

Managing and coping with drought in Bugesera natural region of Rwanda: Kavumu Village Rainwater Conservation Plan

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Abstract

The present paper discusses the strategies to use in order to manage and cope with drought in Bugesera Natural Region of Rwanda. In fact, it is aimed at proposing some long term and sustainable mechanisms that can be adopted by Bugesera people in reference to their capacities in order to cope with water scarcity in the region. The paper is based on the experience of Bugesera people with drought and famine in the period of 1998-2002 and the fact that rainy is one of the natural capital that Rwandans have and should exploit. The researchers therefore suggest the rainwater conservation plan by each household of Bugesera respective villages referring to a model village named Kavumu Village. The methods used to get information include documents related to drought in the history of Bugesera and the main characteristics of the region, the interview with the chief of Kavumu village and the observation made in Kavumu village. Basically, the research is qualitative. From this, the researchers made a water conservation plan referring to the local capacities and vulnerabilities that are common to Rwanda in general and those that are found in Bugesera specifically in Kavumu village.

The plan suggested consists of two types of tanks for the households in Kavumu village i.e. the tank connected to the house and the underground tank. With this, there is a hope that people can cope with drought and famine in a sustainable way as far as agriculture is important in the economy of Rwandan households. This paper is therefore made in order to serve humanitarian workers in the area of disaster management.

Key Concepts: Drought, climate change, rainwater conservation, local people capacities and local people vulnerabilities.

1. Introduction

Bugesera natural region is one of the Rwandan natural regions located to the Southern-East of the country. It shares many characteristics with the rest of Rwanda's region. Rwanda is located just below the equator with an area of 26,338 sq. km. It is a landlocked country bordering Burundi (to the South), Tanzania (to the East), Uganda (to the North) and the Democratic Republic of the Congo (to the West). Despite its small size, the country has very diverse ecosystems (MINECOFIN, 2007). Rwanda forms part of the Great East African Plateau, which rises from the

lowlands in the West (950 m altitude), characterized by swamps and lakes, to the highlands of the East, which divide the country between the Nile basin and the Congo basin. The highlands reach 4,507 m; to their west, altitudes decrease rapidly to Lake Kivu, which constitutes the western border of Rwanda. The terrain is hilly; thus referred as "the land of a thousand hills" (idem). In respect of water area coverage, Bugesera has many lakes and rivers compared to other regions. All the lakes in the region comprise an estimated surface area of 10,635 hectares (UNDP and UNEP, 2007). However, in

spite of Bugesera region being blessed with considerable water resources, it has faced prolonged and repeated drought since 1998 with the direct consequences of food insecurity and massive population movements (The African Development Fund, 2006). The period of 1999-2002 was characterised by long and continuous droughts which even resulted in death of humans and livestock, as vegetation was depleted, and the entire region depended on external food handouts. Additionally, considering that Bugesera was previously a good source of relatively affordable food especially for the neighbouring urban areas of Kigali city, Huye and Muhanga, the food scarcity effects of the droughts were felt beyond the region (UNDP and UNEP, 2007).

In the period of drought, many projects implemented in Bugesera region targeted mainly the alleviation of food insecurity as far as it was felt by many people. The international community and the national organs could bring food for people in a relief point of view. In addition, the government of Rwanda suggested and obliged the plantation of trees and the protection of already existing trees all over the area for coping with drought. What else can be done for managing and preventing drought in this region? The present paper is aimed at proposing some other long term mechanisms that can be adopted by Bugesera people in reference to their capacities in order to cope with water scarcity. It suggests the rainwater conservation plan by each household of Bugesera respective villages. This paper is subdivided into 5 main parts including the introduction, the description of drought and its history in Rwanda as well as the background of drought in Bugesera region, the research methodology, the research findings and the conclusion.

Drought: Its Description and History in Rwanda

Drought is generally defined as an extended period of low or absent rainfall relative to the expected average for a region. It is divided in two categories such as meteorological drought which describes a prolonged period with less than average precipitation and hydrologic drought which occurs when available water reserves (in lakes, reservoirs and groundwater stores known as aquifers) fall below acceptable levels (www.yourclimateyourlife.org.uk retrieved on 16 July 2013). Drought has a big impact on the lives of people and this can be summarized in three categories. First, the economic impacts of drought include losses in the timber, agricultural, and fisheries communities. Many of these losses are then passed on to consumers in the form of higher commodity pricing. Next, social impacts include increased chance of conflict over commodities, fertile land, and water resources. Other social impacts include abandonment of cultural traditions, loss of homelands, changes in lifestyle, and increased chance of health risks due to poverty and hygiene issues. Finally, the environmental impacts of drought include loss in species biodiversity, migration changes, reduced air quality, and increased soil erosion (<http://weather.about.com/od/drought/f/droughts.htm> retrieved on 16 July 2013).

