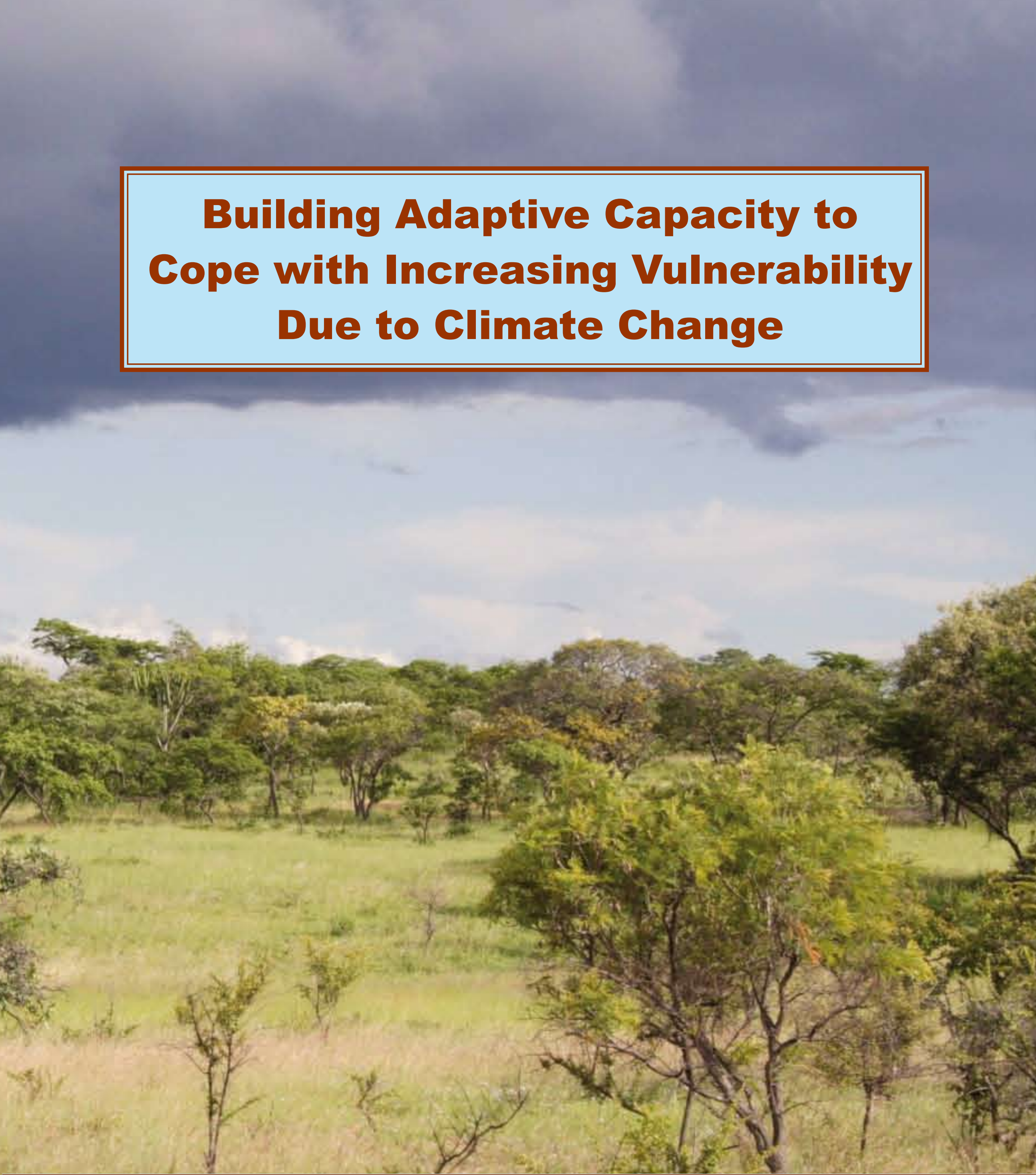

Building Adaptive Capacity to Cope with Increasing Vulnerability Due to Climate Change

ICRISAT
Science with a human face
International Crops Research Institute for the Semi-Arid Tropics

Faculty of Natural Resources Management, MSU

Zambian Meteorological Office, Zambian Agricultural Research Institute

CSIRO
Australian Commonwealth Scientific Research Organization, Sustainable Ecosystems

TSBF
The Tropical and Soil Biology and Fertility Institute of CIAT (TSBF-CIAT)
Centro Internacional de Agricultura Tropical (CIAT-TBSF)

Building Adaptive Capacity to Cope with Increasing Vulnerability Due to Climate Change

Report of the Inception Workshop
Bulawayo, Zimbabwe
7–8 June 2007

Faculty of Natural Resources Management, MSU

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International Crops Research Institute for the Semi-Arid Tropics
Patancheru 502 324, Andhra Pradesh, India

2008

Contents

I. Introduction

The inception workshop to launch the IDRC-funded project on 'Building adaptive capacity to cope with increasing vulnerability due to climate change' was held at ICRISAT-Bulawayo on 7–8 June 2007. Participants included officials from universities, meteorological offices, and extension services from Zambia and Zimbabwe, as well as scientists from various international organizations (for a full list of participants see Annex 1).

The objectives of the workshop were to:

- understand the significance of climate change and adaptation
- familiarize participants with the farmers' perceptions of climate change and current work on adaptation to climate change/extremes in Zambia and Zimbabwe
- revisit the activities and assign tasks and timeframes
- initiate a project monitoring and evaluation protocol
- create a community of practice with other IDRC climate change projects

This document summarizes the presentations and discussions at the meeting.

II. Presentations on Day One

Dr Steve Twomlow (on behalf of Dr Isaac Minde, ICRISAT Country Representative) as well as Mr Joe Sikosana, Head of Matopos Research Station, welcomed the participants.

A series of presentations that described climate change in Zimbabwe and Zambia as well as an update of the most recent projects on climate change and vulnerability followed.

Opening address (Professor Francis Mugabe, Principal Investigator)

Prof. Mugabe presented the workshop objectives as well as the Climate Change Adaptation in Africa (CCAA) objectives, which included various goals such as strengthening the capacity of African scientists, organizations and decision makers, generating better shared understanding of the findings of research, and informing policymakers with high-quality science-based knowledge.

Some of the issues discussed at the IDRC inception workshop held in Ethiopia included ways of promoting regional cooperation in facing shared challenges; sharing knowledge of climatic risks and adaptation to policymakers, researchers as well as those at risk; and strengthening communication within projects.

Table 1 shows the IDRC training workshop schedule. Each of the commissioned IDRC-CCCA projects is allowed to send two project participants and one policymaker to each of the four workshops.

Table 1. IDRC training workshop schedule.

Title	Venue	Dates
Integrated risk assessment	Nairobi	16–19 July
Research methodologicaltraining (PAR & gender analysis)	Dakar	6–11 August
Training in research and project management	Cairo	27–31 August
Research to policy linkages	Johannesburg	September

It was decided that the climatic change terminologies (mitigation, adaptation, coping) that this project uses must be the same as the Intergovernmental Panel on Climate Change (IPCC) to avoid confusion. For example, 'mitigation' and 'adaptation' are not interchangeable terms. 'Mitigation' involves practices that reduce greenhouse gas emissions; in other words, managing risk by avoiding climate variability. Mitigation is often outside the scope of most projects. 'Adaptation' is the management of risk through activities in response to climate variability. 'Coping strategies' are practices that people are already carrying out. 'Adaptive strategies' are how people's behavior changes over a long period of time.

