Agro-biodiversity and food security: Scaling Up Innovations for Building People's Capacities to Respond to Climate Change:

Conceptual and Methodological Development for a Baseline Survey

Technical Report

Oxfam Novib

PARTNERS

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CONTENTS

List of Pictures

List of Tables

List of Figures

ABBREVIATIONS

Agritex	Agricultural Technical and Extension Services in the Ministry of Agriculture, Mechanization and Irrigation Development
ANDES	Asociación para la Naturaleza y el Desarrollo Sostenible
CTDT	Community Technology Development Trust
FFS	Farmer Field School
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change (IPCC)
IPSHF	Indigenous Peoples and Smallholder Farmers
ITPGRFA	International Treaty of Plant Genetic Resources for Food and Agriculture
ONL	Oxfam Novib
OPV	Open Pollinated Variety
PGR	Plant Genetic Resources
PRA	Participatory Rural Appraisal
PVS	Participatory Varietal Selection
SEARICE	South East Asia Regional Initiatives for Community Empowerment
Sida	Swedish International Development Cooperation Agency
UMP	Uzumba Maramba Pfungwe
ZFU	Zimbabwe Farmers' Union
ZMSD	Zimbabwe's Agro-Meteorology Group within the department of Physics, Chinhoyi University of Technology

1. INTRODUCTION

In 2007, reports by the Intergovernmental Panel on Climate Change (IPCC) concluded that observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes[1], particularly temperature increases. The 2007 IPCC synthesis report cited that the impacts on regions, particularly vulnerable regions such as Africa, Asia and Latin America, were adverse. By 2020, yields from rain-fed agriculture in some countries in Africa could be reduced by up to 50%. In Latin America, a projected decrease in the productivity of some important crops, along with a decline in livestock productivity, will have adverse consequences for food security. Furthermore, changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation. In Asia, including Southeast Asia, freshwater availability is projected to decrease by 2050, particularly in large river basins[2]. Climate variability and extreme climatic events will increase globally, leading to greater risks to agricultural production. Therefore, greater access to (and improved use of) genetic diversity is foreseen as one of key adaptation strategies.

Climate change impacts most on indigenous peoples and smallholder farmers (IPSHF). As major players in the collective global responses to food security and nutrition (in the context of climate change), their knowledge of agro-ecosystems, and seed management and resilience are critical to identifying challenges and building appropriate responses at both local and global levels. Despite increasing acknowledgement of the roles played by IPSHF and the knowledge[3] of and studies on farmers' adaptation strategies[4], IPSHF participation in programme and policy interventions related to climate change and food security, remains limited to the margins of mainstream agricultural programmes.

[1] Climate change in IPCC refers to a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity (IPCC, 2007).
[2] Synthesis Report, IPCC, 2007.
[3] In the Convention on Biological Diversity, ITPGRFA, IPCC.
[4] See for Instance: Till Below, T (2010) et al "Micro-level Practices to Adapt to Climate Change for African Small-scale Farmers. A Review of Selected Literature". IFPRI Discussion Paper 00953.
http://www.ifpri.org/sites/default/files/publications/ifpridp00953.pdf

The literature review conducted by the Oxfam Novib and partners[5] suggests there is limited IPSHF adoption of the technical options provided by agricultural research in adaptation to climate change. There have been few studies on how farmers perceive climate change[6]; most tend to focus on why farmers' perceptions do not fit climatology data, rather than on how to understand farmers' traditional knowledge systems for weather forecasting, and how to adapt weather forecasting to allow farmers to design suitable adaptation strategies.

The baseline survey was conducted to help address these concerns. This technical report is for the project: "Agro-biodiversity and food security: Scaling Up Innovations for Building People's Capacities to Respond to Climate Change: Conceptual and Methodological Development for Baseline Survey" (hereafter: baseline survey). This baseline survey was funded through Bioversity International, as part of a project supported by the European Commission (EC) and the International Fund for Agricultural Development (IFAD): "Support for Bioversity International 2011, Project F01: Enhancing the contribution of agricultural biodiversity to human wellbeing, and Project F02: Productivity resilience and ecosystem services from community management of diversity in production". The baseline survey contributes specifically to the Projects F01 and F02 overall framework and methodological development. The implementation of the baseline survey took place between 1 December 2011 and 30 November 2012, and was extended to 2013.

In addition, the Baseline survey aimed **to establish the conceptual and methodological development of a three year IFAD-Oxfam Novib funded project: "**Putting Lessons Into Practice: Scaling up People's Biodiversity Management for Food Security" (hereafter: IFAD-ONL Scaling-up programme)**.** More specifically, the findings of the baseline survey serve as a major input to inform the project's planning, monitoring and evaluation framework of the succeeding three year IFAD-Oxfam Novib project. These findings also serve as input to the project's IPSHF, to plan and track programme progress and results. Results of the survey were verified at a number of specific communities and will be further analysed throughout the course of the IFAD-ONL project.

The baseline survey was developed jointly Oxfam Novib and partners: *Asociación para la Naturaleza y el Desarrollo Sostenible* (ANDES) in Peru, the Southeast Asian Regional Initiative for Community Empowerment (SEARICE) in Vietnam, and the Community Technology Development Trust (CTDT) in Zimbabwe.

This EC-IFAD funded baseline survey had the following objectives:

1. To **develop and adapt tools** for baseline development;
2. To apply tools to **develop a baseline** containing information on:
    - 2.1. Community and household socio-economic situation;
    - 2.2. Status of agricultural biodiversity in relation to people's food security within the specific ecosystems of the project sites;
    - 2.3. Socio-economic and cultural changes that have taken, or are taking, place at household and community levels related to adaptation of agricultural production to climate change;

[5] Oxfam Novib, ANDES, CTDT, SEARICE, CGN-WUR.2013. Building on farmers' perceptions and traditional knowledge: Biodiversity management for climate change adaptation strategies. Briefing paper. The Hague: Oxfam Novib.

[6] For instance: Moyo et al 2012. Farmer Perceptions on Climate Change and Variability in Semi-Arid Zimbabwe in Relation to Climatology Evidence. African Crop Science Journal Vol. 20.

2.4. Roles of women farmers in agro-biodiversity management under changing climatic conditions;
2.5. Indigenous people and farming communities' understanding and perspectives of, and strategies (crop diversity, conservation, and management) to respond to, the effects of climate change.

The **following activities** took place:

A. Inception period and awareness raising within communities in three countries

A.1. A **Global inception meeting**[7] was organized within the framework of the first year work plan and focused on the development of the baseline phase. The meeting was held in Rome, Italy, from 20-25 February 2012, and attended by two representatives from each of the three country partners. The **objectives of the inception meeting** were:

A.1.1 To generate a common framework for the survey design that would allow cross-country comparison of local people's perceptions of how climate change is affecting their livelihoods and farming systems and the available climatological data;

A1.2. To design a flexible survey tool which could be tailored to the diverse socio-economic and agro-ecologies of the project sites in three countries;

A.1.3. To define a common data management system (collection, integration and analysis, including gender disaggregated data);

A.1.4. To illustrate process implementation, identify sample population, work schedules and monitoring at country and global levels (from awareness raising at community levels, baseline survey, global integration of concept, methods and findings and peer reviews);

A.1.5. To define partners and allies (e.g. universities);

A.1.6. To list methods that will be used and/or adapted and tested.

Immediately after this inception meeting, the first peer review of the programme was held. The collegial reviews of the process (sample size of the survey, statistical analysis, type of data to be collected) and the outcomes (scale of the programme's reach, how adaptation strategies would be developed in each case, impact indicators of the program) were provided by Bert Visser (scientific adviser of the IFAD-ONL project Centre for Genetic Resources/Wageningen University and Research), Stefano Padulosi (Bioversity International) and Alvaro Toledo (Secretariat, International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA).

Main **outputs** of the global inception meeting:

- **Methodological tools:** a mix of methodological approaches was agreed upon, using both a survey for quantitative data collection and participatory rural appraisal (PRA) tools for qualitative data collection. A wealth of PRA tools was presented by the country partners, including those integrated in the farmer field school (FFS). Furthermore, a methodology for building consensus and finding correlations between traditional knowledge and scientific climate data was also discussed. More importantly, it was agreed that **the baseline tool** and its findings served as a **major**

[7] Please refer to Project Inception Meeting Report (Oxfam Novib, ANDES, CTDT, SEARICE, 2012)

input to inform the IFAD-ONL Scaling-up programme's planning, monitoring and evaluation framework. The findings also served as input to enable the programme IPSHF **to plan and track programme progress and results**.

- **A collective/common research framework**: this framework facilitated the data collection of the survey and was translated into the questionnaire. It contained the following topics: demographic, biophysical, climatic, adaptation strategies, farming systems, agricultural biodiversity, economic, institutions and policies, gender relations. These main topics were detailed into specific data set to be collected during the baseline implementation. A list of common frameworks was produced, indicating which data are based on traditional knowledge and which on science (or both), the level at which the data are required (household, village, national and global), and the method for data collection.
- **Questionnaire outline**: the survey outline consisted of: i) general demographic information; ii) agro-biodiversity and indigenous knowledge (diversity of crops, knowledge used, gender roles in agro-biodiversity management); iii) climate and indigenous knowledge (main changes and impact, adaptation strategies); iv) institutional policies (awareness of policies and customary laws); v) seed security (access, varieties, sources, price), and vi) food security (stability, procurement, production). Based on the collective outlines, each country partner generated the country specific questionnaire, tailored to the needs and diverse socio-economic and agro-ecologies context of the programme's sites in each country. Oxfam Novib then facilitated the exchange of questionnaires amongst the partners, allowing peer review and improvement to the country's questionnaire.

A.2. **Awareness raising within communities in the three countries**: following the global inception meeting, a series of inception and awareness raising meetings was carried out in Peru, Vietnam and Zimbabwe. This allowed feedback and participatory inputs to the first year work plan and the survey plans.

B. Baseline survey

The country survey was commissioned in May to June 2012 in Zimbabwe, in September to October 2012 in Vietnam and in January to February 2013 in Peru, and in. A pre-test was conducted to allow refinement of the survey questions; training of the survey team was also carried out in each country. The baseline survey was **administered to a total of 847 households**, approximately **10% sample population** of a total of 2,062 households in Peru; 6,750 households in Vietnam and 3,800 households in Zimbabwe The sample population will be expanded through the course of the IFAD Scaling-up program in Vietnam, thus allowing a total of 1,322 sample households in 2015.