In the history of Rwanda there happened different kinds of droughts and subsequent famines with different Rwandese names. Before thinking about the drought in the recent years it is good to understand the phenomenon in the history. The table below shows those episodes in different periods of years, the El Nino /La Nina Episodes in each case, the catastrophe, the drought main effect and the affected region in the country. It starts with the beginning of the 20th century up to the year 2006.

Table 1: Period El Nino/La Nina Episodes and Famines in Rwanda

| Period El Nino/La Nina Episodes and Famines in Rwanda | El Nino /La Nina Episodes¹ | Catastrophe | Consequence | Affected Region |
|--|--|---------------------------------------|---|---|
| 1902/03 | El Nino Episode | - | “Kimwaramwara” Famine | South (Butare) |
| 1916/1918 | La Nina Episode | - | “Rumanura” Famine | Generalized |
| 1924/25 | La Nina Episode | - | Famine | Various regions |
| 1943/44 | La Nina Episode | Drought | “Ruzagayura” Famine | Generalized |
| 1963 | El Nino Episode | Diluvian rain | “Rwagakoco” famine | Generalized |
| 1982/83 | El Nino Episode | Drought, strong heats | Low agricultural production | Generalized |
| 1986/87 | El Nino Episode | Strong heats | - | - |
| 1990 | La Nina Episode | - | Famine | Various regions |
| 1991/92 | El Nino Episode | Drought | - | East |
| 1997/98 | El Nino Episode | Drought, high heats | - | - |
| 1999/2000 | La Nina Episode | Drought, high heats | Famine | East of country especially Bugesera |
| 2005/2006 | La Nina Episode | High heat and prolonged drought | Famine; water sources drying; tendency of desertification | Generalized; East and South mostly affected |

Source: Ministry of Lands, Environment, Forestry, Water and Mines, 2006

¹ El Niño is a complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes changed ocean and weather patterns in many parts of the world, often with significant impacts, such as altered marine habitats, rain changes, floods, droughts, and changes in storm patterns. During an El Niño, the physical relationships between wind, ocean current temperature, and biosphere break down into destructive patterns. The vast tropical Pacific Ocean receives more sunlight than any other region on Earth. Much of this sunlight is stored in the ocean in the form of heat. La Niña is approximately the opposite condition to El Niño. La Niña is characterized by unusually cold ocean temperatures in the eastern equatorial Pacific, as compared to El Niño, which is characterized by unusually warm ocean temperatures in the Equatorial Pacific.

Geographical Description and Climate change of Bugesera Natural Region

Bugesera region has an area of 1303 sq. km (UNDP and UNEP, 2007). It is found in the South-Eastern plains of the Eastern Province. It constitutes 1 of the Rwandan districts which has 14 sectors and 40 cells (The London School of Economics and Political Sciences, 2008). The region is sandwiched between Rivers Nyabarongo and Akanyaru which converge at the southern end to form the Akagera River (UNDP and UNEP, 2007).

Bugesera area is characterized by numerous lakes, the biggest of which are Rweru and Cyohoha (UNDP and UNEP, 2007). The table below shows the size and spatial distribution of Lakes in the Bugesera region. Apart from the water from the rivers and lakes of Bugesera, this region as well as other parts of Rwanda enjoys different rainy season periods. In fact Rwanda has two dry seasons and two rainy seasons: a short dry season from January to February; a rainy season from March to May; a long dry season from June to September; and another

rainy period from October to December (UNEP and IISD, 2005; MINECOFIN, 2007). The annual rainfall is 854 mm i.e. 275 mm in humid period, 515 mm in intermediate period, and 64 mm in dry period (The London School of Economics and Political Sciences-LSE, 2008). The rainy seasons have an average of 110-200mm of rainy per month and the annual underground water rainfall is 88 mm while the Annual water stress is 573 mm (idem).

The relative humidity of Bugesera constitutes 67% and the annual evapo transpiration (ETP) 1339 mm i.e. 187 mm in humid period, 734 mm in intermediate period, 418 mm in dry period (idem). The average temperature in Bugesera varies between 24.6-27.6°C with the hottest months being August, September. The altitude of Bugesera ranges from 1000-4500m above sea level (idem).

