

AgMIP

The Agricultural Model Intercomparison and Improvement Project

INCREASING PRODUCTIVITY AND LIVELIHOODS IN THE NIORO DU RIP BASIN IN SENEGAL

AgMIP-CCAFS WORKSHOP

JUNE 3-4, 2014
COLUMBIA UNIVERSITY
NEW YORK



USAID
FROM THE AMERICAN PEOPLE



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



Summary Report

AGMIP-CCAFS Kickoff Workshop – Increasing Productivity and Livelihoods in the Nioro du Rip Basin in Senegal

June 3-4, 2014

Hosted by the Center for Climate Systems Research (CCSR)
Columbia University, New York

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Participants:

Helen Greatrex, IRI/CCAFS; Jim Hansen, IRI/CCAFS; Jim Jones, U. Florida/AgMIP; Shari Lifson, AgMIP/CCSR; Dilys S. MacCarthy, U. Ghana; Carolyn Mutter, AgMIP/CCSR; Dan Osgood, IRI; Alex Ruane, NASA-GISS/CCSR.; Pierre C. Sibiry Traore, ICRISAT

Meeting Goals:

This was a kick off workshop for the joint AGMIP-CCAFS research project funded by USAID for Activity 2: *Increasing Productivity and Livelihoods in the Niore du Rip Basin in Senegal*. UK aid supported AgMIP participation into the workshop.

The specific goals of the meeting were to:

- Review currently available data from the household survey, meteorological data, crop surveys, crop simulation modelling and previous AGMIP work
- Confirm the interventions (in index insurance, nutrient management and policy) and research questions that this work will investigate
- Specify the characteristics of the index insurance product being used in this work
- Review prior use of TOA-MD in AgMIP project in Niore du Rip Basin, Senegal
- Map out project management details e.g. approximate dates, locations and agendas for the West-African workshops and data sharing portals for models and results
- Discuss key research questions, target publications, and potential authors

Key Workshop Outcomes

- A set of specific questions to address via implementation of the AgMIP integrated assessment that includes index insurance being developed by CCAFS in addition to changes in fertilizer management or other intensification packages
- A research plan and timetable were created for the work in West Africa, identifying research questions, target publications, tasks and the way forwards over the project timeframe.
- Future meetings and workshops were tentatively planned.
- Because the TOA-MD socioeconomic model developers (John Antle and Roberto Valdivia) were unable to come, we also developed suggested activities for them so that insurance could be assessed as a part of a package when bundled with other technologies and policies, for interfacing with the insurance team to ensure suitability of assumptions and analyses, and teaching the West African economic contributors how to use and interpret results from these new analyses.

Agenda: (See appendix)

Summary of Discussions:

Jim J. presented an overview of the AgMIP integrated assessment approach to help CCAFS partners understand how these assessments are done and the types of outputs that are obtained from the analyses. This discussion included the way that crop models are used across farms that were surveyed to simulate a distribution of productivities for current cropping systems using soil, weather, and management in the Nioro du Rip Basin. We also explained how the TOA-MD socio-economic model of farming systems is typically used to simulate a distribution of farm responses for current systems and weather as well as adaptation packages and future weather conditions. The use of the integrated assessments for current climate conditions for comparing current technologies vs. intensified technologies was also discussed. Because Antle and Valdivia were unable to attend, we mostly tabled detailed discussions of what changes, if any, will be needed to the TOA-MD in order to compare intensification packages (that include index-based insurance in addition to alternative technologies, management, policies). John Antle and Roberto Valdivia will address this during the fall months.

Considerable time was spent describing different types of weather-index insurance products. In particular, some focus was on the R4 index insurance that Dan Osgood and Helen Greatrex have defined for use in the Nioro du Rip Basin. The R4 project is currently active in Koussanar, to the east of Nioro, but indices have already been created for Nioro within the WRMF research project. The index is rainfall based, with two windows that cover vulnerable times in the cropping season. Other index structures were also discussed and could potentially be applied later in the project.

One point that was emphasized various times was the importance of packaging index insurance with other yield-enhancing technologies/policies, in that insurance by itself does not really make sense in these low input systems. For example, if insurance will help farmers obtain loans for purchasing fertilizer or other inputs, and applying fertilizer provides a yield increase, then this combination might be accepted by farmers and insurers as well. Several overlapping roles of insurance were discussed in this context:

1. That insurance can be used to reduce the risk aversion of farmers to invest in a productive opportunity
2. That insurance can be used to reduce the risk aversion of lenders to give farmers credit to invest
3. That insurance can form the last piece of a risk management strategy, transferring risk that cannot be reduced in any other way
4. That insurance works in isolation to protect farmers through providing a pay-out in adverse years, leading to income smoothing (this is the hypothesis which is often tested and often found to lead to disappointing demand)
5. That insurance can be used to protect an existing asset (e.g. a cow, technology etc)

Most insurance projects for smallholder farmers which have scaled to meaningful levels fit into one or all of the first 3 hypotheses. It was therefore felt that hypotheses 1-3 would be most interesting to investigate in Nioro and that starting with hypothesis 4 would be a good starting point to catalyze discussion.

