AFRICA RESEARCH IN SUSTAINABLE INTENSIFICATION FOR THE NEXT GENERATION (AFRICA RISING)

USAID'S SUSTAINABLE INTENSIFICATION PROGRAM IN AFRICA

MONITORING AND EVALUATION REPORT

(October 2012 – September 2013)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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Table of Contents

List of Tables

List of Figures

Acknowledgments

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List of Acronyms and Abbreviations

ADVANCE	Agricultural Development and Value Chain Enhancement
AEZ	Agro Ecological Zone
AR	Africa RISING
ARD	Agricultural and Rural Development
ATA	Agricultural Transformation Agency (Ethiopia)
CGIAR	Consultative Group on International Agricultural Research, often abbreviated with CG
CRP	CGIAR Research Program
CSA	Central Statistical Agency (Ethiopia)
DALDO	District Agricultural and Livestock Development Officer
EPA	Extension Planning Area (Malawi)
ESA	East and Southern Africa
FO	Farmer Organization
FTF	Feed the Future
GAEZ	Global Agro Ecological Zone
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
IMET	Impact, Monitoring and Evaluation Team
M&E	Monitoring and Evaluation
MSU	Michigan State University
NAFAKA	Tanzania Staple Value Chain
NARS	National Agricultural Research System
NGO	Non-Governmental Organization
RCTs	Randomized Control Trials
R4D	Research for Development
RISING	Research In Sustainable Intensification for Next Generation
SI	Agriculture Sustainable Intensification
SpatialDev	Spatial Development International
USAID	United States Agency for International Development
WA	West Africa

INTRODUCTION

Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) is a research-for-development program designed to pilot potential interventions for sustainable intensification of mixed crop-tree-livestock systems and provide data and information that will lead to the better design of development projects. The program comprises three linked projects covering West Africa (Ghana and Mali), East and Southern Africa (Malawi, Tanzania and Zambia) and Ethiopian Highlands).[1] HarvestChoice team at the International Food Policy Research Institute (IFPRI) leads an associated project on monitoring and evaluation (M&E) while Wageningen University leads farming systems modeling efforts. HarvestChoice team has acquired work experience over the past four years in developing data and analysis systems to support investment decision targeted to enhancing agricultural productivity and increased value-chain participation by smallholder farmers in Sub-Saharan Africa.

The primary hypothesis of the Africa RISING Program is that sustainable intensification of mixed crop-tree-livestock systems leads to increased whole farm productivity, which in turn leads to development outcomes (improved welfare) such as improved livelihoods (income, assets, capacity etc.) and better food and nutrition security for those who depend on these systems. It is further hypothesized that a combination of relevant interventions is more likely to increase whole farm productivity than single interventions.

The hypothesis will be tested by implementing baskets of interventions in selected communities.[2] Within a community, interventions will be 'offered' to volunteers, with the type of interventions and delivery methods expected to vary across time, space, and local context. Interventions will also vary based on the farm/household typology that will classify farm households 'sufficiently similar' in relation to expected effects of the Program. Farming systems analysis and modelling will be used to help identify and target appropriate interventions across different farm types and to perform ex-ante impact analysis. Crop modelling analysis can also be applied.

[1] The three projects are the cereal-based farming systems in the guinea savannah zone of west Africa covering northern Ghana and southern Mali– led by the International Institute of Tropical Agriculture (IITA), cereal-based farming systems in East and Southern Africa covering Tanzania, Malawi, and Zambia – led by IITA and the crop-livestock systems to improve food security and farm income diversification in the Ethiopian highlands – led by International Livestock Research Institute (ILRI).

[2] Please note that the definition of a community varies between countries, depending on the local administrative and geographical arrangements.

This report summarizes M&E-related activities undertaken in fiscal year 2013 and discusses M&E activities planned for the fiscal year 2014. The rest of the report is organized as follows. Section 1 provides a brief overview of Africa RISING M&E goals and objectives. Section 2 summarizes M&E activities undertaken in 2013. Section 3 outlines M&E activities planned for 2014. Section 4 concludes the report.

1. M&E Goals and Objectives

Monitoring and evaluation of projects is critical for several reasons. It supports effective project management, provides data for timely reporting to project funders, and helps all stakeholders to learn about the project's successes and failures. A robust M&E system will also provide learning opportunities on what did and did not work that, in turn, should inform the design and implementation of new interventions, as well as catalyze adjustments to ongoing activities that might enhance efficiency and effectiveness.

2. M&E in Africa RISING

While they are highly complementary, monitoring and evaluation are separate both in their purpose and their implementation. Bearing this in mind, the current "M&E" plan does not describe a single combined activity, but describes each of them separately

2.1 Monitoring

As the M&E component of USAID's FTF sustainable intensification flagship investment in Africa, Africa RISING is committed to achieving a number of specific goals in terms of its deliverables and approach, as follows:

- **FTF compliance:** Africa RISING M&E will conform to the overarching M&E standards, best practices, and core indicators established for the entire FTF initiative.[3] This includes compliance with guidelines and processes established for the FTF FEEDBACK evaluation initiative where relevant.[4]

[3] http://www.feedthefuture.gov/sites/default/files/resource/files/ftf_monitoringevalfaqs_feb2012.pdf
[4] For example, http://www.agrilinks.kdid.org/library/fy12-feed-future-monitoring-system-guidance-document

- **Open-access platform:** Africa RISING M&E activities will deliver and maintain an open-access, M&E data management and analysis platform to serve the needs of research scientist and other stakeholders. Open data access is mandated by both US Government regulations and the CGIAR Consortium.
- **Information provision:** Beyond its formal monitoring obligations, the Africa RISING M&E activity will generate data and information for a range of farming system and livelihood outcome indicators to provide enhanced research management and outcome mapping needs.
- **Scaling up and out potential outcomes and impacts**: To inform planning and longer-term projections of potential innovation impact at scales beyond the actual action research sites, forward-looking analysis will explore the productivity and sustainability consequences of a range of adoption scenarios and geographic/system spillover pathways across broader landscapes and regions.
- **Multi-scale reporting:** To meet different stakeholders' needs, and to provide the capability to support multi-scale monitoring and evaluation, the Africa RISING M&E platform will be designed to report at several scales and levels of aggregation:

  -Sub-Saharan Africa wide: cross-system reporting to serve the needs of program-wide roll-up of indicators across the three mega-sites (Guinea Savannah, Ethiopian Highlands, East and Southern Africa)

  -Site-wide report: for each of the three project sites

  -Country report: Breakout of site-wide reports to serve the needs of national stakeholders (e.g., USAID country missions, national institutions)

  -Custom/Sub-system reports: Some reporting needs will need to be met by customized aggregation of sub-system indicators (e.g., to generate reports by CRP or by farming system).

2.1 Evaluation

Programs like Africa RISING provide great opportunities to learn about what works and what does not, along with the 'why' and 'how' of it. Information collected as part of the program can support various types of evaluation, especially if evaluation designs are carefully considered at the outset of the program. USAID's evaluation policy also specifies an independent (and rigorous) evaluation, with the recognition that much valuable learning can also be achieved through evaluations carried out by implementers of the various projects. Since the inception of the Program, discussions have been ongoing on the kind of credible evaluation that can be devised within the context of Africa RISING and the requirements for impact assessment, given the scale and type of research activities and available resources.

To test the hypothesis that Africa RISING interventions lead to improved whole farm productivity and development outcomes, one would need to answer the counterfactual question of "how would farm productivity and development outcomes have fared for farmers who are offered (and accepted) the intervention(s) in the absence of the intervention(s)?". Since it is impossible to know the answer to this question, one needs to establish a credible group of farmers who would have had characteristics (farm productivity, welfare, etc.) similar to those who were exposed to the intervention(s) but who were not treated by the intervention(s). The specific approach to be pursued for testing the above hypothesis will be guided by the scale, nature, and timing of (planned) interventions by individual research teams, especially since site- and context-specificity and own-adaptation by beneficiaries are integral parts of the Program.

While Randomized Control Trials are becoming the standard way by which the impacts of a new technology can be assessed, such approach is not applicable in the context of Africa RISING, except in some specific cases limited to the delivery mechanisms, rather than the type of intervention *per se*. It is argued that:

- The intervention households[5] are not selected at random but volunteers (therefore, self-selected) are selected purposively by the researchers;
- The interventions are not unique, but multiple technologies are at play, which additionally vary from community to community and even from household to household;
- The attribution of impact to specific actors or actions is not possible given the multiplicity of actors and partnerships as well as on-going interventions.

To correctly assess the extent to which changes in outcomes of interest, if any, can be attributed to Africa RISING research activities, the M&E team believes on the need for designing and implementing

[5] *Intervention households* are households in the target communities to which Africa RISING interventions are directly applied; *Non-intervention households* are households in the target communities in which interventions are not applied, but which may benefit from spillover effects of facilitated transfer; finally, *Non-target households* are households outside the target communities but in the same development domain.

an evaluation strategy that ensures measurement of these economic phenomena with accuracy and robustness. A properly and scientifically designed impact evaluation is also necessary for well-informed decisions about scaling up. Unlike project monitoring, which examines and tracks whether targets have been achieved, impact assessment examines how outcomes of Africa RISING beneficiaries have changed as a direct (and, if modelled explicitly, indirect) effect of the program. It seeks to provide cause-and-effect evidence and quantifies changes in development outcomes that are *directly or indirectly attributable* to Africa RISING, and not to other confounding factors.

For Africa RISING projects at an early stage of implementation or for future interventions, the M&E team believes that the research teams should be open to seizing possibilities for embedding a rigorous evaluation design (including a pipeline evaluation[6]), for example, to assess the impact of a specific technology or delivery mechanism.[7] When there is a non-random selection of target communities and households, various non-experimental designs could be explored to construct a plausible counterfactual group.[8] For example, if selection determinants are known (or believed to be observable), then various regression-based approaches (e.g., matching) can be employed to construct an acceptable comparison group and mitigate selection bias. If selection determinants are (believed to be) unobserved but are thought to be time invariant, panel data approaches (including simple difference-in-differences) can be employed. When none of the above is possible, the problem of selection bias cannot be addressed and any "impact evaluation" effort will have to rely heavily on the program theory. Qualitative and participatory approaches would therefore build an argument towards plausible association (but not causality). These different approaches are of course not mutually exclusive. It should also be noted that the internal validity of the causal evidence will depend on the quality of the match between target and

6 The idea of this type of evaluation is to use, as the comparison group, people who have applied for a program but not yet received it. The key assumption is that the timing of treatment is random given application. In practice, one must anticipate a potential bias arising from selective treatment amongst the applicants or behavioural responses by applicants awaiting treatment. This effect could represent a great concern in AR, depending on how interventions are conducted.

7 For example, in partnership with another USAID-funded project (the Cereal Systems Initiative for South Asia (CSISA) initiative) Lybbert et al. (2012) designed and implemented a field experiment to better understand heterogeneity of farmers' demand for Laser Land Leveling (LLL) services and another field experiment that combines some of CSISA's new technologies (abiotic stress resistant rice varieties) with weather index insurance policies. Travis Lybbert, Nicholas Magnan, Anil Bhargava, Kajal Gulati, David Spielman. 2012. Farmers' heterogeneous valuation of Laser Land Leveling in Eastern Uttar Pradesh: an Experimental Auction to Inform Segmentation & Subsidy Strategies, *American Journal of Agricultural Economics.*

8 The essential requirement for this evaluation would involve the research teams to carefully document the criteria used to identify households eligible for receiving the intervention(s).

comparison groups, while the external validity of the results will depend on the representativeness of the sample from which the evidence is drawn.[9]

Irrespective of the specific evaluation design, however, target households and communities need to be selected[10] so as to be statistically representative of households and communities within the IFPRI-delineated ‘development domains.’[11] Representativeness is necessary (but not sufficient) to ensure external validity of results and will assist in informed decision making on scaling.[12] In addition, an intervention would need to be offered to ‘enough’ number of farmers to precisely estimates its effect.[13] In the absence of a credible and well-thought evaluation approach as well as target households and communities that are not representative of the population they are drawn from, estimates of the effect of interventions on whole farm productivity and development outcomes will be inaccurate and imprecise and, therefore, cannot be extrapolated.

In order to provide on credible evidence about Program attribution, the M&E team devised a quasi-experimental evaluation design. Below are the main steps involved in this evaluation design and Figure 2.1 provides a graph summary of the evaluation design:

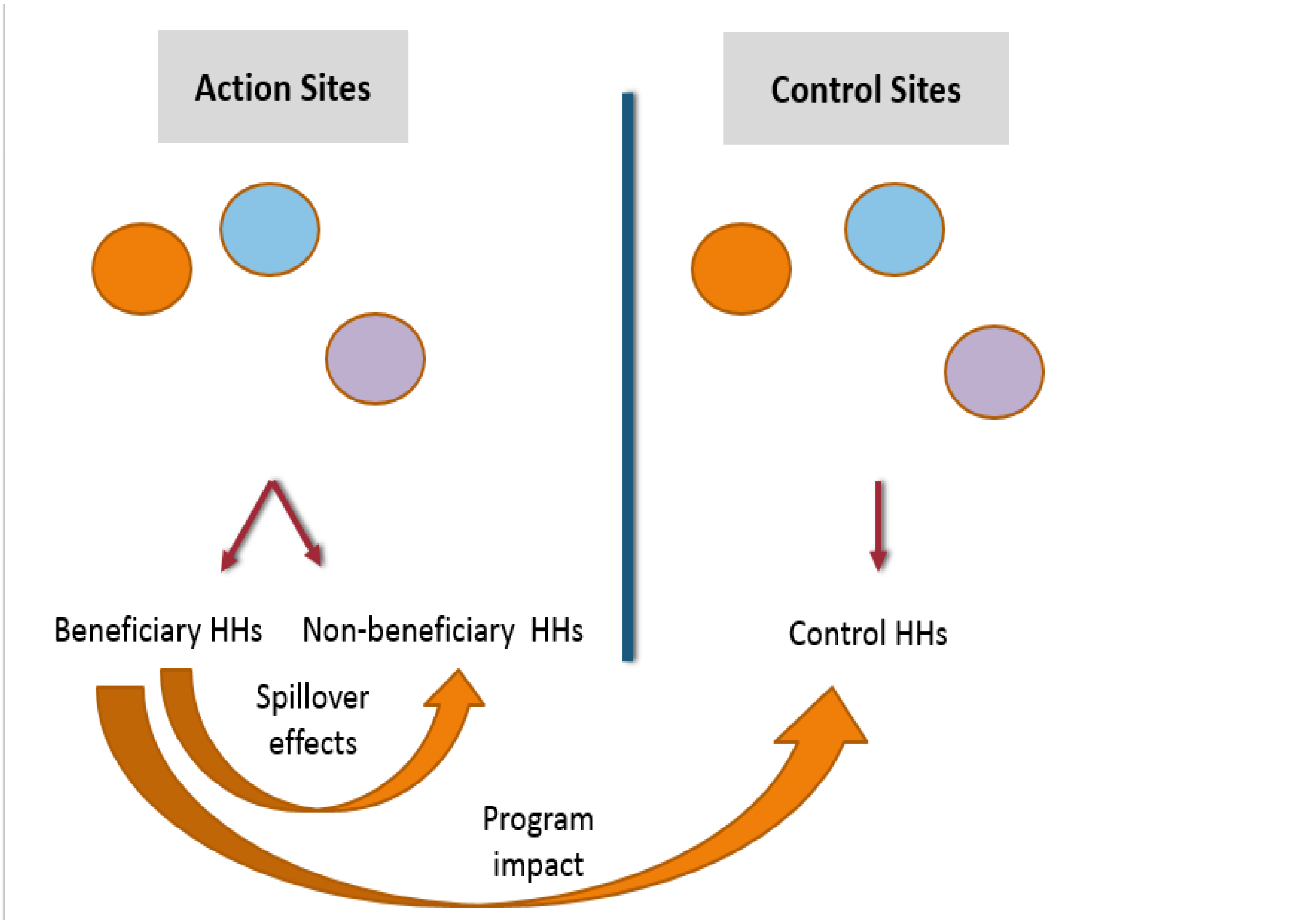
1. Stratification of geographic areas and creation of development domains based on agro-ecological potential and
2. Selection of action sites from the development domains, in collaboration with research
3. Identification of control sites that are in the same development domain as selected action communities.
4. Household listing to compile the list of all agricultural households in action and control communities.
5. Random sampling of households in control sites (control households). Control households will serve as a valid counterfactual to program beneficiary household.

[9] Internal validity refers to the accuracy of the evidence, while external validity refers to the generalizability of the evidence to the population from which the sample is drawn or to another “similar” sample or population.
[10] Selection criteria need to be documented and shared with the M&E team to help inform selection of ‘comparable’ control communities and households.
[11] The ‘development domain’ refers to the original IFPRI designation from the site selection process, which takes into account locally relevant market, biophysical, and demographic indicators, and is therefore defined in a country-specific context.
[12] External validity refers to the generalizability of results about impact of the intervention(s) on farm productive and development outcomes to other settings.
[13] If multiple interventions are being offered in a focus country and in a given period of time but no single intervention is offered to ‘enough’ number of farmers, evaluation efforts will have to focus on assessing the ‘overall effect of Africa RISING’ in the focus country, rather than the effect of the single intervention.

6. Purging of beneficiary households from the household list for action communities discussed under (4)
7. Random sampling of non-beneficiary households (non-beneficiary households) in action communities. Data from non-beneficiary households will be used to examine potential spillover effects.[14]
8. Gather baseline and follow-up data from program beneficiaries, control households, and non-beneficiary households using structured questioners.
9. Using baseline and follow-up data, compare various socio-economic and environmental outcomes of interest among beneficiaries, non-beneficiaries, and control households through regression analysis (e.g., matching).

[14] In this report, spillovers refer to a situation where farmers not eligible to receive AR intervention, or who are eligible to receive the intervention but have not received it, benefit from the intervention indirectly through a variety of ways – such as externalities (e.g., when channeled by successful AR farmers), general equilibrium effects (e.g., depressed maize price through increased maize production due to AR interventions), social and economic interactions (e.g., neighbors and relatives interacting with and learning from a successful AR farmer), and behavioral changes.

Figure 0.1 Evaluation design for Africa RISING program



In addition to the direct interventions on the target farms, research teams will put in place mechanism to facilitate extension of the interventions to other farms in the community, which will not be subject to the same degree of study. While measuring potential indirect effects of the Program (i.e., spillover effects) and understanding of transmission mechanisms certainly provide insights on how the Program operates, careful thought should be given to data requirements for correctly measuring spillovers within the context of the Program.[15]

If the purpose of data collection from current non-beneficiary households in action sites is to measure spillover effect from research activities, then one also needs to think through how current non-

[15] Manuela Angelucci and Vincenzo Di Maro. 2010. Program Evaluation and Spillover Effects. IDB Impact-Evaluation Guidelines Technical Notes, no. IDB-TN-136 (available here).

intervention fare during scaling-out of research activities. Specifically, whether the distinction between intervention and non-intervention households within current target communities will prevail over the time-horizon of the Program depends on the nature and timing of planned research activities. In this regard, there appears to be at least two options.

Option 1. A research team expects to scale up interventions *within currently identified action sites* in the future but it is not sure which of the "non-beneficiary" households will be targeted. When this is the case,

i. Baseline and follow-up surveys of (a sub-set of) non-intervention households at current time (time=t) targets will need to be conducted *before* the start of scaling activities in future time (t+1), if there is no guarantee that the "non-intervention" households from whom baseline data was collected would remain (directly) unaffected by the Program during scaling.
ii. If the research team expects the research activities to have a spillover effect on households outside (but in proximity of) the currently targeted communities, then non-intervention households can be sampled from non-target communities that are *adjacent* to the current targets.

Option 2. A research team expects to scale out research activities to *new target (and non-control)* communities at time t+1.

When this is the case,

2.1.1 Baseline and follow-up survey of (a sub-set of) non-intervention households in currently identified target communities will be part of the overall baseline and follow-up surveys in currently identified target and control communities.

Within the current design, the following pieces of information need to be generated at the specified scales to assess the success (or failure) of the Program.

1. What are the processes (technical, social, institutional) by which the Program is improving farm productivity?

Relevant scale: the household/farm scale.

Who is responsible for providing evidence: led by the regional/country project research teams, using a variety of agronomic, systems, participatory action research and other approaches.

2. What are the implications of these productivity-enhancing processes for environmental, social, economic sustainability?

Relevant scale: the household/farm scale, with some natural resource management (NRM) implications at the landscape level.

Who is responsible: led by the regional/country research teams, using a variety of agronomic, participatory systems analysis, modelling, farming systems, and other approaches.

3. What are the impacts of these productivity-enhancing processes on development or research outcomes, at a variety of scales?

There is a strong need to define what development or research outcomes to assess, in order to properly define the type of data to collect at baseline and follow-up. [16] For example, in order to provide evidence on the impact of the Program on child and women nutrition, data are needed on child and women anthropometry. Once the outcomes are clearly defined, then an evaluation strategy needs to be designed and implemented to ensure measurement of program effect on farm productive and welfare with accuracy and robustness.

i. *Household/farm livelihoods scale:*

- What effect has Africa RISING had on, for example, farm practices and welfare of the intervention households?[17]
  - This take will be led by IFPRI, with input from the regional/country research teams on the type and intensity of interventions, selection process of target communities (from within IFPRI-identified development domains) and households, and any other relevant information.
  - Regional/country research teams will employ agronomic techniques and farming systems modelling approaches (facilitated by the Wageningen team) to characterize households in target and control communities.
  - Baseline and follow-up data will be collected from beneficiary households (to be identified by the regional/country project research teams) and non-beneficiary households in control communities identified by the M&E team, with input from research teams.

ii. *Community scale:*

[16] As such, the length and depth of the survey tool proposed by the M&E team needs to be evaluated against what the team is expected to deliver, among other things.

[17] Here an actual effect is sought, hence simulation models cannot help much, unless we rephrase in "What effect is estimated (or simulated) Africa RISING to have on […]"

In addition to household surveys, community surveys will need to be conducted to provide quantitative evidence on the effect of the Program at community scale. Collection and analysis of qualitative data (in an iterative manner) may also be necessary to generate knowledge about common patterns and themes at community scale. As discussed above, research projects expect to put in place mechanisms to facilitate extension of the interventions to other farms in the community, although the other farmers will not be subject to the same degree of intervention. Nonetheless, correctly accounting for community-level effects of the Program (including direct and indirect effects) may be a challenge without a clear path for the "scaling up" process and the extension.

While the distinction between intervention and non-intervention households within community makes sense in year t, some or all of the households currently identified as non-intervention may be affected by the program at future time t+1, 2, etc. Hence, expectations about an accurate and robust evidence of the effect of the program at the community scale should be reconciled with what can/cannot realistically be delivered within the context of realities on the ground.

- This task will be led by the regional/country research teams and IFPRI.
- For Africa RISING projects with clear (and persisting) distinction in the status of households within target and control communities, IFPRI will employ various non-experimental techniques to provide evidence on program effect at community-level.
- Researcher teams will employ a variety of agronomic, farming systems, and other approaches to assess the effect of AR on input suppliers, traders, natural resource management.
- Baseline and follow-up data will be collected, right after the harvesting time, from:
    - Intervention households (to be identified by the regional/country project research teams),
    - Non-intervention households in target communities or communities that are adjacent to target communities (to be identified jointly by regional/country project research teams and IFPRI), and
    - Non-target households in control communities (to be selected by IFPRI)
- IFPRI will conduct structured community surveys to capture community-level characteristics

iii. *Development domain scale:*

To the extent (i) and (ii) are based on representative households selected, in turn, from representative target communities, evidence generated thereof will provide insight on the scope for scaling up (similar) research activities to other (similar) households in different communities within the development domains under study. It is worth noting that generating a credible evidence to help inform scaling decisions goes beyond simulation and requires cause-and-effect evidence drawn on statistically representative households.

3. M&E Activities in Fiscal Year 2012-3

Fiscal year 2012-3 was characterized by several achievements by IFPRI's M&E team. This section discusses the achievements.

3.1 Program-level 2013 M&E Expert Meeting

The meeting was intended to identify, discuss and agree on main M&E related activities, milestones, targets, challenges and opportunities, as well as to clarify the roles of the M&E and implementing partners. The meeting was held on November 11-13, 2013 in Addis Ababa (Ethiopia).

The first M&E meeting, organized by IFPRI at the ILRI-Addis Ababa campus from 5 to 7 September 2012, gathered representatives from the three AR mega-sites who discussed M&E principles of the program. It aimed at bringing together participants from all areas of the program to collectively discuss and agree on the main components of the M&E framework that would encompass both the day to day monitoring issues and the broader and longer term evaluation questions that Africa RISING needs to answer. The participants shared progress on the overall research framework (which guides the research approach for the entire program) and on research activities in the three mega sites.

The annual M&E meeting was a good opportunity to keep AR stakeholders informed about IFPRI plans around M&E general activities, as well as specific actions and products helpful for the program as a whole (e.g. data management platforms, tools). Most importantly, the meeting helped to keep track and assess the relevance of important issues, such as the key evaluation questions that Africa RISING should focus on and try to answer, the approaches and methods that would help us answering these evaluation questions, the roles and responsibilities of each CG center in M&E activities of the program, the inclusion of the global Feed the Future indicators into the Africa RISING monitoring system.

Some of the topics discussed at the first M&E meeting include[18]:

- Combining the different ideas and priorities between the IFPRI team (in charge of global M&E and data collection) and the regional/national implementation teams (in charge of project implementation and indicators reporting), when the former needs consistent data collection and rigorous evaluation design, and the latter need practical and relevant M&E activities that support the research fieldwork;

[18] Additional information about the first M&E expert meeting can be found here.

- Balancing monitoring (keeping track of ongoing efficiency) and evaluation (ensuring effectiveness of the project and leading from research outputs to outcomes) across the three mega sites, which may have different priorities;
- Dealing with USAID and development partner preferences (e.g. for specific sites to carry out the work) as opposed to scientists' needs (e.g. for sites that satisfy all the criteria for evaluation design);
- Reconciling the different M&E needs and consequent approaches across the three mega-sites
- Assessing the trade-off between a rigorous randomization across action research sites and development partners' preferences for direct site selection due to existing partnerships and ongoing activities, with the latter option yielding future, perhaps intractable complexities in estimating impact
- Choosing among different evaluation designs, some of them involving RCTs (Randomized Controlled Trials) on the "treatment" (where Africa RISING is already working or plans to work) and the "control" sites (similar sites taken as valid counterfactual to assess the relative impact of Africa RISING).

3.2 Site Characterization and Selection

Identification, stratification, and selection of Program action and potential control sites. This was done to ensure representativeness of action sites and to allow a statistically and scientifically rigorous program impact evaluation. The selection process took place in a series of stages, starting early in 2012, and was effectively completed by December 2012 in time for implementation of the program at the start of the main planting season in October 2012 in Tanzania and early 2013 in Ethiopia and Ghana.

The first part of the selection process was the definition of "mega-sites" or project areas. The definitions were agreed at a series of workshops in late 2011 and early 2012, and disseminated in three concept note. The definitions were a combination of geographic areas (administrative regions or districts, elevation zones) and farming systems, always including a mixture of crops and livestock. Details of the definitions of project areas, based on the concept notes, are given in Appendix 1 to this report. The "mega-sites" were selected so as to be representative of large areas of Sub-Saharan Africa, allowing extrapolation of the positive results of Africa RISING to benefit large rural populations.

3. 2.1 Ethiopian Highlands Mega-site

Phase one site selection – woreda (District) level: The first phase of stratification was to identify those woredas where wheat constitutes a significant proportion of the total cereal crop area. A figure of 25% of the total cereal crop area was taken as the cut-off for this targeting study. Out of a total of 656 woredas in the 2008 agricultural atlas, 113 had significant wheat production. USAID and the Ethiopian Government agree that priority should be given in Africa RISING to Agricultural Growth Plan (AGP) woredas. Out of a total of 84 AGP woredas, 19 coincided with wheat-growing woredas. After some discussion, it has been agreed that, while AGP woredas should be targeted preferentially, other non-AGP woredas could be included to fill significant gaps in targeting. The locations of woredas with significant wheat and of AGP woredas are shown in Figures 3.1 and 3.2.

