Community Based Adaptation to Climate Change in Africa (CBAA)

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LIVED EXPERIENCES: ADAPTATION TO CLIMATE CHANGE IN GOGONYO SUB-COUNTY, PALISA DISTRICT, UGANDA

Susan Nanduddu

Series editors:

Judi W. Wakhungu, Joan Kariuki Kung'u and Charles Tonui

Introduction

Climate change has become a local phenomenon just as it is global. The magnitude of climate variability is now being felt at almost all scales and in all regions with extreme events such as drought, excessive rainfall, cold and heat waves as well as dry spells affecting much of rural Africa, Uganda inclusive. Climate change adaptation has now become indispensable due to the increasing vulnerability of rural populations to the effects. Communities which are remotely located in countries such as Uganda, have limited access to social services, dependent on natural resources for their livelihoods and may have limited opportunity to influence the policies that affect their lives are, therefore, likely to be more vulnerable. Gogonyo Sub-County in Pallisa District, Eastern Uganda, represents some of these characteristics and has been affected lately by droughts, excessive rainfall and dry spells, exposing people to hunger to such an extend that some food handouts were distributed in the area1. This report presents results of a study that was conducted to assess the effects of climate change on rural livelihoods in Gogonyo with the aim of identifying practical adaptation and mitigation strategies for the population. The study assesses community perceptions on climate change, vulnerability. It also examines the impacts to livelihoods and socio-economic setup of the Gogonyo sub-county.

Study description and rationale

Pallisa is one of the poorest districts in Eastern Uganda, located in the plains of the Lake Kioga drainage system. Gogonyo Sub-County is located to the west of the district and adjacent to the extensive wetlands of Mpologoma River with numerous lakes that form part of the Kioga system. The area is characterized by a mixture of two major tribes of Itesots and Bagwere. The sub-county is one of the poverty hotspots in the country and region with an index of PUT INDEX 2. The geography is characterized by extensive wetlands and lakes with low lying grasslands. Livelihood activities include majorly, rain-fed agriculture of perennials including cassava, grazing and annuals including sweet potatoes, cotton and rice. Fishing for some communities close to the lakes and wetlands is a major livelihood strategy which also provided employment to youth and women involved in the transportation and trade. The sub-county is also located in the cattle corridor which is a dry land ecosystem stretching from southern Uganda to north eastern corner of the country. The sub county has a high population density relative to neighboring sub counties of 312 persons per sq km3.

Gogonyo Sub County has social, economic and environmental features that have exposed it to the climate change risks. The area is lowly lying with natural sinks that retain water forming lakes, large ponds and permanent wetlands such as Nakuwa4. The natural features couple with social and economic factors and have increased vulnerability of the population to climate risks. Livelihoods have not been spared; property and resources at the disposal of communities continue to be affected negatively by the extreme weather events experienced in the area. It is these factors that motivated an in-depth study to analyze the climate change impacts affecting the area, impact on livelihoods, resources, communities and how the communities are responding and coping with the impacts. The study also examines the adaptation measures already implemented by the communities. The rationale for this study is two pronged. On one hand the need for a response to climate change impacts in rural Uganda has become more than catch phrase due to global and regional debates to a response that is needed to reduce increasing vulnerability of communities as a public policy response. On the other hand, the study also underpins the inherent development challenges facing rural Uganda that are now overlapping with climate change impacts. This is because climate change is worsening

the already grim social, economic and environmental situation in rural Uganda that innovative adaptation and mitigation measures are needed to defray climate change impacts but at the same time reduce poverty and environmental degradation.