Although the vegetation of Bugesera natural region is predominantly made of the tropical savannah (idem), there is also a forest made of big trees. Below is the table showing the distribution of the forest in this region.

Table 2: Size and spatial distribution of Lakes in the Bugesera region

| Lake | Geographical Location | Surface area (ha) | Depth (metres) |
|---------------|-----------------------------------|-------------------|----------------|
| Cyohoha South | Ngenda, Gashora & Nyamata Sectors | 600 | 1.4 |
| Gashanga | Rwinume and Rilima Sectors | 232 | 2.5 |
| Kidogo | Rilima Sector | 225 | 2.5 |
| Rumira | Gashora and Rilima Sectors | 280 | 3 |
| Mirayi | Gashora and Mwendo Sectors | 232 | 4 |
| Kirimbi | Mwendo Sector | 230 | 2.5 |
| Gaharwa | Mwendo and Nkanga Sector | 230 | 2.5 |
| Rweru | Rweru Sector | 1.868 | 5.6 |

Source: UNDP and UNEP, 2007

Table 3: Forest area in Bugesera in 2003

| Ex-district | Public forests (ha) | District forests (ha) | Private forests (ha) | Total (ha) |
|--------------------|----------------------------|------------------------------|-----------------------------|-------------------|
| Gashora | 9,800 | 199.7 | 301.9 | 10,301.6 |
| Ngenda | 10 | 57.1 | 97 | 164.1 |
| Nyamata | - | - | - | 1,100 |
| Total | - | - | - | 11,565.7 |

Source: The London School of Economics and Political Sciences-LSE, 2008

Causes of Drought in Bugesera Natural Region

Table 4: Explanation from research of the drought in Bugesera

| Causes | Explanations from research done |
|--|--|
| Agricultural activities and deforestation | During the period 1960-2002, more than two-thirds of the forest cover was lost; increasing the burden on the forested land to provide food from agriculture (UNDP and UNEP, 2007). |
| Internal Conflicts and deforestation | <ul style="list-style-type: none"> - Internal conflicts caused migration and heavier settlement in the region during the 1950s (The London School of Economics and Political Sciences-LSE, 2008). - Almost 40% of forests have been destroyed during the War and Genocide of 1994 (International Strategy for Disaster Reduction retrieved from http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm on 16.07.2013). |
| Increasing Population and deforestation | Increasing population caused migration and heavier settlement in the region during the 1950s (The London School of Economics and Political Sciences-LSE, 2008). |
| Failure to use the energy saving and deforestation | <ul style="list-style-type: none"> - The general failure to use energy saving implements in Bugesera means that the population relies largely on wood fuel. Like everywhere in Rwanda, the most used energy in Bugesera come from wood and 99% of the population use this kind of energy (Japan International Cooperation Agency & Ministry of Agriculture and Animal Resources Republic of Rwanda, 2006). - The forest was also the sole source for charcoal for cooking in Kigali City, further increasing the burden on the land. In the 1990s, signs of desertification began to show and prolonged drought caused increasing water shortages, which had a devastating impact on human consumption and production. Lake Cyohoha in the North dried up completely (The London School of Economics and Political Sciences-LSE, 2008). - Fuel wood, in the form of firewood and charcoal, is the main source of energy for both domestic and commercial consumers. More than 95% of the households of Bugesera rely on biomass as energy for cooking (Community Development Plans for Ngenda, Gashora and Nyamata, 2004), and therefore ecosystems that provide woody biomass are the most important sources of energy. Additionally, the charcoal making is used to provide employment and income especially among the youth. Bugesera's proximity to Kigali city (only 35 Km from the city centre), where demand for charcoal and firewood is high, has worsened the pressure of fuel wood demand (UNDP and UNEP, 2007). |