Climate change in Zimbabwe (Mr Washington Zhakata, Climate Change Office, Zimbabwe)

The surface temperature in Africa has increased over the past century with a sharp rise in the last 10 years (Figure 1). Human activities have changed the composition of the atmosphere since the pre-industrial era. The use of fossil fuel currently accounts for 80–85% of the carbon dioxide being added to the atmosphere. Land use changes such as clearing land for logging, ranching, and agriculture account for a further 15–20% of current carbon dioxide emissions. If current trends continue, the amount of carbon dioxide in the atmosphere will double during the 21st century.

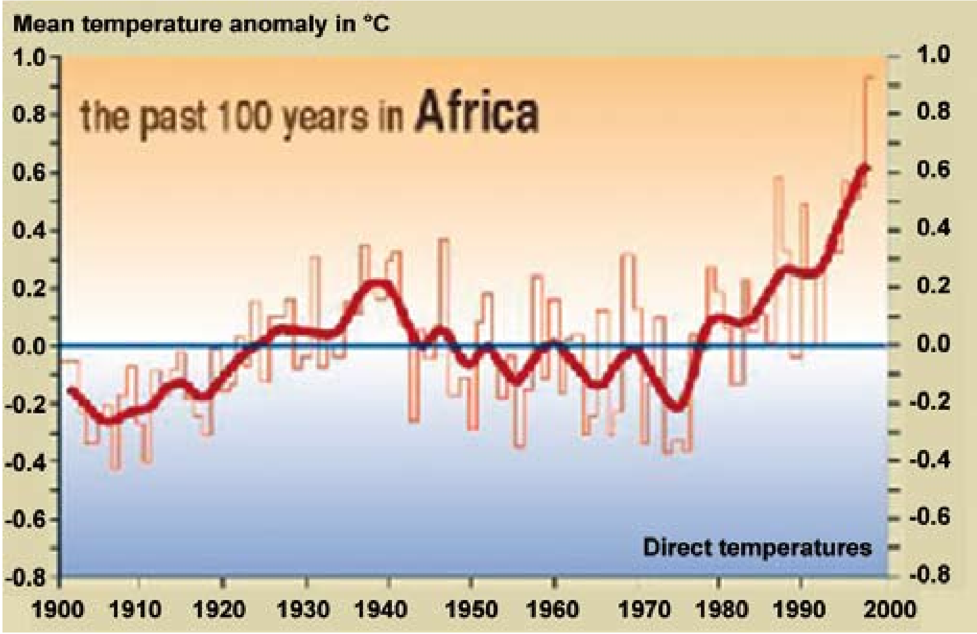

Figure 1. Changes in surface temperatures in Africa over the last century.

The implications of this are serious for Zimbabwe. The number of years with below average rainfall is increasing (Figure 2). There are signs of a gradual warming in both summer and winter temperatures. Models suggest that Bulawayo will experience a minimum rise in daily temperatures of 2.7°C. There

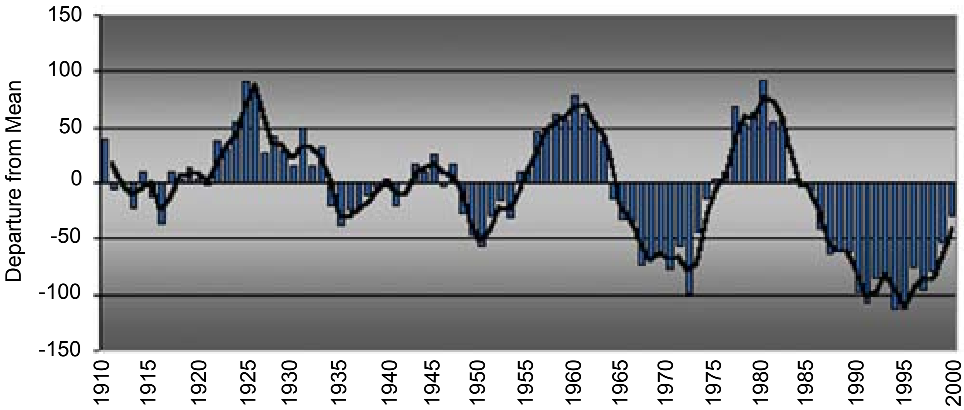

Figure 2. Zimbabwe's national rainfall deviation from the mean from 1900 to 2000.

may be more rain in northern Mozambique, Namibia, Botswana, southwest Angola and western South Africa. However, the predictions are that the rest of the region will experience a decline in rainfall.

To show its commitment to addressing the challenges of climate change, Zimbabwe was one of the first countries to sign and ratify the United Nations Framework Convention on Climate Change in Rio de Janeiro in June 1992. Established in 1996, responsibilities for the Climate Change Office in Zimbabwe include coordinating all climate change related issues in the country and assisting the government with establishing appropriate policies to address climate change. The office also coordinates and conducts research on climate change impact analysis and vulnerability assessments. For example, the Climate Change Office has been working on a project in the Zambezi Valley's flood-prone area attempting to use digital recorders to ensure that people are evacuated when the river rises beyond a certain point. They have also worked on a project in the Limpopo River basin in Botswana, Mozambique, South Africa, and Zimbabwe to assess the vulnerability of the communities along the river.

Farmers' perceptions of climate change in Zimbabwe (Mr Dave Masendike, Agricultural Research and Extension Services (AREX), Zimbabwe)

The information for this presentation is from surveys that asked farmers what indicators they use to predict rainfall as well as 20 years of experience working with farmers. The surveys did not specifically look at ways that farmers were adapting their behavior in response to these observations. This presentation tries to answer three questions:

- Are farmers aware of changes in the climate?
- What are their observations?
- What do farmers think causes climate change?

1. The answer to the first question is simple: yes, farmers are aware of climate change.

2. What changes are they seeing? Farmers have noticed changes in the quantity, quality and efficacy of rainfall. There is a general decline in the amount of rainfall, which is more pronounced in the semi-arid tropics (SAT). In terms of quality, they have noticed differences in distribution as well as more erratic rainfall events. The dry spells appear to be increasing in duration and frequency and this is also more pronounced in SAT. There is an increased incidence of drought. Farmers have noticed that the rainfall is less effective now than before. The rainfall is heavy and infrequent causing more runoff and soil erosion.

There are also certain changes in season length. The end of the rainy season used to be in March/April but now it is as early as February. SR52, the first late maturing maize hybrid, used to be grown in Tsholotsho and Gwanda when it was first released in the 1960s, but now its offspring cannot be grown in these areas.

Farmers have noticed certain environmental changes such as the drying up of wetlands, ponds, pans, and riverbeds. Certain grass species that are associated with the wetlands are disappearing as are some small insect species. Farmers are also finding that they can no longer rely on their traditional signs, such as the flowering of certain tree species, or a halo around the sun or moon signifying rain, to predict the weather.

3. What are the causes of climate change? Some farmers mentioned deforestation. Others say that more rain is received at commercial farms because they have trees that catch the rain clouds. Others believe that the rains are failing because traditional customs are no longer observed. Some commercial farmers say that global warming is the cause of climate change.

Agromet information dissemination to farmers in Zimbabwe (Mr C. Murewi, Midlands State University, Zimbabwe)

The main sources of agromet information are the Zimbabwe Meteorological Services and the National Early Warning Unit. Their main products include: seasonal forecasts, rainfall maps, specialized forecasts and warnings such as frost occurrence and severity. The Met service also produces the fortnight crop and livestock reports for both policymakers and the general public.

The Met service tries to target the needs of the small-scale farmer who has less flexibility in applying forecasts in the face of climate variability as well as the commercial farmer who has more flexibility and a better resource base.

The presentation also included a list of challenges for the users of the information, such as having to pay for it or not completely understanding the information and how to use it. The discussion on the presentation raised questions about the reliability and timeliness of the information as well as the adequacy of the resources available to the Met service.

