

CLIMATE CHANGE AND DEVELOPMENT PROJECT, PILOT PHASE

CLIMATE CHANGE VULNERABILITY ASSESSMENT IN ZAMBIA



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1. INTRODUCTION

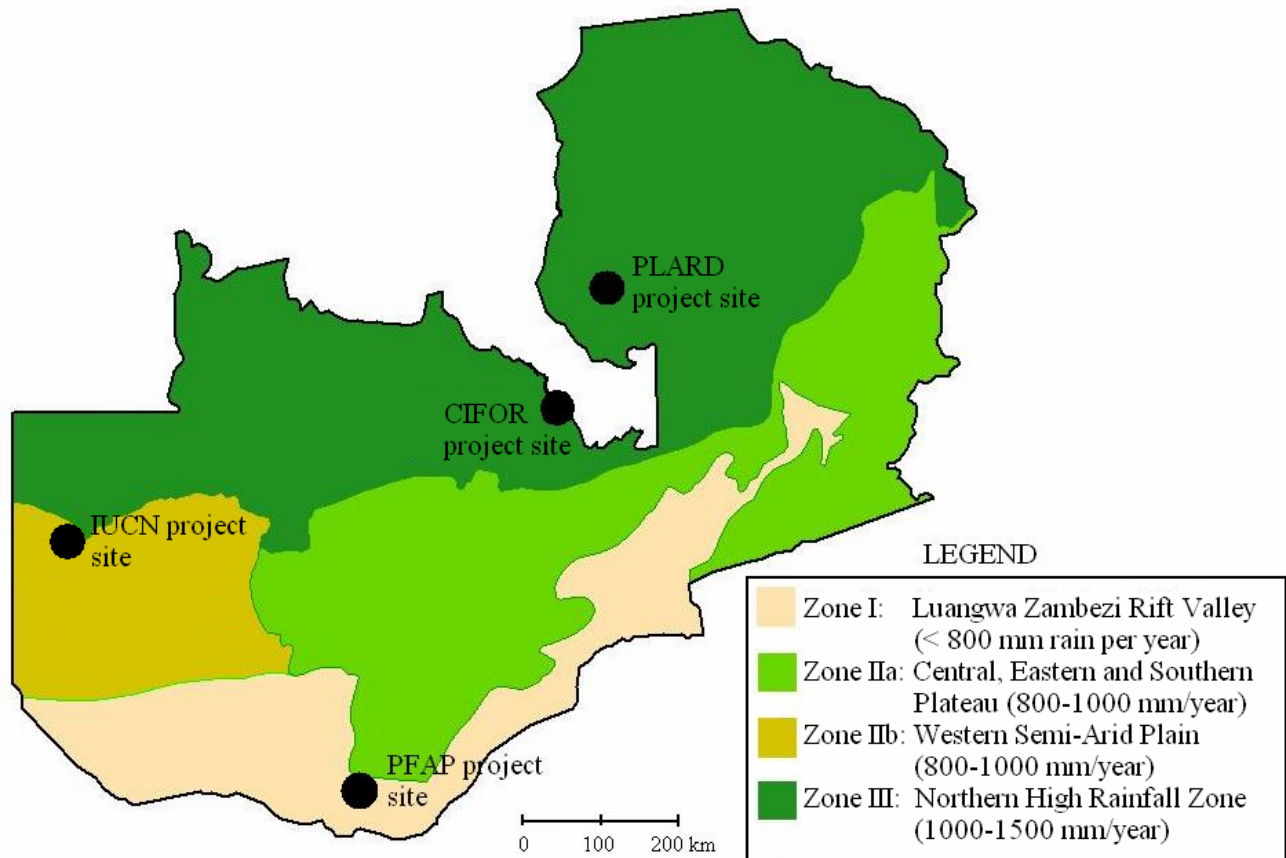
As part of the pilot phase of the IUCN Climate Change and Development Project, funded by the Ministry of Foreign Affairs of Finland, a climate change vulnerability assessment was undertaken in four ongoing field project sites in Zambia. The purpose of this vulnerability assessment was three-fold:

1. To get **indication of the risks related to climate change at the local level for the full-size project proposal**. Ideally, the full-size project will concentrate on increasing resilience towards the risks identified during the pilot phase.
2. Introduce the managers and implementing team of the four ongoing projects **an easy-to-use tool for assessing climate related risks** in their project areas and **provide a framework to adjust project activities** in a way that they will not have negative impact on local coping strategies under the climate pressure.
3. **Provide complementary information** on climate hazards and on existing coping strategies at the local level **for decision makers** and other actors involved in the current national level climate change policy discourse, such as the National Action Plan for Adaptation (NAPA) and National Communication processes.

The four field project sites were located in three different agroecological zones of Zambia (Figure 1):

1. CIFOR project site in Mufulira District, Copperbelt Province (agroecological zone III)
2. The World Conservation Union (IUCN) Zambezi Basin Wetlands Project (ZBWP) Phase II in Lukulu District, Western Province (agroecological zone IIb)
3. Finland-funded Programme for Luapula Agricultural and Rural Development (PLARD) in Luapula Province (agroecological zone III)
4. Finland-funded Provincial Forestry Action Programme (PFAP) Phase II, Dambwa Local Forest, Livingstone District, Southern Province (agroecological zone I)

Figure 1: Agroecological Zones of Zambia and Field Project Sites



Climate change local-level vulnerability assessments were accomplished using Community-Based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL). CRiSTAL is a decision support tool developed jointly by IUCN, IISD, SEI-B and Intercooperation that is intended to enable project planners and managers to assess and enhance a project’s impact on community-level adaptive capacity. This tool includes two modules, four main questions, and a series of subquestions:

Module 1: Synthesizing information on climate and livelihoods

Question 1: What is the climate context?

- 1.1. What are the main climate hazards?
- 1.2. What are the main impacts of those hazards
- 1.3. What are the communities’ strategies to cope with these impacts?

Question 2: What is the livelihood context?

- 2.1. What are the main livelihood resources?
- 2.2. How are those resources influenced by climate hazards?

2.3. How important are those resources for coping with climate hazards?

Module 2: Planning and managing projects for adaptation

Question 3: How are project activities influencing the resources that have been identified in the previous module as being vulnerable to climate risks or important for coping with climate hazards?

Question 4: How can project activities be adjusted to reduce vulnerability and enhance adaptive capacity, and what are the synergies and barriers to making those adjustments?

Module 1 (setting the climate and livelihood contexts) was carried out through community consultations, except for question 2.3. A total of 8 community consultations were accomplished, which included:

1. Beekeepers, Village #14, CIFOR project site
2. Members of the Women's Club, Village #14, CIFOR project site
3. Members of the Mifulira District Charcoal Burners Association, CIFOR project site
4. Symunyingi Village, Lukulu District, IUCN ZBWP site
5. Lukwesa Village, Luapula Province valley system, PLARD project site
6. Chimfula Village, Luapula Province plateau system, PLARD project site
7. Katanshya Village, Luapula Province lake system, PLARD project site
8. Members of Village Resource Management Committees, Dambwa Local Forest, PFAP project site

Question 2.3 and Module 2 (planning and managing projects for climate change adaptation) were accomplished through meetings with local project teams, including staff from development organizations and programmes (CIFOR, IUCN, PLARD) and government officials from the departments of forestry, agriculture, and fisheries.

The next chapter presents some background information on climate change vulnerability and adaptation. Chapter 3 presents detailed results of the 8 community consultations, and an overview of the consultations with local project teams (full analysis of consultations with project teams is available upon request from Beatrice Riche). A summary and analysis of results is provided in Chapter 4, and a conclusion in Chapter 5.

See Annex 1 for mission agenda and itinerary, Annex 2 for lists of participants, Annex 3 for contact details, and Annex 4 for suggestions on CRiSTAL improvements.

2. BACKGROUND ON CLIMATE CHANGE VULNERABILITY AND ADAPTIVE CAPACITY

Vulnerability to climate change is "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes." Vulnerability is a function of:

- The magnitude, character and rate of climate change
- The sensitivity of the system, i.e. the degree to which the system is adversely or beneficially affected by climate-related stimuli
- The adaptive capacity of the system, i.e. the system's ability to adjust to climate change, to moderate or cope with the impacts, and to take advantages of the opportunities (IPCC, 2001).

Some regions of the world are considered more vulnerable than others to climate change. Most less-developed countries, including Zambia, are highly vulnerable because a large part of their economy is dependent on climate-sensitive sectors like agriculture and local natural resources, and their adaptive capacity is often limited by inadequate human, financial and natural resources, and by low institutional and technological capability (IPCC, 2001).

Africa is considered to be among the most vulnerable regions of the world to climate change. According to the IPCC predictions (IPCC, 2007):

- By 2020, 75-250 million people in Africa will be exposed to increased water stress due to climate change
- Agricultural production, including access to food, is projected to be severely compromised by climate variability and change
- There is an expected decrease in area suitable for agriculture, length of growing seasons and yield potential, particularly along margins of semi-arid and arid areas
- In some countries, yields from rain-fed agriculture could be decreased by up to 50% by 2020
- Local food supplies are projected to be negatively affected by decreased fisheries resources in large lakes due to increased water temperatures, which may be exacerbated by continued over-fishing.

