Master's Thesis of Forest Environmental Science

The Impact of Climate Change Education on Local Community's Perception of Forest Conservation.

– An Estimation of Willingness to Pay for Katanino Forest in Zambia–

기후 변화 교육이 지역 사회의 산림 보존 인식에 미치는 영향.

–잠비아의 Katanino 숲에 대한 지불 의사 추정–

August 2021

Graduate School
Seoul National University
Forest Environmental Science

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A Thesis as a Partial Requirement for
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Abstract

This study looks at how climate change education could impact on people's perception of forest conservation and so enhance their willingness to participate in forest conservation. The study was conducted using a maximum of 220 respondents of the local community of Katanino forest area. All the 220, responded to the first questionnaire. Of the 220 respondents, 18 respondents were selected randomly and labelled a control group, while 201 respondents went through climate change education and responded to the second research survey questionnaire. This means that, this study had two research surveys, but used the same questionnaire respectively, in both before and after climate change education. The first survey began by assessing how much the local people knew about climate change, how they perceived forests, and forest conservation, and lastly, how much they were willing to pay for forest conservation. After that, it conducted climate change education. After climate change education, the local community (control group and educated group) were subjected to the second survey, but with the same questionnaire they responded to, before climate change education.

This study was built on two hypotheses. In order to test the first alternative hypothesis, which postulated that there is no significant independence between knowledge and perception, Chi-square T Test, was used. In order to test the alternative sub-hypothesis, which proposed that climate change knowledge and perception of forest conservation have a significant correlation, we used Pearson Correlation. Lastly, in order to test the second hypothesis that suggested that climate change education contributes to promotion of forest conservation, Paired Sample T Test, was used. To estimate the impact of climate change education on willingness to pay for forest conservation, this study employed Cohen's *d* method for measuring effective size, after Paired Sample T Test results. This study showed that there is no statistical independence between knowledge and perception. The study also supported that there is a statistical positive

significant correlation between climate change knowledge and perception of forest conservation. Lastly, this study also showed that climate change education has positive impact on climate change knowledge, perception of forest conservation, and subsequently, willingness to pay for forest conservation. The Cohen' *d* estimation of the effect size of climate change education on willingness to pay for forest conservation was huge, after climate change education. Therefore, climate change education is important for better understanding of climate change, better perception of forest conservation, and increased willingness to pay for forest conservation. Consequently, in order to engage more people in the conservation of forests, climate change knowledge is essential, both for their perception of forest conservation and willingness to pay for forest conservation.

Keywords: Climate Change Knowledge, Impact of Climate Change Education, Local people, Perception of Forest Conservation, Willingness to Pay, Zambia.

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Acronyms

CC Climate Change
CCE Climate Change Education
CVM Contingent Variation Method
EE Environmental Education
ESD Education for Sustainable Development
FAO Food and Agriculture Organisation
FMC Forest Management Committee
GHG Greenhouse Gases
IPCC Intergovernmental Panel on Climate Change
JFM Joint Forest Management
SDG Sustainable Development Goals
UN United Nations
UNFCCC United Nations Framework Convention on Climate Change
UNICEF United Nations International Children's Emergency Fund
VIF Variance Inflation Factor
VRMC Village Resource Management Committee
WMO World Meteorological Organisation
WTP Willingness to Pay
ZFAP Zambia Forest Action Plan

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Chapter 1. Introduction

1.1 Study Background

Climate Change is the defining issue of our time and we are at a defining moment in life on earth. According to World Meteorological Organisation (WMO) provisional statement on the state of climate in 2018, studies show that the 20 warmest years on record have been in the past 22 years, and the top four in the past four years. Over the past century, the average temperature of the Earth has risen by 1.8℉. Over the next one hundred years, scientists are projecting another 0.5 to 8.6℉ rise in the temperature (WMO, 2018). The cause of this temperature change is human activities that have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere (Stocker et al., 2013). The negative consequences of human-driven climate change will continue to accelerate with disastrous effects: land, water resources, animal behavior, crop production, and other things on earth are going to change (Field et al., 2014). Humans, plants and animals will not be able to survive in areas that get too hot or in places that are flooded because of rising sea levels (Trenberth, 2018). The way we grow food, the types of plants that can live in different areas, the patterns of rainfall and hot and cold weather will all continue to change, if we do not halt the process of global warming and climate change (FAO, 2018). To date, the effort to manage climate change has been a matter of high level diplomatic negotiations involving states, international organizations, business groups, minor political actors, local community, and generally every individual. The idea is a call to collective action in combating climate change (Amanor, 2003; Jasanoff, 2004).

Nevertheless, despite that fact, individuals have to make everyday decisions based on knowledge about climate change. Studies contend that knowledge is co-produced, so that the ways in which we know and represent

the world are inseparable from the ways we choose to live in it (Jasanoff, 2004). All knowledge is socially embedded, subsequently, the pending question, now, is that what level of knowledge should scientist expect individuals to know about a particular scientific issue? Assessing how much someone knows about a certain subject, is more as looking at how ignorance has been eliminated or reduced, in that someone, about that subject. In another way, the role of science is to seek to reduce ignorance to risk (Faber, Manstetten, and Proops, 1998).

From the origins of modern science, the problem of knowledge and ignorance has long been recognized (Robichaud, 2017). However, the basic questions are "what can I know? What shall I do?" There seems to be a correlation between knowledge and perception. This means that, the question: what can I know, is the basis for the question what can I do or control? In this context, knowledge is defined as an awareness or familiarity gained by experience or education or a person's range of information or theoretical or practical understanding of a subject. In a more concise way, it is the sum of what is known about a subject (The Concise Oxford Dictionary, 1998). This contrasts to perception, for it is a unique way of understanding phenomena by interpreting sensory. information based on experience, processing information, and forming mental models (Mcdonald, 2012). On the other hand, education is the socially organized and regulated process of continuous transference of socially significant experience from previous to following generations and the main way to receive an education is to take a course or training (Naziev, 2017).

A number of approaches and interventions are being implemented in promoting sustainable use of forests, afforestation, and reforestation, but another question is, "do people understand climate change before we expect them to adopt behavior change compatible with combating of climate change?" Action hinges on the relationship between knowledge and perception. This

paper looks at how climate change education could impact positively local community's knowledge and perception of forest conservation, and eventually, influence their willingness to pay for the conservation of forests, with a case study of Katanino forest in the Copperbelt Province, in Zambia.

1.2 The Problem and Rationale of the Study

Climate change is a global problem caused by cumulative actions of multi-level actions (Stocker et al., 2013). Hence, solving the climate change problem, requires collective action (Stocker et al., 2013). This is why the participation of different stakeholders becomes of paramount importance (Field et al., 2014). Among the ways, that are so key in mitigating climate change, is the conservation of forests, for forests play an important role, they help keep our climate stable, absorbing carbon dioxide and releasing oxygen, and they regulate our water supply and improves its quality (Field et al., 2014). They also provide a home to more than half of all species found on land – a rich variety of life that keeps so many natural systems running. In short, forests play a significance role in the fight against climate change, for they are both a sink and source of carbon (Houghton, 1998). Therefore, many developing countries have joined in the fight against any cause of deforestation, and have objectively labored to foster forest conservation, and Zambia is not exceptional.

Zambia got independence from Britain in 1964. When Zambia got independence, the first national forest policy was issued in 1965. It emphasized the exclusion of local communities' participation in the running of the forests. It was based mainly on safeguarding the forests and taking note of the inventories. However, a huge millstone in the aspect of inclusiveness of local communities' participation, came in with the 1998 national forest policy (Bwalya, 2007; ZFAP Preparatory Review, 2016)). This national

policy opened a new door by realizing that the involvement of the private sector, civil society and local communities in forestry is critical to improved management, conservation and sustainable utilization (ZFAP Preparatory Review, 2016). The term Joint Forest Management (JFM) become widely used (ZFAP Preparatory Review, 2016). The 1998 national forest policy acknowledged that Community-based participation in the management of protected forest areas and forests on customary lands should be promoted (Bwalya, 2007). The Forest Department, in Zambia, Environment, Natural Resources and Environmental Protection.

The total area of indigenous forest in Zambia is 44.6 million hectares and covers 60 percent of the total land area, out of which 9.6 percent are, gazetted forests (Shakacite, 2000). There are 481 Protected Forest Areas; 181 National Forests and 300 Local Forest Reserves in Zambia. However, it has been noted historically that deforestation and forest degradation is particularly more pronounced in the protected forest areas (PFAs), the estates directly administered by the Forestry Department, a central government bureau, than in the open forests which fall under the local Chiefs‟ jurisdiction (ZFAP Preparatory Review, 2016). One of the protected areas was Katanino Forest Reserve, in the Copperbelt Province, which is now Katanino Forest. The majority of the local community that surrounds Katanino Joint Forest is the native people called Lamba (Pensilu, 2009). The Copperbelt Province, as the name entails, in which Katanino Forest falls, is the hive of copper mining. The mining sector accounts for the biggest share of Zambia's economy.

Prior to her independence, history shows that, of the ten provinces, good migrations were being noticed into the Copperbelt, whose provincial headquarters is Ndola (Hugh, 1993). This was as a result of employment and all the other incentives that came with it. However, this did not mean well to

the indigenous people of the copperbelt, the Lamba people, for considered as backwards, uneducated and so remote (Chishiba, 2017). The district in which Katanino Joint Forest falls, is regarded two percent of the population literate (Census, 2010). The mines invited and attracted different people from all other provinces and on a large scale, these people were skilled for their job, and that was not the case with the Lamba people (Compion, 2010), and so they were pushed away from the mines, from the centres of development into the outskirts (Hugh, 1993). To compensate for this, the government moved them nearer to Katanino Forest Reserve (Mulele & Tiffen, 1994; Siegel, 1989). Eventually, Masaiti District was created from the Ndola Rural District, under Statutory Instrument No. 30 of the Local Government Act No. 22 of 1997.

The government introduced JFM to Katanino Forest Reserve to get this community involved. It has been argued that a major reason behind this transition to JFM was the state's need to reduce forest management costs by delegating work to the local communities (ZFAP Preparatory Review, 2016). Nevertheless, despite a clear outline on how the Katanino local community is supposed to participate in this joint venture, the local community's problem is that they seem not to perceive the importance of forest conservation, especially in line with climate change mitigation (Bwalya, 2007). Therefore, the rationale of this paper lies in a postulation that climate change education could help them better their perception of the importance of forests in climate change mitigation, and so impact on their willingness to participate in forest conservation.

1.3 Research Questions

This research aspires to answer the following two research questions:

1. How much do people know about climate change?
2. How do people perceive forests and forest conservation?
3. How much are they willing to pay for forest conservation?
4. Can climate change education influence perception of forest conservation?

1.4 Research Objective

This study focuses on three main objectives:

1. To assess how much the local community know about climate change.
2. To assess how the local community perceive forest conservation.
3. To estimate how much they are willing to pay for forest conservation.
4. To evaluate how climate change education could impact perception of forest conservation.

1.5 Research Hypothesis

This research builds on three hypothesEs:

1. H_a: Knowledge and Perception are not independent.

H_0: Knowledge and Perception are independent.

a) H_a: There is a statistically significant correlation between Climate Change Knowledge and Perception of Forest Conservation.

H_0: There is no statistically significant correlation between climate change knowledge and Perception of Forest Conservation.

2. H_a: Climate change education contributes to the promotion of willingness to participate in forest conservation.

H_0: Climate change education does not contribute to the promotion of willingness to participate in forest conservation.

1.6 Research Significance

The results of this study can increase knowledge about the importance of forest conservation in climate change mitigation. This study can also contribute to the improvement of the management of forest resources by promoting participatory management approaches, especially of the local communities. This study could also be used as a guide when conducting climate change education. Moreover, Zambia, being a developing country, the findings of this paper can enhance the sustainability of combined ecological, sociological and economic systems where human individuals can flourish, and human cultures can advance; but in which the effects of human activities on forest ecosystem services remain within bounds, so as not to destroy the diversity, complexity, and function of the forest ecological life support system. All in all, this study could be quoted as an argument for community based forest conservation.

Chapter 2. Literature Review

2.1 Local Communities in Forest Management in Zambia

In recent years, there has been an increase on the emphasis of forest conservation programs in developing countries with the sole aim of mitigating climate change. However, one of the key actors in implementing forest conservation programmes, at the ground level, is the local communities; they are closer to the forest, and so they understand the forest conditions; for their life depend upon forests (Erbaugh et al, 2020; Thandar, 2019; Galabuzi et al., 2014). Supporting this fact, are studies also that show how often forest conservation programs are rejected and ridiculed, on the ground level, on account that they are not welcomed by the local communities (Barr and Sayer, 2012; Erbaugh et al, 2020; Galabuzi et al., 2014). Basing on this discovery, international actors and governments, therefore, should promote forest conservation programs that enhance the willingness of local communities to

accept and to engage in. In the Zambian context, studies show that the involvement of local communities in the management of forest resources came about with the enactment of the second National Forest Policy, in 1998.

The 1998 national policy acknowledged the need to incorporate local communities. History shows that this was after the knowledge that forests that were being handled by local chiefs were well managed. On the other hand, the government had realized that there was a high cost in handling forests and so the involvement of the local communities came in as also a way to cut on government costs in the management of forests. To enhance this involvement, the government of Zambia took a step further and enacted the 1999 forest Act; which brought with it the idea of Joint Forest Management. The Joint Forest Management (JFM) System is the collaborative management of forests by local communities and the Forestry Department and enshrines forest resource tenure, access rights and financial arrangements. Joint Forest Management (JFM) in Zambia is organized vertically according to central, district, area and village levels. The Environmental and Natural Resources Sub-Committee of the District Development Coordinating Committee coordinates all natural resource management issues at district level including JFM activities. At the JFM area level the Forest Management Committee (FMC) has substantial representation from the state and some representation from local levels. At the village level there is the Village Resource Management Committee (VRMC) with a representative on the FMC, as shown by figure 1.

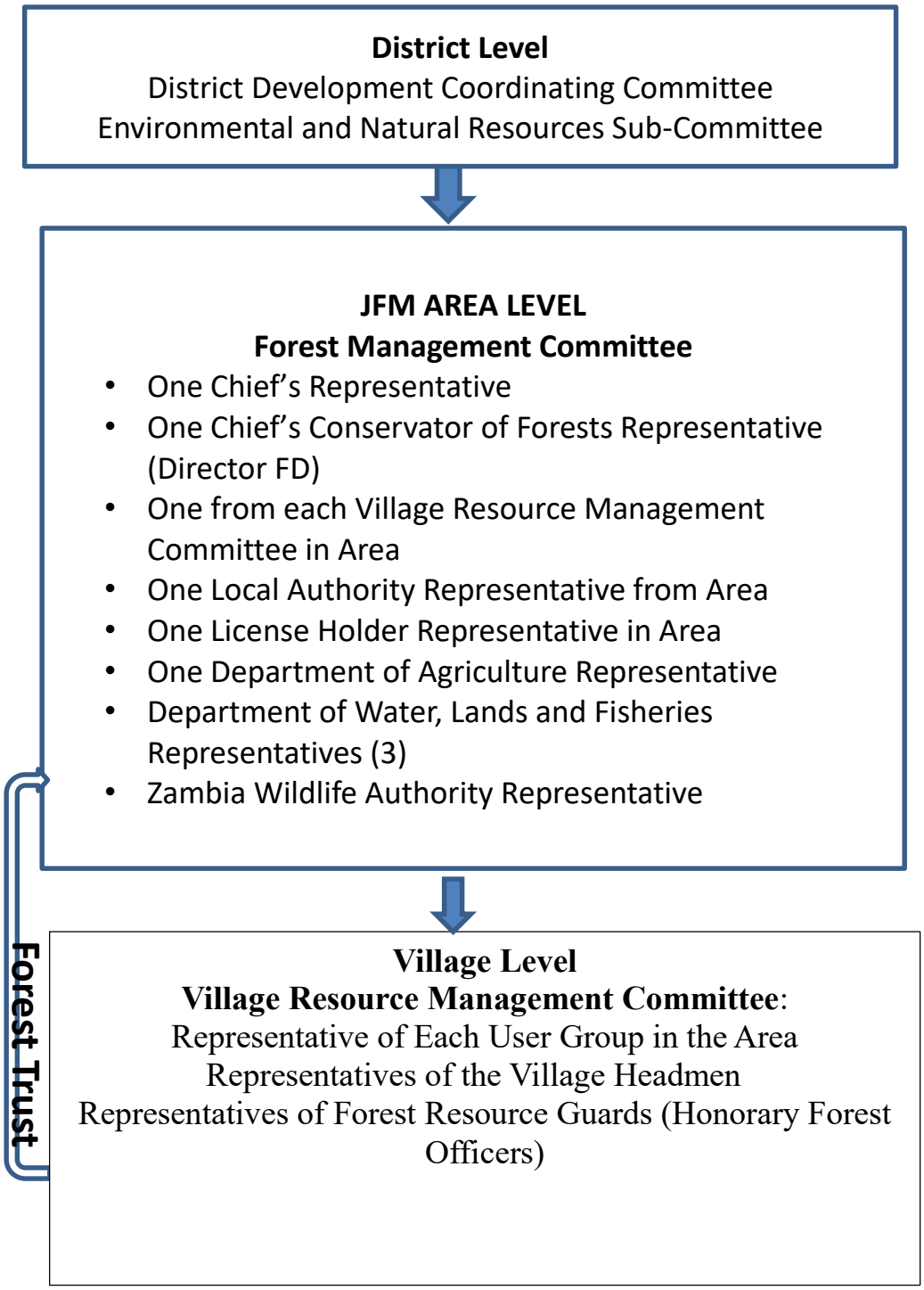

Figure 1. Participation in Joint Forest Management in Zambia (Bwalya, 2012).

2.2 The Role of Forests in Climate Change Mitigation

Climate change refers to the fact that the world's average temperature has been increasing for the past 150 years, may be increasing in the future, and that the world's climate is changing as a result (Kreslake et al., 2016). The Sun serves as the primary energy source for earth's climate. Some of the incoming sunlight is reflected directly back into space, especially by bright surfaces such as ice and clouds, and the rest is absorbed by the surface and the atmosphere. Much of this absorbed solar energy is re-emitted as heat (Susan and Mario, 2010). The atmosphere in turn absorbs and re-radiates heat, some of which escapes to space. If all heat energy emitted from the surface passed through the atmosphere directly into space, earth's average surface temperature would be tens of degrees colder than today (Susan and Mario, 2010). Greenhouse gases in the atmosphere, including water vapour, carbon dioxide, methane, and nitrous oxide, act to make the surface much warmer than this, because they absorb and emit heat energy in all directions, keeping Earth's surface and lower atmosphere warm. Without this greenhouse effect, life as we know it could not have evolved on our planet (Stocker et al., 2013). When the energy leaving is less than the energy entering, earth warms until a new balance is established (Susan and Mario, 2010). Therefore, too much greenhouse gasses emitted by human beings in the atmosphere trap heat, and so climate change happens due to increased heat retention in the atmosphere as a result of increased green gasses concentration.

So, unless significant actions are taken, today, to reverse GHG emissions and to enhance climate resilience, there will be irreversible damage to our planet: land, water resources, animal behavior, crop production, and other things on earth are going to change (FAO, 2018). The way food is grown, the types of plants that can live in different areas, the patterns of rainfall and hot and cold weather will all continue to change. Humans, plants and animals will not be able to survive in areas that get too hot or in places that are flooded

because of rising sea levels (Trenberth, 2018). However, the UNFCCC has identified two separate responses for addressing climate change, namely adaptation and mitigation (UNFCCC, 2007), with special emphasis on mitigation. Mitigation refers to efforts toward reducing the accumulation of GHGs in the atmosphere and so early mitigation of GHG emissions will significantly reduce the need for future adaptation, especially the burden on the poor (IPCC, 2001; 2007). The primary objective of the UNFCCC is the stabilization of GHG concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system (UNFCCC. 2007). Accordingly, this is where forests become important in the fight against climate change. They play a very important role in maintaining natural processes and keeping our climate stable (Aznar-Sanches et al., 2018).

