KNOWLEDGE, ATTITUDES, AND PRACTICES OF SECONDARY SCHOOL TEACHERS TOWARDS RANGELAND CONSERVATION IN LOWER YATTA SUB COUNTY, KITUI COUNTY

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DECLARATION

I, **Irene Mutua,** hereby declared that this research project report is my work and has not been submitted to other universities or institutions for any academic award.

Signed: ---------- Date: 19/07/2023

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Declaration by the university supervisors

This research project report has been submitted for examination with our approval as the University supervisors.

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DEDICATION

I dedicate this research project report to my family and my friend Onesmus Ndali as an inspiration and gratitude.

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ACRONYMS AND ABBREVIATIONS

CBC	Competency-Based Curriculum
CBD	Convention on Biological Diversity
CEE	Committee on Environmental Education
DPEP	District Primary Education Programme
EE	Environmental Education
ESD	Education for Sustainable Development
GoB	Government of Botswana
GoK	Government of Kenya
GoZ	Government of Zimbabwe
ILRI	International Livestock Research Institute
IUCN	International Union for the Conservation of Nature
KAP	Knowledge, Attitudes, and Practices
MoEF	Ministry of Environment and Forests
NCEPC	National Committee on Environment Planning and Co-ordination
NCERT	National Commission on Education, Research, and Training
SD	Standard Deviation
SDG	Sustainable Development Goals
UNEEA	Uganda National Environmental Education Association
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

ABSTRACT

Rangelands offer critical ecosystem services that contribute to the wellbeing of two billion people. However, these ecosystems are facing major threats such as climate change, land-use change, overexploitation and invasive alien species. The majority of these problems have an anthropogenic origin. The creation of an environmentally conscious citizenry through continuous environmental education (EE) especially at youthful ages has been proposed to resolve this problem. The inclusion of environmental awareness units in the Kenyan education curriculum has made teachers the key actors in the achievement of environmental objectives. It has been known that the transfer of knowledge to students is dependent on their attitudes, and experiences on the subject matter. Teachers with good knowledge, attitudes, and practices can impact the understanding of environmental issues by students and their willingness to participate in proconservation activities. This research study sought to assess the knowledge, attitudes, and practices of secondary school teachers in Yatta Sub County, Kitui County, Kenya on rangeland conservation and environmental education. A cross-sectional research design was utilized in this research study. Simple random sampling was used to select 17 schools from a sampling frame of 70 schools. It was also used to pick four teachers from each school for the teacher interviews resulting in a total sample size of 68. Fisher's exact Test was used to test for the presence of significant differences between these levels and the sociodemographic variables of the teachers. The teachers showed moderate levels of knowledge of rangeland conservation concepts, local ecosystems, and their benefits and threats (mean = 0.71, SD = 0.18). The level of knowledge however differed with the teaching subject ($p = 0.0005$), duration of stay in the current school ($p = 0.005182$), training in EE ($p < 0.05$), marital status ($p = 0.001$), and the age group of the teacher ($p < 0.05$). Teachers of natural sciences showed significantly higher pro-conservation attitudes than the teachers of other subjects. The respondents also displayed moderate attitudes toward the enjoyment of nature, waste recycling, rangeland conservation, EE, and Competency-Based Curriculum (CBC) (mean = 0.61, SD= 0.09). None, however, showed good levels of attitude. There were significant differences between the level of attitude and teaching subject ($p = 0.007839$), duration of stay in the current school (0.03096), and age (0.02933). Training on EE did not promote better levels of attitudes ($p = 0.9358$). The teachers also showed moderate environmental practices (mean = 0.70, SD = 0.69). Almost half did not participate in planting trees (42.7%). Language teachers showed significantly better environmental practices than the teachers of natural sciences ($p = 0.001281$). The major challenges affecting the implementation of EE in the Sub-County are; limited EE content in the syllabus especially in languages and humanities, lack of sufficient and diverse reference materials, heavy workloads, and lack of support from school administration. The study recommends the inculcation of EE in non-natural science subjects and the continuous training of teachers on EE and CBC.

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CHAPTER 1: INTRODUCTION

1.1 Background of the research study

Rangelands are natural landscapes that are dominated by scattered woodlands, bushes, shrubs, and grasslands. According to the International Livestock Research Institute (ILRI), rangelands are the dominant terrestrial ecosystems on the earth's surface and cover 54% of the earth's total landmass (ILR *et al.*,2021). In Africa, rangelands occupy 61% of the total landmass (Kariuki *et al.*, 2018). In Kenya, rangelands make up more than three-quarters of the total land area (Kimiti, 2016). These landscapes are diverse and comprise savannahs, grasslands, shrublands, marshes, deserts, and alpine environments (Lulekal *et al.*, 2018). Due to their large geographical extent and diversity, rangelands are important ecosystems not only for the economy but also for the wildlife that is dependent on them. Rangelands offer important ecosystem services such as wildlife habitat provision, carbon sequestration, climate and air regulation, erosion control, soil fertility enhancement, and water purification (Kariuki *et al*. 2018). Globally 1-2 billion people depend on rangelands for their livelihoods (Walker *et al.*, 2017). These people derive pasture, firewood, food, medicine, and other ecosystem goods from these ecosystems. The rearing of livestock, which is common in these ecosystems also provides income and food for more than 1.2 billion people that subsist on a daily income of less than $1 (Holechek *et al.*, 2020). In the semi-arid and arid areas of Kenya, pastoralism and agro-pastoralism account for 95% of income earned by households and 90% of all employment opportunities (Kariuki *et al*., 2018).