- Bush Fires and deforestation – Bush fires are very frequent during the dry season, especially in the eastern and south-eastern regions of Rwanda and cause deforestation. As a result of interview survey, Bugesera District is very famous for its bush fires to exploit farmland, as well as to prevent monkeys from browsing on sorghum during harvest season. It occurs not only during the dry season but also in the wet season, and not only in wetlands but also in hillside in Bugesera. Grass such as papyrus is burnt in wetlands, tree in hillside (UNDP and UNEP, 2007).
- Destruction and burning of the forests by farmers and pastoralists looking for good soil and pasture (International Strategy for Disaster Reduction retrieved from <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm> 16 July 2013)
- Brick making and deforestation Brick making is the predominant industrial activity in Bugesera requiring energy, but use of wood for burning bricks (and charcoal as well) was outlawed by a Cabinet decision in 2004 (UNDP and UNEP, 2007)
- Climate – Climate induced drought has been blamed as the main driving factor for water scarcity in Bugesera region (UNDP and UNEP, 2007)
- Despite relatively high rainfalls, Rwanda suffers from frequent droughts caused by erratic rainfall patterns (Mpyisi 2003) (UNEP and IISD, 2005)
- Precipitation is heaviest and most regular in the Western and North western areas, while the eastern region has less abundant and more erratic rains (MINECOFIN, 2007)
- Forests destroyed by insects – Destruction of trees by termites (International Strategy for Disaster Reduction retrieved from <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm> 16 July 2013)
-

Behind the drought of 1998-2002 that occurred in Bugesera and for which consequences are still felt by several people even today, there may be several causes. The history of Rwanda shows that the first cause behind this natural disaster is deforestation which resulted from people's activities throughout the history. The table below shows various causes mentioned by the researchers.

Bugesera Population Capacities and Vulnerabilities Analysis

According to the August 2012 Population and Housing Census (p. 21), Bugesera has a total population of 363,339. The Population density in Bugesera has progressively increased from 181 inhabitants/ km² in 1980, to 205 inhabitants/km² in 2002 and to 282 inhabitants/km² in 2012.

As far as the plan of the present paper is to help people conserving the rainwater, it is good to analyse their capabilities and vulnerabilities in this respect. This population has some capacities to exploit in order to cope with catastrophe like drought. Likewise, people are also to some extent vulnerable to drought and can't do anything for the project to be implemented.

In respect of the present plan of rainwater conservation, the researchers need to look at their housing system, the distance from one household to the next, the general means of living, the general vulnerability or advantage in respect of climate and climate change and the raw materials that can help in building the water tank in their respective villages if possible.

As for the types of housing, zinc is the most popular in Bugesera since it accounts two thirds of total households. One fourth of people live in the grass roof houses on average (Japan International Cooperation Agency & Ministry of Agriculture and Animal Resources Republic of Rwanda, 2006). However, in the sectors of Rweru, Ruhuha, Ngeruka, Gashora and Kamabuye, more than one third of families live in grass roof houses, and these Sectors are mainly located in southern part of Bugesera (idem). The households that still use grass roof for their houses are more vulnerable and the plan can be done for them only if iron sheets roofs or any other material that can easily conduct the rainwater to the tank are provided.

In respect of the distance from one household to the next, more than half of the households live in isolated houses as a whole (idem). In the present project this constitutes vulnerability but it can be ignored for the project to be implemented as far as the tanks can be personal. However, in some sectors such as Ntarama and Gashora, about 40 % of households live in agglomerations (Umudugudu). In Rilima, nearly a half of households live in former grouped residences (idem).

Generally, Bugesera region is a rural area; thus, many people are poor and others belong to the middle class. They mainly depend on agriculture and livestock. Therefore, whenever there is a natural disaster like drought, the majority is more affected. Their economic situation explains also their lifestyle in respect of housing and the distance from one household to another as far as ground for agriculture is concerned. The table below shows the wealth in Bugesera.

In addition, apart from some other regions in the Eastern part of Rwanda like Umutara, Kibungo and Mayaga, Bugesera is also considered among the most vulnerable regions due to climate change such as prolonged absence of precipitation or drought. As the Rwandan Ministry of Lands, Environment, Forestry, Water and Mines shows (2006), this results in the drop of agricultural production and lack of water and food produces for the populations; in the decrease of levels of lakes and rivers; in the lack of pasture for domesticated animals; in the soil and forests degradation; in the famine and disseminated population; drop in hydro electrical production; in the disappearance of aquatic life (Hippopotamus...); in the decimated domesticated animals and in the desertification tendency.