Forests absorb Carbon from the atmosphere, because when there is too much Carbon (GHG) they trap heat and thereby making the climate hot. However, Carbon Dioxide is also produced naturally when plants or animals die and decay. It is also produced from human activities such as burning wood and operating vehicles (Susan and Mario, 2010). This is why forests are both a source and sink of Carbon. If burnt, deforested or degraded, they contribute to the amount of Carbon in the atmosphere, but if well conserved and safeguarded, forests contribute to making our climate stable. This is why deforestation and forest degradation are strongly castigated. Hidden in this explanation and discovery is that a better perception of forest conservation relies on a prior understanding of the role they play in climate change mitigation (Kumar, 2019).

2.3 Perception of Forest Conservation

Perception refers to the way the brain processes sensory information into memory and experience (Saght, 2014). Perception is important in understanding someone's behavior, for behavior is a symptom of perception. Underlying in this fact is that in order to understand someone's behavior or in order to be part of the process of supporting their growth and flourishing, the focus should be to recognize and explore the nature and impact of their perceptions. According to Combs (1999), Human beings are also organizations, and because experience occurs inside of persons, it is not available for direct observation. This why Combs (1976) developed the idea of perceptual field. According to Combs (1999), perceptual field is each person's personal field of awareness, the field of meanings responsible for their behavior. Therefore, every behavior is rooted in the behaver's perceptions (Combs, 1976), which are directed by the data available in their perceptual field (Combs, 1999). Hence, all perceptions are shaped by the perceptual field. Building on this understanding, local communities' perception of forest conservation is dependent on available data in their perceptual field concerning forest conservation.

This is where climate change knowledge comes in, for knowledge of the role of forests in mitigating climate change influences perception of forests conservation. To this end, therefore, local communities may not be interested or may extremely refuse to engage in the conservation of forests programs it they do not fully comprehend what forest conservation is or how forest conservation could benefit them. Recent studies have shown that lack of basic knowledge, for example, about causes, impacts, and solutions, by the laypeople is an important barrier to personal engagement (Lorenzini et at., 2007). On the other hand, studies have also shown that accurate knowledge about causes of climate change is equally an important determinant of both behavioral intentions and support for climate protection policy measures

(Bord et al., 2000; O'connor et al., 1999). The bottom line is that studies suggest that people's apathy to environmental issues is as a result of low climate change literacy (Jacques et al., 2008; McCright and Dunlap, 2011). Despite this, there is an optimistic perspective, with the perceptual theory, that each and every person has the potential to perceive accurately, to flourish and to develop their capacity, as a result. This is due to education (Combs, 1976, 1999). This is why education is regarded as helping professions and teachers as helpers (Combs, 1976, 1999). Hidden in this, is that as long as someone is not helped, they will continue using limited information in their perceptual field and that will impede on their perception and behavior towards that reality (Combs, 1976, 1999). Therefore, the primary obligation of helping professions and helpers is to remove this impediment and to support autonomy and agency, thereby improving both perception and behavior towards a certain reality (Combs, 1976, 1999). Hence, climate change knowledge influences perception of forest conservation (Stevenson et al., 2014) and higher climate change knowledge have been associated with higher climate change risk perceptions (Tobler et al., 2012).

2.4 Willingness to Participate in Forest Conservation

Forest conservation, like any other forest policies and interventions, need the support of local community members to be successfully implemented (Michael and Elvin, 2014). Moreover, the extent to which people support and comply with policies and interventions is, somehow, linked to the values they attach to the resources (Benston, 1994). Therefore, willingness to participate is also a symptom of perception and behavior, for it shows the interests of actors to address or contribute to the related issue (Aurenhammer, 2017). Hence, to achieve sustainable forest management, there is need for information, guidelines and knowledge that help decision-makers understand the value of the forests to local communities; as these

values influence how they respond and support policies and interventions (Ansong and Roskaft, 2011). One of the ways that could be used to estimate willingness to participate is Contingent valuation method. Contingent valuation method (CVM) is an example of economic valuation methods that can be used to estimate the economic value of forests (Carson and Hanemann, 1998). It is a stated reference method for eliciting the economic value of goods and services that are not traded in markets (Bishop and Heberlein, 1979). It involves directly asking respondents what they will be willing to pay to obtain a non-market good, or what they will be willing to accept to forgo the goods or services (Mcfarlane and Boxall, 2000).

The willingness to pay (WTP) value obtained is theoretical, but provides information about the perceived value attached to the good by the respondents, which in turn may reveal an individual's behavior such as compliance and support for the good or service (Cameron and James, 1987, Pearce and Moran, 1994). So, insofar as the WTP value is a theoretical representation of the perceived value, WTP value is also influenced by the perceptual field, which is, in turn, also enhanced by increased knowledge (Lawi et al., 2017). In conclusion, prior knowledge of forest conservation, therefore, could help in soliciting a higher willingness to pay for forest conservation. This is where education comes in, for it affects perception of forest conservation and so influences the willingness or unwillingness to participate in forest conservation (Soler, 2007; Lawi et al., 2017). Knowledge is commonly perceived as a necessary precaution for a person's behavior (Frick et al., 2004), for a person makes a decision to pay or not to pay for forest conservation basing on his or her available data on forest conservation (Michael and Elvin, 2014).

2.5 Climate Change Education

In moral ethics, culpability of an action is based on somebody's knowledge and freedom during the execution of that action. This means that, insofar as a human act derive from knowledge and freedom, ignorance, sometimes, could be an excuse. "If an agent did not know and could not have known that her action would bring about some bad outcome, it is plausible to maintain that she is not to blame for realizing that outcome." (Robichaud, 2017). Largely, it has been observed that in search for control of the natural world and protection against environmental damage, usually, many scientists concentrate so much on the question, "what can I do?" and subsequently, the question "what can I know?" Conversely, has too often been ignored (Faber et al., 1992). Studies about Ignorance are so complex, however, in this study, ignorance can be classified into Closed Ignorance and Open Ignorance. Closed Ignorance is ignorance where "we are often not aware of our ignorance, and therefore, we feel no need for learning or research." (Faber et al., 1992).

In this case, the ignorant person believes they are not ignorant. This person falsely believes that they are knowledgeable, and does not try to clarify their belief, but rather relies on the ignorant position. This ignorance may spring from the unawareness of unexpected events, or from false knowledge or false judgements. This means that as long as an individual remains in this state, he/she is unable to recognize that state, "only if some event forces the experience of surprise, or if another person is able to move the individual aware of the its state." (Faber et al., 1992). On the other hand, Open Ignorance is the realization of closed ignorance. If an individual becomes aware of their previous state, they reach this state. In this state, "one will become more attentive e.g. to events and information which one had earlier neglected." (Faber et al., 1992). Hence, the goal of science is to move a person from closed ignorance to open ignorance. This is why education comes in. People can change if they are educated (Pruneau et al., 2001) and so a positive path

to transformation of the modern period will depend upon education (Sudarmodi et al., 2001).

UNESCO (2010) underscores the importance of education in the fight against environmental issues, especially climate change. It emphasizes that there is need to change the way individuals think and act to "change minds, not the climate", and education is crucial to achieve the dramatic transformation that is needed. For education, helps people understand, increases climate literacy, and encourages change in attitude and behavior.
On the other hand, Sustainable Development, Article Four (4), asserts that education is the key to improving development in some of the world's poorest communities. Sustainable Development Goal Four calls for inclusive, equitable and quality education for all. Equally, Article 6 of the UNFCCC, emphasizes the role of education. It states that education and training are integral in enabling citizens' contributions to local and global efforts to meet the climate change challenge. Increased knowledge and learning about the causes and impacts of climate change affect everyday lives. Communities can contribute to a solution-oriented public dialogue, while engaging local decision-makers in taking meaningful action and shaping climate policy. Article 12, of the Paris Agreement, declares that it shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement.

Further, Environmental Education (EE) and Education for Sustainable Development (ESD) have strived to incorporate climate change as one of its subject content in rendering respective education approaches. To this end, it is clear that Climate Change Education (CCE) is neither

Environmental Education nor Education for Sustainable Development, it is relatively a new concept (Gardner and Stern, 2008). Unlike the two (EE and ESD) which incorporates climate change science as one of their contents, CCE deals solely with climate change science, as its content (Hung, 2014, Tombe, 2013). It looks at the causes, impacts and solutions to climate change while fostering change in both attitude and behavior, through preparing learners and equipping them to gain capacities, such as knowledge, skill, dispositions and values to deal with future challenges (Stevenson, 2017; Tombe, 2013; UNESCO, 2010). The goal of CEE, therefore, is to impart not only climate change knowledge, but to also to cause these capacities in the learners. This is why CCE is contextual. It is the type of learning that incorporates everyday life, and so it is effective (Kagawa and Selby, 2010) and requires a social holistic learning approach that is flexible (Stevenson, 2017; Hung, 2014) and place-based (Schweizer et al., 2013).

Approaches of integrating climate change science into other courses or subjects, makes climate change coverage and discussion patchy and it causes a lack of rich conceptualization and understanding (Shepherds et al., 2009; Hung, 2014). The main distinctive feature of CCE is that it instills hope in the learners by tackling down in depth the climate change issue as its objective (Ojala, 2012). Therefore, climate change mitigation programs that involve local communities, stand a higher chance of being effective through CCE unlike in any other form of education (Stevenson, 2017; Hung, 2014; Tombe, 2013; UNESCO, 2010; Belgrade Charter, 1975)). Hence, Climate Change Education is a good intervention, for it causes the desired aim or change (Cf. Rogers, 2012, UNESCO, 2014).

Chapter 3. Research Methodology

3.1 Conceptual Framework

As discussed already, education impacts one's attitude towards environmental issues (Tobler et al; JingShi, Vivianne and Visschers, 2016). All things being equal, higher education denotes atleast a higher sensitivity to environmental issues, and lower education, vice-versa. Hence, from this impression, we can take a step further and assert that higher knowledge in environmental issues, could also connote a higher willingness to participate in environmental issues, and lower education, vice-versa. Therefore, expecting people to participate in forest conservation, implies a prior expectation of some scientific knowledge related to the efficacious benefits of participation in such ventures, and void of that, makes participation unrealized, to boost it, knowledge should be provided by those that have it, to the people lacking it (Dickson, 2005). This is why this thesis, postulates that the best concept that underscores the aforementioned factors, is the knowledge deficit theory. The Knowledge Deficit model was coined in the 1980s by social scientists studying the public communication of science. In this deficit theory, scientists assume that there is a knowledge deficit that can be 'fixed' by giving the public more information (Sturgis and Allum, 2004). There are two aspects to this belief: The first is the idea that public uncertainty and skepticism towards modern science including environmental issues and technology is caused primarily by a lack of sufficient knowledge about science and the relevant subjects (Brown, 2009). The second aspect relates to the idea that by providing the adequate information to overcome this lack of knowledge, also known as a 'knowledge deficit', the general public opinion will change and decide that the information provided on the environment and science as a whole is reliable and accurate (Brown, 2009).

The model implies that, (as figure 2. Shows), communication should focus on improving the transfer of information from experts to non-experts (Brown, 2009, Sturgis and Allum, 2004). It is associated with a division between experts who have the information and non-experts who do not (Sturgis and Allum, 2004). It focuses on: what is broken, what is missing, overcoming weakness, problem solving. It is Short-term solution. It highlights past failures and predicts and control (Brown, 2009; Dickson, 2005; Sturgis and Allum, 2004).

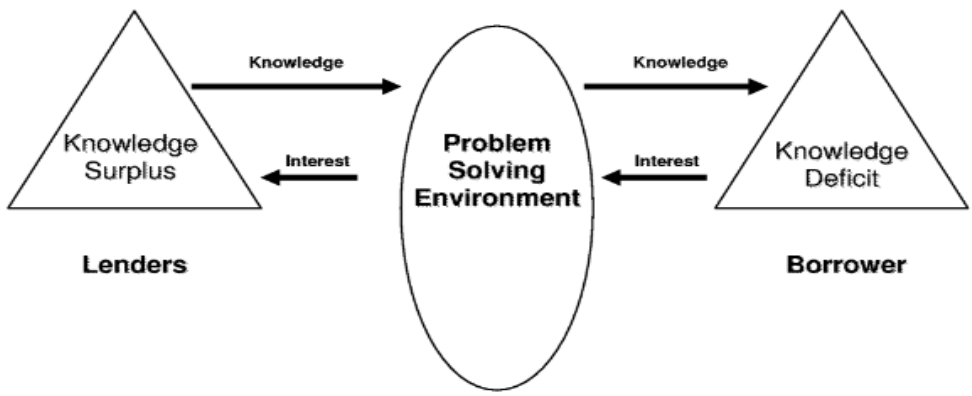

Figure 2. Knowledge Deficit Theory Framework, (Pouliot, 2009).

Basing on the knowledge deficit theory, what fixes or bridges the gap, between the people who know and the people who do not know, is education or knowledge transfer (Dickson, 2005). Education, therefore, has been regarded as the principle strategy with which to promote environmental awareness and inculcate responsibility for global citizens (Schreiner, Henriksen and Hansen, 2005). It is through education that we can ensure that there is a sustainable future for the earth. To support this, UNESCO (2012) holds that the potential of education is enormous and that education, not only informs people, but that it can also change them. Therefore, as a means for personal enlightenment and for cultural renewal, education is not only central to sustainable development, it is humanity's best hope and most effective means in the quest to achieve sustainable development.

3.2 Theoretical Framework

This study focuses on the impact of climate change education on local community's perception. It builds on the fact that when someone has learnt something about climate change, there is need to be able to describe what the person has learnt. In short, what sort of learning outcome can be observed if a person is said to have learnt something about climate change? Following the work of Bloom, Engelhart, Furst, Hill and Krathwhol (1956), on a taxonomy of educational objectives, behaviorists suggested that when the conditions of learning are right, learning outcomes, as described in the educational objectives, should follow. When thinking about the conditions that are required for some capabilities to be learnt, Gagné (1988, 1996) proposed that it is not simply naming what is to be learnt, but acquiring the learning capabilities, that which make students capable of accomplishing things they could not previously carry out. It is these capabilities that make up the outcomes of learning (Gagne, 1988, 1996). When Gagné refers to learning outcomes, he refers to the desired capabilities of a lesson, or to performance categories (Gagne, 1996, 1985) and it is these learning outcomes that can be observed if a person is said to have learnt something about climate change (Gagne, 1996). On the other hand, learning itself is behavior (Schat, 2014), and behavior is a symptom of perception. (Combs et al., 1976; Combs 1999), Therefore, learning is equally rooted in perceptions (Combs 1999). To understand the behavior of another person, or be part of the process of supporting and nurturing their growth and flourishing, understanding their perception is key (Combs 1999). This is why, it could be argued that the theory that responds to the deficit model is the perceptual theory because it helps individuals to shift their perception (Combs et al., 1976; Combs 1999) and to change their behavior through education as a helping professions (Combs et al., 1976; Combs 1999).

Forthwith, understanding the nature of persons' and behavior should be sought in people's perception. By seeking to understand the influence of perception, one may better understand human behavior. This is because every behavior is rooted in the behaver's perceptions, which are directed by the data available in their perceptual field (Combs, 1965). This is where perceptual theory directly links with education because, in both the deficit and perceptual theories, teachers are uniquely positioned to work with developing human beings whose identity and perceptions are becoming (Schat, 2014). On this note, Perceptional theory, supports behavioral change by leaving room for other resources to come along in taking steps to change misbehavior by addressing perception (Combs, 1982). Hence, learning should instill good perception, as with regards to our expectation.

This is where Climate Change Education (CCE) comes in. For, on a larger scale, the goal of Environmental Education (EE) is to improve all ecological relationships, including the relationship of humanity with nature and people and with each other, which will ensure the improvement of individuals' quality of life and also to ensure preservation and improvement of humanity's potentials (Belgrade Charter, 1975). On a narrower view and in short, CCE seeks to help learners develop knowledge, skills, values and action to engage and learn about the causes, impact and management of climate change. The concept of climate change education learning, does not end by making learners able to recall the names of what they have learned only, but also imposing on learners to accomplish new things (Gagne, 1985) and as indicated already, it is these competencies that make up the outcomes of learning (Hung, 2014). In form of graphical illustration, (as figure 3. Shows), the entire framework is circumscribed by the context of the subject matter pertaining to climate change causes, impact and management. Then the subject matter can be described by the domain of cognitive engagement, namely knowledge and skills, and the affective domain of learning: values or attitudes. From these two domains, the third domain, of whether the

confluence of these cognitive and affective learning outcomes will result in awareness or action has been added (Hung, 2014).

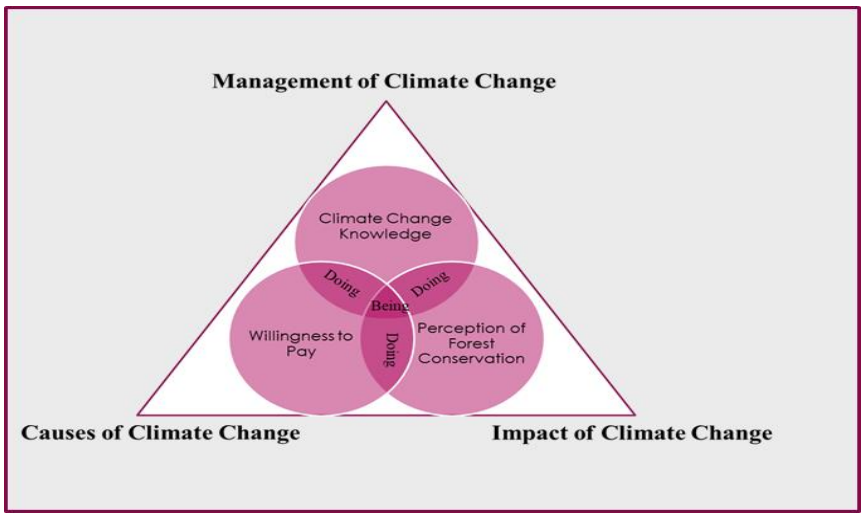

Figure 3. Modified Climate Change Education Framework, (Hung, 2014).

In short, subtracting the last domain, which is a confluence of the two other domains, climate change education framework is made up of two domains: The knowledge domains of learning outcomes and the cognitive and affective domains. The knowledge domains of learning outcomes, for CCE, can be described, in brief, as: climate change causes; climate change impact; and climate change management. On the other hand, the cognitive and affective domains of learning outcomes for CCE can also, in brief, be described as: better perception of forest conservation; and increased willingness to participation in forest conservation (Hung, 2014). The common position is that education has positive impact on both behavior and perception (Pruneau et al., 2001) and so climate change knowledge will positively impact both perception of forest conservation and participation in forest conservation (Hung, 2014) as figure 4. Shows.

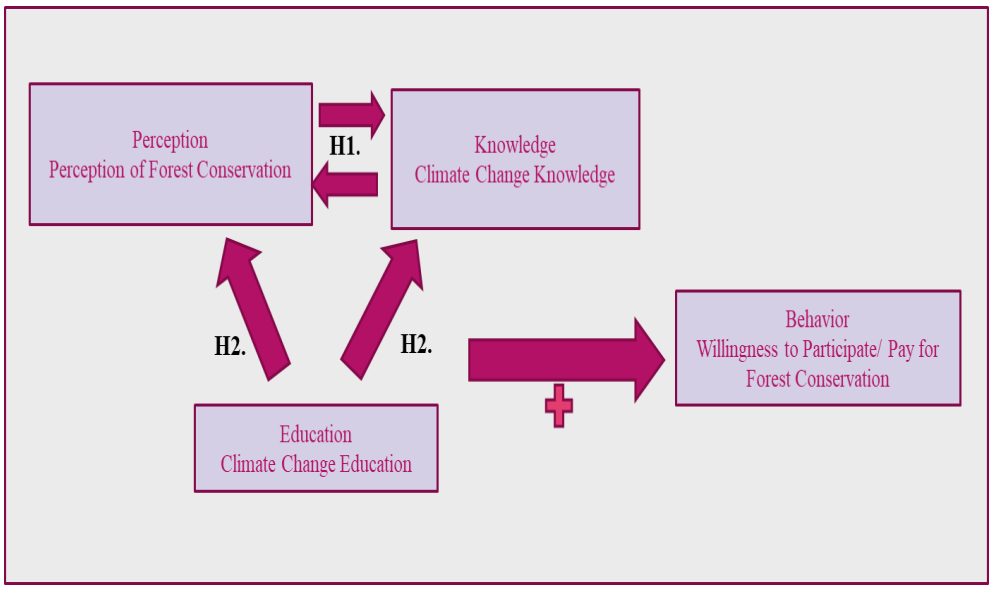

Figure 4. Analytical Framework.