Globally, rangelands are increasingly being threatened by climate change, land-use changes, invasive species, biodiversity loss, soil erosion, and desertification (Wilgen *et al.*, 2020). In the sub-Saharan region, weather change is threatening the accessibility of water resources in savannah ecosystems (Lulekal *et al.*, 2018). Temperature changes with changes in the quantity and seasonality of precipitation cause adverse impacts on landcover (Peters *et al.*, 2013). This is usually characterized by the encroachment of woodlands by grasslands and bare ground including the shift from native perennial grasses to nonnative, unpalatable, annual grasses and bushes. These climate-related impacts are magnified by anthropogenic activities like the suburbanization of rangelands, fragmentation of these ecosystems (Peters *et al*., 2013), overgrazing, and unsustainable resource extraction activities (Wilgen *et al.*, 2020). As a result, these ecosystems are being adversely modified leading to a decline in their ability to offer

crucial supporting, regulating, and cultural services (Lulekal *et al.,* 2018). Since many people depend on rangelands, the decline in ecosystem services provision will affect their livelihoods and result in poverty, hunger, and unemployment. The decline in ecosystem services will also adversely impact the ability of the countries to meet the Sustainable Development Goals (SDGs).

There is a global consensus that the majority of these problems emanate from human insensitivity towards ecosystems and their benefits to our economy and society (Hasan & Bahauddin, 2014). These hinder our ability to find and implement local mitigation and adaptation solutions to challenges posed by rangeland degradation and climate change. The creation of an environmentally conscious citizenry has, therefore, become a key pillar of local and international programs like the SDGs. By providing knowledge, the attitudes of people can be changed to be more pro-environment and pro-conservation (Kioko & Warui, 2010). The development of pro-environmental attitudes can promote pro-environmental behaviour such as advocating for ecosystem conservation or participating in rangeland restoration activities. The key to environmental advocacy is continuous environmental education, especially at youthful ages. Most governments in Africa and the world have therefore implemented environmental education courses in their formal and non-formal education curriculum as mandated by the 1977 Tbilisi Declaration on Environmental Education (UNESCO, 1977). This Declaration outlines the framework, guidelines, and principles for environmental education at the global, regional, and national levels. Its main objective is to ensure that citizens of the world become aware of the complex interactions that occur in the natural world, how it impacts them, and how they can contribute to the conservation of the world's ecosystems.

The inclusion of environmental awareness topics in the education curriculum has made teachers key actors in the achievement of environmental objectives. In most communities, teachers are recognized as custodians of knowledge who pass on this knowledge to the students they teach. This transfer of knowledge is greatly influenced by the teachers' perception, knowledge attitudes, and experiences on the subject matter. Teachers with poor knowledge, attitudes, and experiences in the environment can hinder the achievement of environmental objectives in a particular community (Nguru *et al.,* 2014). It is therefore essential that regular assessments are

conducted to investigate their knowledge, perception, and practices towards environmental conservation and the obstacles they experience in implementing environmental education.

1.2 Statement of the research problem

In Kenya, there have been many programs and activities implemented to promote environmental education and awareness in secondary schools. These include the inclusion of environmental units in all secondary school subjects as recommended by the Tbilisi Declaration (Cheruiyot, 2013; Kimiti & Kipkoech, 2013). Additionally, secondary schools also participate in various environmental-related activities such as clean-up exercises, rangeland restoration and tree planting. The success of environmental education in secondary schools is dependent on having teachers who are environmentally conscious, competent and have the motivation to teach environmental issues to students. Secondary school teachers should be able to impact their students to take proactive steps to protect the environment. It is thus essential to understand the knowledge, attitudes, and practices of teachers to gauge their competence and motivations for environmental education.

Increased environmental awareness and conservation is particularly important for Yatta Sub-County. The Sub-County is facing problems like climate change, soil erosion, land degradation, and deforestation. There is, therefore, a need to ensure that students, particularly in secondary, are well educated on the importance of their environment, the impacts of the threats currently facing them, and what they can do to contribute toward the conservation, restoration, and sustainable use of resources encompassing these landscapes. This can be achieved only by assessing the current state of EE in the sub-county and the perceptions and practices of teachers dealing with EE and rangeland conservation. It is also important to understand the barriers that teachers have in ensuring that environmental-related units are impactful to learners. This is particularly relevant since secondary schools are set to change to the Competency-Based Curriculum. Understanding the knowledge, attitudes, and environmental practices of teachers will be instrumental in the development of teaching strategies that can increase the learning and comprehension of environmental issues by the learners.

1.3 Research questions

1. What is the knowledge on the benefits and threats facing rangelands among secondary teachers in Yatta Sub-County?
2. What are the attitudes of secondary school teachers on environmental education and conservation of rangelands in Yatta Sub-County?
3. What are the environmental practices being undertaken by teachers in Yatta Sub-County to promote the conservation of rangeland resources?
4. What challenges do secondary school teachers face in promoting environmental education?