Community-level projects, mainly those dealing with ecosystem or natural resource management, can either improve adaptive capacity of communities or constrain it. However, a lack of climate change awareness and understanding amongst decision makers and development project planners, and a low capacity to assess vulnerability, limits the inclusion of climate change adaptation as an important issue in decision making, project development and national policies.

3. CONSULTATION RESULTS

3.1. CIFOR Site, Mufulira District, Copperbelt Province¹

Mufulira District is located in the agroecological zone III. The main activities undertaken by communities in this district are:

1. Beekeeping: There is a beekeeping association. It is done by both men and women (the Chairperson is a woman). It is not a traditional activity, it has been introduced as a project by the Forest Department to improve livelihoods and protect the environment. The Forest Department is hoping that beekeeping will enhance forest conservation by local populations.
2. Charcoal burning: There is an association for charcoal burners. This is a traditional activity. People need to buy licenses to burn charcoal.
3. Copper mining: This activity is highly dependent on wood availability. A lot of wood is required for mining operations (to produce electricity and to remove oxygen from copper). The mining industry is presently not engaged in forest management, and monitoring of wood cutting is not effective.
4. Agriculture: This is a traditional activity. It also often involves tree cutting and it is mainly for subsistence. Miners often practice agriculture as well.

Three vulnerability assessments were undertaken in this district, with groups of villagers having different types of livelihood. Consultations were organized with beekeepers in Village #14, members of the women's association in Village #14, and charcoal burners in Sosala village.

3.1.1. Community Consultation, Beekeepers, Village #14

There are about 500 people in this village. The village has existed for about 15 years. There are 16 members in the beekeeping committee.

This region received a lot of rain this year, which resulted in floods, low yields and destruction of houses. Millet is rotting due to heavy rains. Cassava has not started making tubers yet, so villagers cannot harvest. Many houses have collapsed. According to participants, houses are fragile to floods because of poverty. Droughts in recent years have also led to reduced crop yields, and community members need to search for wild foods to survive. In September and October, it gets very dry, and there is often no more water to drink. Villagers cut trees, make charcoal, and sell it to survive. They also go look for mushrooms and sell them to have money to buy food. Participants are asking us “How

¹ For additional information on the vulnerability assessments in Mufulira District, please refer to Hammill, A., *CRiSTAL Application in Mufulira District*. The report is available from virpi.stucki@iucn.org upon request.

can we survive when facing floods and droughts?” and are saying “We need to find other means of survival [than agriculture]”.

The 3 main climate hazards affecting participants’ livelihoods are: floods, droughts, and high temperatures. The climate hazards’ main impacts and the community’s coping strategies are presented in the table below.

Table 1: Climate Context (Beekeepers, Village #14, Mufulira District)

	Hazard	Impact	Coping Strategy
1	Drought	Crop damage/loss	Charcoal making
		Income loss	Casual labour
		Disease (diarrhea, sore eyes, jigas)	Use of medicinal herbs
2	Floods	Crop damage/loss	Gathering of wild food
		Disease (malaria, sores, dysentery)	Use of medicinal herbs
		Damage to dwellings	Putting plastic on top of houses
3	Extreme heat	More diseases (both animal & human)	Medicinal herbs
		Crop damage/loss	Same as for drought & flood
		Physical fatigue & hunger	Bathing frequently

An interesting finding is that there are more flowers and higher honey production in times of drought. Therefore, an additional coping strategy to deal with crop loss in times of drought is to go out to the bush and look for bees for honey production. However, if the drought is prolonged, then honey production will be negatively affected, since bees need water and will move elsewhere. In times of flooding, there are less wild flowers, and lower honey production. There has been a lot of rain and floods this year, so honey

harvests will be reduced and delayed. However, this means that honey prices will go up, which pleases honey producers.

The participants' income generating activities are: charcoal burning, beekeeping, agricultural production (the women sell maize, cassava and sweet potatoes beside the main road, and some cassava is sent to Lusaka), mushroom and caterpillar harvesting and selling, and casual labor (mainly land clearing for agriculture). However, most of the agricultural production is for subsistence. For villagers' own consumption, they produce maize, cassava, pumpkins, sweet potatoes, rice, groundnuts, potatoes, monkey nuts, millet and sorghum. One participant stated during the discussion: "the only way to survive is by making charcoal", which also demonstrates the importance of this activity.

The natural resources identified by participants as being the most important to their livelihoods were all forest resources/products: trees (mostly for charcoal production), bees (for honey production), mushrooms (for consumption and sale), and wild fruits. The main physical resources identified were: roads, agricultural implements, bicycles, and grain storage facilities. The main human resources identified were: charcoal making skills/capacities, agricultural skills/capacities and selling/business skills/capacities. Other skills/capacities which differed in importance between individuals and gender were: knitting, hair plaiting, blacksmithing, fish trapping, basket making, and beer brewing. Participants had difficulty agreeing on the most important social resources. They mentioned: the beekeeping association, the women's club, agricultural cooperatives, the church, and the crime prevention association. Liquid assets (chickens, goats, crops, mushrooms, honey, caterpillars and charcoal) are the most important financial resources. A few participants also receive remittances.

3.1.2. Community Consultation, Women's Association, Village #14

As women and men have different roles and responsibilities, we decided to organize a separate meeting only with women, to see if their perceptions on climate hazards, impacts, coping strategies, and main livelihood resources differed. Most of the women who came to the meeting were present in the previous meeting (Village #14, Beekeepers), but had not expressed their ideas out loud as much as the men. Although women's perceptions and priorities ended up being quite similar to those of the men, this meeting gave us the opportunity to clarify some livelihood aspects more important to women, like crop production and commercialization, and to go further in the analysis and look at how climate hazards are affecting their main livelihood resources. The livelihood resources most important to villagers and the extent to which these livelihood resources are influenced by climate hazards are presented in the table below. Influences (above the 0 level) are all negative, except when indicated in the "Notes" section on the right-hand side of the table.

Table 2: Livelihood Context (Village #14, Mufulira District)

Extent to which livelihood resources are influenced by climate hazards identified in the climate context (0 = no influence, 5 = full influence):																		
Resource	Drought			Floods			Extreme heat											
	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Natural Resources																		
1 Trees				X				X					X					
2 Bees					X						X						X	
3 Mushrooms					X					X						X		
Physical Resources																		
1 Roads		X										X	X					
2 Bicycles				X					X							X		
3 Agricultural implements	X						X						X					
Financial Resources																		
1 Liquid assets (livestock, etc.)					X				X									X
2 Remittances				X						X			X					
3	X						X						X					
Human Resources																		
1 Charcoal making capability	X								X									X
2 Business / selling capability		X					X									X		
3 Agricultural work capability (for casual labour)					X					X								X
Social Resources																		
1 Beekeeper's Association			X						X				X					
2 Women's Club			X						X				X					
3 Cooperatives			X						X				X					

Notes on Climate Hazards	
Notes Hazard 1	Drought has positive impact on bees/flowering; also positive impact on remittances -- more money sent during droughts
Notes Hazard 2	Floods have positive impacts on mushrooms (more supply after flood), remittances and charcoal making skills (increased demand & comp advantage)
Notes Hazard 3	Slightly positive effect on social organisations -- able to sit around and meet/chat

After the meeting, we visited the Beekeepers Association’s honey production site. The association has only one communally owned site so far, which is located in a forest reserve. They have started honey production about 4 years ago. Members are hoping to receive training on honey processing techniques in the near future.

3.1.3. Community Consultation, Charcoal Burners, Sosala Village

Participants in this consultation were part of a Charcoal Burners’ Association. There are about 200 charcoal burners in Mufulira District, and about 100 of them are part of the association. Charcoal burning is the main (and often the only) income-generating activity undertaken by the participants. They transport the charcoal using bicycles or wheelbarrows, and sell it to users in other areas of the Copperbelt Province. Some participants also practice farming, either for their own consumption or for commercialization. However, farming is a more recently introduced activity in these communities, and most participants buy most of the food that they eat, as they do not produce much. Most of the money that they make via charcoal burning is used to buy food.

Due to deforestation and the resulting decrease in the availability of trees in the area, charcoal burners find it more difficult to buy a license to make charcoal. They use trees from indigenous forests and tree planting is not currently practiced. They would be

interested in planting trees, but there is a lack of funds and the government is not providing seeds or seedlings anymore, so they would need to buy some.

The main three climate hazards affecting the participants' livelihoods are: drought, floods, and late coming of the rains (shorter rainy season). Climate hazards' impacts and charcoal burners' main coping strategies are presented in the table below.

Table 3: Climate Context (Charcoal Burners, Mufulira District)

	Hazard	Impact	Coping Strategy
1	Drought	Crop damage/loss	Food rationing
		Water shortage	Dig deeper wells for domestic water
		Reduced charcoal business	Decrease price of charcoal
2	Floods	Damage to dwellings	Rent houses from neighbours
		Crop damage/loss	Casual labour (slash & burn agriculture)
		Increase in disease (malaria, dys, cholera)	Bury ditches (to cover water) & slash surrounding vegetation
3	Late rains / Shorter rainy season	Reduced charcoal prod'n & business (hard ground)	Build charcoal kilns near ant hills (where earth is softer)
		Crop damage/loss	Wild food gathering

Drought leads to more competition for charcoal making and therefore less business. Late coming of the rains also affects charcoal burning business negatively, as competition increases, the ground becomes harder and production is more difficult. Floods, on the opposite, lead to a competitive advantage for specialized, experienced charcoal burners, as they are the only ones who can manage to make charcoal in flood conditions. Also demand usually increases in times of floods.

