CHAPTER ONE: BACKGROUND

1.0 Introduction

Floods have been recorded from time immemorial with their tales told from one generation to another depending on their severity on humans, animals, plants and other forms of life. Meshenberg (1976) points out that despite floods’ long standing records and recognition in human development, they have continued to pose serious threats to humans yearly. Disaster Management and Mitigation Unit (DMMU, 2005) points out that floods induce disaster when human settlements have an overflow of water beyond their normal confines and humans fail to cope with the calamity, or when they result in the destruction of animals, crops, social and economic infrastructures. As a result of this, humans have learnt to live alongside floods whenever they occur. This is made possible through the need by humans to adapt to floods and their effects. However, human adaptation to floods exposes the environment to other diverse impacts that destabilize the balance of the ecosystem for good or ill.

Floods have been defined differently by many academicians depending on which context is being looked at. However, in this research, floods are defined according to Smith (1992:226) as “a high flow of water which overtops either the natural or the artificial banks of a river.” The basic process of flooding starts when the surface runoff enters the stream channels. The river levels rise to carry the surface runoff generated from the land or from direct rainfall. As the water levels in the river keep rising, they lead to discharge of excess water to surrounding areas. The stage at which a river begins to discharge surplus water to surrounding areas is what is referred to as flooding, and flooded areas are in most cases plains commonly known as floodplains, marshes, fens, polders or flats.
Floods may be classified in two types, namely, regional and flash floods. Flash floods are floods that result from large convective thunderstorms, which build up within a matter of hours and quickly set loose terrifying walls of water. Regional floods are floods that occur in large river valleys when rainfall is prolonged (Abbott, 2004). Floods associated with floodplains are regional floods which are the focus of this study. Flood water in regional floods may originate from direct rains or runoff sources into the river channel which later becomes full and overflows its natural or artificial banks. Regional floods are mostly common in river valleys and low lying coastal areas which happen to be settlements for a lot of people in the world. They are settlements because of the socio-economic benefits that humans get from the floodplains.

Basically, humans are attracted to settle in floodplains (river valley and low lying coastal areas) for a number of reasons such as the fertile soils resulting from sediments deposited in floodplains brought from upper parts of the river which are necessary for crop growth. They are also attracted to floodplains because floodplain soils act as natural fertilizer because each new flood brings a new fresh supply of sediments which replenishes the soil nutrients. The rivers in the floodplains also provide a ready supply of fresh water for domestic use and for irrigation purposes. Floodplain rivers also provide communication within the surrounding areas and promote trade between the floodplain dwellers and the upper part of the river valley. Furthermore, floodplains provide habitat to a variety of plants, birds, fish, reptiles and animals which provide food to humans (Munyaradzi, 2000).

Floodplains may also be settlements for a broad population or particular types of people with particular social characteristics. Walker (2012) points out that poor people who have limited livelihood options end up occupying floodplains because they are pushed by market forces. He notes, however, that in Pakistan, some better-off urban residents living
in well built houses welcomed the recurrent annual flooding as a cleansing of the urban space of garbage and dirt thereby seen to be a preventive measure for epidemics and waterborne diseases annually.

As a result of the socio-economic benefits humans get from the floodplains, the floodplains became the first important world sites where human civilization and development began many centuries ago. The earliest known human civilization began in the Middle East, and thrived in the fertile floodplains of the Tigris and Euphrates rivers in modern day Iraq. Human civilization in Egypt also began along the floodplain of the Nile River (Munyaradzi, 2000). Other important human civilizations in the world have as well developed along or within the floodplains. For example, early civilization in China was within the floodplains of the Yangtze and Huang He (Yellow) rivers, and in India, civilization began in the floodplains of the Indus and Ganges rivers. In Europe, major industrial developments in the eighteenth century also took place in the floodplains for water resources and as a transport system.

The Barotse floodplains in the Western province of Zambia are one of the largest floodplains of the country, and the human inhabitants in the area have lived there since the seventeenth century with their capital, Lealui, at the centre of the floodplains (Davies, 1971). Floods and floodplains provide all the resource needs for the human inhabitants including cultural and socio-economic needs. Consequently, humans have intensified their cultural and socio-economic activities in the floodplains over the years. The Zambezi River which runs through the floodplains serves as an important artery for transportation and communication.

Mongu’s Barotse floodplain is part of the Barotse floodplains that is annually flooded and receives floods of varying magnitude, small and great, and they have continued to
occur. Nevertheless, human inhabitants have adapted to these floods each time they occur, and the floods are viewed as part of the natural environment itself. They are perceived as natural features to contend with, and they have forced humans living in the area to find ways of adapting or adjusting to them.
Figure 1. Sketch map of Zambia showing the geographical location of the study area.

Source: (Field Data, 2011)
1.1 Statement of the problem

Despite the annual occurrence of floods in Mongu’s Barotse floodplain, the human inhabitants have continued to reside there whereas other tribes have found the floodplains to be uninhabitable and have failed to adapt due to the increased frequency and magnitude of the floods. Whereas floods are not seen to be problematic when they occur in areas uninhabited by life forms, the annual floods in Mongu’s Barotse floodplain cover habitable areas and affect the human, animal and plant life differently. Despite the long standing annual records of floods there, their impact on the human, animal and vegetative lives has not been adequately explored.

Human inhabitants in Mongu’s Barotse floodplain have adopted some adaptation strategies which have enabled them to continue occupying the floodplain despite the annual floods in the area. The human adaptation strategies seem to have worked well, sustaining continued human occupancy of the area. However, their adaptation strategies might have resulted in unfavourable environmental impacts as well as in modifying the environment in an undesirable manner. Furthermore, the ethical dimensions of the human adaptation strategies to floods in Mongu’s Barotse floodplain have not yet received detailed scholarly consideration.

1.2 Aim

The main aim of the study was to carry out an ethical assessment of the manner in which humans living in Mongu’s Barotse floodplain have adapted to annual floods and how these strategies have affected the human and natural environment.
1.3 Objectives

The objectives of the study were:

1. To investigate the annual duration and extent of floods in Mongu’s Barotse floodplain.
2. To identify the effects of the floods on the human, animal and vegetative life in Mongu’s Barotse floodplain.
3. To identify the adaptation strategies adopted by the human inhabitants to floods in Mongu’s Barotse floodplain.
4. To make an ethical evaluation of the impact of human adaptation strategies on the local environment in Mongu’s Barotse floodplain.

1.4 Research questions

1. What is the annual duration and extent of floods in Mongu’s Barotse floodplain?
2. What are the effects of flooding on the human, animal and vegetative life of Mongu’s Barotse floodplain?
3. What are the adaptation strategies to floods adopted by the human inhabitants of Mongu’s Barotse floodplain?
4. What are the ethical implications of human adaptation strategies to floods on the local environment in Mongu’s Barotse floodplain?

1.5 Theoretical framework

The theoretical framework for the study was informed by the land ethic and utilitarian theories. The land ethic environmental theory is founded on the eco-systemic community
principle. The theory operates on the perception that there is a symbiotic interrelatedness, interconnectivity and interdependence in the natural world between the biocommunity and the abiotic community. In this holistic theory, humans, other life forms and natural features are all part of the whole ecosystem $^1$ and hence humans are expected to interact with moral consideration towards the overall ecosystem.

Utilitarian theory is a traditional ethical theory that focuses on human actions and how the results of these actions impact on the people’s overall well-being. In this regard, the theory holds that the morality of an action depends solely on its consequences. Its focus is to maximize the good (pleasure or happiness or preferences) of the greatest number of individuals involved. In this study, utilitarian theory has been extended to include bringing about the greatest good to the overall human and natural environment.

1.6 Methodology

The methodology of the study was a descriptive study using qualitative methods and involving ethical evaluation. Data were obtained from secondary and primary sources. Primary data was collected using observation, in-depth semi-structured interviews and focus group discussions. The study sample involved the residents of Mongu’s Barotse floodplain, local leaders, and officials from the Zambia Environmental Management Agency (ZEMA), Mongu Municipal Council, Zambia Wildlife Authority (ZAWA), Disaster Management and Mitigation Unit (DMMU), People’s Participation Services (PPS), World Wild Fund (WWF) and Oxfam. The sampling procedure used judgmental, purposive, convenience, snowball and cluster sampling methods. Secondary data involved literature from the university library and university departments, government

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$^1$ Although it is not possible to delimit the exact boundaries of an ecosystem, the term is used here to cover all the organisms (life forms) and the area (environment) affected by floods.
department and non-governmental organizations. Data from the field was evaluated and analysed using two ethical theories: the land ethic and utilitarian theory.

1.7 Ethical considerations

The study took into consideration ethical issues such as principles of respect, justice and beneficence. The research treated participants with respect by not despising or discriminating against any of them, and taking all the answers they gave as important and ensuring confidentiality. They were also informed about the nature of the research before beginning and about the benefits and risks of participating in the research. Furthermore, informed consent was sought from all participants before the interviews commenced.

1.8 Significance of the study

Although many studies have been conducted on floods, most of them have largely focused on the causes, effects and mitigation of floods. Very little attention has been paid to investigating the adaptation strategies taken by the people living in flood-prone areas and the ethical implications of these strategies. This study is the first of this nature to take place with specific reference to the inhabitants of Mongu’s Barotse floodplain. The findings of the study may hopefully be used by the government and other organizations associated with floods in planning for floods in communities living in flood-prone areas and in finding sustainable ways to adapt to floods. It is further hoped that the study may generate more knowledge leading to better adaptation strategies to floods by the human inhabitants in Mongu’s Barotse floodplain. Lastly, the study is also important because it seeks to highlight the ethical issues that surround the adaptation strategies to floods and their impact on the environment.
1.9 Delimitation

The study only focused on human adaptation to annual floods in Mongu’s Barotse floodplain and its impact on the environment. Hence, it did not consider other floodplains for data collection and analysis. Furthermore, the study was confined only to “adaptation” to floods.

1.10 Limitation

The study faced a number of challenges such as the non-availability of some participants such as officials from Keepers Zambia, Concern Zambia and some village headmen. Furthermore, the time of research coincided with the time when people were preparing their gardens in readiness for planting. The research was also suspected by some to be linked to the January 14, 2011 riot and killings in Mongu so that many participants sought anonymity and photos were not allowed to be taken. Furthermore, as most participants did not understand the meaning of the impact of human adaptation to floods on the environment, comprehensive information was not given.

On the side of the researcher, the researcher faced hardships in terms of movements around the plain with villages situated some distance apart. In addition, the researcher had problems in crossing streams due to the non-availability of canoes at points which required them for crossing. Finally, the study was limited by inadequate funds.
CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Throughout history, floods have been affecting human beings to a greater or less extent. Human beings have had to come to terms with the fact that floods are unavoidable and hence different human societies have adapted to them differently depending on their philosophical perception and their moral attachment to the environment where floods occur (Wong and Zhao, 2000). However, adaptation to floods is largely dependent on the frequency, extent, and impacts of the floods. Furthermore, adaptation to floods may be based on the technological advancement of the society involved.

The flood scenario in the world has in recent past years increased in frequency and magnitude resulting from global climate change. As a result, global surface temperatures have increased by about 0.7 degrees Celsius over the twentieth century, with the hottest years coming later (Garvey, 2008). The rising temperatures have increased the rate of evaporation and precipitation translating into heavy floods. The rising temperature is also melting ice in seas and mountains thereby raising the sea level, and inundating low lying habitable and cultivable lands.

2.1 Impacts of floods

The impacts of floods on the environment are many and diverse. They can be either negative or positive. The impact on humans, animals and vegetation is reflected in the depth of water above the normal level of the river or stream, and also in the frequency of
flood occurrences in the area. Below are the impacts of floods on the human, animal and vegetative life.

The impacts of floods on animals and vegetation are mostly on the negative side. On animals the impacts of floods result when they are displaced or drowned. Vegetation is affected when submerged in the waters and subsequently destroyed. The destruction of vegetation has a chain reaction as it leads to starvation of wild and domesticated animals as well as a variety of life forms that directly or indirectly depend on it.

On humans the negative impacts of floods are felt in the social and economic sectors. Cunningham and Cunningham (2004) point out that the greatest negative impact of floods on humans is when they destroy buildings, property and crops. They further add that floods pose threats to humans when they cause contamination through bringing mud and dirt that cause outbreaks of diseases.

Basically, floods have been recorded for ages with the world’s earliest in history dating as early as before Christ (B.C.). Abbott (2004: 357) reports that between 6000 and 1000 B.C., the Clay Tablets recorded the Gilgamesh Epic of the great floods in Babylonia when Utnapishtim built an ark that sailed for seven days and seven nights saving his kin and cattle. In the Book of Genesis (chapters 6-9), the Bible also records that Noah built an ark which saved his family and pairs of all the animal species from a flood that covered the world with water for one hundred and fifty days. The floods of the Gilgamesh Epic, and possibly that of the Bible, are believed to have occurred within the floodplains of the Tigris and Euphrates rivers in modern day Iraq which flow across an extensive low lying plain to the Persian Gulf. Abbott (ibid.) further reports on floods that occurred about 7600 years ago around the Black Sea areas covering farmed and irrigated areas of the earliest farmers there.
Floods have also been experienced in North and South America with the Mississippi and Amazon River basins recording most of these floods. In 1717, floods were recorded in New Orleans in the lower Mississippi river basin (Smith, 1992). Other floods have been recorded on the Mississippi river with the largest on the upper Mississippi in 1927, and the largest on the lower Mississippi in 1993. The Mississippi river floods in 1993 covered more than 20 million acres of land for 160 consecutive days (Abbott, 2004). The floods submerged 75 towns, damaged 50,000 homes and 12 commercial airports were shut down. The flood waters also dug up coffins and carried them down the river in Hardin, Missouri. As a result of these floods, the entire city of Iowa was declared a federal disaster area. Damage in terms of money totalled about US$12 billion, making this flood one of the most destructive and expensive disasters in the United States of America history. The Amazon River basin has been recording floods annually as a result of being in the equatorial region.