In ***Peru***, the project area consists of **23 indigenous communities** (2,062 Quechua families) of the three zones (**Lower, Middle** and **Upper**) located in the district of Lares, Calca Province in the region of Cusco, (See Annex 1, Map 1). In ***Vietnam***, the project area comprises of 4 villages from 4 communes in 4 provinces in the upland area to the Northwest and Northeast of Hanoi, as well as in the North Central region of Vietnam (**Hoa Binh, Son La, Yen Bai** and **Thanh Hoa** provinces) (See Annex 1, Maps 2 to 5). ***In Zimbabwe***, the baseline was undertaken in the following districts: **Chiredzi** district in Masvingo Province (25 villages) (See Annex 1, Map 6), **Goromonzi** (13 villages) and **Uzumba Maramba Pfungwe** (UMP) (7 villages) districts, Mashonaland East Province (See Annex 1, Map 7), and **Tsholotsho** district (13 villages) in Matabeleland North Province (See Annex 1, Map 8). **Results of the survey were verified at a**

number of specific communities in each country and will be further analysed throughout the course of the program.

The three country surveys were **consolidated at global level,** applying the research collective/common framework as the guideline, integrating the research methodologies and performing global analysis as well as proposing global conclusions and recommendations ensuring an iterative process of consultation and feedback from the partners.

Main **outputs**: three country baseline reports and one consolidated baseline report.

C. Global integration of concepts, methods and findings

As described in section B, Oxfam Novib's responsibility was to: i) facilitate the design of the research collective/common framework; ii) review and improve the baseline tools, iii) consolidate the research methodologies and survey findings, including the global data analysis, and propose global conclusions and recommendations; iv) synthesize a policy briefing note based on the outcomes of the surveys. The policy briefing note was launched during the fifth Governing Body meeting of the ITPGRFA in October 2013 in Oman.

Main **output**: briefing note "Building on Farmers' Perception and Traditional Knowledge: Biodiversity Management for Climate Change Adaptation Strategies" (see Annex 3).

D. Peer Review

Two peer reviews were solicited from, amongst others, IFAD, Bioversity International, the ITPGRFA and Wageningen University. The first one took place in Rome during the global inception meeting of the first year work plan (see A.1. above), and during the preparation of the briefing note circulated during the fifth Governing Body meeting of the ITPGRFA.

Main **output**: Project Inception Report, Rome, 2012 (see Annex 1).

2. Materials and Methods

2.1. Survey Methodology

For activity B above, the baseline survey in the three countries used **four sources of information for cross-referencing**: i) farmer interviews, using semi-structured household questionnaires; ii) focus group discussions; iii) participatory rural appraisal, such as crop and gender calendars[8], resource mapping, soil mapping and diversity mapping, and iv) statistical data from meteorological centres. Stratified random sampling was used in Vietnam and Zimbabwe. Whilst in Peru, stratified sampling[9] was done. The reference year varied between countries. When recording perceptions of climate variability over time, the questionnaire refers to farmers' recollection of weather patterns dating back 40 years in Peru, 10-20 years in Vietnam and 10 years in Zimbabwe.

Climatology data

To compare farmers' perceptions of climate change and weather variability with long-term meteorological records, data were collected and analysed from the National Service of Meteorology and Hydrology (SENAMHI) of Peru; the Statistics of Meteorological Centre of Hoa

[8] Gender division of labour on farming and house chores.
[9] The population density between the zones in Peru varies greatly; stratified sampling was used to ensure that equal population of each zone is represented.

Binh, Son La, Yen Bai and Thanh Hoa of Vietnam, and the Zimbabwe Meteorological Services Department. However, the data from the survey have not yet been extensively compared with these meteorological records. This will be further done during the succeeding IFAD-ONL Scaling-up programme. The meteorological data analysed are for the period 1992-2012 in Peru, 2002-2010 in Vietnam, and 1960-2008 in Zimbabwe.

2.2. Target areas

The following table details the survey information of the three countries.

Table 1: Survey information in Peru, Vietnam and Zimbabwe

Survey information	Peru	Vietnam	Zimbabwe
Project households[10] (target group)	2,062 households	6,750 households (546 households in year 1)	3,800 households
Number of Sample Population	**265** (10%)	**200**[11] (3% of total target group) 675 (10%) (by Year 3)	**382** (10 %)
Number of women of the Survey Sample	122 (46%)	125 (62.5%)	241 (63%)
Population estimate and target areas	**7,138** inhabitants (54% men and 46% women) representing **23** indigenous communities and **2,062** Quechua families of the three zones (**Lower, Middle** and **Upper**) located in the district of Lares, Calca Province in the region of Cusco, Peru. These communities represent some of the poorest populations in Peru, where 97% are in poverty and of which 89% are in extreme poverty[12]	**2,340** inhabitants (average 47% men and 53% women) representing **546** farm households in 4 villages from 4 communes in 4 provinces in the upland area to the Northwest and Northeast of Hanoi, as well as in the North Central region of Vietnam (**Hoa Binh, Son La, Yen Bai** and **Thanh Hoa** provinces)	**502,000** inhabitants representing **171, 213** farming households[13] of **Chiredzi** district in Masvingo Province (25 villages), **Goromonzi** (13 villages) and **Uzumba Maramba Pfungwe** (UMP) (7 villages) districts, Mashonaland East Province, and **Tsholotsho** district (13 villages) in Matabeleland North Province
Ethnic groups	Quechua	Hoa Binh Province is composed mostly of Muong origin, while Son La Province is predominantly ethnic Thai	The country does not use ethnic groupings but the main tribes are the Shona and Ndebeles

Source: Baseline reports. ANDES, CTDT, SEARICE (2012).

[10] The average household size in the study area in Peru is 6 people (5 members involved in agricultural activities). In Vietnam, the average household size is 4.4 (ranging from 4 to 4.6), and in Zimbabwe it is 6 people, with 4 adults involved in agricultural activities.
[11] Fifty households in each selected village.
[12] INEI, 2009
[13] Zimbabwe Statistical Agency; ZIMSTAT, 2012

2.3. PRA Tools

As part of the survey methodologies adopted during the survey, the following PRA tools were used with the communities in the three countries:

1. **Crop and gender calendars:** The ***crop calendar*** captures a typical year-long agricultural cycle, including farming activities; technologies applied; the crops planted at corresponding times; off-farm livelihood activities; weather conditions (onset of rainy season/dry season, etc.); occurrences of pests and diseases during a season; and cultural practices associated with the agricultural cycle. For the purpose of this survey, farmers' present perception of the annual agricultural cycle is compared to their perceptions of 10-20 years ago. The ***gender calendar*** captures men's and women's activities in a day, during both the cropping and non-cropping seasons, to see the role and position of women in the family and farming practices, in order to improve their positions and to develop more sustainable livelihoods for the rural poor. The ***gender clock*** reflects differences in the roles/tasks of men and women in a day and within a cropping cycle (seasonal calendar). The crop calendar, gender calendar and gender clock have been adopted in the survey in Vietnam.
2. **Participatory community mapping (resource, soil, and diversity mapping):** The ***resource map*** is a representation of the aerial perspective of an area developed by the community, which could show: (i) geopolitical boundaries of an area; (ii) spatial distribution of natural resources, vegetation/ecosystems; (iii) spatial distribution of human settlement; (iv) spatial distribution of human-made resources, and (v) spatial distribution of farms and other land use systems. The same map can be used to identify areas that are at risk or suffer from the effects of hazards brought about by climate change. These risks or effects could be validated on the ground through site visits and video documentation. An overlay of maps showing crops/farming areas and impact areas of climate change geo-hazards could show the extent of the impact of climate change on agricultural production. A ***soil map*** is an aerial perspective depicting the distribution of farms and the type and quality of soil on these farms. Soil maps can be useful in analysing and planning suitable crop varieties in an area. A ***diversity map (wheel)*** may depict the spatial/farm level distribution of: (i) crops and varieties planted and characteristics of varieties; (ii) pests and diseases, and (iii) other geo-hazards affecting agriculture (see Annex 1, Box 1). On a timeline, the map could show changes in crops and diversity of crop varieties planted, which can be used to capture factors that lead to change in crops/varieties of crops.

3. Results and Discussion

The results of the survey findings are summarized below

3.1. Community and household socio-economic situation

The farming systems in the survey areas in Peru, Vietnam and Zimbabwe are predominantly subsistence and semi-subsistence oriented. In most cases they are geared towards household consumption. In addition, in Peru and Vietnam, agriculture is identified as the main economic activity in which the majority of household members participate, however not the activity providing the highest income. In Peru, work in urban areas, tourism, livestock farming, and crafts generate higher income to families than farming income. In the Low Zone, crop production contributes to the highest income, in contrast to the Middle and Upper Zones where a greater percentage of agricultural production is used for consumption. In Vietnam, crop sales ranked third, after livestock production and off-farm activities, as the main income generating activities. In Zimbabwe, crop production and sales are considered the most important activities, followed by market gardening and informal employment. In Peru and Zimbabwe, almost 98% of farmers practice subsistence farming systems, contributing to household consumption; An insignificant number in UMP and Goromonzi districts practise commercial farming.

In Peru, farmers practise rain-fed agriculture; crop performance and yields are heavily dependent on the weather, and farmers use limited technology for managing crops. The survey reported that 50% of the farmers use more than 80% of their farm produce for domestic consumption and 20% for sales. Potatoes, corn, beans, olluco and oca are the most important Andean or native crops for the Middle and Upper zones, which are grown primarily for household consumption. Each of these products has its ecological zones that influence the types of crops grown in each altitude, and these crops are grown in arable land of 0.8 ha per household. The Low Zone represents greater diversity of crops and agriculture and is more for commercial purposes than household consumption. In the Low zone, 100% of farmers grow maize, 98% grow potatoes, and 94% grow beans, avocado, and coffee. In contrast, farmers in the Middle and Upper Zones primarily produce potatoes mainly for home consumption, while designating a portion of their production for sale.

In Vietnam, rice cultivation plays an important role in food security, income generation, rural employment and export earnings. The survey confirmed that rice is the main food crop in the four districts. The average area planted with rice crops ranges from 0.1 ha in Son La, to 0.3 ha in Hoa Binh. Agricultural farm production in the four districts involves a series of activities and practices that has changed overtime, influenced by productivity, climate and weather conditions, availability of farm inputs, and the condition and growth stages of the crops. Crop production in the four districts is still labour intensive, indicating that the farming practices in the study sites are not yet mechanized. Crop production is also influenced by the availability of arable lands (Thanh Hoa and Son La), and/or constrained by soil salinity and low soil fertility as observed in Thanh Hoa which is located in a coastal plain.