Crop production is negatively affected by the three main climate hazards, and charcoal burners cope by: food rationing, doing casual labor (mainly agricultural work), selling more charcoal, borrowing money for food, and wild fruit harvesting. Late coming of the rains does not allow crops to reach maturity, and charcoal burners lack money to buy early maturing seeds.

3.1.4. Consultation with CIFOR and IUCN staff

The IUCN Climate Change and Development Project and the CRiSTAL tool were presented to Manyewu Mutamba (CIFOR) and Excellent Hachileka (IUCN). A short training on CRiSTAL was provided, and we went through the CRiSTAL process using data collected during the community consultations in Mufulira District.

The CIFOR project in that district is mainly a research project, so no project activity is presently implemented with the communities. Therefore, Module 2 of CRiSTAL did not really apply, but we still went through it using a potential future project activity (tree planting).

3.2. IUCN Zambezi Basin Wetlands Project (ZBWP) Phase II, Western Province

The Zambezi Basin wetlands are some of the most productive ecosystems in Southern Africa. They support some of the largest contiguous wildlife populations and habitat on the African continent, while providing fresh water for human consumption and economic development, pasture for livestock and wildlife, fertile soils for agriculture, and significant yields of fish.

The CIDA-funded IUCN ZBWP started in 1995 and will end in 2009. The overall project goal is to contribute to the sustainable use of Zambezi Basin wetland ecosystems. The ultimate purpose is to influence the development of national policies and regional protocols that maintain and/or improve the ecological integrity of wetland ecosystems, while improving the well-being of wetland communities. The project covers 4 districts in Western Province: Lukulu, Mongu, Kalabo and Senanga. Simbotwe Mwiga is the Field Project Officer for this project and he participated in the climate change vulnerability assessment.

3.2.1. Community Consultation, Samunyingi Village, Lukulu District

Ten farmers (called contact farmers) from Lukulu District are presently involved in the IUCN ZBWP. These contact farmers have been elected by the community members. We did an initial visit to the project site (Mbanga area, Lukulu District) to meet the contact farmers and organize a consultation for the following morning. However, sudden heavy rains and consequent floods, road and bridge destruction prevented us from reaching

these farmers the next morning. We therefore organized a consultation with farmers living in a more accessible village not far from the project site. Even though these farmers were not directly involved in the IUCN ZBWP, their livelihoods and climate context were similar to those of the contact farmers involved in the ZBWP.

The village and area where the consultation took place is called Samunyingi. The village chief (Francis Masheke, also called Induna Samunyingi) is the head of about 30 villages, which involve about 1520 inhabitants. The village in which we did the consultation had 10 adults and about 25 children. All the adults in the village participated in the consultation.

Participants had already heard of climate change through the radio, and described it as “changes in weather patterns”. Participants mentioned having experienced changes in rainfall patterns and temperature during the last 5 years. The rains and floods start earlier and last longer; the temperature is warmer during both the rainy season and the dry season; and during the dry season, there are more droughts than before. Participants think that this is a global problem, as they have heard about “global warming”. However, they had not heard about the causes of this problem. We therefore gave them some basic information on climate change, its causes, impacts, extent, and the importance of mitigation and adaptation measures.

Samunyingi is mainly an agricultural community. They produce maize, cassava and sweet potatoes, mainly for their own consumption. They also sometimes need to buy groundnuts or maize, especially when crops have been destroyed by climate hazards. This year, floods have destroyed almost all the maize production. Villagers are also involved in fishing and animal husbandry (small livestock).

The 3 main climate hazards identified by participants are: floods, drought, and extreme heat. The main impacts of these climate hazards and the communities’ current coping strategies are presented in the table below.

Table 4: Climate Context (Samunyingi Village, Lukulu District)

	Hazard	Impact	Coping Strategy
1	Floods	Crop loss and loss of cropland and grazing ground	Fish catching and selling to buy food
		Life loss (humans and livestock)	Early evacuation when water levels increase
		Damage to dwellings	No prevention measures
2	Drought	Crop damage/loss	Growing cassava
		Water shortage (affects animals and humans)	Dig deeper wells
		Disease outbreaks due to bad water	Traditional medicines (tree products and herbs)
3	Extreme heat	More diseases affecting humans and animals	Traditional medicines
		Crop damage/loss	Alternative income-generating activities

The influence of those climate hazards on the community's main livelihood resources was also discussed with the community members. The table below presents the main livelihood resources in the left column, and the level of influence of the main three hazards. Influences (above the 0 level) are all negative, except in the case of floods' influence on fish and fishing capacity, and extreme heat's influence on bricklaying, which were considered positive.

Table 5: Livelihood Context (Samunyingi Village, Lukulu District)

Extent to which livelihood resources are influenced by climate hazards identified in the climate context (0 = no influence, 5 = full influence):																			
Resource		Floods					Drought					Extreme heat							
Hazard:		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Natural Resources																			
1	Fish				X								X						X
2	Livestock					X						X						X	
3	Fertile agricultural land						X				X		X						
Physical Resources																			
1	School					X		X					X						
2	Roads						X	X					X						
3		X						X					X						
Financial Resources																			
Liquid assets: crops (maize), livestock (chicken, cattle), fish																			
1						X						X						X	
2		X						X					X						
3		X						X					X						
Human Resources																			
1	Farming capability					X						X				X			
2	Fishing capability				X							X				X			
3	Craft-making and brick-laying capability				X						X					X			
Social Resources																			
1	Church			X				X								X			
2	Farming cooperative (but it is not working anymore)	X						X					X						
3		X						X					X						

3.2.2. Consultation with the IUCN ZBWP Phase II Field Project Officer

The last section of CRiSTAL module 1 (the importance of livelihood resources for coping with climate hazards) and module 2 were completed with Simbotwe Mwiga, the Field Project Officer for the ZBWP Phase II.

The screened project activities were:

1. Training of contact farmers in agricultural extension (land preparation, planting, weeding, use of chemical fertilizers and manure)
2. Distribution of farming inputs (NPK fertilizers, seeds, cash for labor costs)
3. Monitoring of crop development by the IUCN project team
4. Training of contact farmers on harvesting techniques and crop storage and marketing

3.3. PLARD site, Luapula Province

The Finland-funded Programme for Luapula Agriculture and Rural Development started in April 2006 and is foreseen to end in 2010. The overall objective of the programme is to contribute to the development of an efficient, competitive and sustainable agricultural and rural sector, which ensures increased income and food security for the people of Luapula province.

There are three seasons in agroecological zone III: the rainy season (November to March), the cold season (May to end of July) and the hot season (August to October). This zone receives at least 1000 mm of rain per year. According to Henry Chilufya, Senior Forestry Officer in Luapula Province, the rainy season in this region is shorter than it used to be – it starts later and ends earlier. The rainy season stops in March now, but it used to last until April. However, during the rainy season, rains are heavier (more intense) than about 10 years ago. This year, there has been about twice as much rain as usual, in only two months. Floods are affecting people and wildlife, which are moving to higher lands. Also, both droughts and erosion (mainly due to deforestation for slash and burn agriculture) affect hydroelectric power generation.

There are three main ecosystems and livelihoods in Luapula Province: lake system (mostly fishing communities); valley system (fishing communities switching to agriculture due to declining fish stocks); and plateau system (mostly agricultural communities). Climate change vulnerability assessments were conducted for each of these three livelihood systems.

3.3.1. Community Consultation – Valley System, Lukwesa Village, Mwense District

Fish depletion, due to over-fishing, has led communities in the Luapula River Valley to find alternative income-generating activities. Many former fishermen are therefore becoming agriculturalists.

Community members mentioned having heard of climate change before. As examples, they mentioned the tsunami in Bangladesh, different diseases that are appearing, variations in rainfall patterns (droughts and floods), and an increase in temperatures. When we asked them if they had, themselves, experienced any long term changes in weather patterns, they mentioned the appearance of different diseases, more floods (especially this year) and droughts, an increase in temperatures, and decreasing crop yields due to drought (even for cassava, which is relatively drought tolerant compared to other crops and which is their main staple food). Climate variations and extremes have been, according to participants, more apparent in the last 15 years than previously. Also, the growing season is shorter than before. Rains stop earlier, and there are many dry spells during the rainy season.

Participants were not aware of the causes, or drivers, of climate change. Some mentioned that a decrease in tree cover could change raining patterns, but this led to a debate

amongst them, as others argued that some areas have a lot of trees but experience changes in climate as well. We therefore explained to participants the basics of climate change (causes, impacts, predictions, and the importance of mitigation and adaptation).

