CGIAR

RESEARCH PROGRAM ON
Dryland Systems

May 2015

Model parameterization for systems analysis

Proceedings of the training and stakeholder discussion held in Malawi

Food security and better livelihoods
for rural dryland communities

Introduction

Analysis of complex and dynamic agricultural and rural livelihood systems is becoming more eminent for better diagnosis, improved identification of gaps and entry/leverage points for intervention, and more insightful and appropriate innovation. In order to demonstrate model set-up and parameterization, data available in the CT of Ntcheu site was employed. Based on that, the following sequential activities were set with initial steps made as detailed below:

- Review the available data (perform preliminary analysis) to check gaps etc.
- Conduct transect-based field visit to get an overall overview of the study site
- Analyzing livelihood typology of the area based on sampled households/farms
- Analyzing biophysical, socio-economic, gender and policy factors affecting SLM adoptions corresponding to different livelihood types of households
- Estimate integrated agricultural production functions
- Undertake farm eco-efficiency assessment based on nutrient balance in Nutmon (MonQI)
- Develop landscape and management planning tool that can help map the spatial distribution of soil erosion and assess the potential impacts of different SWC and SLM options.
- Customize an existing an agent based model (ABM) for conditions and situations of the study site
- Present the process thus far including the need for systems analysis to wider targeted audience and identify potential for modifying uses of the approach and tools in other sites

The CIAT Malawi team and the DS systems analyst first made a familiarization visit to the study area, which is located in the rift valley escarpments of the Shire Basin and spans from sub-humid to semi-arid zones within maize mixed farming systems. Since the socio-economic data were collected from the –upslope-midslope-downslope of the watershed, the field visit was organized such that the team can get an idea of the three 'zones'. The trip was followed by a series of introductory theoretical underpinnings of ABM and data preparation and analysis using different platforms.

Socioeconomic data

The team spent time looking at data to be used for empirical analysis. The dataset contained variables for the household livelihood strategies and a detailed count of plot holdings. To enable spatial referencing, all households and plots were supposed to be georeferenced. However, it was noted that some households and plots did not have complete geo-information. In addition, some plots were identified to have wrong latitude/longitude information – too far out from their expected locations. It was also observed that some 'parts' of the watershed were 'under-represented' in terms of their data density. There is thus a need to fill these gaps in order to appropriately and dully parametrize models.

Topographic data

Topographic data for each plot including slope, elevation, upslope area, wetness index, stream power index etc. were derived from DEM 90m. Other GIS datasets including rivers, roads, markets and villages etc. were extracted for the study sites from existing database for Malawi. The available soil data is scanty, crude and doesn't seem reliable. There is thus a need to check for other data sources including the recently released ISRIC soil property maps. A plot based soil survey would be required to determine the background fertility gradients across the landscape and its effects on varying productivity. Climate data (rainfall for past 10 years) has been obtained from Agricultural Extension Stations within the catchment.

Way forward and progress

The missing coordinates have been re-collected and household sample size increased from 122 to 152. The household's livelihood typologies are being done using PCA and subsequent CA for main cropping systems in the area. Determinants of SLM technologies are to be conducted at both household and plot level. Representative households within each farm household type will be selected for detailed household material transfer tracing. The outputs from preliminary activities are being used to build the ABM to be adapted for the CT considering maize mixed farming systems.

Once the model parametrization and calibration are done, the system analysis and/or the Malawi team will invite the CT CGIAR and other partners DS team and present the whole approach as well as results. This will be an open discussion style but with an aim to build on what is available now and plan for improvement. Depending on the time available, the exercise will include sessions where data analysis will be done considering the existing CIAT database and/or dataset collected by other centers and partners. The DS systems analysis and action site coordinator will discuss suitable date (in consultation with the other CT team) for the data analysis session. Generally, this may likely be after the August data analysis training in Egypt (to be confirmed).

In the meantime, the action site coordinator will discuss with the CT team (especially Everisto and Fred, because they also collected socio-economic data) to prepare data and plan integrated joint data analysis. It is important that all the available datasets be used in a complementary manner.

Participants during the presentation

Name	Institution	Role
Dr Quang Bao Le (Presenter)	CGIAR DS	Trainer and chair of discussions
Dr. Henry	USAID-Malawi	Donor
Dr. Joice Njoloma	CGIAR-ICRAF-Malawi	
Ms. Tima Munthali	Department of Agricultural Research Services (Malawi Gvt)	
Mr. Austin Tibu	Department of Lands, Ministry of Agriculture (Malawi Gvt)	
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Mr. Haig Sawasawa	Total Land Care (Local NGO)	
Dr. Lulseged Desta	CGIAR-CIAT-Malawi	
Mr. Gift Ndengu	CGIAR-CIAT-Malawi	
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RESEARCH PROGRAM ON

Dryland Systems

The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas.

Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centers and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

The program is led by the International Center for Agricultural Research in the Dry Areas (ICARDA), a member of the CGIAR Consortium. CGIAR is a global agriculture research partnership for a food secure future.

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