Group Activity

Following the presentations, each of the participants identified various gaps in knowledge, resources or capacity that the project could begin to address. These were then sorted into four categories:

1. Community adaptation and current coping strategies

2. Data quality and availability: Met office – reliability, end-user dissemination strategies

3. Quality of forecast and reliability of it (risk and adaptive strategies – communication and dissemination)

4. Existing climate records and their use (what databases need to be in place for this project?)

Farmers' current coping strategies (Dr John Dimes, ICRISAT, Zimbabwe)

This project proposes to work with smallholder farmers in dry regions of Zambia and Zimbabwe. In the main, these farmers experience chronic food insecurity, have persistently low crop yields and farm in drought-prone regions. Due to their predominantly low wealth status and climatically risky environment, we can expect the farmers to be strongly risk-averse and conservative in their management practices.

Farmer's current crop management coping strategies and possible rationale (from a researcher's perspective):

- short-duration germplasm – avoid terminal drought
- early sowing – allow opportunities for re-sowing
- multiple sowing dates across fields –if deliberate, helps spread risk of post-sowing dry spells. But may be forced due to labor/equipment constraints.
- drought-tolerant crops – will invest in maize staple, but retain small areas of sorghum or millet in case of drought
- intercropping – variation on multiple sowing
- extensive rather than intensive farming – larger harvest if season is favorable
- Little investment in soil fertility – prefer reliability of an annual yield, even if it is consistently low

Given the low rainfall environment, it might be expected that water management technologies would be commonplace. But they are not, seemingly because of labor constraints (eg, tied-ridging, dead level contours) or impracticalities (eg, residue mulching in a mixed farming system). Even in the case of Conservation Agriculture, yield benefits largely emanate from the fertility inputs of the package rather than water and soil management per se, especially in the short term.

In the main, farmer's current risk coping strategies are geared towards avoiding crop failures. Few strategies target increased productivity (besides perhaps improved germplasm or planting extensive areas). Yet, on average, there is more than sufficient rainfall to substantially increase yields. Hence, it seems that current risk avoidance strategies are been pursued at the expense of increased production opportunities in the better seasons.

An example model application:

We know that farmers in Zimbabwe prefer to use short-season cultivars rather than long-season cultivars. Simulation output can help quantify the benefits across seasons. Figure 3a shows that short duration germplasm clearly reduces the number of years of crop failures, but annual yields mostly remain less than 1 ton ha^{-1}. Only when investments in fertilizer are made do we see significant crop production gains (Figure 3b).

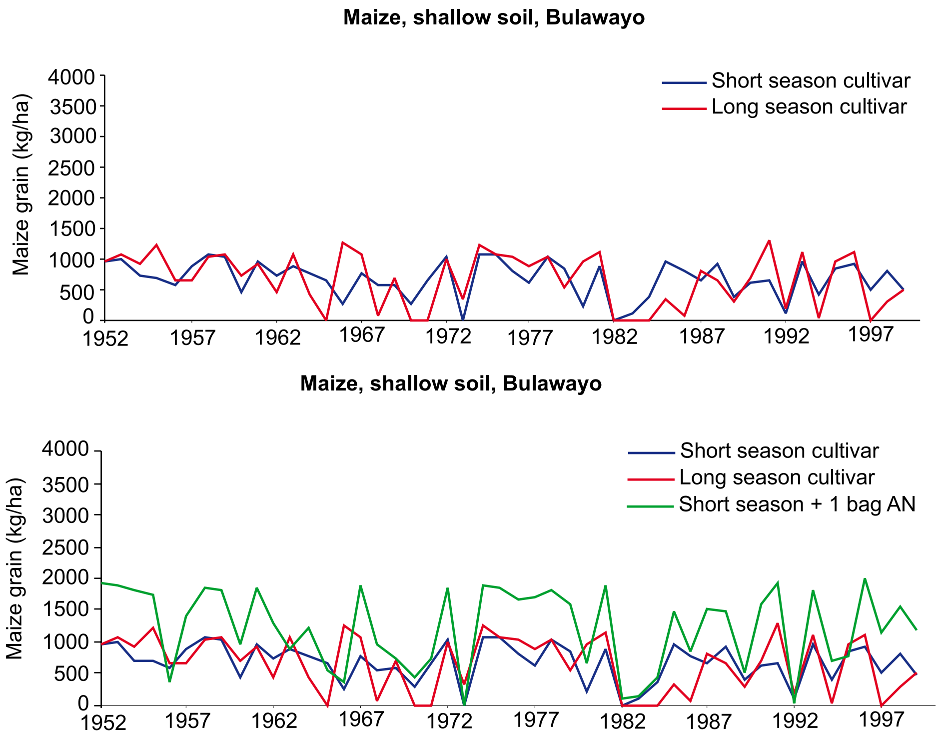

Figure 3. Simulated maize yields at Bulawayo (1952–1999) for (a) top frame, long and short duration cultivars and (b) bottom, addition of a small amount of N fertilizer.

Is there evidence of climate change already?

The project is concerned with adaptations to cope with climate change. The main climatic variable influencing crop production in the project target areas is rainfall. The climate record for Bulawayo and four other sites in Zimbabwe were analyzed for any emerging trends of climate change. In terms of seasonal variations from long-term mean rainfall, maximum length of dry spells in a cropping season or frequency of dry spells (10 days or more), no evidence of change is currently observed (Figure 4). Hence, it appears the project will rely heavily on applications of crop simulation coupled with simulated climate change (rather than any actual climate record displaying change) to evaluate crop management strategies for coping with future climate change scenarios, at least in relation to rainfall.

The project plans to use crop simulation modeling as a tool to quantify the impact of climatic risk on crop productivity and to explore farm management coping strategies for current climate and future change scenarios. If well tested and calibrated for the cropping systems of interest, the crop models should provide objective and deterministic outputs for estimating climate risk. However, from behavioral economics, it is known that risk detection and risk avoidance by humans is predominately a non-rational, emotional process. Hence, there is a high probability that, for any given technology or scenario, there will be large discrepancies between model estimates of climatic risk and those perceived by risk-averse farmer clients. While on the one hand such differences should provide good opportunity for learning to take place, on the other, it may be cause for derision in regard to the credibility of the modeling tool. Managing this tension will be a major challenge, and potentially a major achievement and output, for the project.

Climate change: The role of modeling to assess adaptation options (Mark Howden, CSIRO)

Preconditions of adaptation:

- Capacity to manage existing climate risks
- Confidence that climate changes are real and will continue
- Motivated to avoid risks and use opportunities
- Demonstrated technical and other options available and implementation issues understood
- Support for transitions to new locations, land uses and practices (policy level issues)
- New storage and transport infrastructure
- Monitoring for continuing improvements in adaptation

