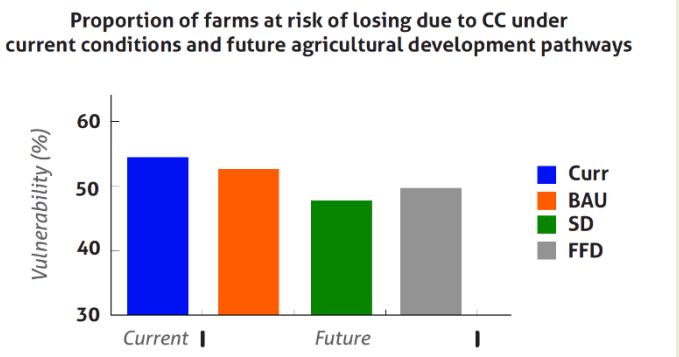
All three future plausible agricultural development pathways (BAU, SD & FFD) result in increased income as well as reduced poverty and food insecurity compared to current agricultural production system under current climate.

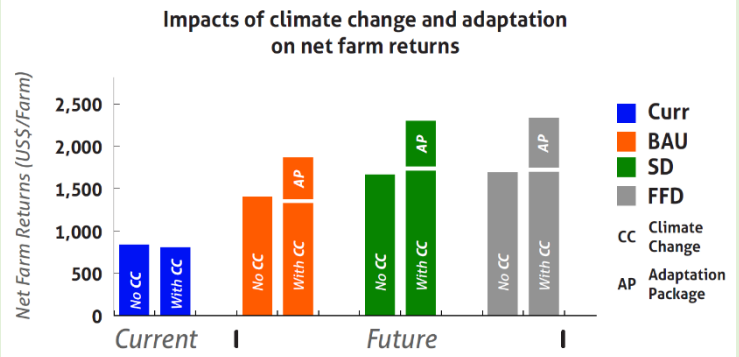


Stakeholder co-generated adaptation packages

With projected climate change:

- BAU agricultural pathway **reduced** the income of smallholders and **increased** poverty and food insecurity.
- SD pathway **improved** income, leading to **reduced** poverty and food insecurity (although large proportion of farms still remain vulnerable to climate change).
- Under the FFD pathway, there was **no change** in income.





Left diagram: Impact of climate change on farm vulnerability at present and in the future production systems. Current Production (Curr), Business as Usual (BAU), Fossil Fuel Driven Development (FFD) and Sustainable Development (SD). Right diagram: Impacts of climate change (CC) and adaptation (AP) on income, under current conditions and for three future agricultural pathways.

Future production system with climate change

- Policies and interventions under the SD pathway help farmers to be more resilient to climate change, compared with BAU and FFD scenarios.
- Vulnerability to climate change remains significant under all pathways, highlighting the need for adaptation strategies that target improved farm productivity, income and household livelihoods.

Future production system with climate change and adaptation

High adoption rates of proposed adaptation strategies would lead to:

- Significant increase in farm net returns under the SD and FFD pathways compared to the BAU pathway
- Decreased poverty rate and food insecurity with the adoption of the adaptation technologies

The adoption of the tested adaptation packages led to projected increases in income and declines in poverty and food insecurity across the three development pathways.

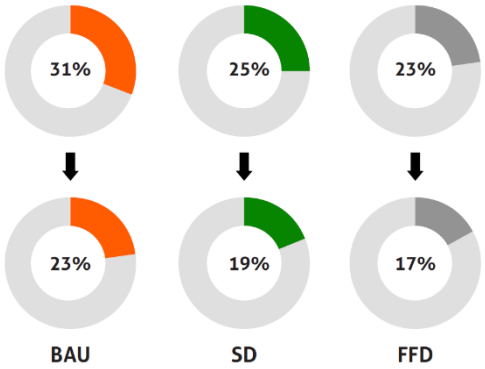
Poverty and vulnerability (food insecurity) were highest along the BAU pathway.

Poverty and vulnerability lessen along the FFD and SD pathways.

Conclusion

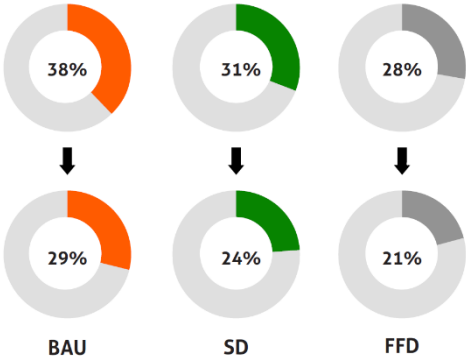
Integrated forward looking assessments that are stakeholder-driven and include multiple climate and crop models across multiple farms provide an important science-based source of evidence for policy, decision making, planning and priority setting. This methodology provides an approach that has been recommended by stakeholders to be scaled up to important crop producing areas in the country, to provide more input to the NAP processes.

Poverty declines to 23%, 19% and 17% under BAU, SD and FFD pathways, respectively.



The adoption of adaptation packages leads to a decline in poverty and food insecurity for all three development packages*

Food insecurity declines to 29%, 24% and 21% under BAU, SD and FFD pathways, respectively.



**The FFD pathway presents additional environmental trade-offs such as degradation of the natural resource base and increasing greenhouse gas emissions that were not assessed in this study.*

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For more information on the AgMIP-CLARE Project, visit http://agmipimpactsexplorer.

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