The negative impacts of these floods in America have been felt in the socio-economic infrastructure which includes flood damages to manufacturing plants, bridges, roads, railways, airports and buildings such as houses, churches and schools (Hoyt and Langbein, 1955). Furthermore, flood impacts are felt in the agricultural sector through destruction of growing crops, stored crops, pasture, farm buildings, livestock, farm equipment, and the land itself through scour or sedimentation (ibid.).

Huang He (Yellow) river in China has flood records dating back to 2356 B.C. The Huang He River has throughout the history of China been periodically devastating large areas through flooding, killing and affecting millions of people to such an extent that the river has been named “River of Sorrow”. The people of China continue to experience the negative impacts of floods in almost all sectors of their lives. Wong and Zhao (2000) report on the adverse impacts of the 1994 floods in China’s Beijiang basin in the North
of Guangdong province. These floods affected two million people with floodwater covering 92 per cent of the built-up area of Qingyuan city and inundating 9,000 villages in the surrounding floodplain. The floods engulfed 100,000 hectares of farmland and destroyed the entire summer paddy crop. About 230,000 houses were damaged by the floodwater of which 66,000 were mud-brick houses that collapsed. The total direct economic loss to Qingyuan city alone amounted to RMB3.2 billion. However, the casualties caused by the floods were relatively small with 102 people dying and 2,000 injured (ibid.).

Floods have also been recorded in India and Pakistan with the worst in history occurring in October, 1955 devastating the northern part of the country and resulting in the death of over 1,000 people (White, 1974). Other floods recorded include those in Bangladesh in November 1970 which caused the inundation of 4,000 sq. miles of the Delta area and a death toll of over a million people (Waltham, 1978). In addition, the adverse impacts of floods in India are felt most powerfully in the fertile agricultural tracts of Ganga and Brahmaputra valleys and the Deltaic areas. The loss from floods in India is on average US$116 million annually. The major damage is to crops which accounts for 73 per cent of the total loss. Other damages relate to houses collapsing, livestock, and public utilities (White, 1974).

In the United Kingdom, the negative impact of floods in 1953 in the East Coast of England caused about 50 million pounds (US$120 million) of damage and 250 deaths (ibid.). The flood damages were largely in the agricultural, industrial and residential sectors since England’s major production sectors are located in the floodplains. Floods destroyed crops, manufacturing plants and buildings such as houses for the floodplain dwellers (Newson, 1975). The estimated damage of the flood in England in money terms

In Africa, floods have been recorded as early as 330 B.C. in Egypt along the plains of the river Nile where many Egyptians established settlements for farming and fishing activities (Hoyt and Langbein, 1955). Although many other floods have occurred in ancient Africa, unfortunately no records have been kept about them since many societies were not developed enough to keep records of flood events. However, the recent past has also witnessed a number of floods in many parts of Africa. These include floods in Botswana, Cameroon, Kenya, Rwanda, Malawi, Mozambique, Namibia, Nigeria, Sudan, South Africa’s coastal areas and Zimbabwe as well as in Zambia.

Amia and Goldstein (2008) report that the negative impacts of floods in Africa are felt in almost all parts of the continent except for the desert areas. Their impacts include destruction of agricultural products, infrastructures (buildings, roads, railways and bridges) and life (vegetation and animals as well as humans). However, in order to draw a closer look at the flood situation in Africa, Mozambique which had suffered more frequent, intense and unpredictable devastating floods than any other country on the continent was used as a case study in this report.

Historically, Mozambique records flood events almost yearly resulting from upstream waters from a large part of Southern Africa. These floods drain through the plains of Mozambique in central and southern regions along river basins, and in areas with poor drainage systems towards the Indian Ocean where flood impacts have been felt by the plain dwellers. Generally, areas associated with floods include river basins such as Limpopo, Incomati, Punge, Save, Zambezi, Umbeluzi, Maputo and Buzi. The major floods which have occurred in Mozambique include the 1973 Buzi River, 1974 Save
River, 1976 Incomati River, 1977 Limpopo River and 1984 Umbeluzi River (UNDP, 2007). UNDP add that the worst flood recorded in Mozambique was in 2000 in the central and Southern regions of the country with a death toll of 700 and more than half a million people displaced. Crops were also destroyed leading to famine. The above flood events were considered the worst in 50 years in Mozambique as they have caused injuries and long-term health impacts, and created severe damages to property and livelihoods thereby disrupted the functioning of the plain dwellers.

In addition to the above, Ehrhart and Twena (2006) report that the extreme flood events in Mozambique highlight the country’s vulnerability to floods. The 1997/8 El Nino, for example, led to flooding, and triggered a national emergency with severe food shortages, skyrocketing food prices, and extensive food, cattle and cash crop losses. They further estimated that floods in 2000/1 affected 2.5 million people (the majority of whom were displaced), and triggered a US$ 167 million emergency relief campaign, and reduced national growth from 8 to 2 per cent.

In summary, impacts of flooding in Mozambique included loss of life for both human and animal inhabitants, damage to crops and ecosystems, outbreaks of pests and diseases, displacement of people, movements of landmines, destruction of infrastructure (communication networks, schools, hospitals, houses, etc.), land degradation and erosion.

Zambia also has records of annual floods which cover many areas and have been affecting humans, animals and vegetation. Floods in Zambia have been caused by river flooding from heavy or severe rainfall. These have been experienced in the lower lying areas of the country, mostly in the valleys and the floodplains. They include the Barotse floodplains, Kafue, Chambeshi, Lower Zambezi (Baluval), Chavuma, Chama,
Chibombo, areas along Luangwa river basin, and a larger part of Luapula province. The country has also experienced urban floods in poorly drained compounds like the Kanyama floods in Lusaka and Chowa floods in Kabwe (DMMU, 2005). In addition, Siamwiza (2009) reports on occasional floods in Gwembe and Sinazongwe in Southern province.

The negative impacts of floods are felt when they destroy crops and buildings and displace people and animals (DMMU, 2005). They also impact negatively on roads and bridges. Many of the roads in Zambia are destroyed annually by floods. The destruction of these roads has led to some towns in Zambia being cut off from the rest of the country which leads to socio-economic losses to the country as well as to the towns themselves. The Post (11 December, 2010) reported on the heavy rains that washed away the bridges in Sinazongwe district in Southern province cutting off the town. Other towns that have been cut off by floods in the past include Chavuma, Chama, Lukulu, Shangombo and some rural areas of Sesheke. Siamwiza (2009) also tells of the floods in Gwembe Valley prior to 1958 that caused food shortages, hence causing a situation of panic and desolation for the human inhabitants when their rain-fed crops were submerged in floodwaters and were eventually destroyed.

G.R.Z. (2007) reports that the negative impacts of floods in Gwembe for 2002/3 and 2006/7 cut across all the key sectors. These included the following: hunger as a result of the destruction of crops; reduction of cultivatable land and soil erosion; loss of shelter; displacement of people; disruption of communications due to destruction of infrastructure; and increase in epidemics such as malaria and waterborne diseases. Furthermore, in the North-Western province, cases of waterborne diseases were on the increase resulting from floods. Floods in the province posed a high risk to humans.
through water contamination resulting from an increase in the numbers of pit-latrines that collapsed. Shallow wells were also flooded.

Furthermore, G.R.Z. (2007) reports that the 2007 floods affected 41 out of the 72 districts of Zambia, a clear indication that floods have increased and have started to affect areas that traditionally had never experienced flooding before. In the Western province where floods are an annual occurrence, they came early and were of unusual magnitude (ibid.).

Although the Meteorological Department of Zambia Data Base (2011) recorded that the reviewed rainfall figures for Mongu and Zambezi districts reveal reduced flood occurrences between 1990 and 2000, nonetheless, the flood occurrences have since increased in the Barotse floodplains since 2000 with adverse impacts massively felt by all life forms in the area.

Peter (1960) pointed out that the negative impacts of floods in the Barotse floodplains included villages getting submerged annually, especially those in the centre of the floodplains, and displacement of residents to other places on higher margins. He further pointed out that floods in the Barotse floodplains had impacted negatively on the human inhabitants in the agricultural sector when floods came earlier than usual and submerged crops in litapa gardens which are found in depressions in the plains. In addition, the pastoral community feels the impacts of floods when the plain grass is submerged giving poor quality fodder for the cattle.

The positive impacts of floods include fertile soils resulting from sediments deposited in floodplains. They are brought by floods from upper parts of the river. These are necessary for the growth of plants. Floods also provide ready supply of water for both plants and animals. They also provide easy communication network within the
surrounding areas through water transport. Furthermore, floods bring closer to the people a variety of birds, fish, reptiles and water animals which provide food to a large group of floodplain residents, (Munyaradzi, 2000).

Walker (2012), reports that floods cleanse or wash away garbage and dirt in the surrounding areas which if left may increase or lead to outbreaks of epidemics and waterborne diseases. In this regard, floods annually prevent or reduce epidemics and waterborne diseases in floodplains.

Lastly, floods provide beautiful scenery to humans as well as promote socio-economic activities such as regatta which may translate into economic opportunities to residents and the nation through tourism.

2.2 Human adaptation to floods

White (1974) points out that adaptation to floods may be conveniently divided into two groups, namely, adaptation by individuals and by collective measures. Furthermore, Hoyt and Langbein (1955) clarify that adaptation by collective measures involves the community and the nation. As a result, adaptations vary from individual to community and national level. At individual level, adaptation measures are simple, cheaper, less sophisticated and not sustainable. At community level, adaptation measures are a collective effort by every member of the community that is afflicted by the floods. Furthermore, at community level, adaptation measures are more advanced than they are at individual level. The last stage is at national level. At this level, the government comes in to remedy the calamity as the floods usually go beyond individual and community efforts. In order to clearly explain human adaptation to floods, the three levels of human adaptation to floods are shown in figure 2 below:
Basically, individual adaptation to floods refers simply to ways or strategies which a person takes to withstand the effects of floods physically, socially, economically and healthwise. Adaptation to floods at the individual level, according to White (1974), includes praying, evacuating upstairs, moving furniture, establishing permanent flood-proof building, preparing to move, buying insurance and listening to weather forecasting.

Furthermore, individuals have adapted to floods by learning some survival skills such as hunting, fishing, swimming and paddling.

Adaptation to floods at individual level differs from society to society. In South and North America, Waltham (1978) report that individuals who have settled in the floodplains have adapted to floods by building high buildings with no walls on the lower floors. Similar buildings in Indian villages have been built with about half a dozen raised platforms, each having a tall evergreen tree used for flood emergency to save life and property. Building brick houses with flat roofs for refuge during floods are also common (White, 1974). Other adaptation strategies to floods, according to Smith (1992), include
blocking up entrances such as doors and windows and using sand bags to keep the flood waters away from structures. Another strategy is by storing food grains above the ground level in sheds. Furthermore, residents have adapted to floods by the acquisition of flood insurance schemes for their properties against flood damages. In addition to the above, Smith points out that individuals further adapt to floods by moving furniture to uplands and only bringing them back when the floods have receded. Another strategy is to grease metallic objects to prevent corrosion when floods come.

Adaptation to floods at community level is characterized by concerted efforts by all the residents in the floodplain. White (1974) points out that communities have adapted to floods by digging narrow and deep trenches to allow an easy flow of floodwaters away from the settlements, as is the case in India. He also points out that in the United States of America, the United Kingdom and other European communities, communities adapt to floods through the construction of dams to store excess water. Floodwalls, canals and levees are also constructed to ensure water flows within the river channels. River diversion is also used as an adaptation strategy to floods. This is simply a strategy that diverts water in the river away from agriculture lands and settlements.

With regards to agricultural practices, flood-based communities (for instance, Chinese and Indian) have embarked on flood-fed agricultural crops which include paddy rice, sugar cane, and sisal and banana production. This is possible through the experiences of residents who have come to know the environmental crops that adapt well to the floods.

The floodplain dwellers have also adapted to the floods in the transport sector through the use of water transport networks. In Bangladesh, due to its many rivers and as a result of floods, the construction of roads and bridges is almost impossible. Hence, short and long distance journeys within and out of the floodplains are travelled by ferrying through
the navigable channels using boats and canoes. This has proven to be a very viable business with substantial profits in the floodplains during floods. Houseboats in Chinese harbours are also widely used by people as a means to adapt to floods.

At national level, the United States of America, Europe and other world governments have initiated flood insurance schemes which residents are encouraged to buy as a cover during floods (Smith, 1992). Furthermore, these governments have ensured that floodplain dwellers build flood-proof and raised buildings with specified building instructions from the National Engineering Departments. These buildings allow floodwater to pass under them without causing damage. Furthermore, they have constructed dams for storage of excess flood water, deepened the canals, and raised the river banks to avoid overflow of water from the river channel. They have provided early flood warning services to the residents of the floodplains through the meteorological department with regard to the intensity of the rainfall and the magnitude of the expected floods. They have also provided relief services to the flood victims in the form of food, water and shelter.

In Africa, Egyptian communities in the Nile floodplains had organized farming systems which they used for thousands of years. Firstly, when the flood water had receded at the end of September or the beginning of October, crops which required only short growing periods were cultivated in the floodplains. The harvest was done just before the floods in April, and the land was left to fallow. Higher lands were irrigated using flood waters with shadoofs (devices which consisted of a pole and bucket, and a counterpoise). When the population increased, they started carrying water from floods or wells to enable the cultivation of the autumn crops (Furon, 1967). With regards to livestock, Furon further reports that pastoral communities in Egypt moved their animals away from the floods.
the case of rural communities, livestock were brought back only after the floods had receded.