In Zimbabwe, mixed farming is most common, i.e. livestock, and crop and horticultural production. Most households in Zimbabwe own at least 1 to 3 cattle per household for draught power, along with local breeds of poultry and goats that can be used to meet the household's cash requirements. Most households in the study areas have access to an average of 2 ha of arable land per household with 90% of the arable land in all districts committed to maize. Maize is one of the staple food crops, grown by 98% of the farmers in all districts. Other major crops in the four districts are cowpeas, groundnuts and Bambara nuts, while sorghum is grown in Chiredzi, Tsholotsho and UMP. Maize is grown on holdings of between 0.4 and 0.8 hectares, with an additional smaller area of land (below 0.4 ha) reserved for groundnuts, cowpeas and other crops. Vigorous promotion of hybrid maize by the corporate seed sector in the country has resulted in reduced interest by farmers to grow other cereal crops. Additionally, farmers considered processing of sorghum and pearl millet grain into mealie meal for sadza[14] but sorghum and pearl millet are more labour intensive than maize, and pearl millet seed is more susceptible to bird damage (attacks by birds could result in over 80% yield reduction). Decisions

[14] Sadza is the cornmeal-based dietary staple of Zimbabwe

on the choice of cereal varieties are shared between men and women, whereas women dominate the choice of legumes varieties. The majority of farmers practice conventional agriculture rather than conservation agriculture; however the latter is adopted widely in all districts, particularly among those farmers who grow maize.

3.2. Status of agricultural biodiversity in relation to people's food security within the specific ecosystems of the project sites

In all three countries the survey reported that food security is the main reason for farmers to engage in crop production. It is also confirmed that the primary crops cultivated by the farmers in the three countries are directly contributing to households' food security. The main staple crops, based on the yield level and cultivated areas, in the three countries include: potatoes and maize in Peru; rice and maize in Vietnam and maize in Zimbabwe.

In Peru, farmers in the Low Zone have more diverse food sources for their nutrition than the Middle and Upper Zones, where the daily diet is based on carbohydrates (from potatoes, maize, lima beans and olluco). The daily diet of households in the Low Zone also includes peanut, avocado, beans, yucca and uncucha. In general, households in the project area have not suffered food shortages in previous years. Chronic malnutrition among children in the survey areas is the result of an unbalanced diet (deficient in necessary proteins and vitamins), not a lack of food. Whilst potato is by far the most important crop in the High Zone in particular, other crops, such as maize and broad beans remain equally important in the Middle and Low Zones.

In Vietnam, a strong relationship between crop production and food security was reported. In Thanh Hoa, where households have higher reliance on off-farm incomes than on crop production, food insecurity was higher, with 92% of the households facing several months of food shortage in a year. Food shortage is also observed in 26-32% of households in other provinces. Other crops contributing to food security include; vegetables in Hoa Binh, vegetables and potatoes in Son La and peanut and sweet potatoes in Thanh Hoa.

In Zimbabwe, cereals are the indicators of food security in most households. The responsibility for food security is shared between men and women. The survey observed an increased involvement of men in small grain and legume production, while in the past they normally engaged in cash crops, such as maize and cotton.

The three country reports cited **displacement of local diverse cultivars by modern varieties**. Some traditional potato varieties in Lares, Peru, were displaced by hybrid potato varieties introduced by public projects and NGOs for the market. Modern rice varieties and maize hybrids dominate crop production in Vietnam. The widespread use of hybrid maize in Zimbabwe, even in the dry zones, displacing the local open pollinated varieties (OPVs), is often influenced by the relatively easier access to hybrid varieties that are often subsidized by governments and NGOs.

Farm-saved seeds

Farm-saved seeds are traditionally selected from standing crops, based on farmers' observations and assessments of crop performance in relation to farmers' preferred traits. These **preferred traits** are influenced by both the farming **households' subsistence needs** and **livelihood priorities**. The seeds are selected and stored for next season's planting (replanting). Farm-saved seeds and traditional farmer-to-farmer exchange play a crucial role in providing food security. The data from the surveys show that, in contrast to farmers in Vietnam, **farmers in Peru and Zimbabwe largely use farm-saved seeds**, which contributes greatly to seed availability and security.

Women have a powerful role in Peru, but the task of on-farm seed production is shared between men and women. In Zimbabwe, seed selection is mainly practiced by women. In contrast, in Vietnam, farmers source their seeds from the market, and gradually from the newly-established

FFSs, organized through the IFAD-ONL Scaling-up programme. Breeding and selection are still male-dominated activities but many women also exert influence, particularly in Son La province. In Yen Bai and Thanh Hoa, women have control over breeding and the selection of planting materials.

With the exception of Zimbabwe, the survey recognized the interconnectedness between the two production systems adopted by farmers (the subsistence and market oriented), as the driving forces **determining farmers' variety preferences** and therefore **their preferences in saving seeds**. In Zimbabwe, almost all of the farmers surveyed (99%) practise subsistence farming. The following table shows how various drivers affect farmers' variety preferences that define the retained seed's preferences.

Table 2 Interconnectedness of various drivers on farmers' preferences

Countries	Farmers' preferences and strategies influenced by interconnected drivers
Peru	• Farmers use combination of cultivation of **modern[15] and native[16] potatoes varieties** that are most in demand in local and regional markets • The introduction of new potato varieties **replaced the use of traditional varieties** i.e. Andina, Huayro, Chaccaro, Native and Sayllorisay
Vietnam	• 90% of farmers purchased rice seed varieties, suggesting **eroded local seed system** • Most provinces **lost some of their traditional varieties of paddy and sticky rice**. Greatest number of paddy rice varieties are still cultivated in Hoa Binh province, however loss of traditional genetic material in the other provinces is anticipated
Zimbabwe	• Farmers use hybrid maize varieties or combination of hybrid maize varieties OPVs, particularly in Tsholotsho • Particularly in the **dry areas of Zimbabwe**, although the yield is at least 15% less than hybrid, farmers prefer to use **saved maize seed from OPVs** than to use high cost hybrid maize varieties. OPV is considered more attractive, as farmers can plant **new** OPV seeds every fourth year and **replant** OPV saved seed for up to three years with reasonably good yield. On the other hand if farmers plant a hybrid variety, they need to procure new hybrid seed every year.

Source: Reproduced from the survey findings of Peru, Vietnam and Zimbabwe (ANDES, SEARICE, CTDT, 2012)

The heterogeneity of the farming communities, seed sources of the main crops, farmers' crop and seeds preferences, and decisions influencing farmers to save seeds, are important factors in designing and implementing future intervention strategies. Nevertheless, the IFAD-ONL Scaling-up programme will need to further understand the sources of varieties of those crops important to farmers, farmers' preferred traits that are catered to their needs (food security, nutrition, income generation) and adapted to their local agro-ecological conditions, as well as existing farmers' indigenous knowledge systems and practices in managing seeds and how the farmers' seed system can be further strengthened. This information will help to design and implement intervention strategies that maintain and strengthen farmers' genetic diversity.

[15] Modern varieties, i.e. Yungay, Canchan, Sayllorisay and Runtus
[16] Native varieties, i.e. Peruanita Churuspi and Mactillo

Therefore, while it is important for the IFAD-ONL programme to work on the diversity of crops, focus placed on the diversity within each of the important/primary crops for food security needs to be explored. Through the application of existing tools, the IFAD-ONL Scaling-up programme will further assist farmers to identify the level of diversity in plant genetic resources (PGR) for the two or three primary crop species and corresponding seed systems (traditional, farmers' varieties, modern, introduced by research institutions or seed companies) and ranked those based on their preferred traits (variety performance). Farmers in the three countries will be facilitated to identify the morphological and agronomic traits (yield, tolerance to stress, duration to harvest, taste, storage life) for their important crop species, including those traits that are important from the women's perspective (processing, storage and household consumption needs) and rank the relative importance of these traits in order to facilitate the understanding of why some varieties are replaced.

In order to design and implement intervention strategies that maintain and strengthen farmers' seed system and farmers' genetic diversity, the IFAD-ONL Scaling-up programme will need to unpack further farmers' reasons for displacement of some crops and diverse local cultivars; farmers' sources of the varieties of crops that are important to farmers; farmers' preferred traits catered to their needs and adapted to their agro-ecological conditions; and finally the existing farmers' indigenous knowledge systems and practices in managing seeds.

3.3. Socio-economic and cultural changes that have taken or are taking place at household and community levels related to adaptation of agricultural production to climate change

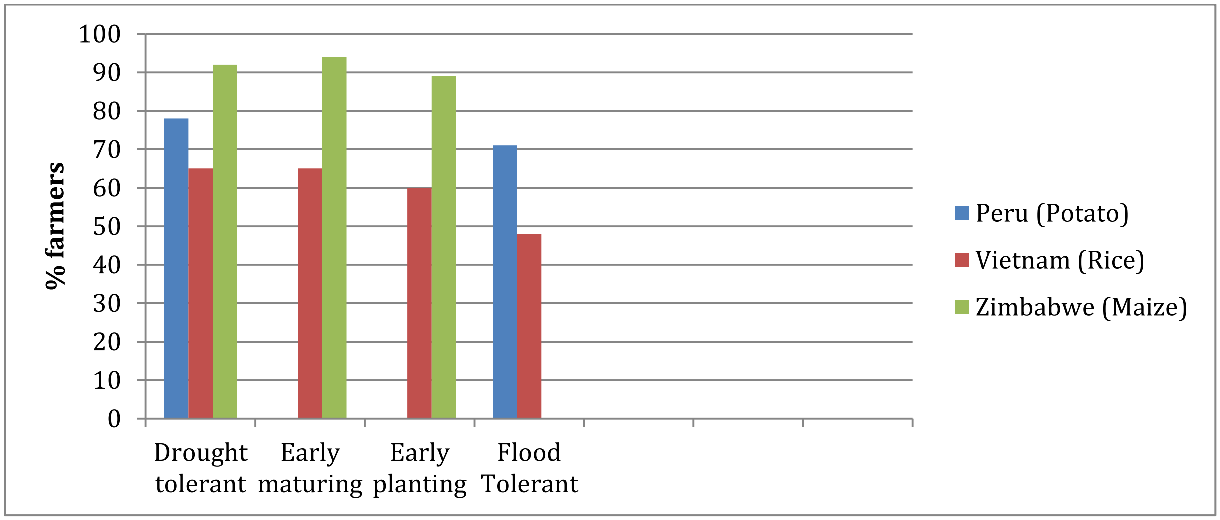
The farming communities in the three countries are dynamic and continuously influenced by the direct effects and externalities of global and national phenomena. The trend to use more local PGR in subsistence systems under stressful conditions (i.e. high altitude areas in Peru, drought areas in Zimbabwe), and greater use of modern or improved varieties, initially promoted by government programs, to increase agricultural productivity, is observed in the three countries. Hybrid varieties of rice in Vietnam and maize in Zimbabwe are widely used, while the use of hybrid potato varieties in Peru is worth further analysis. Moreover, off-farm sources of income provide even higher income than crop production. Although the three reports indicate that agriculture, for reasons such as greater food security, remains the priority for farmers with the highest engagement of labour; off-farm work could mean greatly reduced availability of farm labour, which in turn may impact type of agriculture production systems and the type of PGR that will be used. The preference for short duration varieties may also be affected by the need to move labour to activities as soon as possible. Furthermore, market pressures/opportunities, more reliable access to improved varieties and reduced labour availability may also explain the increasing preference of farmers to buy seeds, even of vegetatively propagated species and easy to produce self-pollinated species.

