

Introduction

This compendium is developed within the framework of a joint project initiated and executed by the Action Group on Governance and Environmental Management (AGGEM), Cameroon, Tanzania Meteorological Agency and Zambia College of Agriculture with technical support from Dr Karen Elizabeth McNamara of The University Queensland's School of Geography and Environmental Management. This was with the financial support of Australian Aid through the Australia Awards Small Grant Scheme. The project sought to further gather, evaluate, compare and disseminate evidence on the use of Local Indigenous Knowledge and Practices (LIKPs) on climate change mitigation and adaptation that has contributed to cushion farmers against the unavoidable impacts of climate change while ensuring they continue to produce staple food which is central to their livelihood. In addition, the project sought to enable the target communities see themselves not only as victims of the phenomenon, but also as co-creators of solutions to the global challenge using their inherent knowledge, skills. In it has been found that climate change offers a huge window of opportunity to these communities through the promotion of climate tourism and education for people interested in researching and gaining more understanding of this community practices and perspectives.

In the course of administering 400 questions in 12 communities which were identified as climate hotspots in the three countries, serving as the major food baskets, in the three countries, clear steps were elaborated to facilitate the gathering of information on the LIKPs used by the agrarian communities. The steps included;



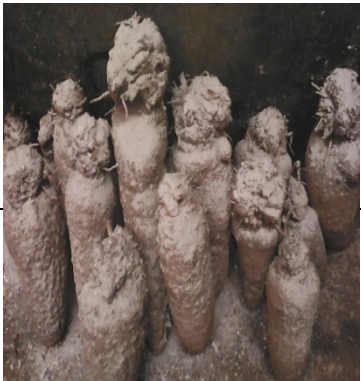





- Description of practice and tool (how it works, how long it has been used, in what ways does it help farmers adapt to or address the challenges associated with climate change?
- Development process (How widely has it been uptake among the farming community (e.g. number of farmers or area on which it has been applied, what were the triggers, key champions and stakeholders involved in the development)
- Effectiveness (what contributed to levels of adoption by farmers, what might constraint its uptake if practice has high potential to address effects of climate change, What biophysical, socio-economic conditions promote uptake and to benefit farmers)
- Impact (what ways has practice helped farmers increase food production in the face of climate change, do special benefits accrue to women and children in farm households, are there any unplanned effects be they positive or negative)

It is advisable to read this compendium with the joint report of data analysis and comparative analysis from Cameroon, Tanzania and Zambia to clearly see how effectiveness LIKPS and how these translate to measurable impacts from the community's perspective. In addition, this compendium is not an exhaustive guide of LIKPs given that not all farmers in the three countries or all custodians of LIKPs were interviewed or interacted with. It only serves to bring this sideline solution to the fore hoping that a community of practice (CoP) for cross-border scaling up of LIKPs and increase consideration in policy development and implementation.

CAMEROON

SEED SELECTION AND PRESERVATION

Products and Pictures	Explanations
<p><u>Maize (Zea mais)</u></p>  <p><u>Beans</u></p> 	<ul style="list-style-type: none"> ➤ Maize cobs harvested are tethered together and hung in kitchen where meals are cooked. Fresh cypress and remnants of harvested maize from farms is burnt in these kitchens or under the locally constructed maize barns. The smoke emanating offers the best insecticide, fungicide and pesticide and preservatives for the maize with communities asserting that maize protected this way more healthy for consumption and when planted is resistant to pest attacks and poor environmental conditions. ➤ Some farmers mix kerosene and wood ash in the maize to keep it save for next planting season. ➤ Other farmers mix cypress and lantana leaves on dried maize to serve as an insecticide. ➤ Other farmers use squashed roots of vetiver grass as medicine to protect maize from weevils and other insects. ➤ When dry, the maize is threshed and stored in air-tight containers especially as seedlings or in bags ready for transportation to the markets. Secondly wood ash and cypress is applied to prevent insects from eating the grains. <p style="margin-left: 40px;">❖ The use of recycling of plastic containers and bags which sometimes end being burnt is s significant contribution to reduce the green house gases that would have ended up in the atmosphere.</p> <ul style="list-style-type: none"> ➤ Different varieties of beans are preserved by drying directly under the sun. ➤ Dried crushed tobacco leaves, kerosene and wood ash are applied as preservative against insect attacks. ➤ Although this has been contested by some farmers, others claim to have successfully