Objective to the study

- To assess the vulnerability of the community of Gogonyo Sub-County to the impacts of climate change, and document the adaptation options practiced.
- To identify adaptation mechanisms required to enhance community resilience to the impacts of climate change

Methodology

The study was conducted through surveys, mapping and in-depth discussion with household heads or representatives in the sub-county. A reconnaissance was conducted before the main survey to establish the climate change impacts and major livelihoods issues affected by climate change impacts or enhancing adaptation and mitigation. A total of 108 respondents were interviewed with a semi-structured questionnaire. The respondents were randomly selected in the villages based on random transects. For maximum cooperation and eliciting quality data as much as possible, five local interviewers were recruited with the support of Pallisa Civil Society Network (PACONET) staff who are partners and very versed with the area. Additionally local guides were recruited to take the team through the villages ensuring randomness in selection and coverage as possible. The interviewers and guides were trained in data collection methods focusing on rapid rural appraisal and Global Positioning System (GPS) readings for locations. Interviews were conducted for four days and a community meeting was held two weeks later. GPS readings were taken for each interviewed household and this data is utilized in the analysis to establish vulnerability and climate change impacts variation in space. Data are analyzed using various techniques and methods. Data on climate change impacts and vulnerability was mainly collected using matrices that identified the unit impacted and the potential climate change effect. This data yielded ranks based on experiences of the households. In addition data on wealth and resources available to households was also collected and this was transformed to rankings using statistical transformation techniques to put all households to a similar scale of measuring their wealth ranks. Wealth ranks are then utilized to analyze vulnerability and relate it to reported impacts both at household level but also across space through villages. A vulnerability index is calculated for households and villages to understand the patterns of vulnerability and give insights into entry points for adaptation and mitigation measures.

Livelihoods in Gogonyo

The primary occupation of households in Gogonyo is agriculture and this combines both crop farming and grazing. Up to 90% of the respondents are engaged in agriculture but they too have several other occupations. The second and third ranked occupations are fishing and agricultural labor, the former related to the existing natural resources in form of extensive wetlands and lakes while the latter related to high population in the area coupled with low per capita land. Low precipitate land for adult population has led to fragmentation of land but also low marginal productivity of labor on household land that individuals mainly youths look for waged jobs by providing labor for agricultural production on fields other than their own or those belonging to the household. Non-agricultural labor, transport services by bicycle or motor cycle (commonly known as *boda boda*) were found not to be significant despite Gogonyo having a high youthful population mostly engaged in the service industry, including transportation. Small businesses such as kiosks, shops and trading are also not common in the sub-county, mainly because

it is largely rural, with few hamlets to provide household requirements. This implies heavy reliance on agriculture, crop farming and livestock keeping. Agriculture is also heavily rain-fed and this condition is important in determining the vulnerability of households and livelihoods to climate change.

Droughts, excessive rainfall, dry spells and strong winds are risks to the major livelihoods of the people in Gogonyo. But as indicated in the table below, the amount of land available for a household is important in determining the ability of the household to respond to the climate change risks. With an average 3.6 ha of land for a household and average household size of nine, it's clear that the pressure on land for agriculture is high. Yet the minimal land has to be divided into fields for crops, grazing and cash crops such as cotton. Land, income and other resources available to the households were utilized to rank households by wealth. The table below further indicates a low mean wealth rank of 0.2305 that signifies less capacity if households are to recover from shocks of climate change effects. The limited available land for households also implies low productivity, although other factors such as management techniques, capital and inputs are important. In the context of climate change, the major livelihood strategies of crop farming and grazing are susceptible to the risk of climate change and have been affected seriously by recent to past climate change extreme events.

Climate variability and change

An important study issue is climate change variability and change in Gogonyo. This was done with two approaches. The first is the analysis of actual climatic data for any significant variations in rainfall and this shows a significant decrease in amount of rainfall by between 1 to 5 per cent over a 60 year period. The analysis of change also reveals variation of amounts received over the same period with a range of up 350 mm of rainfall in variation over the sub county. This variation and or change are important in assessing vulnerability of the communities but also livelihoods.

