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### Nigeria Agricultural Policy Project

#### Climate Change Adaptation in the Nigerian Agricultural Sector

Laura Schmitt-Olabisi, Saweda Liverpool-Tasie, Robert Onyenike, Onyinye Choko, Bukola Osuntade, Awa Sanou, Udita Singa, Stella Chude Chiemela

##### Introduction:

West Africa is expected to suffer yield and production losses of staple crops under climate change, with more severe yield reductions occurring in the period between 2030 and 2050 (Ittersum et al., 2016). In addition, extreme events, including droughts and floods, are expected to become more frequent under climate change, also potentially affecting yields (Abiodun, Lawal, Salami, & Abatan, 2013). Internal displacement and natural resource conflicts are another expected climate impact, as are pest and disease outbreaks (Gregory, Johnson, Newton, & Ingram, 2009; Obioha, 2008). Given these potentially serious climate impacts, a team comprising researchers from Michigan State University and Nigerian partner universities conducted studies intended to inform Nigerian agricultural policy around climate adaptation. This brief presents a summary of findings from 4 of these studies conducted between 2016 and 2019.. Findings of each of these studies have been published separately at:

<https://www.canr.msu.edu/fsp/countries/nigeria/publications>.

##### Key findings and Policy Implications:

1. **There is no ‘silver bullet’ technology which will solve the problem of climate adaptation.**

While technologies such as drought-resistant and early-maturing crop varieties, irrigation systems, and improved crop storage units have an important role to play in the portfolio of climate adaptation strategies, a narrow, single-solution approach to climate adaptation should be avoided. This is because the impacts of climate change on the agricultural sector are varied, both direct and indirect, and unpredictable. For example, drought-resistant maize will not be an effective adaptation strategy in the face of an

##### Key Findings

- There is no ‘silver bullet’ technology which will solve the problem of climate adaptation
- Nigerian farmers and communities are already implementing climate adaptation practices
- Climate adaptation efforts should draw on principles of resilience to be more effective
- Effective climate adaptation will require coordination across multiple sectors of the Nigerian economy and society

extreme rain event washing out a field; nor will it address increasing conflict between agriculturalists and pastoralists exacerbated by climate change (both climate impacts identified by Nigerian stakeholders at national-level workshops sponsored by NAPP) (Olabisi et al., 2018). Our research on maize production in Kaduna indicated that even early maturing maize varieties, which would be adapted to a shorter growing season, could not on their own overcome the expected yield gap under climate change. Climate adaptation in Nigerian agriculture will require a multi-faceted approach including at a minimum improved technologies, agro-ecological principles, economic support, and modifications to human behavior

2. **Nigerian farmers and communities are already implementing climate adaptation practices.**

A majority of Nigerians in the agricultural sector are already aware of and concerned about climate impacts. Our research in Ebonyi state found that organized groups in Nigerian communities are already implementing a wide range of activities in support of climate adaptation, often without any external support (including re-building infrastructure damaged by floods, and educating community members on the dangers of living in

floodplains). In addition, research on the poultry sector suggests that farmers are adapting to climate change by, for example, implementing technologies and practices that reduce heat stress for poultry. Efforts to promote climate adaptation at the national or state levels might therefore do well to first discover what farmers and communities are already doing, and which activities they find to be effective, and partnering with them to support or extend those activities. Communities and farmers are also able to point out gaps in knowledge, skills or resources which external support could provide.

### **3. Climate adaptation efforts might draw on principles of resilience to be more effective.**

The impacts of climate change on the Nigerian agricultural sector are highly uncertain. For example, climate models of future precipitation in West Africa indicate that average rainfall for the region might either increase or decrease under climate change (although all models agree the region will become hotter). Moreover, the Nigerian agricultural sector is a complex system undergoing dynamic changes in other ways as the country grows in population, urbanizes and industrializes. For these reasons, a climate adaptation strategy should strive for resilience rather than, for example, maximizing output of grain crops which could become increasingly vulnerable in a changing climate. While increasing productivity in Nigerian agriculture is necessary, efforts to do so should not come at the expense of maintaining diversity, redundancy, flexibility, and other important principles of a resilient system. Principles of resilience in a management and policy context have been well articulated in publications of the Resilience Alliance (Biggs et al., 2015).

### **4. Effective climate adaptation will require coordination across multiple sectors of the Nigerian economy and society.**

As mentioned above, climate impacts on the Nigerian agricultural sector are and will be both direct and indirect, and involve infrastructure, forestry and wildlands management, the financial sector, the military, etc. Ideally, adaptation efforts should involve coordinated efforts at

multiple scales, from community to state and national, with information flowing between these scales.