1.4 Overall research objective

To assess the attitudes, knowledge, and practices of teachers in secondary schools towards environmental education on the conservation of rangelands in the Yatta sub-County and the approaches and the challenges they face.

1.4.1 Specific objectives

1. To assess the knowledge of teachers in secondary schools in Yatta Sub-County on the benefits and threats facing rangelands.
2. To identify the attitudes of teachers in secondary schools in Yatta Sub-County towards Environmental Education.
3. To determine the environmental practices being undertaken by teachers in Yatta Sub-County in promoting rangeland conservation.
4. To evaluate the challenges facing secondary school teachers in implementing environmental education on rangeland conservation.

1.5 Hypothesis

H_0: There is no association between the knowledge, attitudes, and practices of teachers in secondary school and their socio-demographic variables.

H_1: There is an association between the knowledge, attitudes, and practices of teachers towards rangeland conservation and their sociodemographic variables.

1.6 Scope and limitations of the study

The main objective of this study was to investigate the knowledge, attitudes, and practices of teachers in secondary schools on EE and the participation of teachers in rangeland conservation activities. The study targeted secondary schools located in Yatta Sub-County, Kitui County, Kenya. Due to constraints brought about by Covid-19 containment measures, the research was not able to benefit from the input of Focus Group Discussions. Some teachers also declined to be interviewed due to fear of contracting Covid-19 from research assistants. The increased workload and hectic education schedules that followed the resumption of learning after Covid-19 also restricted some teachers from participating in the study.

1.7 Justification and significance of the study

Environmental education and awareness are primary goals in the domestication and implementation of many biodiversity and environmental treaties. The Convention for Biodiversity 1992 (CBD) encourages member states to "promote and encourage understanding of the importance of and the measures required for the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programs" as provided in Article 17(a) (pg.8) (UN, 1992). The Kunming- Montreal Global Biodiversity Framework that was adopted in 2022, also encourage member states to step appropriate steps to restore, maintain and enhance nature's contribution to people through the provision ecosystem services and functions and the measures they can institute to ensure its conservation and sustainable utilization (Target 1). The Tbilisi Declaration on Environmental Education provides the mechanism through which EE can introduced in a country's formal and non-formal education curriculum. The Kenya Institute of Education has mainstreamed environmental-related units in all subjects of the secondary school curriculum (Kimiti & Kipkoech, 2013).

Secondary school teachers have, thus, become key stakeholders in the goal of achieving environmental awareness in Kenya. Consequently, an assessment of their knowledge, perception, and practices on environmental conservation is important as they affect their ability to significantly shape their students' understanding of ecosystems and their benefits. This can also provide insight into the different activities that teachers and secondary employ to promote the conservation of ecosystems and the challenges they encounter. This can help national

institutions like the Kenya Institute of Curriculum Development to evaluate the ability of the educational curriculum in achieving environmental objectives and how the training of teachers can be enhanced.

1.8 Operational definitions

Attitudes: A set of beliefs, emotions, and behavior towards a certain person, object, idea, event, or thing.

Competency Based Curriculum: A curriculum that places emphasis on what students are expected to do rather what they are supposed to know.

Ecology: The study of living things and how they interact amongst themselves and with their environment

Ecological services: Tangible or nontangible benefits that human beings derived from nature.

Environmental education: Education that enables people to gain knowledge, awareness, attitudes, skills, and values needed to solve the current environmental challenges facing the world, prevent the emergence of new challenges, and ensure the achievement of improved environmental quality. Environmental education encompasses all the forms of education that fall in line with this definition. This includes; conservation education, education for sustainable development, and ecological education.

Intergenerational equity: The equitable access and utilization of economic or ecological resources by the present and future generations.

In-service teachers: Teachers who have completed their training and are currently employed.

Knowledge: The familiarity, understanding, or awareness of someone or something.

Practices: The conscious activities and behavior that are undertaken by teachers to promote Environmental education.

Precautionary Principle: Decision makers should adopt precautionary measures when there is uncertainty in the prevailing scientific knowledge on an environmental problem

Preservice teachers: Teachers who are yet to complete their training but also participate in teaching internships as part of their training or for employment purposes**.**

Rangelands: Large areas of land where the dominant native vegetation is grasses, forbs, and or shrubs. The native vegetation support livestock production and wildlife**.**

Sustainable Development: Current Improvements in the human way of life that do not jeopardize the ability of future generations to meet their own needs using earth's resources.

CHAPTER 2: LITERATURE REVIEW

2.1Introduction

This section summarizes the writings on environmental education. It commences by discussing the factual evolution of environmental education from the past to modern times. It then discusses this expansion and the current status of environmental education in the continents of Africa, Asia, Australia, Europe, and South and North America. An empirical assessment of the knowledge, and attitudes of teachers on environmental education and conservation is also provided. The next section presents the theoretical and conceptual structure that guided the study. It concludes by providing a summary of the gaps identified in the literature reviewed.