Descriptive statistics of household size, land available and wealth rank

	N	Minimum	Maximum	Mean	Std. Deviation
NumberofHouseholdmembers_mean_1	113	8.00	13.00	9.9381	**1.18458**
Totalamountoflandownedha_mean_1	113	2.31	5.00	3.6449	**.86271**
Rank of seasonal shifts-median	113	1.00	2.00	1.8717	**.28173**
Wealth category of household-median	113	.23	.24	.2305	**.00511**
Valid N (listwise)	113				

The second approach in assessing climate change was through the survey in which community perspectives on variations and change were captured. Results show that communities have observed significant changes in terms of increase of rainfall (also known as Edowu in Ateso). However collaborating this with actual data from weather stations shows that the two do not correlate. What is perhaps is known is reduced rainfall which is erratic and received in short periods of time. This is correlated with the low ranking of erratic excessive rainfall by 28.3 per cent of the respondents but high ranking of seasonal

shifts by 63.7 per cent of the respondents. On the other hand longer rain days were ranked lowly implying short periods of intensive rainfall. The pattern emerging from this analysis indicates that there is a variation between short but intensive rains and extended periods of dryness and drought. This finding correlates again with the analysis of the actual rainfall data that shows significant reduced rainfall varying across the sub county. The implication of this variation is far reaching and scales out from livelihoods, homesteads, transportation services, access to social services to life threatening risks of flooding. The next section of the report will analyze and synthesize the vulnerability levels of households based on a preliminary analysis of vulnerability in Gogonyo.

Vulnerability to Climate Change

Assessment of vulnerability to climate change requires the consideration of both the magnitude and stresses affecting rural livelihoods. Rural livelihoods are subject to multiple shocks and stresses that can increase household vulnerability. Climate variability is one of the stresses that individuals and communities in rural areas particularly Gogonyo are coping with. Seasonal changes in the past can form a basis of forecasting the vulnerability of the communities in future. This can help to prepare for and adapt to climate variability and change.

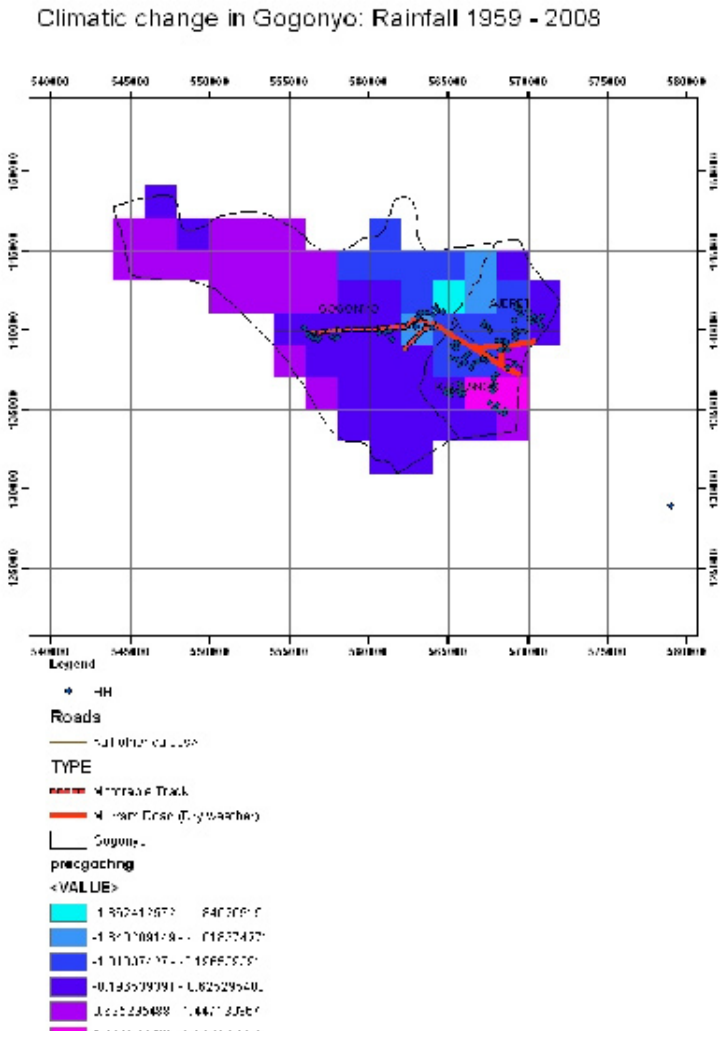
A wetland in Gogonyo: flooding and droughts are constant threats