Figure 3.1 Cereal cropping systems, woredas with significant wheat, Ethiopian Highlands

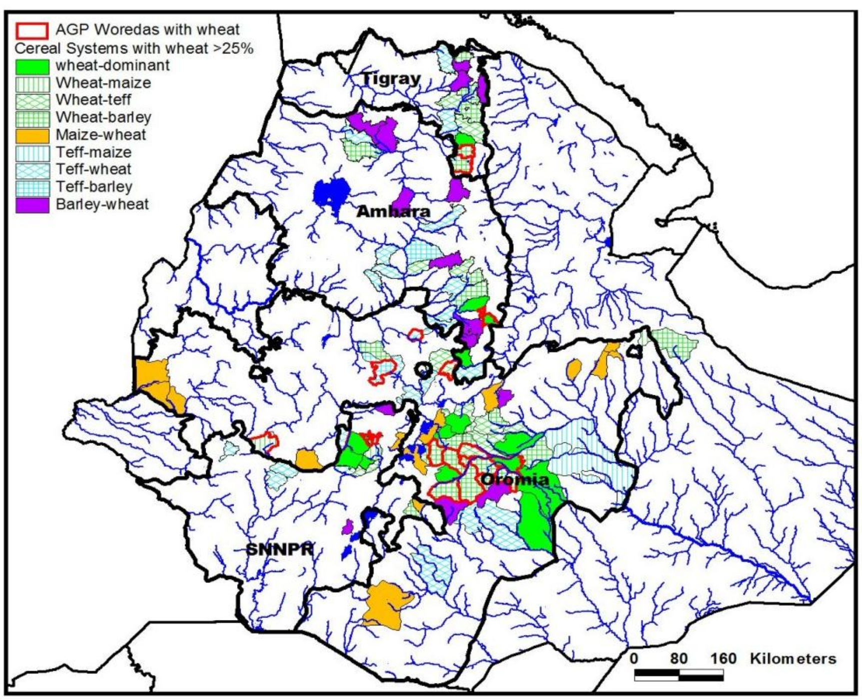
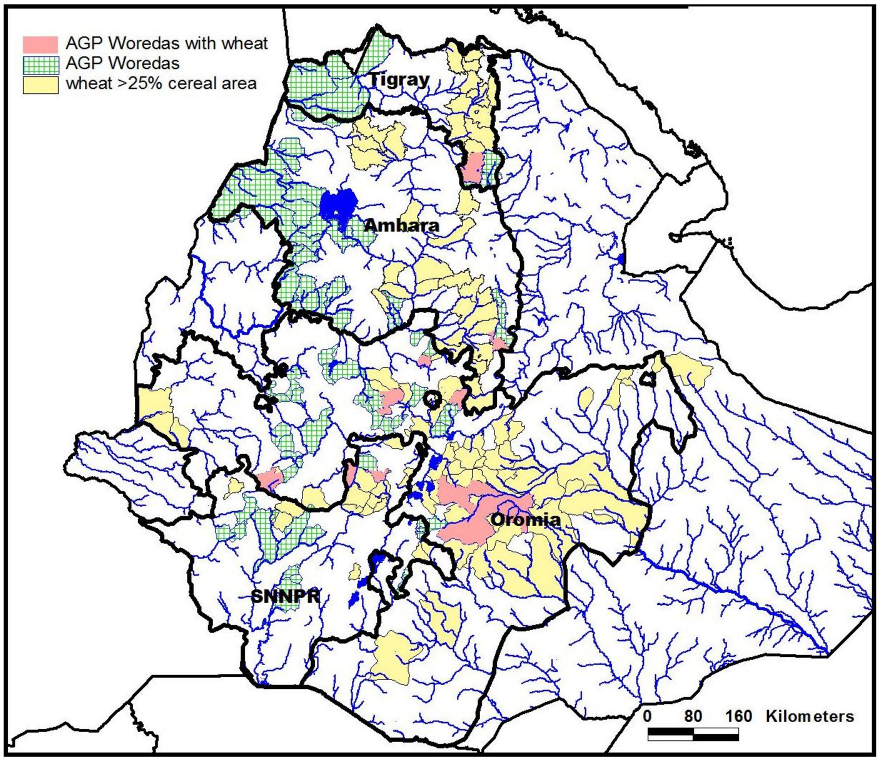


Figure 3.2 Distribution of AGP woredas, Ethiopian Highlands

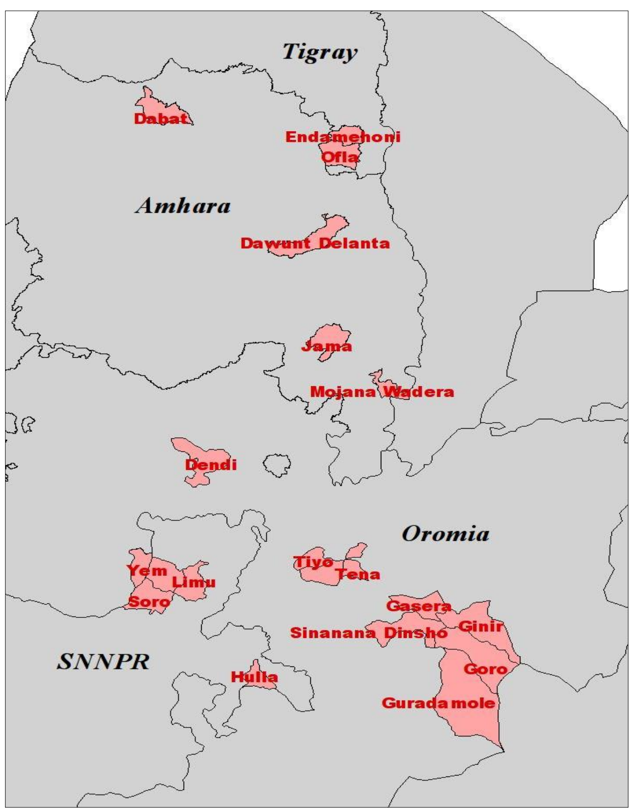


Following the initial selection of wheat-producing woredas, further stratification was undertaken on the basis of elevation, slope, rainfall, population density, livestock density and access to markets. It was apparent that the large size and extreme topography of many woredas make the use of mean elevation and rainfall problematic, but there is little alternative for this “first-pass” stratification. The mean elevation and rainfall of a woreda may not accurately represent the main cropped areas in the woreda. In some cases the main cultivated areas may be on a plateau at the upper elevation limit of a woreda, while in other most cultivation may occur in lower valleys. Once the initial selection of target woredas is agreed, a further stratification should be undertaken at Kebele level, where the variation within each Kebele will be less than in the larger woredas.

Stratification on the basis of elevation, rainfall and population density results in 14 distinct classes, as shown in Table 3.1 in the appendix. Nine of these classes include significant (more than 4) numbers of woredas, so these should all be targeted in order to include the full spectrum of variability in the mega-site.

Within each of the nine significant elevation-rainfall-population classes, target woredas were selected as shown in Figure 3.3. Three further criteria were used to select targets. Market access had to be good to moderate, and livestock density had to be moderate to high. Where there was choice between different cereal cropping systems, those with the most significant wheat production were chosen. Where an AGP woreda existed in a class and met these additional criteria, it was automatically selected. In a few cases, AGP woredas within classes did not meet all of the additional criteria, so these are marked as possible targets depending on how strictly the AGP woreda rule is interpreted. Some elevation-rainfall-population classes are not represented by AGP woredas. This is especially true of the lower elevation classes. In these cases new non-AGP woredas need to be targeted to ensure coverage of the full spectrum of possible variation. Details of all selected woredas were given to the Ethiopia project team as maps and spreadsheets, and the final selection of woredas for the initial stages of Africa RISING, and the selection of action sites (Kebeles) within the woredas was left to the Ethiopia team.

Figure 3.3 Recommended target woreda for Ethiopian Highlands project

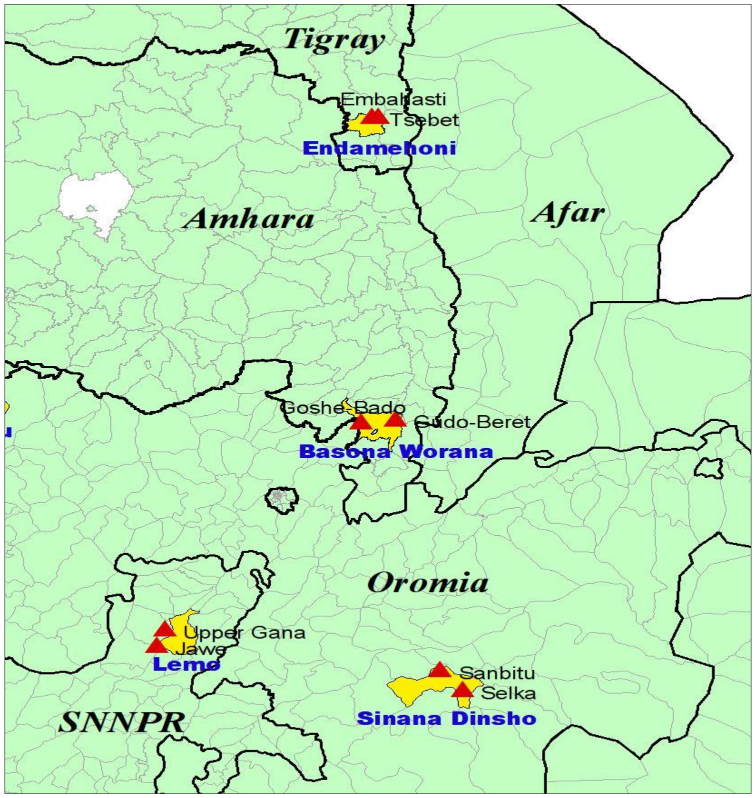


Phase Two Site Selection – action sites (Kebeles) **-**The list of target woredas shown in Figure 3.3 was given to the Ethiopia Africa RISING project team. Selection of initial action sites was based on discussion with agricultural research institutes and other government researchers and extension agents. In each of the four regions within the project area (Tigray, Amhara, Oromia and SNNPR), one woreda was selected from the list provided by the consultant, Two kebeles were then selected within each woreda, based on the levels of farming training, awareness of agricultural innovation, and also on market access. In each region, one kebele with very good access and a second with poorer access were selected. The ILRI/ICARDA team visited Tigray between 19th and 21st November, 2013 starting at the Tigray Agricultural Research Institute then moving to the Tigray Southern Zone, the Alamata Agri Research Centre and the Embekoni woreda, where two villages recommended by Government researchers were visited and approved as action sites. Between 22nd and 24th November, 2013 the team visited SNNPR, starting with SARI and the Regional Bureau of Agriculture in Hawassa then moving to Areka research centre and the Hadiya Zone Bureau of Agriculture in Hosanna. Two Kebeles in Lemo woreda, suggested by the Government officers, were visited by the team and accepted as suitable for the project.

The team visited the Bale zone of Oromia region between 26th and 28th November, 201. After calling at the Bale Zone Administrative office, they went to the Sinana Agricultural office and the Sinana Agricultural Research Centre, then to three candidate Kebeles, of which two were selected as project sites. Between 19th and 21st December, the team visited the Amhara Region, starting with the Debre Birhan Agricultural Research Centre. The team planned originally to work in Mojana Wodera woreda, as recommended by the consultant, but this proved not to have been an AGP woreda. For this, and reasons of access, Basona Worana, an adjacent woreda with similar agro-ecology, was selected. Following a visit to the North Showa Zone office of agriculture, three Kebeles recommended by the government officers were visited, and two selected as action sites.[19] Figure 3.4 shows the eight action Kebeles chosen. No control (counterfactual) communities were selected by the ILRI-led team in Ethiopia

[19] Summarised from ILRI reports.

Figure 3.4 Selected Ethiopian Highlands Action Kebeles



3. 2.2 West Africa Mega-site (Northern Ghana and Southern Mali)

A. Definition of Project Area

According to the December 2011 Concept Note, “The project will focus on the northern regions of Ghana, specifically in the administrative districts of Karaga, Cheroponi, and Tolon-Kumbungu (Northern Region); Kassena-Nankana and Bawku West (Upper East Region); and Wa East and Nadowli (Upper West Region) to address production constraints in rice and cereal-legume production systems.

The northern Regions of Ghana are characterized by small land holdings of low input-output farming systems, which adversely impact food security in terms of availability, access and quality and result in a seasonal cycle of food insecurity of 3-5, 4-5 and 6-7 months for cereals (maize, sorghum, millet) and 5-7, 4-5 and 6-7 months (groundnut, cowpea, and soybean) in the Northern, Upper West and Upper East Regions, respectively (Quaye, 2008). These crops in the savannas are often produced in a continuous monoculture in which soil natural resources are steadily depleted and yields per unit area are falling to very low levels. The poverty profile of Ghana also depicts the three northern regions as the most poverty stricken and hunger spots in Ghana (GLSS, 2000). Gender inequalities are also apparent in these regions where women have less access to resources and capacity to generate income.

In Mali the project will focus on the Sikasso region, specifically the circles of Koutiala and Bougouni, The Sikasso region of southern Mali is ecologically similar to northern Ghana, but stretches northwards into drier zones, where maize cultivation is associated with high economic risks. Sorghum is traditionally the lead cereal and staple crop, but both maize and pearl millet are widely cultivated, to exploit specific ecological niches, and marketing opportunities.

The northern part of the Sikasso region, specifically the Koutiala district, is the most intensely farmed area in Mali. Increasing total production by expanding the area cultivated is no longer an option in this area. Maintaining soil fertility and soil health, and reducing soil erosion, while increasing overall productivity are key issues for agricultural development in this area. In contrast the Bougouni district, in the southern part of the Sikasso region is characterized by low population density, large tracts of reserve forests, and very locally diverse cropping situations, ranging from infertile lateritic rock outcrops on hilltops to large inland valley tracts that allow for double cropping, irrigated farming and vegetable production. The potential for fruit tree cultivation is high.

Integrating livestock management with crop production is a key issue for this region, as it is a zone heavily used by transhumant herders for dry-season grazing. This is resulting in serious conflicts with the local resident farming communities. A key research issues for this region is how to support growing livestock herds temporarily, while increasing crop productivity and maintaining forest cover and diversity."

As shown in Figures 3.5 and 3.6 the project regions in Mali and Ghana are areas of moderate to high child stunting, but relatively low incidence of wasting. This suggests that long-term malnutrition is common, but that there have not been extreme nutrition events recently.

Figure 3.5 Child stunting (height for age) in West Africa, and mega-site districts (in purple)

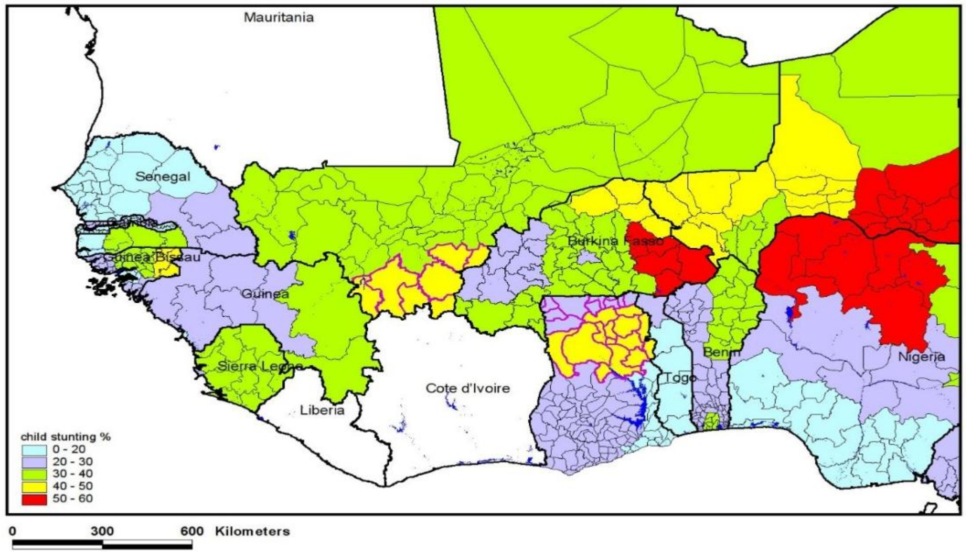
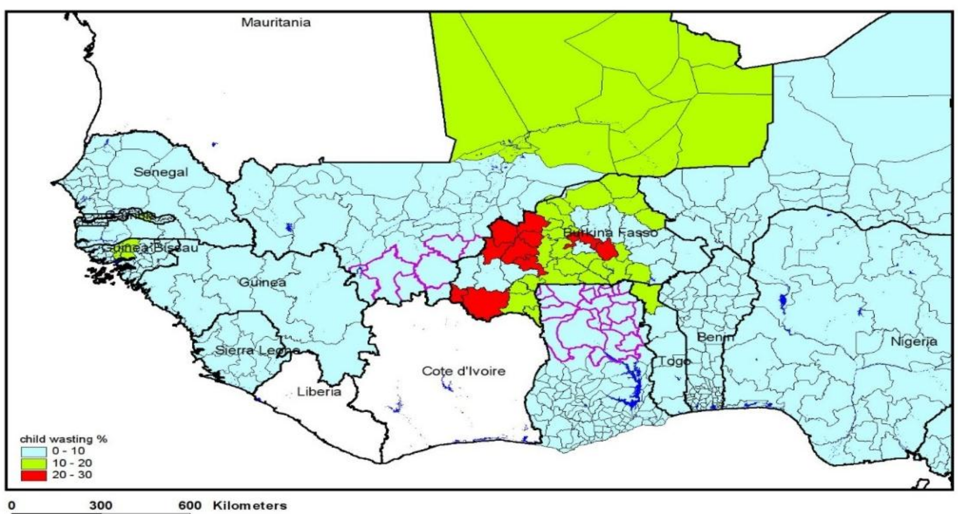


Figure 3.6 Child Wasting (weight for height) in West Africa, and mega-site districts (in purple)



The topography of the project area (Figure 3.7) is relatively subdued, with elevations between 100 meters and 400 meters and a generally undulating surface without prominent mountains. The highest land is in the Mali portion of the project area, where a plateau zone forms the watershed between major river systems. In common with most of the Sahel, rainfall increases steadily from north to south (Figure 3.8), with a sharper gradient in Mali due to the highlands. Variation is from less than 900mm to a high of over 1300 mm per year.

Figure 3.7 Topography of Guinea-Savannah project

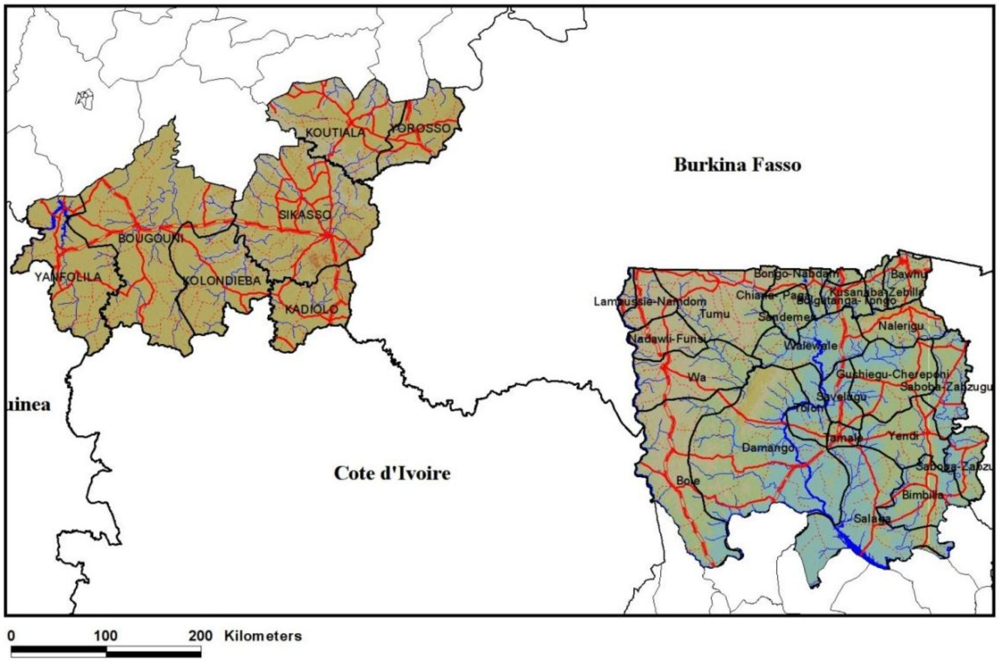
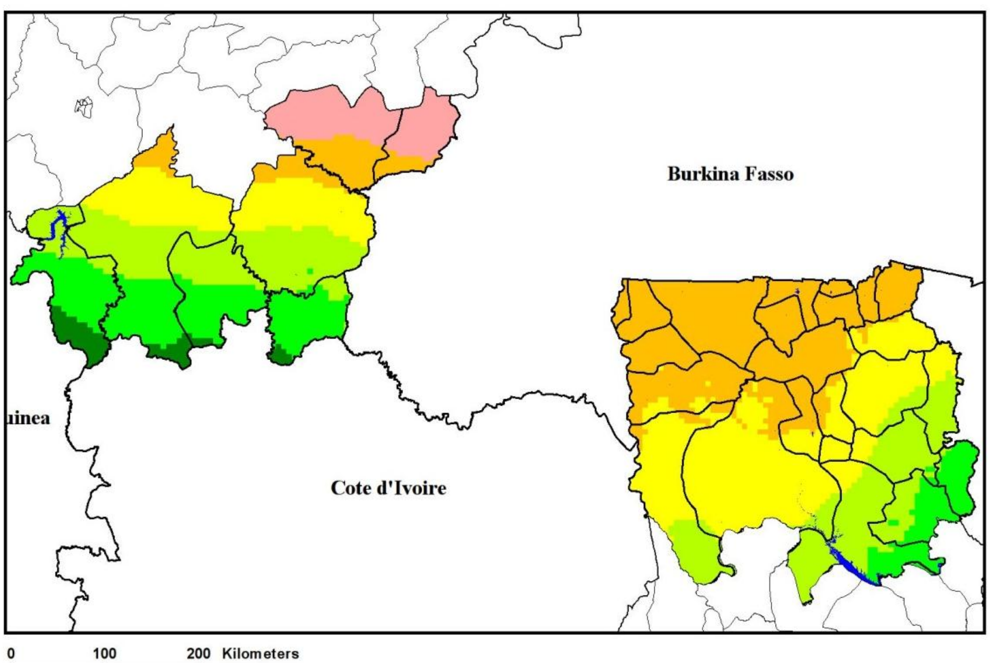


Figure 3.8 Annual rainfall in Guinea-Savannah project area



Note: Rainfall ranges from 900mm (pink) to 1300mm (green)

Population distribution is shown in Figure 3.9. Over much of the area, density is quite low, less than 20 persons per square kilometer, but large areas of the eastern portion of the Mali site have densities over 40. Apart from main towns in Ghana and Mali, there are some areas of extremely dense rural population, notably in the Upper Eastern region of Ghana, where there are significant areas with more than 100 persons per square kilometer. Access to markets is generally good to moderate, with poorest access in the western portion of the Mali project and in the south-west of the Ghana site (Figure 3.10).

Figure 3.9 Population density in Sudano-Sahelian project area

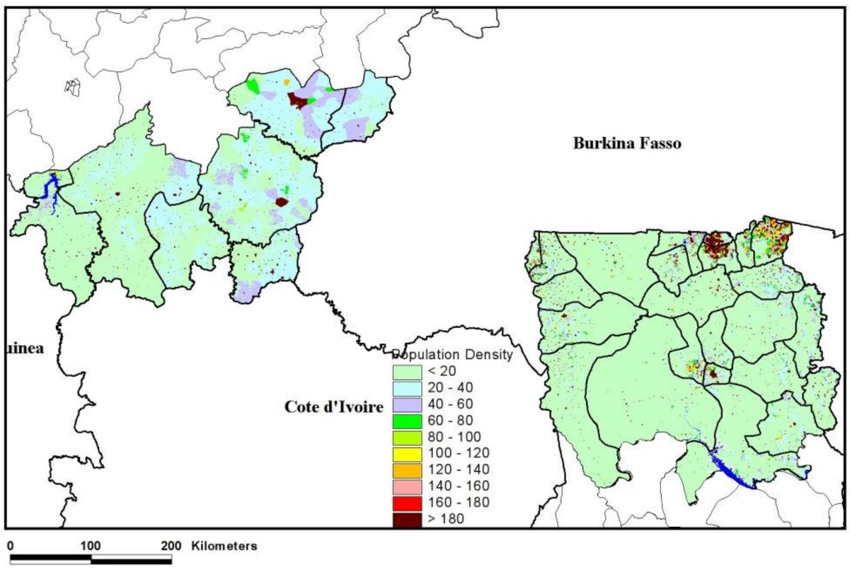
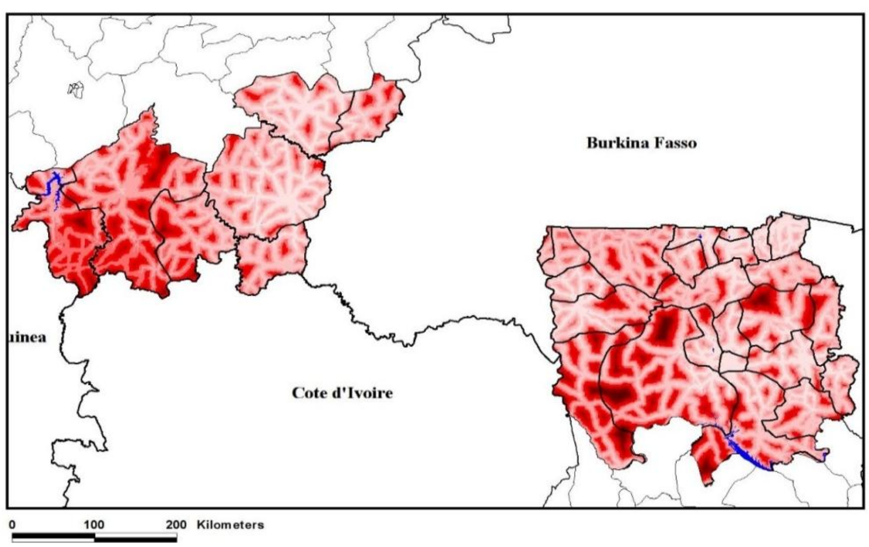


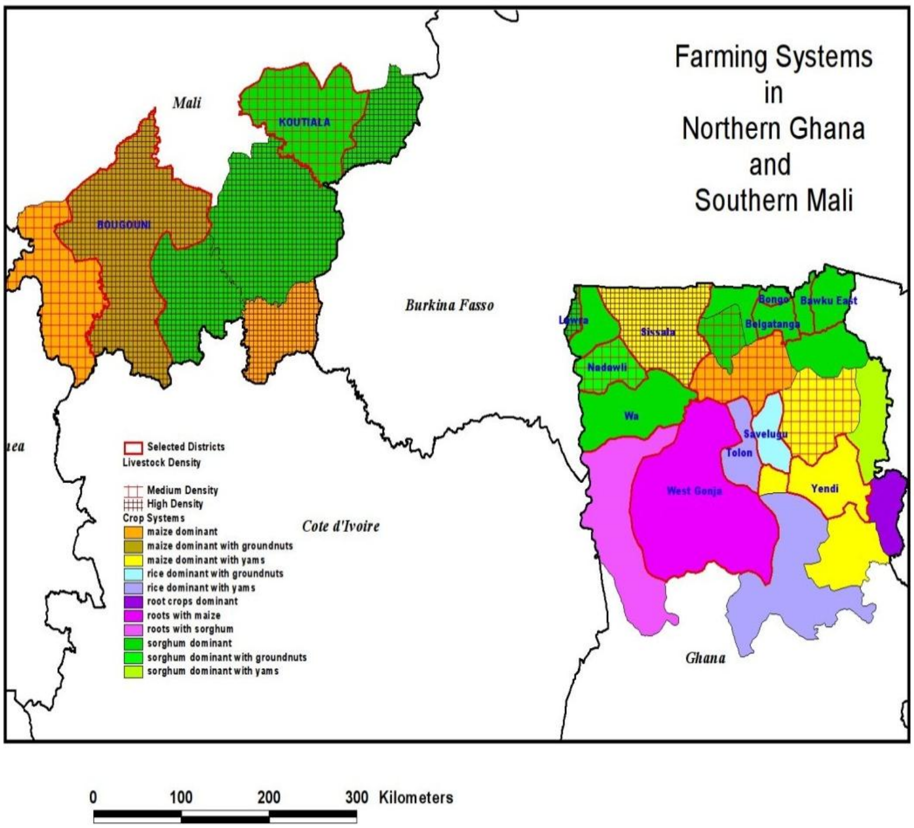
Figure 3.10 Access to markets in Sudano-Sahelian project area



Note: good access (pale pink) to poor access (red)

The distribution of farming systems in the project area is shown in Figure 3.11. There is a rough zoning of cropping systems, from sorghum dominated in the north dryer areas, through maize dominated, to maize, yams and rice in the southern wetter districts. Livestock is most important in the north, in both sorghum and maize systems. Legumes are grown in all districts, and are locally very important.

Figure 3.11 Farming systems in Guinea-Savannah project area



B. First Phase of Site Selection – District-Level Selection

a) Stratification

The project area was stratified initially on the basis of the four main variables; rainfall, elevation, population density and market access. These variables are classified as shown in Table 3.1.

Table 3.1 Classification of main variables (Ghana)

Category	Population	Rainfall	Elevation	Market Access
1	> 100	< 1000	< 200	good
2	50 - 100	1000 - 1100	200 - 300	moderate
3	30 - 50	1100 - 1200	> 300	poor
4	20 - 30	> 1200		Very poor
5	< 20			

The first step in stratification, since the project emphasizes intensification and wishes to reach maximum numbers of farmers, is to remove the few districts that have very low population densities and/or have extremely poor market access. The remaining districts are then grouped into a total of 22 categories based on combinations of the three variables rainfall, elevation and population density, together with dominant cropping systems. This results in the classification shown in Table 3.2. This table also highlights categories already covered by selected communities (Ghana) and districts or cercles (Mali). Some of the categories are fairly similar, and some include significant contributions from root crops, mainly yams, which are not the target of this project. It is not essential, therefore, that every category is covered by operational sites, but three important categories not covered in current planning are highlighted in yellow.

Table 3.2 Classification of districts by rainfall, elevation, population and farming system (Ghana)

Class	Description
A	Low rainfall, high elevation, medium population density, sorghum-dominant
B	Medium rainfall, low elevation, high population density, sorghum dominant
C	Medium rainfall, low elevation, low population density, maize dominant
D	Medium rainfall, low elevation, low population density, sorghum dominant
E	Medium rainfall, medium elevation, high population density, sorghum dominant
F	Medium rainfall, medium elevation, medium population, sorghum dominant
G	Medium rainfall, medium elevation, medium population, sorghum dominant, livestock
H	Medium rainfall, medium elevation, medium population, rice/roots
I	Medium rainfall, med/high elevation, low population, sorghum dominant
J	Medium rainfall, med/high elevation, low population, maize/roots
K	High rainfall, low elevation, high population, maize/roots
L	High rainfall, medium elevation, medium population, rice/groundnut
M	High rainfall, med/high elevation, low population, sorghum dominant
N	High rainfall, med/high elevation, low population, sorghum dominant, livestock
O	High rainfall, med/high elevation, low population, sorghum/roots
P	High rainfall, med/high elevation, low population, maize/roots
Q	High rainfall, low elevation, low population, maize/roots
R	High rainfall, low elevation, low population, sorghum/roots
S	High rainfall, low elevation, low population, rice/roots
T	High rainfall, high elevation, low population, sorghum dominant
U	High rainfall, high elevation, low population, maize dominant
V	High rainfall, high elevation, low population, maize/ground nut

The characteristics of all districts not excluded by low population density and poor access are shown in Table 3.3, together with the classes as outlined in Table 3.2. Cyan highlighting indicates all districts already selected for “quick-start” sites by the Ghana and Mali teams, while pink highlights show districts recommended for sites based on this analysis.