	<ul style="list-style-type: none"> ➤ Different varieties of beans are preserved by drying directly under the sun. ➤ Dried crushed tobacco leaves, kerosene and wood ash are applied as preservative against insect attacks. ➤ Although this has been contested by some farmers, others claim to have successfully prevented weevil attacks by applying palm oil or other cooking oils. ➤ -Cypress and powdered pepper is also applied on beans by some farmers to avoid insects.
	<ul style="list-style-type: none"> ➤ Seedlings for planting for the next season are selected and buried in the soil until its time for planting. ➤ Seeds are also dried from time to time with the use of wood ash.
 	<ul style="list-style-type: none"> ➤ Yam seeds are dried in the sun and some farmers apply wood ash or salt to wounded areas before drying given that yams are very fragile and subjected to cuts when harvested. ➤ Also farmers put sawdust in a hole where yam sets for the next planting season are placed and later covered with plantain leaves.
 	<ul style="list-style-type: none"> ➤ It is preserved by keeping it in the open air for germination. ➤ Seeds are also kept in the sun for a few days and then put in bags to germinate. These are then transported to farms for planting.
 	<ul style="list-style-type: none"> ➤ Stems are transformed into cuttings and covered with grass after harvesting to keep them fresh. ➤ Others simply transplant cassava stems from

Huckle Berry



Wood ash is mixed with squashed seed of the staple vegetable, preventing it from insect attacks and from rot. These are then dried in the sun, stored in air-tight containers in preparation for the next planting season.

Tomatoes



Seeds are allowed to rot and put in water, mature seeds sink and are sieved, dried and are put in air-tight containers for next planting season.

Pumpkins



Gourds are broken and the seeds are mixed with wood ash and dried in the sun. The wood ash with high lime content prevents any pest attack on the seeds. Dried seeds are then stored in air-tight containers and bags in preparation for the next planting season

Pepper



The seeds are washed, sieved and dried under the sun then stored in air-tight containers for planting.

Ginger



Framers keep seeds in a cold place and covered with plantain leaves. Others cover their seeds with grass or bury theirs in the soil for next planting season.

Plantains



Suckers are removed from the ground and stored in a cool dry place for planting in the next planting season.


Some local actions for the mitigation of emissions



Despite the fact that many community households are embracing modernity including using modern construction materials like aluminum roofing sheets, they have still kept the tradition of having thatched roofs alongside these.

The thatch is said to capture most of the smoke generated from the burning of wood which would have been a significant contribution to total greenhouse gases in the atmosphere.

The water harvested from these thatched roofs has been used by communities for ages as a fungicide and pesticide sprayed on subsistence and cash crops. In addition when these roofs are replaced, the thatch once spread on farmland is high value manure, enhancing crop productivity.

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	<p>In this household, the heat from the fireside is used to cook the meals and the remnant heat serves to heat the chicken pen and dry the maize before threshing. Use of electricity only contributes to carbon emissions.</p>
	<p>Use of improved cook stoves with specially chosen heat efficient wood reduce the amount of emissions from households</p>

STRATEGIES USED BY FARMERS TO TIMELY CONTROL WEEDS

- Early mulching of crops especially in the case of maize and beans
- Use of traditional weed killers and insecticides that does selective killing of unwanted insects

- Weeding and cleaning during the dry season
- Use of insecticide to spray grass
- Timely planting
- Timing in manual weeding

STRATEGIES USED TO MITIGATE CROP FAILURE

- Early planting of crops.
- Mulching and Watering of crops before and during periods of drought.
- Use of chemicals like Urea and fertilizer to increase water supply to crops.
- Farms are allowed to fallow and regain fertility after a long period of cultivation especially staple crop farms.
- Advice is gotten from Agric officers on how to prevent crop failure
- Farmers cultivate around streams and also carry out irrigation especially during the drought period.
- Practice of mixed farming.
- Use of Compose Manure Especially Leaves of Calandra and Kajenus Kajan.
- Use of Palm fronds to prevent too much sunlight from affecting the crops.
- Special crops are treated and planted during drought like plantains and bananas since they do well during this season.
- Cultivation of crop is done at the top of the hill where there is availability of water (spring water) with cold temperatures
- Crops cultivated during drought are planted towards the end of the rainy season when the soil is still wet.