Results of the study indicate that there is local specific and household specific exposure to climate change risks. Short intensive rains have led to flash floods but slow on-set floods have also been experienced in the area. Preliminary results indicate a high vulnerability of Gogonyo to variations but also change in climatic parameters. The climate change parameters used in the assessment include; flood, drought, heavy rainfall, heat, cold and riverbank erosion.

Vulnerability is assessed as the degree to which a household as a unit of analysis is exposed to a risk which is any or multiple stressors as enlisted above. The degree of exposure is a differential between the risk and the adaptive capacity. Exposure to the risk is presented in two ways; one through mapping location of households interviewed and relating that to change in climatic parameter of rainfall. This is coupled with the elevation to factor in the risk of flooding as an outcome stressor. The second approach to this analysis is through statistical analysis of

Observed Rainfall total changes

		Frequency	Percent	Valid Per cent	Cumulative Per cent
Valid		6	5.3	5.3	5.3
	Significantly changed	62	55.8	54.9	67.3
	Moderately changed	3	2.7	2.7	8.0
	Reduced	4	3.5	3.5	11.5
	Significantly Reduced	36	32.89	31.9	100.0
	Total	113	100.0	100.0	



Map 1 showing spatial differences in rainfall change over 60 year period

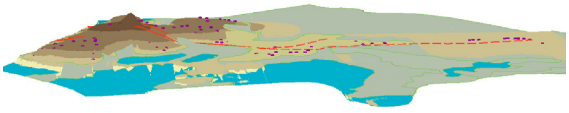
the reported risk of exposure as observed seasonal shifts and erratic events with the wealth rank that is a composite of resources available to the household which could help such a household to recover from the shocks. From the first approach, results indicate that there is spatially spread vulnerability in the area to climate change effects especially flooding since much of the area is flat at between 0 to one per cent slopes. This physiographic feature is important in determining vulnerability to flooding due to the susceptibility of households, crop fields and grazing land to floods. From interviews and interactions with community members, floods have affected their livelihood strategies by destroying crops, livestock and a few homesteads. In the village of Opeta for example, flood waters stretched from the sink wetland to within a few meters from the school which is on a slightly elevated area. This area in Opeta is also one of the communal grazing fields and thus cattle had to be herded to long distances in search for pastures during the floods. A couple of farmers reported losing their cattle in Opeta. Its clear that due to location in a natural "sink" some villages in Gogonyo are highly vulnerable to climate change impacts of flooding and droughts.

The second measure of vulnerability was through statistical analysis by comparing wealth rank as the adaptive capacity and the exposure given by the ranking of changes in climate parameters. As a control and determinant of adaptive capacity, wealth was correlated with exposure risk ranking from the household respondents. Results[5] indicate a high association in seasonal shifts and dry spells as controlled by wealth rank of households. This is significant and reveals that the capacity of households to adapt will influence their perception of risk to dry spells and seasonal shifts. Other significant findings from the table include erratic and low rainfall with seasonal shifts. This further reveals the vulnerability of households and communities in this area to effects of climate change. A further analysis of the data collaborated with in-depth interviews also reveals that wealth and household size influences the vulnerability to effects of climate change. But wealth ranking is more significant than the size of household. These preliminary analyses of vulnerability are at household level. Analysis is in progress to ascertain the vulnerability indices at village level which results are envisaged to inform the interventions and entry points with a picture on spatial variability of vulnerability.