2.2 Historical development of environmental education

The roots of environmental education differ depending on the region. However, the majority are attributed to the nature study that was emphasized by many traditional communities as a way of environmental awareness inculcation to school children (Almeida & Cutter-MacKenzie, 2011). In the United States of America, nature study evolved as a result of the works of Jean-Jacques Rousseau, a philosopher, and Louis Agassiz, a naturalist. Through their writings, they advocated for the use of nature as a pedagogical tool. The works of Anna Botsford (*Handbook of nature*) and Wilbur Jackman (*Nature Study for the common school*) became important reference materials for learners and teachers (Bodzin *et al.,* 2010). Nature studies later metamorphosed into conservation education after the dust bowl and the great depression catastrophes in the USA. Many people and livestock were killed by dust storms during the 1930 drought in the southern plains of the USA (Eneji *et al.,* 2017). Unlike nature studies that utilized mainly fables and moral lessons to teach students, conservation education was grounded on rigorous scientific experiments and methods.

2.2 Environmental education in modern times

The modern environmental education drive gained international momentum in the 1960s following severe environmental degradation due to radiation, the utilization of pesticides, and air pollution. Scientists like Carson and Hardin tried to increase the level of public awareness of the ecological impacts of these anthropogenic activities. They decreed the importance of the public being kept well informed of the impacts of environmental and ecological degradation (Gough, 1993). The first Biosphere Conference on the rational use and conservation of the Biosphere (UNESCO) in 1968 captured the recommendation for the need to have international

educational programs on the environment (UNESCO, 1977). This was actualized in 1970 during the International Working Meeting on Environmental Education in the school Curriculum in Nevada, USA. This meeting was convened by the International Union for the Conservation of Nature (IUCN) and UNESCO. The key objective of this meeting was to discuss and innovate ways of inculcating education on conservation in the curricula of secondary and primary schools. The meeting formalized the definition of EE as the procedure that assists learners to recognize the values and concepts needed for the development of skills and attitudes that acknowledge the important interrelationships between man, his or her culture, and the immediate environment (IUCN, 1970). The meeting recommended that member states should incorporate aspects of the environment in their national curriculum.

The recommendations of this meeting were further deliberated during the 1972 United Nations Conference on Human Environment in Stockholm, Sweden. Participants in the conference were made aware of the need to promote EE internationally. This was expressed by Principle 19 of the Stockholm Declaration. This principle advocated for global efforts in promoting EE not only for the younger generation but also for adults. The declaration also mandated the UNESCO to create a global program that would promote environmental education across all levels of education and be directed to all the citizens of the earth encompassing the young and the old, rural or urban dwellers, and targeting both school goers and those out of school. EE was also supposed to be interdisciplinary meaning that it would be incorporated into all subjects (UNESCO, 1977). In pursuit of this objective, UNESCO in collaboration with UNEP launched the International Environmental Education Programme in 1975 (Eneji *et al.*, 2017). Together they organized the first intergovernmental conference on environmental education in Tbilisi, Georgia in 1977. This conference came with the objectives, nature, and pedagogical principles of Environmental Education (EE). It also came up with guidelines on how environmental education would be implemented. EE was seen as the practice of educating people to solve the environmental challenges that are plaguing the planet through an interdisciplinary approach (UNESCO, 1977). The first goal of EE was articulated as the provision of opportunities for all persons to acquire attitudes, values, and knowledge needed to ensure a committed improvement of the environment. The second goal sought to cultivate and reinforce new patterns of environmentally conscious behavior in society for an improved environment. The last goal of

EE was to cultivate awareness of the ecological, and economic, political and social interdependence at all scales of society.

2.2.1 Environmental education in the United States of America

The deliberations on the international stage were being fueled by the developments of EE from the developed nations most notably, the United States of America. Dr. William Strap, an environmentalist, initiated the environmental education movement in the USA and had a considerable impact on global deliberations. As such he is regarded as the founder of environmental education in the USA (Gough, 2013, 1993). He saw the need for a newer education system that would teach men and women about their relationship with their total environment. He distinguished conservation education from environmental education. The former, he opined, was primarily concerned with primary resources and failed to address the role of people in addressing the solutions to environmental degradation (Eneji *et al.*, 2017; Gough, 1993). He established the Journal of Environmental Education in 1969 and defined EE and its benefits. The journal created more awareness of the need for EE. Soon after, the EE coordinators were placed in all 50 states of the United States of America.

2.3.2 Environmental education in Europe

Prior to the passing of the Education Reform Act in England and Wales, environmental concepts were largely missing from the school curriculum. Apart from religious education, which was compulsory, the content of the other subjects was left to the discretion of the National Rural Studies Organization (Scott, 2020). Consensus led to the addition and development of subjects that taught numeracy skills, literacy, music, and arts. The Keele Conference of 1965, highlighted the need to encompass environmental issues in the school curriculum to improve environmental awareness and promote scientific literacy in the population. Following this Conference, the Council of Environmental Education was formed in 1968 uniting the education and environmental sectors into a single body. With time an argument arose about how environmental problems were to be addressed in the classroom. While proponents such as Sean Carson wanted an integrative approach involving the addition of environmental concepts in the geography, science, biology, and history subjects (Scott, 2020), however, there were many who argued that environmental modules should be included into every course (ibid). Those who wanted environmental education themes to be included into more conventional scientific

courses perceived advocates for a multidisciplinary approach as tainting the integrity of their studies. Her Majesty's inspectorate of schools issued a statement on the curriculum in 1979 that put an end to the controversy by mandating Themes from environmental education should be included into all academic disciplines, and new interdisciplinary courses should be developed at the university level. Include universities (Scott, 2020).