STRATEGIES USED TO MITIGATE THE EFFECT OF CLIMATIC HAZARDS ON THE GENERAL WELL BEING (HUMANS AND ANIMALS)

DROUGHT:

During this season, indigenes engage in either the buying of portable water or digging of wells to get water. Also, they use warm dresses in the morning and evening, kennel oil, Vaseline and glycerin are used to keep the body moist and to prevent body cracks. They eat more fruits and vegetables and also planting of water friendly trees like raffia around catchment area to maintain constant water supply and avoid planting of eucalyptus trees around water catchment which consumes a lot of water from the soil.

MALARIA AND CHOLERA:

In this case, indigenes maintain hygienic and sanitary conditions by boiling water before drinking, eating well prepared food, keeping the environment clean by avoiding standing water which are breeding grounds for mosquitoes and clearing of bushes around houses. They also carry out vaccination and sensitization. They also boil bark of trees and some tree leaves (pawpaw, mangoes, guava, “fever grass” and “Blood tonic”) and sleep under treated mosquito nets to prevent malaria. Furthermore they dig wells far away from toilets to prevent Cholera out break..

FLOODS:

To avoid floods, they widen the drainage systems, increase sizes of water channels, building of embankments and planting of trees along river banks. In addition, they avoid throwing of dirt along water channels which might cause blockage. They also fill bags with soil and place them in risky zones around the compounds.

HIGH TEMPERATURE:

During high temperatures, indigenes wear light dresses, consume cold drinks (water from clay pots), use fans, refrigerators and planting of trees to reduce sunlight and encourage ventilation while avoiding the cutting down of trees and bushfire.

STRATEGIES USE TO MITIGATE THE EFFECT OF CLIMATIC HAZARDS ON STAPLE AND OTHER CROPS

DROUGHT PREVENTION:

There is the digging of wells around farm areas used for the watering crops. Cultivation of swampy areas, use of fertilizer to provide soil with water, putting of grass and palm front on crops to prevent direct sunlight, they also plant deep into the soil especially in the case of cassava and yams to avoid direct sunlight. Wood ash is also sprayed on crops like pepper to prevent insects. In the case of coffee, mulching is done to avoid sunlight penetrating the roots. Crushed tobacco is also used to spray crops against caterpillars.

FLOOD PREVENTION:

There is the construction of good drainage systems for running water, carrying out irrigation methods, cultivating high horizontal ridges and also shift cultivation to hill tops. Widening of streams and straightening of river banks. Planting of trees like pears and mangoes at the river banks to prevent soil erosion

CONTROLLING HIGH TEMPERATURES:


Vegetables are left in an open air area for them to remain fresh after harvest, planting of water friendly trees around farming areas. Trees are replaced immediately a tree is being cut down.

GENERAL STRATEGIES TO COPE WITH CLIMATE CHANGE

- Planting more trees to reduce high temperatures
- Avoidance of bush fire and tree cutting
- Spraying of crops
- Crop rotation
- Use of advice from experts
- Use of Compose manure like calandra, akersia and susbenya for soil fertility

- Use of animal dung, urine, Kerosene, wood ash and tobacco to prevent insects from eating the crops
- Use of insecticides
- Use of reserve seeds in case of crop failure during the seasons of planting

ZAMBIA

	<p>Explanation</p> <p>Data collection process of Local Indigenous Knowledge and Practices (LIKPs) at Damatso village, in Vuward, Lundazi district.</p>
<p>Products and Pictures</p> <p><u>Maize (<i>Zea mays</i>)</u></p>	<p>Explanations</p> <p>Preservation of maize which is a staple food crop is done by sun drying the cobs with husks while still on the field and is stored in the bins with husks. The bins are either smeared with mud or cow dung which is claimed to be a preservative against common weevils.</p> <p>Some farmers preserve their maize crop by drying the cobs, shell them and then bag the grain after mixing it with chili powder. It is believed that chili powder is a very good preservative against common weevils.</p> <p>Another method farmers use to preserve seed maize is by hanging dried cobs in a fire place. This allows cobs of maize to be</p>