It has been argued that climate change education, as a mitigation strategy for climate change, is contingent on the effectiveness of the curriculum. In turn, the curriculum can only be designed and implemented successfully if understanding of where students are in terms of their knowledge and disposition about the issue. Some researchers have shown that students are more engaged and consequently more successful if they are taught in ways that correspond to their levels of readiness (Vygotsky, 1986). It is through identifying what they know and what they do not know that CCE can be more effectively implemented. Inherent in this position is the assumption that there are gaps in the knowledge of learners that need to be identified, this makes knowledge transmission and acquisition easier. Consequently, this research aspires to evaluate the impact of using climate change education as an intervention on the local community's perception of forest conservation and participation of forest conservation.

3.3 Research Study Area

Zambia is one of the few countries in Africa that do not have a coastline, also known as landlocked countries. A total of eight nations - Angola, Tanzania, Zimbabwe, Namibia, the Democratic Republic of Congo, Mozambique, Malawi, and Botswana. It is divided into 10 provinces and 72 districts. Population about 16.5 million, with 72 other languages. English is the official language. The mining sector accounts for the biggest share of Zambia's economy. Population about 16.5 million. This case study research was conducted in Copperbelt Province of Zambia, located between latitudes 12o 20' and 13o 50' south and longitudes 26o 40' and 29o 15' east and covers a total surface area of 31,014 km2 (Kalaba, 2013). The average altitude of the region is 1200 m above sea level, and its geology is made up of granite and granite gneiss, basement schist and lower Katanga rock systems (Syampungani et al., 2010). The province is a high rainfall area, receiving an average annual rainfall of 1200 mm, and experiences three weather seasons that are distinguished based on rainfall and temperature, namely: hot dry (September– November), rainy season (December–March) and cold dry (April-August) (Chidumayo, 1997). The average temperature ranges between 17°C in the cold dry season to 37°C in the hot dry season. In terms of natural vegetation, Miombo woodland systems, makes up 90% of the Copperbelt Province's total vegetation (GRZ, 1998).

3.4 Research Study Site

Katanino is located 75km from the nearest urban town (Ndola, the provincial headquarter of the Copperbelt Province) and lies on the main road connecting Copperbelt Province and Lusaka (Figure 5). The villages are dominated by the people of the Lamba tribe, who are the indigenous inhabitants of Copperbelt Province (Mitchell and Barnes, 1950). The tribe is matrilineal, in marriage a husband moves to the wife's village and land

ownership is linked to the marriage (Mitchell and Barnes, 1950). Female landholding is therefore common among the Lambas. In Katanino, the villages are under the authority of traditional chiefs, who are responsible for land allocation and general leadership. In these rural villages, the residents are more attached to their traditions and beliefs than those of peri-urban villages (Simon et al., 2004). The villages surrounding Katanino Forest were combined to form what is now referred to as Katanino and It is under the traditional authority of Chief Mushili (Bwalya, 2007, 2012).

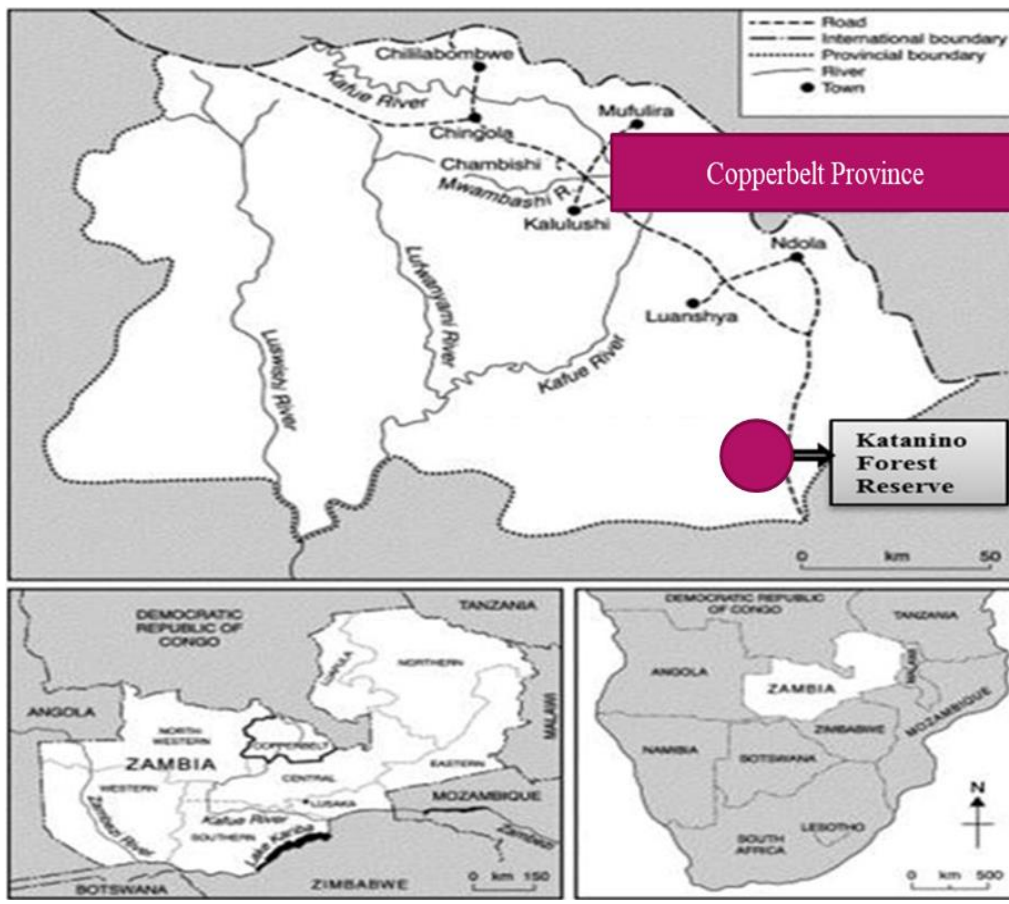

Figure 5. Location of Katanino Forest. (Study Site), modified from von der Heyden and New, 2004).

3.5 Data Collection

The main mode of data collection, for this research, was face-to-face interview, using structured questionnaire (appendix 1). Further, preparatory meetings, consultations, and coordination were done between the period of March, 2019 and June, 2019. The meetings were attended by a representative of the chief (eyes of the chief) and 10 (youth) representatives of the community. Pre-testing survey was conducted in May to almost 30 respondents. This was made possible through coordination with the representative of the chief (eyes of the chief) and helping team, consisting of 10 youth. The first survey was done from the period of October, 2019 to November, 2019. Climate change education was conducted from the period of December, 2019 to December, 2020. The experts that helped in conducting climate change education was made up of one lecturer from the Copperbelt University graduate school of developmental studies, one representative from the forest department, one representative from the community agriculturist, one lecturer under English language and literature, and one representative of the Chief (eyes of the chief), in charge of land disputes. It was conducted using four different church locations with the help of church outstations. To coordinate with the local community in organizing the ventures and handling of questionnaires, the 10 youth were maintained as a helping team. Therefore, in total, the team consisted of 15 members.

3.6 Sampling Method

According to the information gotten through the chief workers, (eyes of the chief), there are atleast 430 household under Katanino Joint Forest Management, as residents living within a range of 5 km from the Katanino Forest (Jere, 2004). The sample size was calculated by applying the formula of (Israel, 1992: Kuezer and Tuan, 2013; Yamane, 1967). As shown by the equation:

$$n = \frac{N}{1+N(e)}2$$

where *n* is the sample needed, *N* is the sample population, and e is the sampling error (0.05). Hence, given a maximum total of atleast 430 houses, a total of atleast 207 samples were needed. However, 220 samples were randomly selected. In order to determine whether the intervention, in this case climate change education, had the desired effect, this thesis needed to prove the counterfactual group, that the effects would not have happened without the intervention. To do so, the first survey was administered to 220 samples, which become our group, and from the same group, in order to create the counterfactual group, we randomly selected 18 samples from the 220 samples, who already answered the first survey questionnaire, and called that group, control group. Remaining with 202 samples, that was named educated group.

However, we extended our invitation to the educated group for climate change education, using single blindness, were the respondents did not know the group they belonged to, and from the 202, only 201 responded, and they went through the climate change education, and later on, responded to the second research questionnaire. According to randomized control trial or experimental design, this thesis was able to create both the educated group, which acted as the counterfactual group, and the control group. The educated group consisted of 201 respondents and the control group consisted of 17 respondents, this is because one respondent did not respond to the second survey questionnaire. Therefore, despite the control group not attending climate change education, both the educated group and the control group respondent to both the first and second research survey questionnaires.

3.7 Description of Survey Questionnaires

To formulate questions on climate change causes, impacts, and management, on the questionnaire, the works of (Hung 2014; Tobler et al;

Siergist 2012, and Sulistyawati, et al., 2018), were of help. To formulate questions to deal with perception of forests and forest conservation, the works of (Kumar 2019; Hung 2014; Alan, 2019; Schat, 2014 and Peterson, et al., 2018) were highly consulted. Lastly, in formulating questions about willingness to participate in forest conservation, works of (Bishop and Heberlein, 1979; Hung, 2014; De-Graft and Onumah E.E 2011; Michael and Elvin, 2014; and Soler, 2007). Therefore, apart from the socio-demographic characteristics, the questionnaire's content included soliciting information on climate change causes, effects, and management; then, perception of forest and forest conservation. Lastly, willingness to pay for forest conservation (appendix 1).

3.8 Measuring the Impact of Climate Change Education

Considering the framework for the goals of CCE, the evaluation of what students know about climate change has to consider how learners develop knowledge, skills, attitudes and action to engage and learn about the causes, impact and management of climate change, of which both skill and attitudes or values are components of perception. To this end, the questionnaire did not just focus on students' knowledge and understanding about climate change only, but also examine their perception of forest conservation, and their willingness to participate for forest conservation. In addition, the impact of climate change education cannot be evaluated minus knowing how much people know about climate change prior to the conduction of climate change education. Hence, the reason for two research surveys, using one questionnaire. Therefore, the methodology of measuring the impact, in this research, come to be in three steps: to assess, to educate, and to reassess.

First Step: **To Assess Climate Change Knowledge and Perception**

This research began on an assumption that the local community seemed not to understand the role of forests in mitigating climate change, hence their poor perception of forest conservation. To ascertain this assumption, the local community was subjected to the first survey in view of testing how much they know about climate change and how that knowledge influenced their perception (Sulistyawati, 2018) (appendix 1).

Second Step: **To Educate on Climate Change and Role of Forests**

The second step was climate change education. The aim of this stage was to teach the local community the role that the forests play in mitigating climate change (Cf. Biesta, 2015; Hung, 2014). The build up to this was to contextually explain climate change and its causes in a tangible Zambian way (appendix 2).

Third Step: **To Reassess Climate Change Knowledge and Perception**

In order to evaluate the impact of climate change education, the respondents were subjected to the same questionnaire, with the hope that their new understanding of climate change and the role forests play in mitigating climate change, will help them respond better to the questionnaire (Cf. UNICEF, 2014; Rogers, 2014) (appendix 1). The second research questionnaire was also administered to the control group. This was to make sure that the probable changes in the educated group was not happening out of random error. As climate change education requires to teach climate change causes, impacts and management (Hung, 2014; Tombe, 2013) and also to teach participants skills and values depending on what is missing (Hung, 2014; Ojala, 2012, Tombe, 2013), all the three steps based on the cause, impacts, management, individual perception of forest conservation and willingness to participate in forest conservation.

3.9 Data Analysis

Before embarking on data analysis, the status of the questionnaire was inspected whether the response for all questions we filled in completely. This research had two surveys and one climate change education. The aim of the first survey was to solicit how much the local community knew about climate change and how they perceived forests and forest conservation. Inherent in this, was the hypothesis that there is no statistical independence between knowledge and perception, and that climate change knowledge and perception of forest conservation have a significant positive correlation. To test for independence, Chi-Square T Test was used. To test for correlation, Pearson Correlation was used. The second survey was built on the hypothesis that climate change education contributes to the promotion of willingness to participate in forest conservation. Therefore, second survey questionnaire was given to both the control and educated groups. To evaluate the impact of climate change education on climate change knowledge and perception of forest conservation, Paired Sample T test was used. To measure willingness to participate in forest conservation, willingness to pay for forest conservation was used.

To measure the impact of climate change education on willingness to pay, Paired Sample T test was used. Lastly, to estimate the magnitude of the impact of climate change on willingness to pay, Cohen's d formula was used. With Chi-Square Test, there is an assumption that if there is no statistically significant relationship or association between two categorical variables, the difference is zero between the expected and the observed counts (Walker, 1995; Turhan, 2020). The basic assumption with the paired sample t test is that, with the null hypothesis, the population mean difference is equal to the hypothesized value. In simple terms, there is no difference (Ross, 2017). Lastly, with the Cohen's d effect size, estimates of effect size are useful for determining the practical or theoretical importance of an effect, the relative

contributions of factors, and the power of analysis (Fritz et al., 2011). All the statistics analyses above, apart from the Cohen's d, were executed using the IBM SPSS Statistics Version 26.0 (IBM Corp., New York, USA, 2020).

Chapter 4. Results

This thesis had two research surveys. The first one was before climate change education. The second was after climate change education.

4.1 Socio-Demographic Characteristics

Of the 220 respondents, 180 (81.8%) were males, while 40 (18.2%) were females. 122 (55.5%) were between the ages of 36-45 years old. 173 (78.6%) were married, 22 (10%) were single, 11 (5%) were divorced, and 14 (6.4%) were widowers/widows. Household mean size was 5.35. of 220 respondents, 120 (54.5%) had gone up to primary education level, 78 (35.5%) up to Junior secondary school, 20 (9.1%) up to secondary education level, and 2 (0.9%) respondents had gone up to tertiary education level. The mean monthly income was 1.56 Kwacha ($1=22 Kwacha). The sum of willingness to pay for forest conservation was K186.

Table 1. Demographic Characteristics of Household Heads

Characteristic	Frequency	Percentage
Gender		
Male	180	81.8
Female	40	18.2
Total	220	100.0
Marital Status		
Married	173	78.6
Single	22	10.0
Divorced	11	5.0
widow/widower	14	6.4
Total	220	100.0
Household Size		
1	2	0.9
2	2	0.9
3	18	8.2
4	45	20.5
5	62	28.2
6	43	19.5
7	26	11.8
8	14	6.4
9	7	3.2
11	1	0.5
Total	220	100.0
Education Level		
Primary Education	120	54.5
Junior Secondary Education	78	35.5
Secondary Education	20	9.1
Tertiary Education	2	0.9
Total	220	100.0
Monthly Income		
k1-K50	120	54.5
K60-K100	78	35.5
K150-K200	21	9.5
K250-K350	1	0.5
Total	220	100.0

4.2 Relationship Between Knowledge and Perception

This thesis based its argument on the assumption that knowledge and perception are not independent and that they are positively correlated. In order to do this, the Chi-Square Test and Pearson Correlation were applied. It is assumed that increased education level leads to increased knowledge. We used education level and computed it against their perception level of forest conservation. The basic reason behind the Chi Square T Test is that if there is independence between the variable, there is no difference between the expected count and the count. As table 2 shows, there is no independence between knowledge and perception.

Table 2. Results of Independence Between Knowledge and Perception

Education Level * Forests Conservation is Important Crosstabulation							
			Forests Conservation is Important				
			I Disagree Strongly	I Disagree	I Neither Agree nor Disagree	I Agree	I Strongly Agree
Education Level	Primary Education	Count	114a	3b	1b	0b	0b
		Expected Count	62.2	16.6	18.2	10.7	10.2
	Junior Secondary Educat	Count	2a	27b	33b	6c	0a
		Expected Count	35.9	9.6	10.5	6.2	5.9
	Secondary Education	Count	0a	1a	0a	14b	17b
		Expected Count	16.9	4.5	4.9	2.9	2.8
	Tertiary Education	Count	0a	0a, b	0a, b	0a, b	2b
		Expected Count	1.1	0.3	0.3	0.2	0.2
Total		Count	116	31	34	20	19
		Expected Count	116	31	34	20	19

Given that there is difference between the expected count and the count, as a shown by Table 2, and that the obtained Chi-Square value (145.976), as shown by Table 3, is bigger than the one in the table (118), and that the p value is less than 0. Given that the Chi-Square value is too large to have arisen by chance; it is more likely to stem from the fact that there were real differences between the observed and expected frequencies. In other words, contrary to our null hypothesis, the categories did not occur with similar frequencies. Therefore, it follows that statistically the null hypothesis is rejected.

Table 3. Chi Square Results for Independence Between Knowledge and Perception

	Value	Degree of Freedom	Asymptotic Significance (2-sided)
Pearson Chi-Square	**145.976**	**6**	**.000**
Likelihood Ratio	115.491	6	.000
Linear-by-Linear	84.376	1	.000
N of valid Observations	220		

Before proceeding to conducting climate change education, this paper needed to prove to what effect the relationship between climate change and perception of forest conservation is. The results showed that there is a positive significant correlation between climate change knowledge and perception of forest conservation (Table 4.).

Table 4. Pearson Correlation

		Forests Conservation	Climate Change Knowledge
Forests Conservation	Pearson Correlation	1	.940**
	Sig. (2-tailed)		0
	N	220	220
Climate Change Knowledge	Pearson Correlation	.940**	1
	Sig. (2-tailed)	0	
	N	220	220

**. Correlation is significant at the 0.01 level (2-tailed).

Therefore, the results were able to prove that knowledge and perception are not independent, for the difference between the count and expected count did not happen due to random error. Further, there is a strong positive correlation between climate change knowledge and forest conservation. Apart from testing the first alternative hypothesis and the sub-hypothesis, another element that encouraged the research to proceed to the second stage, as figure 6 shows, is that 84.1% of the respondents indicated that they were willing to learn about climate change.

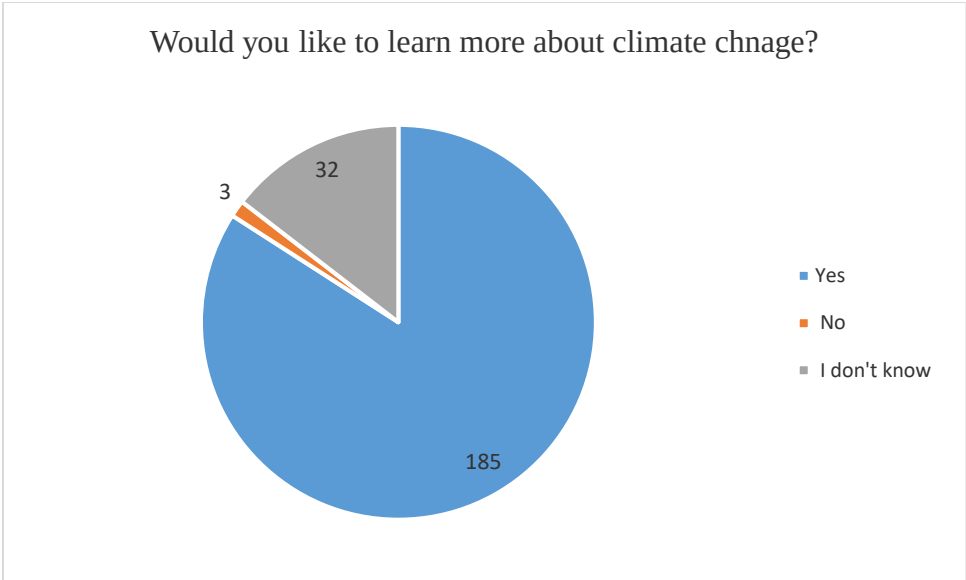

Figure 6. Local People's Willingness to Learn about Climate Change

4.3 Climate Change Knowledge

Based on figure 6, 83 respondents (37.7%) stated that they had heard of climate change (figure 7). On the other hand, 137 respondents (62.3%) indicated that they have not heard of climate change. Further, out of 220 respondents, 201 respondents stated that weather is changing and 19 respondents indicated that had not witnessed any changes in the weather patterns.