Throughout the IFAD-ONL Scaling-up programme, different livelihood strategies, different production systems and the corresponding impact on farmers' PGR preferences will be further observed and analysed to develop intervention strategies that meet IPSHF needs. This will contribute to the IFAD-ONL Scaling-up programme's objectives of broadening the genetic base, and access to and control of PGR and related technologies by farmers.

3.3.1. Seed management as adaptation strategies

In all three countries, the survey suggests that farmers use their choice of seeds and planting dates as part of their adaptation strategies. Farmers have often used seed management to deal with biotic and abiotic stresses[17]. Now, with the climate changing, farmers are also using traditional seed management to adapt to climate variability and change. Seed management strategies of the farmer respondents include combinations of early maturing and early planting varieties, and more drought tolerant and pest resistant seed.

Figure 1: Farmers' perception of how they use different crop varieties to adapt to changing climate



Source: Reproduced from the survey findings of Peru, Vietnam and Zimbabwe (ANDES, SEARICE, CTDT, 2012).

In terms of crop diversity management for climate change adaptation, farmers in the three countries reported that they use their choice of seeds and planting materials to adapt to climate variability. They use combinations of early maturing crop varieties (short duration varieties), drought tolerant and pest resistant seed varieties and a combination of diverse crop species, maize and small grain cereals, legumes, etc., to ensure food security and not to be dependent on single or few crops. As an illustration, with the increasing average temperature some crops (maize, beans, wheat and barley) in the Low Zones of Peru are "moving up" to higher altitudes, displacing native crops like potatoes, oca, olluco and nasturtiums, that are also planted in increasingly higher areas to prevent attack by pests and diseases (see table 3 below).

Farmers **in Peru** indicate that they adapt by cultivating more flood tolerant (71%) and drought tolerant (78%) traditional varieties of potatoes (Boli varieties). Other traditional varieties include yellow and white maize, Pacay broad beans and Canchán potato. **In Vietnam**, where people have lost their traditional varieties, they adapt by using modern drought tolerant and early maturing varieties of rice (65% of households). They also resort to early planting and use flood tolerant varieties when needed. **In Zimbabwe**, the use of early maturing and drought tolerant

[17] Biotic stresses are damage to plants from other living organisms such as bacteria, virus. Abiotic stress includes drought, flood, and salinity

varieties of maize (more than 90% of households) represents the main coping strategy. In addition, in Zimbabwe, hybrid maize is perceived as having average to very poor tolerance to drought. As a possible response to drought tolerance, 37% of the respondents think that hybrid maize could be useful, whilst 54% consider the possibilities of a combination of hybrid and open-pollinated varieties. Farmers in Zimbabwe are shifting from maize to small grains (traditional and modern varieties) of sorghum and millets as a strategy to adapt to increased drought conditions.

Table 3: Change of cropping patterns in Peru, Vietnam and Zimbabwe

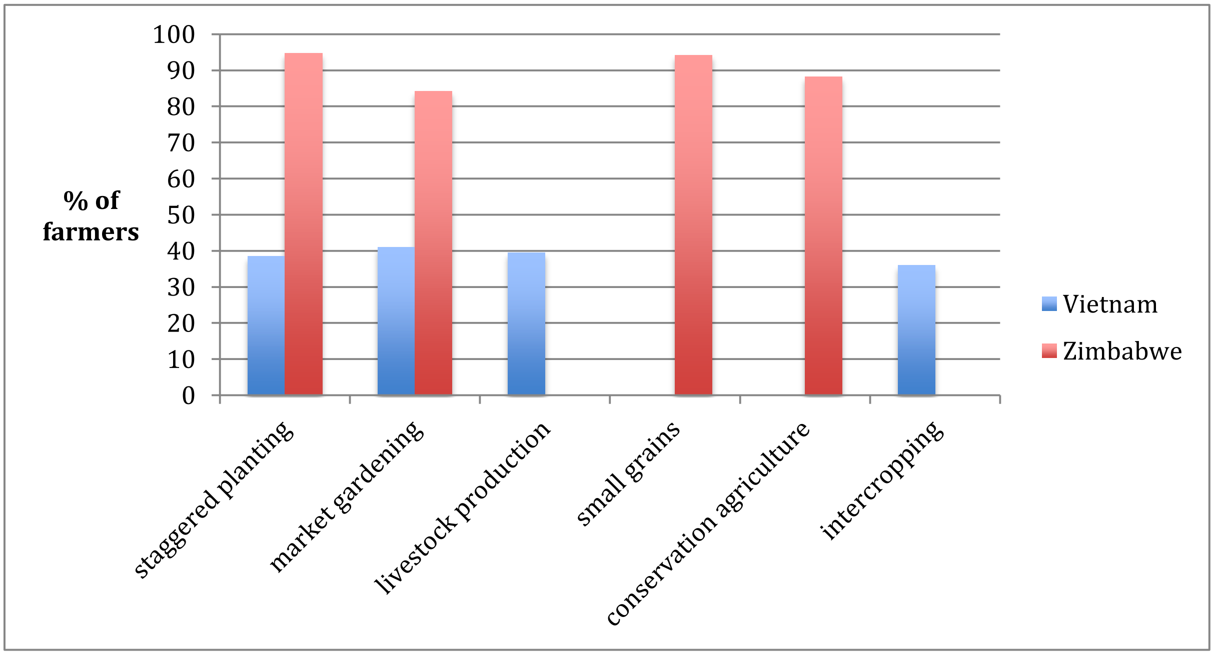
Peru	**With the increasing average temperature, some crops (maize, beans, wheat, and barley) in lower areas are moving up to higher altitudes, 'displacing' native crops like potatoes, oca, olluco and nasturtiums, which are planted in increasingly higher areas to prevent pests and diseases**
Vietnam	During times of drought or flood, farmers **adjust the time of planting and plant early or late maturing varieties**
Zimbabwe	Farmers in the drier districts of Chiredzi, Tsholotsho and UMP are growing **shorter season varieties** including **more and smaller grain crop varieties** because the season length was becoming shorter to support the majority of the hybrid maize varieties

Source: Reproduced from the survey findings of Peru, Vietnam, Zimbabwe (ANDES, SEARICE, CTDT, 2012)

The implication of the adaptation strategies listed above will be further elaborated in the IFAD-ONL Scaling-up programme. The use of short duration varieties may replace the traditional varieties that are often medium and long duration types. One of the activities the programme could consider adopting includes supporting farmers in developing their own short and medium duration varieties of important crop species, e.g. through participatory plant breeding and PVS. As an example, the IFAD-ONL Scaling-up programme may explore the possibility of introducing more diverse OPV cultivars of maize for farmers' selection, or explore possibilities to combine traits of modern hybrids with traditional maize varieties.

3.3.2. More adaptation strategies during droughts and floods

Figure 2: Proposed adaptation strategies during droughts and floods in Vietnam and during droughts in Zimbabwe



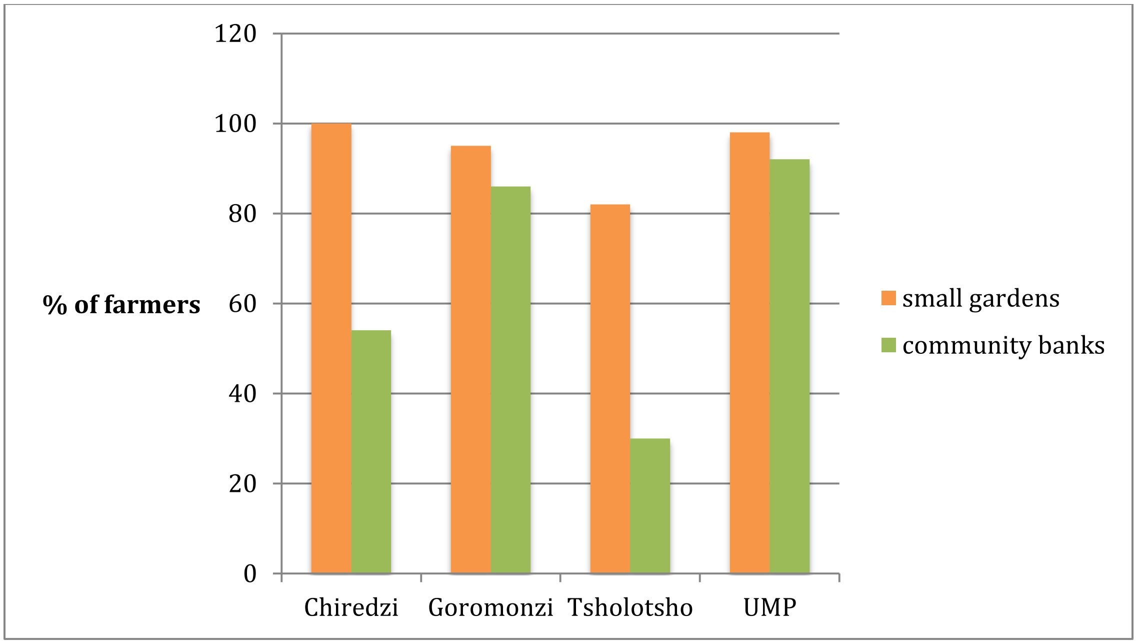
Source: Reproduced from the survey findings of Peru, Vietnam, Zimbabwe (ANDES, SEARICE, CTDT, 2012).

In addition to the seed management strategy adopted by farmers in the three countries, farmers in Vietnam and Zimbabwe **proposed** other mechanisms to cope with drought and/or floods.

In Vietnam, an average of 40% of farmers in the four communes turned to market gardening (horticulture), followed by livestock production, staggered planting and intercropping (39%, 38% and 36% respectively) to cope with droughts and/or floods. Farmers from the four communes are reluctant to use indigenous seed varieties as these are perceived to have poor yields.

In Zimbabwe, an average of 94% of farmers in the four districts chose staggered planting and small grains to cope with droughts, followed by conservation agriculture and market gardening (88% and 84% respectively). Livestock production, multiple cropping, destocking and intensive agriculture are reported to be the last resort.

Figure 3: Adaptation strategies employed by smallholder farmers in Zimbabwe in the event of droughts



Source: Reproduced from the survey finding of Zimbabwe (CTDT, 2012).

In Zimbabwe, small gardens have always been a pillar of food security and livelihoods in all districts. Farmers were reported to rely on small gardens as a drought aversion strategy. Community banks or village savings are quite common in UMP, where market gardening is prevalent, and in Goromonzi which is a high agricultural potential district. Community banks are therefore considered to be one of the coping strategies in times of drought in these two districts.