EE was originally a field of study in Germany, but as human activity had more and more of an effect on the natural world, students of the traditional natural sciences geography, chemistry, and physics began to take an interest in it as well. Nature was the primary focus of the first environmental education texts. They didn't consider man's effect on the environment. At the 1980 Conference on Education, ministers from several countries argued for integrating environmental education into disciplines as diverse as the arts and sciences. They suggested splitting up environmental education into two distinct categories: classroom instruction and extracurricular activities. Students went on field excursions and nature walks to learn about environmental challenges outside of the classroom (Tapia & Gil-Carrera, 2017).

2.2.3 Environmental education in Asian countries

In China, Chen (2020), attributes the development of environmental education to the pollution of the Dalian Bay and the Guanting reservoir. The resultant pollution led to the consumption of fish contaminated with heavy metals from industrial by the local inhabitants. This prompted the discourse on the need for environmental conservation, and afterward, EE. The Chinese government, thereafter, took proactive steps to promote environmental conservation including sending delegates to attend the Stockholm Conference. It also hosted its Conference on Environmental Protection in 1973 which culminated in the development of regulations to safeguard the environment. These regulations also encouraged higher education institutions to promote EE (Chen, 2020; Tian and Wang, 2016). As a result, universities and colleges created environmental science departments (Tian and Wang, 2016) that formulated several courses on environmental issues. Thereafter, EE was scaled down to primary and secondary schools in 1987 (Chen, 2020).

In India, the evolution of EE was a result of environmentalism, education reforms and judicial orders. Mohaptra and Raval, (2018) attributed the rise of environmentalism in India to the rise

of the Chipko movement against the rampant deforestation of the Himalayan forests in the 1970s. The rise of the environmental movement prompted the need for environmental issues in the school curriculum. This resulted from the 1966 report of the Education Commission, popularly known as the Kothari Commission, which included environmental-related issues in the curriculum.(Almeida & Cutter-MacKenzie, 2011). The development of EE in India was also greatly propelled by the global environmental discourse. In 1971, the National Committee on Environmental Planning and Coordination (NCEPC) was formed to spearhead matters of environmental conservation and the creation of environmental awareness. NCEPC would later become the Ministry of Environment and Forests (MoEF) which dealt with all issues pertaining to the conservation of the environment and awareness creation. With a broad mandate, MoEF was unable to achieve the inclusion of EE in the classroom. To this end, in 1984, the Centre for Environmental Education (CEE) was established (Almeida & Cutter-MacKenzie, 2011) to guarantee EE's inclusion at all educational levels.

In the late 1980s, CEE experimented with incorporating EE into existing teacher education programs. The recommendations of these experiments were, however, not implemented (Mohapatra & Raval, 2018). This created a standoff between environmentalists who wanted EE included in the school curriculum and the Government of India. The matter was presented before the Supreme Court for determination in 1991. The Supreme Court of India ruled in favour of environmentalists and mandated that EE be made compulsory in the formal education system (Mohapatra & Raval, 2018). In compliance with this ruling, the District Primary Education Programme (DPEP) began integrating EE into the primary school curriculum by infusing environmental studies into natural science and social science subjects. However, not all states in India adhered to the ruling made by the Supreme Court in 1991. This prompted the apex court to issue stern orders in 2003 requiring all states to incorporate EE in their education Curriculum. The court also ordered that EE units should also be graded across all the Indian states. NCERT (National Commission for Education, Research, and Training) published a new curriculum that incorporated environmental issues. EE was infused into the curriculum of science, social studies, languages, and mathematics subjects from classes VI – X. Lower classes (I-V) had Environmental studies as a mandatory subject. The higher classes (XI-XII) had environmental studies as an optional subject (Almeida & Cutter-MacKenzie, 2011).

In Japan, the disruption of the environment occasioned by industrial air pollution led to the development of Koigai (pollution) education in the 1970s. This education flourished in the formal education system as it enabled students to learn about social and natural history, respect for human beings, and the pollution of the environment. Koigai was driven by grassroots environmental movements. Environment issues addressed by this system were identified by communities living in cities impacted by air pollution, students, and teachers without any government recognition or control. It gained popularity among educators prompting the Ministry of Education to include it in the Social Studies course in 1971(Haruhiko, 2017). A topic concerning pollution was thus made compulsory in all public schools. The enactment of the Tbilisi Declaration in 1977 prompted the need to unite this education with conservation education. Japan thus began to shift toward Education for Sustainable Development (ESD) which was being spearheaded by the United Nations.