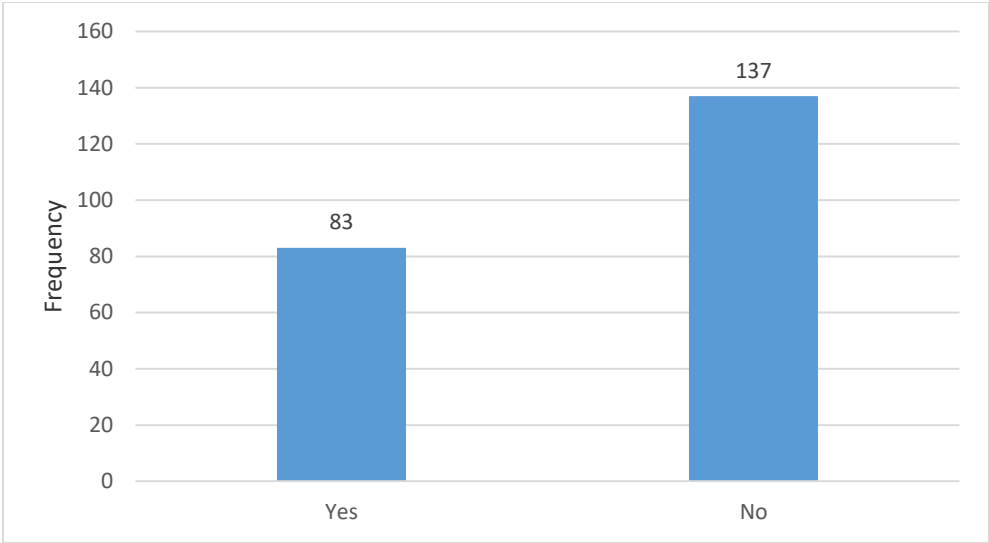

Figure 7. Heard of Climate Change

When the respondents were asked to indicate their knowledge of what causes climate change, based on figure 4, 72 respondents (32.7%) stated that climate change is caused by nature, 25 of the respondents (11.4%) stated that it is caused by human beings, while 123 respondents (55.9% stated that they didn't know, as shown by figure 8 below.

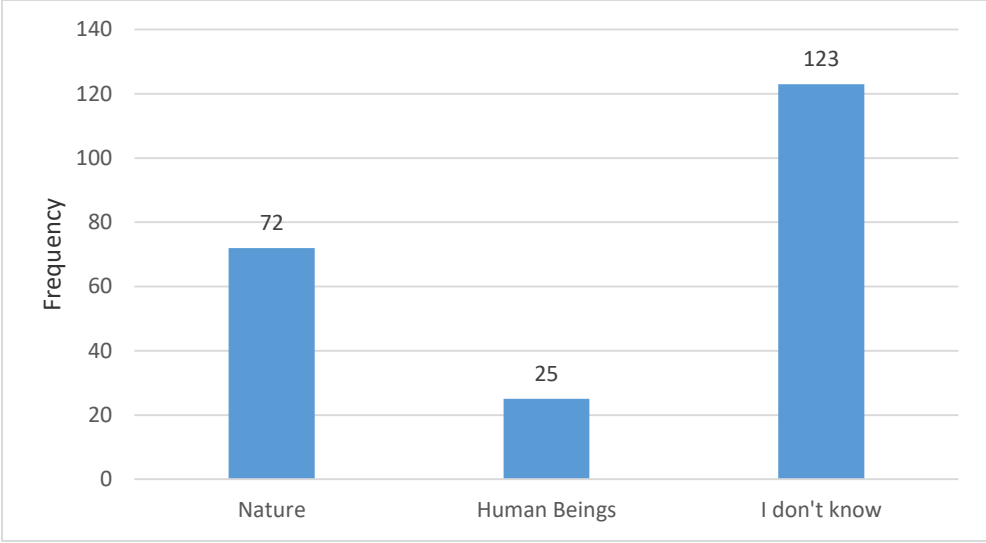

Figure 8. Local People's Knowledge of the Causes of Climate Change

When the respondents were asked to indicated how generally they think they know about climate change and how they could describe their knowledge of climate change, as shown by figure 9, 137 respondents (62.3%) indicated that they did not know what climate change is.

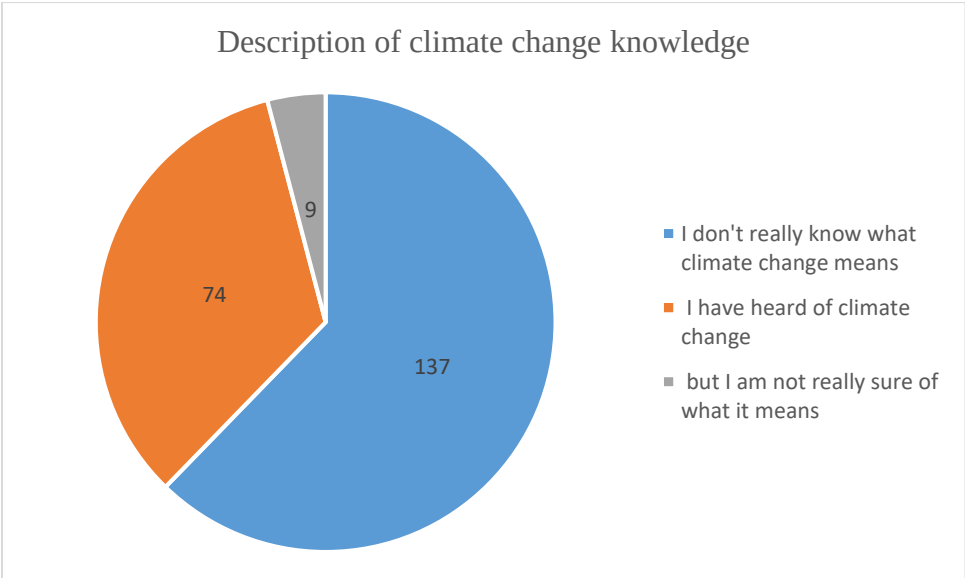

Figure 9. Description of Local People's Climate Change Knowledge

4.3.1 Climate Change Knowledge of the Control Group

When it came to the question about description of climate change knowledge, out of 17 respondents, 5 respondents (29.4%) indicated that they did not know what climate change means, 10 respondents (58.8%) indicated they have heard of climate change, but they did not know what it means, and lastly, 2 respondents (11.8%) indicated that they had some ideas (Figure 10).

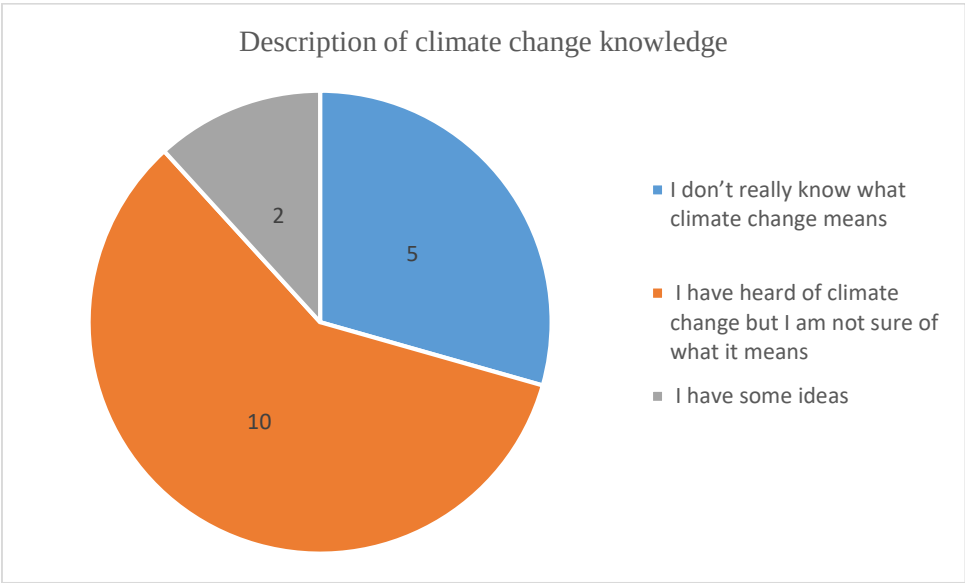

Figure 10. Description of Control Group's Climate Change Knowledge

When it came to the question about the main causes of climate change, out 17 respondents, 8 respondents (47.1%) chose nature, 1 respondent (5.9%) chose human beings while 8 respondents (47.1%) indicated they did not know, as shown by Figure 11.

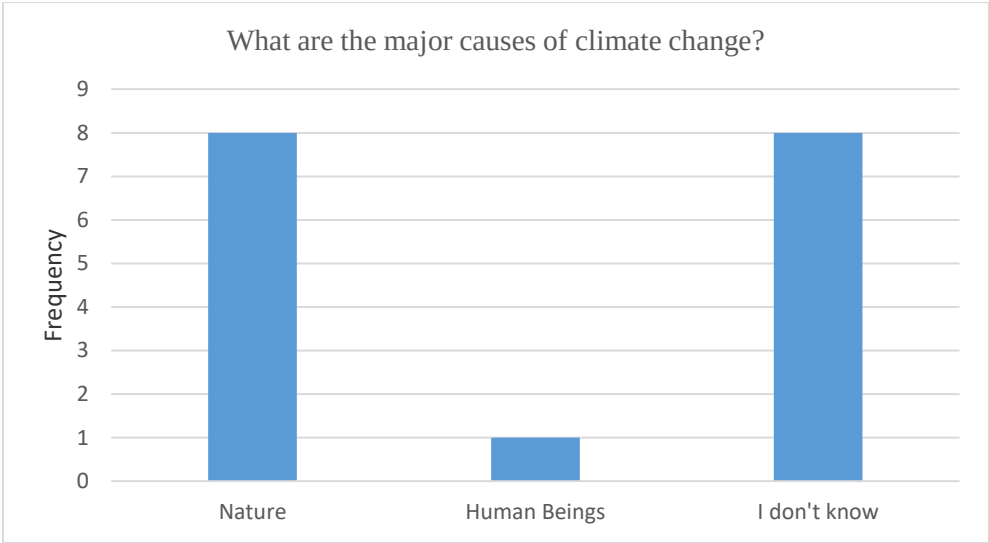

Figure 11. Control Group's Knowledge of the Causes of Climate Change

4.3.2 Climate Change Knowledge of the Educated Group

After climate change education, out of the 201 respondents, 188 respondents (93.53%) indicated that human beings are the main culprits of climate change, a few respondents (5.47%) indicated that climate change is caused by nature, and few of the respondents (1%) indicated that they did not know the main cause of climate change, as figure 12 shows.

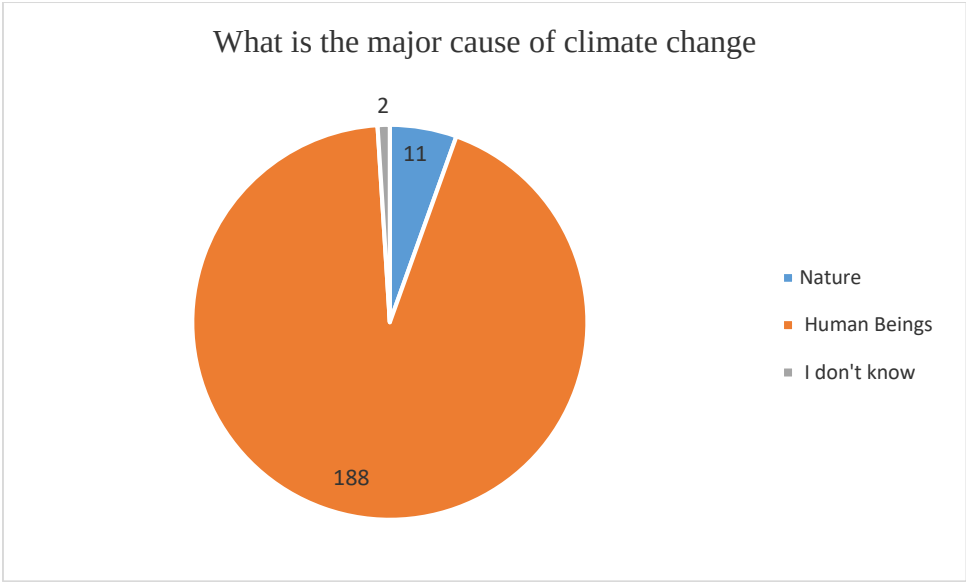

Figure 12. Educated Group's Knowledge of the Causes of Climate Change

Out of 201 respondents, 15 (7.46%) indicated they had some ideas about what climate change means, 3 respondents (1.49%) indicated that they did not really know what climate change means. However, 172 respondents (85.57%) indicated that they had good ideas of what climate change is (Figure 13).

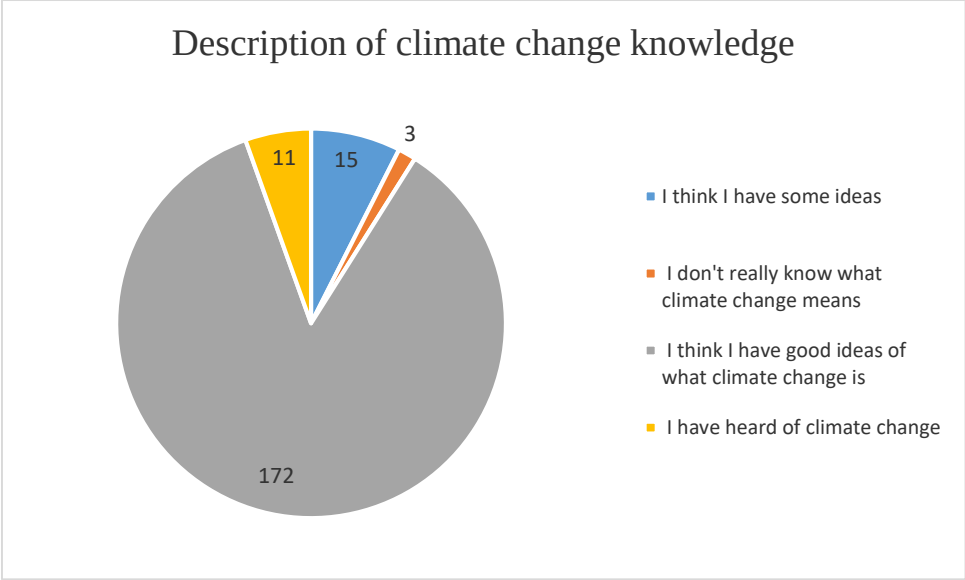

Figure 13. Description of Educated Group's Climate Change Knowledge

4.3.3 Evaluation of Climate Change Knowledge of Control Group

The control group's response to the second survey was evaluated against their response to the first survey basing on climate change knowledge**.** There was minimal or no visible change regarding the climate change knowledge they exhibited in the first survey and the second survey. This could be witnessed in the closeness of the t value to zero, as shown by table 5.

Table 5. Paired Sample T Test: Control Group Climate Change Knowledge

Pair	Mean	Std. Deviation	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed
			Lower	Upper			
Knowledge of climate change (1)-Knowledge of climate change (2)	.000	.500	-.257	.257	.000	16	.332

4.3.4 Effect of Climate Change Education on Climate Change Knowledge.

Climate change knowledge which the educated group had prior to climate change education was labelled knowledge of climate change (1) while climate change knowledge which they acquired after climate change education was labelled as knowledge of climate change (2), as shown by table 6 below.

Table 6. Paired Sample T Test: Educated Group Climate Change Knowledge

Pair	Mean	Std. Deviation	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed
			Lower	Upper			
Knowledge of climate change (1)-Knowledge of climate change (2)	-1.547	.727	-1.648	1.446	-30.160	200	.000

4.4 Perception of Forest Conservation

Of the 220 respondents, when it came to the question concerning how often they go into the forest, 200 respondents indicated very often while 20 respondents indicated often. When the respondents were asked, “what use do you put the forest to?” 120 respondents (54.5%) indicated charcoal, 95 respondents (43.2%) indicated firewood, and 5 respondents (2.3%), indicated medicine. Further, 22 respondents (10%) said yes, 27 respondents (12.3%) said no, while 171 respondents (77.7%) said they didn’t know, when it came to the question, “do you feel some uses of forests and forests products affect forests? As shown by figure 14.

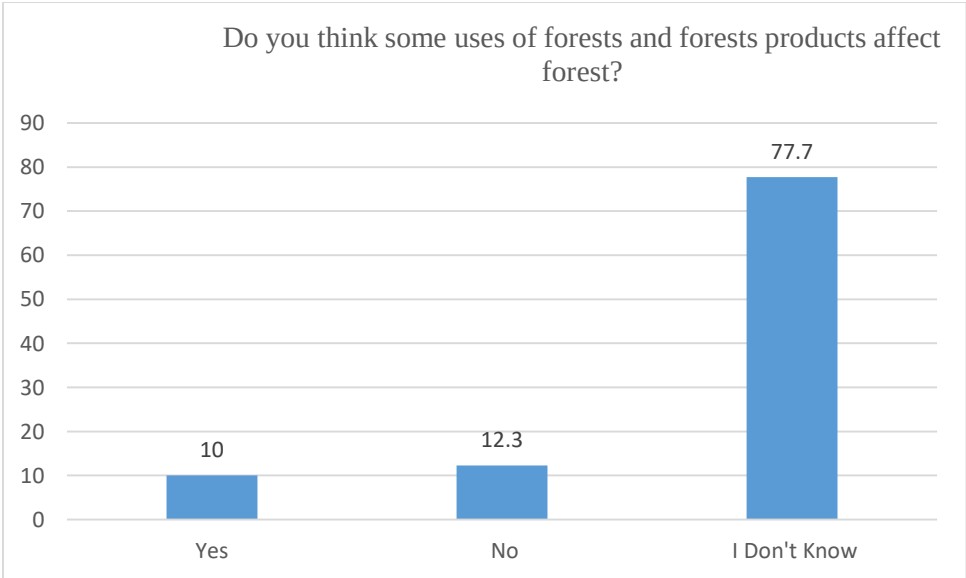

Figure 14. Local People's Perception of Effect of Some Forest Use on Quality of Forest

When it came to the question whether climate change was something that frightens them, 16.8% said yes, while 83.2%, said no. When it came to the question whether they felt something could be done to mitigate climate change, 83.6% said they did not know (Figure 15).

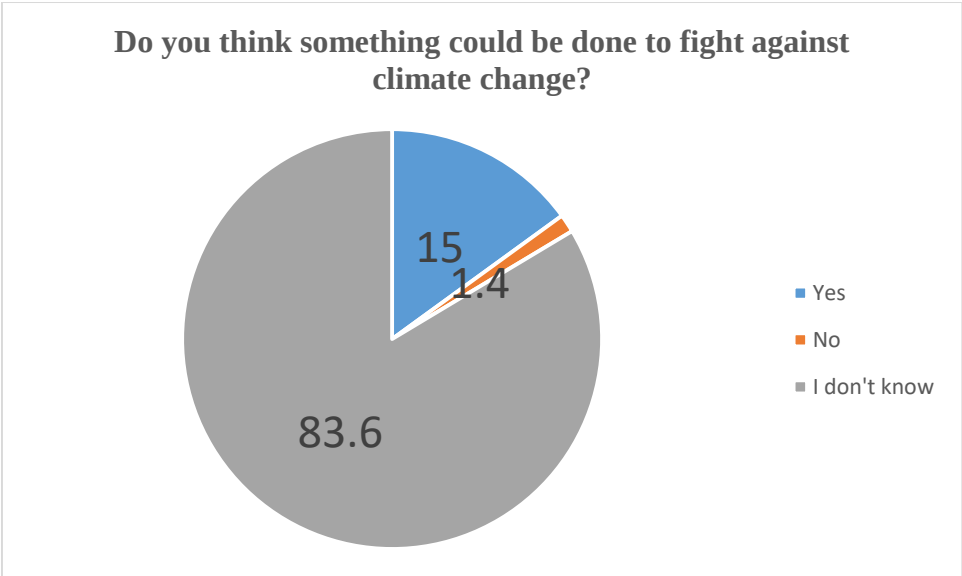

Figure 15. Local People's Attitude towards Combating Climate Change

When it came to the question whether forests are important in the fight against climate change, majority of the respondents showed that they did not know, as shown by figure 16, for the majority of the respondents neither agreed nor disagreed.