The main climate hazards experienced by participants, the impacts of those hazards, and the main coping strategies are presented in the table below:

Table 6: Climate Context (Valley System, Lukwesa Village)

	Hazard	Impact	Coping Strategy
1	Floods	Crop damage/loss	Buying food from other areas
		Destruction of infrastructures (buildings, roads)	Shift living place to higher land
		Increase in water-borne diseases	Boiling water
2	Extreme heat	Increase in diseases (livestock, crops and humans)	Do nothing
		Reduced fish stocks	Income diversification (mainly agriculture)
		Reduced water quality	Boiling water
3	Drought	Crop damage/loss	Trading other commodities for food
		Water shortage	Walk longer distances
		Reduced fish stocks	Income diversification

A significant impact of both floods and drought is crop damage and loss. Community members cope by buying food (using money from fish selling), trading other commodities for food (fish, charcoal, crafts, etc.), and by changing cultivation location (moving to higher or lower lands). As crop loss forces villagers to trade other commodities to buy food, household economy does not improve.

Fish stocks are also affected by drought and extreme heat. The main coping strategy is income diversification, mostly agricultural production. However, as mentioned above, agriculture is also negatively affected by climate hazards.

The increase in diseases (affecting livestock, humans and crops) is an important impact of extreme heat events and floods, mainly due to reduced water quality and increased waterborne diseases and mosquito breeding. Communities have few strategies to deal with the increase in diseases. They mentioned water boiling and the use of chlorine (but very few use these strategies) and the use of traditional medicines.

The main livelihood resources and the impacts of climate hazards on these resources were also discussed with participants, and results are presented in the table below.

Table 7: Livelihood Context (Valley System, Lukwesa Village)

Extent to which livelihood resources are influenced by climate hazards identified in the climate context (0 = no influence, 5 = full influence):																				
Resource	Hazard:	Floods					Extreme heat					Drought								
		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	
Natural Resources																				
1	Fish				X							X							X	
2	Arable land				X						X							X		
3	Water					X					X								X	
Physical Resources																				
1	Fishing implements	X					X					X								
2	Agricultural implements	X					X					X								
3	Bicycles and roads				X		X					X								
Financial Resources																				
1	Liquid assets (fish and crops, etc.)					X					X									X
2	Charcoal				X						X			X						
3	Blacksmithing + carpentry products				X					X				X						
Human Resources																				
1	Fishing capability				X						X									X
2	Agricultural capability				X						X									X
3	Carpentry + blacksmithing capability		X							X			X							
Social Resources																				
1	Women's Club		X							X			X							
2	Business Associations			X						X					X					
3	Multi-purpose Cooperative (for agr., carpentry, etc.)			X						X					X					

When setting the livelihood context, participants mentioned that fish is still the most important natural resource but that arable land and agricultural skills are becoming more and more important, due to declining fish stocks. The crops grown are cassava, maize and groundnuts. Parts of the crops grown are sold. Cassava is the most important crop, as it is a traditional food crop and it does not require many inputs.

Floods have a negative short-term impact on fish catches, as fish have more potential breeding areas. However, the long-term impact on fish resources is positive. Floods may lead to either soil fertilization or increased arable soil erosion. Floods also decrease arable land area and negatively affect water quality. Trading is decreased during the flooding period, since less liquid assets are produced and roads become impassable. However, after the flooding period, fish catches and fish trading might be improved due to flood-induced increase in fish breeding.

Extreme heat and droughts have negative impacts on fish body formation and reproduction. These hazards also reduce microbial activity in arable soils, increase termite activity (leading to crop damage), decrease water levels, and reduce water quality.

Alternative financial resources (charcoal burning, blacksmithing and carpentry products) are also negatively affected by the three climate hazards, as fewer raw materials are available, and human capability to make these products is negatively affected.

The three climate hazards reduce human capability and productivity, due to the hazards' impacts on crop yields (and consequent hunger and malnutrition) and human diseases. The three hazards also lead to less social activities, as members of the Business Associations, Women's Club, and Multi-purpose Cooperative meet less often when there are no products (e.g. fish, crops) to sell.

3.3.2. Community Consultation – Plateau System, Chimfula Village, Mansa District

The plateau system in Mansa District is mainly composed of Miombo woodland species. Communities in Mansa District are closer to the big Mansa markets than communities in Mwense District, so they transport and sell more agricultural products (mostly crops and small livestock), charcoal, and firewood. Along the road between Chimfula Village and Mansa, villagers are transporting bags of sweet potatoes, cabbage, and charcoal on their bicycles, and piles of firewood are waiting to be picked up. There are fewer settlements in the plateau system than in the valley system, as agriculturalists usually live more dispersed than fishermen.

The main livelihood activities of community members in Chimfula Village are: 1) agriculture (mixed farming: crops and small livestock); 2) Charcoal production (mostly done illegally in this region, since it would not be profitable with the added cost of a license); 3) Small-scale fishing and beekeeping, mostly for household consumption.

Community members mentioned having perceived a gradual increase in temperatures, an increase in drought frequency and severity, and a decrease in the length of the rainy season, during the past 3 to 6 years. The increase in temperature is most apparent during the cold season. Villagers have also noticed an increase in rain intensity, though this has not induced any significant damage. Villagers emphasized that the biggest problem is drought.

Participants in the consultation had heard about changes in climate in other regions of the province and in other countries (e.g. Zimbabwe and Malawi). Participants debated amongst themselves regarding the causes/drivers of those changes. Some argued that it is impossible to know the causes, as it only depends on God. Others argued that rainfall patterns are affected by deforestation of large areas. No participant had heard of fossil fuel burning and its effects on climate. We therefore presented to participants some background information on climate change.

The main climate hazards experienced by community members, the impacts of those hazards, and the current coping strategies are presented in the table below.

Table 8: Climate Context (Plateau System, Chimfula Village)

	Hazard	Impact	Coping Strategy
1	Drought	Crop loss and hunger	Earlier planting
		Decreased soil fertility	Avoid late burning of grass
		Soil erosion	Avoid burning and incorporate crop residues
2	High Temperatures	Increase in diseases and health problems	Distribution and use of mosquito nets
		Crop loss	Earlier crop planting
		Decreased livestock feed	Taking animals out early in the morning
3	Shorter Rainy Season	Decreased crop yields leading to hunger	Selling less crops
		Decreased income from selling crops	Alternative sources of income
		Seeds do not mature (mostly legumes)	Buying seeds for next growing season

An important impact of the three main climate hazards is crop loss, leading to hunger and decreased income. Coping strategies to deal with crop loss include: earlier crop planting, using more drought-tolerant crops (e.g. cassava); keeping more crops for household

consumption (selling less to prevent hunger); improve crop storage; irrigation (practiced by very few); and finding alternative income sources (mainly charcoal burning and selling grass and livestock).

Participants mentioned a decrease in soil fertility (due to decreased microbial activity) and an increase in soil erosion in times of droughts. Coping strategies involve: avoiding late burning of grass; incorporation of crop residues; crop rotations; intercropping (e.g. groundnuts and cassava); cover cropping (using beans, groundnuts, cowpeas or sweet potatoes) and contour bands.

The community’s main livelihood resources and the climate hazards’ influences on those resources are presented in the table below.

Table 9: Livelihood Context (Plateau System, Chimfula Village)

Extent to which livelihood resources are influenced by climate hazards identified in the climate context (0 = no influence, 5 = full influence):																			
Resource		Drought					High Temperatures					Shorter Rainy							
Hazard:		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Natural Resources																			
1	Arable land				X							X					X		
2	Water					X						X						X	
3	Forest/Trees					X					X						X		
Physical Resources																			
1	Agricultural implements	X						X							X				
2	Bicycles	X							X				X						
3	Houses and toilets	X						X					X						
Financial Resources																			
1	Agricultural products selling					X						X					X		
2	Charcoal selling					X						X		X					
3	Trading					X	X						X						
Human Resources																			
1	Crop cultivation capability		X								X			X					
2	Animal husbandry capability		X								X			X					
3	Bricklaying capability		X								X			X					
Social Resources																			
1	Multi-purpose cooperative	X						X					X						
2	Women's Group	X						X					X						
3	Youth Group	X						X					X						

Forests and trees are considered important resources, as they provide soil nutrients (for sash and burn agriculture), traditional herbs and medicines, fuel wood, charcoal, timber, honey and roofing poles. All influences noted in the table (above the 0 level) are negative.

3.3.3. Community Consultation – Lake System, Katanshya Village, Samfya District

Katanshya Village is located within an inland wetland ecosystem and the community’s livelihood is mostly based on fishing. All fish comes from wild fish stocks; no fish farming is currently practiced by this community. The bulk of community members’ income comes from fish trading. However, overfishing has led to a significant decrease in fish stocks. Villagers also practice subsistence agriculture and produce cassava, maize, groundnuts, sweet potatoes, beans, cowpeas, and pumpkins.

Community members have observed (since about 1998) a dramatic decrease in rainfall, an increase in temperatures, and a reduction in the length of the rainy season. The rainy season used to be from mid-October to April, but it is now from December to February (only three months instead of six). During these three months, rain intensity has increased. The main climate hazards, impacts, and coping strategies are presented in the following table.