Table 5: Wealth in Bugesera

| Category | Defining Characteristics | % of HHs |
|------------|---|----------|
| Better-off | Salary earners; larger traders (very few with vehicles); own farms but employ others to work for them; 5+ cows (some have sent their cattle elsewhere for pasture); 1-5 goats and some chicken. | 10-20% |
| Middle | Smaller traders with a small shop or bicycle; may employ others to work for them; 1-3 cows; 5-8 goats; some have a pig as well as some chicken and rabbits. | 20-30% |
| Poor | Work for others; do some petty trade; 0-2 goats; May be some chicken and rabbits. | 35-45% |
| Very Poor | Often single headed (male or female) households; Rely on assistance and food handouts from humanitarian agencies (church, WFP,) and local community; possibly a few rabbits but in general, no animals. | 15-25% |

Source: UNDP and UNEP, 2007

Furthermore, it is good to mention that Bugesera population can easily get some material to build the tanks such as the clay, the stones, the sand, the trees and other can be provided to them for conserving the rainwater in a safer and more sustainable way.

2. Research Methodology

Any scientific research requires a certain methodology to reach genuine data. The present research has also used some methods to get information about one village of Bugesera district which serves as a model namely Kavumu village in order to make plans for rainwater conservation.

Description of Kavumu Village

Kavumu village is located in Mayange sector of Bugesera District at about 40 km to the South of the capital city, Kigali. The terrain around Mayange is flatter and drier than most of Rwandan other terrains. The area suffers from sporadic rainfall and declining soil fertility, leading to endemic poverty, illness and a lack of economic opportunity.

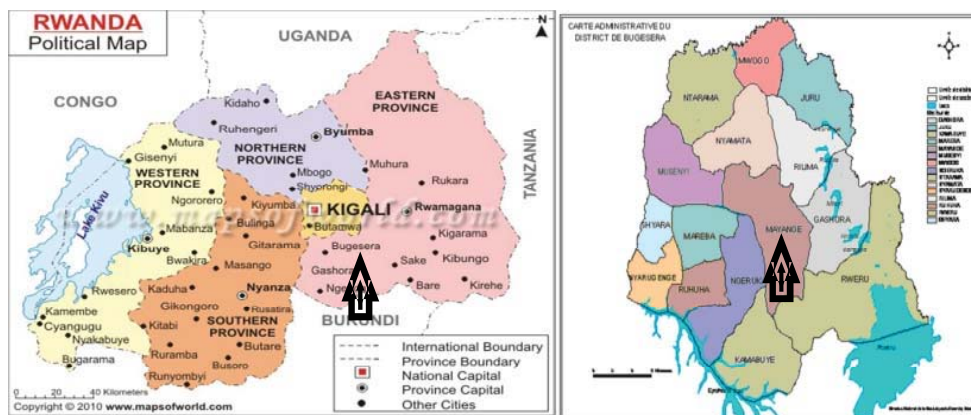
Mayange population faced impending famine because of failing rains and a poor harvest. Unlike most of rural Rwanda, where individual homesteads are scattered across the hilly

landscape, Mayange sector has several villages known as imidugudus, or settlements, of closely spaced dwellings. Kavumu village is one of those villages found in Mayange sector. It was chosen simply because it presents many characteristics similar to those of most villages of Bugesera region and it has many houses closely spaced and built with a roof made of iron sheets which can facilitate the realization of the plan.

The following maps show Bugesera location on the map of Rwanda and Mayange sector on the map of Bugesera district. Methods of Data Collection

According to Punch (2005, p. 19), “Different questions require different methods to answer them. The way a question is asked has implications for what needs to be done, in research, to answer it. Quantitative questions require quantitative methods to answer them, and qualitative questions require qualitative methods to answer them.”

In the context of the present research, the question is qualitative and descriptive. As qualitative research refers to empirical information about the world not in the form of numbers but in the form of words (idem), the present research referred to qualitative methods such as interviews and observation.



Kavumu village was visited and carefully observed to identify the location of its capabilities and vulnerabilities. After the observation, informal interviews with three people living in the area met accidentally were done. The informal interviews led the researchers to have another formal interview with the chief of the village in order to make a map of the village as well as the intervention logic and management plan of drought at a village level as presented below.

3. Research Findings: Intervention Logic and Management Plan of Drought in Kavumu Village

Though many intervention activities have been realized because of drought that Bugesera region faced, more has to be done in this respect. In the present paper the researchers can neither exhaust all the strategies for coping with drought nor give a final solution to the problem of drought that Bugesera region has been facing throughout

the years. The plan simply pretends to contribute with some of the mechanisms that can be adopted and that can help to a large extent.

After realizing that Bugesera people who belong to the middle, poor and very poor classes do not manage to conserve water even in rainy seasons with very simple technologies (Japan International Cooperation Agency & Ministry of Agriculture and Animal Resources Republic of Rwanda, 2006), the researchers suggest to build tanks near people's houses and under their grounds to conserve at least water from the rainy.