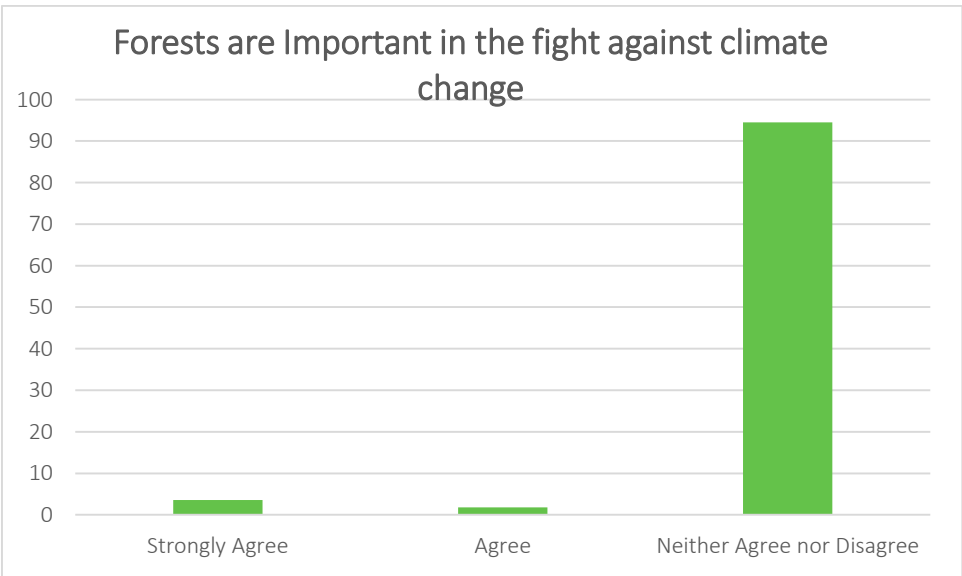

Figure 16. Local People's Perception of the Importance of Forests in Combating Climate Change

Further, when it came to the question as to whether they could agree to leave their private jobs if they discovered that it was affecting the environment negatively, out of 220 respondents, 32 respondents (14.5%) agreed strongly, 43 respondents (19.5%) agreed, 131respondents (59.5%) neither agreed nor disagreed, 12 respondents (5.5%) disagreed strongly, while 2 respondents (0.9%) disagreed (Figure 17).

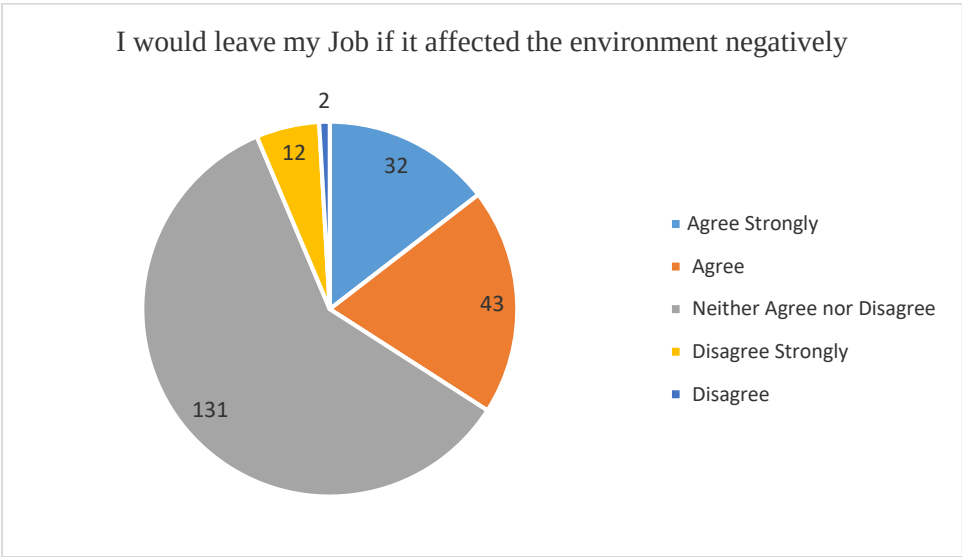

Figure 17. Local People's Willingness to Accept Climate Change Mitigation

4.4.1 Perception of Forest Conservation of the Control Group

When the respondents were asked if they thought some uses of forests and forests products affect forests' quality, out of 17 respondents, 2 respondents (11.8%) said yes, 3 respondents (17.6%) said no, while 12 respondents (70.6%) said they did not know (Figure 18).

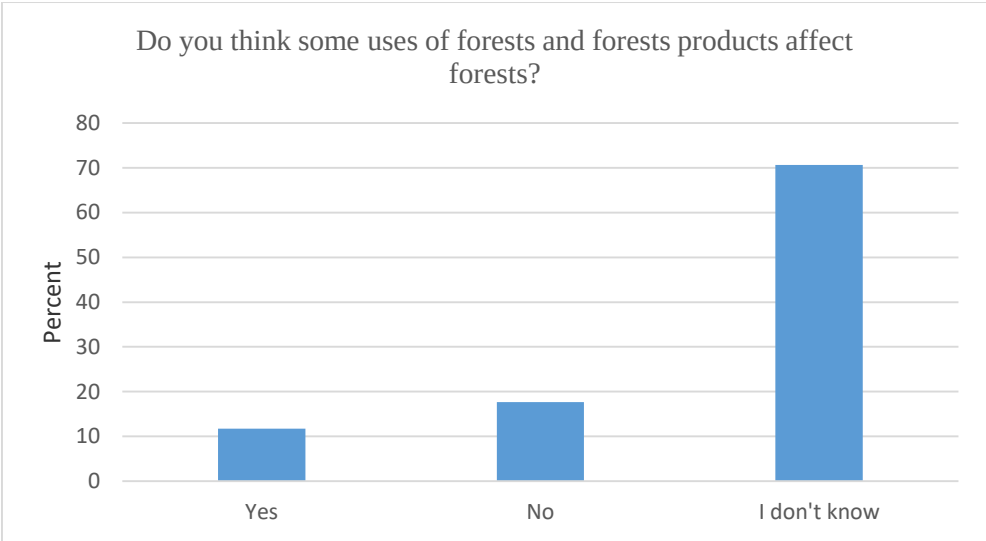

Figure 18. Control Group's Perception of Effect of Some Forest Use

Apart from asking the respondents about their perception of some uses of forests and forests products, they were also asked about how they perceived even climate change. When it came to the question whether climate change frightens them, out of the 17 respondents, 2 respondents yes, 1 respondent said no, and 14 respondents said they did not know, as figure 19 shows.

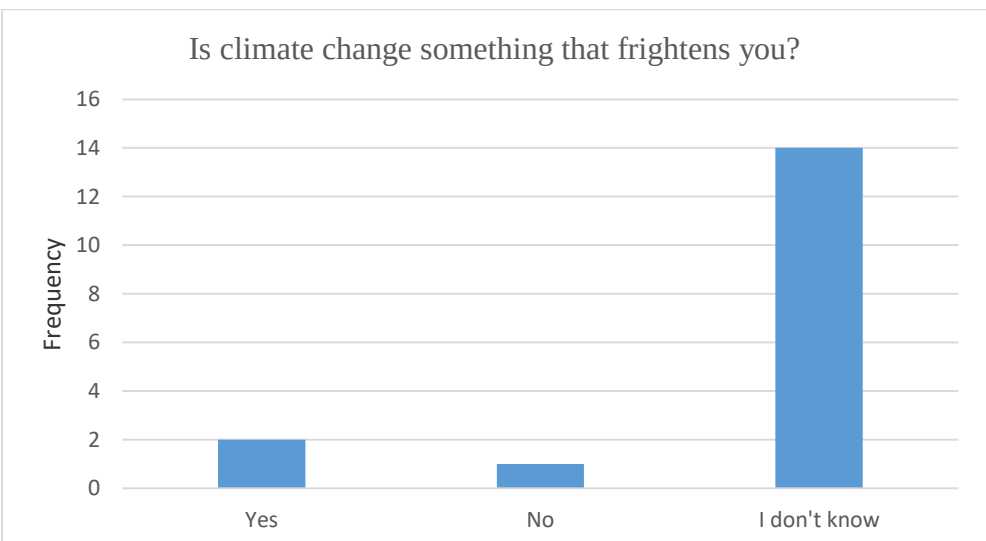

Figure 19. Control Group's Perception of the Effects of Climate Change

When it came to the question “do you feel something could be done to mitigate climate change?” 2 respondents indicated that they thought something could be done to mitigate climate change, 1 respondent thought nothing could be done to mitigate climate change. On the other hand, 14 respondents did not know whether something could be done to mitigate climate change, as shown by figure 20.

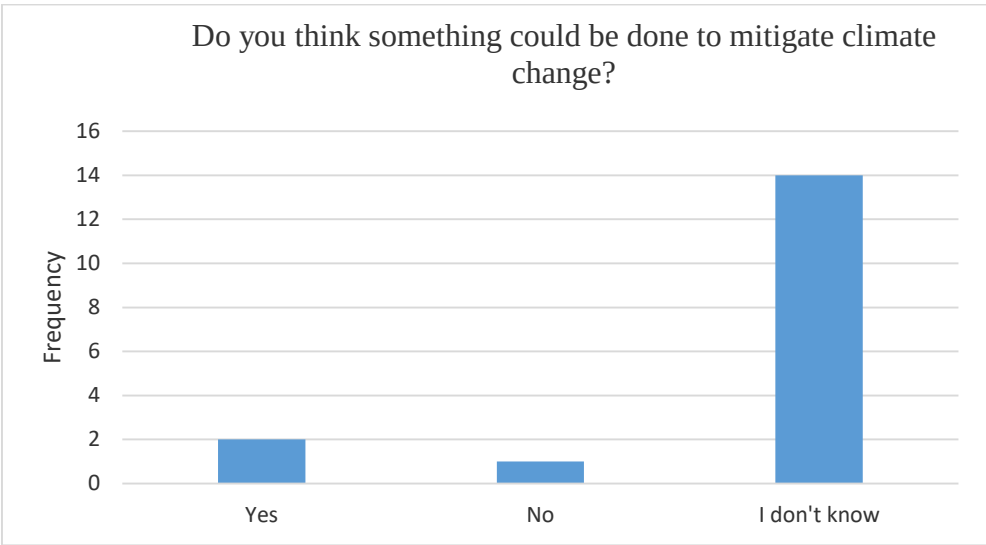

Figure 20. Control Group’s Attitude towards Combating Climate Change

When it came to asking to asking the respondents how the respondents perceived the statement, “forests are important in the fight against climate change.” Out of 17 respondents, 1 respondent agreed, 15 respondents neither agreed nor disagreed, and 1 respondent disagreed, as figure 21 shows.

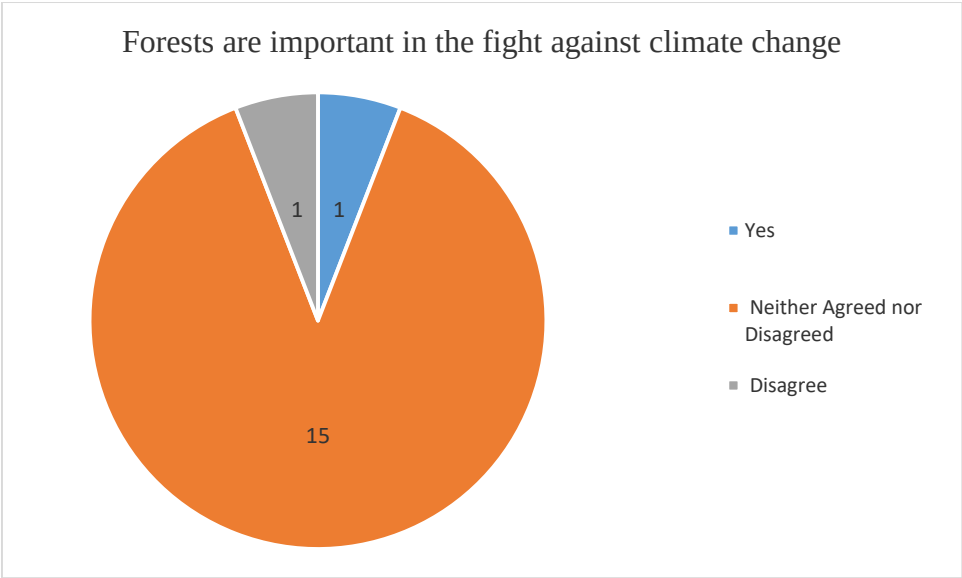

Figure 21. Control Group's Perception of the Importance of Forests in Combating Climate Change

Another question was on finding out how the respondents could react when they discovered that their private jobs impacted on the environment negatively. Could they quit their job? Of the 17 respondents, 1 respondent said yes, 10 respondents neither agreed nor disagreed, 1 respondent disagreed strongly, and 5 respondents disagreed, as figure 22 shows.

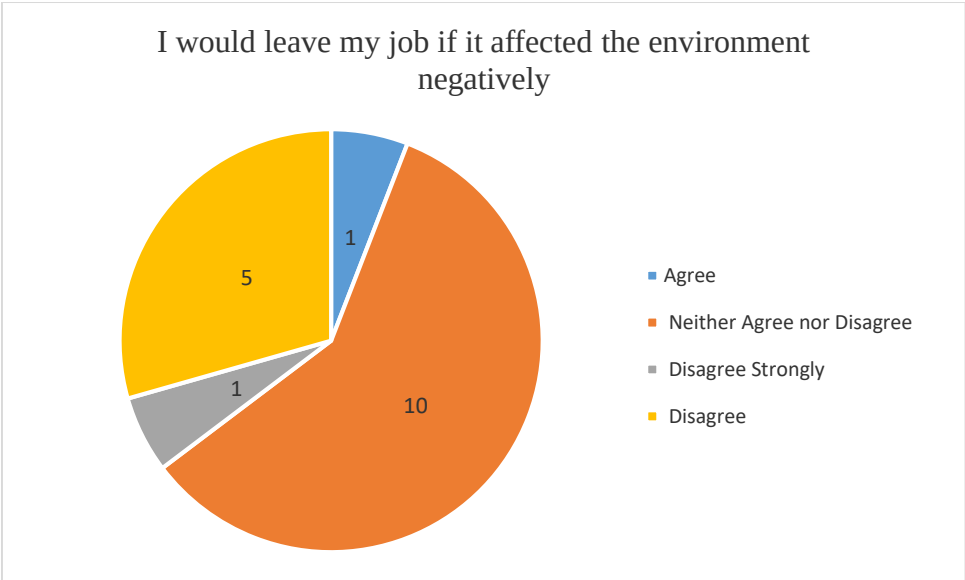

Figure 22. Control Group's Willingness to Accept Climate Change Mitigation

4.4.2 Perception of Forest Conservation of the Educated Group

When the respondents were asked, "do you feel some uses of forests and forests products affect forests? Out of 201 respondents who underwent climate change education, 197 respondents (98%) said yes, 3 (1.5%) respondents said no, and 1 respondent (.5%) picked I did not know. as Figure 23 shows.

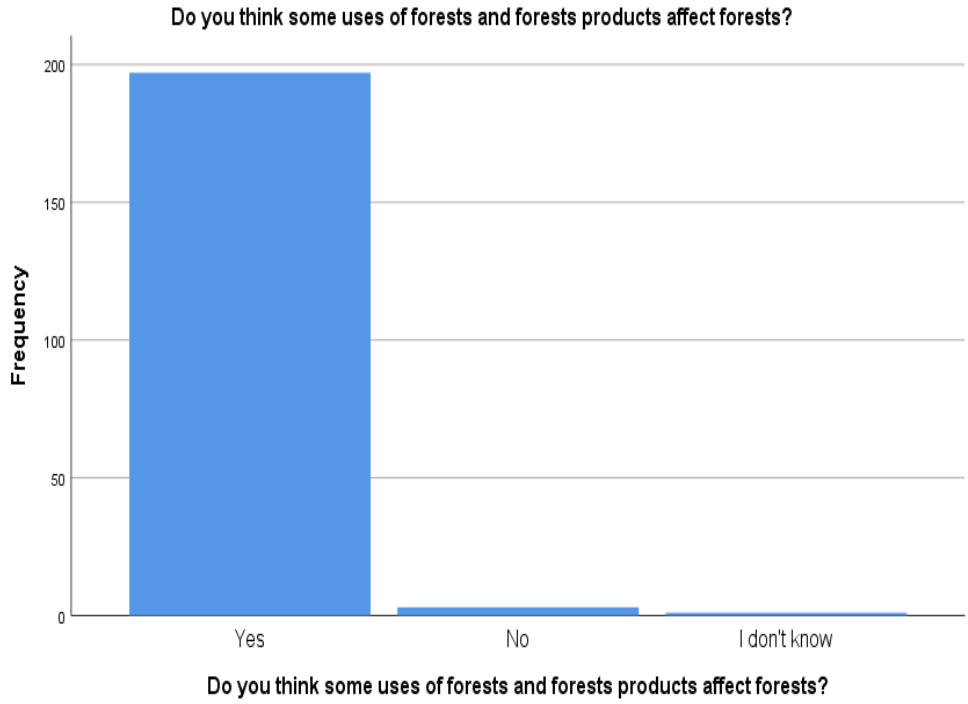

Figure 23. Educated Group's Perception of Effect of Some Forest Use on Quality of Forest.

Further, out of 201, 192 (95.5%) indicated that climate change frightens them while 9 respondents (4.5%) indicated that it does not frightens them. (Figure 24).

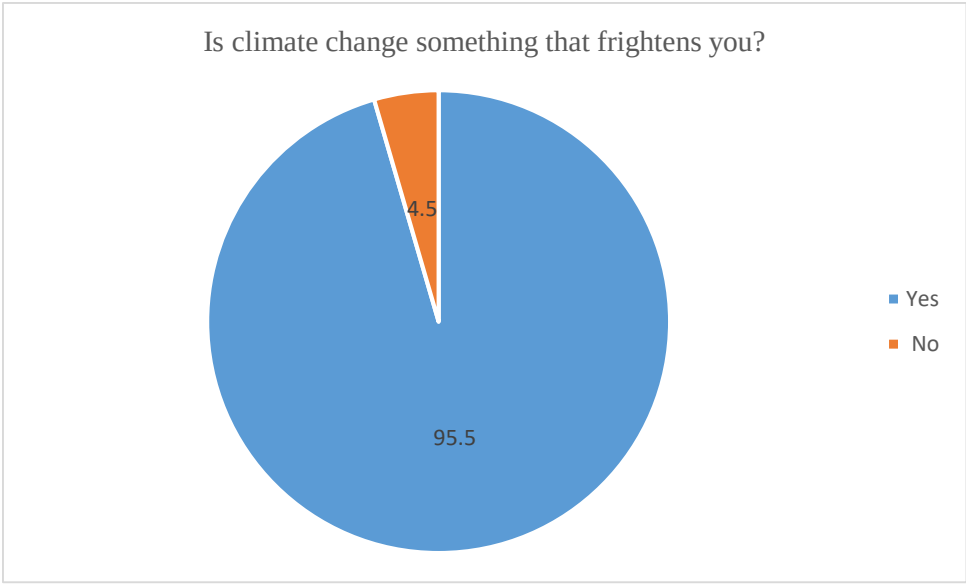

Figure 24. Educated Group's Perception of the Effects of Climate Change

When it came to the question, do you believe something could be done to mitigate climate change? 196 respondents (97.5%) said yes, 1 respondent (.5%) said no and 4 respondents (2%) said they did not know, as figure 25 shows.

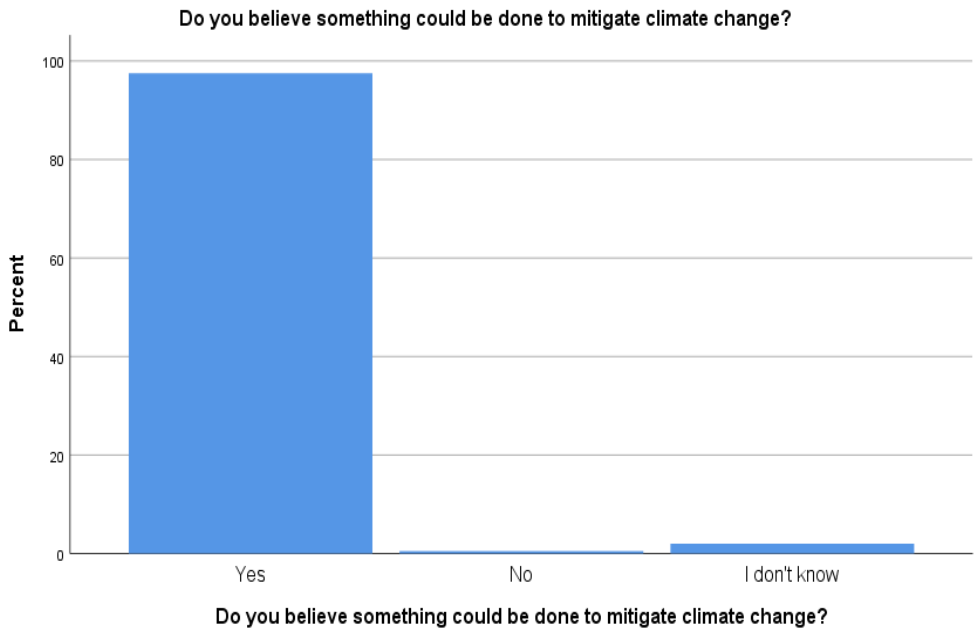

Figure 25. Educated Group's Attitude towards Combating Climate Change

When it came to the statement that forests are important in the fight against climate change, out of 201 respondents that were educated on climate change, 181 respondents (90%) agreed strongly, 14 respondents (7%) agreed while 6 respondents (3%) neither agreed nor disagreed (Figure 26).