Barter market as an adaptation strategy

In Peru, one of the observed socio-economic and cultural changes relating to adaptation of agricultural systems is the shift in the barter market practice. Barter market practice in Lares is a community organized exchange system of diverse food crops between diverse agro-ecological zones. It is an autonomous market guided by ancestral principles of reciprocity and solidarity that govern the exchange of crops, seeds and knowledge. It contributes significantly to the exchange of nutritious foods and medicinal plants. The barter markets in Lares are supplied by potatoes and other carbohydrate-rich Andean tubers from the high-altitude agro-ecological zone, while maize and other sources of amino acids, like quinoa, are supplied by the Middle Zone; vitamin-rich fruits and coca leaves come to the barter market from the Low Zone. In general, the perception of most family members from the surveyed area of Peru, regarding the dynamics of the barter market, is that it is diminishing. Farmers stated the reduced number of participants from other altitudes and the reduction of types and quantities of products to be exchanged. The IFAD-ONL Scaling-Up programme will further analyse and take into account this changing context in supporting the adaptive capacities of IPSHF in PGR conservation, access and sustainable use.

3.4. Roles of women farmers in agro-biodiversity management under changing climatic conditions

The three surveys reported that women are the predominant managers of PGR. Women from the three countries are often **responsible for seed management** including selection, storage, sowing, and exchange. **Informal seed exchange systems** are often female domains and in many cases they contribute to the traditional breeding of new crop varieties, thus they are responsible for the agro-biodiversity in their communities. Changes in socio-economic and cultural context, exacerbated by change in climatic conditions, including the diffusion of new varieties (market oriented) may affect the traditional role of women farmers. As an illustration, in Peru, the task of on-farm seed production is shared between men and women, whilst in Zimbabwe, seed selection is mainly carried out by women. In Vietnam, breeding and selection are still men-dominated activities but many women also exert influence, particularly in Son La, Yen Bai and Thanh Hoa. The IFAD-ONL programme will continue to analyse how the different roles in seed management between men and women **affect men and women's knowledge, access and use of genetic resources.**

This may mean, for example, that in determining the design and activities of the IFAD-ONL Scaling-up programme's intervention, it is important to carefully consider and find the right balance between the different preferences of women and men in terms of varietal traits. In many cases, men, in general, are primarily interested in varietal traits that are important during growth and harvest, whilst women are generally more concerned with culinary and post-harvest characteristics. While the survey managed well in applying useful tools and collecting gender disaggregated information (e.g. women's access to quality seeds and diversity of seeds; women's access to breeding materials; the level of women's agro-ecological know-how), it is noted that those data containing women's participation, preferences/opinions need to be better represented in the analysis of each key topic discussed in the survey.

3.5. Farming communities' understanding, perceptions and strategies to respond to the effects of climate change

3.5.1. Meteorological information of the project areas in Peru, Vietnam and Zimbabwe

The climatic pattern of the survey areas in the three countries varies significantly, ranging from **tropical monsoon climate** to **high mountain dry tundra climate**. **In Peru**, the farming communities of the project area are primarily based in **two agro-ecological zones** defined as the Puna Zone or Upper Valley Zone and the Quechua Zone or Middle Valley Zone. The project areas in Vietnam are divided into North Central Coastal region, North Eastern region, and North Western region, all characterised by hot and humid tropical monsoon climates. **In Zimbabwe**, Tsholotsho, Chiredzi and UMP districts are located in agro-ecological region 4 and Goromonzi falls under agro-eological region 2b. Table 4 summarizes the range of climatic characteristics represented in the survey.

Table 4 Meteorological information of the project areas in Peru, Vietnam, and Zimbabwe

	Peru[18]		Vietnam	Zimbabwe	
Regions	Puna/Upper Valley Zone	Quechua /Middle Valley Zone	North Central Coastal Region (Thanh Hoa), North Eastern Region (Yen Bai), North Western Region (Hoa Binh and Son La)	Agro-ecological region 4 (Tsholotsho, Chiredzi, UMP districts)	Agro-ecological region 2b (Goromonzi)
Climate classification	High mountain, dry tundra	Cold boreal climate	Tropical monsoon climate	Semi-arid	Semi-arid/sub-humid
Temperature (average)	0°C and 7°C	11°C and 16°C	19°C and 23.7°C	15°C and 28°C	10°C and 22°C
Average rainfall/ annum	200-1,000 mm		1,200- 2,200 mm	450-600 mm	800 mm
Season	Rainy and dry seasons		Rainy (hot) and dry (cold)	Rainy and dry seasons	Rainy, cold and dry seasons

Source: Baseline Survey of Peru, Vietnam and Zimbabwe (ANDES, SEARICE, CTDT 2012); UNDP 2013; Brown, D. et al. 2012

3.5.2. Observable changes in climate from the survey

The climate changes being experienced in the three countries are likely to be perceived in the **timing (onset and cessation), duration, and intensity** of the weather events (rain, frost, drought), **change in temperature, the occurrence of extreme weather climates** and **pest diseases**.

In general, it is observed that farmers perception of, and responses to, climate changes may be associated with how they affect the outcomes of their farming activities/crop performances and farming systems. Understanding farming systems and crop diversity will be good entry points to support IPSHF; and collaboration between and among agro-biodiversity and climate change experts is recommended. The IFAD-ONL Scaling-up programme will further build on farmers' perception and traditional knowledge, to strengthen the use of weather forecasts in their adaptation strategies; and for the scientific community to address the discrepancies between weather forecast and people's perception.

3.5.3. Indigenous knowledge, weather and prediction of climate patterns

The three sets of survey data suggest that in terms of responding to climate variability and change, as outlined above, farmers are resourceful and act upon their own locally-developed (indigenous) knowledge and practices. Although this traditional knowledge is diverse, and country or site specific, the data showed that observable natural and/or environmental indicators are the main means for farmers to predict weather and to develop their corresponding adaptation and survival strategies.

In Peru, traditional knowledge and ancestral practices used in the rural communities are primarily based on the Andean worldview, where all elements of the ecosystem are regarded as

[18] W. Köppen's climate classification, http://www.elmhurst.edu/~richs/EC/101/KoppenClimateClassification.pdf

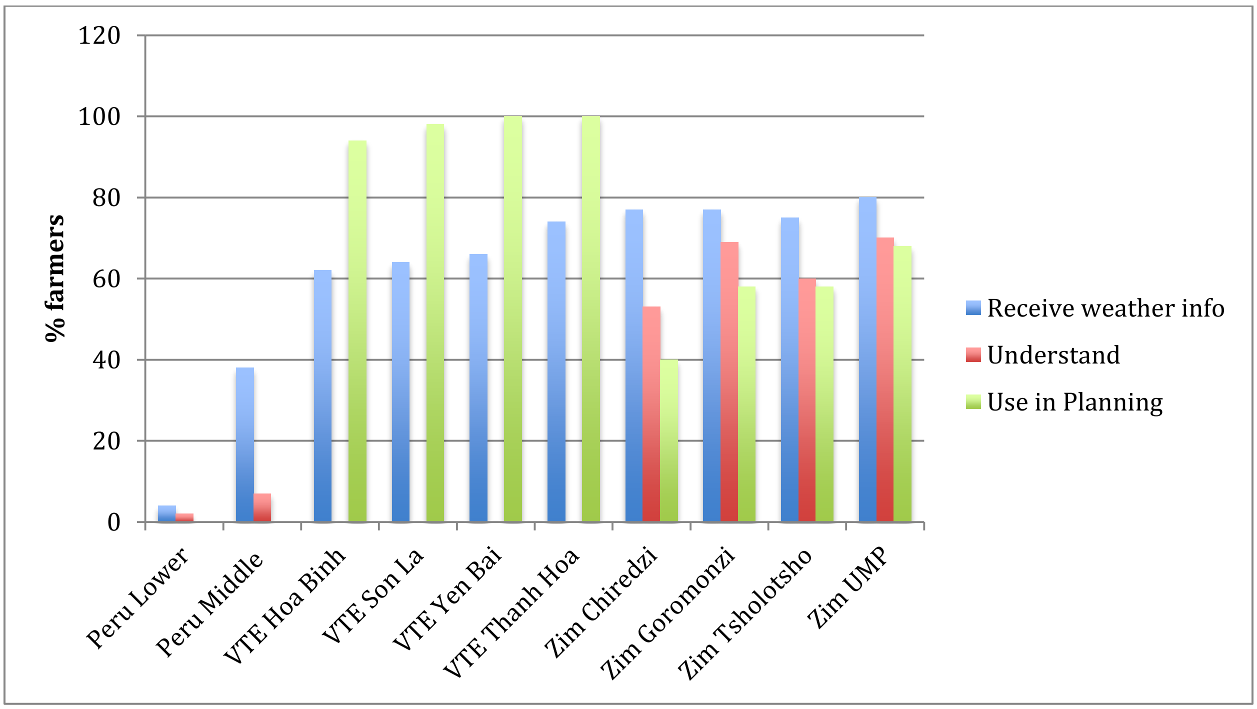
living beings. The farmers' relation with the natural world enabled them to develop environmental observation skills, which help predict, with some margin of anticipation (3 to 4 months) the occurrence of rainfall and its intensity. This is then used in their agricultural planning. All the communities plan their production cycles from one year to another and base this on observable environmental conditions. This is of their survival strategies. In this sense, this predictive or forecast ability is the basic condition of their survival and adaptation to new environmental conditions. The vast majority of the residents of the project area in Peru can predict the onset of the rainy season through cloud behaviour, wind direction and the dry season climate; a smaller group do so from watching the changes of trees and animal behaviour.

Similarly, **in Zimbabwe**, communities have their own ways of forecasting seasons, using traditional knowledge. The most commonly used indicators are animal behaviour, tree phenology, pre-season heating and cooling, prevailing wind direction, and cloud systems **In Vietnam**, farmers in Yen Bai and Thanh Hoa predict weather patterns by observing changes in the behaviour of animals and cloud formation. In all four provinces, it is confirmed that weather forecasts from meteorological services are an important resource to predict weather[19].

3.5.4. Weather forecasts and cropping patterns

Access to weather information

Figure 4 Correlation between farmers' access to weather information and the use of the information in agricultural planning



Source: Reproduced from the survey findings of Peru, Vietnam, Zimbabwe (ANDES, SEARICE, CTDT, 2012).

[19] In the past in Zimbabwe, rain-making ceremonies were led by traditional chiefs, who conducted them at sacred places at the beginning of the season. However, this practice is no longer common due to religious influence (Christianity). Indigenous or ethnic rituals were not discussed or mentioned in the baseline survey in Vietnam.