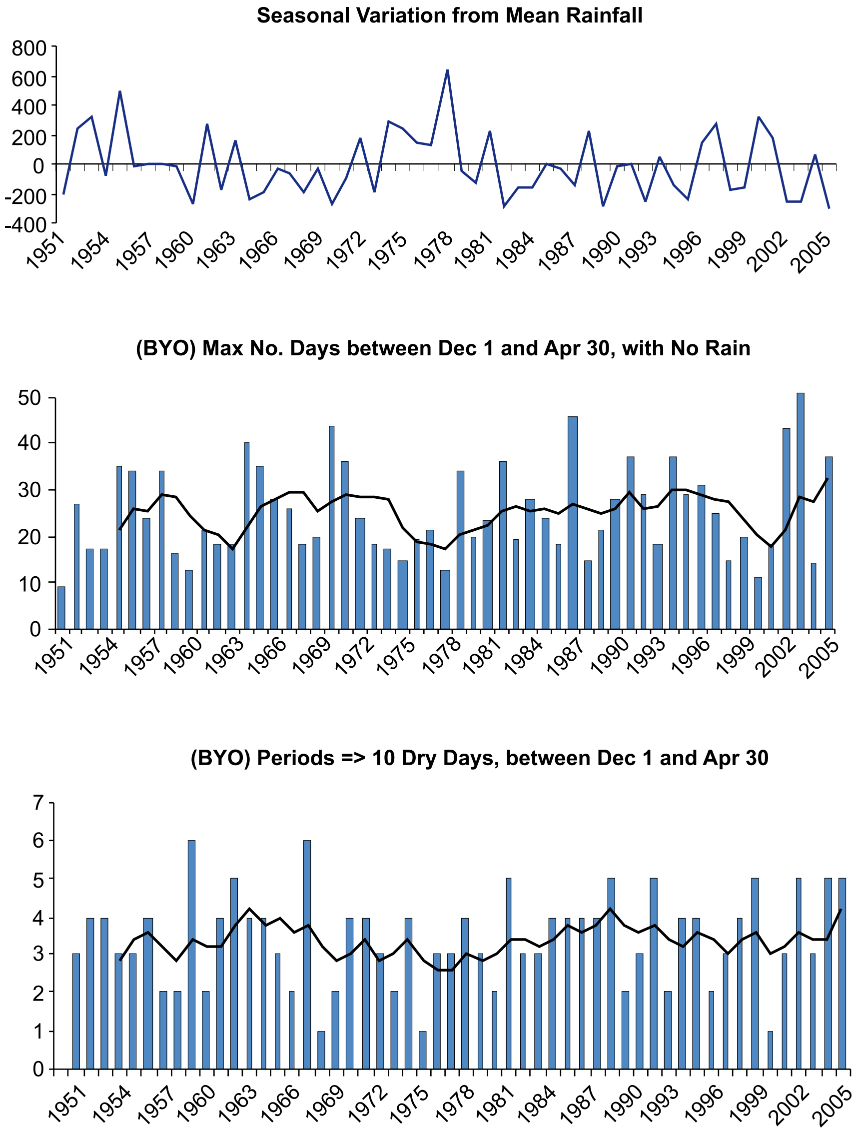

Figure 4. Analysis of climate variables at Bulawayo (1951–2005).

With only few exceptions, most of globe has warmed. This cannot be explained without taking human actions into account. The warming is not just on land. Sea surface temperatures have also risen, influencing ocean currents, storm patterns etc.

Current carbon dioxide levels are unprecedented in the entire history of our species (Figure 5). This is a fundamental change in the system. Experiments studying increases in carbon dioxide show significant changes in species composition. For example, FACE experiments have shown a 36% increase in aboveground net primary production. The response to carbon dioxide varies with the type of year. The response is strongest in moderately dry years rather than in very wet years or very dry years.

Climate change can be seen as an operational concern now, NOT as a strategic planning exercise. Climate variability used to be the entry point for climate change. Now climate change is the entry point for assessing broader climate risk management.

Rainfall projections are highly uncertain, but decreases are likely in most subtropical land regions, continuing observed patterns in recent trends (Figure 6). Winter rainfall is more likely to be less than summer rainfall.

Other climate changes include: increases in temperatures (1.1 to 6°C), possible reduction in frost, increases in rainfall intensity and dry spell length, changes

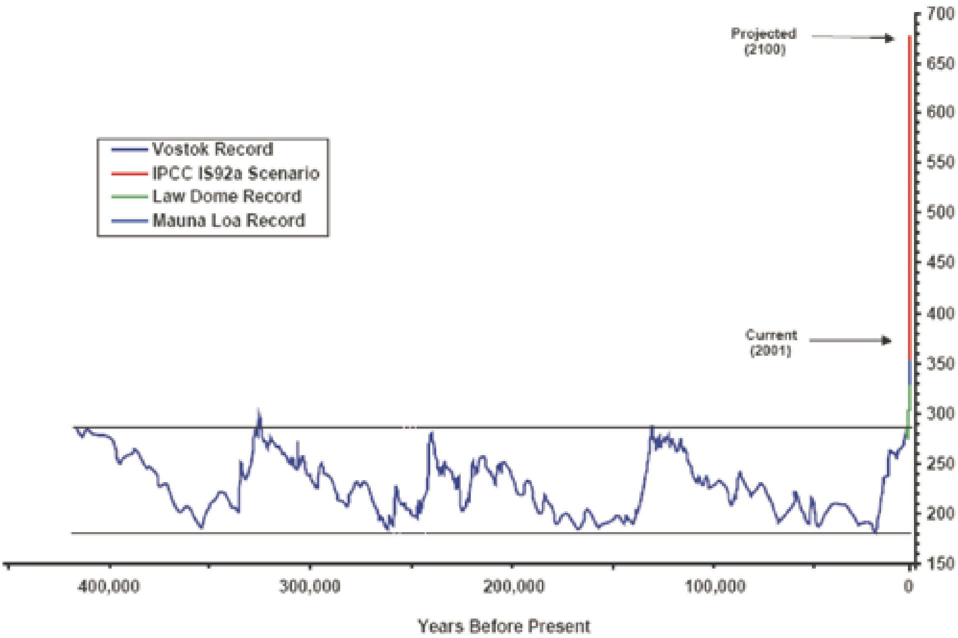

Figure 5. Carbon dioxide concentration in ice core samples and projections for the next 100 years.

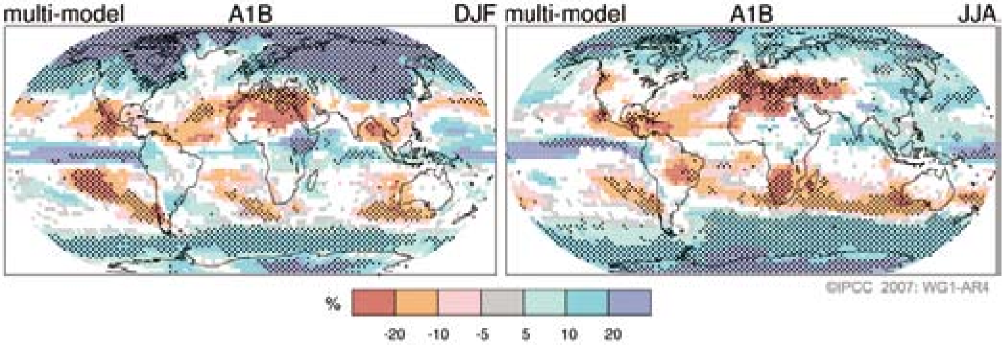

Figure 6. Projected patterns of precipitation changes.

in seasonality of rainfall, increases in evaporation, and possibly more frequent, intense and southerly tropical cyclones.

We need to be able to assess the things that are most likely to change such as climate and atmospheric changes (temperature means and extremes; rainfall mean, seasonality, intensity; carbon dioxide effects); management responses and other variables of interest such as productivity, production risk, farm economics, rural livelihoods, natural resource condition.

Some guiding principles:

- The choice of model should fit the needs of the project. Make the method fit the project, not the other way around. This means you need to have a clarity of who the clients are and a well-defined scope.
- Deal with the things that need to be varied in a balanced way. There is no point in having incredible precision in one area such as carbon dioxide levels if you do not have precision in rainfall data.
- The analysis needs to fit the scale of the decision.
- Confidence vs. precision (it is better to be roughly right rather than precisely wrong).
- Assessment of relative effectiveness and acceptability of options – neither optimization nor absolute measurement.