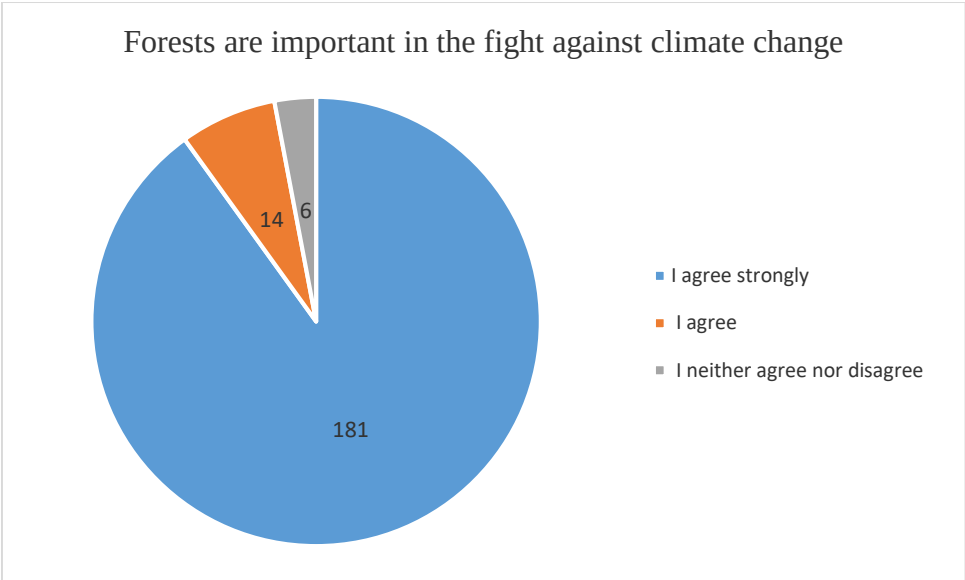

Figure 26. Educated Group's Perception of the Importance of Forests in Combating Climate Change

When it came to the question whether the respondents could agree to leave their private jobs if they discovered that it was affecting the environment negatively, out of 201 respondents, 97 respondents (48.3%) agreed strongly, 87 respondents (43.3%) agreed, 9 respondents (4.5%) neither agreed nor disagreed, 4 respondents (2%) disagreed strongly, while 4 respondents (2%) disagreed (Figure 27).

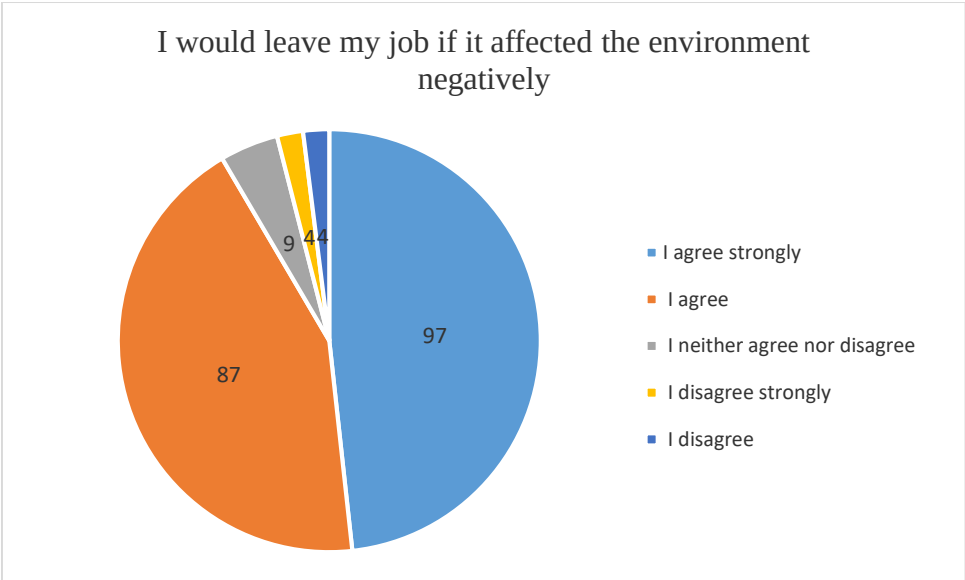

Figure 27. Educated Group's Willingness to Accept Climate Change Mitigation

4.4.3 Evaluation of Perception of Forest Conservation of the Control Group

The results showed no big difference between the first and second surveys. The t value also indicated a minimal difference and change.

Table 7. Paired Sample T Test: Control Group Climate Change Perception

			95% Confidence Interval of the Difference				
(Pair) Perception of Forest Conservation (1)- Perception of Forest Conservation (2)	Mean	Std. Deviation	Lower	Upper	t	df	Sig. (2-tailed
	.000	.345	-.182	.182	.000	16	.269

4.4.4 Effect of Climate Change Education on Perception of Forest Conservation

The perception of forest conservation which the respondents showed before climate change education was labeled perception of forest conservation (1) while the perception which they exhibited after climate change education was labeled as perception of forest conservation (2), as shown by table 8.

Table 8. Paired Sample T Test: Educated Group's Perception

			95% Confidence Interval of the Difference				
(Pair) Perception of Forest Conservation (1)- Perception of Forest Conservation (2)	Mean	Std. Deviation	Lower	Upper	t	df	Sig. (2-tailed
	-1.781	.585	-1.862	-1.700	-43.189	200	.000

4.5 Willingness to Pay for Forest Conservation

When it came to the question as to whose responsibility is it to fight climate change, out of 220 respondents, 52 respondents (23.2%) picked international organisation. On the other hand, 122 respondents (55.5%) indicated the nation government, 37 respondents (16.8%) indicated local government, and 10 respondents (4.5%) indicated everyone, as shown by figure 28.

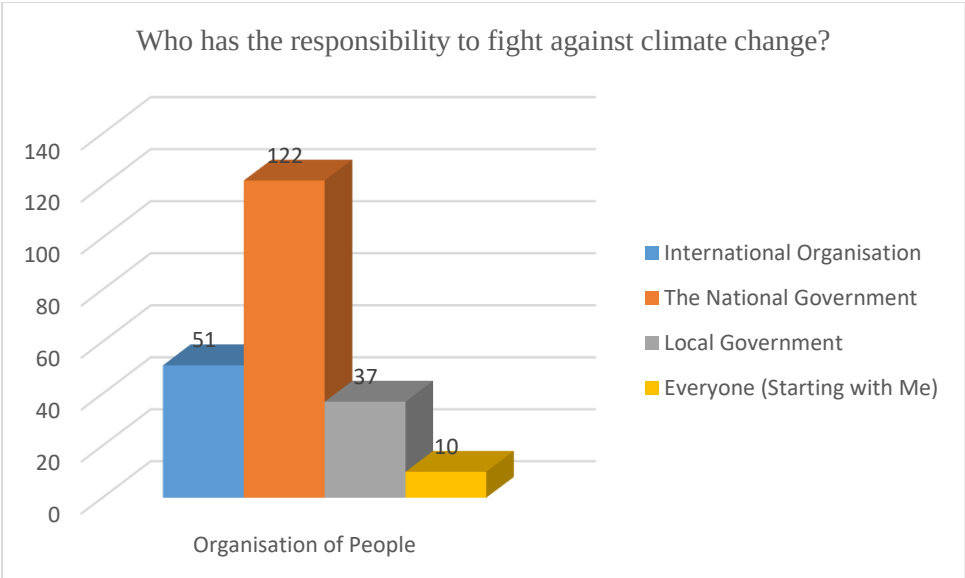

Figure 28. Local People's Perception of Responsibility for Climate Change Mitigation

When it came to how much they were willing to pay for forest conservation, out of the 220 respondents, 34 respondents (15.5%) pledged to pay nothing, while 186 respondents (84.5%) pledged K1. As figure 29 shows, the sum of willingness to pay was 186 Kwacha. The mean was K0.85. However, $1=K22.

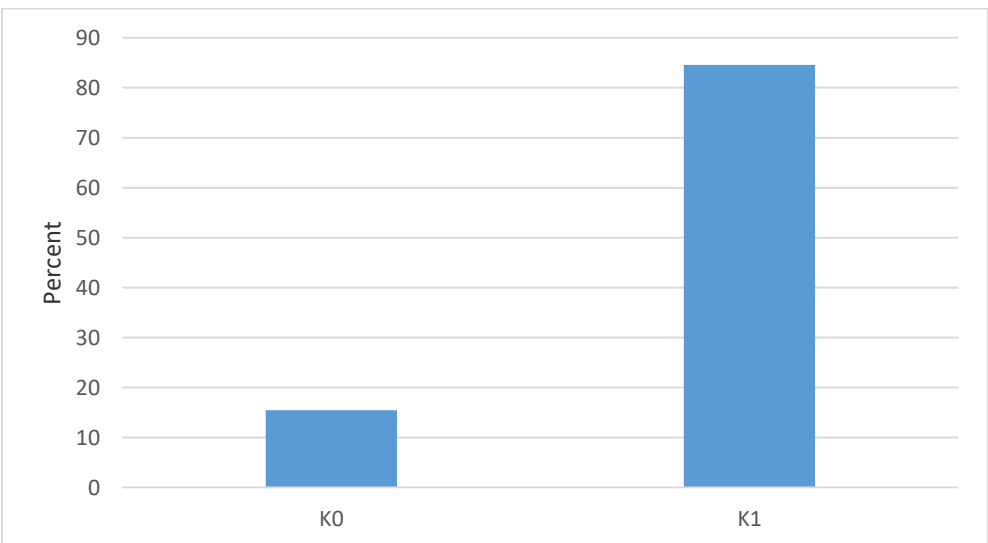

Figure 29. Local People's Willingness to Pay for Forest Conservation

4.5.1 Willingness to Pay for Forest Conservation of the Control Group

When it came to indicating whose responsibility it is to combat climate change, out of 17 respondents, 1 respondent indicated International Organization, 1 respondent indicated the National Government, and 15 respondents indicated the Local Government (Figure 30).

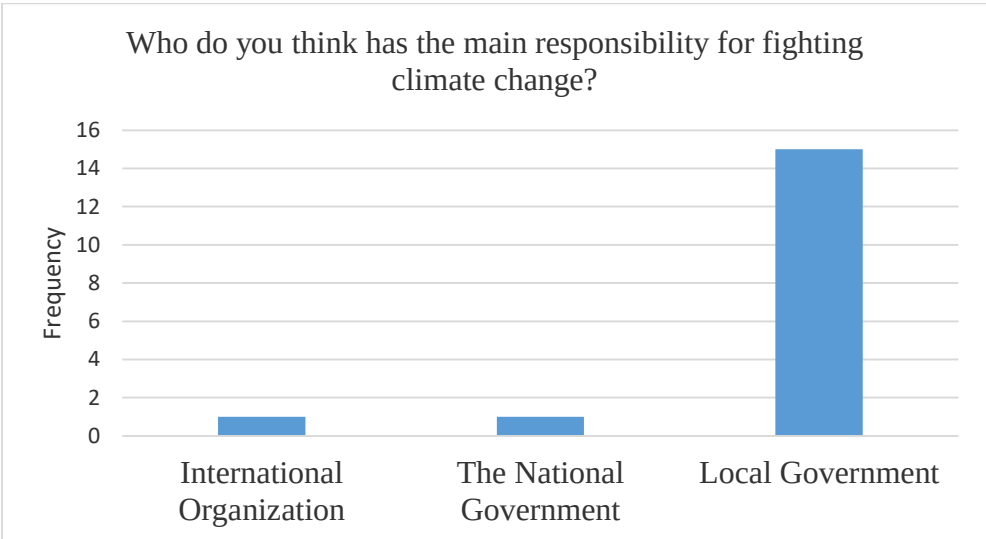

Figure 30. Control Group's Perception of Responsibility for Climate Change Mitigation

Based on figure 31, out of 17 respondents, 1 respondent pledged to pay nothing (K0), while16 respondents pledged to pay K1 each. The sum pledged was K15 and the mean was K0.94 ($1=k22).

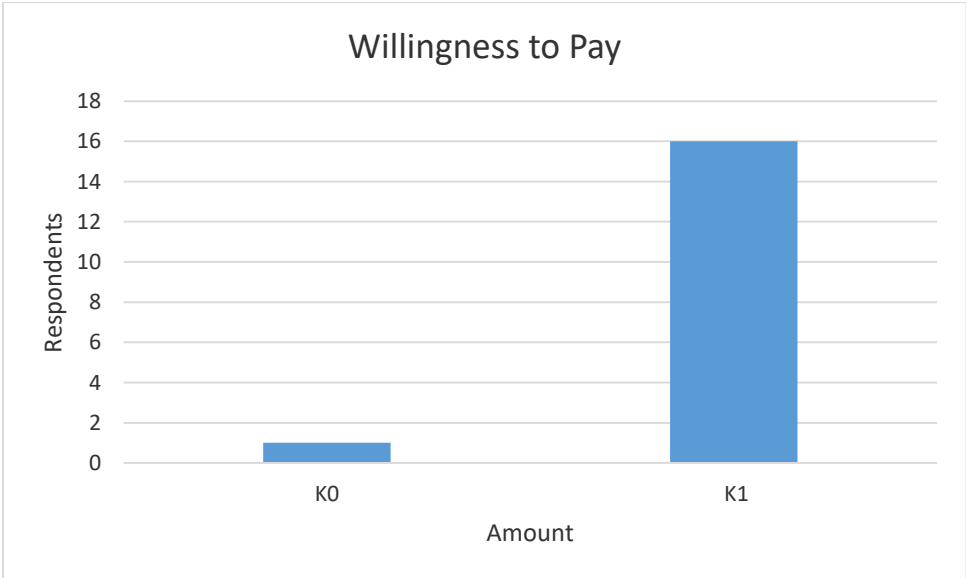

Figure 31. Control Group's Willingness to Pay for Forest Conservation

4.5.2 Willingness to Pay for Forest Conservation of the Educated Group

When it came to indicating which group of people the respondents thought has the responsibility of mitigating climate change, out 201 respondents, 189 respondents chose everyone (starting with me), 1 respondent chose specific people, 2 respondents chose local government, 3 respondents chose the national government, and 6 respondents chose international organization (Figure 32).

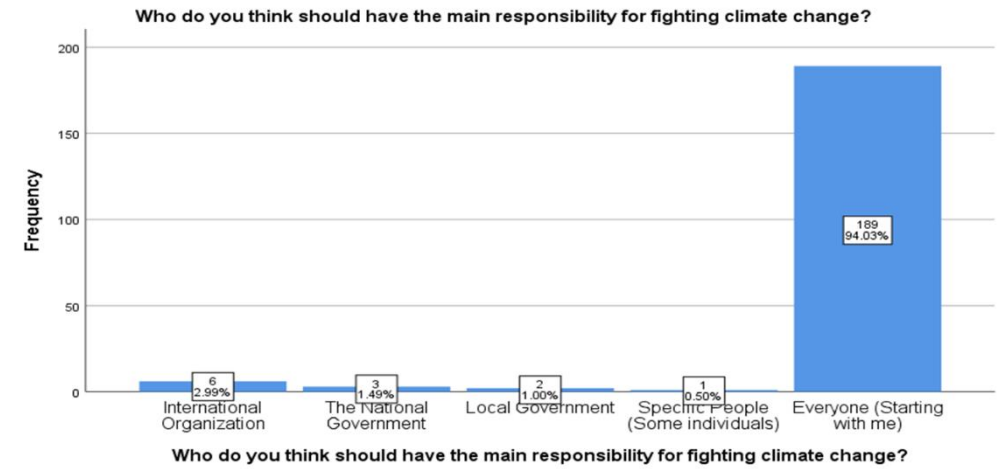

Figure 32. Educated Group's Perception of Responsibility for Climate Change Mitigation

Basing on figure 33, out of 201 respondents, 2 respondents (1%) pledged to pay nothing (K0). 15 respondents (7.5%) pledged K1, 71 respondents (35.3%) pledged K2, 61 respondents (30.3%) pledged to pay K4, and 26 respondents (12,9%) pledged to pay more than K5. The sum pledged was K574 and the mean was K2.86. $1=k22.

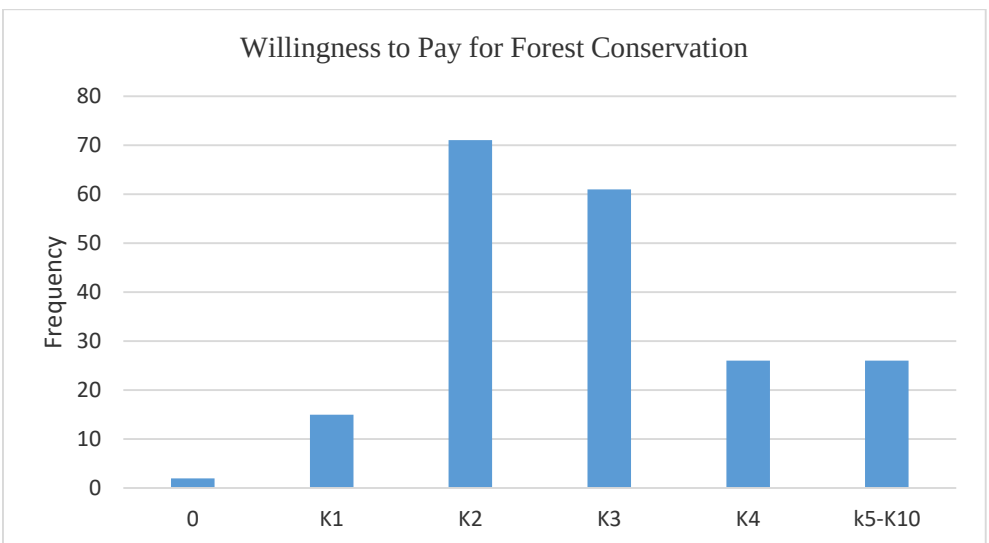

Figure 33. Educated Group's Willingness to Pay for Forest Conservation.

4.5.3 Evaluation of Willingness to Pay for Forest Conservation of the Control Group

The difference between the amount they exhibited in the first survey from the amount they pledged in the second survey, showed a minor change. The mean and the t value were so close to zero too, as shown by table 9 below.

Table 9. Paired Sample T Test: Control Group: Willingness to Pay

			95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Lower	Upper	t	df	Sig. (2-tailed
(Pair) Willingness to Pay (1)- Willingness to Pay (2)	.000	.500	-.257	.257	.000	16	.332

4.5.4 Effect of Climate Change Education on Willingness to Pay for Forest Conservation

Computation of willingness to pay for forest conservation before climate change education against willingness to pay after climate after climate change education, as shown below by Table 10.

Table 10. Paired Sample T Test: Educated Group's Willingness to Pay

			95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Lower	Upper	t	df	Sig. (2-tailed
(Pair) Willingness to Pay (1)- Willingness to Pay (2)	-1.995	1.206	-2.163	-1.827	-23.449	200	.000

As may have been observed, the paired sample T Test clearly denotes the difference between the mean and explains that the differences were either happening out of random error or not. In order to estimate the effect size of the difference, in this case the effects size of climate change education on willingness to pay for forest conservation, Cohen's d was employed.

$$\text{Cohen's d} = \frac{t}{\sqrt{N}} \text{ or } \textbf{Cohen's d} = \frac{\textbf{Mean}}{\textbf{Standard Deviation}}$$

Cohen's d = $\frac{1.995}{1.206}$ = 1.654.