The CIWARA West Africa AgMIP team (represented by Dilys MacCarthy and Sibiry Traore) presented the work that they have already done to assess climate change impacts and adaptation packages for the households in Nioro du Rip in Senegal within the DFID AgMIP project (based on a 226-household sample of farming systems). They have 30 years of weather data for each village (total of 6 villages where the 226 households exist), soil inputs for crop model simulations, and defined current management practices for the 226 households. These current systems have already been simulated and represent baseline simulations against which we will compare alternative intensification packages that will be defined and simulated in this project. In order to create model inputs for intensification management options, the inputs for baseline simulations will be modified to include some level of fertilizer input for maize and possibly new cultivars of groundnut or other cultural management practices. Specific intensification practices will be determined by working with stakeholders and researchers in a workshop in the Nioro du Rip Basin area that will be scheduled as soon as possible.

Discussions then turned to the new USAID project, and specifically to the questions that we will address for a core set of analyses that will be conducted as well as additional questions that will be done to contribute information to the core set of analyses or to extend the analyses to other useful questions. Three core questions were developed to demonstrate the use of the integrated assessment methodology to evaluate sustainable intensification options that include index-based insurance.

E1: #1 vs. #2: What is the benefit to farmers that purchase insurance?

E2: #1 vs. #3: What is the benefit to farmers that adopt riskier practices?

E3: #1 vs. #4: What is the benefit of insurance enabling riskier practices?

To address these three questions, three “experiments” will be needed: 1) E1 – comparing benefits to farmers in the Nioro du Rip Basin of purchasing index insurance vs. no insurance when farmers continue to use their existing (baseline) management of their farming systems, 2) E2 – comparing benefits to farmers of the riskier intensification practices such as purchasing inorganic fertilizer for maize and improved seed for groundnut, but without any insurance, and 3) E3 – evaluating the increases in adoption and benefits of specified riskier practices combined with index insurance. To analyze these experiments, all 226 farms in the Nioro du Rip Basin will be simulated using at least one set of crop models (DSSAT) for each of current and intensified management to produce biophysical results for use in the TOA-MD model, which will be used to estimate adoption of the alternative system for each of the three experiments. Key outputs from the analyses will be farm level production of food and feed and socioeconomic estimates of adoption, economic benefits, changes in poverty levels, and the net benefit to farmers

in the Basin. The comparisons are summarized in the table below. In total, the analyses will require a minimum of 226 crop model runs for current management systems for 3 crops – groundnut, maize, and millet – and 226 model runs for intensified management of these crops. There will be three sets of TOA-MD analyses as noted in E1, E2, and E3 above.

In parallel simulation experiments will also be carried out at for a few selected farms at a field scale (e.g. 3 crops, about 5 farms). The output will be analyzed using a gross margin/utility approach on the types of insurance that might work in this system, which will also provide useful input information for the TOA-MD analysis. It will then lead into parallel research into basis risk and index design

Preliminary Design of Model-Based Analyses of Insurance-Enabled Intensification Options:

	No insurance	Insurance
Current practice	#1 Base Mgt.	#2 Base Mgt.
Riskier practice	#3 Intensified Mgt.	#4 Intensified Mgt.

Key Research Questions and Target Papers, with lead authors underlined:

- 1) **“What are practical options for intensification and how do these change risks to smallholder farmers in Senegal?”** – mean and variability of yield responses to fertilizer or residue incorporation, driven by expert inputs, crop model simulations [no TOA until further development] – Dilyls, Sibiry, Jim J., Helen, Jim H., Bertrand.
- 2) **“How does the design of index insurance influence potential benefits to farmers?”** – test multiple index insurance designs through economic analyses at the field scale using inputs to crop models from selected farms (about 5). This work will contribute information for selecting the insurance design that will be used in the integrated assessment using the crop and TOA-MD socioeconomic models. It will also allow another approach to looking at aspects such as utility– Helen, Dan, Sibiry, Dilyls, Jim H.
- 3) **“Benefits of index insurance amplified through combination with intensification”** - (E1-E3) analyzing adoption rate, average benefit for adopters and wider community, populations more likely to adopt [with TOA-MD, possibly after further development by Antle and Valdivia], review and possibly extend the TOA-MD model development for use in analyzing risk to climate variability and use of insurance, including temporal variability, risk aversion, and insurance

mechanisms, effect of adopters on wider community – John A., Roberto V., Jim J., Jim H., Dan, Alex, Sibiry, Dilys, Helen, Ibrahima, Bertrand ??? This will be done in two steps, first by Antle and Valdivia working with Greatrex, Hansen, and Osgood, and secondly the revised TOA-MD will be used by the West African team, led by Ibrahima with participation by Helen, Osgood, and Bertrand.