Different climate adaptation analysis methods are available. These include historical data analysis for variation which tends to ignore a lot of issues, expert opinion, time for space substitution, simulation pathways such as APSIM, mixed models, agent-based models, livelihoods analysis (social and natural capital).

The aim is to make adaptations more effective and efficient in the face of climate change. Trial and success rather than trial and error.

Some suggested steps:

- Establish the real and perceived climate risk
- Determine how farmers have coped in the past
- Explore improvements in these coping strategies via simulation analyses in a participatory way
- Identify projected change in climate variables
- Quantify impacts of these changes on the existing agricultural systems
- Explore adaptations to these impacts (which may include opportunities) with farmers
- Assess the institutional and other barriers/synergies to these adaptations
- Identify the capacity building needs and implement further training
- Adopt an effective communication strategy

The role of modeling in participatory systems (Peter Carberry, CSIRO)

The key message from this presentation is that the promised improvements in agricultural systems productivity as a result of participatory research approaches are still not fulfilled. Out of 400 examples of articles on models reviewed by Mathews and Stephens, only 11 are examples of models having impact. We need to use the model in the real world and engage with farmers using our models and tools.

III. Presentations on Day Two

Dr Twomlow provided a brief summary of the events of the previous day and stated that the two key questions that the project aims to address are:

- Do farmers have the capacity to respond to forecasts and the climate (capacity can vary with wealth and scale of farmer)?
- Do change agents have the capacity to respond and do they have flexible messages that take climate change into account?

Farmers' perception of climate change in Zambia (Brighton Miyanze, Ministry of Agriculture and Cooperatives)

The southern province of Zambia has 235,1444 households with 24% of them being female headed. The total area of the province is 85.283 square kilometers.

Rainfall fluctuates every year and as a result so does crop production. Rainfall also affects animal health with the shortage of water leading to changes in pastures.

Effects of climate change in the southern province include a decline in crop production, as well as low water levels in natural reservoirs. It also includes a decline in the cattle population between 1985 and 2005, which could be linked to a decline in rainfall (Figures 7 and 8).

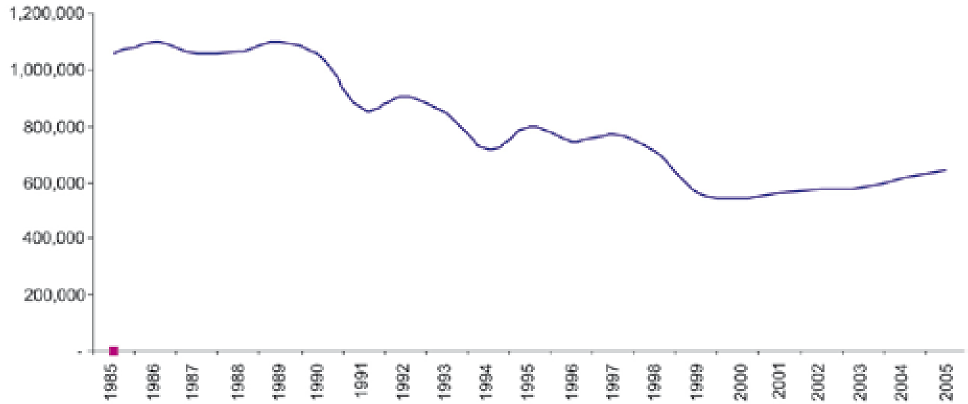

Figure 7. Cattle population in the Southern Province, Zambia, from 1985 to 2005.

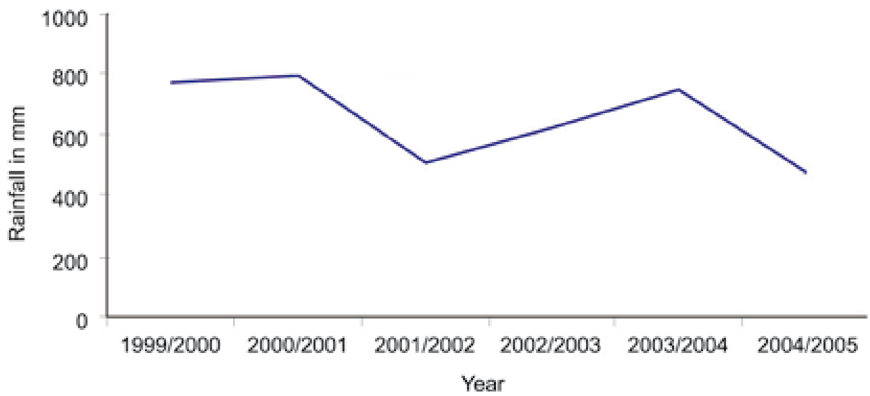

Figure 8. Average annual rainfall for the Southern Province, Zambia, from 1999/2000 to 2004/2005.

Drought mitigation strategies practiced by farmers include:

- crop diversification
- soil fertility
- erosion control structures
- supplementary feeding
- nursery establishment and tree plantation
- conservation tillage

Farmers fall back on sorghum and/or plant both sorghum and maize as sorghum is more drought resistant. They also plant sweet potatoes and legumes. Farmers in Gwenbe and Sinazongwe have switched to growing cotton and prefer to buy rather than grow maize. Small stock such as goats are also common in these districts.

In order to mitigate the effects of reduced water and loss of fertility, the Ministry of Agriculture and Cooperatives along with other ministries and cooperatives, have promoted certain technologies including: crop residue management, mulching and crop covers, and composting.

Agromet information dissemination to farmers in Zambia (Elijah Phiri, University of Zambia/Durton Nanja, Zambian Meteorological Office)

The presentation provided the reasons for the establishment of Agromet services in Zambia and the problems that clientele face when using them. These include a lack of ability to understand raw data and its interpretation for the relevant action; language technicalities; lack of awareness of the importance of the Agromet information; lack of timeliness to respond to early warnings; problems associated with technological advances such as poor telephone infrastructure and internet facilities.

The information dissemination targets are policymakers, intermediaries (NGOs, change agencies,) and other stakeholders. Communication pathways include radio, extension services, vernacular literature, and crop weather bulletins. The following questions frame effective communication: Relevance for decisions? Credibility of sources? Compatibility?

The Zambian Met Department releases a crop weather bulletin at the provincial level and is trying to determine how best this can be used by people on the ground. It may be necessary to narrow down the forecast to the local area. The Met Department does not have the capacity to marry soil conditions with weather predictions, so certain recommendations may apply to a certain farm but not another.

Maize yields in Zambia average 1.2 metric tons. Every time there is a within season fluctuation, there is a drop in yield. There are no feedback mechanisms in place to assess how the Met forecasts are used. The government must be sensitized to meteorological issues, so that the feedback mechanisms, which are key for understanding the lessons that emerge, are implemented and funded. There is also a need to assess whether farmer perception matches with the reality.

The presentation also included a few words from Agnes Hamabuyu, a Zambian farmer who attended the workshop: When you talk to us in your language most people do not understand. You should talk to us in our language. You should use farmer groups to communicate with farmers. We need inputs to enhance productivity. We need to understand what is the government strategy and then most farmers are willing to listen to recommendations.

Group activity

Following the presentations, the participants divided into four groups to determine whether the gaps identified the previous day were adequately covered in the project objectives. Each group then presented their results.

1. Gaps in community adaptation and current coping strategies

The group felt that most of the issues were covered under Objectives 1 and 2. The objectives are listed as surveys and so the surveys need to be disaggregrated between risk avoidance vs. coping and adaptation strategies.

The idea of impact or quantifying the impact of climate change on communities is missing from the objectives. There is also the issue of attribution: how do we tell that the changes that are being seen are as a result of climate change and not as a result of the general economic situation in Zimbabwe for example. This is a methodological issue and must be addressed so that when conducting surveys there is an adequate attribution mechanism.