Table 3.3 Characteristics of selected districts (Ghana)

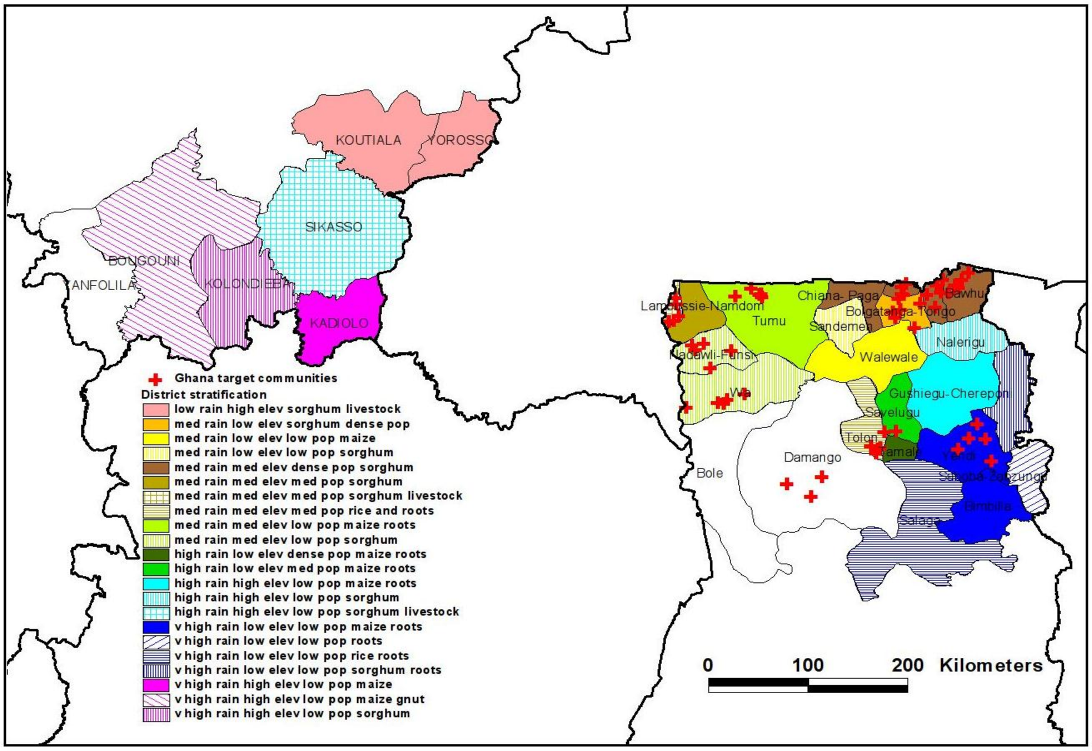
REGION	DISTRICT	crop system	popclass	rainclass	elevclass	acclass	CLASS
Northern	Bimbilla	maize_roots	3	4	1	2	P
Northern	Gushiegu-Chereponi	maize_roots	4	3	2	2	O
Northern	Nalerigu	sorghum	2	3	3	2	M
Northern	Saboba-Zabzugu	sorghum_roots	3	4	1	2	Q
Northern	Saboba-Zabzungu	roots	3	4	1	1	R
Northern	Salaga	rice_roots	3	4	1	2	S
Northern	Savelugu	rice_gnt	2	3	1	1	L
Northern	Tamale	maize_roots	1	3	1	1	K
Northern	Tolon	rice_roots	2	2	1	2	H
Northern	Walewale	maize	3	2	1	2	C
Northern	Yendi	maize_roots	3	4	1	1	Q
Upper East	Bawhu	sorghum	1	2	2	1	E
Upper East	Bolgatanga-Tongo	sorghum	1	2	1	1	B
Upper East	Bongo-Nabdam	sorghum	1	2	2	1	E
Upper East	Chiana- Paga	sorghum	1	2	2	1	E
Upper East	Kusanaba-Zebilla	sorghum	1	2	2	1	E
Upper East	Sandemen	sorghum	3	2	1	1	D
Upper West	Lambussie-Namdom	sorghum	2	2	2	1	F
Upper West	Lambussie-Namdom	sorghum	2	2	2	1	G
Upper West	Nadawli-Funsi	sorghum_gnt	3	2	2	2	I
Upper West	Tumu	maize_roots	4	2	3	2	J
Upper West	Wa	sorghum	3	2	2	2	I
SIKASSO	BOUGOUNI	maize_gnt	4	4	3	2	V
SIKASSO	KADIOLO	maize	3	4	3	2	U
SIKASSO	KOLONDIEBA	sorghum	3	4	3	2	T

Note: Cyan highlighting indicates villages already selected by project management for operational sites. Pink highlighting indicates districts recommended for sites. Very low population density and very poor market access excluded.

b) *Preliminary District Selection*

A number of districts and sites have already been selected by the Ghana team, as shown in Table 3.3 and Figure 3.12. It is apparent that there are some duplications and some important omissions. Three districts in the Upper Eastern Region with Class E characteristics (medium rainfall, medium elevation, high population density and sorghum the dominant cereal have already been selected and initial work undertaken in the communities. Similarly, two selected districts in Upper Western Region have Class I characteristics (medium rainfall, medium/high elevation, low population density and sorghum dominant). Two important classes, N and O, with high rainfall, medium/high elevation, low population density and sorghum dominant with livestock and sorghum/roots respectively, do not have any proposed sites. It is suggested that the sites in Bongo and Kusanaba be abandoned, and new sites selected in Bimbilla and Gushiegu districts.

Figure 3.12 Distribution of stratified districts (Ghana)



Note. Communities already selected by Ghana team for "Quick-Wins" indicated as red crosses.

In Mali, Bougouni and Koutiala cercles have already been selected for project implementation, although individual communities have yet to be selected. It is suggested that Kolondieba cercle be added, since this has a combination of parameters significantly different from the others.

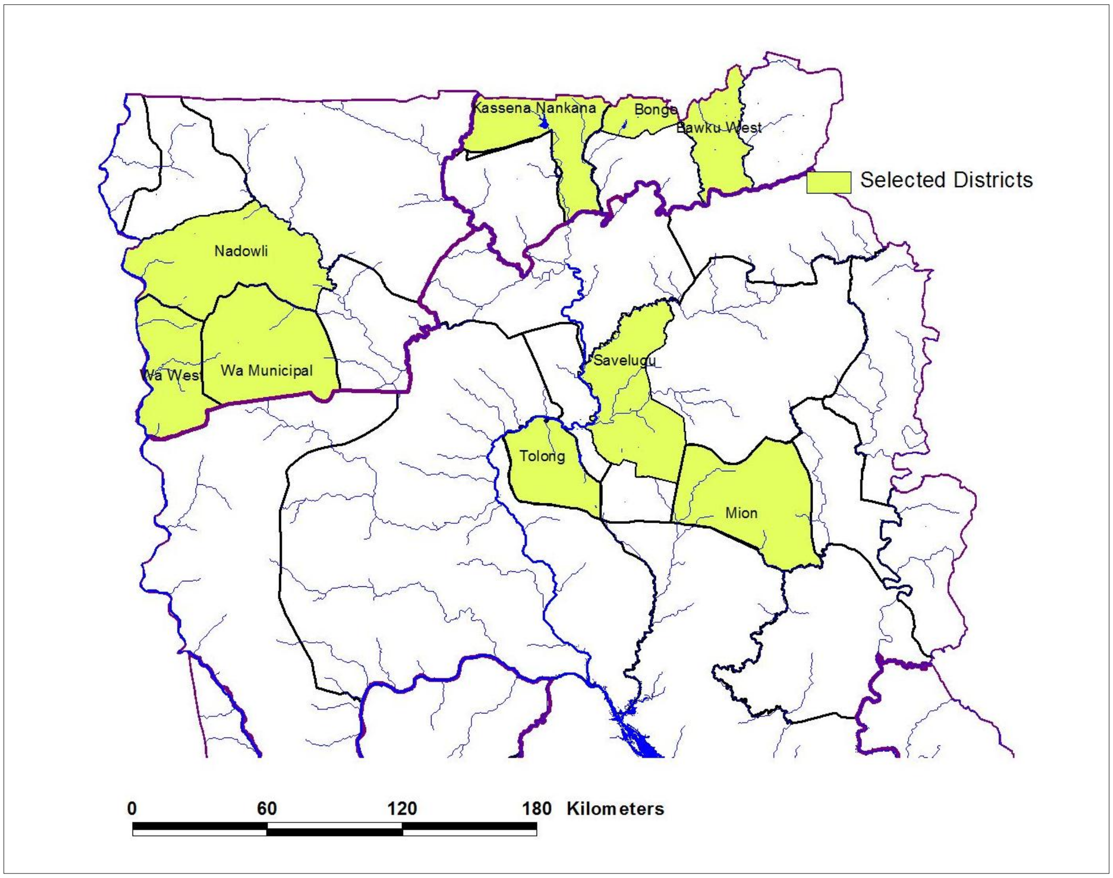
C. Second Phase of Site Selection – Field Visits in Northern Ghana and selection of Communities

Following stratification and detailed study of the results of the first phase of selection, and in consultation with local project management in Tamale, Northern Ghana, six districts were identified as being primary targets. However, it was proposed during and subsequent to field work, to identify five action sites (communities) in each district. It was subsequently discovered, during field work that some districts had been recently subdivided, and that areas of very dense rural population in the Upper East were not adequately sampled. Table 3.4 summarizes the original and revised districts and Figure 3.13 shows the districts that were selected after the field work.

Table 3.4 Intervention Districts (Ghana)

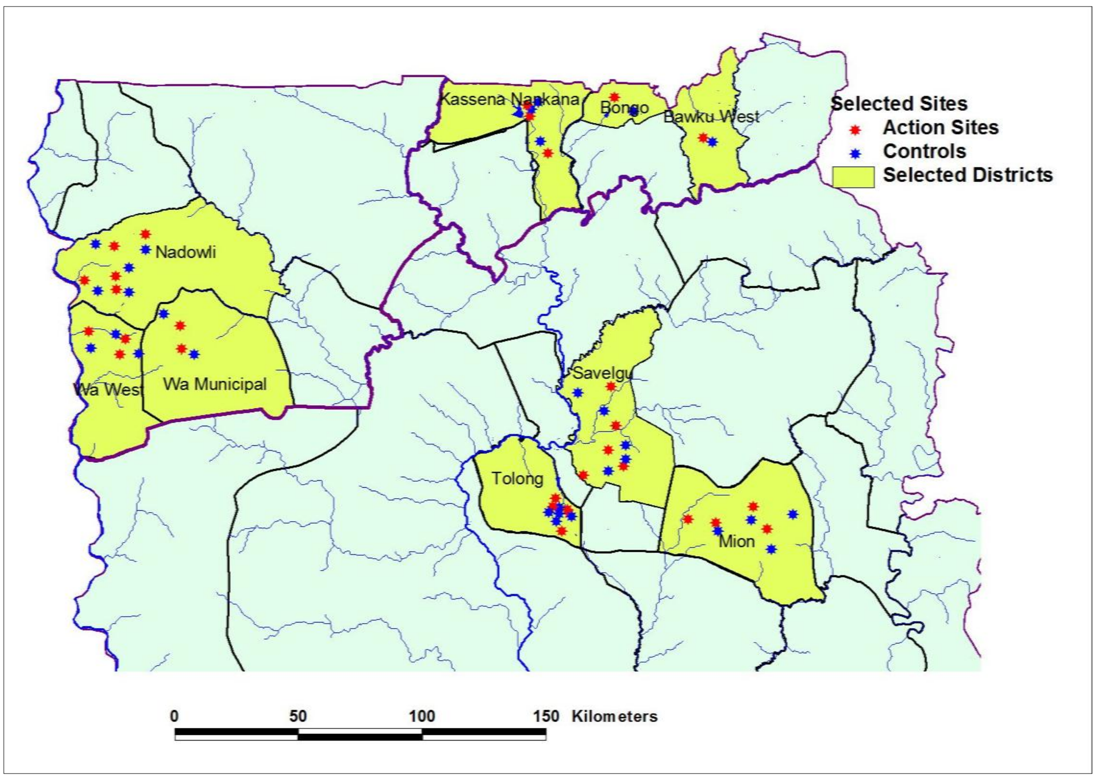
Region	Original Selection	Revised Selection
Northern	Savelugu/Nanton, Tolon/Kundungu, Yendi	Savelugu, Tolon, Mion
Upper West	Wa, Nadowli	Wa Municipal, Wa West, Nadowli
Upper East	Kassena-Nankana	Kassena-Nankana, Bongo, Bawku

Figure 3.13 Districts selected after field work (Ghana)



When target districts had been selected interactively in Tamale, based on stratification, communities within these districts were selected as Action sites and counterfactuals. Maps were prepared of all known villages within each district, based on digital locations of villages provided by Africa Rice and digitization of locations from printed maps. New market access maps were prepared from the latest available digital maps of roads and tracks, updated daily as field work progressed, and these were used to eliminate inaccessible communities. Potential action sites and counterfactuals were selected before field work on the basis of random selection of villages within a geographic framework so as to ensure maximum separation of action sites and counterfactuals, and paper and digital maps prepared before each day's field work. All selected communities were visited to check their suitability in terms of farming systems, accessibility and size of communities. The field team consisted of the consultant, the project manager and other staff from IITA, and officers from the Ministry of Agriculture familiar with the district. Some pre-selected villages were abandoned, and other suitable sites located during field work. The locations of all suggested action and counterfactual sites were presented at a planning workshop in Tamale at the end of October 2012 (Figure 3.14).

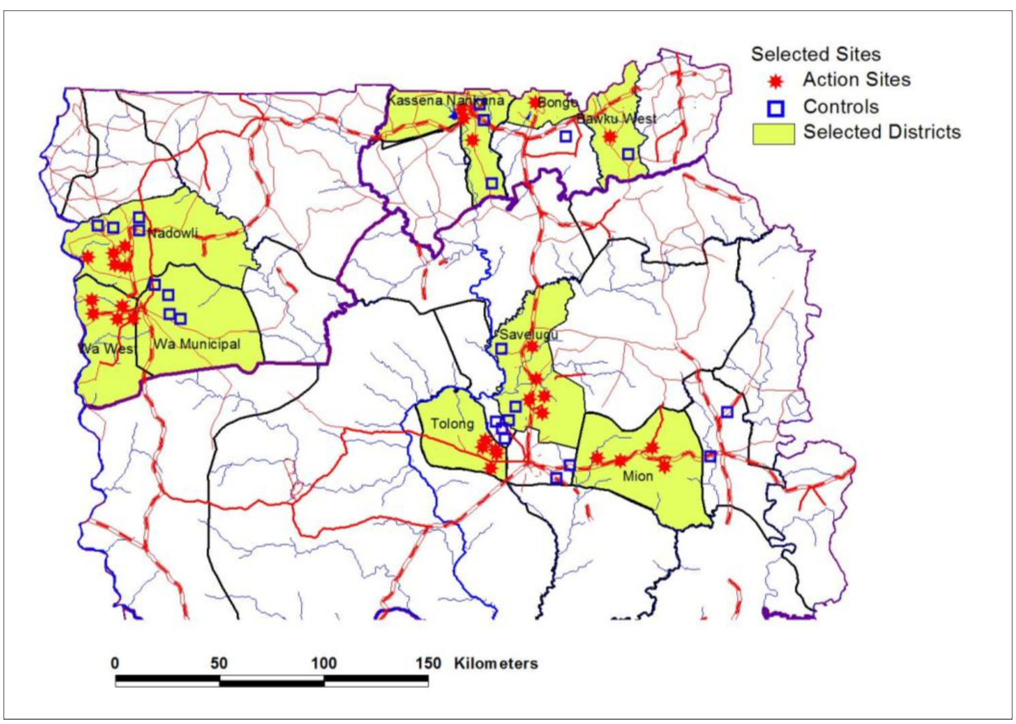
Figure 3.14 Action and counterfactual sites presented during Tamale Workshop (Ghana)



D. Third Phase of Site Selection – Counterfactuals in Northern Ghana

Following the October workshop in Tamale, concern was expressed by IFPRI about the physical closeness of action and counterfactual communities in Tanzania, and it became obvious that the pattern of action and counterfactual communities in Ghana did not provide sufficient physical separation of sites. Some kind of re-selection was required. Identification of suitable counterfactual communities is a very difficult problem. These communities are to form the basis for measuring impact within action communities. For reliable impact assessment, the counterfactuals should have identical properties – population density, cropping system, market access, etc. - as the action communities, but should be as isolated from the action communities as possible. Ideally, inhabitants of counterfactual communities should not meet inhabitants of action villages, and thus should not share markets or other public facilities. These two main conditions – similarity and isolation – can very rarely be achieved. The best solution would be to have action and counterfactual sites in different districts. In northern Ghana this is rarely practical because of big differences in market accessibility and sometimes of cropping systems. There are no major physical barriers to movement such as very large rivers, swamps or mountain ranges. Major markets are shared by inhabitants of adjacent districts. In practice a range of approaches, as described in detail below, were adopted to suit different districts. The IFPRI-led M&E team can decide how many counterfactuals are required, and select randomly from the suggested sites. As far as possible, action communities identified in the initial planning exercise, before the October Tamale Workshop, have been retained, although in a few cases the role of the originally selected site has been converted from action site to control or vice versa. The suggested sites for Northern Ghana are shown in Figure 3.15.

Figure 3.15 Revised action and counterfactual communities (Ghana)



3. 2.3 East and Southern Africa Mega-site (Tanzania, Malawi, and Zambia)

A. Tanzania Project Area

Definition of Project Area

According to the Concept Note for East and Southern Africa, "Feed the Future (FtF) Tanzania is focusing on reducing poverty and improving nutrition through key investments to improve availability and access to staple foods by enhancing the competitiveness of smallholders. These investments are being geographically focused in areas with high agricultural potential bordering chronically food insecure districts: Morogoro (rice); Manyara and Dodoma (maize); and Arusha, Kilimanjaro, Tanga, Zanzibar, Dar es Salaam, Morogoro, Iringa and Mbeya (horticulture).

Dodoma and Manyara Regions in Tanzania are the geographic focus for this project. These areas are located in the Southern Agriculture Growth Corridor of Tanzania. Dodoma Region is a region centrally positioned in Tanzania. This Region is bordered by Manyara Region in the North, Morogoro in the East, Iringa in the South and Singida in the West. Much of the region is a plateau rising gradually from some 830 metres. There are three agro-ecological sub-zones in this region.

Zone I includes the drier areas with 300-500 mm. This agro-ecological zone covers most of the Manyara region and the Masai Steppe in Northeast part of Kondoa, Southern part of Dodoma Rural and Southwest part of Mpwapwa District. The area is dominated by dry, flat or undulating plain with low population. Rainfall is very unreliable. The soils are mostly reddish-brown loamy sands with grey clays in depressions. Major crops in these areas are sorghum, pearl millet, cassava, sweet potatoes, groundnuts, simsim, grapes, Lablab purpureus and sunflower. Potential legume crops include pigeon pea, and cowpea. Potential vegetable crops include African eggplant, Ethiopian mustard, African nightshade, amaranth and vegetable cowpea

Zone II has rainfall of 500-700 mm. It covers central and southern part of Kondoa District, Northern part of Dodoma District, the whole part of Kongwa District and part of Mpwapwa. The area has dark-brown and dark-reddish loamy sands. Major crops are maize, sorghum, groundnuts, grapes, sunflower, cassava, and simsim. Cowpea, tepary (Phaseolus actufilius) and pigeon-pea are legumes with high potential. Ethiopian mustard, African nightshade and vegetable cowpea are vegetables with high potential.

Zone III has better rainfall of 700mm-1000mm. It covers the central part of Mpwapwa District and the Bereko highlands in Kondoa District. This area has deep dark-reddish brown clay loams and black-clay soil in depressions and valleys. Major crops are maize, sunflower, grain legumes, vegetables and bananas. The region is suitable for cowpea, soybean, pigeon pea and beans. Tomato, African eggplant, Ethiopian mustard, African nightshade, amaranth, vegetable cowpea, jute mallow and spiderplant are among vegetable crops with a significant potential in this region."

Characterization of Project Area

The project area, although nominally within a single agro-ecozone, includes high levels of variability in many biophysical and human parameters. Elevation ranges from less than 800 to more than 2000 meters (Figure 3.16), rainfall ranges from less than 500 to more than 1000 mm per year (Figure 3.17), rural population density from less than 2 persons per square kilometer to more than 20 (Figure 3.18), and while most parts of the mega-site are relatively flat, rift-faulting, volcanic activity and ancient highlands result in some zones of steep slopes (Figure 3.19). Access to markets also varies (Figure 3.20).

Cropping intensity varies dramatically across the area, as shown in Figure 3.21, with most intensive cultivation in the higher, wetter areas, and large parts of Simanjiro and Kiteto Districts having little or no cropped land. In terms of farming systems, at a national scale most of the mega-site is either maize-dominated or maize with either sorghum or millet with moderate to high livestock densities. At a more detailed scale, and data is unfortunately not available for Dodoma Rural District, much of the mega-site is dominated by maize, with areas of maize with millet and sorghum, and some small areas dominated by either sorghum or millet. Livestock density is mostly high to very high (Figure 3.22).

Figure 3.16 Elevation (Tanzania)

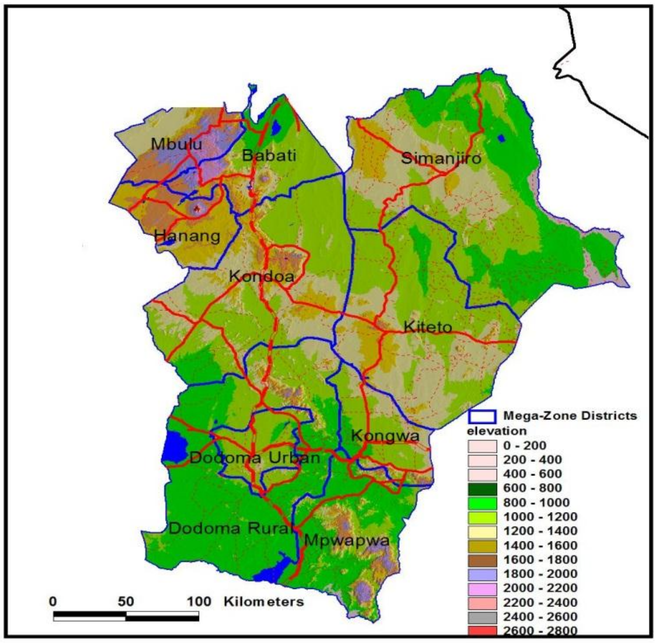


Figure 3.17 Annual rainfall (Tanzania)

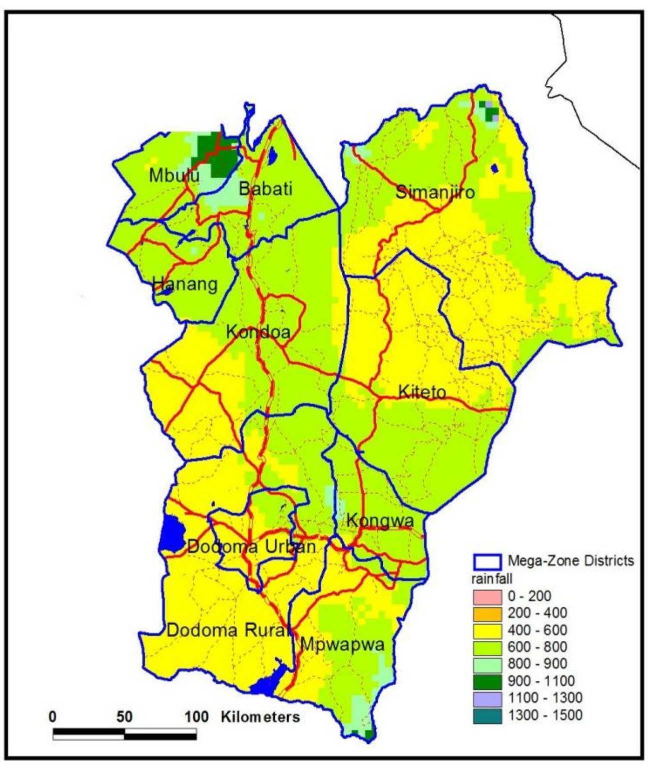


Figure 3.18 Population density (Tanzania)

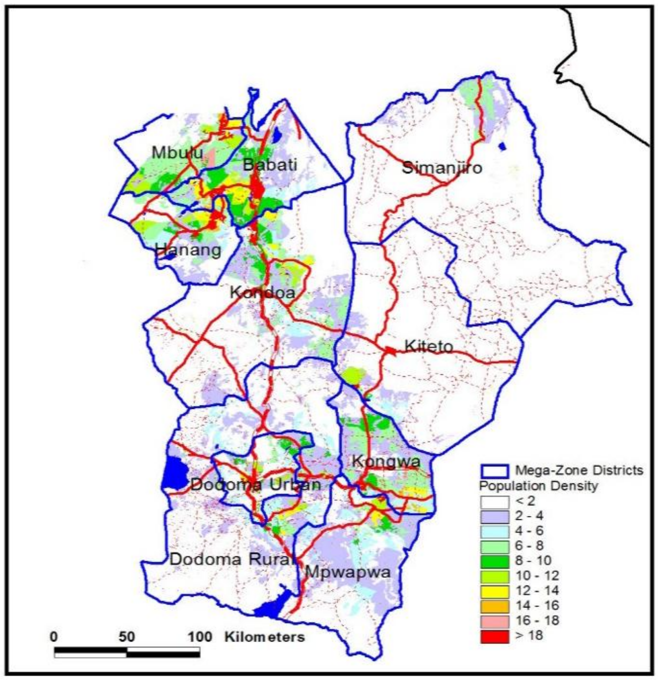


Figure 3.19 Slope (Tanzania)

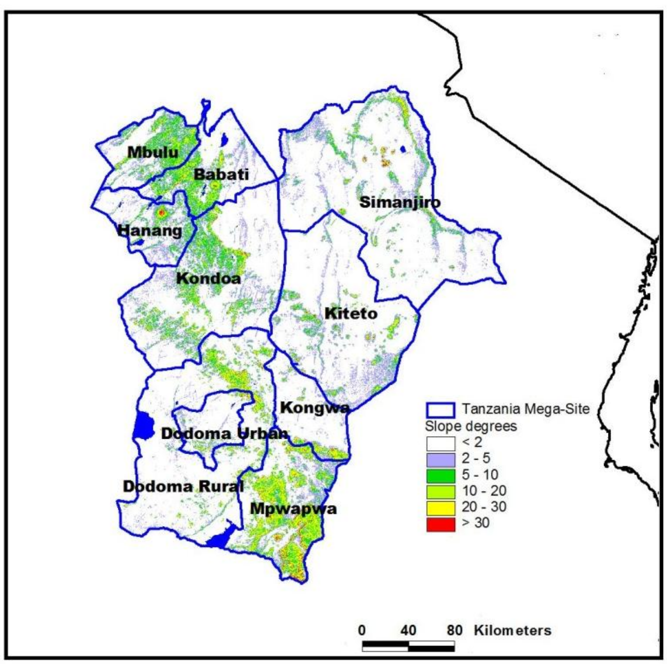


Figure 3.20 Access to markets (Tanzania)

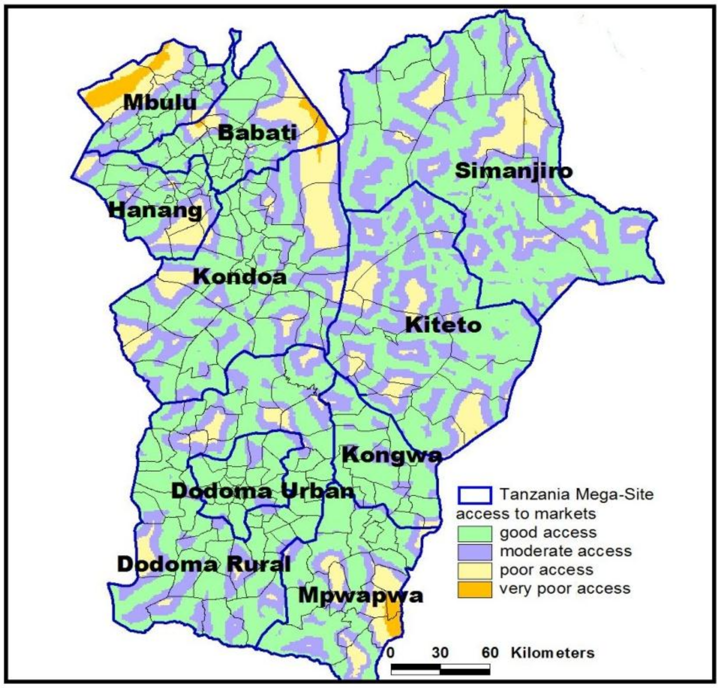


Figure 3.21 Cropped areas in 2001 (Tanzania)

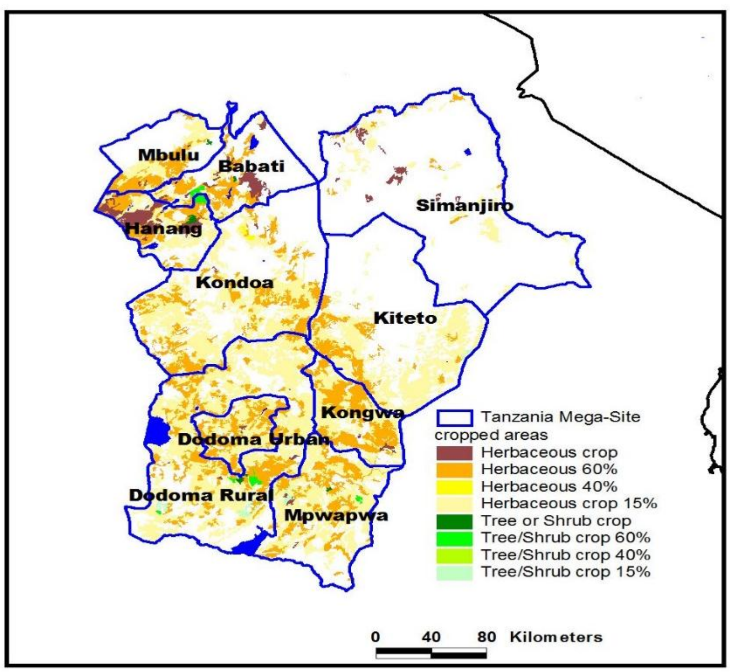
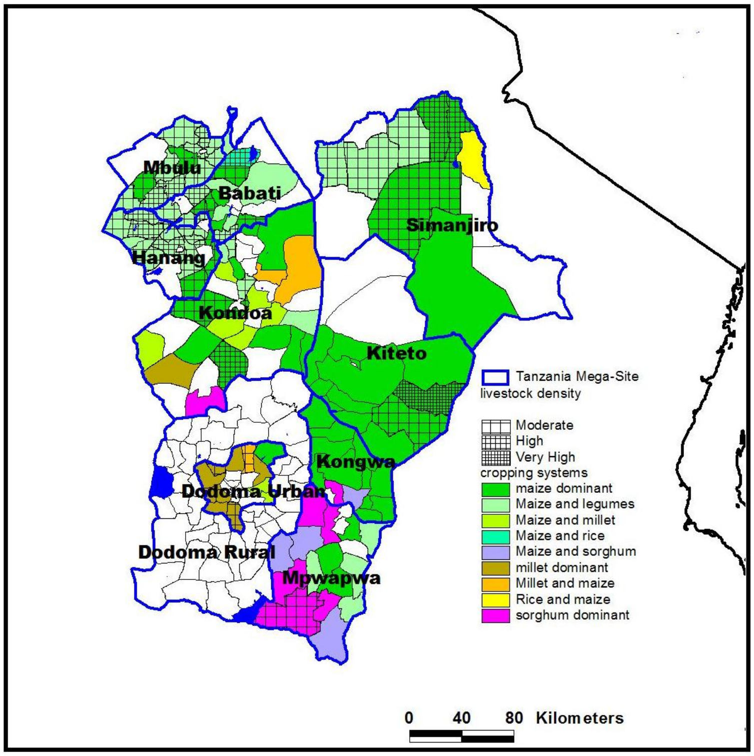


Figure 3.22 Farming system and livestock density (Tanzania)



First Phase site selection – District Level

Based on discussions in the three project areas, actual project sites will be communities (villages) or groups of communities. Project sites for Africa RISING should, ideally, cover the full range of biophysical and human variability within the project area, except that, since the emphasis of the project is on sustainable intensification, areas with poor access to markets and very low population densities should be avoided. Annual rainfall (length of growing season could alternatively be used) is the dominant factor determining what crops can be grown. Elevation is a useful proxy for temperature, both mean and maxima/minima. Slopes are an important constraint to agriculture, affecting the area of land available for simple cultivation, the farming techniques applied, and the risk of erosion.