With regards to access to weather information from the public system in the three countries, it appeared that farmers in the survey areas of Vietnam and Zimbabwe had relatively good access to such information, whereas this was less the case in Peru. **In Zimbabwe**, 75-80% of farmers have access to weather information from the Zimbabwe Meteorological Services Department (ZMSD), mostly through the radio and Agritex (government extension) personnel. Of these, an average of 63% of farmers in the four districts understood the weather forecasts, and 56% used the information from the public sector to plan their agricultural activities. On the other hand, there is still a mixed perception as to the timeliness of the forecasts. Most farmers rate the ZMSD forecasts as reliable, but in Chiredzi district, 40% of the farmers regard the forecasts as unreliable. The farmers suggested that there is generally no agreement between the ZMSD forecasts and the traditional forecasts, currently used by the farmers. **In Vietnam**, 60-70% of the farmers in the survey areas receive weather forecast and information; more than 95% of those farmers have been able to plan their farming activities, using this weather information as a reference. It is also reported that this influences the types of crops grown on farms in the following season. **In Peru**, the Servicio Nacional de Meteorología e Hidrología (SENAMHI) has made significant progress in the monitoring and modelling of climate in these past years. Technological advances have enabled the installation of new weather monitoring stations, allowing for the flow of information in almost real time, and its use in short-term weather predictions. Nevertheless, availability of information has not been the problem; the problems lie in reaching the farmers with easy-to-understand information in a timely manner. It is reported that very few households manage to receive the information from SENAMHI. The vast majority of households in the Low and Upper Zones do not have access to any communication medium or to the SENAMHI weather information. It is solely in the Middle Zone that 38% of households have received the information, and this is probably because the district capital is found in the area and media is more accessible. Of those who do receive the weather information, few are able to understand and use it[20].

Relationship between prediction and crops

In terms of adaptation strategies, IPSHF largely practice crop management techniques to reduce the risk of adverse weather conditions[21]. These techniques include adjusting the crop calendar, and using more diverse crops to, for instance, mitigate the consequences of erratic rainfall.

[20] Influencing factors include: poor weather forecast data management in the station, weak linkages in the communication and dissemination to farmers, and inadequate integration of weather forecast information for small farmers.

[21] As reported by other studies in Sub-Saharan Africa and Vietnam (Bryan et.al., 2013; De Wit, 2006; Nhemachena and Hassan, 2007; Dang et.al., 2013).

Table 5 Relationship between weather and crops in the three countries

	Peru	Vietnam	Zimbabwe
Rainfall		In areas with higher risk of waterlogging, tolerant varieties are planted and the appropriate crop management is practiced.	Farmers in the marginal parts of the country grow a mixture of both drought and flood tolerant crops to adapt to crop failures that are induced by droughts.
Temperature	Facing increasing average temperature, the strategy is to adapt different crops to higher altitudes to prevent pests and diseases.	Drought tolerant and early maturing short season varieties are grown during the "hot" months. Staggered planting is also identified as an option. Farmers resort to alternative crops such as potatoes and vegetables during the "cold" months.	Farmers hardly respond to temperatures to decide on which crops to grow.
Frequency of typhoon	N/A	There is an average of 6-8 typhoons per year. Crops are destroyed.	The country does not experience typhoons.
Drought incidence	Drought resistant varieties are cultivated: Boli potato in Middle and Upper Zones, yellow and white maize and Pacay broad beans in Middle Zone.	Growing early maturing varieties, and planting early are the coping mechanisms farmers generally practice in times of drought and floods. Other strategies to mitigate drought include mulching (practiced by 60% of farmer respondents in Son La), water pits, tied ridges, contour ridging, and other soil moisture conservation measures.	As a drought adaptation and mitigation strategy, farmers grow short season varieties.
Floods and flash floods	Flood resistant varieties are cultivated: Boli potato in Middle and Upper Zones, Pacay broad beans and yellow and white varieties in Middle Zone.	Flood (water logging) tolerant and early maturing (short season) varieties are cultivated.	Low lying districts such as Chiredzi and Tsholotsho are affected by floods in 1 out of every 4-5 years. If such incidences occur, farmers' crops are destroyed, but those staying close to rivers and low lying areas resort to vegetable production soon after the rainy season to benefit from the residual moisture.
Pest and disease incidence	Pest and disease tolerant varieties are cultivated: yellow and white maize and Cahchan potato in Middle Zone, and Boli potato in Middle and Upper Zones.	Periods of outbreak and incidence of pest infestation are recorded and the planting calendar is correspondingly adjusted. Resistant and tolerant varieties, and in some cases, indigenous varieties are planted.	Major pests that affect crop productivity in the country are armyworms, which especially affect crop production during the early vegetative stages of crop growth

Source: Reproduced from the survey findings of Peru, Vietnam, Zimbabwe (ANDES, SEARICE, CTDT, 2012).

4. Conclusions

a. The initial findings of the survey agree with most other studies, that farmers in the three countries are aware that **climate change is a present issue**. This survey reveals that farmers' perception of, and responses to, climate change are filtered by **how their farming systems and crop performances are affected**. Climate change has been determined as **one key driving force for the disappearance of their traditional**

varieties (also market forces). Farmers considered that some indicators of the shift in climate to be: increases in pests and diseases in crops; increased droughts and flooding; warmer winters; hotter summers, and alteration in the growth cycle of crops. The study further confirms that, as a coping mechanism for climate change, most of the farmers in the three countries **chose to sow those varieties of their major crops that are resistant to drought, floods, and pest and diseases**. Some of the farmers, as illustrated in Zimbabwe, moved towards growing small grains that are more drought tolerant, such as sorghum and pearl millet, as well as shorter season varieties (groundnuts, bambara nuts, cowpeas) to adapt to climate change. This suggests that the **farmers' seed systems**, in particular those that could respond to the variability of climate, has been **central in climate adaptation strategies**. Therefore, the IFAD-ONL scaling up programme will prioritise **support to farmers to maintain and strengthen their seed systems, i.e. through increasing crop diversity on-farm** and by promoting those activities that could **bring back lost varieties** for adaptation and as breeding materials for future programmes.

b. The study in Peru reveals that the ancient practice of food and seed exchange, the barter market, is at risk, i.e. due to market pressure to produce for distant markets[22]. This could pose a serious threat to local food and seed security. **Strengthening the barter market practices** is crucial to ensure food, nutrition and livelihood security as well as the continuity of households' diversity of crops and varieties.
c. In Zimbabwe, the **community seed bank** is observed as one **strategy for farmers to conserve family seed collections**. A number of the crops and crop varieties adopted by farmers are from the community seed banks. In UMP district, the community seed bank is the main source of seeds for farmers, especially during periods of drought or crisis. It conserves both active seeds and locally important genetic resources. Community seed banks are therefore considered to be one coping strategy for farmers to **access breeding materials and good quality seeds**.
d. The **growing dependency on external seed sources and the displacement of local diverse cultivars** with modern varieties are considered to weaken local communities' seed system, as illustrated by rice farmers in Vietnam and maize farmers in Zimbabwe. Despite this dependency, farmers confirmed that the varieties obtained from the formal systems are often **not adaptable to local agro-ecosystems and to farmers' preferred varietal traits**. Moreover, these modern rice varieties and maize hybrids are much costlier and are observed to have declining yields when re-planted. In Vietnam however, the use of local varieties is not common because these varieties could not compete with the modern ones in terms of yield and quality. Some farmers in the Tsholotsho district of Zimbabwe reported that open pollinated varieties (OPVs) have been grown since the late 1970s and have been obtaining reasonable yields. Facilitating farmers to improve and **produce their preferred varieties and good quality seeds**, and having these seeds readily accessible through **saving activities** could strengthen farmers' seed systems.
e. The three country surveys cited that farmers use different methods to forecast or predict the quality of the upcoming seasons. With **traditional knowledge**, they were able to do this by observing animal behaviour, tree phenology, pre-season heating and cooling, prevailing wind direction, and cloud behaviour during the dry season. These traditional indicators should be further nurtured and understood. Understanding of this traditional knowledge is important to **better assist farmers in planning their agricultural activities**.

[22] Lennox, E., Gowdy, J., 2014.

f. The study confirms, along with other past studies, that **climate data and farmers' perceptions do not always seem compatible**. This surveyfurther suggests that there are valid, functional reasons why this is the case. The survey confirms that when people have good access to, and understanding of, the government weather forecasts, such as illustrated in Vietnam, they use this information to inform their seasonal agricultural planning. The survey suggests to further **build on farmers' perceptions and traditional knowledge, to strengthen the use of weather forecasts in their adaptation strategies**, and for the **scientific community to address the discrepancies** between weather forecasts and people's perception.

5. Recommendations for future work

The following section synthesizes the recommendations for the three year IFAD-ONL Scaling-up programme, as well as the recommendations for further improvements on methodology.

5.1. Recommendation for future programme

- To support farmers in producing their own preferred varieties and good quality seeds, and to strengthen their local seed systems, the IFAD-ONL Scaling-up programme will build on and scale up the successful experience of **Farmer Field Schools** (FFSs). FFS is an **empowering experiential learning tool,** used by smallholder farmers to find solutions to a broad range of challenges and problems affecting them. Although this tool is adopted by the partners, many of the agricultural extension services, as illustrated by Zimbabwe, are new to this concept. Series of consultations will be done with communities to explore the **inclusion of Participatory Variety Selection (PVS) in the FFS**. Through the PVS, farmers will be supported to identify their preferred seed traits (production and end-use), identifying farmers' needs and to search for genetic materials to be tested on-farm under the real conditions faced by farmers. Through the PVS exercises, farmers will be encouraged to **create farmers' own seed varieties,** combining the preferred traits from both modern and traditional seed varieties that are important to farmers. The IFAD-ONL Scaling-up programme will help strengthen the capacity of farmers to broaden the genetic base of their crops, through specific varietal adaptation trials of diverse cultivars (traditional and modern), including their capacity to breed their own varieties. Breeding new crops would take longer than the three year project period, in this case, the IFAD-ONL programme will concentrate on capacity building and institutional strengthening of the FFS, to enable farmers to have continuous access to breeding materials and to have the collective know-how in participatory plant breeding.
- Informed by the findings of the survey, to bridge the discrepancies between farmers' perceptions and meteorological data, **focus group discussions** (FGDs) will be **embedded into the FFS,** to validate farmers' perceptions of climate change (i.e. with timeline analysis) and how they correspond to actual long-term climatic records. The FGDs will be organized in such a way that the participation of both farmers and meteorological office staff is ensured. Farmers' traditional methods of weather forecasting (using basic tools to record rainfall data, wind direction, etc.), will be shared for peer input. In addition, ways to **transfer formal weather information effectively,** so that it can be easily interpreted for agricultural planning, will be discussed collectively. The outcomes of this will inform a pathway that will build on IPSHF perceptions and traditional knowledge, to strengthen the use of weather forecasts in their adaptation

strategies; and for the scientific community to bridge the inconsistencies between meteorological data and people's perceptions.