There were two gaps that were beyond the scope of the project: 'Inclusion of all agro-ecological areas as sites to compare climate change' and 'Establishing mitigation measures at the community level'.

2. Data quality and availability; Met office – reliability, end-user dissemination strategies

The group felt that all the gaps were covered by the objectives especially Objective 2. Some of the issues that need to be looked at are: a review of previous project outputs such as RAINMAN; the quality of available data from met offices; access and downloads from IPCC datasets and prognoses; a decision on which climate variables are to be looked at (temperature, rainfall, wind, solar radiation etc.); identifying seasonal forecast indicators and testing their role in climate change; NCEP reanalysis data.

The group also discussed climate data resources that are required to carry out the project and methods of obtaining access to them.

They also discussed the choices of project sites and decided that some of the questions that need to be answered include: what data do we have about those locations? What are the prognoses for those locations? Should we be linking with all 16 projects in terms of downscaling?

3. Quality and reliability of forecast (risk and adaptive strategies – communication and dissemination)

What is the reliability of the met data?

How can farmers access weather forecasts/information? (Objective 5)

Need for capacity building in the interpretation of weather information at all levels? (Objective 3)

How effective are the indicators – traditional and otherwise? (Objective 1)

Currently the met offices are blind broadcasting; they need to target the user appropriately.

4. Existing climate records and their use (what databases need to be in place for this project?)

The cards developed in the previous group session mostly addressed Objectives 1 and 4. There is still a need to determine farmer indicators and use them as tools to evaluate the situation. Also, the various types of indicators – environmental, vulnerability, climate, livelihoods, traditional/indigenous – need to be looked at closer.

The role of evaluation in a successful project (Dr Steve Twomlow, ICRISAT)

Monitoring and evaluation is a prime objective of the project. Evaluation is a broad concept and can be defined as the systematic assessment of a situation at a given point in time. Evaluation occurs at the institutional/systems level as well as project/individual level.

As our approach to solving agricultural and environmental problems changes, so should our approach to evaluation change. There are many reasons for not conducting an evaluation such as thinking that this project is different from others or it would cost too much or there is not enough time.

An evaluation will look at all aspects of the impact chain and determine who are the beneficiaries of the impacts (Figure 9). Never switch your mind off to the opportunities to interact with all the stakeholders. Evaluation is only of value for the identified audience.

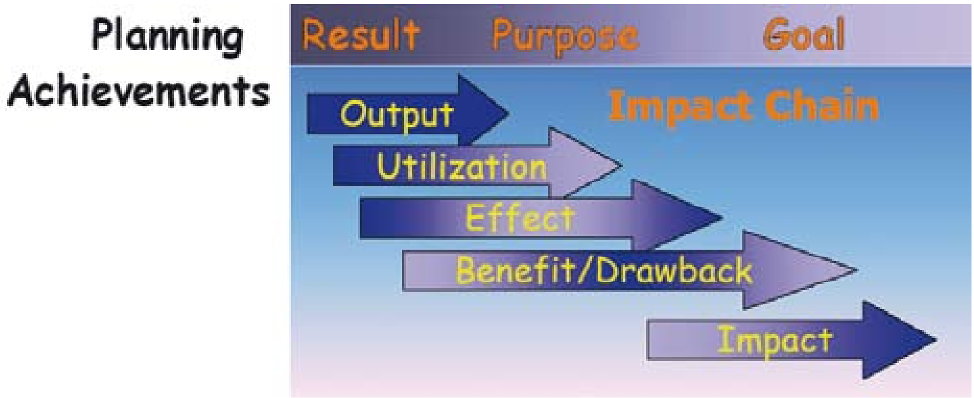

Figure 9. Diagrammatic representation of an impact chain.

Participatory Monitoring and Evaluation (Dr Jemimah Njuki, CIAT)

The project needs to develop monitoring and evaluation (M&E) protocols and determine what the protocols must capture. M&E is not about coming back at the end and determining what happened. M&E has to be occurring throughout the project.

PM&E is a culture. There should be no action without plans, no activities without records, no records without analysis, no analysis without sharing, no sharing without learning, and no learning without action. PM&E has to involve all the stakeholders.

PM&E has many goals/purposes:

- accountability
- tracking progress
- generating knowledge
- improved decision making
- learning

Some key questions to ask when developing M&E protocols are:

- What do we want to monitor and evaluate?
- Why? For what purposes?
- What methods?
- Who will do it; who will be involved?
- What is the process, system, arrangements of monitoring?
- How will we use the results?

We assume that positive projects have positive impacts. But this might not always be the case. PM&E can occur at different levels. It can occur at the activity level where the successful implementation of each of the project activities is evaluated. There is process monitoring, which looks at the processes that occur during the implementation process such as stakeholder participation and farmer involvement. It can occur at the output level where technology outputs such as new varieties or process outputs such as increased capacity are evaluated. PM&E can also take place at the outcome level and evaluate technology outcomes such as technology adoption/adaptation as well as process outcomes such as institutional change and changes in behavior. PM&E can also include impact assessments.

The project has to develop indicators for M&E. There are different types of indicators such as scientific and local, qualitative, quantitative and these have to be gender sensitive.

The budget for M&E should be no less than 10% of the total. However, it is important to remember that PM&E is part and parcel of the activities. We've always seen PM&E as separate to the rest of the project activities. This has to stop.

It is important to use PM&E for reflection, change and institutional learning. How do you reflect on the information from PM&E? The International Center for Tropical Agriculture (CIAT) uses an indicator-based participatory system. This is what we wanted, this is what happened, why did it happen, do we need to change it, etc.… Have you met your target, have the processes to your satisfaction, how happy are the farmers and what do they feel? This is usually a facilitated process. It is difficult to do it otherwise.

We need to ask ourselves what are the results we expect from this project. Once we identify those results we need to determine what the indicators are that we are going to use to assess whether or not we are achieving those results. If you are not clear what the results are then you are not going to be clear what you are trying to monitor. The first step is to define the results, then go back and think of activities for each objective.

We need to critically look at the objectives and the activities that are in the project proposal. We should define what the expected results are going to be and develop at least two indicators that will determine whether or not each result will be achieved. The target must also be time-bound. The milestones for each activity are vague; so for each activity it is important to develop a milestone with figures and numbers as well as assign responsibility to someone for each.

Group activity: Assessing the objectives

The participants were split into five groups based on the five objectives and were requested to fill out Tables 2 and 3 for each objective.

Table 2. Expected results and indicators

Objective	Expected results	Indicators	Target	Information to be collected
		Indicator 1		
		Indicator 2		
		Indicator 3		

Table 3. Activities, milestones and data collection requirements

Activities	Milestones	By when?	Who?	What information do we need to collect?

The results of this exercise are presented below.

Table 4. Objective 1: Expected results and indicators.

Objective	Expected results	Indicators	Target	Information to be collected
Establish smallholder farmers' perceptions on risks associated with climate change in the project areas	Case studies of existing knowledge	Review report	Review report produced by Aug 2007	Case studies on how communities have been affected by climatic change/ extreme and their adaptation strategies
	Baseline information on what farmers know about climatic change and risks associated with it	Baseline report	Baseline report produced by Oct 2007	Farmer knowledge on risks associated with climate change Vulnerability context
	Historical met data profiled for the project areas	Climatic data profiles	Climatic data profiles produced by Nov 2007	Rainfall, temperature, radiation, wind speed, humidity data
	Historical profiling of drought years and impact on crop yields and livestock performance	Baseline report	Baseline report produced by Oct 2007	Yields trends and livestock population trends from CSO Available opportunities and challenges

Table 5. Objective 1: Activities, milestones and data collection requirements.