Characteristics of Kavumu Village

First of all it is important to highlights the findings on Kavumu village capacities and vulnerabilities. In the table below are the characteristics of Kavumu village as given by the chief of the village as well as some people during a survey and by observation of the village.

Table 6: Characteristics of Kavumu Village

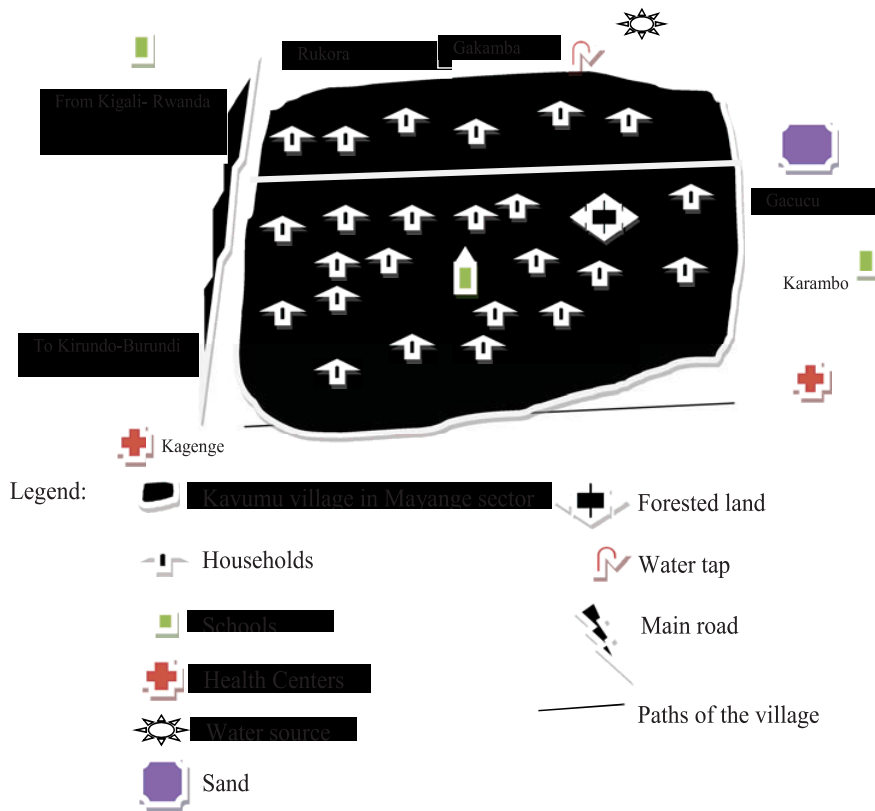
| Characteristics of Kavumu Village | Number or indicator |
|---|---|
| Area | 6 km ² (2km*3km) |
| Number of Households | 239 |
| Number of people | 947 |
| People with at least high school education | 8 (including 1 with bachelors degree) |
| Households with a good financial status on average | 3 |
| Very poor and vulnerable households | 12 |
| People with talents or training in construction | 80 |
| People physically able to do other construction related | 100 |
| People who cannot contribute in construction | 767 (very young, very old, women, |
| common water tap | 0 |
| Water Source identified | 0 (except 1 found in the neighbouring |
| Households with metal sheets or tiles | 239 |
| Rivers | 0 |
| Schools | 1 nursery school (primary and secondary |

| | |
|---|--|
| Health centre or hospital | 0 (except 1 Health centre and 1 health |
| Cultivable land | 50ha on average (other bigger land for |
| Marshland | 0 |
| Source of sand and stones | 0 (except sand found in the neighbouring |
| Source of clay | From each household |
| Forested land | 6ha on average |
| Households with bicycles | 210 |
| Households with electricity | 170 |
| Households with water at home | 9 |
| Households with registered business | 12 |
| Households which cannot afford to pay 3000rwf for | 36 (112 people) |
| Common market | Found at Nyamata |

Source: Survey, 2013

Apart from the mentioned characteristics in the table above, in collaboration with the chief of Kavumu village, we drew a map showing the local resources and its location comparing to the

main road of Kigali (Rwanda)-Kirundo (Burundi). Below is that map of Kavumu village:



The steps to follow for involving the population

After highlighting the characteristics of Kavumu village, it is good to set the steps that must be

followed in order to implement the plan. The steps are divided in whole year starting from September 2013 to September 2014.