In 1991, a teacher's guide for EE was then developed and given out to teachers. This guide directs the teaching of environmental issues in junior and high schools. As per the guide, learners are supposed to engage the following skills in the environment; skills in sensing environmental changes, solving environmental challenges, data processing, use of information, critical thinking, forming agreements on environmental issues, environmental justice, and participation in environmental protection and conservation (Kodama, 2017). However, there is no subject in the school curriculum titled environmental education. All subjects have an environmental viewpoint. This viewpoint is incorporated as a unit on environmental education. For instance, all books on home economics, social science, and social studies have topics on ecosystem consumption behavior and energy. The Japanese Language subject and moral education subject contain literary works on environmental issues.

2.3.1 Environmental education in Australia

The roots of informal environmental education in Australia can be tracked down to the migration of the Aboriginal people from Asia approximately 40,000 years ago (Fien & Ferreira, 1997). They developed an elaborate means of codifying the knowledge of the environment, its ecosystems, and their respective uses and value. This knowledge was handed down from one

generation to the next through the establishment of sacred places, dances, songs, stories, and cultural ceremonies. This system of education persists even today through the establishment of special educational programs in Aboriginal community schools (Fien & Ferreira, 1997). This education system was however not accepted by the European settlers. The traditional values and care for the environment by the aborigines were quickly supplanted by the Europeans' desire to conquer the natural environment for their benefit. What followed was severe rangeland degradation, ecosystem fragmentation and proriferation of invasive species. Due to the resulting environmental issues and shifts in societal attitudes, environmental education emerged in the 1970s. The development of environmental education in Australia may be traced back to two major conferences. Australia's capital city of Canberra hosted a series of events titled "Education and the Environmental Crisis" in 1970. In 1975, Melbourne hosted the second meeting ahead of the 1977 Tbilisi meeting (Greenall, 1987). These, together with the Tbilisi meeting, prompted the National Curriculum Development Centre to create an environmental education curriculum in 1980 (Greenall, 1980). After this, environmental education programs were quickly implemented by state and territory school systems throughout the country. Schools in various states and territories have access to filed study centres to enhance their teaching of EE. Government and state environmental agencies also offer a variety of curriculum resources to schools. In addition, environmental education officers have been employed to assist teachers to develop and implement EE programs in their various schools (Gough & Gough, 1993).

EE was initially taught in ecology. Overtime it was gradually added to other subjects such as social studies, outdoor education, and geography. Lastly, it was integrated into the music. media, history, and language studies(Ibid).

2.3.2 Environmental education in South America

The development of EE in Brazil began in the 1970s. This development was initiated as a result of the developments in the global debate on the environment raised during the Stockholm Conference in 1972. A series of organizations were established that played pivotal roles in the rise of EE in the country. The first was the National Secretary of Environment in 1972 and the Brazilian Network of Environmental Education in 1992 (Cristina *et al.*, 2016). This network was pivotal in bringing together EE enthusiasts from all regions in Brazil to discuss the

implementation of EE in Brazil. It took part in a critical function in the formulation of Brazilian environmental education policy. The first law to formally recognize the value of EE in the classroom sector was the National Environment Policy which was approved in 1981 (Brazil 1981). It mandated the inclusion of EE at all levels of education in the country. This was followed by the inclusion of EE in the 1988 constitution of Brazil. Article 255, item 5 mandated the promotion of EE in all levels of education and public awareness of the conservation of the environment. This was followed by the establishment of the National Environment Fund to provide financial support for EE projects. In 1994, the National Environmental Education program was launched with the object of ensuring a balanced integration of the multiple dimensions of sustainability into the national education programs. In order to enhance the development of curriculum for this sector, the National Curriculum guidelines for environmental education were developed in 2012 by the National Council of Education(Cristina et al., 2016). EE has therefore been buttressed in the curriculum. Environmental issues have been inculcated in all subjects.

2.2.4 Environmental education in Africa

Colonial educational regulations and the emergence of a global environmental agenda both contributed to the growth of environmental education in Africa. For instance, the Rhodesian government during the colonial period created conservation education in Zimbabwe, where it is taught as nature studies in the elementary school science curriculum. The primary goal of conservation education was to raise public consciousness about the need of preserving the native species of flora and wildlife. However, the nation could not benefit much from the nature-focused lessons that were included in the curriculum. As a result, in 1975, the Ministry of Education recommended alterations to this curriculum, leading to the formation of a new topic known as Environmental Studies (Mapira, 2014). This course included a wide range of topics, including ecology, history, geography, and even personal hygiene. Up to 1981, students may take this course. In 1982, the field of Environmental Studies was formally divided into two distinct academic disciplines: social studies and environmental science. In 2000 and 2001, an education policy was developed by the Government of Zimbabwe (GoZ) (GoZ, 2003). This policy allowed the integration of environmental education into the curriculum of both primary and secondary school teacher training programs. It also allowed the integration of

environmental education issues into the curriculum of secondary and primary schools using the cross-curricular method. The role of the environment in the learning process of students was recognized in mathematics, agriculture, science, clothing and textile education, Geography, English and professional studies (Chimbodza & Ongevalle, 2004).