Impacts of climate change

Climate change impacts in Gogonyo majorly manifest in form of flooding, droughts, dry spells, heavy rainfall, heat and riverbank erosion. Data were collected on how these experienced and felt impacts have impacted on livelihoods and production systems. There are fewer households whose homesteads are affected by flooding up to 11%. This is also visually evident on the map where most households interviewed were located on land that is relatively high in elevation. However the village of Opeta is largely in a sink compared to other villages and this is where vulnerability of homesteads is high to flooding. But drought and heavy rainfall were reported to severely impact homesteads. Drought because of long dry periods affects the building materials especially the roofs. This was revealed during in-depth interviews and communities expressed concern about the scarcity of grass for thatching which now is collected from long distances compared to previous periods and the frequency of change increasing. On the other hand, heat, cold and erosion were reported to affect homesteads lowly compared to heavy rainfall and droughts. As part of the homesteads, trees are an important form of asset for communities in Gogonyo. This is because the species planted around the homesteads provide input materials but also food during droughts and famines. Some of the trees include the palms and eucalyptus with the former providing thatching materials and fruits while the latter, poles and timber. These trees are an important asset that also form an adaptive measure especially with providing fruits. Climate change was reported to be impacting on these assets.

Heavy rainfall, droughts and flooding were reported to impact poultry severely. Poultry is mainly turkey but several households also have exotic chickens kept around the homestead. While droughts severely impacts on cattle rearing with decline in pastures and available water for the animals. The area has a significant number of grazers with cattle and goats being the most dominant. Crop farming was the most significantly impacted production system. The impacts are reported high by droughts 65 per cent and floods by 40 per cent of the respondents. Crops grown include; cassava, maize, sorghum and vegetables and all these were reported to be affected severely by floods, droughts, heavy rainfall (sometimes associated with strong wind) and erosion. There was reported drying of crops, low yields and when flooding



Drought and heat are significant effects of climate change on fishing

occurs fields are destroyed. In Opeta and Akisim villages, scars of flooding were evident and community members narrated stories of the 2007 flood that affected much of the eastern part of the country having destroyed their crop fields. This flood took more than three weeks to recede but it left many households with no food reserves and with the inadequate food aid residents were left to adapt in a hard way. As Joseph Agama exclaimed with a lot of emotion concerning the food aid, "what can one cup of maize floor per household do?" Similarly, respondents pointed out that food was no longer enough to sell, limiting their income.

Another important livelihood strategy affected by climate change is fishing. Drought and heat are the most significant effects of climate change to affect fishing. Drought implies reduced water and possible receding levels of the lakes and wetlands which exposes the areas in which fish lay eggs. Young fish are killed in the process while continued fishing also does spare the young fish. As Tambati Alamanzani (the caretaker of the Nakuwa Landing site) noted, the community has had training in managing wetlands, fish monitoring and managing landing sites. As observed in the photo below, young and small fish being loaded for transportation to trading centers from the landing site. Several trainings have taken place in the area but also from elsewhere as recorded in the book at the landing site. This livelihood strategy employs many youths, involves transportation services and is a key revenue collection source for the local government. Threat to fishing in the area affects not only the employed, but also the consumers and the local government to get the needed revenue to run activities and investments in infrastructure. A 0.7 km long canal was built to link the former landing site on Nakuwa wetland to where the water has receded. This canal is maintained by local people, fishermen and supervised by the manager of the landing site. The length of the canal is increasing and this was attributed to the low rainfall leading to the receding of the lake. There is increasing indication of agriculture being extended into the wetland system along this canal which further stresses the fishing in the wetland system.

Coping and adaptation to climate change

Crop farming, cattle and fishing are the most significant livelihood strategies in Gogonyo. All these however are affected, have been and are increasingly susceptible to effects of climate change. Results show moderate to severe impacts on these three major livelihoods and the stressors differ from flooding, droughts, heat and heavy rainfall. The changes in climate have been observed by the communities for much longer as noted during the in-depth interviews and Focus Group Discussions. With or without external support, communities in Gogonyo have been early adapters though limited by their capacity to adapt to these effects.