SEED AND FOOD CROP PRESERVATION



Beans locally known as *Chilemba* and *Nchungu* in Bemba and Tumbuka languages respectively are also sun dried and preserved by applying chili powder and wood ash. For storage, beans are preserved in clay pots and sisal bags for those who can afford to buy. Seed beans can also be preserved in pods and stored in bins locally called *Tuku* in Tumbuka language. One respondent said it is better to preserve seed beans while in pods because it is less attractive to pests and diseases.

Sweet Potatoes (*Ipomoea batatas*)

It is preserved in a dug out pit measuring 1m x 1m x 0.45m depending on the quantity, which is then treated with wood ash before the tubers are buried in it. Farmers claim that tubers remain fresh without being attacked by soil pests and diseases for more than 4 months after harvest in the soil.



Groundnut/peanuts (*Arachis hypogea*)



Groundnuts, which is also known as *Syaba* in Tumbuka language is sun dried after harvest, preserved and stored in bins called *Tuku* by the local people in Lundazi study area. The pods are stored unshelled and are mixed with either ground cow dung or wood ash or/and sometimes without any of these two as long as the bin has been well smeared with mud or cow dung.

FARMERS STRATEGIES TO ADAPT AND MITIGATE AND VARIABILITY

THE IMPACTS OF CLIMATE CHANGE

ADAPTATION AND MITIGATION STRATEGIES

Diversification into rearing of livestock



Adapting to climate change by poor resource farmers is an enormous challenge for this group. When asked as to how they manage to survive droughts which lead to crop failure, one farmer responded that it would be suicidal for anyone to entirely depend on crop production. The farmer said it was important to diversify into rearing of small animals which he said were well adapted to the environmental conditions. The interviewer was further told that

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Use of suitable agroforestry species and manure



In view of the ever rising cost of mineral fertilizers in the country, poor resource farmers are more and more turning to organic fertilizers and incorporating tree species in their farming systems that fix nitrogen in the soil such as the Musangu tree (*Faidherbia albida*) which is native to Zambia. It has been found to sequester carbon and small scale farmers believe that it provides fertilizers to the soils.

PREDICTING SEASONS AND CLIMATE VARIABILITY

Migrating Birds



During focus group discussions, it was learnt that farmers both in Lundazi and Mpika use migrating birds which they call *Ifyoso* in Bemba to predict seasonal changes. It was revealed that the movement of these birds help them predict the onset of rains. When these birds are observed flying from north to south, then the farmers know that the rains were around the corner and start

INDICATOR(S) USED FOR SELECTION OF FARMING LAND

Acacia Tree



Selection of farming land is not as easy as one would think among the poor resource farmers. One respondent in Lundazi district said knowledge of forestry tree species is very vital in selecting farm land. The respondent said if land has numerous acacia trees, in Tumbuka known as *Ngobezituba* then the land is said to be fertile for farming and that it would require very little external inputs such as mineral fertilizers for crop production.



IT RELATES TO AGRICULTURAL PRODUCTIVITY



It is generally acceptable that healthy issues directly affect agricultural productivity. The communities in the study areas claimed that they use Prickly pear cactus (*Likafyamubili* in Bemba) and aloe vera (*Chinthembwe* in Tumbuka) to treat numerous diseases namely diarrhoea, skin burns and acne. In Bemba language diarrhoea is known as *kupolomya*, in Tumbuka skin burns and acne is known as *vilondavyamwavi*. They claim aloe vera and cactus have been known for

Horsemint



Malaria is one of the killer diseases in Zambia. Anopheles mosquitoes transmit plasmodium, a vector that causes malaria. The project target respondents in Lundazi district use horsemint, known as *kalengazimu* in Tumbuka language to repel mosquitoes. They claim the fresh herb is placed inside the house to prevent mosquitos from biting them in the night while asleep. They revealed that the herb produces a strong smell that keeps mosquitoes at bay.