In Uganda, Environmental education also developed as an offshoot of the nature study which was taught in primary schools in the 1960s (Mapira, 2014). In 1987, EE was included in all levels of basic education (Mapira, 2014). This integration was however done without a national education policy to anchor EE concerns into the law. In 1995, the government established the National Environmental Management Authority (NEMA) with the mandate to include EE into all levels of schooling. Additionally, 1995 saw the birth of the Uganda National Environmental Education Association (UNEEA). It was a forerunner in mainstreaming environmental education in schools. It coordinated environmental education research throughout the country and advocated for the needs and actions of environmental educators via curriculum development, revision, and distribution. Thanks to the work of these two groups, EE is now a standard part of elementary, secondary, and higher education. EE is taught with other science and social studies subjects in secondary schools (Mapira, 2014).

Apart from Zimbabwe where the development of environmental education was built upon the foundation left by the colonial government, in some African countries, EE developed as a response to the rise of environmentalism in the international arena. Global conferences such as the Stockholm Conference in 1972, the Belgrade Conference in 1975, the Tbilisi conference in 1977 the Earth Summit in Rio in 1992 (Abubakar, 2014) were important to the development of EE in these countries. The development of EE in Morocco, for instance, was also prompted by the Stockholm Conference. Environmental units and concepts were then infused into biological and natural sciences subjects in secondary schools in 1979 (Legrouri, 2017). Botswana on the other hand. formulated its revised national policy on education in 1994, two years later the Rio de Janeiro summit (GoB, 1994). This policy mandated all teachers to infuse environmental concerns into the school curriculum (Ketlhoilwe, 2003).

2.2.5 Environmental education in Kenya

Kenya just like many African nations also endeavored to adopt the recommendations of the Tbilisi declaration in its education system (Otieno, 2002). To achieve this, three meetings on Environmental Education were organized in Nairobi. The first was the Association of African Universities' workshop in 1978 that recommended that universities should increase students' environmental awareness by including environmental issues in their traditional disciplines. The second, The Kenya National Symposium on Environmental Education was held in 1979. In this symposium, EE was adopted and environmental issues were added to subjects such as geography, science, and agriculture following the interdisciplinary approach. The symposium also acknowledged the significant function played by teachers in EE and the importance of ensuring that they were cognizant of environmental issues. The third was a conference at Kenyatta University. Participants at this conference saw the need to offer a compulsory EE course that was interdisciplinary. EE was added to other subjects such as home science, chemistry, biology, and history in 1985 and taught in all schools (Otieno, 2002). EE was also added to the training curriculum of primary school teachers in 1986 and secondary school teachers in 1974 (RoK, 1988). All of these were legalized through Sessional Paper No. 6 of 1988 on "*Education and Manpower Training for the Next Decade and Beyond''*, in which the Government of Kenya (GoK) decreed that education on environmental issues should be mainstreamed in the education system and teachers' training curriculum to ensure that teachers were well equipped to educate learners on Environmental Education (RoK,1988; Otieno, 2002).EE was also integrated in the sessional paper no.1 of 2005 on "*a Policy Framework for Education, Training and Research*"(RoK, 2005), Environment was one of the key principles governing the philosophy of education in the country. Schools were mandated to be channels through which skills and knowledge that would allow conservation and the continuous use of the environment were to be transmitted to the communities. To fulfill international obligations after the 1992 adoption of the United Nations Conference on Environment and Development, Kenya's National Education Sector Plan (RoK, 2014) included Education for Sustainable Development into its curriculum from 2013 to 2018.

2.4 Assessment of teacher's knowledge, attitudes, and practices on environmental education: An empirical review

Teachers are important to the success or failure of EE. A teacher's attitude, perception, belief, knowledge, and skills can determine how students understand and apply EE (Kiarie, 2016;

Sutherland, 2017). Researchers have investigated the connection between the attitudes, knowledge, perceptions, and practices of teachers from native American communities towards various aspects of environmental education. Liu *et al*., (2015), for instance, investigated the relationship between in-service teachers' (teachers who have finished their training and are employed) beliefs and attitudes towards global climate change before and after a climate change workshop in the United States of America. The results showed that the in-service teachers who were skeptical of climate change before the workshop shifted their attitudes toward climate change. The teachers also expressed varying perspectives on the exploitation of natural capital for the profit of humanity. Their study, moreover, discovered that most of the teachers had a limited understanding of the impacts of climate change before the workshop. Additionally, the attitudes of the teachers were weak indicators of their level of knowledge.

In Israel, Pe'er *et al.*, (2007) also focused on the attitudes, knowledge, and environmental behavior of teachers in training colleges. The results showed that even though the preservice teachers had limited knowledge of the environment, they displayed positive environmental attitudes. Kandir *et al.*, (2012) compared the environmental attitudes of in-service teachers and teacher candidates on teaching EE in Ankara, Turkey, while Aznar-Díaz *et al.*, (2019) also focused on trainee teachers in Spain. These two studies examined the attitudes of these teachers on biodiversity, pollution, conservation, and natural spaces. Their results revealed that female trainee teachers had slightly higher attitude scores on biodiversity and natural spaces than their male counterparts. Teachers' attitudes toward waste recycling were lower than toward pollution, conservation, and natural spaces. This was possibly due to the low recycling rates in Spain compared to other European countries (Aznar-Díaz *et al.,* 2019).