- The IFAD-ONL Scaling-up programme will build on the **farmers' indigenous knowledge system** (IKS) and/or management system in seed production. Understanding farmers' traditional knowledge will help farmers to adapt to changes in production systems and in climate. New types of varieties and seeds require new knowledge and skills. For example, newly introduced, stable OPVs of maize require a higher level of selection techniques to maintain the OPVs' potential. Understanding the need for new, acquired skills will help define the role of, and support from, modern science and public research institutions to strengthen farmers' seeds systems. The three country reports cited cooperation with public research institutions as sources of new varieties and seeds. Finally, the IFAD-ONL Scaling-up programme will analyse the role of these institutions further and will consult them and the communities regarding potential participation in the program.
- Seed security and farmers' seed systems are central to the continuity of food security in Peru. The **seed banks** capitalise on **a unique collaboration between local farmers in Lares, communities of the Potato Park, and national and international scientists**, i.e. from the International Potato Centre (CIP), which underlines the importance of bridging knowledge systems. Based on this importance, the program in Peru will explore the **feasibility of forming this institution** in the program areas.
- The survey reported that **women are closely involved in farm-management**, and their role has become more prominent, since a significant proportion of men have migrated to towns and cities to earn cash in exchange for their labour. Understanding this role and how it differs from the role men is therefore central to the success of the IFAD-ONL Scaling-up programme plan and its implementation. **Improvements will be made to the baseline and FFS tools,** to ensure that **data on women's participation, preferences and opinions** are well captured.

5.2. Recommendation for an improved methodology

The baseline survey has been an effective tool to understand the current situation, and for planning, monitoring and evaluation. Furthermore, it has been an empowering tool to facilitate IPSHF communities to reflect on their current situation, subsequently develop their plans and hold the programme's partners accountable.t allows across the globe comparison for a stronger narrative, planning, policy advocacy and impact; guide the IFAD-ONL's partners to understand and support women's roles as managers of biodiversity, and finally to capture measurable and demonstrable results. Moreover, it is intended that this baseline survey serves as a public tool that could be used by any programmes interested in conducting similar work. The survey exercise is also seen as an iterative learning process, allowing improvements to be incorporated in future baseline and monitoring tools. Any data gaps identified in the current baseline survey will be addressed through the season-long FFS and focus group discussions, and respective improvements to the baseline tools will be made accordingly. The following section presents a summary of the lessons-learned, reflection and recommendations.

<u>Programme partners' reflection on the common framework topics, adopted by the baseline survey:</u>

a. *Process and methodology*: the common framework developed at the beginning of this survey proved to be a good practice for global consolidation and has been useful in terms of structuring and guiding the analysis of the country-specific baseline reports.

The key topics covered by the common framework include; demographic information, biophysical information, climatic phenomena, farming systems, agro-biodiversity, economic information, institutions and policies and gender relations in agriculture. Information collected on demographic, biophysical and climatic phenomena is comprehensive. However, data on farming systems; agro-biodiversity; institutions and policies (power analysis of different PGR actors, in particular, outlining the role of institutions in strengthening community PGR systems) and food and nutrition will need to be further refined during the IFAD-ONL Scaling-up programme, through the use of other participatory tools. The potential use of these participatory tools will be discussed with the IFAD-ONL Scaling-up programme partners and communities, to complement any data gaps the country specific surveys. Recommendations pertaining to the participatory tools are briefly presented below.

b. *Gender aspect*: the application of the tools (see below) will ensure that i) both women and men share their inputs, ii) the data documented will be disaggregated for female and male, iii) the data containing women's preferences and opinions will be processed, analysed and presented accordingly, for each of the key topics of the baseline survey.
c. Within *each topic of the common framework*, additional basic units of observation or analysis will be collectively agreed upon (i.e. variety, crop species, and seed lots).
d. In addition to the common framework, the survey could benefit from the use of *a set of hypotheses* and *key questions for each key topic of the common framework*.
e. *The link* between the survey's *common framework's key topics* and *the indicators* of the IFAD-ONL Scaling-up programme could be further strengthened. Seed security and food security were identified as important indicators of the Scaling-up programme. Similarly, farmers' adaptive capacity is an important topic of the survey, as it determines the programme's future intervention. Thus, for future reference, seed security, food security and farmers' adaptive capacity will be included as key topics within the common framework.
f. The IFAD-ONL programme can consider to broaden the understanding of the existing power relations amongst the stakeholders, in terms of access to and control over PGR and access to market; as well as exploring the potential roles of research agencies, government and private sector, in supporting farmers PGR management. This is especially needed for building capacities for developing new cultivars in the context of climate change. Besides the secondary data gathering, a comprehensive Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, key informants' interviews, and focus group discussions, focusing on power relations within the access to and control of PGR can be carried out.

Reflection on the tools applied in the baseline surveys

From the findings of the baseline survey, it is observed that the data on demographic, biophysical and climatic phenomena are comprehensive, whilst the information on farming systems, and in particular on agro-biodiversity, could be more elaborate. The following recommendation for tools improvement focuses on the PGR component (agro-biodiversity key topic of the common framework) of the baseline survey.

Recommended tools on agro-biodiversity[23]

a. **Tools on crop diversity** aim to enable farmers to have a collective and systematic understanding of their production systems, of the crops cultivated in these (changing) systems. , These include: *four square analysis or diversity wheel (for crops), crop listing*

[23] Some of the recommendations are adapted from the Field Guide for Participatory Plant Breeding in Farmer Field Schools, PEDIGREA (H. Smolders and E. Caballeda, 2006)

and categorization, crop prioritization and time line analysis. The crop listing and categorization include a list of key crops and each crop is categorized according to how seeds are accessed or produced, i.e. from seeds by farmers, vegetatively propagated by farmers, outside inputs. The crop diversity tool currently applied by the survey is good and recommended for further use. It is recommended to focus mainly on major crops. This tool could also be useful to analyse the extremely PGR diverse home gardens. For future programmes, focusing on nutrition, it is recommended to cover the neglected and underutilized species (NUS). The existing farmers' crop management tools and questionnaires are good. This will describe the management, whether it is intensive or low input, or a combination of the two.

b. **Tools on genetic diversity** aim to facilitate farmers to: i) have an overview of the level of diversity of their chosen major crops, ii) identify the different positive and negative traits of the particular varieties preferred by farmers, and iii) have an understanding of the changes of varieties of their important crops over time, including those influenced by climate variability. Farmers could start by listing the varieties per major crop as an indication of the level of diversity (*variety listing and characterization/categorization*). Thereafter, farmers could identify the important morphological and agronomic traits and rank these varieties (*diversity wheel*). The current tools applied by the survey on the sources of varieties, type of varieties (traditional or modern, or farmers' varieties or formal/commercial) remains relevant as it is part of the core focus of PGR work. The current tool on "changes of varieties in use" (*timeline analysis for varieties*) can be systematised as there are clear reasons why some varieties are lost, maintained, or gladly received and adopted. These then can be used to assess varieties and help determine the reasons for not using some varieties and adopting new ones. The timeline analysis should focus on: i) changes of the agro-ecosystems (e.g. irrigation will change cropping patterns and change varieties); ii) changes in crops; iii) changes in varieties, and iv) changes in the market (increased access like roads will also change agriculture systems). These exercises could help farmers to identify areas of development, and potentially breeding objectives.

c. **Tools on seeds system analysis** aims to facilitate farmers to analyse their seeds supply system in relation to specific crops (traditional, OPVs, self-pollinating crops and hybrids) and if applicable, the reasons for changes in seeds sources. These include: assessment of seed sources according to farmers' criteria and timeline analysis for seed lot sources. Farmers could start identifying their important seed lot qualities (e.g. purity, seed health and vigour, free from disease, free from pest eggs, free from weed seeds, germination percentage, etc.). Farmers could then assess their seeds, and the seeds from other sources. The tool on *"seeds sources"* is good and recommended. Farmers can rank their sources according to the farmers' criteria mentioned above. Inclusion of "varieties" in the tool for seed lot assessment is not recommended. The existing tool to assess *farmers' seed production systems* is useful and recommended for further use, especially as they move from local exchange to greater participation in the seed market.

d. **Tools on farmers' analysis of their PGR management** aims to facilitate farmers to i) collectively analyse their knowledge, skills and techniques in developing and maintaining varieties, ii) understand existing limitations and practical challenges faced by their system of PGR management (access to diversity and pre-breeding capacity) and iv) identify areas for improvement and required institutional (including policy) support. The tool used for this purpose is the *comparative analysis table* between the farmers' PGR management, to create and maintain varieties with the formal system of research and development. A specific tool to assess strengths and weaknesses of farmers' systems (e.g. access, capacity to create diversity, techniques to facilitate genetic progress, capacity for adaptation trials) *in relation to indigenous knowledge system (IKS)* should be integrated in the next survey (and/or FFS) to help define the learning objectives.

Reflection on other tools applied by the survey:

e. **Tool for household livelihood activities** (discussed under socio-economic topic of the common framework) is very good and recommended for further use. It is recommended that, if it is not yet included in the baseline, follow up questions will be added to clarify the ranking of livelihood strategies.
f. **Tool (questionnaire) on land use** (to collect demographic information) proved to be useful to indicate the importance of each major crop. It is recommended, however to assess the crops with a separate tool, to determine the importance to households' livelihood systems. A simple timeline on crops could show important changes in the production systems. Furthermore, a tool that could help farmers identify other neglected and underutilized species is also recommended for use (see point a., "tool on crop diversity" above).
g. **Tool on asset base** is important to guide farmers in identifying their assets (social, human/labour, infrastructure, institutions). In Zimbabwe, it is useful to understand that farmers practice a mixed type of agriculture, that includes crop and horticultural production, livestock, and whatever assets (land, livestock, labour, agricultural inputs) are available to each household. Therefore, it is recommended to continue using and sharpening the asset base tool.
h. **Tool on crop market analysis** aims to provide farmers with an overview of the existing markets and market channels, and an idea of the contribution of certain crops and varieties to income generation in the community. The tools include: village market analysis (importance of markets for income generation) and market chain analysis.
i. At the time of the baseline completion, the IFAD-ONL programme partners could only estimate and appreciate some part of **farmers' adaptations strategies**. An in-depth analysis and verification of farmers' adaptation strategies as well as areas of development and potentially breeding objectives will remain to be further discussed in any follow up FFS and FGD.