For Mozambique, adaptation strategies to floods had much to be desired as not much effort had been made to institute sustainable coping strategies to natural disasters. This was as a result of Mozambique’s weak economy. However, Ehrhart and Twena (2006) report that the government of Mozambique ratified a convention on 24th August, 1994, on climate change and its resulting effects. The convention came up with a document that presented an inventory of national sources of greenhouse gas emission, provided an assessment of vulnerability and adaptation to climate change impacts, and suggested policy options for mitigation and public awareness. The Ministry for Co-ordination of Environmental Affairs (MICOA) was tasked to oversee the campaign and impacts of climate change which included flooding.

MICOA was responsible for compiling the reports and remained the focal point for government’s climate change response. As part of its tasks, the Ministry developed a National Adaptation Programme of Action (NAPA) which sought to prioritise projects contributing to the national adaptation effort in order to qualify for funding from Global Environment Facility through the United Nations Environment Programmes (UNEP) (ibid.).

Working under MICOA is Mozambique’s National Institute for Disaster Management. The Institute was mandated to rescue victims of climate change with regard to drought and floods. Flood victims were rescued with boats, and warehouses were built which were stocked with various goods for humanitarian assistance such as maize flour, tents, tarps, and boots and rain coats among them. The Institute also embarked on construction of small dams in flood prone areas, intensifying forecasting and warning systems, and
mapping of flood prone areas as well as creating alternative grazing systems for animals as adaptation strategies (World Bank, 2010).

Other adaptive strategies to floods in Mozambique include government’s creation of resettlements for flood victims (ibid.). Some resettlement zones have been established in various parts of the country as homes for people evacuated from flood prone areas. Tchetcha Um located some 30 miles away from Caia is one such resettlement zone and home for over 5,000 families who were evacuated from Caia.

The government also partnered with some Non-governmental Organisations (NGOs) like Save the Children and Care International in programmes that promoted livelihood resilience and adaptation (Ehrhart and Twena, 2006). The programmes were aimed at diversifying income sources for the people thereby making them self-reliant. The government and the NGOs also helped communities and individuals to come up with farms for growing crops for both consumption at home and sale at local markets. They further helped communities and individuals to grow crops in the absence of rains by assisting them with irrigation systems and other agricultural inputs such as seeds, fertilizers, insecticides and many more. In total, Save the Children alone funds about 4,500 farmers across the country.

Furthermore, in trying to meet human adaptation to floods, the government through MICOA published a manual script for recommendations for the reduction of vulnerability in zones of informal occupation prone to floods titled “Learning to live with floods 2004” (MICOA, 2007: 22). The document stressed the need to have a well established early warning system, emergency committees with well-defined or clear tasks for each member, contingency plans, identified actions for flood mitigation like re-
zoning, zoning of slums, improved sanitations, suitable constructions for areas prone to floods, and a reduction of deforestation.

At individual level, adaptation to floods in Mozambique includes catching fish which is consumed at home and the extra traded. Individuals also trade in various other goods for money. Other individual adaptation strategies include gardening, collecting wild foods (fruits and roots), and engaging in casual or temporal employment to secure their immediate survival. Furthermore, like elsewhere in the world, some individuals in Mozambique wait for relief services from the government such as shelter, food and water.

Other adaptation strategies by individuals include building silos in trees where personal belongings such as blankets, clothes and other household goods are kept for protection from floods (www.youtube, 2010). Individuals also protect themselves from floods by staying in silos (ibid.).

Like other countries in the world, Zambia has adapted to annual floods to ensure that the impacts of floods are mitigated. To do this, the government formed the Disaster Management and Mitigation Unit (DMMU) to manage all forms of disaster, including floods in the country. The DMMU has designed strategies to assist flood victims. The strategies include relief services when crops are destroyed by floods, evacuation programmes from affected areas and construction of drainages in areas with poor drainage systems (DMMU: 2005).

At community and individual levels, the adaptive research conducted by Kajoba (2009) through the Research Institute for Humanity and Nature (RIHN) reported that the human inhabitants in Southern province have adapted to floods through selling livestock to raise money to cushion the losses that result from floods. He further added that the human
inhabitants catch and sell fish as an adaptive strategy to the floods. Siamwiza (2009) found that though floods were a rare occurrence in the history of Valley Tongas, when they occurred, the Valley Tongas used these floods to irrigate their gardens. In these floodwater gardens, maize, legumes, and cucurbits were inter-planted with vegetables and a local variety of Turkish tobacco. In this way, the human inhabitants in Southern province were able to adapt to floods.

In the North-Western province, where floods occur more frequently than in the Southern province, Chabatama (2009) reported that human dwellers have adapted to floods in Zambezi (West bank) by living on wild roots and fruits, and acquiring cassava, finger millet or bulrush millet from the East bank (Zambezi East), or from Angola in the case of those in Chavuma. These were exchanged for hoes, axes, fish and cattle. Furthermore, he added that the human inhabitants would relocate to Angola or the East bank until the floods receded. Nonetheless, those living in Chavuma no longer relocate to Angola due to restrictions from modern boundaries. Another adaptive strategy currently practiced is to wait for the government to provide them with relief food or to relocate temporally to drier lands (ibid.). Furthermore, G.R.Z. (2007) indicated that chlorine was distributed widely to prevent the outbreaks of diseases from water contamination.

In Mongu’s Barotse floodplain, unlike in other societies, people living there invest the annual floods that occur in their land with great importance. They have realized that they cannot separate their land from the floods and they have therefore developed an abiding relationship between themselves and the floods. The floods in the area have simply become an integral part of the lives of the inhabitants. The presence or absence of floods is crucial in determining their livelihood. In fact, most human activities in the area are an outcome of the annual floods. In this context, Namafe (2004) points out that almost all the human productive activities, movements and monthly calendars are determined by
the floods. He adds that social life moves with every change of the waters and associated changes of weather. The annual floods centrally influence the human philosophy, religion and cultural approaches to life including economic, aesthetic and other elements.

People living in the Barotse floodplains of the great Zambezi river have adapted to the floods in many different ways. Some of the strategies which they have adopted are as follows. Gluckman (1943) points out that most people build their homes on the ‘mounds’ (Mazulu), higher parts of the plains, so that when the annual floods come after the summer rains, the homesteads stand above the waters. Peters (1960) explains that the villages in the Barotse floodplains are in this case invariably small with very few residents throughout the period of their stay. He clarifies that these villages are limited in size as a result of the relatively small mounds on which they are built. These are regarded as an adaptive strategy to annual floods since these mounds stand above the floods when they occur.

Gluckman further reports that towards the height of the flood at the end of February or beginning of March, the human inhabitants move for a few months to other homesteads built above the waterline on the margins of the plain. They move to their temporal homes on the higher grounds together with their cattle, and they remain there until the fall of the waters in winter to enable them to return to their permanent homes in the plain. They practice a mixed economy as a means of adapting to the annual floods. They are fishermen, cattle-keepers and agriculturalists, and a mixed economy has allowed them to withstand the losses from floods in case one or two of their economic activities are adversely affected by floods.

Gluckman further mentions that they are proficient gardeners with many different kinds of gardens which include Lizulu, Litongo, Lishanjo and Litapa, and which are planted
with a variety of crops from June to December. Some of these gardens are built above the floodplains, while others on the margins are drained and situated widely apart in the centre of the plains extending to the bush slope which encloses it. Gardens are covered, uncovered, or watered by floods. However, the residents have designed their farming activities in such a way that by the time the floods come, the crop in the gardens has been harvested leaving safe those planted on high grounds.

According to Trapnell and Clothier (1996), the *Litapa* garden is best adapted for the Barotse floodplains. The garden is placed on the fertile clay soils in the depressions (*Milapo*) in the plains and its fertility is renewed by depositions of silt from the annual flooding. The receding flood uncovers the *litapa* gardens in June which are then ploughed or hoed and planted in July. Maize is the chief crop planted in *litapa* gardens together with kaffir corn, pumpkins and melons. Cropping in the *litapa* gardens is on a yearly basis due to renewed fertility by the floods. Through this kind of gardening, residents have adapted to the annual floods.

Besides gardening, cattle-keeping occupies the second largest portion of the human economy after fishing. The cattle-keepers raise their cattle in the floodplains where the cattle graze the rich pastures that grow in the silt deposits from floods from June to February. When the floods come, they take their cattle to graze in the higher grounds, and then bring them back to better plain pastures as soon as the floods recede (Peters, 1960). Cattle provide milk and meat for people and the milk which is taken sour or fresh ranks highest in their diet.

Small stocks which include goats, sheep, pigs and donkeys are also fairly common. Poultry, which include chickens and ducks, are kept in fair quantities and by almost everyone (Gluckman, 1943). The cattle provide meat and the donkeys supply transport.
Sometimes both cattle and donkeys are sold for money. Poultry provide eggs and are also sold for money.

Gluckman further reports that dwellers in the Barotse floodplains are keen and skilled fishermen with twenty-two recorded ways of catching fish. The fishing methods depend on the state of the flood and on the weather (season). A variety of fish species are caught during floods and even after floods have receded. Fishing is an important activity that is done by almost every inhabitant and is done throughout the year. Fish has provided for the dietary needs of the people in good and bad farming seasons.

Munyaradzi (2000) reports that the Barotse floodplains are rich in wildlife so that hunting is common. He points out that the floodplains are particularly rich in reptiles and amphibians. These amphibians include monitor lizards and tortoises which provide food during and after the floods. Namafe (2004) adds that people also engage in a communal bird hunt in June as an adaptive strategy.

The Barotse floodplain dwellers are keen traders because of the variety of economic resources in the area. These have enabled different people to produce different types and quantities of goods which they exchange or sell to one another. In exchange for fish and cattle, they trade with the bush people who bring baskets, nets, bark rope, paddles, dugout canoes and iron goods which they use in their social and economic activities. The Zambezi river and its tributaries provide the linkage between the floodplain dwellers and the surrounding bush people in the trade (Gluckman, 1943).

Siamwiza (2009) points out that the local inhabitants have traditional indigenous knowledge about their ecological surroundings which enables them to adjust to the prevailing ecological conditions. He notes that they use traditional indigenous knowledge to adapt to annual floods. For example, they use spiders to predict high or normal floods,
and the presence of many cobwebs is an indication that the coming season will be one of heavy floods (ibid.).

Finally, the Barotse floodplain inhabitants have taken advantage of the annual floods for an annual social event. They have made their seasonal movements away from the floods an exciting social ceremony called the ‘‘Kuomboka’’. Kuomboka, which means “to come out of the water”, is annually celebrated in the area. In fact, in recent years, the ceremony has acquired international recognition as a tourist event. Referring to the kuomboka ceremony, Namafe (2006: 119-120) highlights the attachment of inhabitants to the floods through the following poem:

Lozi Flood Poem

*It is flood time in Bulozi*
*The floodplain is clothed in the water garment.*
*Everywhere there is water!*  
*There is brightness!*  
*There are sparkles!*

*Waves marry with the sun’s glory*  
*Birds fly over the floods slowly,*  
*They are drunken with cold air.*  
*They watch a scene which comes but once a year*  
*Floods are beautiful.*

*Bulozi is the flood’s dwelling place.*  
*Every year floods pay us a visit*  
*A Lozi does not ask or beg for floods.*  
*We do not resort to herbs to bring floods.*  
*We practice no witchcraft whatsoever.*  
*These are flood waters indeed!*  
*The floods are ours.*

*They know their own route.*  
*They know their own home.*  
*They know where they are needed*  
*They know where they are cared for.*

*And when we see them ourselves, we are filled with happiness,*  
*Our hearts become lighter*  
*We do not fear the floods.*  
*Floods are a Lozi’s “patelo” (playing arena)*
When the floods are in, we prepare the royal boat.
It is a happy occasion in Bulozi.
Listen! The royal drums boom in the palace,
Calling the paddlers, young and old.
Floods are a Lozi’s “patelo”
The royal drums are never bought,
They cannot be priced,
They cannot be given away
We might give away cobs of maize or fishes,
But the royal drums are ours and ours alone.
Their booming sound stirs our blood.

We get wild with our cultural heritage,
We dress in animal and lion skins.
Floods, the Kuomboka Ceremony and the royal drums
Are all ours alone.

This Lozi flood poem describes the attachment and relationship that humans in Mongu’s Barotse floodplain have towards the annual floods in their land. They view their land extremely blessed by the arrival of floods. The presence of floods is viewed as a blissful time that brings the inhabitants together from far and near. Indeed, the floods are viewed as a divine occurrence. Hence, the absence of floods saddens the inhabitants to the extent that they go to the shrines to consult their ancestral spirits.

The global occurrence of floods resulting in natural forms of risk and hazard is not easily separated from issues concerning justice. An adequate theory of the impact of floods would require such an analysis. As Walker (2012: 130) states, “the transition through a flood becoming a hazard and then becoming a disaster is even more resolutely about the social processes that create vulnerability and achieve different degrees of coping and resilience”. This study, however, does not aim to produce such a grounded theory with regard to disaster management practices and strategies.
2.3 Summary

People have adapted to annual floods in the Barotse floodplain by building homes on mounds and relocating to their second homes on the higher ground when their homes on the plain become submerged. They have also adapted through a mixed economy strategy which includes fishing, cattle-keeping and crop cultivation. Crop cultivation in the plain is divided into a variety of gardens which include litapa, litongo, lishanjo and mazulu, and which are harvested at different times before the floods. Adaptation has taken place through hunting wild animals as well as through communal bird hunting, trading in various commodities within the plain and the surrounding areas. In the economic sector, fishing, hunting and agricultural activities and trading have been identified. Using their traditional knowledge, they have been able to predict abnormal or normal floods and have thereby prepared themselves for the coming floods. Lastly, local dwellers have adapted to the annual floods through a colourful social activity called the “Kuomboka”, a seasonal movement of people away from the water to their summer homes on higher ground.