Table 7: The steps to follow for involving the population

| Steps | Description of a step or activities to be done | Timeframe |
|--|--|--|
| 1. Anticipation of a disaster in regional contexts on the basis of climatological conditions, geographical location and past experiences | Due to their past experience Kavumu people understand and confirm that during the two rainy seasons they have enough water that can be conserved and used during the dry season. They have raw materials such as clay to make bricks, they can easily get stones and sand from the neighbourhood to build strong tanks, etc for conserving that rainwater and prevent at their level and with their local resources the drought. They know in which period they feel more the drought and its consequences. | Already done in a survey and again in September 2013. |
| 2. Alarm phase of an imminent disaster | Sensitization of the population prior the rainy season to build the tanks and during the rainy season to collect the rainwater. | September 2013 |
| 3. Impact phase | Researchers will analyse the impact of their sensitization, if all people of the village understood the need of water conservation plan. | October 2013 |
| 4. Inventory phase (Capacities and Vulnerabilities) | Analysing the capacities and vulnerabilities of people as well as their willingness to get involved in the project in order to support with the project where they can't help themselves. Kavumu village capacities: Local raw materials such as clay and trees found in the village; sand found in the neighbouring village; a good number of people (at least 180) who can build the tanks and help in this respect (this includes the already trained people in construction, the young and strong people who are physically in good conditions and who are committed to collaborate who constitute a big number from the whole population of the village); at least 20 people who are willing to contribute financially; all houses with iron sheet or tiles roof materials; people's willingness to participate in the whole process as shown in the informal discussions (almost everyone); many bicycles for transportation of construction materials; the two rainy seasons; Collaboration with EWSA as well as its subscribers for getting water needed for construction activities; activities done during a rainy season (September to December); Schools and health centres in the neighbourhood willingness to contribute to the project; at least two local and 2 international NGOs willing to support; the local and | Already done in a Focus Group Discussion and again in October 2013 |

| | | |
|--|---|---|
| | <p>central government good policies and willingness in order to support; the assured sustainability of the project due to the people's ownership; etc.</p> <p>Kavumu Village Vulnerabilities: 12 households of very poor and vulnerable people; No public water tap in the village, no water source and no river or other source of water in the village; low knowledge on the techniques of the project; few households which do not have enough space of the homestead; many people who cannot afford to buy some materials such as the cement, the underground water pumps as well as other more expensive materials to use in the construction; etc.</p> | |
| 5. Rescue phase | We will start the project of rainwater conservation in Kavumu village of Mayange sector by building the tanks and the taps. The starting point will be the trainings of people willing to participate in the implementation and then will follow the construction. Apart from the raw materials that the community has, other materials will be provided. In this respect, the government and NGOs will contribute. | September-December 2013 |
| 6. Relief phase | The water that was conserved can be used in the water scarcity period and can be shared with other people who could not conserve the rainwater from their house roofs. | January, February and June-September 2014 |
| 7. Long-term reconstruction and rehabilitation | The water will be used in different household activities and the project will be spread in the whole region if possible. | The years ahead |
| 8. Development and disaster preparedness | Every year we will make sure that before the rainy season starts the tanks are well maintained so that they may help to conserve the rainwater of the season. | The years ahead. |

Apart from showing the steps that can be followed in order to implement the project, the researchers showed the plan that can be used by each household (Appendix1). The plan describes what can be done and how it can be done practically in a scheme. It doesn't necessary show the location of the houses because they are not built on the same line as it is in the graph. In fact the plan has two kinds of tanks i.e. the tank connected to the house and the underground

tank. For the tank connected to the house, there should be something that leads the rainwater

from the roof to the tank and something that helps to fetch the water from the tank in the form of a tap when the need arises. As for the underground tank, people (at least two families together) should make a very big hole in such a way that the water cannot penetrate the ground or destroy the hole. They should make sure that the rainwater has a path from their both

respective lands to follow up to the hole during the rainy season. There should also be the underground water conducting tubes so that in the end the population may have clean water from the tap of the community or the village.

Conclusion

Having realized the impact of drought in Bugesera natural region of Rwanda, the study aimed at contributing to the coping strategy with this dramatic situation. The main idea of this paper is simply to suggest the rainwater conservation during the rainy seasons for the use in the dry seasons when drought is more felt. The target was to suggest a model tank

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construction in Kavumu village which can serve other villages as well.