Table 10: Climate Context (Lake System, Katanshya Village)

	Hazard	Impact	Coping Strategy
1	Drought	Fish Death	Income diversification
		Crop damage/loss	Shifting from highlands to lower lands
		Water shortage	Sinking of wells
2	Increase in temperature	Increase in diseases	Going to the clinic
		Decreased soil fertility	Fallowing
		Crop damage/loss	Buying food (with money or through exchange with other commodities)
3	Increase in rain intensity	Crop damage/loss due to waterlogging	Early harvesting
		Decline in fish catches due to fish migration	Income diversification (agr. prod., crafts)
		Food Scarcity	Working for food

Due to droughts, there has been a shift in cultivation from highlands to lower lands. Cassava yields are affected by drought, but cassava is more drought-tolerant than the other crops. People are resistant to increase cassava cultivation to cope with droughts, because high rain intensity during the rainy season negatively affects post-harvest drying of cassava.

Due to this year's floods, people have been forced to move back to the uplands. Increased rain intensity is leading to reduced crop yields, crop damage/loss (villagers cannot dry their cassava crops anymore, and the cassava planting material gets damaged), food scarcity, and soil nutrient leaching. Cassava drying in times of high rains is a big issue, and community members are asking for assistance to find technological or managerial solutions to this increasing problem.

Fishing is also negatively affected by droughts and high rain intensity. The villagers' main coping strategy is income diversification (e.g. engage in agricultural production, craft making, and grass selling). However, these alternative income-generating activities are also negatively affected by climate hazards. Changing fishing gear to catch smaller fish, and selling less fish (keeping most of it for household consumption) were other coping strategies mentioned.



3.3.4. Consultation with Government Officials in Mansa

A presentation was done by Beatrice Riche (IUCN) to government officials from the Agriculture, Fisheries, and Meteorology Departments in Mansa District, regarding:

- 1) Climate change: scientific basis, impacts, vulnerability, and adaptation
- 2) IUCN Climate Change and Development Project
- 3) Community-Based Risk Screening Tool - Adaptation and Livelihoods (CRiSTAL)

This was followed by a period of questions and discussion on climate change impacts, mitigation and adaptation.

3.3.5. Consultation with PLARD team in Mansa

Results from the three community consultations in Southern Province were presented to PLARD staff in Mansa. This led to interesting discussions on the communities' livelihoods, the impacts of climate hazards, and communities' current coping strategies.

This was followed by training of project staff on the use of CRiSTAL. As part of this training, we completed together Module 1 for the Plateau System and Module 2 for the Lake System.

The project activities analyzed in Module 2 were:

- 1) Setting up fish processing facilities
- 2) Promote productivity of cassava
- 3) Formation of farm forum groups
- 4) Formation of village fisheries management groups

Full analysis is available upon request from Beatrice Riche (contact details in Annex 3).

3.4. Provincial Forestry Action Programme (PFAP) Phase II, Southern Province

The PFAP Phase II started in February 2000 and was planned to end in 2005, but the funding period was extended for a few more years. The overall objective of this programme is to improve livelihoods and status of forests in Zambia. The project purpose is the implementation of sustainable collaborative forest management practices in 7 pilot districts located in 4 provinces (Southern, Copperbelt, Luapula and Eastern provinces).

3.4.1. Community Consultation, Dambwa Local Forest, Livingstone District

Around the Dambwa Local Forest, joint forest management (JFM) plans have been developed with 8 villages (village resource management areas – VRMA). Participants in the community consultation were members of various village resource management committees (VRMC) around the Dambwa Local Forest. Communities' livelihood in this area is mostly based on agricultural production (crops, including maize, beans, sunflower, cassava, groundnuts, sorghum and sweet potatoes, and livestock, including cattle, goats, pigs, sheep and chickens) and harvesting of local forest products (firewood, timber, charcoal burning, mungongo seeds, wild fruits and herbal medicines). These products are used both for household consumption and for selling (as a source of income).

Some participants had heard of climate change through the radio, but they did not know if this is a local or a global phenomenon and had not heard of the causes/drivers. They mentioned having experienced changes in weather patterns, mainly an increase in temperature and changes in raining patterns. Previously, it used to be cooler in April and March; now it is very hot. Previously, the rainy season used to be from October or November to the end of April. Now, rains start later (20th of December this year) and stop earlier (in mid-March or April). Even during the shorter rainy season, participants mentioned that it rains less often. They also mentioned changes in the distribution of the rains (it rains a lot in some areas and not at all in others). They only started noticing these

changes in weather patterns in the last few years, and mostly during the last year. The main climate hazards, impacts and coping strategies are presented in the table below.

Table 11: Climate Context (Dambwa Local Forest, Livingstone District)

	Hazard	Impact	Coping Strategy
1	Drought	Crop damage/loss	Income diversification (mostly charcoal prod)
		Increase in diseases	Use of traditional/herbal medicines
		Water shortages	Sinking boreholes
2	Extreme heat	Increase in diseases	Use of mosquito nets and repellents
		Decreased human capacity to work and sleep	Working earlier in the morning
		Loss of life (animals + humans)	Buying medicines for cattle

Droughts have destroyed almost all of their crops this year. Income diversification to deal with drought-induced crop damage includes: charcoal production (#1 coping strategy), timber, honey and beer production, and selling livestock. Additional coping strategies involve: harvesting wild fruits, and getting support from NGOs and the government. Villagers are already growing the most drought-tolerant crop species available (cassava, millet and sorghum), so switching to more drought tolerant crops is not really possible.

During the consultation, we also identified the main livelihood resources and the impacts of climate hazards on these resources. Results are summarized in the table below.

Table 12: Livelihood Context (Dambwa Local Forest, Livingstone District)

Extent to which livelihood resources are influenced by climate hazards identified in the climate context (0 = no influence, 5 = full influence):																			
Hazard:		Drought					Extreme heat												
Resource		0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
Natural Resources																			
1	Arable land			X				X						X					
2	Forest products					X						X		X					
3	Water (from rivers and streams)						X						X	X					
Physical Resources																			
1	Agricultural implements	X						X						X					
2	Roads and bridges	X						X						X					
3	Water boreholes	X						X						X					
Financial Resources																			
1	Livestock selling						X					X	X						
2	Crop selling						X					X	X						
3	Charcoal selling				X			X						X					
Human Resources																			
1	Farming skills/capacity	X										X	X						
2	Bricklaying skills/capacity	X										X	X						
3	Charcoal production skills/capacity	X										X	X						
Social Resources																			
1	Agricultural Cooperatives	X						X						X					
2	Anti-HIV/AIDS Group	X						X						X					
3	Church	X						X						X					

3.4.2. Consultation with PFAP team (Forestry Department staff) in Livingstone and Choma

Module 2 of CRiSTAL was completed with Bernard Sinyangwe, Livingstone District Forestry Officer. The project activities analyzed with CRiSTAL were:

- 1) Promotion and facilitation of Mungongo seed collection and extraction
- 2) Promotion and facilitation of sand mining
- 3) Forest protection and management by government and communities (inside and outside the local forest)

Since PFAP is also implementing project activities in the Ndonde Local Forest in Choma District, we also organized a meeting with Charles M. Taulo, Principal Extension Officer in Choma, to discuss project activities and the climate and livelihood contexts in the Ndonde Local Forest.

4. SUMMARY AND ANALYSIS OF RESULTS

4.1. Climate Hazards, Impacts, and Coping Strategies

Four climate hazards were identified as having a major influence on people's livelihoods:

- Drought was considered the #1 climate hazard by 5 of the 7 communities. It was mentioned as one of the main three climate hazards by **all** of the 7 communities.
- Floods (or an increase in rain intensity) were considered the #1 climate hazard by 2 of the 7 communities (in Western Province and in Luapula Province valley system; two lowland areas). It was mentioned as one of the main three climate hazards by 5 communities. Only communities in Southern Province (agroecological zone I) and in Luapula Province plateau system (located in the higher lands) did not mention floods as an important climate hazard.
- Extreme heat was considered as the second most important climate hazard in 4 of the 7 communities. It was mentioned as one of the main three climate hazards by 6 communities.
- A shorter rainy season was considered one of the main three climate hazards by 2 of the communities. It was mentioned as an important observed change in weather patterns by all communities except in Western Province.

Variability is a feature of the Zambian climate, which has a history of droughts and floods. However, all communities mentioned an increase in droughts, rain intensity, and extreme heat events. They evaluated the start of changes to 3 to 9 years ago. These changes are in accordance with the IPCC climate change observations and predictions (IPCC, 2007) for the 20th and 21st centuries, i.e. increased frequency of warm spells and heat waves over most land area; warmer and more frequent hot days and nights; increased frequency of heavy precipitation events, and increased area affected by drought.

The impacts of these climate hazards on people's livelihoods, in the 7 communities met, are summarized in the table below.

Table 13: Main Impacts of Climate Hazards

Drought	Floods	Extreme Heat	Shorter Rainy Season
<ul style="list-style-type: none"> • Crop damage/loss, leading to food scarcity and hunger • Water shortages • Reduced fish stocks • Income loss • Reduced charcoal business • Increase in diseases (affecting humans and animals) • Decreased water quality • Increased soil erosion • Decreased soil fertility • Increased honey production (if drought is not too severe) 	<ul style="list-style-type: none"> • Crop damage/loss, leading to food scarcity and hunger • Loss of crop land and grazing ground • Decline in fish catches • Increase in diseases (malaria, dysentery, cholera, etc.) • Destruction of infrastructures (houses, roads) • Life loss (humans and livestock) 	<ul style="list-style-type: none"> • Increase in diseases affecting animals, crops and humans (especially malaria) • Decreased human capacity to do work • Loss of life (animals and humans) • Crop damage/loss • Reduced fish stocks • Decreased livestock feed • Reduced water quality 	<ul style="list-style-type: none"> • Decreased crop yields • Crop damage/loss • Decreased income from crop selling • Crop seeds do not reach maturity (which negatively affects the next crop generation) • Reduced charcoal production and business

All communities mentioned very similar climate hazard impacts on agricultural production, water availability and quality, and human and animal health. The other impacts mentioned (concerning fish stocks/catches, charcoal burning, honey production) depended on people’s livelihood systems.