The literature, however, has not adequately discussed current adaptive strategies to floods. It does not capture current changes in climate as well as in environment, and human responses to these changes. Consequently, this study aimed to give a more current evaluation of human adaptive strategies to floods in Mongu’s Barotse floodplain.
CHAPTER THREE: THEORETICAL FRAMEWORK

3.0 Introduction

The theoretical framework of this research involves the land ethic ecosystem and utilitarian theory. A brief summary of each of these theories follows.

3.1 The Land Ethic Theory

The Land Ethic of Aldo Leopold is an ecosystem theory that is founded on a wider community concept. It arose from Leopold’s experiences and observations as a forest manager. He had intended to use the traditional forestry approach to game management by trying to wipe out predators such as wolves. However, later reflection on this practice convinced him that such management techniques disturbed the ecological system and led to an unsustainable explosion in game populations (Palmer, 1997). In addition, Leopold was concerned about the negative effects of many kinds of human activities on the natural environment which included inappropriate recreation and wildlife management strategies, and the development of previously wild areas for industry and agriculture (ibid.).

In the extended community concept which involves the whole environmental ecosystem, Leopold argues that each individual is a member of a community of interdependent parts. He further points that each member in such a community must compete for a place as well as co-operate in order to have a place to compete for (Leopold in Reynolds et al., 2009). Wenz (2001) notes that Leopold refers to this community as an ecosystem
community in which humans are a part. He adds that ecosystems include all living organisms that interact with one another and with their inorganic surroundings, hence maintaining eco-stability. In this regard, the Land Ethic simply enlarges the boundaries of this interactive and interdependent community to include soils, waters, plants and animals, or collectively, “the land” (Leopold in Reynolds et al., 2009). In this interactive community, each one occupies only a part of the earth. An individual in the community is seen as acting together with others. The ecosystem supports the functions of all members, and plays a critical role in preparing and drawing individuals to their fullness of being.

The Land Ethic theory, therefore, operates on the perception that there is a symbiotic, inter-relatedness, interconnectivity and interdependence in the natural world between the bio-community and the non-living (abiotic) world (Wenz, 2001). In this holistic theory, humans, other life forms and abiotic elements are part of the whole ecosystem. As a result, each element in the natural environment is perceived important as it serves one or more other elements in the biotic or abiotic community. Consequently any destabilization on any of the elements would eventually affect the stability of the natural environment (ibid.).

Leopold illustrates this inter-relatedness, interconnectivity, symbiosis and interdependence in the form of a pyramid and its implications in terms of land-use. He notes that plants absorb energy from the sun, and this energy flows through a circuit called the biota which may be represented by a pyramid consisting of layers. The bottom layer is the soil. A plant layer depends on the soil, an insect layer on the plants, a bird and rodent layer on the insects, and so on up through various animal groups to the apex layer which consists of the larger carnivores.
Basically, the species of a layer are alike not because of where they came from, or in what they look like, but rather in what they eat. Each successive layer depends on those below it for food and often for other services, and each in turn furnishes food and services to those above. As this proceeds upwards, each successive layer decreases in numerical abundance. Humans share an intermediate layer with the bears, raccoons, and squirrels which eat both meat and vegetables (ibid.). The overall process is referred to as “the food chain”.

Nevertheless, though there is a symbiotic relationship between the biotic and the abiotic community, the land ethic views humans to be the highest form of life with moral consciousness in the biotic community pyramid. Hence, humans have a moral obligation to ensure that the natural environment remains stable and intact. To do this, humans need to have knowledge of ecology in order to have an adequate perception about land. Wenz (2001:157) writes that:

>a land ethic changes the role of Homo sapiens from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such. Leopold summarizes the land ethic in the maxim: a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.

The Land Ethic thus permits the use of environmental resources “with respect” to serve members of the biotic community. Humans, as citizens of the biotic community, are therefore entitled to exploit the natural environment to survive and attain their potential aspirations. However, the land ethic urges humans to act in an ethical manner such that they benefit from the natural environment while at the same time taking into consideration the integrity, stability and beauty of the natural environment. In other words, an ecosystem has intrinsic value, value-in-itself, and not just the kind of utilitarian value that focuses on the use value of the natural environment to humans.
In this study, therefore, the adaptive strategies of the human inhabitants in Mongu’s Barotse floodplain will be ethically assessed by the land ethic with reference to their impact on other life forms and on the physical environment.

### 3.2 Utilitarianism

Utilitarianism is an ethical theory that belongs to a group of consequentialist theories. It was begun by a British philosopher and economist, Jeremy Bentham (1748 - 1832). He believed an action to be good which would bring about the greatest pleasure for the greatest number of people. The theory has had an enormous influence on moral philosophy, legal and political theory, and social policy, and it has shaped public decision-making in the nineteenth century in the administrative machinery of the British government. Bentham declared that in order to come into accord with the laws of nature, governments and citizens should act to increase the overall well-being of the community (William, 1999).

Bentham argued that nature has placed humans under the governance of two sovereign masters, pain and pleasure. These two independent variables operate on the two fundamental ideas on which utilitarianism is founded, namely, human actions and their results. Secondly, utilitarianism assesses and compares the pleasure and pain that human actions cause in relation to their impact on people’s well-being (ibid.). He further sought to devise a quantitative scale of pleasures and pains, rating them in terms of their intensity, purity, duration, propinquity or remoteness, certainty, fruitfulness, and the extent to which pleasure and pain are shared among the greatest number of people.

John Stuart Mill, however, although also a utilitarian, was not at ease with the exclusive measurement of pleasure and pain in quantitative terms only. Hence, he believed that ‘‘happiness’’ was a more adequate term to allow for the qualitative evaluation of
pleasure. Later utilitarians introduced the notion of maximizing “preferences”. In general terms, then, as an ethical guide towards human actions, utilitarianism focuses on maximizing the good consequences (Frankena, 1989).

In this study, however, utilitarian theory is being extended to the natural environment such that it does not restrict itself to human welfare only but includes the well-being or good of all life-forms in the environment as well as the physical environment itself. Utilitarian theory, therefore, will be used to assess the human adaptation strategies to floods in Mongu’s Barotse floodplain and the good that these strategies bring to both humans and other life forms in the environment.

### 3.3 Summary

This chapter has presented the reader with the ethical framework for the study, namely, the land ethic and utilitarian theory.

The land ethic is an ecosystem theory. “Land” includes soils, waters, plants, and animals. All are inter-related, interconnected and interdependent on one another.

Utilitarianism was founded by the philosopher and economist, Jeremy Bentham. It rests on the two fundamental ideas, namely, human action and their results on the people’s well-being. In general, utilitarianism focuses on maximizing the good. In this study, however, utilitarianism is being extended to include also the well-being of the natural environment in Mongu’s Barotse floodplain.
CHAPTER FOUR: METHODOLOGY

4.0 Introduction

The research used a qualitative study design involving ethical analysis. Primary data sources involved observation, in-depth interviews and focus group discussions in the study area (Mongu’s Barotse floodplain). Secondary data sources included literature from the university library and university departments such as geography, environmental education and biological sciences (ecology). Also included was material from government departments such as the Disaster Management and Mitigation Unit, the Zambia Environmental Management Agency and other organizations relating to environmental issues.

4.1 Study site

The study was conducted in Mongu’s Barotse floodplain which is found in the Western Province of Zambia and is inhabited mainly by the Lozi speaking people. The floodplain begins at Chavuma where the Zambezi re-enters Zambia from Angola and extends into Namibia (Munyaradzi, 2000). It covers 12,950 sq. km of the total land area in the Western province (C.S.O., 2010), and is on an altitude of about 900m above sea level (Namafe, 2006). The Zambezi River divides the floodplain into two parts in the western part of Mongu Boma, and is situated north-west of Senanga, south-west of Limulunga and south-east of Kalabo (See map in figure 1.)

Mongu’s Barotse floodplain comes under Lealui ward and has a population of 4,556 with 1,213 households for the local residents (C.S.O., 2010). It is characterized by treeless
plains with abundant grass, and by water resources and seasonal floods that cover a large part of the area from March to June. It is further characterized by a favourable climate for rice production, cattle ranching, fishing, and abundant bird and animal habitation. The climate also supports seasonal traditional agricultural practices executed by the local residents.

4.2 Target population and sampling

The target population for this study was the residents of Mongu’s Barotse floodplain who consist mainly of the Lozi people. Participants for the research were drawn from ordinary residents and local leaders such as headmen/women and indunas in the following villages: Kakula, Lealui, Likanda, Lindu, Liyala, Malabo, Mangongi, Musika, Nkanda and Suka. Furthermore, the study targeted participants from government departments and non-governmental organizations in Mongu. These included officials from the Disaster Management and Mitigation Unit, the Ministry of Agriculture and Cooperatives, Mongu Municipal Council, ZAWA, Oxfam and People’s Participation Services (PPS).

An in-depth interview schedule was used to interview the Induna of Lealui, and the headmen of Liyala, Mangongi, Likanda, Kakula, Musika, and the headwoman of Lindu. Officials interviewed were the principal agricultural officer at the Ministry of Agriculture, the livelihood/humanitarian officer at Oxfam Zambia, the project officer at PPS, regional co-ordinator at DMMU, the head teacher at Malabo primary school, and ZAWA officials (the area warden and the ranger). Focused group discussions were carried out with residents from Lealui, Liyala, Lindu, Likanda, Mangongi, Kakula, Musika, Malabo, Nkanda and Suka villages.
The total sample for the study was ninety (90) and was picked using judgmental, cluster and snowball sampling techniques. Table 1 below gives a breakdown of the sample.

**Table 1: breakdown of participants interviewed**

<table>
<thead>
<tr>
<th>Interviewees</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government officials</td>
<td>5</td>
</tr>
<tr>
<td>Non-governmental officials</td>
<td>2</td>
</tr>
<tr>
<td><em>Indunas</em></td>
<td>1</td>
</tr>
<tr>
<td>Headmen</td>
<td>5</td>
</tr>
<tr>
<td>Headwomen</td>
<td>1</td>
</tr>
<tr>
<td>Ordinary residents</td>
<td>76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
</tr>
</tbody>
</table>

*Judgmental sampling:* This technique was used to enable the researcher to select participants to take part in the research based on his judgment of the suitability of a respondent to participate. Under the judgmental technique, purposive and convenience techniques were used. Purposive technique allowed the researcher to pick participants who were directly affected by the floods. Convenience (accidental or available) technique was used based on, or considering the availability of subjects (present at the time of the interview or easily accessed).

*Cluster sampling:* Using this technique, the entire population that was interviewed in Mongu’s Barotse floodplain was divided into a number of clusters (villages). A total of ten (10) villages were sampled, with a varying target population of between 5 - 9 residents and a leader from each village. Focus group discussions (FGDs) were used to collect data from residents in the clusters or units.
Snowball sampling: This technique was used to establish contact with relevant organizations such as Oxfam Zambia, PPS and MTENR.

4.3 Analysis

Data from the field was discussed and analysed, and an ethical evaluation was carried out applying the Land Ethic and Utilitarian theory.

4.4 Summary

This chapter has presented the methods used in the study. It involved a descriptive study design using qualitative methods. Data was collected from primary and secondary sources. The primary data was collected from the field using observation, in-depth semi-structured interviews and focus group discussions. The study sample included Mongu’s Barotse floodplain residents, local leaders, and officials from different government departments and non-governmental organizations such as DMMU, ZEMA, MTENR, MACO, ZAWA, PPS, WWF and Oxfam.

The sampling procedure involved judgmental, purposive, convenience, cluster and snowball sampling methods. Data from the field was evaluated and analysed using the land ethic and utilitarian theory.
CHAPTER FIVE: FINDINGS, DISCUSSION AND ANALYSIS

5.0 Introduction

This chapter presents the findings followed by discussions and analysis of data in relation to the objectives of the study which were: (a) to investigate the annual duration and extent of floods in Mongu’s Barotse floodplain, (b) to identify the effects of the floods on the human, animal and vegetative life in Mongu’s Barotse floodplain, and (c) to identify the adaptation strategies adopted by the human inhabitants to floods in Mongu’s Barotse floodplain. The findings were based on field observations, interviews and focused group discussions with residents of Mongu’s Barotse floodplain.

5.1 Duration and extent of floods

An interview with an induna of Lealui royal village, five headmen and a headwoman of Lindu revealed that in the recent past years, floods came earlier than expected and in greater volume. They said floods came as early as December to February unlike in the past when they came around February and March. They as well mentioned that floods receded at the end of June or in July. Flooding in Mongu’s Barotse floodplain therefore lasted between five (5) to eight (8) months of total flood coverage.

Focus group discussions with ordinary residents in villages also revealed similar response to those of the induna, the headmen and the headwoman. They further noted that floods were covering larger areas than ever experienced before. The above findings confirm what was noted by G.R.Z. (2007). Basically, the increased frequency and size of floods were suspected to be a result of global climate change and the ceasing by local
residents in the plain to deepen floodplain canals. In the past years, canals were regularly deepened to contain large volumes of water thereby preventing floods from covering a wide surface area. However, as the canals had not been deepened, the canal beds were raised due to debris brought by floodwaters.

5.2 Effects of floods

The effects of annual floods in Mongu’s Barotse floodplain were both positive and negative. The negative effects, as noted by the induna, the headmen, the headwoman, and several ordinary residents in the villages included destruction of crops leading to hunger, reduction of cultivatable land, siltation/sedimentation, hardships in communication (movement), waterlogged burial sites, submerging/destruction of shelters such as houses, destruction/loss of property, and destruction of grazing lands for animals. This is in line with the findings by G.R.Z. (2007) and Peters (1960).