	Activity	Milestones	By when	By who	Information to collect
1.1	Start-up workshop	Workplan developed/ workshop report	June 2007	Mugabe, Twomlow, Nanja	Who to do what and when in the project

Continued.

Table 5. *Continued.*

	Activity	Milestones	By when	By who	Information to collect
1.2	Develop survey instruments	Survey tools developed and tested	July 2007	Munodawafa, Mugabe, Nanja, Met, Masendeke, Shirichena, Mwale, Phiri, Hungwe	
1.3	Review case studies of existing knowledge and perceptions	Report on case study of existing knowledge	Aug 2007	Munodawafa, F.T. Mugabe, Nanja, Twomlow	
1.4	Parcipatory baseline surveys	Baseline report	Oct 2007	Munodawafa, Mugabe, Nanja, Met, Masendeke, Shirichena, Mwale, Phiri, Hungwe	
1.5	Correlate historical climate data to those years farmers claim were dry years	Report	Nov 2007	MSU, ZMO, AREX, ZARI, ICRISAT, CIAT	
1.6	Data analysis and documentation	Data analysis for paper completed	Dec 2007	Munodawafa, Hungwe	
1.7	Feedback workshops	Workshop report	Nov/Dec 2007	Munodawafa	
1.8	Develop a paper on farmers' perceptions of drought in the four districts of Zimbabwe and Zambia	Draft paper Paper submitted	Jan 2008 March 2008	MSU, ZMO, AREX, ZARI, ICRISAT, CIAT	None

Table 6. Objective 2: Expected results and indicators.				
Objective	**Expected result**	**Indicators**	**Target**	**Information to be collected**
Determine how rural communities have coped with existing climate variability and extremes and develop appropriate strategies for adapting to future climatic change	Synthesis and documentation of key practices farmers have adapted to cope with climate change	Number of documents compiled Type of practices identified Number of farmers practicing the different coping mechanisms	One report compiled by end of year 1	Type of existing coping mechanisms Desegregation of farmers based on gender and type of mechanisms adapted Socioeconomic information on the contribution of these coping mechanisms to community resilience in relation to food security and climate change
	Identify promising coping mechanisms to recommend for scaling out	Publishing of simple-to-read policy briefs on respective coping mechanisms	Five policy papers/ briefs	Geographical prevalence and potential of coping mechanisms General weather/climate information
	Active involvement and support of policymakers (traditional leadership, government leaders, NGOs, donor community) in implementing appropriate coping mechanisms for climate change	Increased participation of policymakers in programs pertaining to climate change		Number of meetings/ visits in which policymakers participate Type of organizations actively involved in climate change mitigation programs

Table 7. Objective 2: Activities, milestones and data collection requirements.				
Activity	**Milestones**	**By when?**	**Who?**	**What information do we need to collect**
Activity 2.1 Identify attitudes to risk and vulnerability and farmers' perceptions of climate change and coping strategies to meet their livelihood goals using participatory diagnosis and visioning tools				
2.1.1 Undertake a baseline survey to carry out an inventory of coping mechanisms in the project sites	Baseline survey starts by September 2007 Data analysis and report writing completed by December 2007	By December 2007	Agric dept, Zambia ZARI AREX Met Dept MSU Farmers CIAT	Type of existing coping mechanisms and farmer practices Desegregation of farmers based on gender and type of mechanisms adapted Socioeconomic information on the contribution of these coping mechanisms to community resilience in relation to food security and climate change
2.1.2 Identifying and training of support staff to assist in data collection	Training of support staff conducted by end of August 2007	August 2007	AREX ZARI Agric. Dept UNZA MSU CIAT	Number of support staff to target for the training Resources to be used for the training
2.1.3 Presentation of baseline information on coping mechanisms	National stakeholders' workshop held by December 2007 to present preliminary survey findings	December 2007	AREX ZARI Agric. Dept UNZA MSU CIAT	Draft survey report Inventory of key partners
2.1.4 Publication of final baseline report	Final report produced by end of January 2008	January 2008	AREX ZARI Agric. Dept UNZA MSU CIAT	Draft survey report

Continued.

Table 7. *Continued.*

Activity	Milestones	By when?	Who?	What information do we need to collect
Activity 2.2: Identify, characterize, and disaggregate indigenous and innovative adaptations to climate change by gender, social capital and resource endowment				
2.2.1 Conduct focus group discussions to develop criteria for wealth ranking	Criteria for wealth ranking developed	February 2008	CIAT MSU	What are the criteria for measuring wealth?
2.2.2 Develop an index for social capital using questions/variables from baseline data	Social capital index and paper developed	May 2008	CIAT MSU	Indicators of social capital Information for all indicators from households during baseline survey
2.2.3 Analyze data categorizing coping strategies by gender, wealth and social capital index	Data analysis for papers completed	April 2008		Coping and adaptation strategies Gender of head of household Social capital indicators
2.2.4 Develop two papers on the role of resource endowment, gender and social capital in influencing farmer coping and adaptation to climate change	Two draft papers completed Papers submitted to journal	June 2008 September 2008		None

Continued.

Table 7. *Continued.*

Activity	Milestones	By when?	Who?	What information do we need to collect
Activity 2.3: Quantify the biophysical, resource and economic thresholds that affect farmers' adaptive capacity to climate change though focus group discussions, interviews and participatory diagnosis tools, such as, participatory budgeting				
2.3.1 Identify PhD student				
2.3.2 Develop PhD proposal and data collection tools		September 2008	PHD student/ Free state/ CIAT	
2.3.3 Develop tools and collect data on resource and economic thresholds affecting farmers adaptive capacity	Data collection and analysis completed	June 2009	PHD student CIAT	Farmer resource endowment Natural, financial capital of different households Measures of adaptive capacity
2.3.4 Draft and final thesis	Draft thesis Final thesis	December 2009 June 2010	PhD student CIAT	
2.3.6 Draft papers for publication	Paper on economic and resource thresholds that affect farmers adaptive capacity to climate change	December 2009	PhD student CIAT	Economic and resource thresholds of different farmers vs. their adaptive capacity to climate change

Table 8. Objective 3: Expected results and indicators.

	Expected output	Indicators	Target	Information to collect
Build capacity and competency within Zambian and Zimbabwean institutions to use simulation and climatic forecasting tools for predicting climatic variability	Undergraduate students training	Number of students	30 (MSU), 40 (UNZA)	Attendance list
	Extension staff training	Number of participants	15 (ZIM), 15 (ZAM)	Attendance list
	APSIM training	Number of participants	15 (ZIM), 15 (ZAM)	Attendance list
	IDRC/CCAA training	Number of participants	6 (ZIM), 6 (ZAM)	Attendance list
	Post-graduate training	Number of participants	6 (ZIM), 3 (ZAM)	Attendance list
	Undergraduate attachment	Number of participants	6 (ZIM), 15 (ZAM)	Attendance list

Table 9. Objective 3. Activities, milestones and data collection requirements.					
	Activity	**Milestones**	**By when**	**By who**	**Information to collect**
3.1	Develop and conduct training courses and lectures Conduct needs assessment for public sector, private sector and undergraduate students Develop and conduct training courses for extension staff Develop and conduct courses for undergraduate students on agronomic modeling and climatic change and adaptation	Reports on: Course outline Course materials Module being taught	 30 July 2007 31 Aug 2007 29 Feb 2008	Mugabe/ Phiri	Level of education Computer literature and skills IPCC documents and other sources
3.2	Explore and strengthen synergies between public and private sector institutions Invitation of public and private participants to a climate change modeling course	5 public and 5 private sector participants At least 50 participants attend course	August 2007 January 31, 2008	ICRISAT	APSIM materials
3.3	Provide support to MSU and UNZA in the use of simulation models Organized training conducted by ICRISAT	Reports Number of participants	Every 12 months starting September 2007	ICRISAT	Identification of participants Nominations for the course

Continued.