All wards in the two target regions were coded for classes of rainfall, elevation, mean slope, population density and market access (Table 3.5), and an initial selection made on the basis of moderate to high rural population densities and good to moderate access to markets. The wards were then grouped into twelve categories of rainfall-elevation-slope classes to represent the full range of each of these variables, and two wards selected within each category for project implementation. The selected wards are always the largest wards meeting the required combination of characteristics, in order to permit greater choice of final target communities. Where possible, the two wards selected for each class are in different districts, although some combinations of rainfall, elevation and slope are found only in single districts. Suggested wards are listed in Table 3.6, and their locations shown in Figure 3.23.

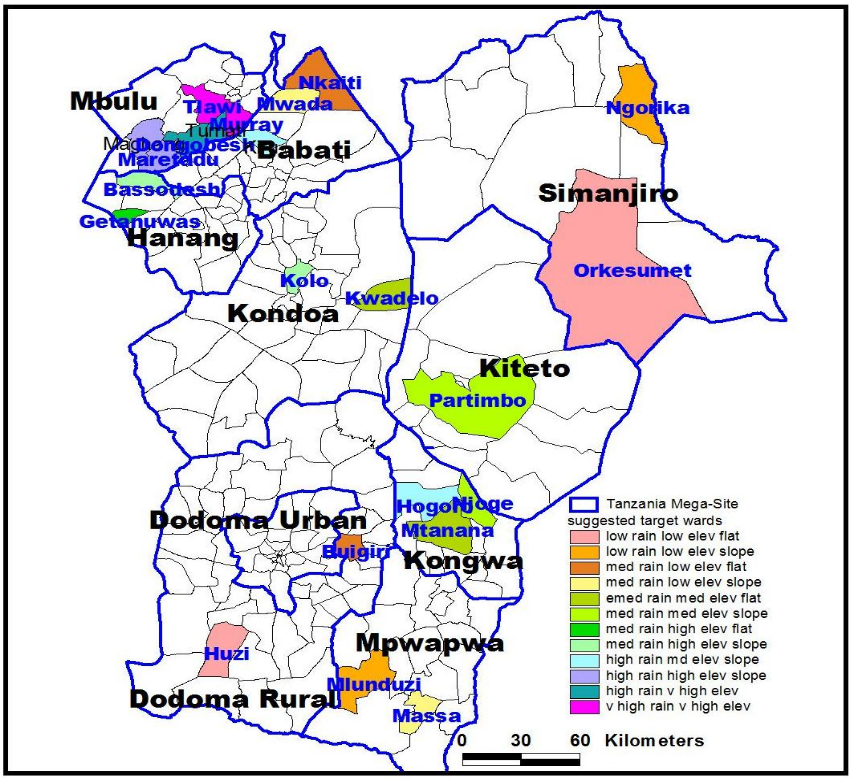
Table 3.5 Classification Criteria for Stratification Parameters (Tanzania)

Class	Population	Rainfall	Elevation	Slope	Access
1	> 500	500-650	700 - 1000	< 1	< 300
2	200 - 500	650 - 800	1000 - 1400	1 to 2	300 - 600
3	100 - 200	800 - 950	1400 - 1800	2 to 5	> 600
4	50 - 100	950 - 1100	1800 - 2200	> 5	
5	10 to 50				

Table 3.6 Recommended target wards (Tanzania)

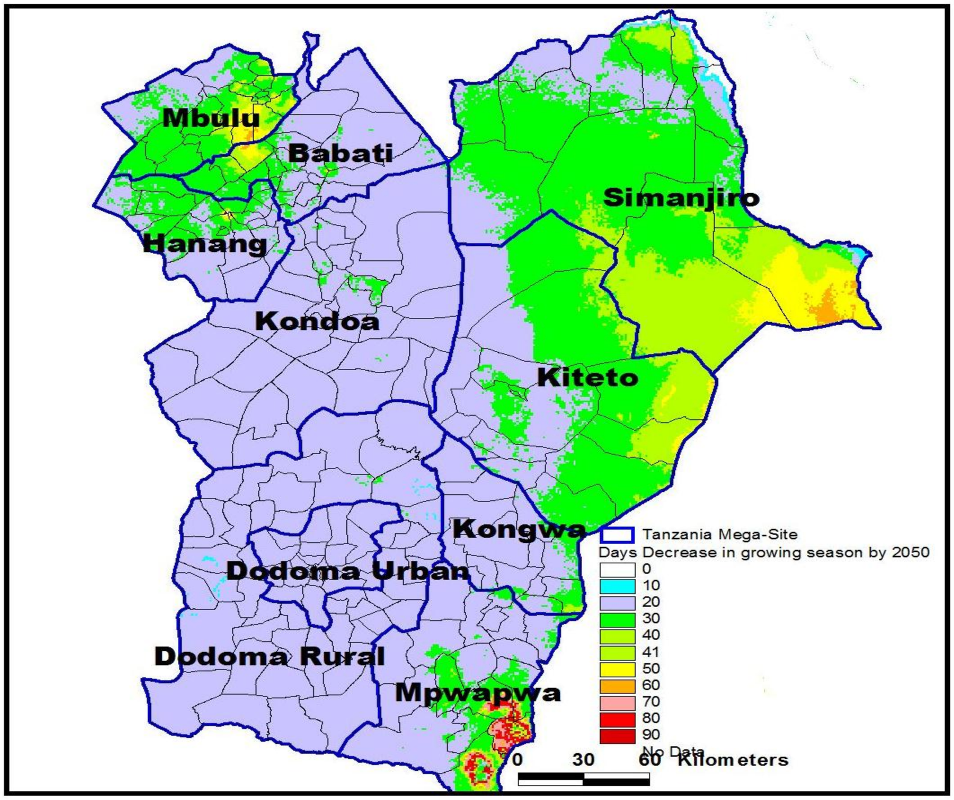
Class ID	Description	CN Zone	Wards
A	Low rain low elev	Zone 1	Orkesumet, Huzi
B	Low rain low elev	Zone 1	Mlunduzi, Ngorika
C	Med rain low elev	Zone 2	Nkaiti, Buigiri
D	Med rain low elev	Zone 2	Massa, Mwada
E	Med rain med elev	Zone 2	Kwadelo, Mtanana
F	Med rain med elev	Zone 2	Partimbo, Njoge
G	Med rain high elev	Zone 2	Getanuwas
H	Med rain high elev	Zone 2	Bassodesh, Kolo
I	High rain med elev	Zone 3	Kiru, Hogoro
J	High rain high elev	Zone 3	Maghang, Maretadu
K	High rain v high	Zone 3	Tumati, Dongobesh
L	V high reain v high	Zone 3	Tlawi, Murray

Figure 3.23 Recommended target wards for Africa RISING (Tanzania)



The final selection of implementation sites had to be made by the project teams in the area, based on existing projects in SIMLESA, CRP 1.1 and CRP 1.2 and other linkages, as well as assessments of the importance of livestock and legumes. Climate change is predicted to affect the whole area, with a reduction of length of growing season of more than 20 days by 2050 (Figure 3.24). The reduction will be greater in the already dry eastern portions of Simanjiro and Kiteto Districts, so any project design will have to allow for this. Reductions in length of growing season in the more humid highlands of Mbulu and Babati may not have such serious consequences. If the number of classes proposed by this phase of targeting was too great, then similar classes could be combined, for example medium rainfall and low elevation combined with medium rainfall and medium elevation.

Figure 3.24 Predicted reduction in growing Season by 2050 (Tanzania)

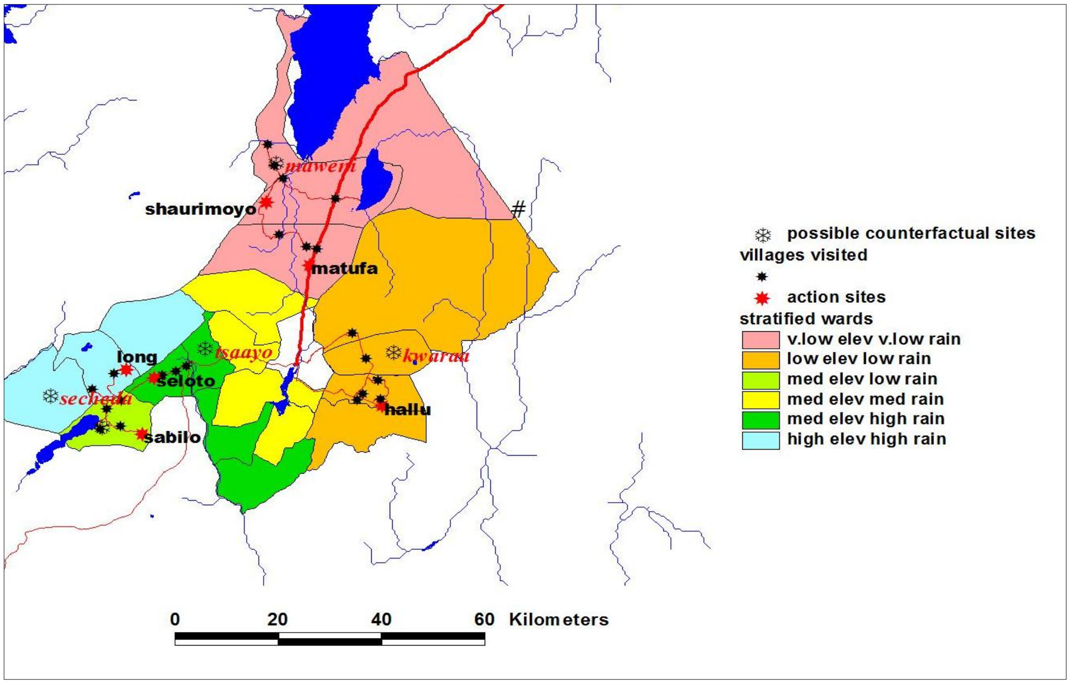


Within the East and Southern Africa maize-legume-livestock program site. Kiteto and Kongwa districts were selected because of NAFAKA involvement. Babati was selected as the most diverse in terms of maize-based systems, population and livestock density, and in combination with already selected sites in Kongwa and Kiteto, provided coverage of the majority of the stratified classes identified during this phase of targeting.

Second Phase Site Selection- Action and Counterfactual Communities based on field work

In Babati District, wards were stratified by elevation and rainfall, and then selected in each ecozone based on cropping and population density. As many villages as possible in selected wards were visited by the project team, including the Consultant, the Project Manager and officials of the Ministry of Agriculture familiar with the District. Following field work, it was agreed that ward center villages should be eliminated because they had unusually high concentrations of non-farming households. From the remaining villages, action sites chosen randomly based on the name of the village starting with the last letter of the alphabet in each ward. Potential counterfactual sites were selected randomly in wards adjacent to and with similar characteristics to the action sites. See Figures 3.25 and 3.26.

Figure 3.25 Selected action and counterfactual Sites in Babati district (Tanzania)



As in Babati, wards in Kongwa and Kiteto District were stratified initially based on elevation and rainfall. At the request of USAID, action sites in these districts must correspond with villages targeted by the NAFAKA project. Villages within target wards in Kongwa District coinciding with NAFAKA sites were visited and action sites selected randomly where possible. Time did not permit visits to villages in Kiteto District, which were relatively remote with poor road access. Potential counterfactual sites were identified in wards adjacent and with similar characteristics to the action sites

Figure 3.26 Selected action and counterfactual sites in Kongwa and Kiteto districts (Tanzania)

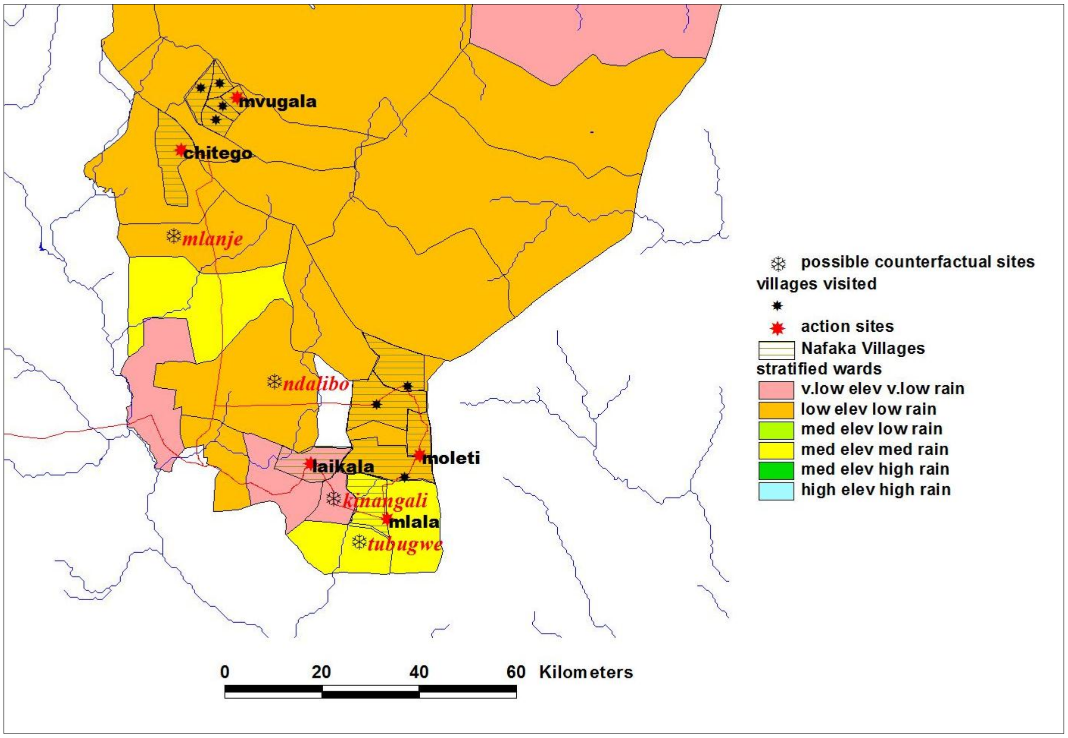
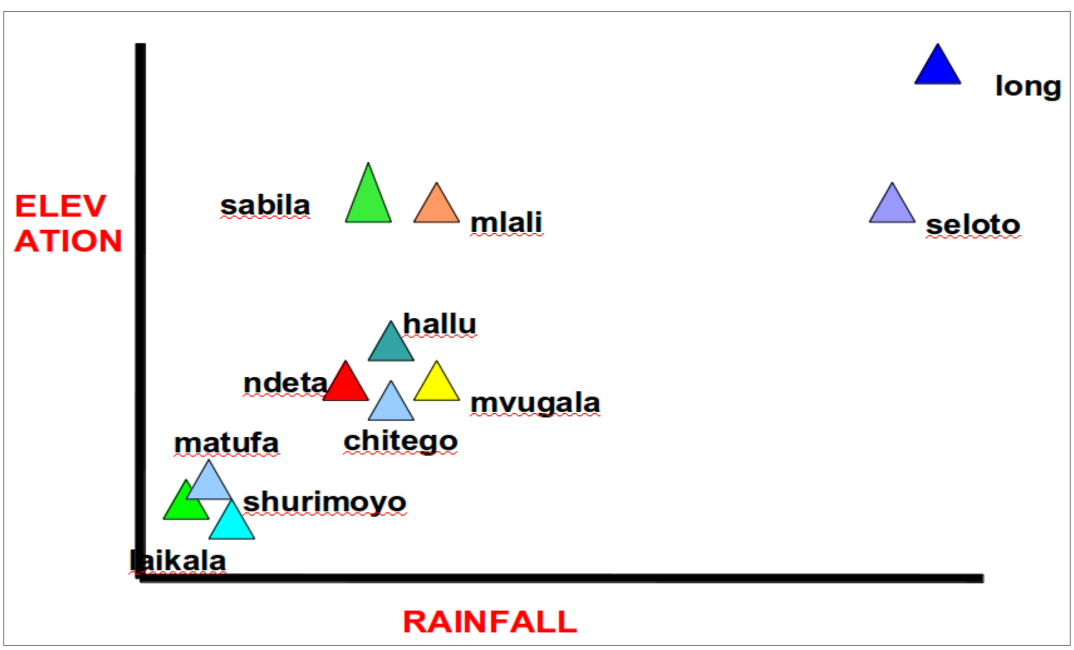


Figure 3.27 Elevation and rainfall distribution of selected action sites (Tanzania)



Third Phase Site Selection. Revision of Counterfactuals and Action Communities

Concern was expressed that suggested counterfactual (control) communities in the Tanzania project area, particularly in Babati District, were often too close to action communities, introducing danger of "contamination" of and "spill-over" into counterfactuals from work carried out in action sites. This problem could be partially addressed by locating control sites in wards further away from action sites, but still within Babati district, and partly by using communities in wards outside the district but with similar characteristics to the action sites.

Ideally, control sites should be as physically isolated as possible from action sites, with little interaction between the inhabitants of the two types of sites. If possible, the inhabitants should use different markets to minimize the sharing of agricultural produce, seeds and ideas. Since comparison of control and action sites forms the basis for evaluation of impact, lack of developmental progress in control sites will maximize apparent impact. In order for the M&E process to be credible, it is extremely important that insistence on physical isolation between action and control sites does not result in the selection of control sites with relatively poorer market access than action sites. This is the dilemma that we face in trying to select new and more isolated control sites in the Tanzania maize-legume-livestock project area.

Figure 3.28 Revised action and counterfactual sites in Babati (Tanzania)

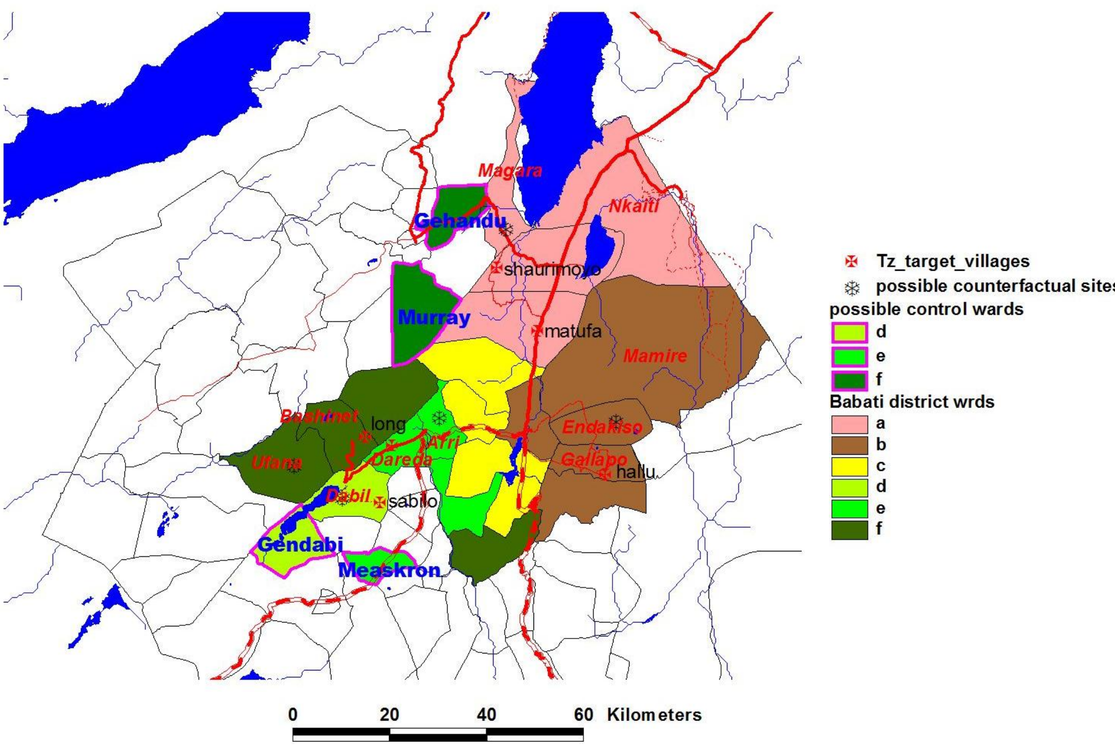


Figure 3.28 shows the location of proposed action sites in Babati district, together with color coding of the different agro-ecozones. The proposed action sites in Dabil and Derada wards represent two distinctly different zones. Both are at medium elevation, at elevated portions within the Rift Valley resulting from volcanic activity within the Rift. Rainfall is significantly higher in Dareda and some adjoining wards than in Dabil. The latter is in a "rain-shadow" created by the huge mass of Mt. Hanang, while the former has enhanced rainfall on the windward side of the mountain. The available rainfall maps do not capture this feature. Rainfall maps are interpolations between relatively sparse long-term weather stations, and while the interpolation procedures incorporate models to allow for some orographic modification to rainfall, they do not model the very complex effects of the relationship between topography and prevailing rain-bearing wind direction. Field observations during recent visits to the area revealed these local differences, and suggest that the relatively high rainfall in Dareda continues along the main road southward from Dareda around the eastern flank of Hanang. The ward of Measkron (Hanang District), on the main road east of Mt. Hanang, is suggested as a possible analogue to Dareda, suitable for a control site. Even though this is some distance from Dareda, the main regional market will still be Babati town. It seems likely that the Ward Gendabi (Hanang District), west of Hanang and on the southern shores of Lake Balangida, has similar characteristics to Dabil, except that market access is poorer. A village in this ward could be a suitable control for the Sabilo action site in Dabil, since contact between the two wards is very restricted by the extreme topography along the Balangida lake-shore.

The proposed action community of Long in Bashinet ward, represents a very specific agro-ecology in the highland plateau west of the main Rift Valley. The wards of Murray and Gehandu in Mbulu district have similar agro-ecological characteristics as well as similar cropping systems, although the current access status is not clear. A control site could be located here, but access would have to be checked by a field visit.

Three other action sites could probably be monitored by counterfactual sites within Babati district, but more physically separated from them than the originally suggested sites. Hallu village in Gallapo ward has analogues in Mamire ward further north than the originally suggested control site. Mamire village itself is probably not suitable, but other villages further east in this ward might be better. They still use Babati town market, but otherwise physical contact between the communities is probably rare, since both use different roads to get to market. The two action communities in the northern part of Babati district, Shaurimoyo and Matufa, could probably be covered by a single control community. In place of the community suggested in Magera ward, a village close to the main road could be selected in Nkaiti ward, where access would be similar to the action sites, and climate and soils comparable.

In Kongwa and Kiteto districts, selection of counterfactual communities is not as constrained as in Babati. The topography and climate is more uniform, and large areas show very similar characteristics. It is suggested that sites should be selected randomly, constrained only by market access to ensure similar development possibilities.

B. Malawi Project Area

Definition of Project Area

Malawi is one of the target countries in the East and Southern Africa mega-site. Dedza and Ntcheu districts (highlighted in Figure 3.29) have been selected as focused areas in the country. Figure 3.34 provides a further breakdown within the two districts to look at Traditional Authorities (TAs) and the location of the four pairs of proposed sections (intervention and counterfactual) initially selected by MSU.

Figure 3.29 Target districts (Malawi)

Figure 3.30 Traditional Authorities in target districts (Dedza and Ntcheu districts)

Characterization of Project Area

In order to stratify and characterize the focused districts, the M&E reviewed available spatial biophysical and socio-economic data layers to understand the spatial pattern and homogeneity of each of the candidate data layers and to choose the appropriate dataset for the stratification analysis. The candidate layers that were reviewed include: population density, Agro-Ecological Zone (AEZ), precipitation, elevation, slope, farming system, market access, Length of Growth Period (LGP), and maize harvested area. The metadata of the individual datasets are listed in Table 3.7.

The variables are first mapped in order to visualize their spatial distribution, and then they are aggregated by classes.

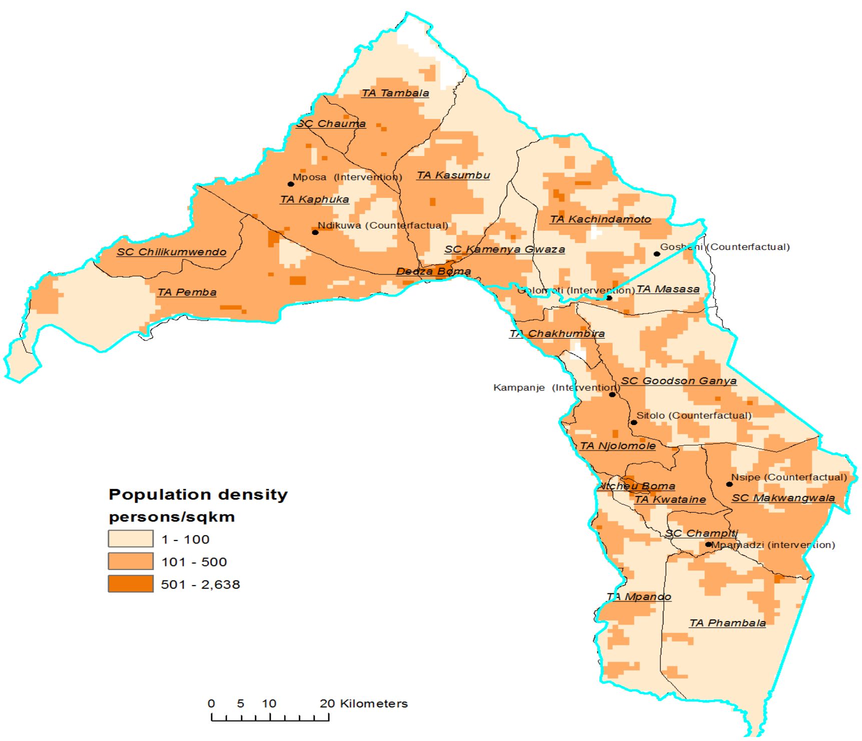
Table 3.7 Characteristics of the candidate data layers (Malawi)

Datasets	Spatial resolution	Year	Source
Population density	1 sqkm	2000	CIESIN
Agro-Ecological Zones	~10sqkm		IIASA
Precipitation	50 sqkm	long term (> 50 years) average	CRU
	1 sqkm	long term (> 50 years) average	WorldClim
	100 sqkm	long term (> 50 years) average	NASA POWER
	50sqkm	long term (> 50 years) average	GPCC
	1sqkm	long term (1976-2008) average	interpolated from national weather station
Elevation	1 sqkm		USGS
Slope	1 sqkm		USGS
farming systems	shape file		John Dixon (2012 version)
Market access	1 sqkm	2000	HarvestChoice
Length of growth period	~10sqkm	long term (> 50 years) average	IIASA
Maize harvested area	~10sqkm	2000	HarvestChoice

Population density

Population density in Dedza and Ntcheu is generally higher than the average population density in East Africa. As can be seen from Figure 3.35, most of the area shows population density higher than 100 persons per squared kilometer, and it is classified into 3 categories with the following cut-offs: less than 100, 100 -500, and greater than 500.

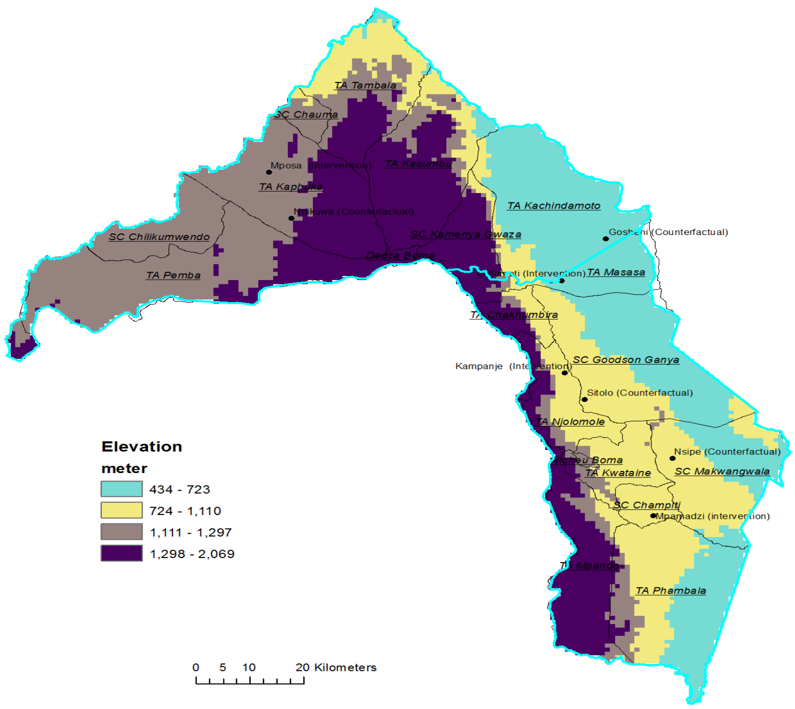
Figure 3.31 Population density (Dedza and Ntcheu districts)



Elevation

There are many datasets available on elevation for Malawi: the USGS Hydro1k data layer has been chosen because most of the other data used in Africa Rising site selection analysis is at 1km resolution (***Figure 3.32***). In order to avoid arbitrary selection of cut-off values, the quintile of elevation distribution at 1km pixel level has been used.