Floods were also reported to have increased epidemics such as malaria, athlete’s foot (sinyayi- a fungal skin infection disease) and waterborne diseases like dysentery and diarrhoea resulting from water contamination from human excreta deposited directly in the water and from pit-latrines. In addition, they said that the annual floods brought dangerous creatures closer to humans such as insects, snakes, crocodiles and hippopotamuses which often attacked people.

Participants mentioned also that life forms such as birds, rodents, rabbits, snakes, tortoise and many more were annually pushed away from their habitation by floods to drier lands, while some got trapped and perished. Grassland and plant life got submerged in floodwaters, and subsequently destroyed hence herbivore animals were left with nowhere to graze on. Habitation for a variety of life forms was also destroyed as grassland got
submerged in floodwaters. The ZAWA area warden further noted that floods came with some strange animal diseases which negatively affected animals.

The positive effects of floods identified by the induna, the five headmen, the headwoman of Lindu village, and several ordinary residents included increased fishing and easy movements in the plain using canoes. Furthermore, the induna of Lealui, the headmen of Kakula and Likanda villages, and some local residents in the villages said that floods promoted cultural heritage through the kuomboka ceremony. The Principal Agriculture officer at MACO and ZAWA area warden in Mongu, also said that floods brought deposits which were a natural fertilizer that rejuvenated soil fertility important for crop growth.

5.3 Human adaptation strategies

Interviews with the Regional Co-ordinator at DMMU noted that humans living in Mongu’s Barotse floodplain had managed to adapt in one way or another to floods considering the length of time they had lived in the annually flooded area. Some residents interviewed agreed to the above assertion but emphasized that they had done so with great difficulty as they had little choice in the matter as they were unwilling to leave their home environment\(^2\). Having said this, they identified the following adaptation strategies as ways in which they managed to adapt to the annual floods although with difficulty:

\(^2\) Interviews with the induna of Lealui, five headmen, headwoman of Lindu and the focus group discussions with residents from all the ten villages.
5.3.1 The Homesteads

The researcher observed that the residents had adapted by erecting all their villages on mounds to withstand floods when they occurred (cf. Figure 3 below).

Figure 3: A village built on a mound (lizulu) in Mongu’s Barotse floodplain.

Source: Field Data, 2011.

Since mounds stood above floods, villages built on them were in most cases never submerged. This is in line with a similar observation made by Peters (1960). Nonetheless, in times of heavy floods, they raised the grounds of their villages by adding extra soil to restrain flood waters from submerging villages\(^3\). The headwoman of Lindu village added that in view of the flood scenario, her children in town were to raise Lindu village using heavy earth moving machines. This strategy has not been noted in the literature reviewed.

The researcher also observed that the housing units for residents were made out of mud, reeds, fibre, poles and grass (cf. Figure 4 above). These were materials got within the

\(^3\)Interviews with the induna of Lealui, headman of Mangongi, headwoman of Lindu, head teacher for Malabo primary school and the ordinary residents in the ten villages.
plain and at the margin of the plain towards the plateau. It’s probable that these materials were used as building materials to avoid major injuries and losses when houses collapsed or were destroyed by floods. However, these materials have a shorter life span and are easily destroyed hence most housing units in the plain were yearly destroyed, and rebuilt from the above materials. However, the researcher was of the view that lack of finances for most residents had to some extent contributed to the non-availability of better and durable housing structures that could withstand floods. This strategy has not been highlighted in the literature reviewed.

When floods were too heavy, residents mentioned that they vacated the flooded plain to their second homes on higher grounds locally known as Sana or Mukulo (at the margins of Mongu and Limulunga)⁴. However, as not all residents had homes on higher grounds, some squatted with friends on higher grounds throughout the flood period. In separate

⁴Interviews with induna of Lealui, five headmen, headwoman of Lindu and the ten ordinary residents in the entire ten villages.
interviews with the officials, they also confirmed that residents vacated the flooded plain during heavy floods to higher grounds for safety\(^5\). They stayed there until floods receded at the end of June or around July when they decided to go back to their floodplain homes. Gluckman (1943) highlighted this fact.

Since flooding was an annual event, vacating the flooded plain was an important annual adaptation strategy that residents had for minimizing flood losses and risks. The interviewees actually mentioned that vacating the flooded plains to higher grounds provided residents with greater protection against floods than any other means.

5.3.2 Household belongings

Some residents kept their belongings on a raised platform above the flood waters to keep them safe while others placed goods on piles of grass for protection against floods\(^6\). Belongings were also protected from floods by raising the floors of houses. The above adaptive strategies helped to some extent to protect belongings from coming into contact with water, and which were therefore protected from the destructive effects of floods. The researcher observed, however, that a majority of residents had very few belongings such that very little could be destroyed by floods. The literature reviewed has not taken note of this strategy.

5.3.3 Fishing

Fishing was said to be the major way by which residents had adapted economically to the annual floods\(^7\). It has been the most important activity that they engaged in during the

\(^{5}\) Interviews with Officials from MACO, ZAWA, DMMU, Oxfam Zambia, PPS and the Head teacher for Malabo primary.

\(^{6}\) Interviews with the induna of Lealui, the five headmen and ordinary residents in all the ten villages.

\(^{7}\) Interviews with the induna of Lealui, the five headmen, headwoman of lindu and focus group discussions with ordinary residents in all the ten villages.
flood period. This was confirmed in other interviews as well. The researcher also observed the extensive fishing activity in the study area. Fishing has been done on both a commercial and subsistence basis. Fish has been used for home consumption as well as sold to enable residents generate income for buying essential goods and other services. It has also been sometimes exchanged for cassava and maize with people on higher grounds of Limulunga and Mongu. Literature reviewed in Gluckman (1943) and Peters (1960) highlighted this adaptive strategy too.

5.3.4 Crop agriculture

With regard to crop agriculture, human adaptations to annual floods involved making advance preparations (cf. Figure 5 below) which included: (a) Planting crops early before the onset of rains near water bodies for easy irrigation, (b) planting crops early in depressions before the onset of rains and then transplanting them on mounds (*mazulu*),

*Figure: 5. Residents irrigating maize field before the onset of rains.*

Source: Field Data, 2011

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8Interviews with Officials from DMMU, MACO, ZAWA, Oxfam Zambia and Malabo primary school.
(c) harvesting as soon as the crop matured, and (d) storing the crop in a raised platform structure called silo (*sishe*te)*\textsuperscript{9}.*

However, the last mentioned strategy was exceptional as most crops were destroyed at growing stage so that nothing was harvested and stored.

Discussants pointed out that agricultural activity had been very hard for residents in recent past years. They complained that rains either came too early leading to early flooding before crops could mature for harvesting, or came too late such that plants planted early ended up being scorched by the sun before the onset of rains\textsuperscript{10}. However, to adapt to the varying rainfall calendar, others interviewed mentioned that other agricultural activities were carried out by residents who had villages on higher grounds\textsuperscript{11}. They said that rice was a major crop and was planted from as early as February and March to June or July when it was harvested. Next to fishing, rice production has been the most important economic activity that residents engaged in during the flood period. Other interviewees also confirmed the presence of rice production in the higher grounds\textsuperscript{12}. As with fishing, rice has also been used for home consumption as well as sold for money which in turn has been used for buying other goods and services.

Furthermore, an interview with an official at Oxfam revealed that other crops such as millet, sorghum, cassava and sweet potatoes were grown in the higher grounds as an adaptive strategy. He said that the crops were a supplement to their food. Since crops like millet and sorghum grew quite fast, they were often used as a substitute for maize when it was destroyed by floods in the plains.

\textsuperscript{9}Interviews with officials from Malabo primary school, MACO, Headman of Liyala village and focused group discussions with ordinary residents in Lindu, Liyala and Nkanda villages.
\textsuperscript{10}Focus group discussions with some ordinary residents in Lealui, Musika and Suka.
\textsuperscript{11}Interviews with the induna of Lealui, five headmen, headwoman of lindu and the local residents in all the ten villages.
\textsuperscript{12}Interviews with Officials from Malabo primary school, DMMU, Oxfam Zambia, PPS and ZAWA.
The researcher observed that different crop varieties were also grown in Mongu’s Barotse floodplain to improve on food security. Crop diversification acted as a means that residents adopted to adapt to changing flood scenarios in their land thereby enabling them not to depend on a single crop variety. It greatly reduced the adverse impacts of floods on residents. It also encouraged residents to grow crops that were never grown in the plain before such as cabbages, rape, carrots, paprika and tomatoes. These crops were grown near water bodies, probably for easy irrigation, and were planted once the floods receded\(^{13}\). Crops, especially vegetables, were also sold for money which later could be used to buy other essential goods for home use.

### 5.3.5 Livestock agriculture

Another important economic activity was keeping cattle\(^{14}\) (cf. Figure 6 below). Cattle have been very useful in a time of poor harvest resulting from floods and during fish ban periods. During such gloomy times, people fed on milk, and in some cases, sold milk either as fresh or sour to generate income.

Although animals have been sometimes killed for consumption, the practice has not been common and has only been done in very critical times such as when floods had destroyed everything leaving them with no other alternative. The researcher observed that almost all the villages had cattle which were carefully protected because of the role they played in bad farming periods resulting from floods or drought. In such times, cattle have been the most important possession local residents had for food and other services. Actually, cattle have for a long period of time been used as a measure of wealth and they have determined one’s social status in Mongu’s Barotse floodplain. Because of the value

\(^{13}\)Personal observations

\(^{14}\)Interviews with Officials from MACO, DMMU, Oxfam Zambia, PPS, ZAWA and ordinary residents in all the ten villages.
humans placed on cattle, they kept them in kraals near to their villages at night for protection. Although they were left to wander about for food in the day, they were brought back at mid-day for milking, and were released after they were milked. Milk was consumed at home and the extra sold to cushion the devastating effects of floods or droughts.

Figure 6: A herd of cattle in Mongu’s Barotse floodplain.

Source: Field Data, 2011.

The researcher also observed that a small number of donkeys, pigs and birds such as chickens and ducks were also kept in fair numbers. Donkeys were observed to be instrumental in providing transport. Pigs and poultry provided meat and were sometimes sold for money. This strategy has been highlighted by Gluckman (1943) too. Pastoralists adapted to annual floods in the area by relocating their animals to higher grounds of Mongu and Limulunga royal village\(^\text{15}\). They relocated their animals after the flood waters had risen to the level that could not allow animals to graze pasture. Those without villages on the higher grounds left their animals with relatives or friends until

\(^{15}\)Interviews with the induna of Lealui, the five headmen, headwoman of Lindu and ordinary residents in all the ten villages.
floods receded towards the end of June or early July. When flood waters dropped to the river canals and depressions, animals were brought back to the rich grass of the plain. This strategy has also been noted by Gluckman (1943) and Peters (1960).

The *Induna of Lealui* mentioned, however, that grass left by floods dried up quickly and became unpalatable for animals to graze on. Pastoralists, therefore, burnt the plain grass to allow new or fresh grass to sprout for cattle to graze on. He further said that the practice was not new and had been under the authority of Barotse Royal Establishment (BRE). He added that the BRE authorized grass in certain areas to be burnt while other areas were left until the already burnt areas had grass germinated on them. He also said that fires were controlled to avoid burning grass in areas not authorized. He regretted, however, that grass was in the past recent years set on fire at the discretion of individuals and that fire went beyond the intended areas negatively affecting wildlife and animals alike. The researcher also observed this practice in the study area; a practice has not been highlighted in the literature reviewed.

5.3.6 Hunting

In an interview with ZAWA officials (the area warden, and the area ranger), they pointed out that hunting wildlife was also an adaptive strategy adopted by local inhabitants. They mentioned that residents hunted down wild animals that were trapped by floods as well as those that got sick during flood time due to outbreaks of diseases. They also said that residents illegally carried out seasonal hunting of birds that were breeding, which the local people term as "kuloba sitaka." This practice is also noted by Namafe (2004).

However, the *induna of Lealui* said local residents no longer hunted animals and birds because they were forbidden by government, probably by the Zambia Wildlife Authority. The headmen and residents in the villages also denied hunting down animals and birds.
But taking a closer look at what they said, it could be argued that they wanted to conceal that information from public domain. Hunting provided residents with game meat for home consumption and it was also sold in town for monetary gain. However, because it was illegal, it was carried out by very few residents.

5.3.7 Fruit gathering

Focus group discussions with ordinary residents of Kakula and Musika villages revealed that fruits (locally known as mampana) were gathered from water lilies that developed underneath flood water. The fruits are potato-like and are eaten either raw or cooked. These fruits were said to provide meals for residents during the flood period. However, in one focus group discussion, ordinary residents from Lealui agreed that in the past years, they used to gather mampana but that these fruits had become rare because of the increased numbers of pigs that ate the remains of the lily fruits after floods receded. This strategy has not been highlighted in the literature reviewed.

5.3.8 Business activities

The ZAWA warden stated that residents engaged in business activities included selling natural resources such as reeds (kuma and mataka) and thatching grass (matengenya and mwange) to residents of Mongu town and Limulunga royal village. These resources were used for making walls and roofs for houses as well as fences, and provided financial relief to a large number of people. Evidence of this business was observed by the researcher in Mongu town through the numerous existing housing units with walls, fences and roofs made from the above resources. However, the researcher also observed that whereas thatching grass business was common to those residents with homes on
higher ground, reed business was more common in the lower grounds in the plain. This strategy has not been taken note of in the literature reviewed.

The researcher further observed that a few residents owned some makeshift stands, mini markets and mini shops where they sold some groceries which included mealie meal, rice, cooking oil, toiletries, sugar, and many other household requirements. These were very common in Lealui royal village. However, it was also common to find one or two household businesses in other villages besides Lealui. These businesses had, to a large extent, reduced the negative impacts of floods on humans and their dependence on the natural environment.