STRATEGIES USED BY FARMERS TO TIMELY CONTROL WEEDS

Apart from the use of approved scientific agronomic practices such as mulching, use of herbicides and insecticides strategies taught by agricultural extension officers, farmers of the project study sites

continue to use strategies that have been in existence for time immemorial to control weed. Some of the strategies used include:

- Use of labour in exchange for food. Some people who may not have money to buy food are engaged to weed the fields in exchange for food. The quantity of food given depends on the size of the field weeded.
- Use of family labour. The normal size of a household on the average may comprise not less than 6 members. In polygamous situation, a household may have a membership that might exceed 20 and during high peak agricultural activities such as weeding, all are called upon for the task at hand. This is common in Lundazi among the Tumbuka speaking people.
- Use of alcoholic beverages, none alcoholic beverages known as *moba* and *chindongwa* also known as *munthibi* respectively. Both the Bemba and Tumbuka speaking peoples use these strategies in order to finish weeding of the crop fields within a short space of time.

STRATEGIES USED TO MITIGATE CROP FAILURE

Other than using learned skills from agricultural extension and camp officers, the farming communities in the study areas use other strategies that have orally been passed on from generation to generation. Some of the strategies used include the following:

- Diversification of field crop production. The staple food crop grown in the two study areas is maize which is very susceptible moisture stress. In Mpika, farmers grow maize side by side with cassava which is tolerant to drought and so do the farmers in Lundazi district.
- Rearing of different types of livestock. Most households rear both poultry and animals of different types at subsistence level. In terms of poultry, they rear chicken, ducks, doves, and guinea fowls. Animal rearing include goats, cattle, pigs and sheep. During feminine, they use batter system to get the necessities for the household. They are also able to send their children to school after sale of any of these livestock.
- Engage in vegetable production. More than 80% of the study samples also engage in a variety of vegetable production. Some for purely income generation while others for both home consumption and income generation. In times of water scarcity, they dig shallow wells for the purpose of vegetable production.

STRATEGIES USED TO MITIGATE THE EFFECT OF CLIMATIC HAZARDS ON THE GENERAL WELL BEING (HUMANS AND ANIMALS)

FLOODS:

To avoid floods, the indigenes widen the drainage systems, increase sizes of water channels, build embankments and plant trees along the river banks. Moreover they avoid throwing of dirt along water channels which might cause blockage while avoiding land reclamation. They also fill bags with soil and place them in risky zones around the compounds just like it is in Cameroon. Apart

from that, communities come together to build bridges where government may not have reached and provided the vital infrastructure. This helps the community transport their agricultural products to markets during the rainy season.

HIGH TEMPERATURE:

Just like in the case of Cameroon, during high temperatures, indigenes wear light dresses; consume cold water from clay pots and resting under the shades of trees for cooling purposes.

STRATEGIES USE TO MITIGATE THE EFFECT OF CLIMATIC HAZARDS ON STAPLE AND OTHER CROPS

STRATEGIES TO REDUCE THE IMPACT OF DROUGHT:

Like in Cameroon, farmers embark on digging of shallow wells around the farm areas to be used for watering of crops. During this season, indigenes engage in either digging of shallow wells or women and girls travel long distances to fetch water.

In some cases humans and animals share the same sources of water for their drinking and washing of their clothes.





Since maize which is a stable food crop in Zambia including the indigenes susceptible to drought, farmers diversify to growing other crops such as finger millet, sorghum, cassava and fruit trees such as mangoes, oranges, guavas etc. A small proportion of the indigenes said they are aware of conservation farming and use some of the practices such as minimum tillage which in Tumbuka is known as *gampha*. Early maturing local maize variety called *kafula* is also grown during drought years.


STRATEGIES TO REDUCE THE IMPACTS OF FLOOD:

Farmers use ridges for their crop production such as maize, groundnuts and tuber crops like Irish potatoes and sweet potatoes. Houses are constructed away from the banks of the river and so are their field crops in order to avoid riverine floods. The farming communities also plant mangoes and other tree crops along the river banks to prevent soil erosion.