Figure 3.32 Elevation (Dedza and Ntcheu districts)



Precipitation

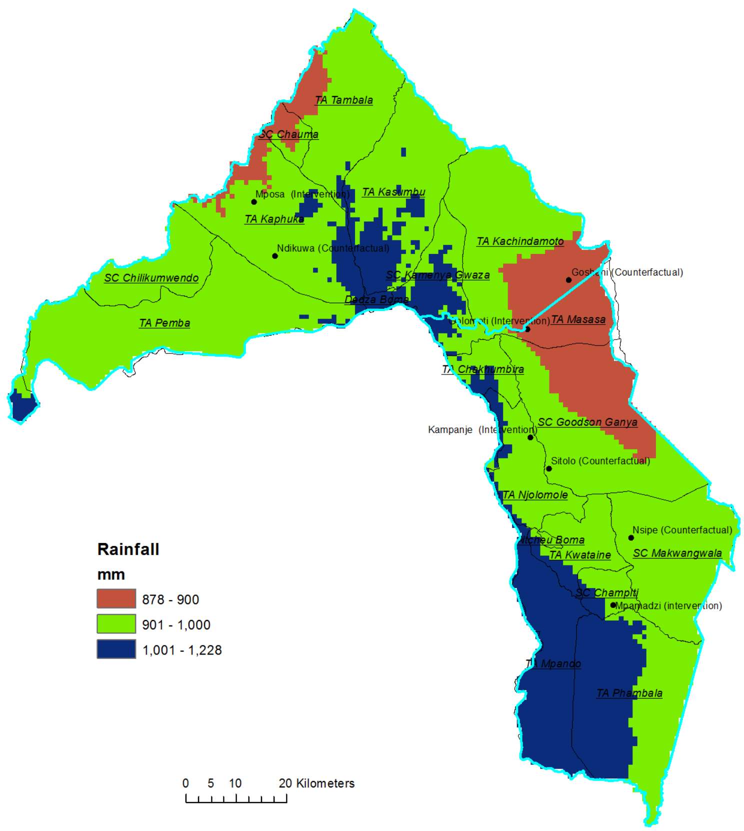
Even though there are several publicly available precipitation data layers, most of them are more suitable to global studies than to country or sub-national analysis, being at a very coarse resolution. There are two methods to derive precipitation data point at the pixel level. One is from weather station records with spatial interpolation. The second method is from satellite observation.

The data from WorldClim has the highest spatial resolution, at 1km (***Figure 3.33*****Error! Reference source not found.**). Nevertheless, these data need to be used with caution, as their reliability has been questioned from various parts.

Other possible climatic data sources are CRU, NASA POWER, and GPCC, being all at half degree resolution. Their main drawback is the very coarse resolution, which makes them inadequate for the analysis on the focused districts.

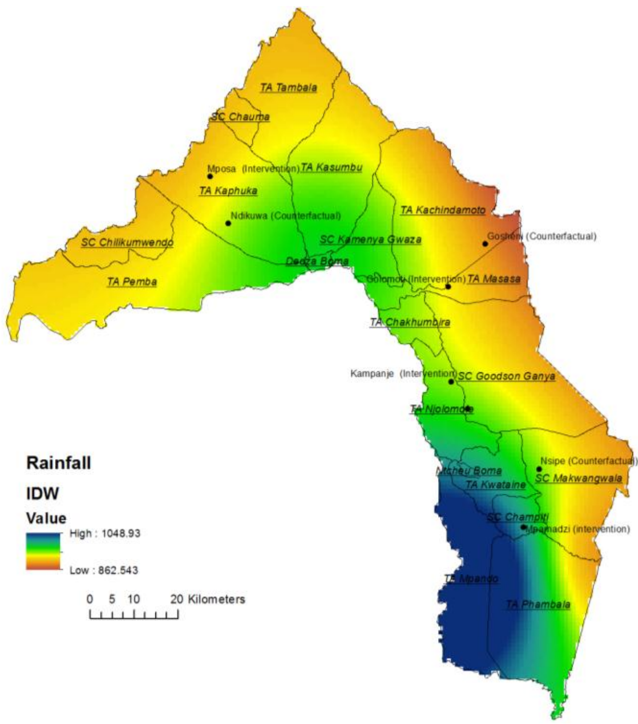
Finally, the last option is relying on national weather data. The department of climate change and meteorological services at the Ministry of Natural Resources, Energy and Environment provide long term precipitation data from weather stations for the period 1961.[20] IFPRI has access to these data through its office in Lilongwe, and the analysis below is based on the precipitation layer in Figure 3.34 for the period 1976-2008. Figure 3.33 is reported for comparison purposes.

Figure 3.33 Long-term average precipitation (Dedza and Ntcheu districts)



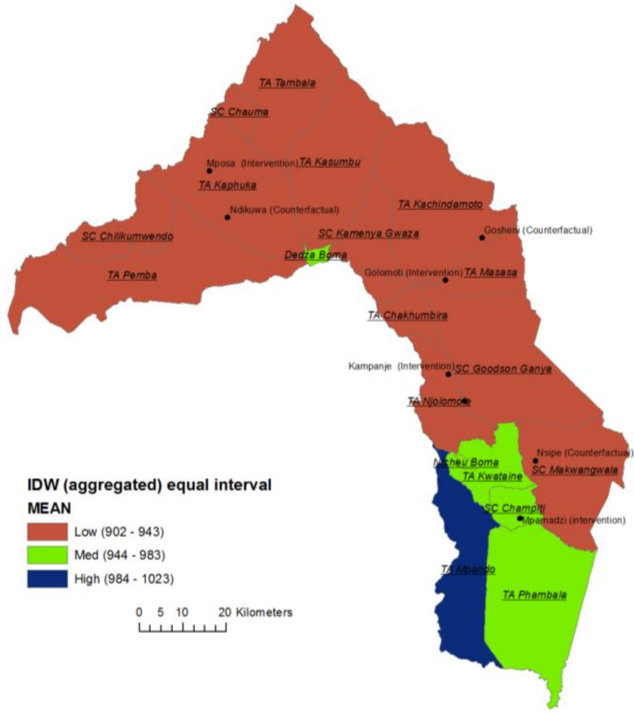
[20] See more here: http://www.metmalawi.com/weather/stations.php

Figure 3.34 Long-term (1976-2008) average precipitation (Dedza and Ntcheu districts)



The map in Figure 3.34 was then classified based on equal interval at pixel level in Figure 3.39 below. If three equal intervals of around 40mm rainfall are considered, the entire Dedza district would belong to the low rainfall stratum, except for Dedza Boma. Ntcheu district would be divided in three groups, with only one TA (Mpando) in the high rainfall category. This classification has been used for the final stratification.

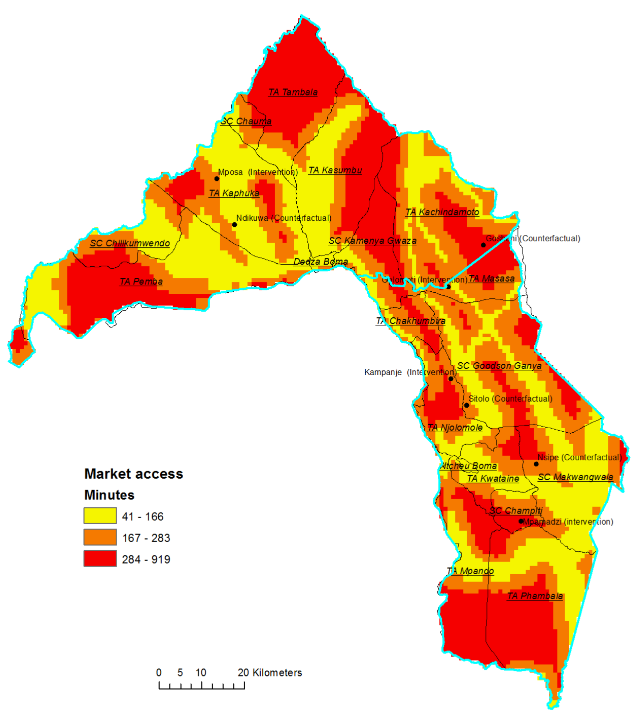
Figure 3.35 Long-term (1976-2008) average precipitation classified in equal intervals at pixel level



Market Access

Market access is largely used as an indicator of accessibility. Figure 3.40 shows the tercile classification (high, medium, and low) based on travel time in minutes to the nearest city with at least 50 thousand people is applied in this analysis.

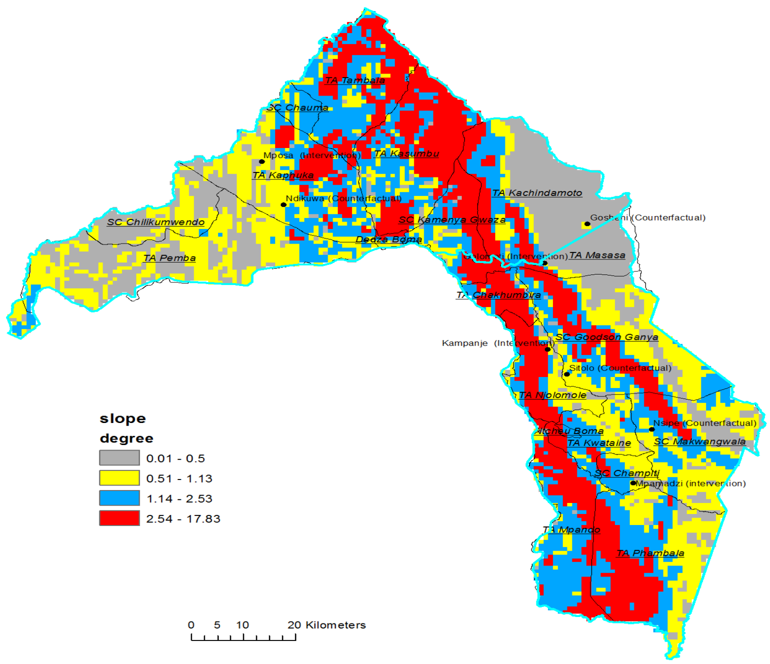
Figure 3.36 Market access (Malawi)



Slope

The slope is acquired from USGS Hydro 1k project. The quartile classification is used to classify the pixels (Figure 3.37).

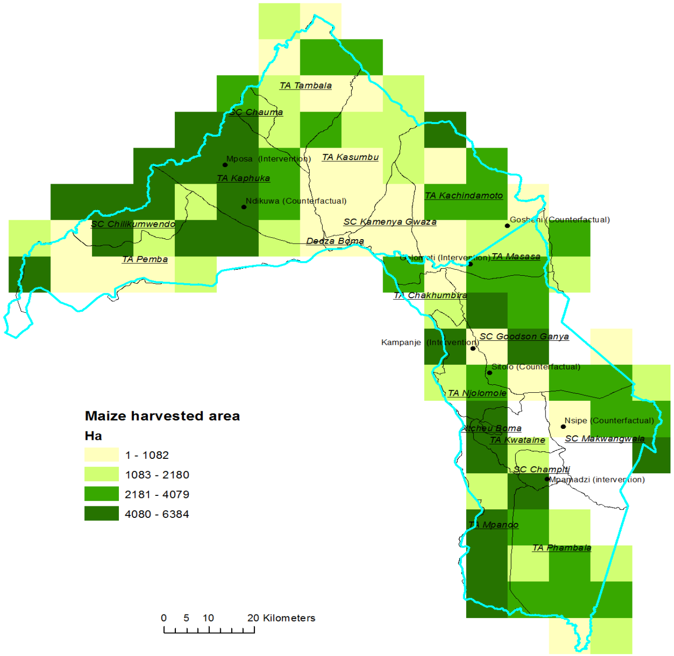
Figure 3.37 Slope (Malawi)



Maize Harvested area

Maize is the dominant crop grown in Malawi, and the maize harvested area is used in the analysis. The dataset for maize harvested area is derived from the Spatial Production Allocation Model (SPAM) by HarvestChoice, where pixels are classified by quartile (Figure 3.38).

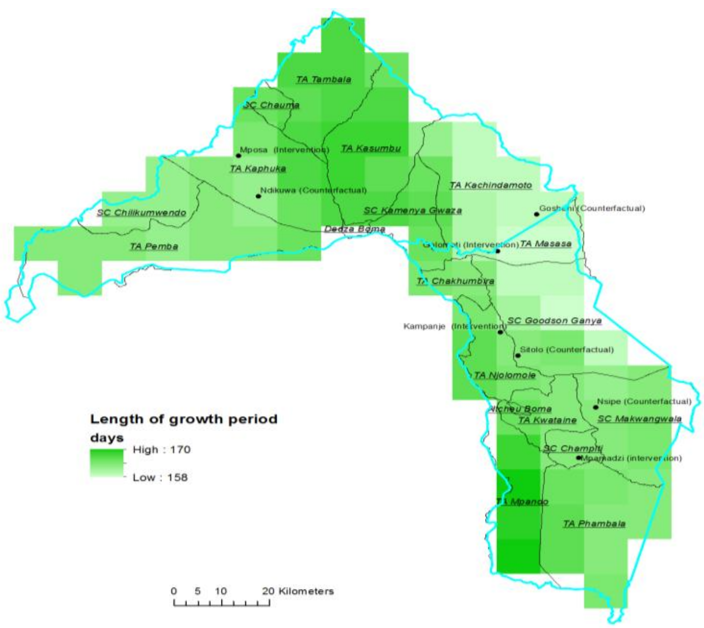
Figure 3.38 Maize harvested area (Malawi)



Length of growth period

The length of growth period, a good proxy of agriculture potential, measures how many continuous suitable days are available for the crop to grow based on soil water capacity holding, soil moisture, temperature, and elevation. Its quintile distribution is shown in Figure 3.39.

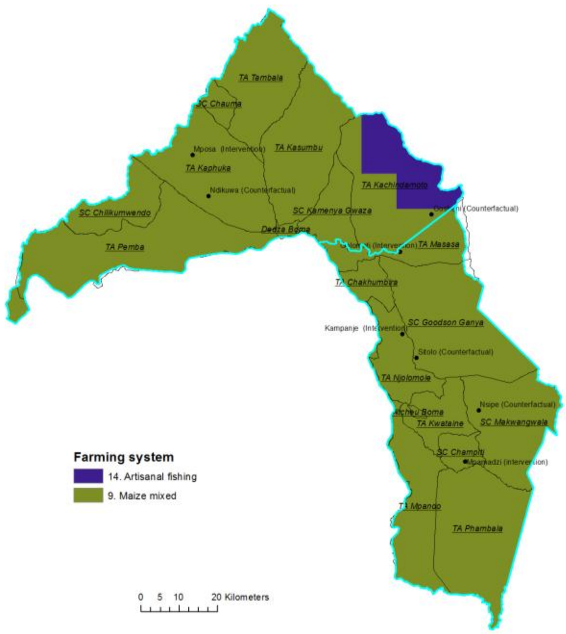
Figure 3.39 Length of growth period (Malawi)



Farming systems

The farming system map shows that the dominant system is maize mixed, with a small area based on artisanal fishing on the shores of Lake Malawi (Figure 3.40).

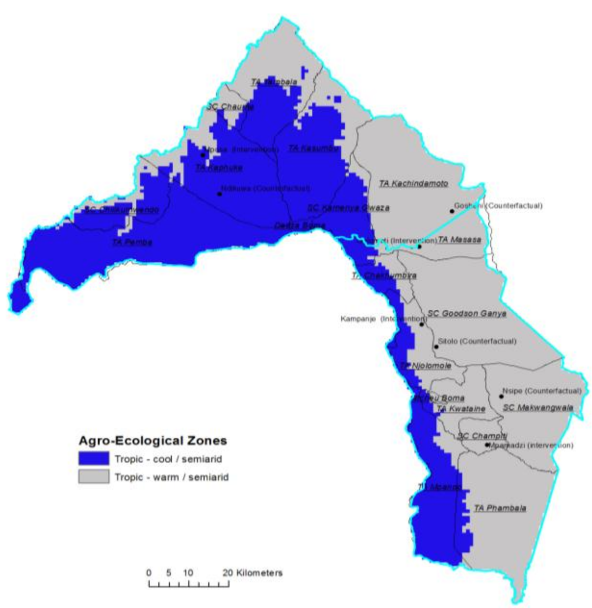
Figure 3.40 Farming systems (Malawi)



Agro-Ecological Zones

The AEZ layer shows two AEZ zones in Malawi: tropical cool semi-arid, and tropical warm semi-arid (Figure 3.41).

Figure 3.41 Agro-Ecological Zones (Malawi)



Proposed stratification for site selection

After a review of the candidate variables, the data layers used to stratify the two districts are listed in Table 3.8.

Table 3.8 Proposed variables and their cut-offs (Malawi)

class	pop	rainfall	elevation	slope	market	maize harvested
1	1-100	902-943	434-723	0.01-0.5	41-166	1-1082
2	101-500	944-983	724-1110	0.51-1.13	167-283	1083-2180
3	500-2638	984-1023	1111-1297	1.14-2.53	284-919	2181-4079
4			1298-2069	2.54-17.83		4080-6384

Table 3.9 shows each candidate variable summarized at the Extension Planning Areas (EPA).

Table 3.9 Average values at the EPA level (Malawi)

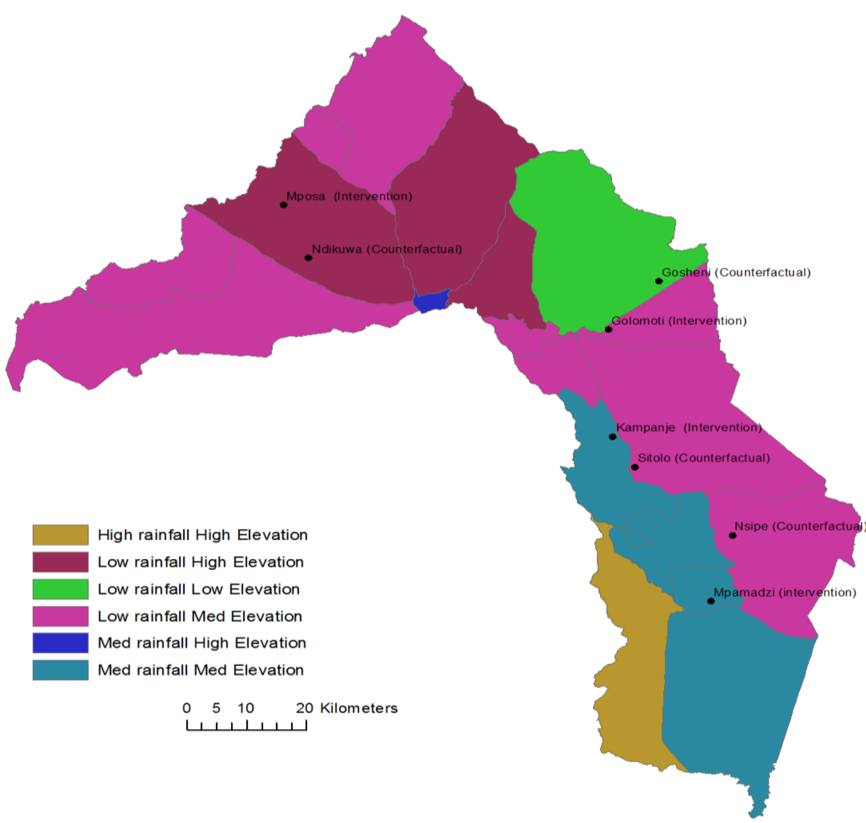
NAME_2	Name 1	Prep (mm)	Elevation(m)	Mkt Access(min)	Slope (degree)	Pop density (person/sqkm)	Average maize harvested area per pixel (ha)
Dedza Boma	Dedza	1,025.8	1,559.3	119.1	2.2	852.1	<Null>
Ntcheu Boma	Ntcheu	985.6	1,139.4	111.6	2.2	979.4	<Null>
SC Champiti	Ntcheu	993.2	910.2	253.6	1.4	168.1	3713.4502
SC Chauma	Dedza	899.8	1,169.9	221.6	1.4	263.0	<Null>
SC Chilikumwendo	Dedza	918.9	1,216.9	197.0	0.5	218.6	3285.3501
SC Goodson Ganya	Ntcheu	911.5	736.5	212.5	1.7	115.9	2349.1001
SC Kamenya Gwaza	Dedza	989.2	1,413.6	365.3	4.4	132.2	825
SC Makwangwala	Ntcheu	959.0	773.9	162.7	1.2	147.0	658.26666
TA Chakhumbira	Ntcheu	955.9	1,168.9	247.3	5.1	201.1	2030
TA Kachindamoto	Dedza	909.5	569.3	235.1	1.5	112.2	2525.1428
TA Kaphuka	Dedza	940.2	1,332.7	165.0	1.7	190.4	4051.9714
TA Kasumbu	Dedza	972.3	1,338.9	255.4	3.6	110.3	860.6875
TA Kwataine	Ntcheu	984.4	1,050.8	195.7	1.6	206.1	2873.5999
TA Masasa	Ntcheu	908.6	736.2	262.9	1.3	76.1	2099.45
TA Mpando	Ntcheu	1,118.5	1,405.3	344.7	2.7	93.3	3980.375
TA Njolomole	Ntcheu	968.1	1,139.4	231.0	3.4	194.1	3036.6001
TA Phambala	Ntcheu	1,019.5	814.7	292.1	2.0	77.1	2776.9287
TA Tambala	Dedza	925.2	1,140.2	490.7	2.8	121.5	1740.55
TA Pemba	Dedza	947.2	1,278.1	250.1	0.6	153.1	2254.45

According to this initial categorization, six candidate variables are classified into 3-4 classes with 1728 combinations -3 (population) x 3 (rainfall) x 4 (elevation) x 4 (slope) x 3 (market access) x 4 (maize harvested area)-. In order to reduce the number of combinations, the final variables used are elevation and rainfall only, deemed to be the main drivers of agricultural potential. Moreover, the 4 elevation classes were merged into 3 classes, with med-high and med-low merged into med classes. Elevation and rainfall classes are then matched to stratify the TAs in the two districts (Table 3.10 and Figure 3.42).

Table 3.10 Combination of rainfall and elevation (Malawi)

TA	Distric	Elevation (m)	Elevation	Rainfall (mm)	Classification
SC	Dedza	1,217	Med	904	Low rainfall Med Elevation
TA Kachindamoto	Dedza	569	Low	904	Low rainfall Low Elevation
SC Chauma	Dedza	1,170	Med	905	Low rainfall Med Elevation
TA Tambala	Dedza	1,140	Med	906	Low rainfall Med Elevation
TA Pemba	Dedza	1,278	Med	917	Low rainfall Med Elevation
TA Kaphuka	Dedza	1,333	High	921	Low rainfall High Elevation
TA Kasumbu	Dedza	1,339	High	925	Low rainfall High Elevation
SC Kamenya	Dedza	1,414	High	938	Low rainfall High Elevation
Dedza Boma	Dedza	1,559	High	948	Med rainfall High Elevation
TA Masasa	Ntcheu	736	Med	902	Low rainfall Med Elevation
SC Makwangwala	Ntcheu	774	Med	910	Low rainfall Med Elevation
SC Goodson	Ntcheu	737	Med	910	Low rainfall Med Elevation
TA Chakhumbira	Ntcheu	1,169	Med	929	Low rainfall Med Elevation
TA Njolomole	Ntcheu	1,139	Med	943	Med rainfall Med Elevation
TA Kwataine	Ntcheu	1,051	Med	963	Med rainfall Med Elevation
TA Phambala	Ntcheu	815	Med	967	Med rainfall Med Elevation
SC Champiti	Ntcheu	910	Med	972	Med rainfall Med Elevation
Ntcheu Boma	Ntcheu	1,139	Med	974	Med rainfall Med Elevation
TA Mpando	Ntcheu	1,405	High	1,023	High rainfall High Elevation

Figure 3.42 Combination of rainfall and elevation (Malawi)



The values of the variables displayed above at the TA level are also reported at the eight initial sections chosen by MSU (Table 3.11). Their classification is also presented in Table 3.12.

Table 3.11 Averages of the variables in the eight Sections selected by MSU (Malawi)

District	EPA	Section	Latitude	Longitude	prep	Elevation	Market access	slope	Pop densi	Maize Harvest area
Dedza district	Linthipe	Mposa (Intervention)	14°12'21"S	34°05'58"E	908.00	1,242.00	179.00	0.67	181.00	5,082.80
Dedza district	Linthipe	Ndikuwa (Counterfactual)	14°18'11"S	34°08'16"E	920.00	1,276.00	156.00	0.89	220.00	5,132.50
Dedza district	Golomoti	Golomoti (Intervention)	14°26'03"S	34°35'30"E	890.00	553.00	190.00	0.74	129.00	2,242.80
Dedza district	Golomoti	Gosheni (Counterfactual)	14°20'45"S	34°40'01"E	890.00	498.00	379.00	0.47	36.00	1,345.70
Ntcheu district	Kandeu	Kampanje (Intervention)	14°37'45"S	34°35'51"E	931.00	913.00	269.00	3.77	217.00	815.10
Ntcheu district	Kandeu	Sitolo (Counterfactual)	14°41'05"S	34°37'53"E	944.00	951.00	245.00	0.68	173.00	3,620.80
Ntcheu district	Nsipe	Mpamadzi (intervention)	14°55'47"S	34°44'47"E	994.00	857.00	343.00	1.11	214.00	5,520.60
Ntcheu district	Nsipe	Nsipe (Counterfactual)	14°48'34"S	34°46'42"E	981.00	968.00	229.00	1.02	317.00	1.60

Table 3.12 Stratification of the eight Sections selected by MSU (Malawi)

Site	EPA	Section	Latitude	Longitude	prep	Elevation	Market access	slope	Pop density	Maize Harvest area
Dedza district	Linthipe	Mposa (Intervention)	14°12'21"S	34°05'58"E	2	3	2	2	2	4
Dedza district	Linthipe	Ndikuwa (Counterfactual)	14°18'11"S	34°08'16"E	2	3	1	2	2	4
Dedza district	Golomoti	Golomoti (Intervention)	14°26'03"S	34°35'30"E	1	1	2	2	2	3
Dedza district	Golomoti	Gosheni (Counterfactual)	14°20'45"S	34°40'01"E	1	1	3	1	1	2
Ntcheu district	Kandeu	Kampanje (Intervention)	14°37'45"S	34°35'51"E	2	2	2	4	2	1
Ntcheu district	Kandeu	Sitolo (Counterfactual)	14°41'05"S	34°37'53"E	2	2	2	2	2	3
Ntcheu district	Nsipe	Mpamadzi (intervention)	14°55'47"S	34°44'47"E	2	2	3	2	2	4
Ntcheu district	Nsipe	Nsipe (Counterfactual)	14°48'34"S	34°46'42"E	2	2	2	2	2	1

Given the close proximity between action and counterfactual sections within in each pair of sites identified by MSU, and the new stratification proposed in this document, a re-selection of sections and sites in Ntcheu and Dedza districts in Malawi is advised. Depending on the exact location of the villages within each section selected (especially Gosheni, Golomoti, Kampanje and Sitolo), virtually four of the eight sections proposed are in the low-rainfall med-elevation stratum, and only two in the low-rainfall high-elevation stratum. Therefore, this selection did not seem to guarantee an adequate coverage of the spectrum of biophysical conditions prevailing in the two districts, preventing a broad assessment of the interventions in areas with different agricultural potential.

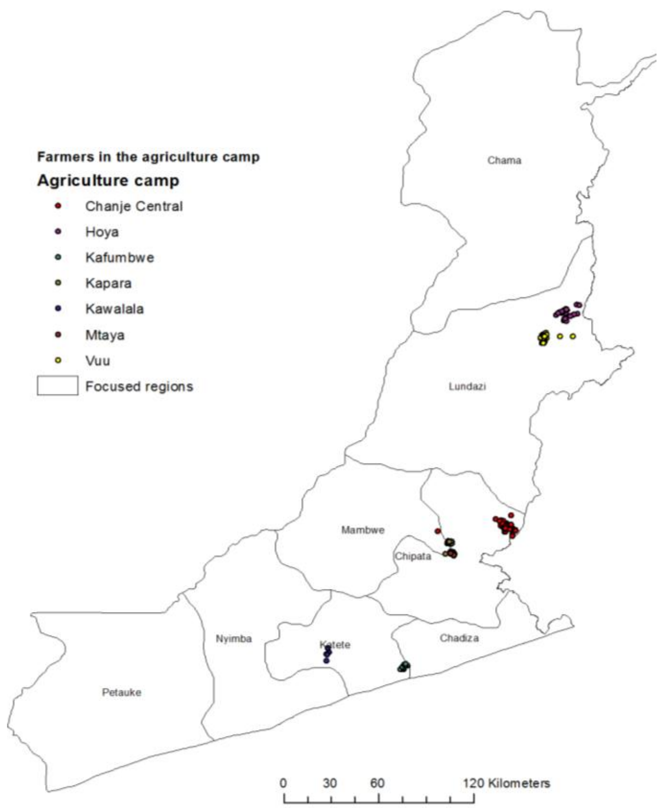
In particular, it was recommended to locate the activities in sections belonging to the strata high rainfall-high elevation (TA Mpando) and low rainfall-med elevation (many TAs are in this category), and eventually also in the low elevation-low rainfall stratum (TA Kachindamoto), if local conditions allow. In the low rainfall-high elevation stratum, it is also recommended to locate activities in TA Kusumbu and SC Kamenya Gwaza, in addition to the existing locations in TA Kaphuka. The control sections and villages should then be chosen within the same stratum identified, but with enough remoteness to reasonably avoid potential contamination between actions and counterfactual sites.

C. Zambia Project Area

Site Characterization

In order to understand the spatial pattern and heterogeneity and choose appropriate data layers for stratification of Africa RISING action sites in Zambia, the M&E team performed characterization of SIMLEZA sites in the Eastern province of Zambia.[21] SIMLEZA project covers three districts (Katete, Chipata and Lundazi) and a number of villages and communities with the aim of increasing yield by 15%. Figure 3.47 shows the location of 225 SIMLEZA farmers.

Figure 3.43 SIMLEZA action Sites in the Eastern Province of Zambia



In order to better target Africa RISING interventions, identify representative or otherwise appropriate action and control sites, and guide scaling-up/scaling-out efforts, the M&E team examined data layers summarized in Table 3.13.