5.3.9 Health services

Healthwise, residents adapted to annual floods by accessing medical services from Luatile clinic in Lealui whenever they were unwell\(^\text{16}\). Furthermore, the government, through the Ministry of Health and its co-operating partners, distributed mosquito nets to residents. Mosquito nets greatly protected residents against mosquito bites and hence reduced malaria cases in the area. Regrettably, however, the researcher observed that mosquito nets were widely used for fishing by some of the residents leaving them vulnerable to mosquito bites leading to increased cases of malaria. However, some residents believed that they survived by the grace of God (Muhau wa Nyambe wangula) and hence did not do anything to protect themselves, while others had a fatalistic acceptance to whatever happened.

The head teacher at Malabo primary school, and some other local residents in Lealui royal village pointed out that in the recent past years, chlorine had been used as an

\(^{16}\)Interviews with the Induna of Lealui, the five headmen, headwoman of Lindu and ordinary residents from the ten villages.
adaptive strategy to kill the harmful pathogens in their water for drinking. However, they were quick to mention that only some few pockets of residents were aware of chlorine and how it was used. He further added that few residents boiled their water for drinking.

With regard to excretory needs, some male participants in Lindu village where the researcher was lodged admitted that residents used the flooded plain for excretion purposes since their pit latrines got full with the absorbed water, or collapsed during the flood period. Therefore, in time of floods, they acknowledged that residents paddled some considerable distance away from the villages in the flooded plain to avoid contaminating the water near the villages. Residents believed that water was only contaminated and harmful within a circumference of 500 meters so that paddling some considerable distance away from the villages for excretory purposes would ensure no outbreaks of waterborne diseases. The researcher observed that only two out of ten of the study villages had pit latrines. He was therefore of the view that the plain was in fact used for excretory purposes in the absence of floods as well as during floods. It could be said that residents did not erect pit latrines in the villages as they tended to collapse during floods.

**5.3.10 Social activities**

With regards to social activities, it was pointed out that the *Kuomboka* ceremony was and still is the major way in which residents have adapted to the annual floods\(^\text{17}\). The *Induna* of Lealui added that a “Lozi is a water person” (*Mulozi ki mutu wa kwa mezi*) and that flood time is, therefore, a blissful time in Barotseland as it promotes Lozi cultural heritage through the *Kuomboka*. He noted that it is also a time when people interact with

\(^{17}\)Interviews with the Induna of Lealui, the five headmen, headwoman of Lindu, and some focus group discussions with ordinary residents in all the villages.
relatives who live in various towns. Other interviewees gave a similar response\(^\text{18}\) Namafe (2006) and several others have highlighted this adaptive strategy too.

The *Kuomboka* ceremony is the biggest and most important social function in Mongu’s Barotse floodplain and it is nationally and internationally recognized. This is the case ever since the *Lozi* people came to settle in Barotseland. *Kuomboka*, which simply means “to get out of water”, is a traditional ceremony celebrated yearly. Initially, it was meant to drive the king and residents of Mongu’s Barotse floodplain away from the floodwater to higher grounds for their comfort and safety. However, in the recent past years, the ceremony has acquired a new emphasis from merely delivering the king and residents from floods to safety to becoming an economic venture for local residents as well as the nation. At the *Kuomboka*, socio-economic activities such as regatta and traditional dances by traditional dancing troops like the *Nayuma* and several others from the province and from the country are showcased. At these activities, people pay money to participate and watch. As a result, local people are financially empowered. During the ceremony, canoes are used to ferry people and their belongings. The *Nalikwanda*, the royal badge, is the biggest boat and is used to ferry the king. It is followed by the *Notila* which is used by the queen and by other boats for ordinary people. Other than *Kuomboka*, other social functions such as initiation ceremonies, funerals, visitations, beer drinking and weddings are been held. Canoes have been used to get to social activities in other villages (cf. Figure 7 below).

On the negative side, however, ordinary residents in *Lealui, Suka* and *Liyala* villages pointed out that during floods, social activities were largely reduced as most of the time people were exposed to dangers from animals and canoes capsizing which sometimes resulted in injuries and deaths. Hence, they rarely moved from one village to another for

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\(^{18}\) Interviews with Officials from Oxfam Zambia, ZAWA, DMMU, PPS and Malabo primary school.
social functions. Both headman of Mangongi village and head teacher at Malabo primary school added to the above assertion adding that during floods, aquatic animals such as hippopotami and crocodiles wandered about in the floodwaters and posed threats to humans. The headman of Mangongi village further observed that floods were sometimes associated with winds which interfered with social functions.

Figure 7: A Young boy paddling a dugout canoe.

Source: Field Data, 2011

Canoes have been owned by almost all villages and have been used in day to day social and economic activities during flood time. Those without canoes have been paying the canoe owners for such services. In fact, the canoe business in the plain has been very apparent, especially during floods.

It should finally be noted that most residents, including children, have developed the survival skill of swimming in adapting to the annual floods.
5.4 Impacts of human adaptation on the environment

The impacts of human adaptation to floods on the environment in Mongu’s Barotse floodplain were both positive and negative and were as follows:

5.4.1 Positive impacts

5.4.1.1 Fishing and Hunting

The direct positive effects of human adaptation to floods on the environment in Mongu’s Barotse floodplain included fishing and hunting. Fishing and hunting of wild animals and birds regulate the size of the population of environmental life forms both terrestrial and aquatic. For example, ZAWA warden in Mongu, pointed out that some species become overabundant thereby exceeding the carrying capacity of the area they inhabit resulting in them competing for limited food. In this regard, he noted that reducing the numbers of some species by fishing and hunting helped in maintaining environmental stability and sustainability as well as in controlling the population of species. However, he cautioned that hunting and fishing were only advantageous to the natural environment if done using appropriate methods and technologies.

Referring to the warden’s observation, experience and expertise, hunting wild animals and birds has a positive effect on the natural environment, bearing in mind that an ecosystem is a community network system. Therefore, the size of the population of each species in the community is critical to the survival of the other species. In this regard, for example, the survival of grass depends on the population of herbivores that prey upon it. Hence, if the population of herbivores is not controlled, their overpopulation will risk exceeding the carrying capacity of the ecosystem. This will eventually deplete the grass and hence lead to starvation and the possible extinction of species that depend on grass.
Likewise, an uncontrolled animal population is detrimental to the environment since it leaves the area bare thereby exposing it to erosion and some harsh environmental conditions such as floods and droughts. In this regard, hunting animals and birds in Mongu’s Barotse floodplain by humans is beneficial to the natural environment in retaining its stability and equilibrium.

5.4.1.2 Livestock agriculture

The principal agricultural officer in Mongu observed that keeping animals plays an important role in preserving the health of the natural environment in Mongu’s Barotse floodplain. He observed that animals such as cattle, goats and donkeys keep the size of grass in check. The plain grass is checked or controlled by the animals that graze on it. He also observed that animals add value to the natural environment by their dung which is valuable to insects such as the dung beetles that feed on animal dung, and use it for laying their eggs. Dung beetles also digest and dispose of animal dung thereby speeding up the recycling of nutrients in the environment. He furthermore noted that dung beetles play a remarkable role by consuming and burying dung (containing nitrogen and carbon dioxide) deep in the soil for plant use. In this way, greenhouse gasses mentioned above are kept underground thereby reducing the greenhouse effects by about eighty per cent (80%). In view of this, keeping animals in Mongu’s Barotse floodplain is beneficial to the natural environment.

5.4.1.3 Burning of dry grass

The Induna of Lealui, the headman of Kakula village and the warden, all pointed out that burning dry grass has a positive effect on the natural environment. They explained that it enhances new growth of grass fairly quickly, provides fresh grass for animals to feed on
as well as covering and greening up the landscape. Furthermore, burning encourages
easy feeding for a variety of bird species, especially birds such as Nongolo that feed on
snails, and Nalukapwa that feed on snakes. Burning also creates a suitable environment
for birds to peck on the new plants that sprung up after the older plants are burned away.

The researcher observed that burning of dry grass also had specific positive effects on
plant and wildlife habitats as it released natural carbon dioxide stored within the grass.
The carbon dioxide released into the atmosphere maintains and regulates carbon dioxide
levels in the environment. In addition, carbon dioxide is absorbed by plants during
photosynthesis (a process through which green plants, algae and certain bacteria use the
light energy to convert carbon dioxide and water into the simple sugar glucose) and the
by-product of this process is oxygen which is an extremely important element on which
most organisms depend. Oxygen is taken in by animals during metabolism reaction, a
process in which oxygen is used to break down food into smaller particles that can be
absorbed by animal cells. The by-products in this process are energy and carbon dioxide
and the process continues.

5.4.1.4 Crop and economic diversification

The researcher also observed that economic and crop diversification had some positive
effects on the natural environment. For example, growing a variety of crops adds a
variety of nutrients and elements that help in improving soil fertility while other valuable
elements such as nitrogen, potassium, and many others are released to the environment
thereby promoting environmental stability and fitness. Crop diversification also reduced
the risks that resulted from rain-fed crops which were often vulnerable to floods. It also
increased agricultural products keeping in mind the different risks and expected returns
from each crop thereby increasing food security for residents as well as reducing the
dependence burden on the environment by humans.

Economic diversification in the plain also expanded to include multiple economic
activities through forms of entrepreneurship which maintained a smooth flow of income
among the local inhabitants. A greater proportion of local residents in Mongu’s Barotse
floodplain have ventured into diverse economic activities.

In view of the above, economic and crop diversification in Mongu’s Barotse floodplain
has enabled humans to minimize their direct dependence on the natural environment for
most of their livelihoods.

5.4.2 Negative impacts

5.4.2.1 Threat to fish species

An interview with ZAWA officials (the area warden and the ranger) revealed that human
adaptation to annual floods has some negative effects on the environment. Referring to
fishing which was the major economic activity in the area, they confirmed that fishing
was greedily done by residents for monetary gain using destructive fishing methods
which include the use of mosquito nets. They observed that the use of mosquito nets (cf.
Figure 8 below) threatens the existence of fish species as this method traps all sizes of
fish including fingerlings. This has not been taken note of in the literature reviewed.

Because of the bad fishing methods by fishermen, there is a higher chance that the
population of fish is likely to be affected. This, in turn could create a chain reaction
response that would eventually affect the health of the aquatic ecosystem and could lead
to the possible extinction of fish and certain aquatic species. In this way, fishing was
seen to be a threat to the environment even when the harm could not be certain or
measured. In this way, the precautionary principle of not taking undue risks due to probable negative consequences was not being observed.

*Figure 8: Children fishing using a mosquito net.*

Source: Field Data, 2011.

The ZAWA officials further expressed concern over the practice of selling fishing rights to non-residents by the headmen who were appointed to supervise fishing activities. The non-residents came from other provinces for business on the understanding that the fish traders lived by the river banks catching fish for sale. Like the residents, they used fishing methods which were not sustainable.

### 5.4.2.2 Thatching grass and reed business

The ZAWA area warden expressed concern that cutting thatching grass and reeds for business was impacting negatively on the environment. He explained that thatching grass, reeds and other plants in Mongu’s Barotse floodplain provides habitats and a niche for a variety of insects, birds and animals. Birds are mostly affected since they use these
reeds for nesting. As a result of this, he noted that a large number of the bird family has migrated away. The literature reviewed has not taken note of this activity.

5.4.2.3 Burning of dry grass

The burning of Mongu’s Barotse floodplain grasslands to allow fresh grass to sprout for cattle grazing has a negative impact on the environment (cf. Figure 9 below). The Induna of Lealui condemned the practice pointing out that grass provides a variety of foods, habitats and cover for smaller organisms. He noted that grasslands are breeding grounds for birds and smaller animals and that burning destroyed nests and kills a large variety of life forms living in the grasslands as well as the micro-organisms in the soil. He pointed that it is because of this that the BRE controlled burning of dry grass in the plain to minimize the destruction of wildlife habitation and life forms therein. This practice had also led to mass migration of wildlife species away from the area.

Figure 9: Burning dry grass in Mongu’s Barotse floodplain.
Source: Field Data, 2011.
The researcher observed that burning has to some extent contributed to soil erosion in the Barotse floodplain because it has left the land bare thereby exposing it to erosion by animals and water. This has probably contributed towards the lowering of the mounds in Barotseland which were submerged by the annual floods.

5.4.2.4 Unsustainable agricultural practices

The Principal Agricultural Officer at the Ministry of Agriculture and Co-operatives (MACO), said that humans have impacted negatively on the environment through their bad and unsustainable agricultural practices which have exposed the land to soil erosion. He attributed this to bad farming practices such as ploughing along the slope (mounds) and fertilizing mounds using animals. He explained that as animals tramp on the mounds, they weaken and break the soil particles which later become susceptible to running rain water leading to soil erosion. Soil erosion has consequently lowered the mounds so that they became submerged by floodwater.

5.4.2.5 Human occupancy of the mounds

Human occupancy of the floodplain during the flood period had also impacted negatively on other life forms in the area. The head teacher at Malabo primary school pointed out that during the flood period, a variety of wildlife flee the flooded plain to mounds which are a drier part of the floodplain. The mounds annually provide safety to a variety of life forms in Mongu’s Barotse floodplain which include birds, mice, insects, snakes and trapped animals. Unfortunately, however, most of these mounds in the floodplain are occupied by humans who eventually resort to killing wildlife that seek shelter there.
5.5 Summary

The findings revealed that floods in Mongu’s Barotse floodplain have increased over the years and are of greater magnitude, come earlier than expected and cover a larger landmass than ever experienced before.

On the positive side, the study revealed that the floods increased fishing activities, united people through the Kuomboka, eased up movements, and rejuvenated soil fertility. On the negative side, the floods affected residents through destruction of crops, houses, property, grazing lands for animals, reduction of cultivable land, siltation, hardships in movements and water logged burial sites. The floods also increased epidemics such as malaria, athlete’s foot, and waterborne diseases such as dysentery and diarrhoea. They also brought dangerous creatures closer to the people such as insects, snakes, crocodiles and hippopotami. Furthermore, they destroyed wildlife habitation, submerged vegetation and brought strange animal diseases.