TANZANIA

	FARM PREPARATION
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1.		<p>Thunderstorm and heavy cloud are signals for starting farm activities usually in October and November at Mukuranga districts. The communities wait until thunder is heard to start farm preparation.</p> <p>Another signal for good rains is the thunderstorm originating from the coast. This is an indication for warm and moist air coming from the coast hence they can plan for a good harvest.</p>
2.		<p>The farmers do not plough the farms. They applying conservation agriculture taking into consideration minimum disturbance of the soil hence conserve soil carbon and do not expose the soil to erosion.</p>
3.		<p>Farmers use fire to clear farms and fire kills some diseases locked in the last harvest can be destroyed by fire hence minimize disease speeding. Slash and burst is still the old method of farm preparation though common at this village. This extensive agriculture could limit future soil organic matter by exposing the soil to erosion there is a need for further education on this to minimize impact to climate change.</p>
4.		<p>The community in Vikindu prepare terraces in their farms to collect rainwater and this is water conservation strategies and is done during farm preparation.</p>



5.		<p>Weeds are removed by hands the activity is named “kitotola” usually done after crops have planted especially cassava.</p>
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HOW TO COPE WITH DRY SPELL AND DROUGHT

		<p>They plant drought resistant crops, “Cassava mostly” that mostly sustain dry spell and drought.</p> <p>The community naturally have adapted to plant cassava because they had signal for dry spell in maize when they see no development of maize at tussling stage. Dry spell is a common climatic risk and affect crop development during rain seasons. The most affected crop with dry spell is maize. What the community done to adapt to dry spell. Most they engage with cassava crops. What do cassava do to withstand dry spell, most of time they use the first rains and when the cassava has two to three branches, it just enough to live and withstand dry spells in the short period of no rainfall during rainfall season.</p>
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		<p>When the community sees wind coming from the south towards north this is a good indication for the nearby dry conditions. Also the wind coming from south is mostly accompanied by long periods of sunny weather named Lugunya this is the indication of the dry period. What do they do? They use the long period of sun to dry their food especially the cassava for future use.</p>
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		<p>Few farmers do irrigations to cope with drought and cultivate vegetables</p>
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SIGNALS FOR GOOD RAINS		
		<p>Signals for good rain are detected by the bird named Chole. Usually the birds start to whisper in September to October. The rains sometimes delay until November. The bird usually stays in trees until the rain passed.</p> <p>Another signal to enough rainfall is the bird named Nyege. The birds contains a lot of water and the water keep on discharging in the body and if you pass nearby tree that the bird is laid the water may be dropped over you. When the rain passed it kills the birds.</p>
SIGNALS FOR DROUGHT		
		<p>Guarding water at the wells overnight is a signal for scarce water in the wells and this can be interpreted as dry year. Water conflicts is an indicators for drought conditions</p>
		<p>Dried firewood dominated in a wider area of a local forests is an indication for drought conditions and when they see no dried firewood for extended period of time is an indication of water scarcity</p>
		<p>When children are suffered by rashes is an indication for excessive temperature and drought.</p>
HOW TO PRESERVE SEEDS-CASSAVA		
		<p>The cassava seed are stored just under the shade of a big tree, they never get dried until the next season.</p>

HOW TO PRESERVE CASSAVA		
		<p>Cassava can stay at the soil for more than one year. They harvest the cassava when they need to eat. The rest is stay in the soil.</p>
HOW TO PRESERVE RICE		
		<p>The farmers use rice bag to store rice with their husks. They can stay safe for a longer period with the rice husks.</p>

Conclusion

The contributions of Local Indigenous Knowledge and Practices (LIKPs) to cushion local farmers in Cameroon, Tanzania and Zambia against climate change with enhancement of staple food production is significant. This compendium sought to bring to the fore some of those community practices. Interaction with communities in these target countries has brought this sideline solution to the fore and there has been a renewed interest valuing this inherent community practice. The sharing of experience between three countries has resulted in new opportunities to test successful practices that have a huge potential to address the cause of climate change at micro levels and those that cushion communities against the unavoidable impacts of the global phenomenon. This is not an exhaustive list given that more research and interaction with communities needs to be done to gather as much information as possible to establish the credibility of these community practices. In addition, these practices need to be tested to further prove their effectiveness and impact. This will therefore result in the integration of this community solution and science-based knowledge and technologies those leading to enhanced food security resilient communities.