Because food security is important in the household, food production systems have been altered to adapt to the effects of climate change. One of the noticeable adaptation measures has been extension into the wetland system for agricultural land. At Nakuwa wetland, there is clear evidence of extension of agricultural fields into the wetland systems as the water recedes. Areas were cleared for maize, cassava but most significant is the shift to paddy rice production. Although rice is not a significant part of the menu in the area, it is not yet clear whether the local menu has been altered to include rice. There is still a significant reliance on cassava and maize coupled with beans and vegetables. Extension into the wetland system within this sink may enable the households to ensure relative food security but it does not reduce the vulnerability to floods as it may to droughts. Extension into wetland systems implies search for moisture which is almost readily available due to the permanence of these systems in terms of wetness. Paddy rice fields are evident through all the parishes of Angodi, Gogonyo, Ajepet and Kachango. The low lying areas have numerous streams that are all year round having some moisture which can enable rice and other crops to thrive. This form of adaptation may however be a mal-adaptation since it means further destruction of the wetland ecosystem by draining.

Associated with extension into wetland systems is the shift to paddy rice. There is a long history of rice production in the area and surrounding sub counties in Busoga and Budaka districts. But the main crops for the people in Gogonyo have been cassava, maize and cotton as a cash crop. The move to rice has two dimensions: First as a way of diversifying incomes due to dwindling cotton prices and second to diversify food sources within households Rice production in the area is seen as a strategy to defray the risks associated with drying of maize and cassava during droughts. Several households interviewed have slowly included rice on their household menus but mention that it used to be a cash crop. Because flooding severely affects food security as reported by the households coupled with location of the fields in generally low lying areas, rice is produced to offset the risks of crop loss should the hazard occur. For grazing, adaptation measures are limited to forecasts of climate extremes and adjustment in terms of preparing animals for long distances for water and pastures. Sometimes animals are moved to the islands during the drought period and only moved back when it starts to rain.

Flooding and drought are therefore the major stressors for which adaptations are necessary. During floods some families move to their relatives on drier land. There is also reported dependency on remittances from urban areas and or abroad. More families are externalizing excess labor to urban areas in search of jobs so that they can support their families in form of remittances. The limited income is mostly used to buy food (a recent phenomenon) from neighboring places such as Ngora, which is expensive. Some women have adopted social strands in order to adapt by forming groups with diverse objectives but targeting increasing their income generating activities.

Adaptation action points

Some of the possible adaptation measures to climate change identified during field work and from experiences elsewhere are as follow:

- Introduce drought resistant crops of cassava and maize which are key crops for food security.
- To increase food security sensitization about change in menu to adopt rice may serve well in view of increasing vulnerability of cassava to diseases and droughts.

- Consider tree planting especially in low lying areas following the right procedures to tap into the CDM as an alternative source of livelihood. Additionally, tree nursery beds should be established within Gogonyo to ease accessibility by the communities.
- Explore alternative sources of income such as quarrying.
- Livestock need dips and taking veterinary services closer to the communities.
- Weather and climate information needs to be provided in a timely and accurate manner to inform farmers' decisions.
- Water harvesting and management skills need to be introduced.
- Additionally, small scale irrigation schemes should be introduced and encouraged.
- Soil conservation and management
- Indigenous knowledge should be documented and disseminated widely for replication.
- Provision of safe water.