[21] SIMLEZA stands for Sustainable Intensification of Maize- Legume Systems Eastern Province of Zambia

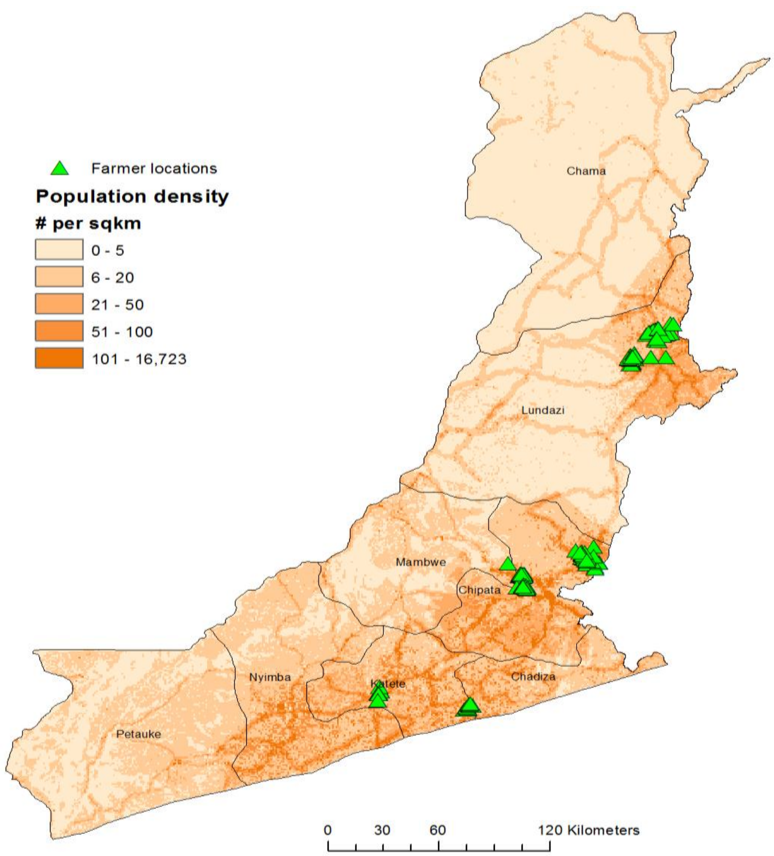
Table 3.13 Candidate layers for characterizing SIMLEZA sites (Zambia)

Datasets	Spatial resolution	Year	Source
Population density	1 sqkm	2009	Land scan
Precipitation	50 sqkm	long term (> 50 years) average	CRU
	1 sqkm	long term (> 50 years) average	WorldClim
	100 sqkm	long term (> 50 years) average	NASA POWER
	50sqkm	long term (> 50 years) average	GPCC
	1sqkm	long term average	interpolated from national weather station
Elevation	1 sqkm		USGS
Slope	1 sqkm		USGS
Market access	1 sqkm	2000	HarvestChoice
Length of growth period	~10sqkm	long term (> 50 years) average	IIASA
Temperature	1 sqkm	long term (> 50 years) average	WorldClim

Population Density

As can be seen in Figure 3.44, there is little heterogeneity with regard to population density.

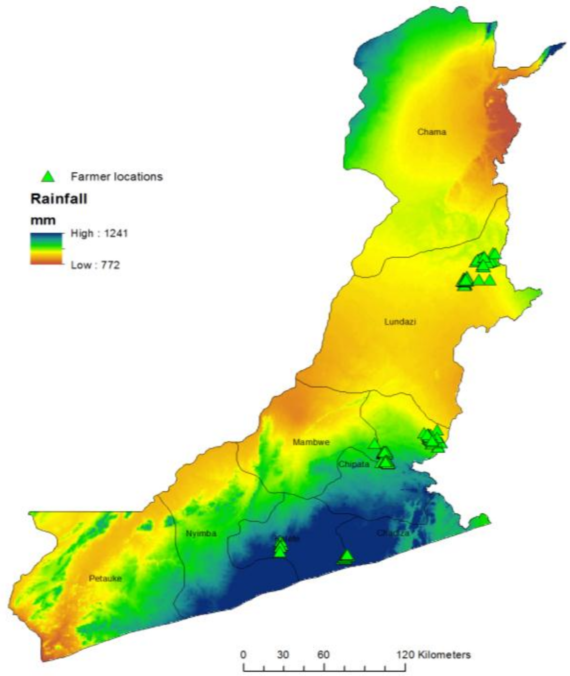
Figure 3.44 Population density (Eastern province)



Rainfall

Figure 3.45 shows spatial heterogeneity with regard to rainfall.

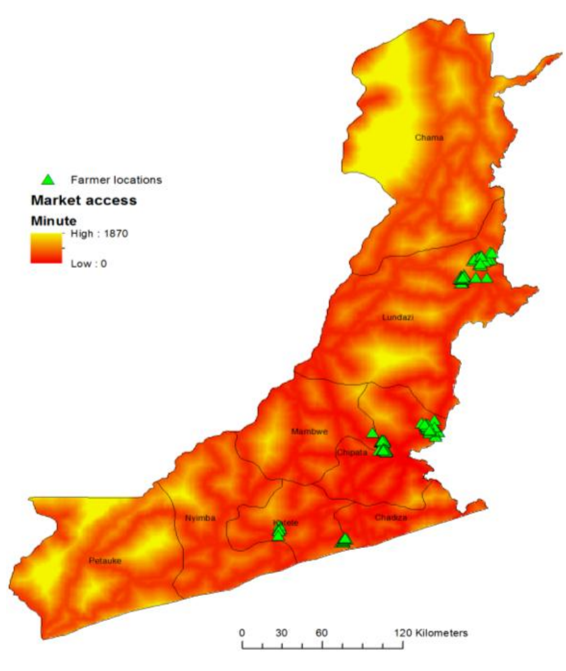
Figure 3.45 Rainfall (Eastern province)



Market Access

Figure 3.46 shows little heterogeneity with regard market access, measured by the time (in minutes) it takes to get to the nearest town of 20, 000 population.

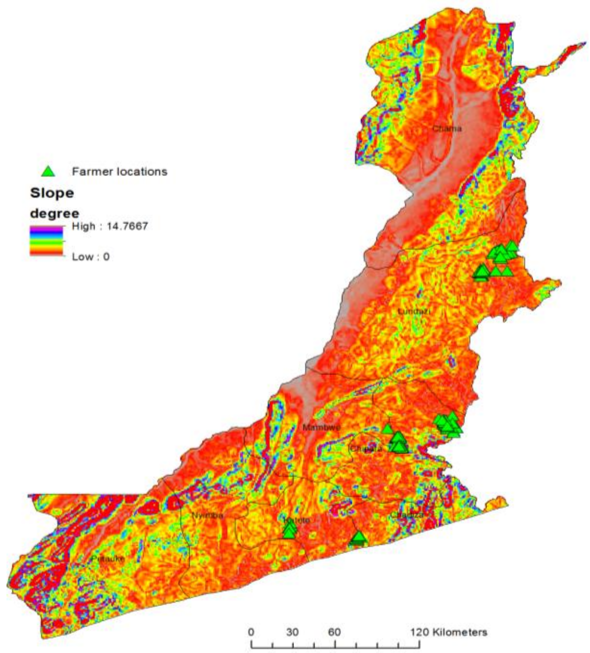
Figure 3.46 Market access (Eastern province)



Slope

Figure 3.47 shows little heterogeneity with regard slope (measured in degrees).

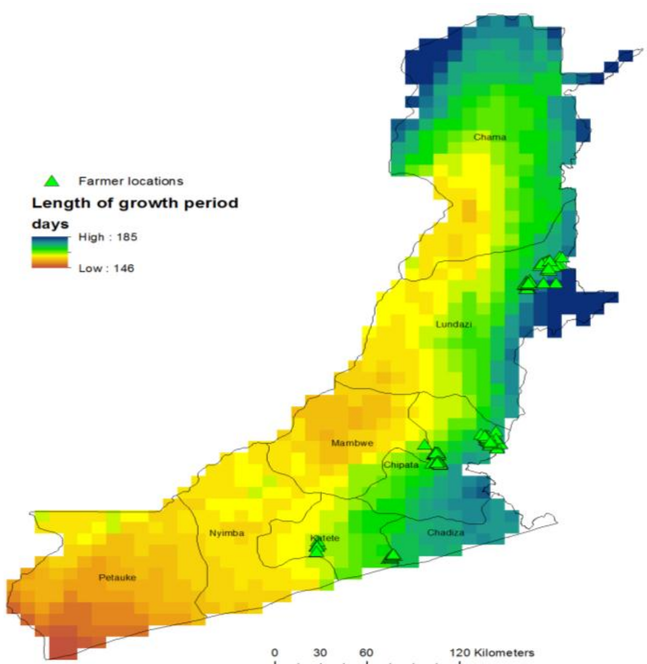
Figure 3.47 Slope (Eastern province)



Length of Growth Period

Figure 3.48 shows little heterogeneity with regard slope length of growth period.

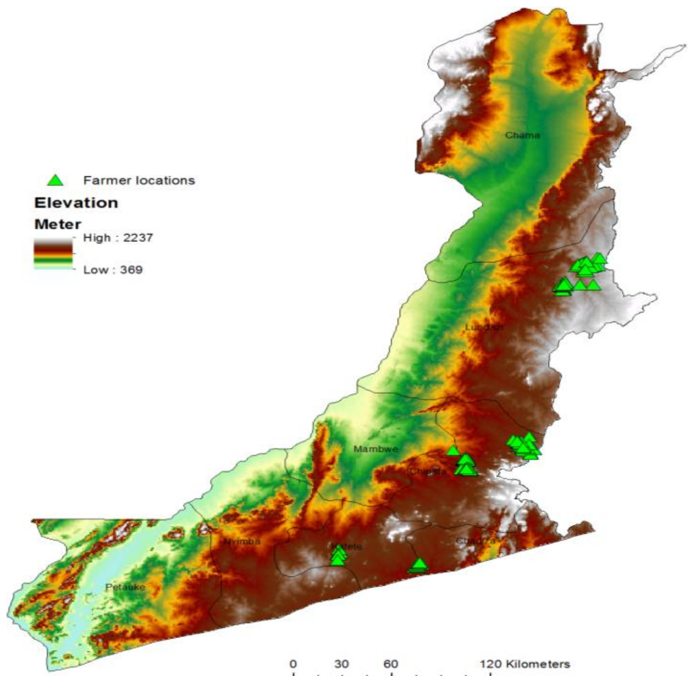
Figure 3.48 Length of Growth Period (Eastern province)



Elevation

Figure 3.49 shows some heterogeneity with regard slope elevation (in meters).

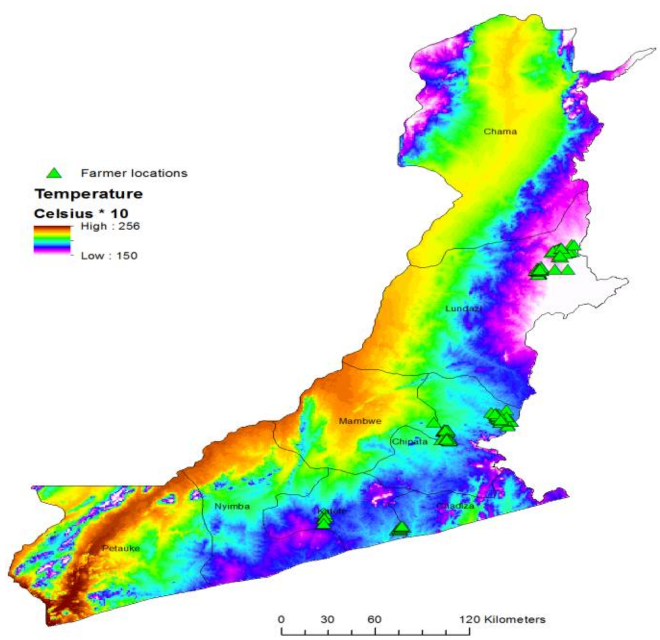
Figure 3.49 Elevation (Eastern province)



Temperature

Figure 3.50 shows some heterogeneity with regard slope temperature (in degree Celsius*10).

Figure 3.50 Temperature (Eastern province)



Results summarized in Figure 3.51 to Figure 3.52 show spatial heterogeneity in rainfall and elevation and a correlation b/n spatial distribution of temperature elevation. Based on these results, two data layers and 9 classes were chosen to stratify SIMLEZA districts (Figure 3.53).

Figure 3.51 Rainfall classification (Eastern province)

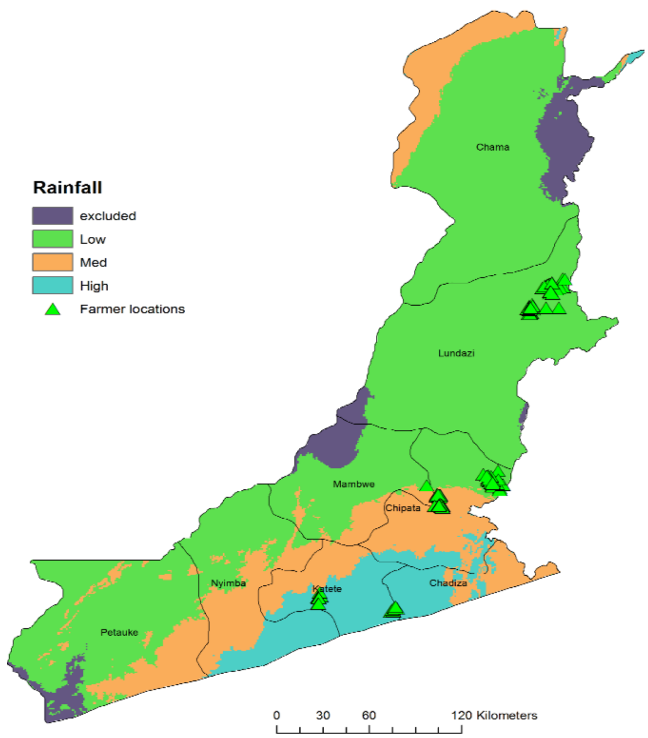


Figure 3.52 Elevation classification (Eastern province)

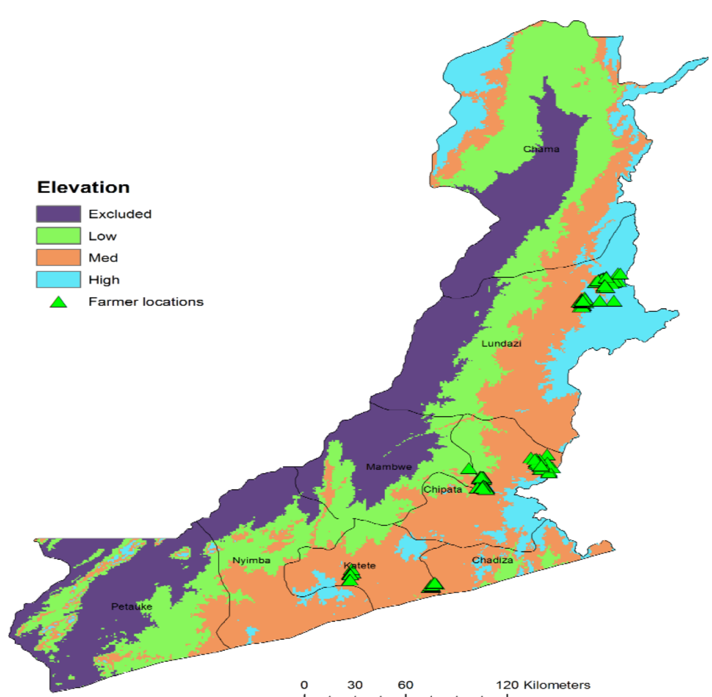
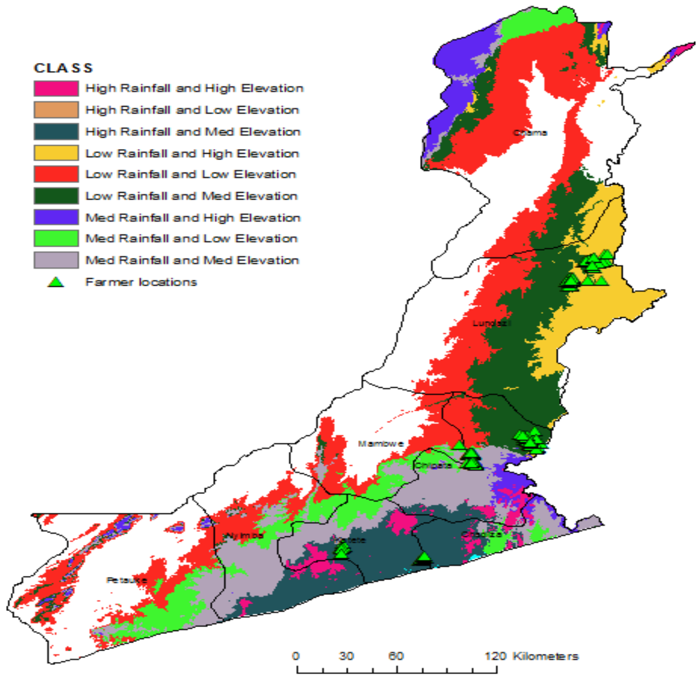


Figure 3.53 Final classification (Eastern province)



Based on this classification, Ludanzi district (Hoya and Vuu camps) will be within the low rainfall-high elevation stratum; Chipata district (Kapara, Mtaya, and Chanje campls) will be within the low rainfall – medium elevation, medium rainfall-medium elevation, and medium rainfall-low elevation strata, respectively; and Katete district (Kawalala and Kafumbwe camps) will be within the high rainfall - medium elevation stratum. Further discussions will be needed to identify Africa RISING action sites within the SIMLEZA districts and camps.

3.3 Staff Recruitment and Training

One global and two local M&E coordinators joined the M&E team in early 2013. The M&E coordinators are integral part of the M&E team, being mainly responsible for overseeing the overall and local M&E activities and for monitoring the FTF indicators. Local M&E coordinators will also keep constant relationships with the AR research teams on the ground. Various consultants have been hired at different stages for temporary needs, for site characterization and selection, as well as to manage and supervise the household and community Africa RISING Baseline Evaluation surveys (ARBES).

3.4 Development of Household and Community Survey Tools

The team developed detailed and exhaustive household and community questionnaire for baseline data collection, to try capturing the baseline characteristics of both beneficiary and control households and communities. To assess sustainable intensification trajectories for different household typologies as they occur, and to inform the development of scaling up and out strategies, data need to be collected on composition of households, crops grown at the plot level, livestock systems, farm and crop management practices, use of inputs, and key livelihood strategies employed, all dimensions that the survey instrument currently captures. These are crucial data to evaluate sustainable intensification trajectories, and evolution of changes in farm practices within the development domains of interest. The two tables below summarize modules included in the household and community survey tools used for the Malawi survey, respectively. The survey was conducted on 1154 households and 55 communities in the two Africa RISING districts of Dedza and Ntcheu (see below). The tool at the household level comprised about 9 questions collected over 24 modules.

Tables 3.14 and 3.15 summarize the modules included in the household and community survey tool. The exact survey instruments of the household and community tools used in Malawi are available from the IFPRI M&E team upon request. Survey tools for program focus countries are quite comparable to the one used in Malawi, upon proper customization of the tool of each country to the local context. Use of comparable survey tools across program focus countries will allow cross-country comparison of results.
Community questionnaire were administered to local leaders and knowledgeable members of the community in a group meeting. Among those who should be considered for inclusion in the group of informants for the community questionnaire were group village and village headmen, counselors to the headmen, religious leaders, school teachers, health workers, agricultural field assistants, and business leaders. Five to eight village informants, including at least one woman, participated in the focus group. The group was kept as diverse as possible to capture different views and needs within the community. When possible, effort were made to involve extension workers as part of the focus group.

Table 3.14 Summary of Africa RISING baseline evaluation household survey tool

Module	Type of information
Household members	Educational attainment, marital status, and primary/secondary occupation of household member
Labor	Employment, earnings, unemployment, and seasonality in employment
Health	Visited health facilities, on how much was spent on any illnesses/injuries,
Agricultural land	Land ownership, land and soil characteristics, and water sources (at parcel-level)
Crop inputs (conservation)	Farming and soil conservation practices. Data will be collected at a parcel-plot level.
Crop inputs (cost)	Seeds, pesticides, fertilizer, and non-labour expenses the household used. Data will be collected at a parcel-plot level.
Crop inputs (labor)	Labour input on crops grown on each plot during the rainy and dry seasons. Data will be collected on how many person-days were used for different activities for each crop grown on a plot. Person days are calculated as the number of workers times the number of days they worked
Crop inputs (seed)	Seeds were used by cropping season.
Crop production	Different crops grown on each plot and the different varieties of the crops.
Crop sale	Sales produced by the household.
Crop storage	Storage methods used by households and how effective the methods are/have been. Questions will be asked about all the crops the household grew in the previous cropping season.
Livestock ownership	Number of the different livestock types (disaggregated by local and improved) owned by the household at the time of data collection and during the preceding 12 months.
Livestock feed and drinking water	Sources of food and drinking water for different livestock categories
Challenges	Agriculture-related problems faced by the household and coping strategies
Extension and Africa RISING	Household's interaction with agricultural extension agents and participation in Africa RISING
Other income	Non-agricultural income activities that the household has used to acquire/increase the household income in the past 12 months
Credit	Household access to and use of credit
Housing	Facilities the household has inside the home
Welfare & Food security	Household food security and seasonality in terms of access food (at household level and selected demographic groups)
Food consumption	Household food expenditure on food, including cereals, starches from roots, sugar, pulse, nuts and seeds, vegetables, fruits, meat, meat products, and fish, milk and milk products, oil and fats, spices and other foods, beverages, and wild fruits, vegetables and meat products
Non-food expenditure	Data about household's non-food expenditures. Data on food and non-food expenditure will be used to construct a measure of poverty
Shocks	Various types of shocks the household mighty have experienced over the past five years and coping strategies
Women anthropometry	Nutritional outcomes of women 15-49 years
Child anthropometry	Nutritional outcomes of children 0-59 months old

Table 3.15 Summary of Africa RISING baseline evaluation community survey tool

Module	Objective: Gather community-level data about…
Basic services	Access to basic services
Extension	Agricultural labor, extension services, and agricultural problems
Land	Land use
Demographics	Organizations, labor movement, major crops provides, and amount and fluctuation of rain water
Water, shocks, and food	Access to water, shocks, and food consumption
Local units	Metric conversion of local measurement units

3.5 Survey Design Meetings

The tool initially developed for Malawi was discussed and fine-tuned during three in-country meetings involving all the program stakeholders and research teams in each mega site. Meetings occurred in Arusha and Dar es Salaam (for East and Southern Africa), Accra (for West-Africa), and Addis Ababa (for Ethiopian Highlands).

3.6 Screening and Recruitment of Survey Firms

Given the complexity of the survey tool proposed for Africa RISING baseline surveys, the M&E team did screening of 8 survey firms (2 for Malawi, 3 for Tanzania, 1 for Mali, and 2 for Ghana). The screening process involved putting together Terms of References, reviewing financial and technical proposals submitted by candidate firms, and holding rounds of follow-up phone and in-person discussions. The team hired two survey firms: one for Malawi and another one for Tanzania.

3.7 Implementation of Malawi Africa RISING Baseline Evaluation Surveys (MARBES)

Baseline household and community surveys have been conducted in Malawi. The M&E team partnered with a Malawian survey firm called Invest in Knowledge Initiative (IKI) to undertake a survey of 1200 households and 55 villages (25 beneficiaries and 30 controls) with the following sample composition: 450 beneficiary farmers, 200 randomly selected non-beneficiaries in action sites, and 550 randomly selected control households. In addition to socio-economic data, anthropometry data was collected from 548 children 5 years or younger and 886 women within the reproductive age (15-49 years).

The Malawi surveys were conducted using Computer Assisted Interviewing (CAPI) technology in SurveyCTO software. The main activities implemented during preparation phase include adaptation of draft questionnaire, questionnaire translation (to Chichewa) and back-translation (to English), questionnaire programming using SurveyCTO, preparation of enumerator and supervisor manuals, and training and piloting using the paper questionnaire and tablets for one month. IFPRI M&E team and IKI provided training for 30 enumerators, supervisors, quality controllers, and data managers.

Household and community data from MARBES are currently available in raw (Stata) format, although still under a cleaning process. Below are some summary statistics based on uncleansed household survey data. Preliminary results were presented at the annual Monitoring and Evaluation Expert Workshop in Addis Ababa (November 11-13, 2013).

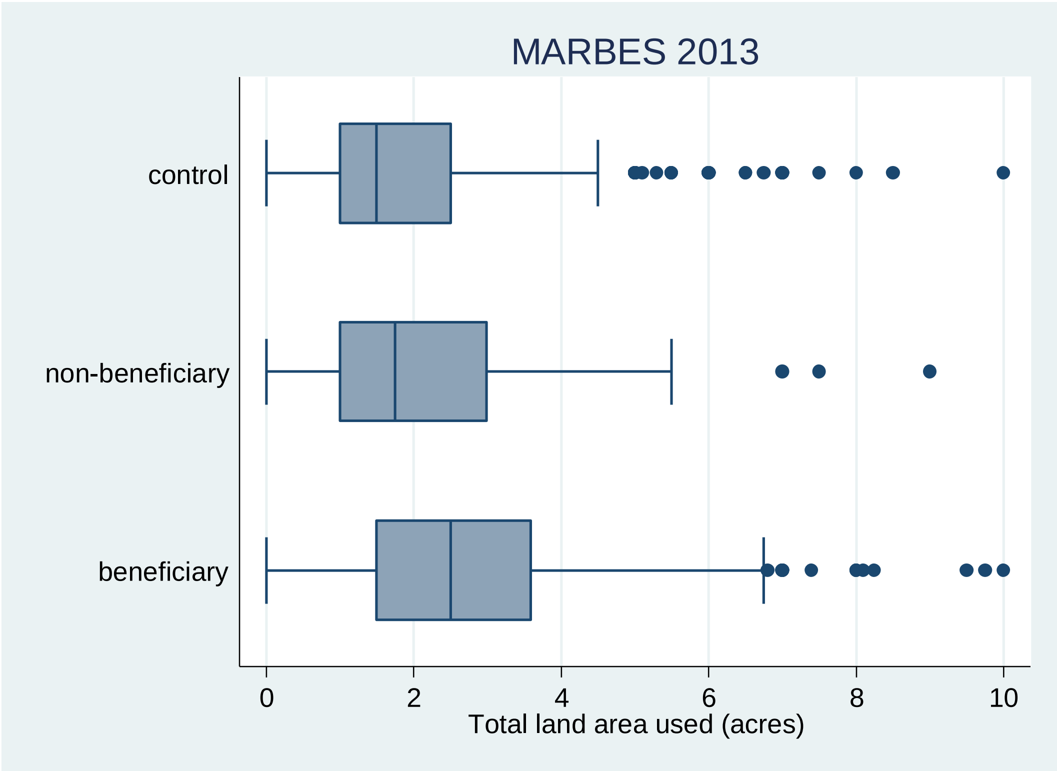
Table 3.16 Summary of basic variables by beneficiary status (MARBES)

	Beneficiary (B)	Control (C)	Difference: B-C
Have you heard of Africa RISING?	0.9	0.01	0.903***
Number of agricultural parcels	2.9	2.0	0.931***
Size of parcels (acres only)	2.9	2.0	0.902***
Size of parcels	3.0	2.1	0.907***
Household size	5.1	4.7	0.414***
Female headship rate	0.3	0.3	-0.054*
Age of household head	45.5	45.0	0.491
Household head is literate	0.7	0.6	0.092***
Dependency rate	112.3	120.2	-7.853
Observations	958		

="* p<0.10 ** p<0.05 *** p<0.01"

Source: Malawi 2013 ARBES

Figure 3.54 Land size (in acres) by beneficiary status (MARBES)



Source: Malawi 2013 ARBES

Table 3.17 Child nutritional outcomes by beneficiary group (MARBES)

	Beneficiary	Control	Difference
Height-for-Age(Z-score)	-1.6	-1.8	0.206
Weight-for-Age(Z-score)	-0.5	-0.8	0.342
Weight-for-Height(Z-score)	0.9	0.1	0.728*
Observations	549		

Table 3.18 Livestock Ownership by beneficiary status (MARBES)

	Ownership (Percentage)			Ownership (Numbers)	
	Beneficiary	Control	Difference	Beneficiary	Control
Draught cattle	0.01	0.003	0.009	2.2	2.0
Bulls -local	0.03	0.004	0.025***	2.8	1.0
Fattening cattle -local	0.002	0	0.002	3.0	
Cows -local	0.07	0.02	0.056***	3.5	3.3
Heifers -local	0.02	0.001	0.023***	2.0	1.0
Calves -local	0.04	0.004	0.035***	2.0	0.7
Horse/donkey/mule	0	0.001	-0.001		2.0
Goats -local	0.5	0.3	0.208***	4.0	0.1
Goats -improved	0	0.003	-0.003		3.5
Pigs -local	0.2	0.1	0.128***	3.4	3.1
Pigs -improved	0.007	0.01	-0.006	3.3	2.0
Chickens	0.7	0.5	0.188***	8.3	0.8
Fish	0	0	0		
Other livestock	0.1	0.09	0.052**	8.0	0.1
Honey bees	0	0.003	-0.003		4.0
Observations	1148			880	

3.8 Field Trips

M&E coordinators have conducted several field visits to select adequate and appropriate areas within which to select control sits. The field visits were necessary to realize the suitability of particular areas to be selected as control communities/villages, being as similar as possible to the areas selected by the AR for the interventions (i.e. belonging to the same development domain), but far enough to avoid a possible contamination effect. Meetings were also held to sensitize the research teams about the importance of suitable site selection.

3.9 Compilation of Feed the Future Indicators

The local M&E coordinators in West-Africa and East and Southern Africa worked with the research teams on data compilation of the FtF monitoring indicators to help USAID gauge progress along identified set of agreed indicators.

3.10 Qualitative Data Collection

Focus groups were held with field day attendees in Babati, Tanzania, to identify agriculture-related problems, discuss potential entry points, as well as to recruit volunteer farmers into a research study that will provide empirical evidence on the causal effect of information/training and ease of access to agricultural inputs (fertilizer and improved seeds) on productivity and household welfare.

3.11 Babati Impact Evaluation

Figure 3.55 Coupon Recipients

A full impact assessment was set-up in the district of Babati, Tanzania, with the aim of exploring how farmer's behavior change according to different input subsidies proposed at different stages over the agricultural season. Initial randomization was conducted in July 2013 and coupons (Figure 3.59) were provided to a sub-sample of randomly selected farmers who attended CIMMYT-organized field days in Seloto, Sabilo, and Long villages , with fertilizers' and improved maize variety distribution to the beneficiaries in October, 2013. Table 3.19 summarizes the impact evaluation design.

Some of the research questions Babati impact evaluation project will address are:

1. How does subsidized and targeted agricultural input supply impact sustainable adoption of technology (and productivity)?
2. How does training (about fertilizer and improved seeds, disease recognition, natural resource management, etc.) impact technology adoption and productivity? Which mode of knowledge delivery is the most effective?