Chapter 5. Discussion

The aspiration to conduct this research came as a result of curiosity to discover the best starting point to getting people more involved in the conservation of forests, for forests are key in mitigating climate change and its effects. To the knowledge of the researcher, this is the first study, in Zambia, that narrowed its focus on the impact of climate change education on local community's perception of forests conservation. The underlying assumption was that if climate change knowledge could be imparted on the local community, it would, in turn, impact their perception of forest conservation, as a result of the knowledge of the role that forests play in the carbon cycle. Eventually, it would increase their willingness to pay for forest conservation. This research begun by postulating that there is a no statistical independence between knowledge and perception, and that there is a significant correlation between climate change knowledge and perception of forest conservation. Lastly, this study projected that climate change education contributes to the promotion of forest conservation; for it serves to enhance climate change knowledge, perception of forest conservation and, lastly, but not the least, increases willingness to pay for forest conservation. Fortunately, this has been reflected in this research. Therefore, the results of this study could serve as an empirical evidence in the growing interest of promoting dissemination of climate change knowledge in the collective call to combat climate change.

5.1 The Relationship Between Knowledge and Perception

Studies have shown that there is a positive correlation between knowledge and perception, and that an increase in knowledge entails an increase in perception (Siegrist et al, 2002; Young, 2003; Okezie-Okeh et al., 2015). This was the building point of this study. Subsequently, the results of this study are also in agreement of previous studies. When educational level

was computed against perception of the importance of forest conservation, results showed that a higher educational level attainment also signaled a better perception and disappearance of uncertainties, as shown by figure 34 below.

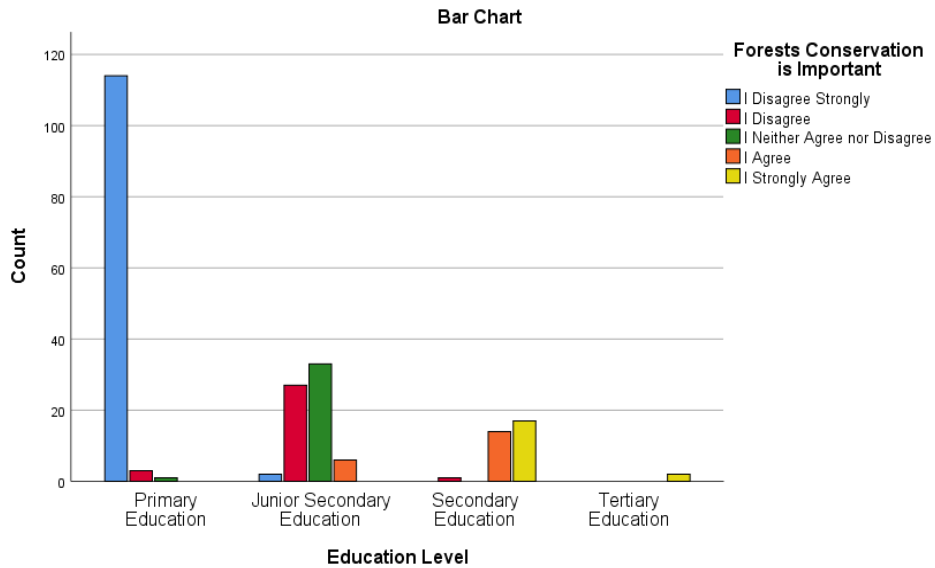

Figure 34. Educational Level versus Perception of Forests

Further, this study also supports that there is no independence between knowledge and perception and that there is a positive correlation between climate change knowledge and perception of forest conservation. Hence, an increase in climate change knowledge would equally result in a better perception of forest conservation and a higher willingness to participate in forest conservation, as table 12 summarizes.

5.2 Climate Change Knowledge

A growing body of literature suggests that people's apathy to environmental issues is as a result of low climate literacy (McCright and Dunlap, 2011). Recent past studies also indicate that accurate knowledge about the causes of climate change is an important determinant of both behavioral intentions and support for climate protection policy measures

(Bord et al. 2000; O'Connor et al. 1999). Further, they also assert that lack of basic knowledge (e.g., about causes, impacts, and solutions) by laypeople is an important barrier to personal engagement (Lorenzoni et al. 2007; Tobler, 2012). This is what this study also discovered. When the study assessed how much people knew about climate change before conducted climate change education, as already shown, very few people had the basic information on climate change. Moreover, out of 220 respondents, 137 respondents (62.3%) stated that they had not heard of climate change. In a way, the first survey results, on climate change knowledge, were in line with the findings of Kumar, (2019), who discovered that urban students are far better than rural students, as urban students have better understanding than rural students on global warming and climate change. As the case of this study, a rural community showed a low understanding of climate change issues before they went through climate change education.

Building on the fact that climate change is a global problem and that it needs everyone to get involved from all walks of life, inclusive of the local community. In order to tackle it, however, as Kumar (2019) also emphasizes, it requires introducing a basic and common understanding of public vulnerability involved with climate change. Given that reasoning, this study is supported, in that, it also begun from a basic and common idea that as soon as people understand about the differential features of the atmosphere, they can employ their efforts, not only to face immediate challenges, but even partake in fighting against long term effects, through promotion of forest conservation (Tobler, 2012). This is what climate change education did in our study. It enhanced the knowledge of the local community on climate change, especially the role that forests play in the carbon cycle. In the due course, as other studies also support, climate change knowledge and the role that forests play in the carbon cycle, played a crucial part in the climatic knowledge

development of the local community (Kumar, 2019; Tobler, 2012). Therefore, the findings of this study also supports that climate change knowledge is a prerequisite of good climatic behavior and perception (JingShi et al., 2016).

5.3 Perception of Forest Conservation

Knowledge is perceived as important for successful action (Tobler, 2012; Hung, 2014). Consistent with this, knowledge-based campaigns have always been a popular means of promoting certain behaviors in the general public, like conservation behavior (Frick, 2004; Boerschig and Deyoung, 1993). A good example is in health. In health, knowledge is provided to encourage people to avoid harmful behavior (Buller & Borland, 1999) or drunk driving (Mann, Leigh, Vingilis, & Genova, 1983). In all these enterprises, knowledge is regarded as a means to overcome psychological barriers such as ignorance and misinformation; it is also viewed as a necessary precondition for successful action (Frick, 2004). In other words, knowledge may be considered at least as a fuel of other mechanisms that facilitate behavior change (cf. Pratkanis & Turner, 1994; Ronis & Kaiser, 1989; Schahn & Holzer, 1990). Further, studies suggest that, in order to be fully effective, educational campaigns should be designed with a profound understanding of the underlying knowledge structure (Frick, 2004). It is important to ascertain how much people already know and what type of knowledge is essential to promote the target behavior (Anderson, 1976), and this is what this study did. Before embarking on climate change education, the local community was assessed on how much they understood climate change and how they perceived forests and forest conservation.

This study, therefore, supports the findings of Kathryn T., et. al, (2014) that climate change knowledge affects perception of forest conservation, in that, both the knowledge and perception that the local

community exhibited before climate change education was different to that which they did after climate change education. On the other hand, the perception of the control group continued to be the same or rather showed no visible changes despite being surveyed on two different times. In the study of Tobler et al., (2012), it was discovered that higher levels of climate change knowledge are associated with higher climate change risks perception. So, in order to raise perception and to overcome skepticism, education is needed (Stevenson et al., 2014). This is what climate change education did in this study. This paper supports that local communities have poor knowledge of climate change and that affects their perception (Kumar, 2019; Higuchi et. al., 2018; Huda, 2013, Daba et al., 2018; Huda, 2013; Kabir et. al., 2016; Sjoberg, 1999).

In the first survey, out of 220 respondents, 25 (11.4%) stated that climate change is caused by human causes, 123 (55.9%) stated that they did not know, while 72 (32.7%) stated that it is caused by natural causes. When it came to who has the responsibility to fight climate change, 51 (23.29%) stated that International Organization, 122 (55.5%) stated that the National Government, 37 (16.8%) stated that the Local Government, and finally, 10 (4.5%) stated everyone. Further, when it came to whether climate change was something that frightened them, 37 (16.8%) stated yes, while 183 (83.2%) stated no. Nevertheless, after climate change education, there was an increase in the knowledge of the causes of climate change. Out of 201 who got educated, 188 (93.51%) stated that climate change is caused by human causes. This study also observed a change in terms of who has the responsibility to fight climate change. Out of 201, 189 (94%) indicated that everyone. When it came to whether climate change is something that frightens them, 192 (95.5%) stated yes. However, after probing further the respondents who were not frightened by climate change after climate change education, a good number of them stated that they were not scared of climate change owing to

that there is something that could be done to combat it. Finally, when it came to forests being important in the fight against climate change, out of 201, 181 (90%) agreed strongly, 14 (7%) agreed, while only 6 (3%) neither agreed nor disagreed. Therefore, this study supports other studies that state that there is a positive correlation between climate change knowledge and perception of forest conservation and so an increase in climate change knowledge enhances perception of forest conservation (Frick et al., 2004).

5.4 Willingness to Pay for Forest Conservation

In the recent past, more studies have come up, agreeing to the importance of forest conservation in the fight against climate change (Bakaki and Bernauer, 2016; Hung, 2014; Tobler, 2012). The call, for now, is to get everyone involved in safeguarding forests. However, when it comes to estimating how much local people are willing to pay for forest conservation, this study supports the studies of Bakaki and Bernauer, (2016); Michael and Elvin, (2014), who agrees that to enhance willingness to pay for forest conservation, knowledge is key. In addition, in the findings of Lawi, Ogunsola and Polycarp, (2017) it was discovered that knowledge has both direct and indirect effect on perception; for instance, of forest conservation, and subsequently, influences people's unwillingness/willingness to pay. The willingness to pay, in the case of the group that did not attend climate change, in the first survey, did not differ very much from the willingness to pay for forest conservation in the second survey. There was no statistical difference. However, with the group who participated in the climate change educationprogram, there was a great shift in the willingness to pay for forest conservation in the first survey and the willingness to pay for forest conservation, after climate change education, in the second survey. To this end, like the aforementioned studies, this study agrees that knowledge, especially climate change knowledge is necessary to get people to pay more

for forest conservation. This is what climate change education did in our study. In the first survey, before the local community underwent climate change education, the sum of their willingness to pay was K186 and the mean was K0.85. After climate change education, the sum of their willingness to pay increased to K574, while their mean was K2.86. In addition, according to Cephas et al., (2014), consumers tend to pay more once they perceive that a good or service improves their life. so, the increase, in terms of the local community's willingness to pay, was as a result of their newly perceived understanding of the role that forests play in the fight against climate change.

This study also supports the works of De-Graft and Onumah, (2011), that poor perception is as a result of low information. This why the works of (Frick et al., 2014; Combs, 1965; Hung, 2014; Soler, 2004), commonly perceived knowledge as a necessary precondition for a person's behavior. This is what climate change education did in this study. It availed the local community to the reality of the causes of climate change, the effects of climate change, and the management of climate change, and with that at their disposal, the local community were given more reasons to get involved (Keating, 1993). It is only through education that people can develop a sense of concern for what is happening on both local and global scales, and be encouraged to take appropriate action, in case of this study, to willingly pay more for forest conservation (Hale, 1993).

5.5 Estimation of Effect Size of Climate Change Education on Willingness to Pay for Forest Conservation

The effect size of willingness to pay for forest conservation by the control group was zero. This is because both the mean and the t value were 0.000 on the paired sample t test results, despite standard deviation being 0.500. According to Cohen's d formula:

Cohen′s $d = \frac{t}{\sqrt{N}}$ or **Cohen′s d** $= \frac{\textbf{Mean}}{\textbf{Standard Deviation}}$, for the control group's effect size: $\frac{0.000}{0.500} = 0$.

Cohen's $d = \frac{1.995}{1.206} = 1.654$, for the educated group.

The assumption of the effect size is that the null hypothesis always means that the effect size is zero (Fritz et al., 2011). Therefore, to reject the null hypothesis, the effect size is supposed to be some specific nonzero value in the population, whatever the manner of representation of a phenomenon, in a particular research (Fritz et al., 2011). By this, it can now readily be made clear that when the null hypothesis is false, it is false to some specific degree. Building on this, Cohen's d, proposed the following guideline to estimate the effect size:

Table 11. Effect Size (Fritz et al., 2011)

Relative size	Effect size	% of control group below the mean of experimental group
	0.0	50%
Small	0.2	58%
Medium	0.5	69%
Large	0.8	79%
	1.4	92%

Therefore, given Cohen's *d*=**1.654,** it can be clearly stated that the second null hypothesis was rejected strongly by the educated group, for climate change education's magnitude on the local community was large. Further, this can state that an increase in climate change knowledge, which later impacted on perception of forest conservation, could also help us estimate an increase in willingness to pay for forest conservation. All in all,

given the effect size of the impact of climate change education on climate change knowledge, on perception of forest conservation, and lastly, on willingness to pay for forest conservation, this study therefore, statistically asserts that climate change education contributes to the promotion of forest conservation, for it unfolds information that was lacking and unveils participants to willingly to pay more for forest conservation.

Table 12. Summary of Impact of Climate Change Education Program

Topic	**Question**	**Answer**	**Before Education Count (%)**	**After Education Count (%)**
Climate Change Knowledge	Have you heard of climate change?	Yes	83 (37.7%)	200 (99.5%)
		No	137 (62.3%)	1 (0.5%)
	Are weather patterns changing?	Yes	201 (91.4%)	201 (100%)
		No	19 (8.6%)	0 (0%)
Causes of climate change	What is the cause of climate change?	Nature	72 (32.7%)	11 (5.47%)
		Humans	25 (11.4%)	188 (93.5%)
		Do not know	123 (55.9%)	2 (1%)
Description of climate change knowledge		I have a good idea	0 (0%)	172 (85.57%)

		I have some ideas	9 (4.1%)	15 (7.46%)
		I have heard of it but don't really know	74 (33.6%)	11 (5.5%)
		Not really sure	137 (62.3%)	3 (1.49%
Perception of Forest Conservation	Do you feel some use of forests and forests products affect forests?	Yes	22 (10%)	197 (98%)
		No	27 (12.3%)	3 (1.5%)
		I don't know	171 (77.7%)	1 (0.5%)
	Is climate change something that frightens you?	Yes	37 (16.8%)	197 (95.5%)
		No	183 (83.2%)	9 (4.5%)
	Do you believe something could be done to mitigate climate?	Yes	33 (15.0%)	196 (97.5%)
		No	3 (1.4%)	
		I don't know	184 (83.6%)	1 (0.5%)
Willingness to Participate in Forest Conservation	Forests are important in the Fight against climate change	I strongly agree	8 (3.6%)	4 (2.0%)
		I agree	4 (1.8%)	181 (90%)
		I neither agree	208	14

	nor disagree	(94.5%)	(7.0%)
	I disagree strongly	0 (0%)	6 (3.0%)
	I disagree	0 (0%)	0 (0%)
I would leave my job if it affected the environment negatively	I strongly agree	32 (14.5%)	97 (48. 3%)
	I agree	43 (19.5%)	87 (43.3%)
	I neither agree nor disagree	131 (59.5%)	9 (4.5%)
	I disagree strongly	12 (5.5%)	4 (2.0%)
	I disagree	2 (0.9%)	4 (2.0%)
Who do you think should have the main responsibility for fighting climate change?	International Organisation	51 (23.2%)	6 (3.0%)
	The National Government	122 (55.5%)	3 (1.5%)
	Local Government	37 (16.8%)	2 (1.0%)
	Everyone	10 (4.5%)	190 (94.5%)
How much are you willing to pay for forest conservation?		K186	K574

Chapter 6. Conclusion

This study and the research problem were developed based on three fundamental premises: first, there is no statistical independence between knowledge and perception; second, there is a positive correlation between climate change knowledge and perception of forest conservation; and, third, climate change education contributes in the promotion of people's attitude towards forest conservation. Focusing on the findings of this study, the outcome of this study, first of all, supports that there is no independence between knowledge and perception. Secondly, also proves that there is a positive correlation between climate change knowledge and perception of forest conservation. Thirdly, the output of this study can contribute effectively to the promotion of local communities' involvement in climate change mitigation projects, especially in the conservation of forest conservation.

The results of this study suggests that local communities' willingness to participate in forest conservation is highly influenced by their perception of forests, forest conservation, and knowledge of climate change. As a result, this study also suggests and agrees that ignorance of the role forests play in combating climate change negatively impacts on perception of forests and forest conservation. In particular, the results of this study show that ignorance of the causes of climate change affects local communities' attitude towards forest conservation. Further, the findings of this study validates the need for climate change education among the local communities. This is justified in this study, in that, unlike the control group which continued to be in a state of ignorance, after climate change education, the local community (educated group) had a better understanding of climate change, a greater perception of forest conservation, and lastly, an increased willingness to pay for forest conservation. Therefore, in the quest to get everyone from all walks of life engaged in the safeguarding of forests, in view of mitigating the impact of climate change, this study recommends climate change education to be

extended to different local communities. Further, in the fight to narrow the gap between experts or climate change scientists and the local communities, climate change knowledge should be transmitted to local communities in the context of their setting. It should be tailored for place-based climate change engagement needed (Schweizer, 2013; Alan, 2019). This is why this study recommends the publication of climate change information in local languages, arrangement of seminars, symposiums, workshops, group discussions, and also school curriculum to emphasise climate change issues. If different people have to be involved in the fight against climate change, equally, climate change knowledge should be inculcated in fitting setting of every person's or culture's uniqueness, in so doing, different and diverse cultures will all be responding to the same problem using their available means and actions. As this study showed, inasmuch as people are not able to identify the damages and dangers associated with their actions, they will continue to contribute to the problem and not to the solution. This is why UNFCCC, ESD, SDG, Paris Agreement, and CCE all support that the role of scientists is not to change the climate, but the mindset of people.

Nevertheless, despite that this study proved that climate change education as positive impact on perception of forest conservation, and willingness to pay for forest conservation, there could still be other factors that could impact practically the engagement of local communities in forest conservation. The impact of climate change knowledge could be the starting point, but other incentives and factors should also be measured that could practically entice local people to participate in forest conservation. Future study should investigate factors such as economic incentives or other factors, such as land tenure and regulations. Moreover, inasmuch as this study involved two surveys and conducting climate change education, it would be necessary to plan it articulately, so that all costs are well catered for.

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Appendix I: The Interview Questionnaire

SEOUL NATIONAL UNIVERSITY
College of Agriculture and Life Sciences
Department of Forest Science

Interviewer:_____ Respondents ID:_____

1. PERSONAL INFORMATION

1.Sex
- ☐ Male
- ☐ Female
- ☐ I prefer not to indicate

2. **Please indicate the age or age bracket you are in: (Age: _____ years old).**

3. Marital Status:
- ☐ Married
- ☐ Single
- ☐ Divorced
- ☐ Widow/Widower

4. Household size (_____)
- ☐ 1-5
- ☐ 6-10
- ☐ 11-15
- ☐ Others

5. What is your highest qualification?
- ☐ No Education
- ☐ Primary School
- ☐ Junior Secondary School
- ☐ Secondary School
- ☐ diploma
- ☐ certificate
- ☐ Degree or equivalent
- ☐ Postgraduate

6. How much do you earn -like every month?
- ☐ K1-K50
- ☐ K50-K100
- ☐ K150-K200
- ☐ K200-K300

7. Do you feel the pattern of the weather is generally changing?

- ☐ Yes
- ☐ No
- ☐ Don't know

8. Have you ever heard of climate change?

- ☐ Yes
- ☐ No
- ☐ Don't know

9. How would you describe your knowledge of what climate change means?

Choose one answer only:

- ☐ I don't really know what climate change means
- ☐ I have heard of climate change, but I am not really sure of what it means
- ☐ I think I have some ideas
- ☐ I think I have a good idea of what climate change is

10. Who do you think should have the main responsibility for tackling climate change?

Please tick one box only

- ☐ International Organizations (e.g. UN)
- ☐ The National Government
- ☐ Local Government
- ☐ Some Individuals
- ☐ Everyone, starting with me.
- ☐ Others (Please write in _____)

II. Climate Change Knowledge: Causes of Climate Change

Please indicate how much you agree or disagree with the following statements about climate change by ticking one box on each row.