The impacts of climate hazards and climate change on people’s livelihoods are in accordance with the IPCC predictions for Africa (IPCC, 2007). The severity of current impacts (many communities have lost almost all their crops this years due to climate hazards, and there are high current levels of hunger, malnutrition and diseases) points out the communities’ high vulnerability to climate change and variability. Some adaptation to current climate variability is taking place, as demonstrated by the coping strategies undertaken by the various communities and summarized below, but these strategies are not necessarily sufficient to deal effectively with present and future climate change and variability.

Table 14: Main Coping Strategies

Drought	Floods	Extreme Heat	Shorter Rainy Season
<ul style="list-style-type: none"> • Income diversification (charcoal making, fishing, honey and beer production, selling grass and livestock, casual labor) to buy food • Trading other commodities for food • Gathering and selling wild food • Food rationing • Selling less crops to keep more for household consumption • Shifting agricultural production from highlands to lower lands • Earlier crop planting • Growing more drought resistant crops (e.g. cassava) • Incorporation of crop residues instead of burning • Crop rotations, intercropping, and cover cropping • Irrigation (practiced by very few) • Sinking wells • Walking longer distances to get water • Using medicinal plants to treat diseases • Going to the medical clinic • Boiling water or treating it with chlorine • Getting support from NGOs and the government 	<ul style="list-style-type: none"> • Income diversification (charcoal, crafts, mats and beer making, fishing, grass selling, casual labor) to buy food • Trading other commodities for food • Gathering and selling wild food • Shifting agricultural production, livestock and houses to higher lands • Using medicinal plants to treat diseases • Boiling water or treating it with chlorine to prevent diseases • Bury ditches to prevent waterborne diseases • Early evacuation when water levels increase • Improve drainage around houses • Putting plastic on top of houses • If houses are destroyed, build temporary shelters or live temporarily with neighbors 	<ul style="list-style-type: none"> • Using medicinal plants to treat diseases • Boiling water or treating it with chlorine to prevent diseases • Going to the medical clinic • Buying and using mosquito nets and repellents • Working earlier in the morning • Buying medicines for cattle • Income diversification (e.g. agricultural production to cope with decreased fish stocks; charcoal production to cope with crop loss) • Trading other commodities for food • Earlier crop planting • Taking animals out early in the morning • Using zero-grazing for some animals 	<ul style="list-style-type: none"> • Income diversification (selling charcoal, livestock or grass; casual labor) • Selling less crops to keep more for household consumption • Gathering wild food • Buying seeds for the next growing season • Exchanging crop seeds between community members or between villages

Strategies to deal with increases in diseases (e.g. using traditional medicinal plants; boiling water; treating water with chlorine; going to the medical clinic) are very similar between villages. According to most villages, these strategies are not very efficient:

medical clinics are often far away from the village and traditional medicines are not considered by villagers as being very effective.

Coping strategies to deal with crop loss and decreasing fish stocks are also very similar between the different villages. Communities cope mainly by diversifying their sources of income and relying more heavily on alternative natural resources from forests and wetlands. However, there are major differences in income diversification possibilities. Some communities have access to more natural resources (wild foods, non-timber forest products, fish, etc.) or have a higher level of specialization, education, expertise, coordination, or institutional support (e.g. specialized charcoal makers in the Copperbelt Province) than other communities, which enhances their adaptive capacity. In addition, there are major differences in the extent of agricultural knowledge and coping strategies associated to crop management (use of crop rotations, intercropping, cover crops, etc.).

4.2. Links between Livelihoods and Climate Change Vulnerability and Adaptation

The following table summarizes the livelihood resources most affected by climate hazards in the different Zambian communities.

Table 15: Livelihood Resources Most Affected by Climate Hazards

	Copperbelt Province, Beekeepers	Copperbelt Province, Charcoal Burners	Western Province	Luapula Province, Valley System	Luapula Province, Plateau System	Luapula Province, Lake System	Southern Province
Natural Resources	Bees Mushrooms	Land Grass	Fish Livestock Fertile agricultural land	Fish Arable land Water	Arable land Water Forest/Trees	Fish Water	Forest products Water
Physical Resources	Roads	Roads Storage sheds for charcoal	School Roads	Roads			
Financial Resources	Liquid assets: crops, livestock, charcoal, honey	Liquid assets: crops, livestock	Liquid assets: crops (maize), livestock (chicken, cattle), fish	Liquid assets: fish, crops, charcoal, and blacksmithing and carpentry products	Liquid assets: agricultural products and charcoal	Fish selling Crop selling Casual labor	Liquid assets: cash crops and livestock
Human Resources	Charcoal burning capability Agricultural work capability	Farming capability	Farming capability Fishing capability	Fishing capability Farming capability		Farming capability Fishing capability Marketing capability	Farming capability Bricklaying capability Charcoal production capability

Social Resources							
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The climate hazard impacts on the livelihood resources listed above are all negative, except for a few exceptions:

1. Bees and honey: Drought (if not too extended or severe) triggers plant flowering and therefore has a positive effect on bees and honey production. However, if the drought is too prolonged, bees may die or migrate.
2. Mushrooms: They are positively affected by floods, but negatively affected by droughts.
3. Charcoal production: Floods have a negative impact on charcoal production for unspecialized producers, but have a positive impact for more experienced, organized and specialized producers (e.g. members of the Mufulira Charcoal Burners' Association), who have a competitive advantage when conditions are more difficult. Also, charcoal demand usually increases in times of floods.

The 7 communities are all greatly dependent on climate-sensitive resources (e.g. water, arable land, fish, and forest products). In addition, climate hazards' impacts on those resources are being amplified by other local factors, like inappropriate natural resource management (overfishing, deforestation, reduced agricultural fallow time, etc.).

The livelihood resources most important to cope with climate hazards in the different communities are summarized in the table below.

Table 16: Livelihood Resources Most Important for Coping with Climate Hazards

	Copperbelt Province, Beekeepers	Copperbelt Province, Charcoal Burners	Western Province	Luapula Province, Valley System	Luapula Province, Plateau System	Luapula Province, Plateau System	Southern Province
Natural Resources	Trees Bees Mushrooms	Trees Land Grass	Fish Livestock Fertile agricultural land	Fish Arable land Water	Arable land Water Forest/Trees	Fish Water Arable land	Arable land Forest products Water
Physical Resources	Roads Bicycles Agricultural implements		Roads	Fishing implements Agricultural implements Bicycles and roads	Agricultural implements Bicycles	Agricultural implements Bicycles	Agricultural implements Roads and bridges Water boreholes

Financial Resources	Liquid assets (cash crops, livestock)	Liquid assets (cash crops, livestock)	Liquid assets: crops (maize), livestock (chicken, cattle), fish	Liquid assets: fish, cash crops, charcoal, and blacksmithing and carpentry products	Liquid assets: agricultural products and charcoal	Fish selling Crop selling Casual labor	Liquid assets: cash crops, livestock and charcoal
Human Resources	Charcoal making capability Marketing capability	Charcoal burning capability Farming capability	Farming capability Fishing capability Craft making and bricklaying capability	Fishing capability Agricultural capabilities Carpentry and blacksmithing capabilities	Crop cultivation capabilities Animal husbandry capabilities	Farming capability Fishing capability Marketing capability	Farming capability Bricklaying capability Charcoal production capability
Social Resources	Cooperatives	Charcoal association Agricultural cooperatives	Farming cooperative	Women's club Business associations Multi-purpose cooperative		Multi-purpose cooperative Women's club	

Human capabilities are very important to cope with climate hazard impacts: they allow communities to diversify their incomes in order to reduce their vulnerability to climate hazards.

Social resources are also very important, since associations, cooperatives, and women's clubs play an important role in product commercialization and are therefore crucial for income generation and diversification.

A wide variety of natural resources (trees, bees, mushrooms, arable land, grass, water, animals, fish) are also important to cope with climate hazards, as they allow livelihood diversification. They also provide wild foods when crops fail, medicines, and a wide array of saleable products.

Many coping mechanisms (e.g. buying mosquito nets, food, medication and seeds) require financial resources, so liquid assets (e.g. cash crops, livestock, fish, honey and charcoal) are also considered crucial.

4.3. Links between Project Activities and Climate Change Vulnerability and Adaptation

The impacts of development project activities on livelihood resources that are either impacted by climate change or important for coping will influence local populations' vulnerability and adaptation strategies. As mentioned earlier, resource management practices can either increase or diminish people's vulnerability and adaptive capacity.