3. Is there complementarity between access to agricultural inputs (hardware) and training (software)?
4. How are the gains from improved agricultural technologies and training, if any, distributed among different household types? What explains the variance in impact?

Table 3.19 Babati Impact Evaluation Research Design (Babati district, Tanzania)

Phase I					→
Group	**July 2013**	**October 2013**	**February/March, 2014**	**July/August, 2014**	**TBD**
Group 1 (230 households)	Recruitment + Education about 10 different improved maize varieties through farmer field days + Mini survey	-	Detailed household survey as part of Africa RISING baseline survey	Focused household survey	TBD
Group 2 (230 households)	Recruitment + Education about 10 different improved maize varieties through farmer field days + Coupons for free improved maize variety and local chemical fertilizer + Mini survey	Provision of improved maize varieties and local chemical fertilizer	Detailed household survey as part of Africa RISING baseline survey + Assessment of farmers' willingness to pay for improved seed and fertilizer + Subsidized inputs through coupons	Focused household survey	TBD
		Input Use Monitoring by Extension Agents →	→		
Phase II					
Group 3 (about 230 households)			Baseline Survey	Recruitment + Training at Farmers Training centers	Household survey

Group 4 (about 230 households)			Baseline Survey	Recruitment + Training at Farmers Training centers + Unconditional cash transfer	Household survey

From a theoretical point of view, this evaluation setup will help answer the question of whether the binding constraint to adoption of improved technologies and potential benefits thereof is credit-based (Research Question 1), skills-based (Research Question 2), or both such that relaxing one constraint only will not be sufficient (Research Question 3). By following study subjects over a relatively long time period, this project will provide evidence on factors that determine 'sustained' adoption of improved technologies. In addition, and by examining alternative scientific knowledge delivery modalities, we will identify effective delivery methods that may suit specific household types better (e.g., female-headed households. The study aims to generate robust evidence on the causal effect of each (set of) intervention on various outcomes. The basic statistical model we will estimate to examine research questions 1-3 is given below:

$$Y_i = \alpha + \beta_1 Training_i + \beta_2 TrainingANDInputs_i + \boldsymbol{\beta}'\boldsymbol{Z}_i + \epsilon_i \qquad (1)$$

Where i is an index for households/individuals, Y can be a contemporaneous outcome (e.g., adoption of a given technology) or future outcomes (e.g., yield, income, and nutritional outcomes), $Training$ is an indicator for whether study household received relevant training, $TrainingANDInputs$ is an indicator for whether the household received training and inputs, $\boldsymbol{Z}$ is a vector of baseline covariates, βs are parameters of interest to be estimated, and ϵ is the random error term.[22] Alternatively, $Training$ may represent a specific training modality. To estimate the effect of free input distribution (from Phase I) based on post-intervention data to be collected in February/March, 2014, we will estimate Equation 1 using OLS on a sample of randomly selected farmers offered (field day) training only and training and free inputs.

[22] Estimated standard errors will be clustered at village level to account for potential intra-village correlation.

To estimate the effect of Phase II interventions (training versus training and unconditional cash transfer), we will exploit the availability of baseline (February/March 2014) and follow-up (the timing of which is yet to be determined) data on Y and employ Difference-in-Differences as shown in Equation 2,

$$Y_i = \alpha + \beta_1 Post_i + \beta_2 Treat_i + \beta_3 (Post * Treat)_i + \boldsymbol{\theta}'\boldsymbol{X}_i + \varepsilon_i \qquad (2)$$

Where $Post$ is pre-post time indicator, $Treat$ is indicator that takes 1 if household receive both training and unconditional cash transfer and 0 if otherwise (i.e., training only), and other variables are as defined before.

To provide evidence on research question 4, the basic models in Equations 1 and 2 will be re-estimated by including interaction terms between treatment assignment variables and a covariate of interest (e.g., land size or gender of household head). In addition, and to better understand factors behind heterogeneous impact of training and inputs, if any, we will conduct qualitative analysis through focus groups with beneficiaries.[23]

3.12 Program- and Project-level Meetings

The M&E team actively participated in various Program- and Project-level meeting (East and Southern Africa Review and Planning Meeting, Ethiopian Highlands Planning Meeting, Program Learning Event).

3.13 Africa RISING Project Monitoring and Mapping Tool (PMT)

In order to assist in the periodic (bi-annual) reporting of the progress with regard to the 9 aggregate USAID FtF indicators and additional project-specific indicators, the M&E team updated its web platform that was created in 2012. The PMT is intended to visualize where AR intervention is taking place, and to match it with a wide suite of biophysical and socio-economic spatial layers available in the team's data holdings. The updated platform is intended to serve four distinct audiences:

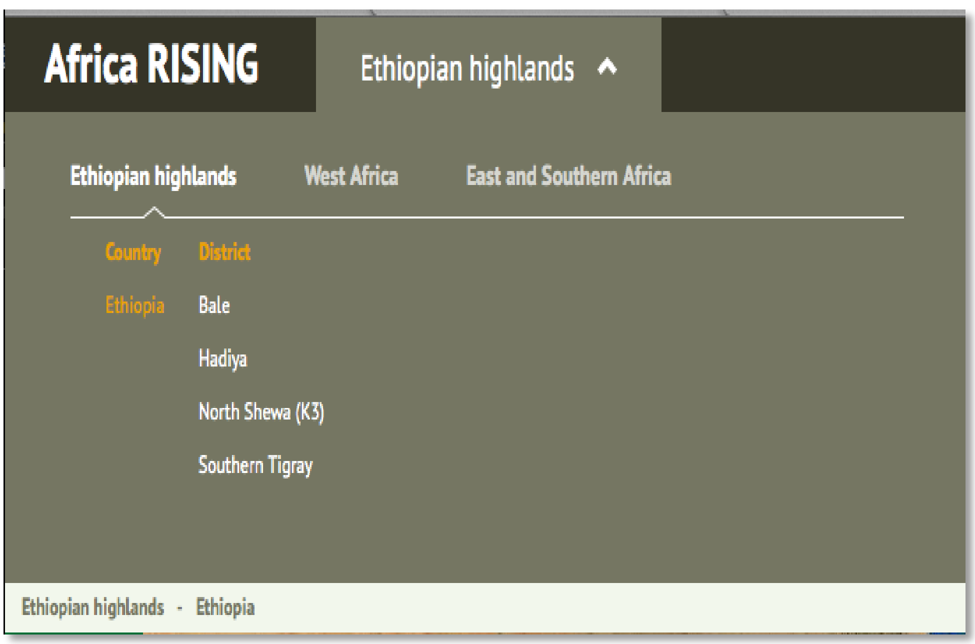
- **Research teams** and **collaborators**, who can use the website to share data, stories (incl. multi-media content), lessons-learnt, and as a one-stop-shop for up-to-date M&E information.
- **Harvest Choice's M&E Officers**, who will provide curated maps, datasets and summary reports outlining the approach and methods used, as well as outcomes over time.

[23] The M&E has conducted focus groups with selected group of farmers who attended Babati maize field days in June 2013 to identify potential entry points and help inform CG partners in their designing of relevant intervention.

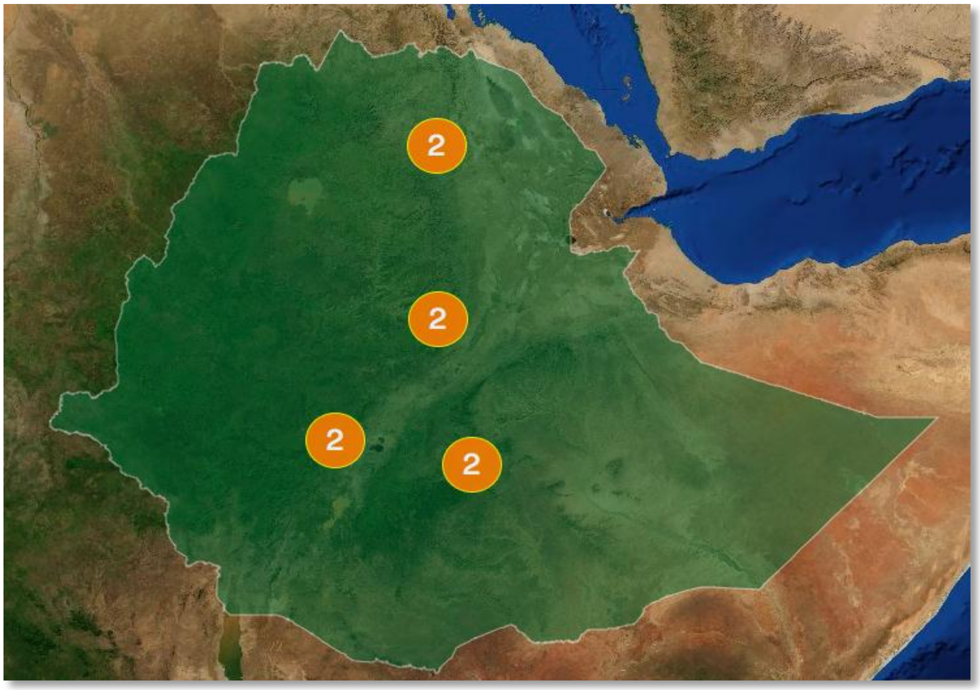
- **M&E Officers at USAID Offices**, who will have access to both project-level and aggregate information to be further imported into the Agency's own reporting systems.
- The **general public**, who will have access to sections of the website upon approval.

As part of this round of platform update, a number of new user requirements will be embedded in support of AR M&E function. Among other features, users will be able to upload data onto the platform, view summary information (key characteristics of sites and communities) and reports for each action site (including baseline statistics), securely enter and document periodic performance indicators, view monitoring indicators for each action site, and edit project- and site-specific information. In addition, the M&E platform will be linked to AR wiki page to provide users with additional background information about the program and the projects in each mega-site. The screenshots below highlight the main features of the PMT.

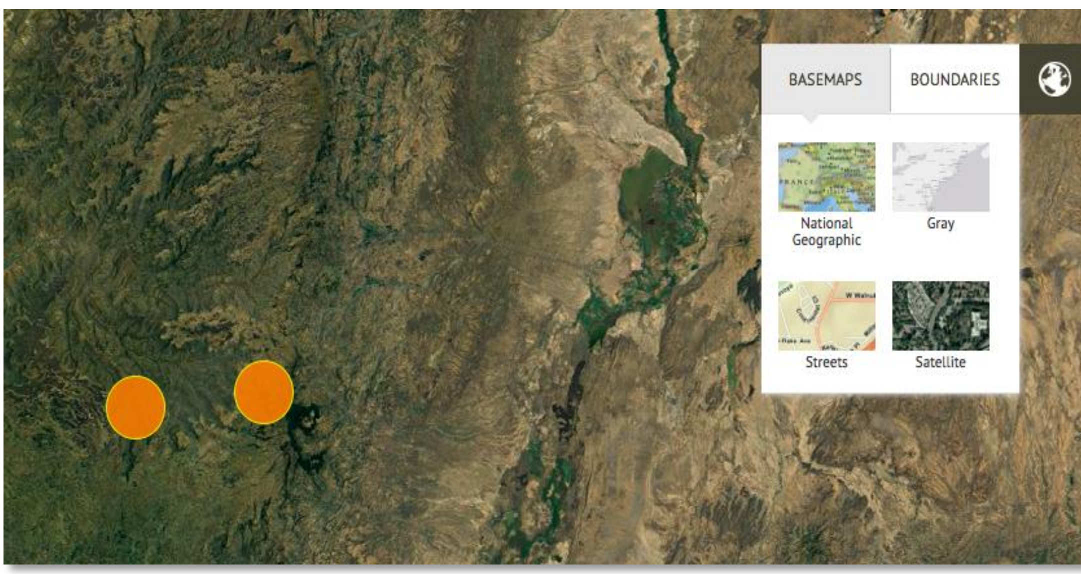
Location selector: Zoom to a selected location.



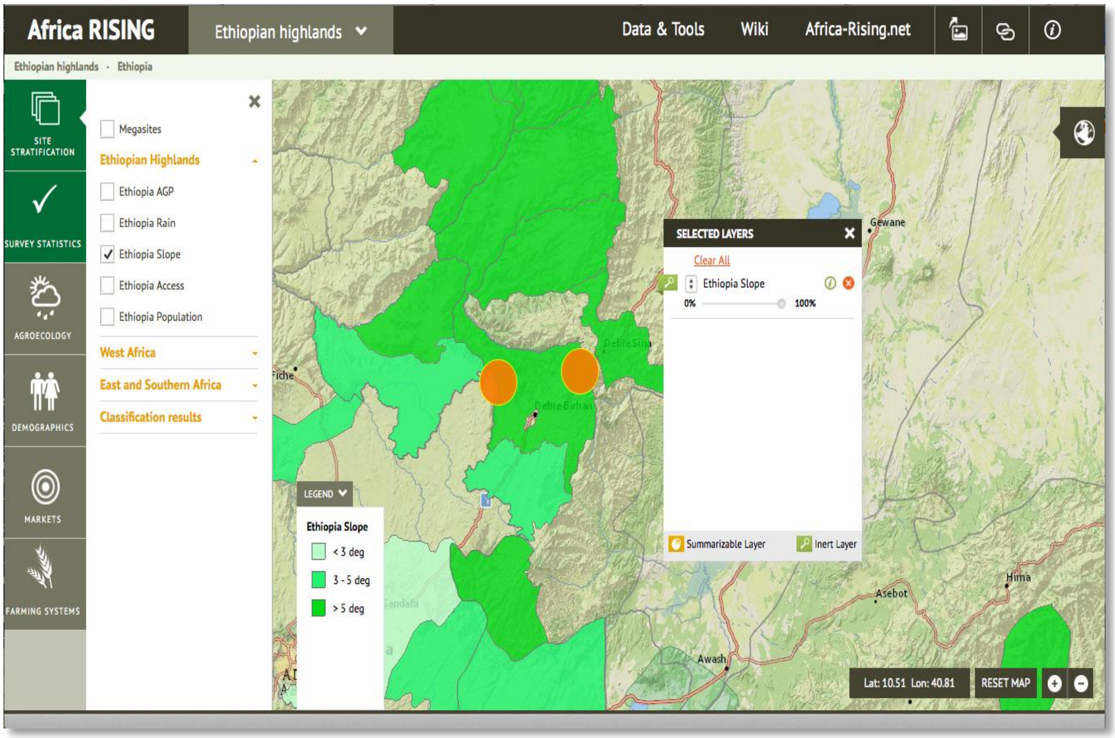
Site Clusters: Action and Control sites grouped by country.



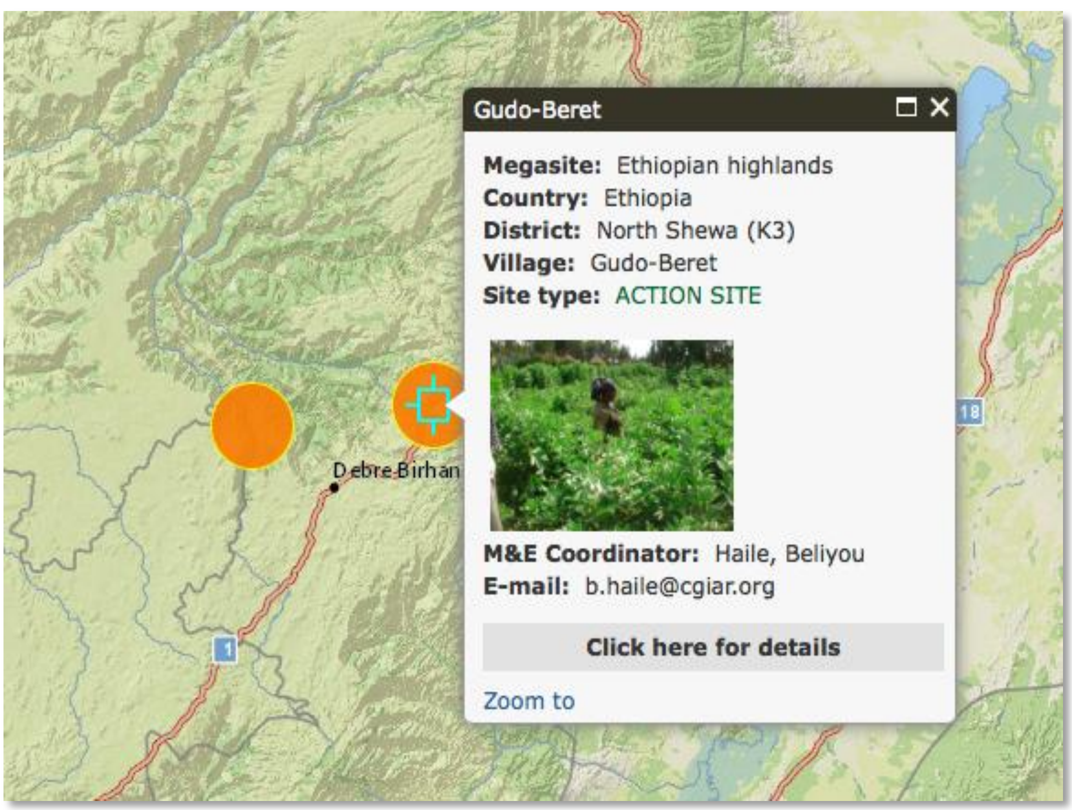
Basemap Selector: Choose between photography, topography and street map hybrids.



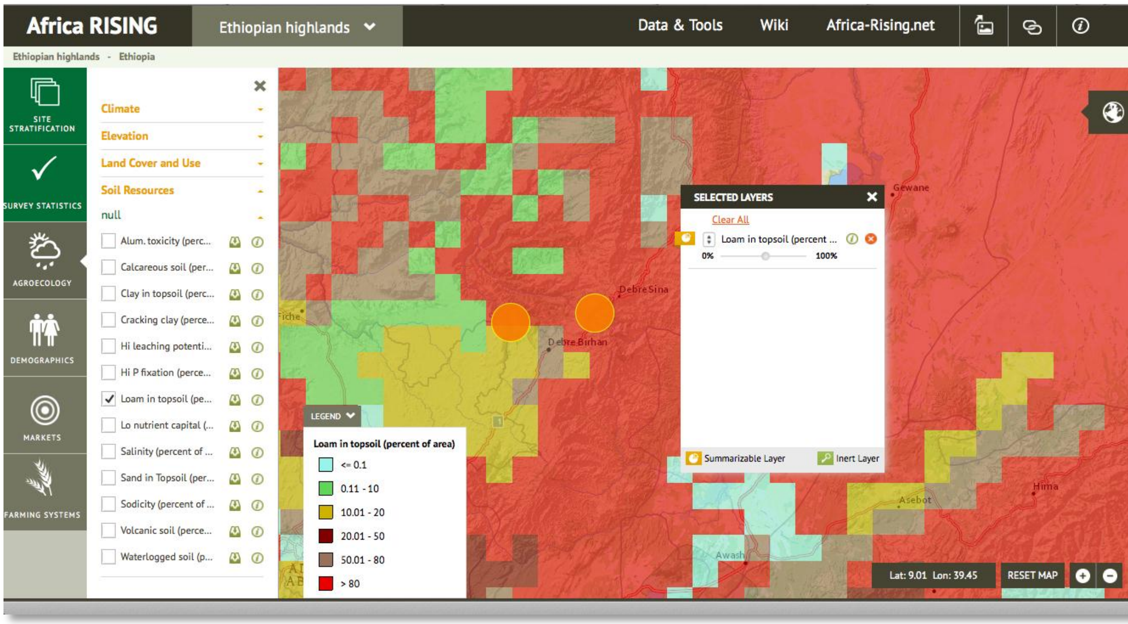
Info boxes: Click on a site to view more details or to zoom in to a single community location



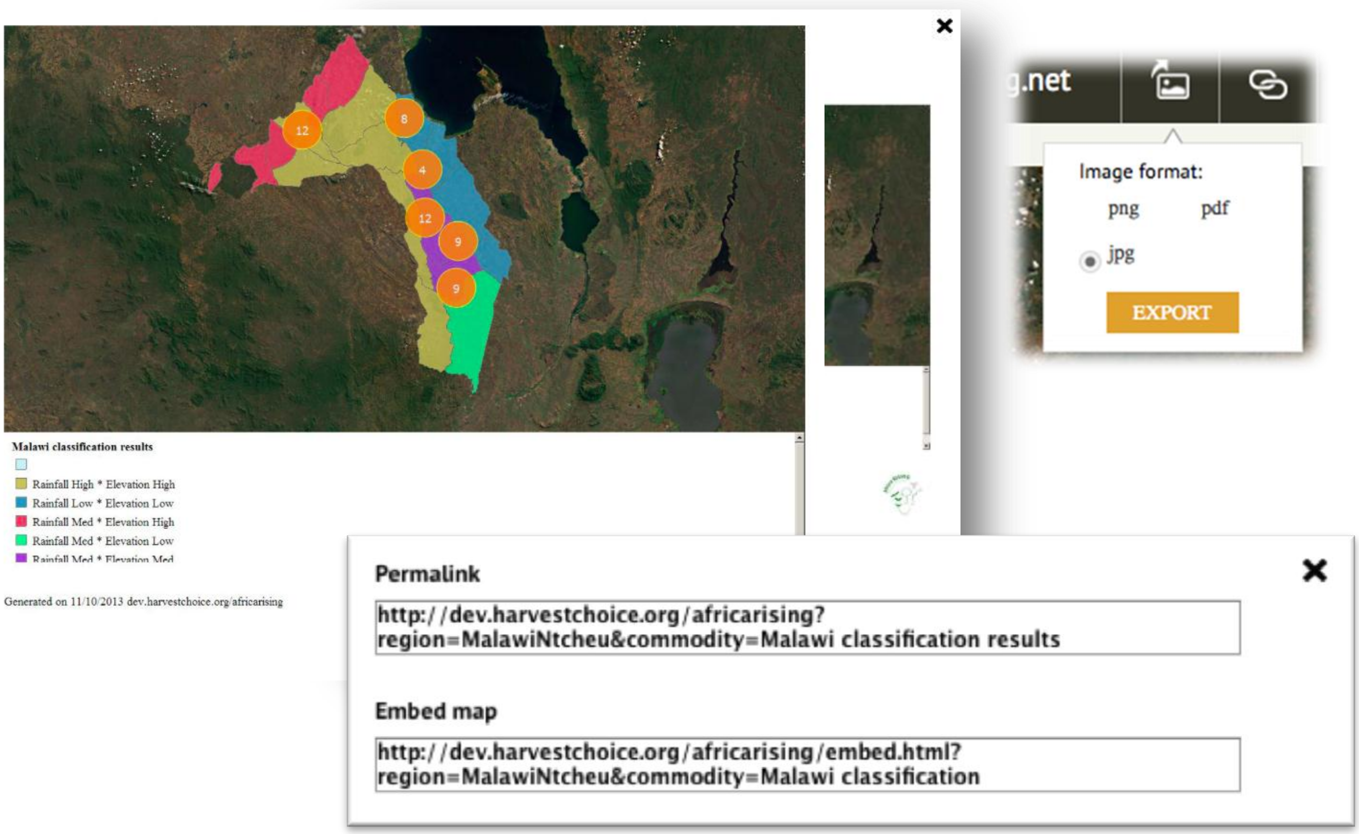
Layer Library and Control: Choose from a wide variety of contextual maps.



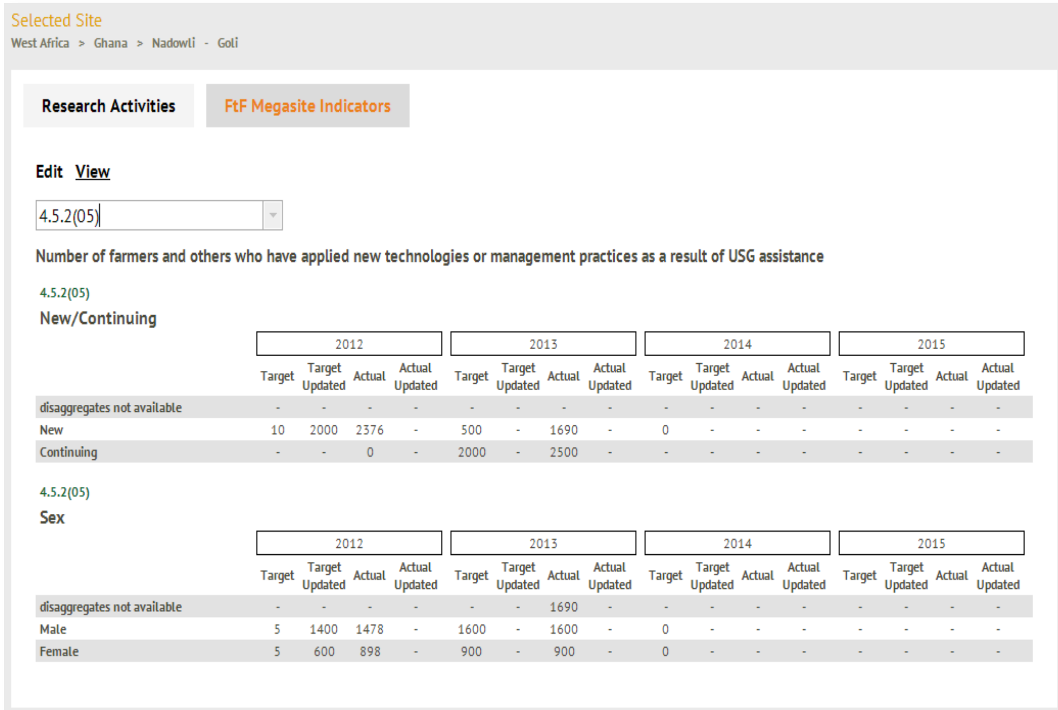
HarvestChoice Spatial Data Library: access over 350 bio-physical, socio-economic and agricultural data layers at 10x10km resolution



Map Print: Create an image file of your map to print or include in a document.



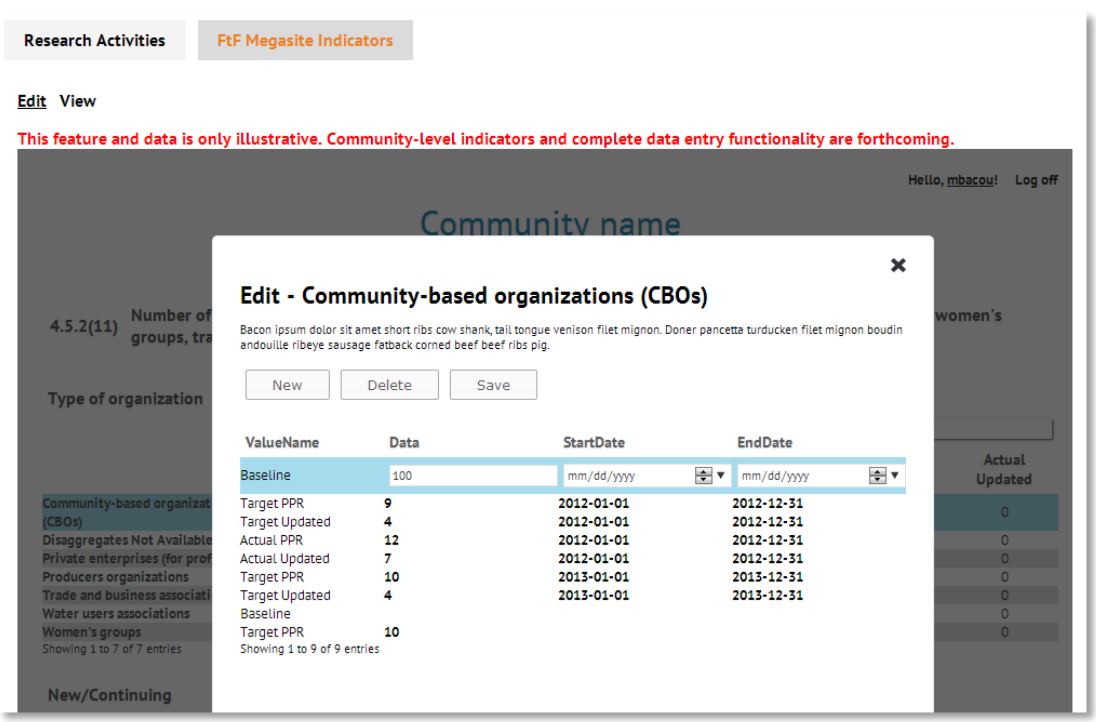
FtF Indicator Reporting: Allow data entry on FtF indicators



	2012				2013				2014				2015			
	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated
disaggregates not available	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New	10	2000	2376	-	500	-	1690	-	0	-	-	-	-	-	-	-
Continuing	-	-	0	-	2000	-	2500	-	-	-	-	-	-	-	-	-

	2012				2013				2014				2015			
	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated	Target	Target Updated	Actual	Actual Updated
disaggregates not available	-	-	-	-	-	-	1690	-	-	-	-	-	-	-	-	-
Male	5	1400	1478	-	1600	-	1600	-	0	-	-	-	-	-	-	-
Female	5	600	898	-	900	-	900	-	0	-	-	-	-	-	-	-

Data-entry forms: to capture FtF indicators by community.



ValueName	Data	StartDate	EndDate
Baseline	100	mm/dd/yyyy	mm/dd/yyyy
Target PPR	9	2012-01-01	2012-12-31
Target Updated	4	2012-01-01	2012-12-31
Actual PPR	12	2012-01-01	2012-12-31
Actual Updated	7	2012-01-01	2012-12-31
Target PPR	10	2013-01-01	2013-12-31
Target Updated	4	2013-01-01	2013-12-31
Baseline			
Target PPR	10		

3.14 Partnerships

Multiple organizations operating in the AR regions of interest have been contacted, and with most of them there is an active collaboration, both on methods and data collection. Partner institutions include FAO, MSU, World Bank, Wageningen University, Conservation International, and the Earth Institute at Columbia University (Vital Signs project).

3.15 Preparation for the Annual Monitoring and Evaluation Expert Workshop

The 2013 expert workshop brought together, for the first time, researchers from two major programs on the sustainable intensification of agricultural production: AR and CSISA (Cereal Systems Initiative for South Asia). The meeting addressed how the sister programs are innovating in technology development and promotion, managing data and information, addressing challenges related to M&E, assessing impact, and enabling field- and project-level learning.

Some of the challenges the M&E team faced during 2013 fiscal year include the following:

-Different views between the M&E team and AR implementing partners on whether and how the M&E team can provide evidence on the economic impact of research activities.

-Delays in baselines surveys due to difficulty in hiring competent survey firms capable of collecting good quality data.

-Delays in recruitment of local M&E coordinators

4. M&E Activities Planned for Fiscal Year 2014

For 2014, the M&E team envisions to accomplish the following tasks.