With regards to the ways in which adaptation to annual floods in Mongu’s Barotse floodplain has affected the behaviour of the human inhabitants, the findings revealed that the residents have adapted through building villages on mounds, raising the floors of villages and houses, building housing units from easily accessible materials such as grass, reeds, fibre, mud and poles to avoid losses in case of heavy floods and by vacating the floodplain to higher grounds in times of heavy floods. They have also kept their few belongings on raised platforms. Other adaptive strategies have included fishing, agriculture, cattle keeping, hunting, gathering fruits, business enterprises, medical services sought from clinics and the development of physical skills like swimming.

With regard to the ways in which human adaptation to annual floods has affected the natural environment in Mongu’s Barotse floodplain, the study revealed both positive and
negative effects. The positive effects include activities such as hunting, keeping animals and crop and economic diversification. The negative effects include the sale of thatching grass and reeds, unsustainable agricultural practices and wildlife threatened by human occupancy of the plain. However, the burning of dry grass and fishing are seen to have had both positive and negative effects on the natural environment.

The researcher notes with regard to the human adaptation to annual floods in Mongu’s Barotse floodplain, the following activities do not seem to have received mention in the literature: raising the grounds of villages, building housing units using easily accessible materials (grass, reeds, mud, fibre and poles), keeping belongings on raised platforms, gathering fruits, seeking medical services from the clinic in Lealui, and engaging in business activities like selling reeds and thatching grass.

With specific reference to the impact of human adaptation on the environment the following impacts were noted. The positive impacts are hunting and fishing, keeping animals, and crop and economic diversification. The negative impacts are threats to fish species, the sale of thatching grass and reeds, unsustainable agricultural practices, and human occupancy of the mounds. Fishing and burning of dry grass had both positive and negative effects on the natural environment.

5.6 Overall Analysis

Despite the difficulties and inconveniences experienced by the local inhabitants in having to adapt to the annual floods, adaptation has become an accepted part of their livelihood. While the consequences of the floods for both the human inhabitants and the natural environment have proven to be beneficial in many ways, there are also negative consequences that need to be acknowledged as have been mentioned in this study.
CHAPTER SIX: ETHICAL EVALUATION

6.0 Introduction

This chapter gives an ethical evaluation of human adaptation strategies to annual flood in Mongu’s Barotse floodplain. It relates to objective four which is to make an ethical evaluation of the impact of human adaptation strategies on the natural environment in Mongu’s Barotse floodplain. The ethical framework for this evaluation involves the land ethic environmental theory and an extended form of utilitarian theory.

6.1 General Evaluation

In attempting to make an ethical evaluation of the findings on the human adaptation to annual floods in Mongu’s Barotse floodplain and its impact on the environment, the evaluation assesses the ethical dimension of human adaptation strategies. Attfield (2003:15) states that environmental ethics involves “the kind of approach to environmental issues which finds independent value to be situated not only in the interests of humanity or of sentient creatures but also in the good of natural living creatures or their ecosystems”. The land ethic views human beings as full participants in the bio-community in which species create niches for one another as well as holding one another in check. On the other hand, utilitarian theory holds that any action taken must maximize the overall good. However, utilitarianism in this study has not restricted itself to humans alone but has been extended to the natural environment to include the overall good of other life forms as well as the totality of the natural environment. In sum, then, whereas the land ethic emphasizes the importance of focusing on the holistic ecosystem
while not ignoring the importance of individual life forms and the special importance of human inhabitants, utilitarianism in its extended form seeks to maximize the good of all biotic and abiotic beings in the human and natural environment.

Consequently, whereas humans ought to use environmental resources for their benefit, this should not be to the extent of degrading the natural environment. While appreciating the instrumental values of environmental resources to humans, extended utilitarianism and the land ethic advocate also for a direct relationship between the environment and human welfare. Ethics is rooted in values such as intrinsic values (values of beings in themselves including species and ecosystems) and inherent values (aesthetic values of appreciation by humans) in addition to utilitarian values that ought to be respected. Therefore, the environment, and the life forms and other elements therein, must be respected not only for their use value to humans or to other life forms but because they have value in themselves and offer species diversity to the natural environment. In other words, extended utilitarianism seeks for actions that would benefit the natural environment as well as benefitting the human inhabitants.

Organisms and their environment constantly interact, and both are changed by this interaction. Like all other living creatures, humans in Mongu’s Barotse floodplain have interacted with their environment and, in adapting, have clearly changed it; and they have done so generally on a greater scale than have all other species in the biotic community. To make an ethical assessment of human adaptation to annual floods in Mongu’s Barotse floodplain and its impact on the environment, this chapter will accordingly examine the human socio-economic activities, the technologies used to execute these socio-economic activities, and the impact of these socio-economic activities on the wider environment.
Humans in Mongu’s Barotse floodplain are the highest life form and the most important dimension of life involving moral consciousness. They have lived there for more than two centuries and have therefore evolved a complex relationship based on systems of eco-kinship with the elements of the environment. In line with this, they have developed a moral respect for, and a familiar relationship with their natural environment. They view their natural environment and themselves as one which places them within the natural order in which all life forms are interrelated and interdependent. The most important aspect of this natural order is their realization that if they care for the environment and the life forms it supports, the environment will in turn support them. In this regard, humans in Mongu’s Barotse floodplain consider all life forms to play an important role because their lives are dependent on the well-being of their environment. This dependence of humans on their environment has resulted in a basic understanding that destroying their environment is a direct destruction of themselves. This conviction is rooted in a traditional cultural recognition of the symbiotic relationship existing between humans and other life forms and the physical environment.

Nevertheless, humans have over the years learnt to consciously exploit the natural environment with a view to sustaining their present and future needs. They have managed all their cultural and socio-economic activities in such a way that they are sustained by the environment, and they have learnt to keep within their environment’s resource base for their socio-economic development. They have learnt that these environmental resources need to be protected through a careful and moral relationship to ensure the survival of humans and other life forms and the integrity of the physical environment. This moral relationship between humans and the natural environment is thus seen to be supported by both the land ethic and utilitarian theories.
It is an undeniable fact that humans in Mongu’s Barotse floodplain depend entirely on the environment to sustain their livelihood and that it is a necessary condition of their human development. However, it is also undeniable that the human struggle for survival has impacted on the environment in the process of adapting to floods.

6.2 Specific Evaluation

6.2.1 Homesteads

Building villages on mounds using materials such as mud, grass, reeds, fibre and poles is one of the adaptive activities that has satisfied human needs as well as not harming the environment. This adaptive strategy has brought about great benefit to humans in the plain and has not interfered with environmental stability. In this regard, humans in Mongu’s Barotse floodplain are working in conformity with environmental ideals whilst satisfying their survival needs. As members of the ecosystemic community, by building villages on the mounds, humans are both competing and co-operating in the community. When they vacate the floodplain to upper grounds during heavy floods, this activity has not affected the environment but has brought safety and security to the humans. In sum, then, building villages on mounds has been a very successful adaptation strategy to floods that has benefitted humans without harming the natural environment.

6.2.2 Crop Agriculture

Farming has been carried out on a subsistence scale using traditional hoes and ox-drawn ploughs, and gardens have been fertilized using animal dung as well as being rejuvenated by floods. No artificial fertilizers, herbicides and insecticides have been used so that the environment has not been harmed. For example, not using chemicals in agricultural activities has preserved environmental fitness. If chemicals were used, insects, fish, birds
and many other life forms that prey on them would most likely be affected thereby destabilizing the environment. As members of the ecosystem, human inhabitants thus interact with the wider environmental community through their agricultural activities without doing any harm. In sum, then, agriculture activity in Mongu’s Barotse floodplain has enabled human survival without adversely affecting other life forms and the physical environment in view of the traditional technologies applied.

6.2.3 Livestock Agriculture

Regarding the keeping of animals as an adaptive strategy, humans have kept their cattle by grazing them in the rich floodplain grass on a free ranch system. The cattle have thus greatly benefitted and improved the livelihood of people and they have controlled the abundance and size of grass in the plain. Consequently, the adaptive strategy of keeping cattle has benefitted both the human inhabitants and the natural environment.

The land ethic considers domesticated animals as members of the bio-community like other organisms which have to reproduce and be drawn to their fullness of being to ensure their species continuity in the ecosystem. For domesticated animals to reach their fullness of being, they are supposed to interact with the natural environment for food and other requirements as required by the land ethic theory. Domesticated animals in Mongu’s Barotse floodplain have competed for a niche in the ecosystem but they have also provided benefits to humans economically and socially. For example, humans have obtained milk from cattle which constitute a large part of their diet and have sometimes been sold for money. Cattle have also provided humans with a source of cheap labour in the agriculture sector. In sum, then, keeping animals has been of benefit to both the humans and the natural environment.
6.2.4 Burning of dry grass

Burning dry grass for animal grazing has been one way in which humans in Mongu’s Barotse floodplain have ensured balance and stability in the natural environment. This practice has cleaned up the environment by reducing the population of dangerous insects and snakes which are harmful to humans, animals (domesticated and wild) and other life forms. Burning the plain grass has also helped to get rid of the old grass thereby allowing fresh grass to sprout quickly. Furthermore, this practice has added oxygen to the environment unlike the old dead grass which does not. In this regard, burning grass as an adaptive strategy is beneficial to humans, other life forms and the physical environment. For example, after burning grass in Mongu, a black coloured bird locally known as *Nongolo* found feeding on snails easy. The same was true of another bird locally known as *Nalukapwa* that fed on snakes. Although burning grass is generally considered to be detrimental to life forms and the natural environment, nevertheless the life forms in Mongu’s Barotse floodplain have managed to survive. For instance, worms went deeper into the soil to escape from the heat and birds flew away to other places.

6.2.5 Fishing

Fishing as an adaptive strategy has impacted both positively and negatively on the fish species. On the positive side, humans have adapted to the harsh realities of flooding through catching fish for consumption and for sale during the time when their agricultural crops have been destroyed by floods. Fishing benefits the environment as it controls the size of the fish population in the water bodies and hence regulates the population of fish and other aquatic life forms that fish prey on.

On the negative side, however, fishing is a life threatening practice to the existence of the fish family. The use of unsustainable fishing utensils such as mosquito nets and a net
known locally as *sefa-sefa* are not environmentally sustainable practices. The two nets trapped all kinds of fish including the fingerlings and fish eggs, a practice which can lead to the extinction of fish. Furthermore, fishing has become a trade commodity which has pulled people from all over Zambia to the Barotse floodplains. The business boom in fish has subjugated humans in Mongu’s Barotse floodplain to the laws of capitalist accumulation and to the rationality of acquisition. Such economic rationality is ultimately destructive of environmental sustainability.

**6.2.6 Reed and thatching grass business**

The reed and thatching grass business has benefitted and improved the livelihoods of people in Mongu’s Barotse floodplain. This business involves cutting reeds and grass while they are still fresh and they are later dried up before being used. Unlike fishing, the reed and grass business is not a threat to the environment as it does not involve uprooting the whole plant. This has enabled reeds and grass to regenerate which has taken very little time to grow back compared to trees that require many years to grow once cut.

Hence, although humans in Mongu’s Barotse floodplain cannot avoid cutting reeds and grass, this activity is seasonal and it does not deplete natural resources. It functions within the overall ecosystem and is dependent upon goods and services provided for by the ecosystem that support human survival.

**6.2.7 Hunting**

Natural resources are goods that nature supplies and that are available for consumption, use and enjoyment. If humans did not hunt herbivores, animals and birds in Mongu’s Barotse floodplain, their populations would grow exponentially resulting in death by starvation because the resources would not be able to support such a population. Besides,
most of the hunters use traditional tools such as bows, arrows and spears and only very few use rifles. Hunting, therefore, does not pose a threat to the survival of animals and birds. Furthermore, big game hunting such as the killing of hippopotami is not at any given time carried out without authority from the king. In addition, reptiles such as crocodiles are only killed on special occasions. Likewise, some birds like the eagle are considered sacred and hence were never killed except for special functions. These are deliberately left unharmed because they take time to reproduce and multiply themselves so that killing them would eventually lead to their extinction. Controlled hunting, therefore, is ethically justified in that it benefits humans without degrading the natural environment.

Basically, then, it can be said that hunting as an adaptation strategy in Mongu’s Barotse floodplain is a form of responsible land management that includes not only consideration for human well-being but also for other life forms. According to the land ethic theory, controlled hunting promotes ecosystemic balance. Hunting also promotes interconnectivity, symbiosis and interdependence in the bio-community and in the physical environment where humans are also actors. The utilitarian theory also supports hunting since it satisfies human needs thereby maximized the good. In sum, then, hunting contributes to the integrity of the ecosystem as well as maximizing benefits for humans while at the same time limiting potential adverse impacts on the natural environment should animals be left to multiply without control.

**6.2.8 Health Services**

In terms of health, humans living in Mongu’s Barotse floodplain have not impacted negatively on the environment. They have sought medical services at the clinic and excreted in the waters some distance away from their villages. A few residents used
chlorine to purify the water to drink and others boiled water for the same purpose, and this has not adversely impacted on the natural environment. They have also received mosquito nets from the government and its cooperating partners to protect them from mosquito bites thereby minimizing their chances to get malaria. Such activities have greatly improved the quality of human lives in the floodplain without unduly harming the natural environment. However, it must be noted that the use of mosquito nets for fishing purposes has had a negative impact on the aquatic ecosystem. Furthermore, the lack of pit-latrines has threatened health.