Most project activities analyzed with CRiSTAL had both positive and negative potential impacts on the livelihood resources that are important for people's adaptation. Going

through the CRiSTAL process provided the opportunity for project teams to understand more clearly the links between project activities and climate change vulnerability and adaptation. Project teams were able to come up with small modifications to their project activities in order to decrease potential negative impacts on livelihood resources, enhance positive impacts, or transform neutral impacts into positive impacts. Completion of the synergies and barriers matrix allowed project teams to see if these modifications were feasible and which barriers would need to be removed.

This vulnerability assessment was also useful in sensitizing project teams, government officials and communities on the necessity of including climate change as an important issue in decision making. Climate change, its causes, impacts, and how we can tackle it, is often not well understood by development project teams and decision makers.

5. CONCLUSION

Through the climate change vulnerability assessment in Zambia, we met the three following objectives:

1. We got **an indication of the risks related to climate change at the local level for the full-size project proposal**. Community consultations on 7 sites, covering 4 provinces and 3 agroecological zones of Zambia, revealed a rise in the frequency and severity of extreme events, including droughts, floods and high temperatures, and a decrease in the length of the rainy season. Droughts and extreme heat events are widespread and are considered major climate hazards throughout the country. Heavy precipitation events are also widespread and increasing in frequency, and are causing greater damage in river valleys and floodplains (e.g. along the Zambezi river). The rise in extreme climatic events is negatively affecting the natural, physical, financial, and human resources that are crucial for people's livelihoods, and is leading to increased food insecurity and health issues. When facing climate hazards, small scale farmers (which are negatively affected by disruption of their normal farming cycles) rely heavily on access to alternative natural resources from forests and wetlands.

Recommendations for the full-size “Climate Change and Development” project:

- Should focus on increasing resilience of communities towards the risks identified in the vulnerability assessment, i.e. resilience towards the impacts of droughts, floods, increased temperature, and a reduced rainy season.
- Strategies to increase resilience should build on the communities' current coping strategies to climate variability, and should aim to enhance livelihood resources that are either impacted by climate hazards or important for coping with the impacts of those hazards.

- If possible, as for the pilot phase, the full-size project should involve various development project teams and cover various ecological zones and types of livelihoods. As the IUCN-ZBWP and PLARD projects will continue for another 2 and 3 years, respectively, it would be interesting to continue working with these project teams for the full-size project.
2. Managers and implementing teams of the four ongoing projects have been introduced and trained on how to use CRiSTAL, an **easy-to-use tool which provides a framework to assess climate risks and adjust project activities** to avoid negative impacts and enhance positive impacts on communities' adaptive capacity in the face of climate variability and change. A feedback form has been sent to these project teams to help us improve CRiSTAL's usefulness.
 3. This assessment provides **complementary information on climate hazards and current coping strategies** at the local level **for decision makers**. This information will be especially valuable for the completion and implementation of the National Adaptation Programme of Action on Climate Change (NAPA). The information collected during the vulnerability assessment will be communicated to national stakeholders during a workshop in June 2007.

ANNEX 1: MISSION AGENDA

Saturday, March 24th, 2007

- Meeting with Anne Hammill (IISD) at Geneva airport
- 17h00: Departure from Geneva

Sunday, March 25th, 2007

- 11h00: Arrival in Lusaka
- Meeting with Manyewu Mutamba (CIFOR)
- Planning for the trip to Mufulira District

Monday, March 26th, 2007

- 8h00-11h00: Meeting with Excellent Hachileka (Programme Coordinator, IUCN Zambia and Zimbabwe)
- 11h00-18h00: Drive from Lusaka to Mufulira District, Copperbelt Province

Tuesday, March 27th, 2007

- 9h00: Meeting with Tembo Frank (District Forestry Officer, Mufulira)
- 14h00-17h30: Community consultation: Village #14

Wednesday, March 28th, 2007

- 9h00-12h00: Community consultation: Mufulira Charcoal Makers Association
- 14h00-17h00: Community consultation: Women Club, Village #14
- 17h00-18h00: Visit of honey production site
- 20h00-21h00: Input of data collected during community consultations into CRiSTAL

Thursday, March 29th, 2007

- Training of Manyewu and Excellent on CRiSTAL use and application
- Continuation of the CRiSTAL process (completion of Module 1 and beginning of Module 2) for Village #14 with Manyewu and Excellent
- Debriefing meeting with District Forestry Officer
- 13h00-19h00: Drive from Mufulira to Lusaka

Friday, March 30th, 2007

- Meeting at the IUCN Zambia office in Lusaka, for preparation of mission at the IUCN Zambezi Basin Wetlands Project (ZBWP) Phase II site (trip logistics: bank, internet, buying of consultation material and fuel)

- Departure of Anne to Lusaka airport, flight back to Geneva
- Departure of Beatrice to the IUCN-ZBWP site (Lukulu District) at 15h00; Arrival at 2h00 the following morning.

Saturday, March 31st, 2007

- Presentation of the IUCN Climate Change and Development Project and CRiSTAL to Simbotwe Mwiya (IUCN Field Project Officer, ZBWP Phase II)
- Initial meeting with Contact Farmers in Mbanga Area, Lukulu District (farmers involved in the ZBWP) and setting up of a community consultation for the following morning

Sunday, April 1st, 2007

- Morning: We tried to drive to the project/consultation site, but access was impeded by heavy rains, consequent flooding, and road and bridge destruction – consultation with contact farmers was cancelled
- Organization of a consultation with farmers living in more accessible village not far from project site. Even though these farmers are not directly involved in ZBWP, their livelihoods and climate context are similar to those of the contact farmers involved in the ZBWP.
- 12h00-14h30: Community consultation
- 16h00-18h00: Input of collected data into CRiSTAL
- 19h00-20h30: Completion of CRiSTAL Module 1 with Simbotwe

Monday, April 2nd, 2007

- 9h00-11h00: Work on mission report
- 11h00-13h00: CRiSTAL Module 2 with Simbotwe
- 14h00-19h00: Completion of CRiSTAL analysis for IUCN-ZBWP

Tuesday, April 3rd, 2007

- Travel back to Lusaka, with a short stop at the IUCN office in Mongu – Departure at 4h30am from Lukulu; Arrival in Lusaka at 23h30 (19 hour-long drive, 1000 km).

Wednesday-Saturday, April 4-7, 2007

- Completion of reports for first 2 sites
- Preparation for trip to Mansa and Maputo
- Preparation of climate change presentation for next Tuesday

Sunday, April 8th, 2007

- 8h00-19h00: Drive to Finland-funded Programme for Luapula Agriculture and Rural Development (PLARD) site, located in Mansa District, Luapula Province

Monday, April 9th, 2007

- 9h00-10h00: Meeting with PLARD
- 11h00-15h00: Farmer Consultation 1: Valley system
- 16h00-18h00: Input of data into CRiSTAL

Tuesday, April 10th, 2007

- 8h00-9h00: Courtesy call PACO
- 9h00-14h30: Farmer Consultation 2: Plateau system
- 15h00-18h00: Climate change presentation by Beatrice to government officials (from fisheries, agriculture, and meteorology departments) and PLARD staff. The presentation focused on: climate change scientific basis, impacts, vulnerability and adaptation, the IUCN Climate Change and Development Project, and CRiSTAL.

Wednesday, April 11th, 2007

- 9h00-14h30: Consultation with Fishermen
- 15h00-19h00: Meeting with Henry Chilufya to train him on CRiSTAL and complete Module 1

Thursday, April 12th, 2007

- 9h00-13h00: Meeting with PLARD team to discuss the results obtained from the three community consultations in Luapula District, train them on using CRiSTAL, and start Module 2.
- 13h30-14h30: Lunch with PLARD team
- 15h00-17h00: Showing of Al Gore's *An Inconvenient Truth*
- 17h30-18h30: Debriefing meeting with Guni at PLARD office

Friday, April 13th, 2007

- Break

Saturday, April 14th, 2007

- 8h00-18h00: Drive from Mansa to Lusaka

Sunday, April 15th, 2007

- Preparation of trip to Southern Province

Monday, April 16th, 2007

- 9h00-19h00: Drive to Choma and Livingstone, Southern Province
- People from Forestry Department working on PFAP were not present in either Choma or Livingstone and had not prepared our visit

Tuesday, April 17th, 2007

- Organization of a community consultation with the help of Perry Mwawda (Forest Department, Livingstone) and Charles E. Muleya (Chairman of the Forest Management Group), for the following morning

Wednesday, April 18th, 2007

- 8h30-15h00: Community consultation, Dambwa Local Forest (P22), in Livingstone District

Thursday, April 19th, 2007

- Meeting with Perry Mwawda (Forest Department, Livingstone)

Friday, April 20th, 2007

- 9h00-11h30: Meeting with Bernard Sinyangwe, Livingstone District Forestry Officer
- 11h30-14h00: Drive from Livingstone to Choma
- 14h00-16h30: Meeting with Charles M. Taulo, Principal Extension Officer, Forestry Department in Choma

Saturday, April 21st, 2007

- 9h00-16h00: Drive from Choma to Lusaka

Sunday, April 22nd, 2007

- 13h00: Return flight Lusaka-Johannesburg-Paris-Geneva

Monday, April 23rd, 2007

- 9h00: Arrival in Geneva

ANNEX 2: LISTS OF PARTICIPANTS

1. Beekeeping Committee Members, Village #14, Mufulira District

1. Roidah Kabinga, Chairperson
2. Rhodah Paison, V I Chairperson
3. Jane Sambaulu, Secretary
4. Richard Chambaywo, V I Secretary
5. Isaac Chipayeni, Treasurer
6. George Kombe
7. Sambaulu Kasanga
8. Regina Chileshe
9. Dainess Yotamu
10. Maureen Muyomba
11. Mary Musonda
12. Siyambuli Mishecu
13. Mwebe David
14. Loveness Kapenya
15. Maria Kapepa
16. Betty Chikasa