4.1 Implementation of ARBES

In 2013 the team initiated a sizeable work of conducting household and community surveys in five of the six Program countries in less than a year time. The team expects to implement and complete baseline surveys in Tanzania, Ghana, Mali, and Ethiopia in early-mid 2014. The household and community survey tools used in Malawi will further be improved and customized based on the team's experience from Malawi. Similar to what was done in Malawi, the M&E team will partner with (competent) local survey firms to implement electronic data collection.

4.2 Cleaning and Analysis of ARBES Data

As baseline data continues to be collected, the team will allocate a significant amount of time to clean and analyze ARBES household and community data. Since GIS coordinates of study households will be collected, key summary statistics from ARBES (e.g., average land size, main crop and livestock types, yield, poverty rate, percentage of children 0-59 months who are (severely) stunted, wasted, underweight, ease of access to basic services) will be aggregated at community level and will be uploaded onto the Africa RISING PMT. The team will also produce a series of country and cross-country reported based on analysis of ARBES data to be shared with research teams, USAID and other stakeholder.

4.3 Babati Impact Evaluation Research Project

The team will continue and refine the impact assessment project in Babati, Tanzania, to answer an important research question, which will be further explored in a study to be submitted to a peer-reviewed international journal.

4.4 Project on Improving Reliability of Land Characterization and Agriculture Monitoring

Knowledge of cropland distribution and crops' allocation are important for monitoring and planning agricultural resources at different levels: from landscape studies to regional and continental studies.

Knowledge of “what” is being grown and “where” is key to provide decision makers with essential information on segments of the population who are most vulnerable to food insecurity and poverty.

To provide empirical evidence on how best to improving reliability of land characterization and agriculture monitoring through use of multi-scale satellite images, field observations, and household surveys, the M&E will develop and implement a research project in Africa RISING action and control communities in Northern Ghana. The team expects to partner with Vital Signs (VS) on this research project. The research project is expected to fill the gap in the literature on reliable and up-to-date land cover products. Since ARBES is a multi-topic survey that includes a detailed agriculture module aimed at collecting crop production, yield and self-reported crop area, data thereof could be useful to characterize current land use conditions. In addition, since all ARBES households are geo-referenced, data from ARBES can be combined with multi-scale data from satellite image collected by VS. For this research, the M&E will use Global Positioning System (GPS) devices to collect land area measurement from a sub-sample of ARBES households in northern Ghana.

While collection of plot boundary and locations is costly (time and cost wise), comparison of GPS-based and self-reported land size will shed light on whether smallholder farmers systematically under-report the size of their plots, with implications on the level of production per unit of land that are not linked with efficiency in the production process (Carletto, Savastano, and Zezza, 2013). So the first contribution of the Ghana research to examine the reliability of (self-reported) production and land area data collected through household surveys. The second important issue related with household survey data is its spatial coverage and representativeness. While household surveys usually cover from a few villages to hundreds (or, sometimes, thousands) of villages and data thereof could be representative at a certain administrative level, the extent to which their spatial coverage is representative of areas outside the sample is unknown. More importantly, this point based information (i.e. household GPS coordinates) cannot easily be spatially interpolated into area especially considering cropping/farming systems.

Over the last decade, remote sensing data have been widely applied in studying land characterization, land cover and land use changes, as well as agricultural monitoring. Researchers can now access to earth observation products at different spatial resolution (from 10km to less than 1 meter) and higher frequency of revisits (monthly to daily) at no or low costs. More sophisticated methods have been developed to quantify crop land area, and monitor crop health as well as growth at various scales. Therefore a need to evaluate and validate the methods (e.g., on land cover classification) in order to identify the most suitable for the area of interest has arisen. Below are questions of policy relevance the Ghana survey aims to address:

- Which land classification methods are more suitable in this region?
- How is accuracy of classification output impacted by the sample size?
- How to design and develop a classification system using a bottom-up approach from household land characterization to regional land identification?
- How can we better understand the trends of agricultural production at a regional and national level by triangulating official statistics, remote sensing information, climate data, and social and economic indicators from household survey data?

The research project is expected to involve the following important steps

- Analysis of different land classifications using the sample plots
- The method with the highest accuracy will be picked for the bottom up land classification system. The first classification will be conducted at the village level (approximately 10 km by 10 km block), using very high resolution images in selected sites.
- These results will then be checked with images acquired from drone, and the final output will be used in the land classification process of landsite scenes (at 30 m resolution) at the district level.
- The classified results will be finally run using the MODIS data (at 250 m resolution) in order to develop the land cover product in the region. The sensitivity of classification accuracy to sample size will be evaluated across agriculture farming system zones. After different crops have been identified, the crop condition index (CCI) will be estimated in order to monitor current compared to historical crop characteristics. The statistical relationship between crop characteristics and subnational production quantity will be tested using historical remote sensing data and subnational production information. The possibility of applying the model in estimating production trends will be further investigated.

4.5 Recruitment of Additional Staff

The team plans to hire two survey residents to be in charge of the data collection and analysis in Mali and Ghana. The team will also hire a consultant to serve as a local M&E coordinator for Ethiopian Highlands. Pending on availability of funding, the two short term consultancy positions for East and

Southern Africa and West Africa local M&E coordinators will be filled with long-term positions through negotiations with IITA (for East and Southern Africa) and IWMI (for West Africa).

The team also plans to hire a data manager to be in charge of providing overall guidance related to management of data collected by the M&E team and the research teams. The data manager will be in charge of managing data to be housed in the PMT and providing guidance to program and mega-site wide data collection efforts. Specifically, the data manger is expected to:

- Support Program researchers in completing yearly data management plans; help with cleaning, summarizing, and reporting of data products to be posted to the PMT
- Support local AR M&E coordinators with timely collection and publication of performance indicators in accordance with AR M&E log frame
- In coordination with AR Communications team, assemble, summarize and publish activity summaries (incl. some HTML and multimedia content, photos and/or videos) to Africa RISING "mapping and reporting" platform
- Make suggestions for improving the ease-of-use and overall reach of AR web-based platforms
- Support AR M&E Team in preparing documents and presentations for key events and training workshops
- Participate in the organization of key meetings including documenting events/sessions and preparing reports

4.6 Further PMT Updates

Both USAID and the Gates Foundation expressed interest in the PMT becoming the new standard in this type of projects for donor institutions. The PMT will go through another round of updates by embedding additional data user features and by incorporating feedback received from researchers during the Annual M&E expert meeting. The launch of PMT 2.0 is imminent. Table 4.1 summarizes the major updates to be incorporated into the PMT.

Table 4.1 Updates to the Africa RISING Project Mapping and Monitoring Tool (PMT)

Planned Enhancement	Intended to…
AR PMT Monitoring and Reporting Module	- Simplify indicator data-entry to only record 2 actual and 2 target values per year - Allow users to record indicators at multiple reporting units (work package, partner, district, country) - Allow AR partners to define and record additional project-specific indicators - Create an MS Excel template and parsing tool to facilitate bulk data-entry - Allow users to edit indicator values while disconnected from the Internet - Allow indicators to be summarized in a tabular format across work packages, partners, districts, countries, and mega-sites
User roles and permissions	- Create a user management module - Create 3 user roles: Administrator (can administer user accounts and data), Data Manager (can add/edit indicator definitions and values), Editor (can add/edit indicator values) - Create a mechanism for linking AR PMT and CKAN user accounts and credentials
Export and print	- Provide an option to export indicator summaries in MSExcel (or CSV) format - Create a pre-set layout for printing and exporting PMT maps and activity summaries (similar to MAPPR export feature)
Add support for displaying 3rd-party spatial layers	Third party spatial layers such as AgTrials sites, locations of AGRA agro-dealers, etc.

In addition to improving the PMT, the M&E team will:

- Conduct a PMT training involving Africa RISING M&E coordinators and representatives from each research team. The training is aimed at testing and deploying the latest PMT features into the field.
- Develop a detailed PMT-user manual and training materials (e.g., agenda, brochure)
- Develop draft data management plan to provide guidance on the following topics:
  -types of data, samples, physical collections, software/tools, curriculum materials, and other relevant materials to be produced during the course of the project

-standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies)

-policies for access and sharing, including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements

-policies and provisions for re-use, re-distribution, and the production of derivatives, and

-plans for archiving data, samples, and other research products, and for preservation of access to them

-data sharing and confidentiality

4.7 Program- and Project-level Meeting

The M&E team will continue to actively participating in various Program- and Project-level meeting, which will be attended by Carlo Azzarri and/or Beliyou Haile when necessary.

4.8 Field Trips

The M&E team in general and the local M&E coordinators in particular will continue conducting field visits to project sites to better understand the research activities and tailor the M&E activities to the needs of the research teams. For Northern Ghana, the M&E team will validate control communities to align them with Vital Signs action sites.

4.9 Program- and Project-level Meetings

The M&E team will continue to conduct visits to get a better understanding of the research activities to better tailor its M&E activities to the needs of the research teams.

4.10 Compilation of Feed the Future Indicators

The M&E team will work with the research teams to compile data on Feed the Future indicators for reporting to USAID. For this task, it is envisaged that the use of PMT will streamline and consolidate the monitoring requirements set by USAID.

4.11 Development of Sustainability and Custom Indicators

The M&E team will work with the research teams to develop indicators of sustainability and custom indicators to assess the effect of the Program on sustainability and to gauge progress within individual projects, respectively.

4.12 Partnerships

The M&E team will continue to explore further collaborations with organizations working in areas of common interest that the M&E has been communicating with in 2014.

SUMMARY AND CONCLUSION

Monitoring and Evaluation activities, including site selection process, of agricultural research and development projects such as Africa RISING are complex by their nature. Monitoring efforts have been characterized by the focus on indicators reporting, whereby M&E local coordinators and research teams alike collaborated efficiently for timely provision and careful value check. It is expected that the recent and ongoing improvement of the Project Mapping and Monitoring Tool would further streamline and automatize the indicators reporting activities, under the requirements set by USAID. As for the evaluation, in the particular case of Africa RISING, the highly participatory, decentralized, and demand-driven approach followed poses additional challenges for a consistent, unique, structured, and systematic evaluation. Nevertheless, with the careful and statistical selection of control sites to be juxtaposed to action sites, the proposed quasi-RCT approach will yield consistent results, which will inform project management on the direction and impact of the program on the beneficiary households and, beyond, at scale-up. For the latter, a solid site selection has been put in place to assure statistical representativeness, while non-experimental methods are expected to be used to control for possible systematic bias between treated and control households/action sites.

Not only should the operational sites for the project be located so as to achieve maximum impact in a cost effective manner, but also as much of the natural variation of the target areas as possible should be covered, and the wishes of the donors regarding co-location of new interventions with pre-existing projects should be accommodated where practicable. It is also vital that the selection of sites permit statistically valid monitoring and evaluation of the effort and impact of the project. Finally, the partnerships with institutions implementing the project on the ground are guaranteeing that recommended sites satisfy the multiple requirements advocated by the different stakeholders. These demands are often conflicting, and a combination of rigorous science, flexibility and adaptation to local context, as well as willingness to compromise, are required to achieve a result acceptable to all parties.

The sites selected in Ethiopia, Ghana, Tanzania, Malawi, and Tanzania are the outcome of a compromise between statistical representativeness, representation of different agro-ecozones, competing requirements and adequate presence of research partners in the field that could be achieved within the time constraints. They are only current action sites for Africa RISING, where work started in late 2012 or early 2013. Additional sites will likely be chosen as the project proceeds, and some of these present sites may be abandoned if they prove unsuitable for any given reason.

Over the course of 2013, IFPRI has mostly been engaged into indicators' monitoring and baseline surveys with the idea of providing a base against which to compare results at the end of the project through a difference-in-difference method using a quasi-RCT approach. For this to happen, the M&E team still has some work to do in convincing field partners of the necessity for the separation of action and counterfactual sites to avoid possible contamination effect in isolating the impact due to Africa RISNG only. Alongside the ARBES, AR research programs currently undertake a series of data collection exercises at various levels, most notably at plot-, household-, landscape-, and community-level.

A fully functioning M&E should feature a seamless flow of information from plot- and parcel-level characterizations useful to farmers, extensionists, and research teams, up through final reporting to research team managers and funders, and on to dissemination to external audiences. Functionality should see research program leaders taking full responsibility for the initial stages of data capture and transmission. Work package leaders themselves should convey raw questionnaires and other data capture forms, along with enhanced datasets, to the M&E team. In AR, some individual work package activities include formal individual-unit surveys while others CG centers delegate more ad hoc data capture to project-tied research assistants and to district-, ward-, and village-based extension officers with whom they partner. This will eventually be collected and stored into the IFPRI or ILRI project repository, in order to preserve the institutional memory and the data the program has generated.

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APPENDIX

Appendix A. Definitions of Program Areas

Ethiopian Highlands Mega-Site

According to Version 3 of the Concept Note for the Ethiopian Highlands Mega-Site (which may be superseded by a modified concept note) "The integrated research will focus on the wheat-growing area in the Ethiopian Highlands. This area exhibits large variations in existing levels of intensification, cereal-legume rotations and other crop-combinations, as well as crop-livestock integration. Furthermore, the factors driving intensification such as agricultural potential, access to available technologies, demand for livestock products, and integration with markets vary a lot within the area.

A number of study sites will be chosen from these wheat-growing areas. They will represent contrasting levels of intensification to enable the characterization of different trajectories and identification of technology combinations that lead to sustainable development pathways.

Guinea Savanna Mega-Site

According to the December 2011 Concept Note, "The project will focus on the northern regions of Ghana, specifically in the administrative districts of Karaga, Cheroponi, and Tolon-Kumbungu (Northern Region); Kassena-Nankana and Bawku West (Upper East Region); and Wa East and Nadowli (Upper West Region) to address production constraints in rice and cereal-legume production systems. The northern Regions of Ghana are characterized by small land holdings of low input-output farming systems, which adversely impact food security in terms of availability, access and quality and result in a seasonal cycle of food insecurity of 3-5, 4-5 and 6-7 months for cereals (maize, sorghum, millet) and 5-7, 4-5 and 6-7 months (groundnut, cowpea, and soybean) in the Northern, Upper West and Upper East Regions, respectively. These crops in the savannas are often produced in a continuous monoculture in which soil natural resources are steadily depleted and yields per unit area are falling to very low levels. The poverty profile of Ghana also depicts the three northern regions as the most poverty stricken and hunger spots in Ghana. Gender inequalities are also apparent in these regions where women have less access to resources and capacity to generate income.

In Mali the project will focus on the Sikasso region, specifically the circles of Koutiala and Bougouni, The Sikasso region of southern Mali is ecologically similar to northern Ghana, but stretches northwards into drier zones, where maize cultivation is associated with high economic risks. Sorghum is traditionally the lead cereal and staple crop, but both maize and pearl millet are widely cultivated, to exploit specific ecological niches, and marketing opportunities.

East and Southern Africa Mega-Site

According to the Concept Note for East and Southern Africa, "Feed the Future (FtF) Tanzania is focusing on reducing poverty and improving nutrition through key investments to improve availability and access to staple foods by enhancing the competitiveness of smallholders. These investments are being geographically focused in areas with high agricultural potential bordering chronically food insecure districts: Morogoro (rice); Manyara and Dodoma (maize); and Arusha, Kilimanjaro, Tanga, Zanzibar, Dar es Salaam, Morogoro, Iringa and Mbeya (horticulture).

Dodoma and Manyara Regions in Tanzania are the geographic focus for this project. These areas are located in the Southern Agriculture Growth Corridor of Tanzania. Dodoma Region is a region centrally positioned in Tanzania. This Region is bordered by Manyara Region in the North, Morogoro in the East, Iringa in the South and Singida in the West. Much of the region is a plateau rising gradually from some 830 meters. There are three agro-ecological sub-zones in this region.

Appendix B. Classification of Wheat Producing woredas and Target Identification in Ethiopia

Woreda	Zone	Cereals	AG	elevati	el_ran	mean	rainfal	popdens	AC	TLU_l	elev_clas	rain_clas	slope_cl	pop_clas	tlu_class	category	Targets
Minjarna Shenkora	North Shewa (K3)	Teff-wheat	0	1567	1498	3.21	781	87	2	0.71	1	1	2	1	2	A	
Merti	Arsi	Maize-wheat	0	1743	2132	2.95	853	98	2	1.04	1	1	1	1	3	A	
Ziway Gugda	Arsi	Maize-wheat	0	1787	669	2.48	786	90	2	1.03	1	1	1	1	3	A	
Legehida	Bale	Teff-maize	0	1243	1124	2.52	666	10	3	0.90	1	1	1	1	2	A	
Seweyna	Bale	Teff-maize	0	975	1698	1.12	538	6	5	0.80	1	1	1	1	2	A	
Arsi Negele	East Shewa	Maize-wheat	0	1795	1493	1.45	783	139	1	0.86	1	1	1	2	2	A	
Goro	Bale	wheat	0	1516	1710	2.77	837	33	2	0.87	1	1	1	1	2	A	potential
Guradamole	Bale	wheat	0	1116	1994	3.10	652	5	4	1.21	1	1	2	1	3	A	
Mennana Arena Buluk	Bale	Teff-wheat	0	1370	3183	2.84	793	16	4	1.07	1	1	1	1	3	A	
Odo Shakiso	Borena	Teff-wheat	0	1530	1376	3.45	743	30	3	1.03	1	1	2	1	3	A	
Yabelo	Borena	Maize-wheat	0	1528	1042	1.91	552	14	2	1.40	1	1	1	1	3	A	
Ginir	Bale	wheat	0	1720	1410	2.16	974	53	3	0.97	1	2	1	1	2	B	potential
Amigna	Arsi	Wheat-teff	0	1713	1608	3.82	958	51	4	1.30	1	2	2	1	3	B	
Seru	Arsi	wheat	0	1648	1625	5.69	965	46	4	1.29	1	2	3	1	3	B	
Gololcha	Bale	Wheat-barley	0	1648	1672	3.78	965	75	3	0.62	1	2	2	1	2	B	
Gidami	West Wellega	Maize-wheat	0	1053	1843	3.81	1087	35	5	0.32	1	2	2	1	1	B	
Ahferom	Central Tigray	Teff-wheat	0	1925	1343	3.66	640	125	2	0.56	2	1	2	2	2	C	
Gulomahda	Easetern Tigray	Wheat-barley	0	2309	1053	4.97	574	161	1	0.46	2	1	2	2	1	C	
Hawzen	Easetern Tigray	Barley-wheat	0	2055	1122	2.88	625	135	1	0.56	2	1	1	2	2	C	
Wukro	Easetern Tigray	Wheat-barley	0	2135	828	3.22	607	114	1	0.51	2	1	2	2	2	C	
Degua Temben	Central Tigray	Wheat-teff	0	2154	1336	6.07	649	109	1	0.61	2	1	3	2	2	C	
Enderta	Southern Tigray	Wheat-barley	0	2149	1050	3.40	576	97	1	0.56	2	1	2	1	2	C	
Samre	Southern Tigray	Teff-wheat	0	1817	1258	4.21	639	71	2	0.91	2	1	2	1	2	C	
Hintalo Wajirat	Southern Tigray	Wheat-teff	0	2146	2018	5.30	575	83	2	0.68	2	1	3	1	2	C	
Ofla	Southern Tigray	Wheat-barley	1	2383	1964	7.30	772	147	2	0.54	2	1	3	2	2	C	AGP targ
Jijiga	Jijiga	Wheat-barley	0	1803	1027	2.00	745	107	2	0.46	2	1	1	2	1	C	
Dodotana Sire	Arsi	Wheat-teff	0	1880	1541	2.45	865	134	1	0.73	2	1	1	2	2	C	
Dodotana Sire	Arsi	Wheat-teff	0	1880	1541	2.45	865	134	2	0.73	2	1	1	2	2	C	
Jarso	East Harerghe	Wheat-maize	0	2006	1603	5.58	803	215	2	0.47	2	1	3	3	1	D	
Kurfa Chele	East Harerghe	Maize-wheat	0	2043	1739	5.54	853	219	1	0.37	2	1	3	3	1	D	
Bedeno	East Harerghe	Maize-wheat	0	1841	1998	7.08	864	236	2	0.51	2	1	3	3	2	D	
Lanfero	Guraghe	Maize-wheat	0	1836	711	1.42	888	220	2	0.84	2	1	1	3	2	D	
Hagere Mariamna Kesem	North Shewa (K3)	wheat	0	2367	2016	6.50	909	77	3	0.85	2	2	3	1	2	E	
Agarfa	Bale	Wheat-barley	1	2356	2391	5.24	1035	73	3	1.23	2	2	3	1	3	E	
Nenesebo	Bale	Barley-wheat	0	2330	1940	6.02	1061	37	3	1.49	2	2	3	1	3	E	
Debark	North Gonder	Barley-wheat	0	2054	2973	6.99	919	102	3	0.55	2	2	3	2	2	F	
Dabat	North Gonder	Teff-wheat	0	1918	1830	5.88	940	128	2	0.63	2	2	3	2	2	F	
Wegera	North Gonder	Wheat-barley	0	2167	1888	4.91	1004	125	3	0.58	2	2	2	2	2	F	
Sayint	South Wollo	Teff-barley	0	2303	2921	8.50	1085	112	4	0.78	2	2	3	2	2	F	
Debresina	South Wollo	Wheat-teff	0	2194	2316	7.76	1055	173	3	0.83	2	2	3	2	2	F	
Jama	South Wollo	Teff-wheat	0	2362	1232	6.25	1029	123	1	0.72	2	2	3	2	2	F	
Moretna Jiru	North Shewa (K3)	Teff-wheat	0	2092	1373	8.50	922	144	2	0.45	2	2	3	2	1	F	
Siya Debirna Wayu & Ensarc	North Shewa (K3)	Teff-wheat	0	2340	1425	4.47	925	141	2	0.50	2	2	2	2	2	F	
Yaya Gulelena Debre Libanos	North Shewa (K4)	Teff-wheat	1	2353	1361	4.96	1007	175	3	0.71	2	2	2	2	2	F	
Jeldu	West Shewa	Wheat-barley	0	2251	1802	6.06	1087	150	3	0.97	2	2	3	2	2	F	
Gimbichu	East Shewa	Wheat-teff	1	2283	1008	3.22	939	108	2	0.77	2	2	2	2	2	F	
Akaki	East Shewa	Teff-wheat	0	2073	1102	2.13	969	103	1	0.83	2	2	1	2	2	F	
Kersana Kondaltiti	West Shewa	Teff-wheat	0	2307	1736	2.67	1070	114	2	0.81	2	2	1	2	2	F	
Aseko	Arsi	Barley-wheat	0	2279	1778	8.46	1074	128	3	0.92	2	2	3	2	2	F	
Chole	Arsi	Wheat-barley	0	2385	2295	7.90	1070	142	3	0.81	2	2	3	2	2	F	
Sude	Arsi	Wheat-teff	0	2330	1527	5.84	1093	114	3	0.96	2	2	3	2	2	F	
Robe	Arsi	Wheat-teff	0	2132	2700	5.20	1099	121	3	1.02	2	2	3	2	3	F	
Shirka	Arsi	Wheat-teff	1	2233	2370	5.27	1039	142	2	1.09	2	2	3	2	3	F	
Gasera	Bale	wheat	1	2140	1312	4.71	1099	138	3	0.54	2	2	2	2	2	F	AGP targ
Mojana Wadera	North Shewa (K3)	wheat	1	1991	2240	6.93	1040	150	2	0.34	2	2	3	2	1	F	
Kersa	East Harerghe	Maize-wheat	0	2117	1360	4.35	903	357	1	0.44	2	2	2	3	1	G	
WEREDA 19	Zone 3	Teff-wheat	0	2224	275	2.08	1041	3439	1	0.05	2	2	1	3	1	G	
WEREDA 26	Zone 6	Teff-wheat	0	2173	214	1.12	1007	586	1	0.21	2	2	1	3	1	G	
WEREDA 27	Zone 6	Teff-wheat	0	2116	113	1.20	986	1808	1	0.11	2	2	1	3	1	G	
Limu	Hadiya	Wheat-maize	1	2166	1200	2.59	1029	411	2	0.59	2	2	1	3	2	G	AGP targ
Menjiwo	Kaffa	Teff-wheat	0	2145	2116	7.22	1750	96	3	0.81	2	3	3	1	2	H	
Gera	Jimma	Wheat-maize	1	2124	1588	3.95	1876	68	3	0.99	2	3	2	1	2	H	
Gesha Daka	Kaffa	Teff-wheat	0	2221	808	2.12	1929	45	4	0.50	2	3	1	1	2	H	
Goncha Siso Enese	East Gojam	Teff-wheat	0	2252	2002	6.15	1234	141	2	0.59	2	3	3	2	2	J	
Enarj Enawga	East Gojam	Teff-wheat	0	2316	2800	6.44	1193	173	2	0.62	2	3	3	2	2	J	
Kedida Gamela	Kembata Alaba Teml	Wheat-teff	0	2048	920	3.64	1107	614	2	0.42	2	3	2	3	1	J	

Appendix C. Action and Control Sites in Northern Ghana

ACTION

community	lat	lon	region
Goli	10.297161	-2.631169	Upper West
Goriyiri	10.345478	-2.632489	Upper West
Gyilli	10.202748	-2.633025	Upper West
Natodori	10.257167	-2.626606	Upper West
Papu	10.235586	-2.578928	Upper West
Guo	10.062071	-2.608257	Upper West
Nyagli	10.016431	-2.613818	Upper West
Pase	10.037027	-2.710677	Upper West
Siiriyin	10.042371	-2.593258	Upper West
Zanko	10.067212	-2.595719	Upper West
Bonia	10.87064	-1.12764	Upper East
Gia	10.869269	-1.122731	Upper East
Nyangua	10.935432	-1.073623	Upper East
Sabulungo	10.955178	-0.859288	Upper East
Tekuru	10.914777	-1.049759	Upper East
Botingli	9.6117	-0.78867	Northern Region
Cheyohi No. 2	9.4384688	-0.984598	Northern Region
Duko	9.562964	-0.83237	Northern Region
Gbanjon	9.4524979	-1.101237	Northern Region
Jana	9.47813	-0.77973	Northern Region
Kpallung	9.6845	-0.78154	Northern Region
Kpirim	9.5497741	-1.006748	Northern Region
Tibali	9.666837	-0.84398	Northern Region
Tiborgunayili	9.4983929	-1.243575	Northern Region
Tingoli	9.3758738	-1.009357	Northern Region

CONTROL

community	lat	lon	region
Wogu	10.41565	-2.38784	Upper West
Issa	10.38845	-2.33265	Upper West
Tabiase	10.36396	-2.31514	Upper West
Fian	10.38693	-2.46981	Upper West
Naro	10.33669	-2.46734	Upper West
Sa gie	10.263573	-2.353563	Upper West
Tanina	9.90989	-2.45926	Upper West
Goripie	9.97153	-2.27068	Upper West
Shia	10.66041	-0.84252	Upper East
Yenduri	10.65581	-0.82488	Upper East
Namiyila	10.58426	-0.82766	Upper East
Arigu	10.57779	-0.87596	Upper East
Karemiga	10.56093	-0.83298	Upper East
Basigu	10.55174	-0.88719	Upper East
Kukua	10.30044	-0.8191	Northern Region
Laogri	10.27545	-0.82711	Northern Region
Nasia	10.15774	-0.80384	Northern Region
Kukobila	10.1215	-0.80755	Northern Region
Disiga	10.01388	-0.82406	Northern Region
Pigu	9.98003	-0.82407	Northern Region
Kadia	9.90423	-0.85712	Northern Region
Gushie	9.80585	-0.85995	Northern Region
Nabogu	9.74691	-0.82352	Northern Region
Kpelung	9.67147	-0.93988	Northern Region
Tindan	9.66772	-0.91786	Northern Region

Appendix D. Action and Control Sites in Malawi

District	Extension Planning Area (EPA)	Section	Villages	# of farmers surveyed
Dedza	Linthipe	Mposa (Intervention site)	Phwere, Mkuwazi, Mbidzi, Ng'anjo and Chibwana	100-125
	Lobi	Thete (Counterfactual)	Chizuzu I, Kabinda II, Gogo, Maphiri, Mafuko, Mambewe and Chimbwala	50-75
	Golomoti	Golomoti Center (Intervention site)	Msamala, Pitala, Kalumo, and Wilson	100-125
	Mtakataka	Mtakataka Center (Counterfactual)	Fwalikire, Chidzondo, Kakhome I, Kautsire, Kudoole, Chikawola, Manyika and Tseka	50-75
Ntcheu	Kandeu	Kampanje (Intervention site)	Dauka, Gonthi, Kanjuzi, Katsese, Kampanje I, Kampanje II, Kampanje III, Khomba, Selemani, Mitchi and Kaziputa	180-200
		Sitolo (Counterfactual site)	Kambadya, Majawa, Sitolo and Zaunda	50-75
	Nsipe	Mpamadzi (Intervention site)	Hiwa, Gwauya, Champiti, and Amos	100-125
		Mwalaoyera(Counterfactual)	Chilumo, Chimwala, Sanjani, Jingo, Hauya, Kahowela, Mnkhwani, Mnkhwani II, Pendanyama	50-75

Appendix E. Action and Control Sites in Tanzania

district	village	type	lon	lat
Babati	Dudie	control site	35.5768	-4.2158
Babati	Gidas	control site	35.7020	-4.4274
Babati	Gidewari	control site	35.4026	-4.3360
Babati	Gidngwar	control site	35.4344	-4.1621
Kongwa	Leganga	control site	36.3620	-5.7100
Kongwa	Ngutoto	control site	36.2881	-5.6584
Kongwa	Njoge	control site	36.6836	-5.9542
Kongwa	Chitego	action site	36.3717	-5.6141
Kongwa	Laikala	control site	36.6101	-6.1930
Kongwa	Mlali	action site	36.7519	-6.2950
Kongwa	Moleti	action site	36.8123	-6.1775
Kiteto	Njoro	action site	36.5000	-5.2500
Babati	Sabilo	action site	35.4833	-4.3333
Babati	Seloto	action site	35.4985	-4.2407
Babati	Shaurimoyo	control site	35.6932	-3.9139
Babati	Mer	control site	35.5515	-4.0547
Kiteto	Dosidos	control site	36.3968	-5.4738
Babati	Managhat	control site	35.3700	-4.1660
Kongwa	Mautia	control site	36.4827	-6.1672
Babati	Hallu	control site	35.8945	-4.2934
Babati	Long	action site	35.4520	-4.2250
Babati	Matufa	control site	35.7682	-4.0302
Kongwa	Makame	control site		