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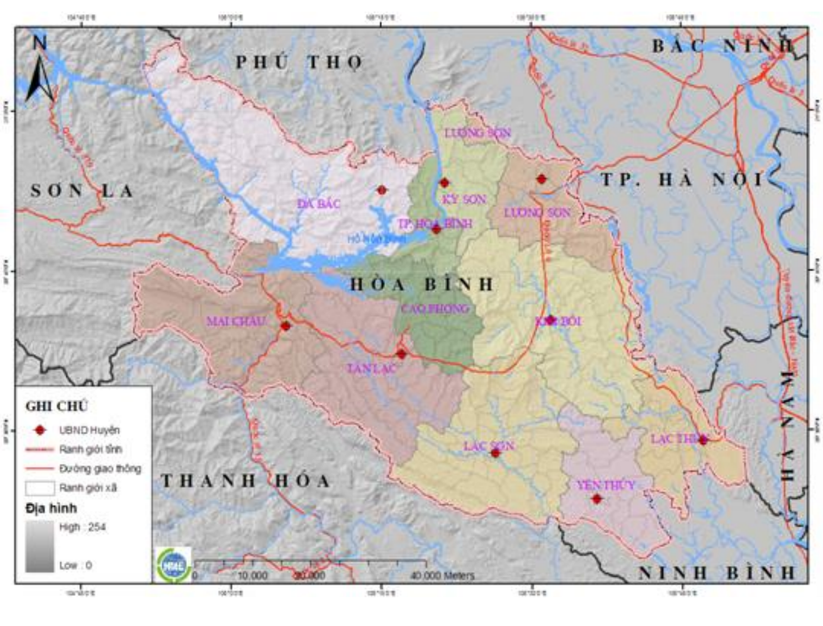
7. Attachments

Annex 1

Map 1 Location of the rural communities participating in the project in Lares District

Source: Own elaboration from maps of the Ministry of Energy and Mines. Peru. 2009.

Map 2 Administrative map of Hoa Binh Province, Vietnam

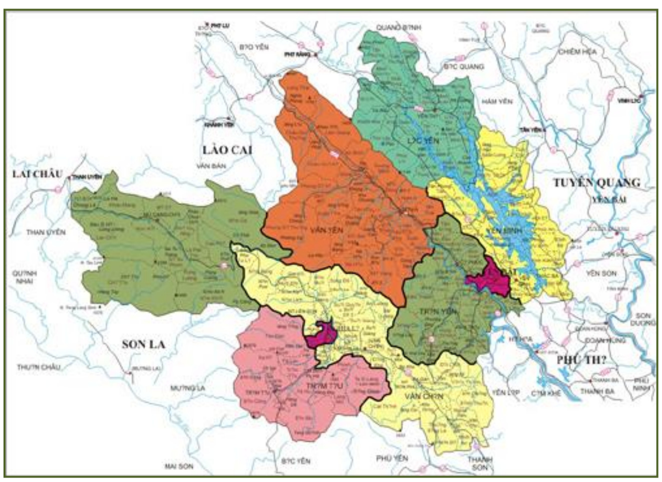


Source: Statistics of Meteorological Centre of Hoa Binh province.

Map 3 Administrative map of Son La Province, Vietnam

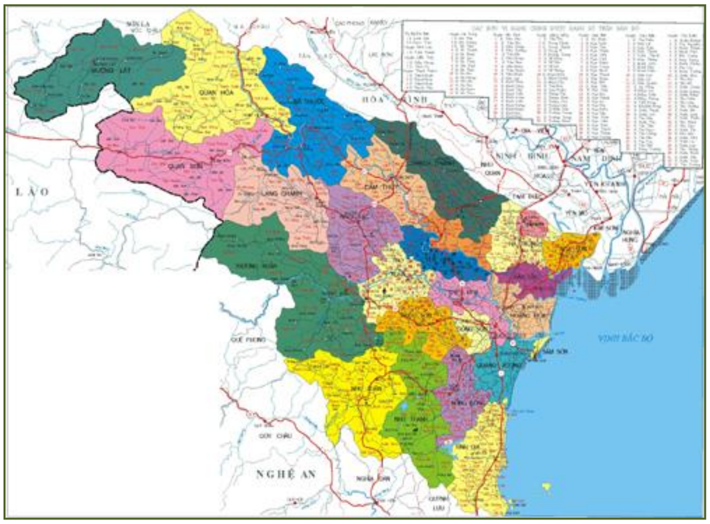
Source: Statistics of Meteorological Centre of Son La province

Map 4 Administrative map of Yen Bai Province, Vietnam



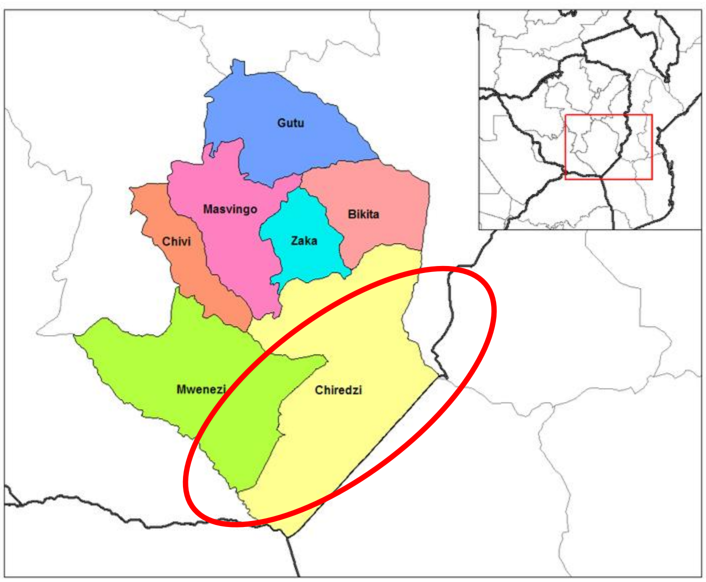
Source: Statistics of Meteorological Centre of Yen Bai province

Map 5 Administrative map of Thanh Hoa Province, Vietnam



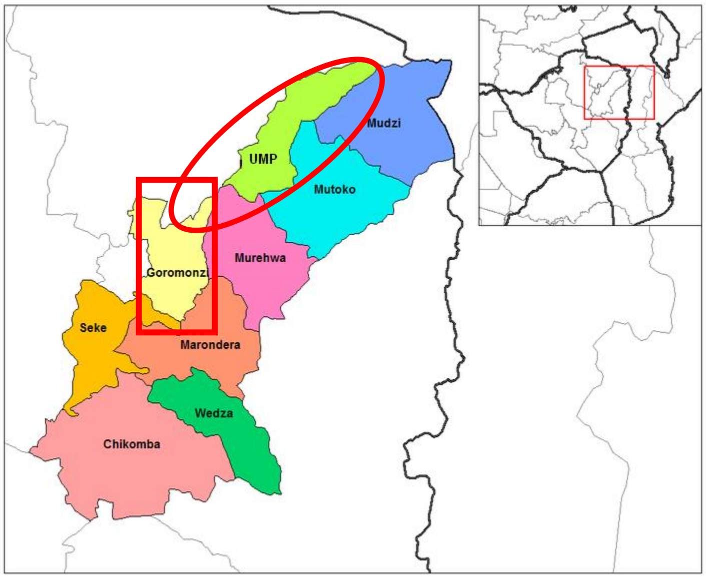
Source: Statistics of Meteorological Centre of Thanh Hoa province

Map 6 Chiredzi District, Zimbabwe



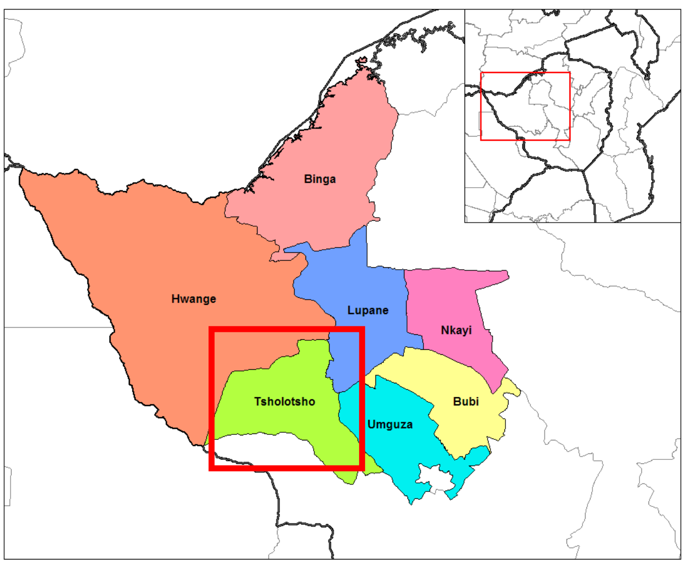
Source: http://en.wikipedia.org/wiki/Districts_of_Zimbabwe

Map 7 Goromonzi and UMP Districts, Zimbabwe



Source: http://en.wikipedia.org/wiki/Districts_of_Zimbabwe

Map 8 Tsholotsho District, Zimbabwe



Source: http://en.wikipedia.org/wiki/Districts_of_Zimbabwe

Box 1 What is a Diversity Wheel?

A d**iversity wheel is a tool for** analysing **the status of crop diversity. It is an adapted version of the** four **square analysis tool by Bioversity International and improved by Li Bird**[24]**.**

The meaning of the 5 categories:

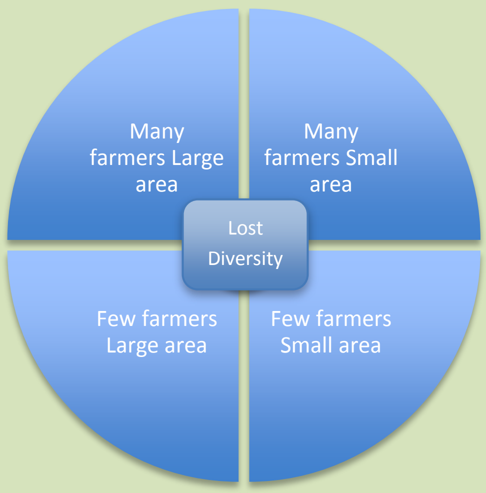
Many farmers Large area: **these are common crops in the area**, **including staple food crops**

Many farmers Small area: **not commercially important crops and are often used as food supplements. Nutritionally, these are very important crops.**

Few farmers Large area: **crops with a high market value (usually cash crops**, **e.g.**, **tobacco, wheat, cotton)**

Few Farmers Small Area: **these are endangered crops and are on the verge of disappearing**

Lost Diversity: **these are crops that the communities have lost but can** be **very important for** household **food security. Interventions to bring them back to communities include seed fairs and repatriation from gene banks.**



[24] Further information can be obtained through the Local Initiatives for Biodiversity, Research, and Development (Li-Bird).

Picture 1: Woman farmer in Zimbabwe benefitting from the use of rain gauge, a simple tool to predict rainfall

(Source: Shepherd Tozvireva, Oxfam Novib, 2013)

Picture 2: Diversity Wheel demonstration in UMP District, Zimbabwe

(Source: ONL, 2013)

Other documents:

- **Project Inception Meeting Report, Rome, 2012.**
- **Briefing note "Building on Farmers' Perception and Traditional Knowledge: Biodiversity Management for Climate Change Adaptation Strategies"**
- **Sample Questionnaire from Vietnam**