6.2.9 Social Activities

With regard to social adaptive strategies to annual floods in Mongu’s Barotse floodplain, humans have managed their social activities in line with the flood scenario. For example, during floods, all kinds of social activities have continued except that canoes are often used to get to social functions which are far away. Furthermore, when floods are above normal, they relocate to higher grounds in a joyous and colourful social ceremony, the kuomboka. This activity is very beneficial economically and socially to the local inhabitants and is a major tourist attraction. It has not compromised the well-being of the natural environment or the life forms therein. It has rather taken full advantage of the opportunities supplied by the floods.

6.3 Summary

The ethical evaluation of human adaptation to annual floods and its impacts on the environment of Mongu’s Barotse floodplain has used two ethical theories, the land ethic and an extended form of utilitarianism.
The findings in general supported both theories. For example, villages built on mounds and houses built using materials such as mud, grass, fibre and poles are ethically permissible. Furthermore, keeping animals, hunting, fishing, burning of dry grass, the sale of reeds and thatching grass and agricultural activities are all part of the human way of interacting responsibly with the overall ecosystem. Although some adaptive strategies like fishing, agricultural activities and dry grass burning in Mongu’s Barotse floodplain appear destructive to the environment, on balance, they are ethically justified because they are a necessary condition for human survival. In most cases, the negative effects cannot be avoided if the interdependence, interconnectivity and symbiotic relationship in the bio-community is to be maintained.

The human adaptive strategies have been adopted executed using traditional technologies which include the use of hoes, spears, ox-drawn ploughs, bows, arrows, machetes, axes, and a few guns. In agricultural activities, for example, humans use animal dung to fertilize the soil. All in all, the technologies used have not harmed the environment unduly but have benefitted both humans and the environment itself with all its living and non-living parts. By and large, the overall ecosystem has been protected and the greatest good of available choices has been achieved.
CHAPTER SEVEN: SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

This chapter provides the summary, conclusion and recommendations of the study as presented below.

7.1 Summary

Floods are a worldwide occurrence affecting humans, animals and vegetation alike. Mongu’s Barotse floodplain in the Western province is one such place that is annually flooded but has experienced higher volumes of water in recent years covering areas that have never been covered before. The purpose of this study has been to examine how the human inhabitants in the Mongu floodplain have adapted to the floods and how their adaptive strategies have impacted on the overall ecosystemic community. The study revealed both positive and negative impacts. The floods contributed positively by rejuvenating soil fertility, easing movements, increasing fishing and promoting the local culture ceremony (Kuomboka). The negative impacts were that floods annually submerged villages, destroyed crops in the fields at different stages of crop growth resulting in hunger, destroyed property and housing units, resulted in outbreaks of waterborne diseases and hardships in movement, and destroyed pasture for animal grazing.

The study further revealed that humans living in Mongu’s Barotse floodplain have adapted to the floods in the following ways: building villages on mounds, raising the floors for houses, using materials such as grass, fibre and poles for building, placing
goods on raised platforms, vacating to higher grounds, planting crops early, harvesting crops early, storing crops in shades, cultivating rice during floods, seeking medical care from the clinic, sleeping under mosquito nets, excreting in the floodwaters (a distance away from the villages), fishing, expressing entrepreneurship, hunting and gathering (water fruits and vegetables).

By directly depending on the natural environment for their sustenance using traditional technologies, the adaptation strategies adopted have had relatively little negative impacts on the environment. Burning grass and fishing have been unavoidable outcomes in the struggle for survival.

7.2 Conclusion

The ethical assessment involved the application to the findings of the environmental land ethic theory and an extended form of utilitarianism.

The land ethic which focuses on the holistic ecosystem emphasizes the importance of the overall wellbeing of the natural environment in supporting biotic and abiotic elements within it. Hence, although humans in Mongu’s Barotse floodplain are the most advanced form of life in the ecosystem, their interests need to be balanced against the value of other life forms in particular so that the overall ecosystem is not irresponsibly exploited or degraded.

With its focus on maximizing the good consequences, an extension of utilitarian theory looks to the overall benefit of all life forms including humans in addition to non-life forms. Of the options available to the inhabitants of Mongu’s Barotse floodplain, the adaptation strategies that they have adopted have resulted in the greatest good to the
overall environment with the least form of destruction despite the unavoidable negative effects under the circumstances.

In sum then, the ethical assessment has revealed that humans living in Mongu’s Barotse floodplain have adapted to the annual floods in such ways as to benefit the majority of the inhabitants without unduly degrading the natural environment. Using the land ethic which advocates for the overall wellbeing of the ecosystem, humans included, and extended utilitarian theory which emphasizes the overall greatest good for all concerned, the study therefore concludes that the adaptive strategies to floods undertaken by the human inhabitants of Mongu’s Barotse floodplain have been justified by both theories.

7.3 Recommendations

The study noted various threats which, if not taken into consideration, may lead to environmental destruction as well as harm to humans and other life forms therein. In view of this, the following recommendations are made:

- The government, BRE and local residents ought to deepen the existing canals annually, and dig up some new canals in Mongu’s Barotse floodplain to contain the floods. These would minimize on the level and magnitude of floods in the area thereby reducing on the flood coverage. The banks of these canals would also increase the lands that stand above the floodwaters thereby providing shelter to many life forms such as snakes and mice and many others in the plain.

- The BRE should introduce systematic and controlled dry grass burning in the plain which would ensure that only the intended areas would be burnt.

- The government and BRE should restrict access to resources such as fish, birds and animals to residents of Mongu’s Barotse floodplain and should exclude all
non-residents, especially in fishing activities. This restriction should include the non-usage of exploitative fishing nets and fishing methods which would be possible if the indunas of the silalo (an area an induna is in charge of) would be involved. Such a practice should also be accompanied by constant checks on the fishing nets and the fishing methods. In addition, the involvement of local leaders such as indunas and headmen/women would facilitate enforcement of the law and discipline the subjects contravening the law.

• MACO should introduce early maturing crops in Mongu’s Barotse floodplain to lessen the destructive effects of floods on the crops. Early maturing crops would greatly improve the food security in the area that is annually threatened by floods.

• The Meteorological Department should improve on the weather forecasting awareness systems by giving early warning signs based on traditional and scientific knowledge to allow residents adequate time to prepare for the floods.
References


Gluckman, M. (1943) *Lozi land tenure and property rights of the king and royal family.* Livingstone Institute, Livingstone.


Metrological Department of Zambia Data Base, 2011.


Appendix 1

Consent form

THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF PHILOSOPHY AND APPLIED ETHICS.

Dear respondent,

I am a Masters Degree student of Applied Ethics in the School of Humanities and Social Sciences doing second part of the course. I am currently carrying out a research in partial fulfilment of the Masters Degree on *the ethical assessment of human adaptation to annual floods in Mongu’s Barotseland floodplain and its impact on the environment.*

You have been identified to help answer the questions in the interview schedule below.

The responses you will give will be kept confidential and strictly be used for study purposes.

Your co-operation will be highly appreciated.

Thank you.
Appendix 2
Self-administered Interview schedule for residents

Village........................................................................................................................................

Chief........................................................................................................................................

Headman/ Headwoman..............................................................................................................

1. How long have you lived in this area?....................................................................................

2. What time of the year do you experience floods?..............................................................

3. How often do you experience floods in this area?.............................................................

4. When floods occur, how much of an area do they cover?...................................................

5. When do the floods recede?...................................................................................................

6. When was the worst year for floods in Mongu’s Barotse floodplains?
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7. In which area of your life are you highly affected by floods?
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.....................................................................................................................................................

8. Are your crops affected by the annual floods? Yes [ ] No [ ]

9. If your answer to question 8 is yes, how are your crops affected by annual floods?
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10. At which stage are your crops affected by annual floods?

   Germinating stage [ ]  Growing stage [ ]  Harvest stage [ ]

Any other

specify……………………………………………………………………………………

……………………………………………………………………………………………

11. Which crops are mostly affected by the annual floods in Mongu’s Barotse floodplains?

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12. Are your livestock affected by the annual floods? Yes [ ]  No [ ]

13. If your answer to question 12 is yes, then how are your livestock affected?

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14. Are your household properties affected by the annual floods? Yes [ ]  No [ ]

15. If your answer to question 14 is yes, how are your properties affected by the annual floods?

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16. Is your health affected by the annual floods? Yes [ ]  No [ ]

17. If you and other people are affected, what are the major health problems in Mongu’s Barotse floodplains as a result of floods?

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18. Is your social life affected by the annual floods? Yes [ ]  No [ ]
19. If your answer to question 18 is yes, how is your social life affected by annual floods?

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…………………………………………………………………………………………………………

20. Are your movements affected by the annual floods in this area? Yes [ ] No [ ]

21. If your answer to question 20 is yes, how are your movements affected by the annual floods?

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…………………………………………………………………………………………………………

22. What activities do you and other people engage in during flood time?

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…………………………………………………………………………………………………………

23. How do you ensure that your crops are protected from the annual floods?

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…………………………………………………………………………………………………………

24. Do you have crops that you grow during floods? Yes [ ] No [ ]

25. If your answer to 24 is yes, what crops are they?

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…………………………………………………………………………………………………………

26. Do you carry any crops for food from one farming season to another? Yes [ ] No [ ]
27. If your answer to question 26 is yes, what crops do you carry on?

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28. How do you store your crops to carry them to the next farming season?

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29. Apart from crops, what other sources of food do you depend on during floods?

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30. How do you keep your animals during floods?

……………………………………………………………………………………………………………………………………………………………………………………

31. How do you protect your household properties from the annual floods?

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32. What skills have you and other people developed to adapt to the annual floods?

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33. What social activities do you and other people engage in during floods?

……………………………………………………………………………………………………………………………………………………………………………………

34. Do you think your way of life during the annual floods is affecting the environment?
Yes [ ] No [ ]

35. If your answer to question 34 is yes, how is the environment affected?

A. Wild animals

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B. Birds

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C. Fish/ Water creature

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........................................................................................................................................

D. Insects

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E. Any other

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........................................................................................................................................

Thank for your co-operation.
Appendix 3

Self-administered In-depth interview schedule for the indunas, headmen and headwoman.

1. Village……………………………………………………………………………………

2. Chief……………………………………………………………………………………

3. Headman/Headwoman………………………………………………………………

4. How old is your village?
   Specify……………………………………………………………………………………

5. How long have you lived in this village?
   Specify……………………………………………………………………………………

6. When did you become the leader of this village?
   Specify……………………………………………………………………………………

7. How would you rate the frequency and magnitude of floods in this area?
   High [ ]  Middle [ ]  Low [ ]

8. Depending on the frequency and magnitude, do these floods affect your village?
   Yes [ ]  No [ ]

9. If your answer to question 8 is yes, how do floods affect your village?
   ..............................................................................................................
   ..............................................................................................................

10. In which area of your lives are you and your people highly affected by the annual floods?
11. Are your people’s crops affected by the floods? Yes [  ] No [  ]

12. If the answer to question 11 is yes, how are your people’s crops affected?

13. Mention the crops that are highly affected by the annual floods in your area?

14. Are your people’s animals affected by the annual floods? Yes [  ] No [  ]

15. If your answer to question 14 is yes, how are your people’s animals affected by the annual floods?

16. What signs do you observe during the floods that make you conclude that animals are affected?

17. Are there outbreaks of diseases in your village during floods? Yes [  ] No [  ]

18. If your answer to question 17 is yes, what diseases breakout during the floods?
19. Are your People’s movements affected by the annual floods? Yes [ ] No [ ]

20. If your answer to question 19 is yes, how are your people’s movement affected by floods?

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21. Are your people’s social life affected by the annual floods? Yes [ ] No [ ]

22. If your answer to question 21 is yes, how are your people’s social life affected?

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……………………………………………………………………………………………

23. As a leader in this village can you say that you and your people have adapted well to the annual floods in Barotse floodplain? Yes [ ] No [ ]

24. If your answer to question 23 is yes, what activities do you and your people do to ensure your adaptation to the annual floods is successful?

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25. When floods come how, do you and your people ensure crops are not destroyed?

a. During growth

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……………………………………………………………………………………………

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b. At harvest stage
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26. Do you and your people have other sources of food during floods? Yes [ ] No [ ]

27. If your answer to question 26 is yes, mention the other sources of food for you and your people during floods?
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28. How do your people protect their livestock from the annual floods?
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........................................................................................................................................

29. How do you and your people adapt to the annual floods regarding to
a. Movements ........................................................................................................................................
........................................................................................................................................

b. Housing ........................................................................................................................................
........................................................................................................................................
c. Household property

30. Do you think your adaptation to floods has an impact on the environment?
   Yes [ ]   No [ ]

31. If your answer to question 30 is yes, explain how the environment has been affected by your adaptation strategies?

   Thank you for your co-operation.
Appendix 4

Self-administered In-depth interview schedule for government and non-governmental officials.

Name of organization………………………………………………………………………………………………

Position of respondent ……………………………………………………………………………………………

1. As an organization, are you aware of the annual floods in Mongu’s Barotse floodplain?
   Yes [ ] No [ ]

2. If your answer to question 1 is yes, does your organization know of how residents have adapted to the annual floods in Mongu’s Barotse floodplain. Yes [ ] No [ ]

3. If your answer to question 2 is yes, mention the human adaptation strategies to floods in Mongu’s Barotse floodplain?
   ……………………………………………………………………………………………………………………………
   ……………………………………………………………………………………………………………………………

4. Do you as an organization think the human adaptation to floods has an effect on the environment of Mongu’s Barotse floodplain? Yes [ ] No [ ]

5. If your answer to question 4 is yes, what are the effects of human adaptation to floods on the environment in Mongu’s Barotse floodplain?
   ……………………………………………………………………………………………………………………………
   ……………………………………………………………………………………………………………………………
6. What is your organization’s position on the effect by humans on the environment in Mongu’s Barotse floodplain?

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7. What recommendation can you make as an organization to attain environmental friendly and sustainable human adaptation to floods in Mongu’s Barotse floodplain?

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Thank you for your co-operation.