Table 9. *Continued.*

	Activity	Milestones	By when	By who	Information to collect
3.4	Train lecturers from MSU and UNZA on aspects of the project during inception phases Train project team members	Reports Attendance at IDRC/ CCAA workshops	Dec 2007	Mugabe/ Mwale	Identification of participants Nominations for the course
3.5	Train postgraduate students (3 PhD & 4 MSc/MPhil under MSU and 3 PhD under ZARI/DMS/ UNZA Post graduate training Identify PhD students Develop PhD proposal and data collection tools	Progress reports Identification of candidates Registration PhD proposal Annual reports, peer reviewed articles	June 07 July 07 Dec 07	MSU/ UOVS/ ZARI/ DMS/ Students	Identification of participants Nominations for training Draft copies Receipts

Table 10. Objective 4: Expected results and indicators.

Objective	Expected results	Indicators	Target	Information to be collected
Use farmer participatory research approaches linked with simulation and climate forecasting methods to develop and evaluate scenarios with farmers that enable adaptation to climate variability and change within the agricultural systems	Adaptation strategies/ measures to reduce farmers' vulnerability to climate change and variability	Knowledgeable and understanding farmer (on adjusting cropping activities according to climate forecasts)	Farmer	Farmers' initial expectations versus final perceptions
		Localized climate and crop forecasts	Farmer, scientist, extension officers	Historical climatic and crop records; expected changes in climatic variables.
		Stabilized agricultural yields	Farmer	Agricultural yields
		Appropriate extension messages formulated and disseminated to the smallholder farmer	Farmer, scientist, extension officers	Initial farmer expectations versus final perceptions
		Training programs (farmers, extension staff, researchers/ scientists)	Farmer, scientist, extension officers	Numbers trained

Table 11. Objective 4: Activities, milestones and data collection requirements.

Activity	Milestones	By when?	Who?	What information do we need to collect?
Baseline survey (Agronomic survey to identify: options for the crop simulation models; adaptation strategies to climatic change and variability)	Research questions developed and tested Survey conducted	Aug 2007 Oct 2007	Njuki/PhD student	Current agronomic practices and systems, constraints to agricultural production Perceptions on climate change and variability Current coping strategies to climate change and variability
Training smallholder farmers on the concept of climatic forecasts and their usefulness in making decisions for cropping and livestock activities	Production of training course materials Hold training workshops with farmers Pre and post season workshops (present current forecast and review previous season)	Aug 2007 Oct 2007 Oct 2008 & 2009.	Murewi to lead Durton	Number of farmer groups and group sizes from each project site. Literacy levels and languages of the target group. Current seasonal forecasts. Feedback from farmers on previous season outcome (rainfall patterns, crop performance)
Collection and analysis of historical climatic, crop yields, soil types, location specific (geographical coordinates,	Climate record for project sites Crop yields record for project sites Geographical coordinates, altitudes, topography	Aug 2007 Aug 2007 Aug 2007	Makuvaro to lead Gondwe	Rainfall, maximum temperature, minimum temperature, solar radiation; evaporation, wind speed and direction, and humidity

Continued.

Table 11. *Continued.*

Activity	Milestones	By when?	Who?	What information do we need to collect?
altitudes, topography) data for project sites	Establish relationships/ trends among variables (climate, yields)	Dec 2007		Crop yields for three major crops for each site Geographical coordinates, altitudes, topography
Generating climate forecasts and climate change scenarios (downscaling) for project sites	Climate forecasts from GCMs and RCMs Climate scenarios from GCMs and RCMs Localised climate change scenarios Localised climate variability scenarios (seasonal forecasts) Attend regional and national seasonal outlook	Sept 2007 Sept 2007 Nov 2007 Sept 2008 Sept and Oct 2007, 2008, 2009	Murewi to lead Durton	Climate outputs from GCMs and RCMs; regional and national seasonal forecasts
Participatory crop simulation modelling	Simulated crop yields under current agronomic practices/ systems and current climate Simulated crop yields under current agronomic practices/ systems and climate change scenarios	Oct 2007 Oct 2007 Oct 2007 April 2008	Dimes to lead	Climate change scenarios. Identified coping strategies Current agronomic practises/systems Farmers' views on adoption of adaptive strategies

Continued.

Table 11. *Continued.*

Activity	Milestones	By when?	Who?	What information do we need to collect?
	Simulated crop yields under identified agronomic adaptive strategies and climate change scenarios Likelihood of adoption tested (farmers' perspectives) Economic analysis carried out	April 2008		Agronomic input costs; Crop commodity prices
Participatory establishment and evaluation of on-farm trials	Field experiments established in the project areas Field experiments evaluated	Oct 2008 & Oct 2009 May 2009 & Apr 2010	Twomlow to lead	Input requirements (seed, fertilizers, pesticides) Crop yields Farmers' views on crop performance and nature of cropping season
Policy workshops in each country	Outreach program for administrative personnel from agriculture, meteorology at national and provincial levels; political leadership developed	Mar 2010	Mugabe to lead	Project results

Table 12. Objective 5: Expected results and indicators.				
Objective	**Expected results**	**Indicators**	**Target**	**Information to be collected**
Develop, test and disseminate climate risk communication materials and appropriate delivery mechanisms	Quality and accessible climatic data and analyzed for use in climate change and variability	Quality controlled data Analysis of climatic variability and change completed	Farmers	
	Effective climate dissemination services of critical information for users		Scientists, extensionist and farmers	
	A globally recognized conference on adaptation to climatic change	A global conference	Scientists	

Table 13. Objective 5. Activities, milestones and data collection requirements.				
Activity	**Milestones**	**By when?**	**By who?**	**What information do we need to collect?**
Establishment of a community of practice with climate change consortium for Africa	Agreement on common downscaling methods across projects	September 2007	Mugabe to lead	Needs of existing projects What are the viable downscaling methods Assessment against data availability
Review of existing dissemination strategies and materials	Complete the review and pass it to other project components Publish a review	End of September 2007 February 2008	Nanja Zhakata	Dissemination strategies and materials

Continued.

Table 13. *Continued.*

Activity	Milestones	By when?	By who?	What information do we need to collect?
Develop and test an existing strategy and adaptation measures	Develop and test a draft extension and dissemination approach Develop a final extension and dissemination approach	End of October 2007 Assess it at the end of May 2008 and reviewed each season after that Final strategy delivered end 2010	Mugabe to lead	Staff levels matching information dissemination with available resources Review of methods used in other parts of the world and an assessment of the feasibility for Zimbabwe and Zambia
Develop and disseminate information packages on climate change	Document the information	End of 2010	Swathi and Mugabe	Compiled information from other projects and processing it to make it suitable for continental level decision makers and for rural community in Zambia and Zimbabwe
Continental conference	Additional funding US$100,000	April 2009	Mugabe	Contribution of other IDRC projects to the conference Contact detail for potential funders
Climate data collection and analyses	Quality control data for each site Analysis undertaken for climate variation in relation to seasonal or other climate predictors and for climate trends	April 2008	Durton Zhakata	Long-term quality climate data Climate predictors

IV. Workshop Closing

Mr Durton Nanja closed the workshop and thanked the participants for their presence and comments. He said that the workshop has left the participants with a clear understanding of the objectives and the enthusiasm to move forward and carry out the activities.

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About ICRISAT

ICRISAT
Science with a human face

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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