### **Conclusion:**

Climate change poses a very serious but not insurmountable threat to the productivity of Nigerian agriculture and to the wellbeing of Nigerians whose livelihoods depend on the agricultural sector. These research efforts under NAPP have pointed to some principles for building resilience and adaptation into Nigerian agriculture, and have emphasized the need for a concerted and coordinated effort around climate adaptation.

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### Box 1: Summary of key study methodology: Systems Dynamics modelling

System dynamics modeling allows researchers to investigate the future state of a complex system with both social and ecological components. These models are used to build tools for supporting policy decisions by incorporating essential dynamics from more data-intensive agronomic models into a more accessible system dynamics tool. To understand Climate Change Adaptation in the Nigerian Agricultural Sector, we developed the system dynamics model used to study the impact of climate change on maize production with stakeholder input from Northern Nigeria, as described in detail in (Schmitt Olabisi et al. 2016).

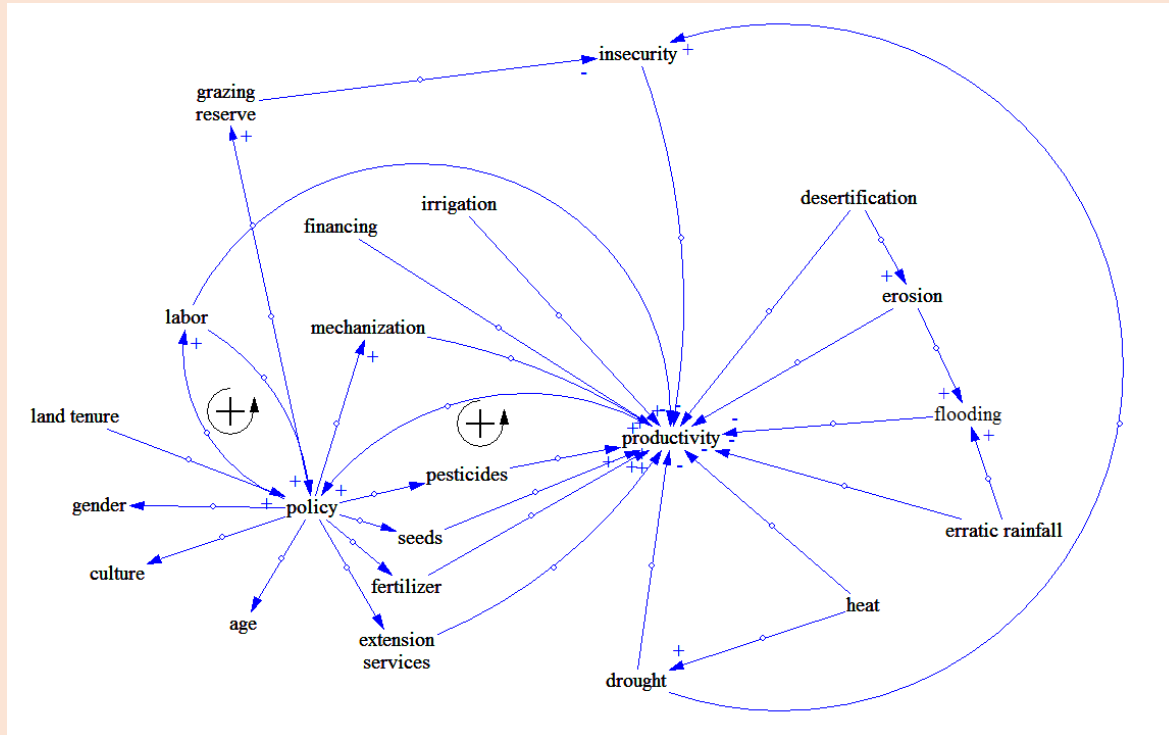


Figure 1: Causal Loop Diagram for North Central Nigeria, based on data collected in a participatory workshop in Ibadan Nigeria in June, 2016.

Based on the diagram developed by stakeholders, we parameterized the model using quantitative data. First, we calibrated population, agriculture and maize production trends in Kaduna State from 1990 to 2017 (27 years). The baseline model simulated historical maize production in Kaduna while incorporating population growth, agricultural land use change, current adoption rates of existing maize technology (early maturing maize varieties, fertilizer use management) and past historical climate trends. By calibrating the model in this way, we ensured that the model was accurately representing the system dynamics that affects maize production in Kaduna. Then we incorporated future climate trends in precipitation, temperature and maize production, exploring various scenarios of climate, fertilizer use efficiency and better diffusion of drought tolerant maize varieties from 2017 to 2050.

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