Questions that may lead to Additional Papers (an Extension of Core Activities):

- 4) **“What is the influence of input uncertainty on basis risk?”** – test multiple climate datasets, crop models, planting dates, etc. – Helen, Alex, Dan, Dilys, Sibiry
- 5) **“Forward-looking design of index insurance”** – set index insurance using simulations of future agricultural practices – Helen, Dan, Sibiry, Dilys, Bertrand

Suggested Activities for TOA-MD Development Team:

Although The TOA-MD Development Team members (John Antle and Roberto Valdivia) were not able to attend the workshop, those who were there developed a set of suggested activities for them. These are intended for their review and refinement so that new protocols can be developed for including insurance in the integrated assessment of intensification practices and policies.

1. John A. and Roberto V. work with Helen Greatrex and Dan Osgood to consider whether revisions are needed to the TOA-MD software in order for it to be used in integrated assessments that include bundles of options, including index insurance, especially that it currently appears to input multiple-year means rather than parameters more relevant for modeling year-to-year risk. A decision will be made about what changes to make, if any, in the short term for the upcoming integrated assessments vs. over the longer term to facilitate more options.
2. Make modifications (as deemed appropriate) to the TOA-MD for this project. Working as a team, these four will develop a set of protocols specifically to be used by the CIWARA Team in West Africa to conduct the analysis. This includes any modifications needed to protocols for developing Representative Agricultural Pathways (RAPs) for near term climate variability and for specific simulations to make with the TOA-MD and crop model inputs needed to do this.
3. Attend one integrated assessment workshop in Senegal to help guide the work to be done.
4. Provide additional guidelines to the CIWARA team on near-term RAPs and on use of the TOA-MD for integrated assessments of intensification practices and policies bundled with index insurance. This includes guidelines on what farming systems analyses to perform and how to correctly interpret outputs from the integrated assessments with advice on what to look for as key messages from the work.

Timetable for Project Activities:

Planned Timetable	Names	Months during 2014-2015										
		J	J	A	S	O	N	D	J	F	M	
Review existing data	DM, ST, HG	■										
Organize expert meeting	HG, DM, ST	■	■									
Preliminary intensification options	DM, ST, HG, BM	■	■									
Run preliminary crop model simulations	DM, ST, HG, JJ			■								
Preliminary index insurance design setup	HG, DO, JH	■	■	■								
Hold expert meeting	DM, ST, HG, BM				■							
Finalize interventions and index insurance options	HG, JH, DO				■	■						
Final farm-subset crop model simulations	DM, ST					■	■					
Draft Paper #1	DM, ST, HG, JJ						■	■				
Final index insurance analyses at a field scale	HG, JH, DO						■	■				
Draft Paper #2	HG, JH, DO, DM, ST							■	■			
Full-farm crop model simulations	DM, ST							■	■			
Add TOA functionality	JA, RV, HG, DO, AR	■	■	■	■	■	■	■				
TOA simulations	IH, DM, ST, JA, RV							■	■	■		
Draft Paper #3											■	■
Workshop in Dakar (one econ and one final)						e	■				fi	
Final Report						n					nal	■

AR – Alex Ruane
 DM – Dilys MacCarthy
 DO – Dan Osgood
 HG – Helen Greatrex
 IH – Ibrahima Hathie
 JA – John Antle
 JH – Jim Hansen
 JJ – Jim Jones
 RV – Roberto Valdivia
 ST – Sibiry Traore

Preliminary Designation of Teams Responsible for the Activities:

0: TOA set up	
1: Expert Team in Nioro	Discuss design of insurance, including how often it should pay out, what part of the season should be insured, and what intensification practices to consider.
2: Climate team –	Provide 30 year time series
3. Insurance Team	Trigger, exit Historical premium/payouts
4: Crop Team	30 years, simulated crop yields, all farms, all crops, all technologies
5: Economic Assessment Team	Using site specific economic models to look at utility and gross margins for these questions Also using the TOA with each of 30 years specifying mean yields for question #3
6. TOA-MD development Team (e.g., John Antle, Roberto Valdivia, Ibrahim) (potential future work)	Develop temporal variability inputs & variability Develop risk aversion inputs and functionality Develop insurance payout inputs and functionality
7. TOA Team (future work)?	Run updated TOA-MD for Questions #1-3
8. Other Potential Future Work	Multiple crop models and risky practices and insurance and climate datasets