	Agree Strongly	**Agree**	**Neither agree nor disagree**	**Disagree**	**Disagree strongly**
11.Human activities have no significant impact on climate change					

12. Charcoal burners should take the blame also for climate change

13. Cutting forests adds to climate change

14. Humans are severely abusing the planet

15. What do you think are the major causes of climate Change

- ☐ Nature itself
- ☐ Human Beings
- ☐ I do not know

16. Do you believe that mankind should do anything to change the rate of climate change?

- ☐ Yes
- ☐ No
- ☐ I do not believe climate change is happening

III. Climate Change Knowledge: Effects of Climate Change

Please indicate how much you agree or disagree with the following statements about climate change by ticking one box on each row.

Agree Agree Neither agree Disagree Disagree

Strongly Nor disagree strongly

17. The effects of climate change are likely to be

catastrophic

18. Climate change effects will improve the weather

of Zambia.

19. Climate change effects will impact negatively on agriculture,

animals, and every human being

20. Do you think climate change is something that is affecting or is going to affect you, personally?

- Yes
- No
- Don't know

21. If yes, in what way(s) is it affecting you or going to affect you?

_____
_____
_____
_____
_____
_____

IV. Climate Change Knowledge: Climate Change Management

22. By ticking one box on each row, please indicate how much you would trust information about climate change if you heard it from…

	A lot much	**A little all**	**Not very**	**Not all**	**Can't choose**
A family Member					
A scientist					
The government					

An environmental organization

(Zambia Forestry Department)

Media (radio, television, newspaper)

Please indicate how much you agree or disagree with the following statements about climate change by ticking one box on each row.

Agree Agree Neither agree Disagree Disagree

Strongly Nor disagree strongly

23. Trees have same rights as humans to exist

24. There is a balance in nature which should not be

disturbed by over harvesting of trees

25. Planting of trees helps in fighting climate change

26. Forests are so important in the fight against climate

Change

27. Every tree is important when it comes to

Forest conservation

3. EFFECT OF CLIMATE CHANGE KNOWLEDGE

3.1 Effects of Climate Change Knowledge on Perception of Forest Conservation

28. Do you feel climate change is happening or is going to happen?

- ☐ Yes
- ☐ No
- ☐ Don't know

29. How important is the issue of climate change to you?

- ☐ Very important
- ☐ Quite important
- ☐ Not very important
- ☐ Not important
- ☐ Don't know

30. Do you think climate change topic is relevant to you?

- ☐ Yes
- ☐ No
- ☐ Don't know

31. Would like to learn more about climate change?

- ☐ Yes
- ☐ No
- ☐ Don't know

32. Do you believe that something could be done to mitigate climate change?

- ☐ Yes
- ☐ No
- ☐ Don't know

33. Do you feel climate change is something that frightens you?

☐ Yes

☐ No

☐ Don’t know

34. Do you think it is dangerous to use forests to their depletion?

☐ Yes

☐ No

☐ Don’t know

35. who do you think should have the main responsibility for protecting forests?

Please tick one box only

☐ International Organizations (e.g. UN)

☐ The National Government

☐ Local Government

☐ Some Individuals

☐ Everyone

☐ Others (Please write in _____)

36. How often do you go into the forest?

☐ Very often

☐ Not often

☐ Don’t go into

37. What uses do you put the forest to? Tick as many as are appropriate

☐ Cutting trees for charcoal

☐ Cutting for fire wood

☐ Don’t know

☐ medicine

☐ worship and recreation

☐ Any other_____

38. Do you think some forest uses affect the forest?

- ☐ Yes
- ☐ No
- ☐ Don't know

39. If yes, which forest uses affect forest? Tick as many as appropriate

- ☐ Cutting trees for charcoal
- ☐ Cutting for fire wood
- ☐ Don't know
- ☐ medicine
- ☐ worship and recreation
- ☐ Any other_____

40. Have you ever taken, or do you regularly take any action out of concern for climate change?

- ☐ Yes
- ☐ No
- ☐ Don't know

41. If yes, what actions have you taken?

_____
_____
_____
_____
_____

Please indicate how much you agree or disagree with the following statements about climate change by ticking one box on each row.

	Agree Strongly	**Agree**	**Neither agree Nor disagree**	**Disagree**	**Disagree strongly**
42. I cannot join forest conservation while other people are busy cutting trees					

☐ ☐ ☐ ☐ ☐

43. I can make a difference through preserving forests and cutting trees

☐ ☐ ☐ ☐ ☐

44. I can all do my bit to reduce the effects of climate change

☐ ☐ ☐ ☐ ☐

45. If my job caused environmental problems, I would rather be unemployed

☐ ☐ ☐ ☐ ☐

46. I am willing to take personal sacrifice in fighting deforestation

☐ ☐ ☐ ☐ ☐

47. Charcoal business is more important than preserving forests

☐ ☐ ☐ ☐ ☐

48. I can encourage a friend to practice forest conservation

☐ ☐ ☐ ☐ ☐

49. Are you a member of any forest conservation group or any environmental group?

☐ Yes

☐ No

☐ If not, go to question 50

50. Are you willing in any way to join in forest Conservation?

☐ Yes

☐ No

☐ I do not know what forest conservation is

3.2 Willingness to Pay for Forest Conservation

51. How much would you be willing to contribute if you were asked to pay, every month, concerning forest conservation?

☐ K1-K10

☐ K15-29

☐ K30-39

☐ K40-K50

☐ K55-K100

Thank you for giving up your time to complete this questionnaire. It is very much appreciated. If you would like to receive a copy of the results of this research, and if you would be willing to take part in a brief interview (either on phone or in person) please enter your postal/email address, and your phone number below:

Appendix II: Climate Change Education Guide

Climate Change Education

The main method and approach in conducting climate change education was using images and group discussion to facilitate the intended objectives. Each new heading or subtopic was beginning with group discussions, then explanations and teachings used to build on the answers that were gotten from discussions. The discussions were exciting and well animated. They helped in setting up a good foundation for learning.

A Brief Introduction to Climate Change Education

Assessment on Weather Patterns

Rainfall: Flooding/period of Rain Season

Coldness: Temperatures/period of coldness

Hot Season: Temperature/ period of hotness

Group Questions

- **Where are we (humankind) going in terms of climate?**

- Do you feel there is:
- more rainfall or less rainfall in the future?
- Colder or less cold in the future?
- Hotter or less hot is the future**?**

- **What is causing our climate to change?**

- It is just the natural makeup of the earth that is making our climate to change.
- It is human beings making climate to change.
- It is both human beings and natural causes that are causing our climate to change.

- It is both human being and natural causes, but the rate at which human causes are happening is way more than natural causes.

Definition of Climate Change

After hearing the different answers, the concept of climate change was introduced. Climate change was defined, first of all by separating the two words, climate and change. Climate is the average of the weather conditions at a particular point on the Earth (Bothe, 2018). Typically, climate is expressed in terms of expected temperature, rainfall and wind conditions based on historical observations (Bothe, 2018). On the other hand, to change denotes to alter something or to make something different. Climate change is a change in either the average climate or climate variability that persists over an extended period (Kreslake et al., 2016). In simpler terms, climate change refers to the idea that the world's average temperature has been increasing for the past 150 years, may be increasing in the future, and that the world's climate is changing as a result (Kreslake et al., 2016). After the definition, the objective of conducting climate change education was outlined, in which it was started that the objective of climate change education is to improve understanding of forest conservation based on a better understanding of climate change, the causes, the effects and management of climate change.

Causes of Climate change

When tackling the causes of climate change, it was necessary to go back to the introductory group discussions on what is causing our climate to change. All the given options as answers to the questions for discussion were explored and discussed. However, the main emphasis was on reviewing option four (4), for it had both human and natural causes.

Natural Causes of Climate Change

The Earth's climate has always changed. Changes in the Earth's orbit, the energy output of the sun, volcanic activity, the geographic distribution of the Earth's land masses and other internal or external processes can influence climate. Scientists refer to this type of long-term climate change as natural climate change (Susan and Mario, 2010). As a result of natural climate change, the earth has experienced regular cold periods (or hot periods) in the past. The natural imbalance that may cause such was explained, but already it could be observed that many people could not clearly be for the idea, for such natural imbalances are rare.

Anthropogenic Causes of Climate Change

If natural causes were the only type of climate change, then the interest to sociologists would be minimal. However, scientific observations and models indicate that the Earth's climate is now changing due to human activity. This is termed anthropogenic climate change (UNFCCC, 2007). The processes involved are complex but can be summarised as follows. Human activities, such as burning fossil fuels, suchcoal, oil and natural gas) to make electricity and power vehicles, clearing forests for farms and cities, and cultivating livestock, release greenhouse gases into the atmosphere. Over time, the enhanced greenhouse effect results in global warming; an increase in the Earth's average temperature (Tombe, 2013; Schweizer et al., 2013). Global warming is one type of climate change and it drives other changes in the climate, such as changes in rainfall patterns and the frequency and distribution of weather events such as droughts, storms, floods and heat waves (UNFCCC, 2007).

Figure 35. Illustration of Greenhouses Gases Actions using Blanket. (Loffler's Image, 2019)

In simpler terms, the main greenhouse gases are carbon dioxide, methane, halocarbons, and nitrous oxide. These gases accumulate in the atmosphere and allow radiation from the sun to pass through but trap some of the heat radiating back from the Earth (UNESCO, 2010). This is called the greenhouse effect because the principle is similar to a greenhouse, where the glass roof allows sunlight in but traps heat for growing plants (UNFCCC, 2007). The question that may follow is, how does that have to do with the local communities?

The Effects of Climate Change

Human senses are good at identifying short-term environmental changes, but not so good at noticing long-term climate changes. In order to understand well the effects of climate change, a question that helped the discussion is that, what could happen when the earth became so hot?

Figure 36. Illustration of the Effect of Climate Change on life on Earth. (Climate Change Transparency, 2017)

The impact of climate change is and will be devastating for natural and human systems. Hence, that climate change poses an existential threat to human civilization. Climate change means that the land, the forest, the water resources, animal behavior, crop production, and other things on earth are going to change (FAO, 2018, Tombe, 2013). The way we grow food, the types of plants that can live in different areas, the patterns of rainfall and hot and cold weather will all continue to change if we do not halt the process of global warming and climate change. Humans, plants and animals will not be able to survive in areas that get too hot or in places that are flooded because of rising sea levels (UNFCCC, 2007; Tombe, 2013; UNESCO, 2010). From this impression, responding to the question earlier on, what climate change has to do with the local community, we emphasized that climate change effects do not discriminate. Everyone is affected (Trenberth, 2018). The questions that followed, hinged on what could be done in order to stop climate change and its effects.

Introduction to Management of Climate change

We began with two sets of questions; one set required individual responses, the other one invited group discussion.

1. Personal Responses: Do you think anything can be done to tackle climate change?

   Yes, No, Don't know.

2. Group Questions/ Discussion: What can be done in the fight against climate change?

It is also important to make mention that as a result of pictorial presentation of how the earth could become so hot, the answers that were forwarded as a way of making the earth cooler were so intriguing and showed inner desire to learn more about climate change.

Management of Climate Change

Scientists tell us that the main culprit, one of the greenhouse gases, in climate change is carbon in the form of Carbon Dioxide (Brander, 2012). Carbon is one of the most common elements in the universe (Brander, 2012). Carbon is in the air, in the water, in the soil, in the forest and even in humans; carbon is in all things on earth (Brander, 2012). This is what makes forests very important in the fight against climate change. For forests are both a source and sink of Carbon (Susan and Mario, 2010). In order to explain contextually, how forests play an important role in the fight against climate change, a traditional African example was used, that served as a closer and contextual way of explaining climate change and the role that forests play- in Bemba *ukufutikila*-act of putting a sick person in a blanket with a hot liquid in a pot, (the idea is to make that person sweat a lot).

Figure 37. Climate Change in an African Context: ukufutikila-act of putting a sick person in a blanket with a hot liquid in a pot. The idea is to make that person sweat a lot. (Stock Photo, 115087990).

The idea behind this illustration is that, when a person is not feeling well, this could be as a result of a cold or some suspected illness associated with fever, that person will be put in a thick blanket, and a hot liquid, containing some traditional herbal medicines, will be made available. The logic behind this practice is to trap all the heat being emitted by the hot liquid, then heat, plus the steam, will make the person inside to sweat profusely. Using the same question, what could be done to make the heat reduce or make the hot environment in the blanket cooler? There were a lot of suggestions that came. Some suggested making openings in the blanket. Others suggested the removal of the hot liquid, and lastly, others suggested removing the blanket from the person covered.

From this, another step to outlined how climate change could be managed, with the help of the forests, was taken. There are two kinds of

responses to the threat identified by climate scientists: adaptation and mitigation (UNFCCC, 2007). Adaptation is a process of adjustment to climate change, in which humans take action to moderate or avoid negative impacts, and exploit beneficial opportunities (IPCC, 2001). This could involve shifting to crops that thrive in the modified climate conditions.

The other option is mitigation, or reduction in human emissions of greenhouse gases to reduce the extent of climate change (IPCC, 2001). Therefore, if there is to be survival on this earth in the future, then there will be need to stop activities that increase the release of carbon into the atmosphere and causing climate change, and learn to adapt to new ways of doing things (Susan and Mario, 2010). The call for now is mitigation, meaning stopping or reducing human emissions of greenhouse gases. Having in mind that local people do not own factories that produce pollutants in the atmosphere, so what human emissions should they stop?

In responding to this, the participants were reminded of some of the greenhouse gases mentioned earlier. Further, it was emphasized that all life on earth need carbon to grow and survive, but there is also carbon in non-living things such as rocks, gases, or fossil fuels. Further, it was illustrated how forest is both a source and sink of Carbon.

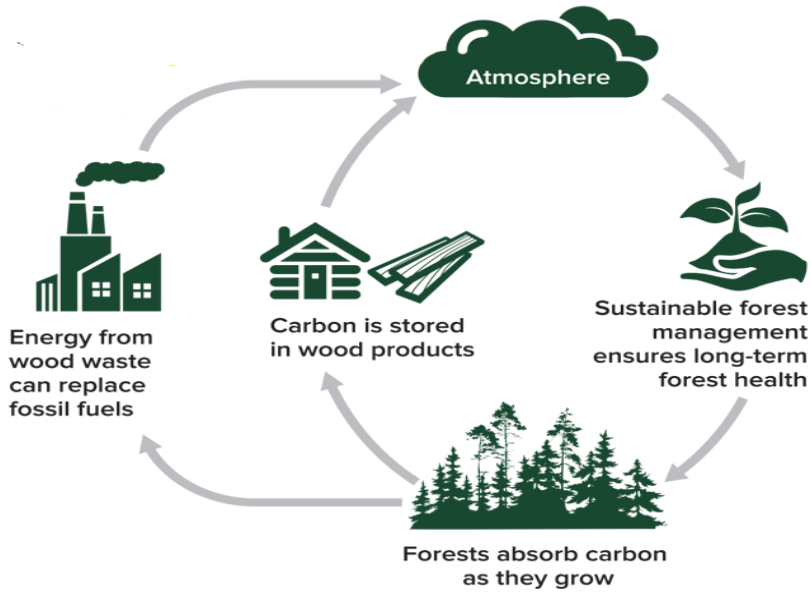

Figure 38. Forests and Carbon cycle (State of Ontario, 2016).

Humans, local people in this context, therefore, also causes climate change by deforestation and forest degradation; that is by cutting down trees, thereby producing carbon from the trees, and also by cutting down the trees that are meant to absorb the greenhouse gases from the atmosphere. Another way, is by changing the nature of the land surfaces. For example, by clearing forests for farming.

This is why forests are so important and why global deforestation is a key part of climate change. Trees remove carbon dioxide from the atmosphere through photosynthesis. They release the oxygen back into the atmosphere for us to breathe and use the carbon to build cell walls. Therefore, as long as the tree is alive, it soaks up Carbon; together trees in a forest become a carbon sink holding carbon that cannot contribute to global warming. Hence, forests with many trees store a large amount of carbon (Susan and Mario, 2010). This is where the value of forests conservation, in

climate change mitigation, comes from. It comes from the role that forests play in the Carbon Cycle, as a vital part of storing and releasing Carbon. (Houghton, 1998).

Conclusion

After this presentation, participation in a collective action of forest conservation was presented. Taking advantage of the material from literature review, on participation in conserving Katanino forest, it was outlined why each and every person is key in the fight against climate change. This presentation, ended with questions and answers, after which participants were subjected to the research questionnaire and they were reassessed on how much they understood climate change and perceived forest conservation after climate change education. The session was concluded by stressing that human beings, therefore, are both the causer and solution to climate change.

추상적 인

많은 연구에서 권장하는 것처럼 교육이 효과적이고 의도한 목표를 달성하려면 맥락에 맞아야 하고 행동에서 누락된 것을 사용할 수 있어야 합니다(Anderson, 1976; Hung, 2014; Cook et al., 2013). 이 연구는 기후 변화 교육이 산림 보존에 대한 사람들의 인식에 어떻게 영향을 미치고 산림 보존에 참여하려는 의지를 높일 수 있는지 살펴봅니다. 연구는 Katanino 산림 지역의 지역 사회에서 최대 220명의 응답자를 사용하여 수행되었습니다. 220명 전원이 1차 설문에 응했다. 220명의 응답자 중 18명의 응답자를 무작위로 선정하여 통제집단으로 분류하였고, 201명의 응답자는 기후변화 교육을 이수하고 2차 조사 설문지에 응답하였다. 즉, 본 연구는 2개의 연구조사를 실시하였으나 기후변화 교육 전후에 동일한 설문지를 각각 사용하였다. 첫 번째 조사는 지역 주민들이 기후 변화, 산림 및 산림 보존에 대해 얼마나 알고 있는지, 마지막으로 산림 보존을 위해 얼마를 지불할 의향이 있는지를 평가하는 것으로 시작되었습니다. 이후 기후변화 교육을 실시했다. 기후변화 교육 후 지역사회(대조군과 교육받은 집단)를 대상으로 2차 설문조사를 실시하였으나, 기후변화 교육 전 동일한 질문에 응답하였다.

기후변화에 대한 지역사회의 지식과 산림보전에 대한 인식을 측정하기 위해 기후변화의 원인과 영향, 관리에 대한 간단한 질문을 주었다. 마지막으로 지역사회의 산림보전 참여 의향을 추정하기 위해 지역사회가 산림보전을 위해 얼마를 지불할 의향이 있는지 묻는 우발변동법을 사용하였다. 이 연구는 두 가지 가설에 기초했습니다. 지식과 지각 사이에 유의한 독립성이 없다고 가정한 첫 번째 대립가설을 검증하기 위해 카이제곱 T 검정을 사용하였다. 기후변화 지식과 산림보존에 대한 인식이 유의한 상관관계가 있다

는 대안적 소가설을 검증하기 위해 Pearson Correlation을 사용하였다. 마지막으로 기후변화 교육이 산림보전 촉진에 기여한다는 두 번째 가설을 검증하기 위해 Paired Sample T Test를 사용하였다. 본 연구에서는 기후변화 교육이 산림보전비용 지불의사에 미치는 영향을 추정하기 위해 Paired Sample T Test 결과를 도출한 후 Cohen의 유효크기 측정방법을 적용하였다.

이 연구는 지식과 인식 사이에 통계적 독립성이 없음을 보여주었습니다. 이 연구는 또한 기후 변화 지식과 산림 보존에 대한 인식 사이에 통계적으로 유의미한 양의 상관관계가 있음을 뒷받침했습니다. 마지막으로 본 연구는 기후변화 교육이 기후변화에 대한 지식, 산림보전에 대한 인식, 산림보전을 위한 비용지불의사에도 긍정적인 영향을 미치는 것으로 나타났다. 기후변화 교육 이후에 기후변화 교육이 산림보전을 위한 지불의사에 미치는 영향의 크기에 대한 Cohen's d 추정은 컸습니다. 따라서 기후변화 교육은 기후변화에 대한 더 나은 이해, 산림보전에 대한 더 나은 인식, 산림보전에 대한 대가를 지불할 의지를 높이는 것이 중요하다. 결과적으로 더 많은 사람들이 산림 보존에 참여하기 위해서는 산림 보존에 대한 인식과 산림 보존 비용을 기꺼이 지불할 의사가 있는 기후 변화 지식이 필수적입니다.

키워드: 기후 변화 지식, 기후 변화 교육의 영향, 지역 사람들, 산림 보존에 대한 인식, 지불 의향, 잠비아.

학생번호: 2019-24871.

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Thank you so much!