Although there is no pretention to exhaust all the means, the researchers believe that this solution can help many people in addition to other measures that were taken or will be taken. As far as water issue is concerned during a drought episode, future planners may think in terms of the water recycling, the sustainability of rainwater conservation and the amelioration of methods in water conservation. Not one plan can solve a big problem like that of drought which has been felt in Bugesera region; thus additional ideas and plans are also needed by Bugesera people.

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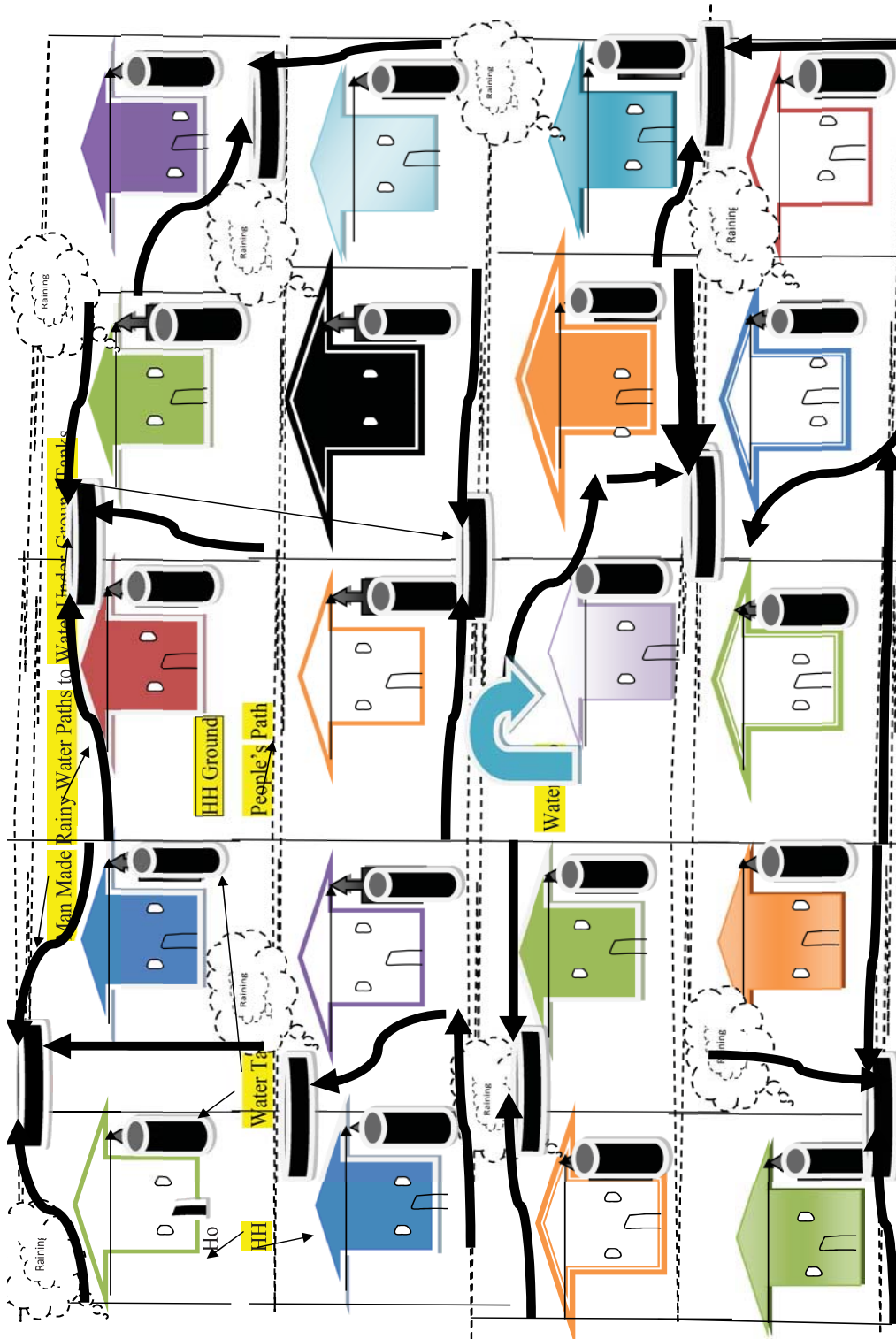
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The important used symbols:

-  : House coloured differently by the owners in a Village
-  : Something that leads the water from the roof to the tank
 Tank near the House
-  The Under Ground tank
-  Path to conduct the rainwater to the underground tank (from two households)
-  Rainawater tap for a Village