2. Charcoal Burners' Association, Mufulira District

1. Victor Chilongo, Chairperson
2. Moses Tom Njamba
3. Peter Kaula
4. Henry Kakoma
5. Chime Sam
6. Richard Kakoma
7. Sunday Mbumba
8. Elias Simumba
9. Chileuwa Bwalya
10. Alex Musenge Mwansa
11. Augustine Samundelu
12. Godfrey Chibwe
13. Mpundu Chibwe
14. Nicodemus Kapinga
15. John Mwila
16. Victor Mambwe
17. Mary Phiri
18. Janet Kaunda
19. Matias Mumba
20. Febian Mwewa
21. Euaristo Mwanshibulwa

22. Agness Nkala
23. Alex Dgashima
24. Joseph Mwansa
25. Justine Lonawe

3. Samunyingi Village, Lukulu District

1. Francis Masheke - Induna Samunyingi (M)
2. Sendoi Masheke (M)
3. Kalaluka Masheke (M)
4. Maureen Sifuba (F)
5. Kahilu Sokayuta (F)
6. Nalishebo Akapelwa (F)
7. Namatama Akapelwa (F)
8. Mary Masiye (F)
9. Mungangami Kamana Manga (M)
10. Agatha Muyambongo (F)

4. Valley System, 09/04/2007

1. Henry Chilufya, Facilitator and translator, Forestry Officer
2. Winkler Siluyele, Agriculture and Fisheries Department, Ministry of Agriculture and Cooperatives (MACO)
3. Rayford B. Mambwe (M)
4. B.M. Mushota (M)
5. Aram Katongo (M)
6. Chibelele Alfred (M)
7. Abraham Musonda (M)
8. Chishala Dammah (M)
9. Chabala Gift (M)
10. Goodson Nkendu (M)
11. Bertha N. Ponda (F)
12. Rabeccah Chabala (F)
13. Fece Mwandwe (F)
14. Kabwita Margie (F)
15. Chiyomena James (M)
16. Mwewa Bernard (M)
17. Dages Ponde (M)
18. Dekin Kunda (M)

5. Plateau System, 10/04/2007

1. Henry Chilufya, Facilitator and translator, Forestry Officer

2. Moonle Lusters (M), Kalaba Camp Officer
3. Chibaye Stanley (M)
4. Chola John (M)
5. Daniel Wilson Chola (M)
6. Boniface Mwaba (M)
7. John Mpundu (M)
8. Justine Chola (F)
9. Barnabas Mwansa (M)
10. Charles Mushimba (M)
11. Mwewa John (M)
12. Moses Chipili (M)
13. Ackson Chabecha (M)
14. Mpun Dunoah (M)
15. Yolanda Mumba (M)
16. Richard Kunda (M)
17. Godfye Mwape (M)
18. Wilson Chola (M)
19. James Mweshi (M)
20. Everlyne Mwewo (F)
21. Mr Christanbala (M)
22. Mwansa (M)
23. Wilson Mwansa (M)
24. Balusaka (M)
25. Alan Chibesa (M)
26. Roidah Bwalya (F)
27. Foster Mwelwa (F)
28. Rose Chila (F)
29. Doreen Chilufya (F)
30. Moreen Mwandwe (F)
31. Elizabeth (F)
32. Margie Mwelwa (F)
33. Rozalia K. Chitalu (F)
34. Musaba Musenge (M)
35. Agness Kunpa (F)
36. Abraham Katungo (M)
37. Matipa Nicodemas
38. Peter Chisuala (M)
39. Chitambala Benny (M)
40. Chiasaya Peter (M)
41. Cosmas Safe (M)
42. Erika Kalaba (F)
43. Stephen Mwewa (M)
44. Danny Mibenge (M)
45. Donald Mwewa (M)
46. Lackson Chitamfya (M)
47. Masonda Bernard (M)

6. Lake System, 11/04/2007

1. Henry Chilufya, Facilitator and translator, Forestry Officer
2. Godwin Chitamuica, Fisheries Department, MACO
3. Peter Kapenigwe (M)
4. Mwaba Luance Chilolah (M)
5. Kalima Benson (M)
6. Chipulu Sunga (M)
7. Alice Ngolo (F)
8. Mary Mpundu (F)
9. Borwface Chilufya (M)
10. Freddy B. Somuwa (M)
11. Innocent Mwanso (M)
12. Tobias Mumba (M)
13. Wuam Mwaba (M)
14. Paul Chipulu (M)
15. Justina Mumba (F)
16. Protasio Mkianashiku (M)
17. Florence Mushibwe (F)
18. G. Mubanga (M)
19. Tresphord Mubanga (M)
20. Sebgo Muselela (M)
21. Peter Mumba (M)

7. Climate Change Briefing with Government Officials, Mansa, 10/04/2007

1. Beatrice Riche, IUCN
2. Jonathan Chilembo, Provincial Meteorological Officer, Meteorology Department
3. Blackson P. Jeke, Provincial Agriculture Officer, Agriculture Department
4. Blackson T. Ndhlovu, Assistant Secretary, Provincial Administration
5. Annie M. Magayane, Senior Agriculture Information Officer, Agriculture Department
6. Sidney Maboshe, Principal Fisheries Coordinator, Department of Fisheries
7. Alex Kabwe, Agriculture Specialist, Agriculture Department
8. Evans Kanda, Extension Assitant, Forestry Department
9. Guni Mickels Kokwe, Chief Technical Advisor, PLARD
10. Henry Chilufya, Senior Technician, Forestry Department

8. Debriefing meeting with PLARD team, Mansa, 12/04/2007

1. Beatrice Riche, IUCN
2. Sidney M. Maboshe, Principal Fisheries Officer, Department of Fisheries, MACO

3. Abraham Ngoliya, Chief Research Officer, ZARI and MACO
4. Mighten K. Mpiya, Programme Director, PLARD
5. Guni Mickels Kokwe, Chief Technical Advisor, PLARD
6. Njekwa Mukamba, Programme Assistant, PLARD
7. Annie Magayane, Senior Agriculture Information Officer, Agriculture Department, MACO
8. Joseph Chanda, Treasurer, Mansa District Farmers Association

ANNEX 3: CONTACT DETAILS

Beatrice Riche, Junior Programme Associate, IUCN Headquarters, Switzerland, email: beatrice.riche@iucn.org

Excellent Hachileka, Programme Coordinator, IUCN Zambia/Zimbabwe Offices, email: excellent.hachileka@iucn.org

Manyewu Mutamba, CIFOR, email: m.mutamba@cgiar.org

Simbotwe Mwiya, IUCN Field Project Officer, cell phone: 097-715885, email: simbotwe.mwiya@iucn.org

Guni Mickels Kokwe, PLARD, cell phone: 099-711224, email: cta@plardzambia.org

Henry Chilufya, Forestry Officer, Box 720011, Samfya, Zambia, cell phone: 097-359778, email: henrychilufya_06@yahoo.com

Perry Mwawda, Forest Department, Livingstone; telephone: 03-321484

Charles E. Muleya, Chairman of the Forest Management Group, House #ME82, Livingstone; cell phone: 097-687085

Bernard Sinyangwe, Livingstone District Forestry Officer, P.O. Box 60066, Livingstone; telephone: 03321489, cell phone: 097-333044 or 096-136157

Charles M. Taulo, Principal Extension Officer, P.O. Box 630116, Choma; tel/fax: 220491, email: fdsouthern@yahoo.com and cmtaulo@yahoo.com

ANNEX 4: SUGGESTIONS FOR CRiSTAL IMPROVEMENT

Prior to the climate change vulnerability assessment in Zambia, CRiSTAL had been tested on different project sites in Africa, Asia and Central America, by the four partner organizations who developed the tool (IUCN, IISD, SEI-B and Intercooperation). However, the vulnerability assessment in Zambia was the first real application of this tool. In order to continue to improve CRiSTAL's usefulness, here are some suggested improvements, derived from the Zambian experience:

- More space should be available in the summary sections (many table cells are too small), and in the synergies and barriers section
- Spaces for notes should be added in the livelihood resources section
- Neutral activity impacts on resources should appear in the summary pages as well
- It would be useful to analyze if, and which, current coping strategies are really working/useful and if they are sustainable on the long term. It would be useless to build on coping strategies that are not sustainable. We could include some technical input during module 1 as well (this was suggested by the PLARD team)
- As a final step, we could also assess how project activities lead, or could lead, to new or improved adaptation strategies

If you have been using CRiSTAL, or if you are planning to use it in the future, please send us your feedbacks, to help us make CRiSTAL as useful as possible.

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IPCC. 2001. Climate change 2001: Impacts, adaptation, and vulnerability. Summary for policymakers. A report of the Working Group II of the Intergovernmental Panel on Climate Change. Third Assessment Report. 17 pp.

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