Conclusion

From the discussion, climate change impacts in Gogonyo are far reaching and affecting the well-being of the communities. Crop farming, grazing and fishing are the major livelihood strategies in the area. All these are affected differently by effects of climate change including flooding, droughts, heavy rainfall, heat and erosion of the banks. Impacts on livelihoods range from moderate to severe impacts depending of the livelihood and stressor. Whereas heavy rainfall and flooding affects crop farming more, droughts and affects grazing and fishing highly. Different coping mechanisms have been implemented by the communities to the major livelihoods and though some indicate mal-adaptation, the community has responded to the stressors and is innovative. Communities now need to be supported through dialogue to identify amplification of good adaptation measures and enhance others so that their effects are not adverse to the environment. One key issue about rural livelihood adaptation that will remain shaping the magnitude, scale and impact is population increase coupled with limited land resources. This will continuously put more and more people at risk and can be a threat to the population in the future as the search for additional land to increase production increases. Therefore as a root factor and indirect form of adaptation, family sizes need to be reconsidered for sustainability of rural livelihoods. The externalization of excess labor therefore might be an alternative adaptation measure with long-term sustainability benefits.

Footnotes

1. Joseph Angama, a resident informed research team about the food rationing of half a kilo of maize flour and a half for beans distributed in May 2009
2. UBOS Poverty ranking 2007
3. Lwasa S., 2007, Uganda Gridded Population
4. Nakuwa wetland system is a Ramsar conservation site
5. Appendix 1

Appendices

Control Variables			Rank of seasonal shifts	Rank of erratic excessive rain	Rank of Erratic low rain	Rank of longer rainy days	Rank of Long dry spells
Wealth category of household median	Rank of seasonal shifts	Correlation	1.000	-.694	.287	-.251	.324
		Significance (2-tailed)	.	.000	.019	.040	.008
		df	0	65	65	65	65
	Rank of erratic excessive rain	Correlation	-.694	1.000	-.388	.083	-.154
		Significance (2-tailed)	.000	.	.001	.504	.213
		df	65	0	65	65	65
	Rank of Erratic low rain	Correlation	.287	-.388	1.000	-.093	.083
		Significance (2-tailed)	.019	.001	.	.456	.502
		df	65	65	0	65	65
	Rank of longer rainy days	Correlation	-.251	.083	-.093	1.000	-.619
		Significance (2-tailed)	.040	.504	.456	.	.000
		df	65	65	65	0	65
	Rank of Long dry spells	Correlation	.324	-.154	.083	-.619	1.000
		Significance (2-tailed)	.008	.213	.502	.000	.
		df	65	65	65	65	0

For more information on the project, please contact:				
Eastern Africa:				
	Country	Contact Person	Organization	Email address
1	Kenya	Prof. Judi W. Wakhugu	African Centre for Technology Studies	j.wakhungu@acts.or.ke
2	Sudan	Dr. Sumaya Zaki- Eldeen	Sudanese Environment Conservation Society	zakields@yahoo.com
3	Tanzania	Ms. Euster Kibona	Environmental Protection Management Services	epms@bol.co.tz
4	Uganda	Ms. Susan Nanduddu	Development Network for Indigenous Voluntary Association	pna@deniva.or.ug
Southern Africa:				
5	Malawi	Mr. Khumbo Kamanga	Coordination Unit for the Rehabilitation of the Environment	kjkamanga@yahoo.co.uk
6	South Africa	Ms. Bettina Koelle	Indigo development and change	bettina@indigo-dc.org
7	Zambia	Dr. George Kasali	Energy and Environmental Concerns Zambia	kasaligeorge@yahoo.com
8	Zimbabwe	Mr. Shepard Zvigadza	ZERO Regional Environment Organization	shepard@zeroregional.com
Non-African Partners:				
9	Great Britain	Dr. Saleemul Huq	International Institute for Environment and Development	Saleemul.huq@iied.org
10	Bangladesh	Mr. Mozaharul Alam	Bangladesh Centre for Advanced Studies	mozaharul.alarm@bcas.net
11	Sweden	Dr. Richard Klein	Stokholm Environmental Institute	richard.klein@sei.se

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For more information, please visit: www.cbaaafrica.org; www.clacc.net; www.acts.or.ke: Contact Email: info@acts.or.ke