Preservice teachers in Rwanda also displayed positive environmental attitudes based on the study by Nsengimana *et al.*, (2017). The majority of the teachers (78.3%) however, did not appreciate how EE was taught and integrated into their courses. They lamented that the integration only had a small portion of biodiversity conservation. Additionally, the majority of the teachers derived their knowledge of EE from the media and a few from community-based conservation education from the adjacent parks. As this study was focused on preservice teachers, the role of EE in the practices of teachers was not evaluated. Another study by

Rachmatullah & Ha, (2018) observed in Indonesia that fieldwork had a moderate effect on the ecocentric concern, human utilization of nature, and personal conservation behaviour of preservice teachers. The fieldwork variable was, however, based on the perception of the respondents on the use of fieldwork for environmental education. Additionally, the participation of teachers in fieldwork activities was associated with negative personal conservation behaviours and negative attitudes toward the utilization of nature.

Chi-Chung Ko & Chi-kin (2003) also assessed the perception of science teachers in Hong Kong teaching EE within the science curriculum. The study discovered that the attitudes, skills, beliefs, and intention of teaching EE were strongly associated with their teaching practices on EE. Kiarie (2016) also assessed the perceptions of biology teachers on environmental education in Gilgil, Kenya. The teachers possessed positive perceptions of EE but stated that the biology syllabus ill-prepared students to be appreciative of the environment. The teachers also stated they did not have the materials, skills, or competency to teach EE. The school administrations limited their ability to adequately enhance the environmental awareness of their students by failing to facilitate or initiate activities that could enhance the creation of environmental awareness. This study explored the challenges facing teachers in conducting EE. The study was, however, limited to only biology teachers even though EE has been integrated into other subjects of the secondary curriculum. Chikati (2018), also assessed the perception of both teachers and students on EE in secondary schools in Machakos Sub-County as part of his Ph.D. thesis. His results revealed that students and teachers in the Sub-County displayed weak perceptions of EE. This observation contradicted the findings of Kiarie (2016) and points to the existence of regional discrepancy in the appreciation of EE. This study also focused on the teachers' attitudes toward EE and did not consider the effect of EE on the environmental attitudes of teachers.

2.5 Research gaps

Even though environmental attitudes, knowledge, and practices play important roles in the success of environmental education objectives, limited studies in Kenya and other African countries have explored the environmental attitudes of secondary school teachers and their determinants. The empirical review has established that the majority of peer-reviewed research articles and theses on this topic are mainly from researchers from American and European

countries. Research on the environmental attitudes, knowledge, and practices of teachers towards environmental education is still needed especially in African countries. Secondly, the majority of these studies have been conducted in humid environments. Limited studies have been focused on arid and semi-arid landscapes like in the study area. Such studies are needed to explore the relationship between the type and environment and its impact on pro-conservation attitudes and practices. Lastly, the majority of the papers written on the KAPs of teachers differed greatly in the way they measure environmental attitudes, knowledge, and practices. The lack of standard scale in the continent means that the studies have little comparative value with the ones conducted from other continents. This study adapted the environmental attitudes inventory developed by Milfont & Duckitt, (2010). This ensured that its outcomes can be compared to numerous studies that have utilized this study to investigate environmental attitudes and practices.

2.6 Theoretical and conceptual framework

2.6.1 Theory of reasoned action

This theory was proposed by Ajzen and Fishbein (2005). It explains why individuals engage in a specific behaviour like agreeing to participate in an ecosystem conservation activity. According to Ajzen and Fishbein (2005), three beliefs influence a person's intent to perform a certain behaviour or activity. These are behavioral beliefs, perceived norms, and perceived behavioral control. Behavioral beliefs comprise instrumental attitudes and experiential attitudes. Instrumental attitudes assess the consequences of performing a certain behaviour while experiential attitudes assess the positive or negative effect of engaging in the behaviour. These two beliefs determine a person's attitude in engaging in a given behaviour. Perceived norms assess the influence of other people's approval or disapproval in performing the given behaviour. They are influenced by a person's opinion on what other people think of the given behaviour and what other people are doing. Lastly, behavioural control is affected by the capability of an individual to accomplish a certain behaviour and the belief that he or she can perform the behaviour (autonomy). These three factors affect a person's desire to perform a given behaviour. The stronger the desire the more likely that person will perform the behaviour.

2.6.2 Conceptual framework

The conceptual framework underneath shows the link among teachers' socio-demographic variables, knowledge of rangeland resources, attitudes, and participation in rangeland

conservation activities. It is expected that demographic variables like age, gender, teaching subject, and teaching experience will affect teachers' attitudes and knowledge of EE and practices towards rangeland conservation. For instance, teachers, who have many years of teaching experience are likely to have more familiarity with EE. The conceptual framework is grounded on the theory of reasoned action. Teachers who received training in environmental-related courses are expected to have more knowledge than those who have not had such training. As EE has been mainly inculcated in the science and geography subjects, teachers who teach such subjects are expected to have more knowledge and by extension have better pro-environmental attitudes than teachers of non-science subjects. Training increases the knowledge of a person. It also increases the capacity of that person to undertake a certain behaviour as postulated by the theory of reasoned action. Thus, Training in addition to the knowledge gained by the teachers who teach environmental-related subjects is expected to lead to more proconservation practices and attitudes.

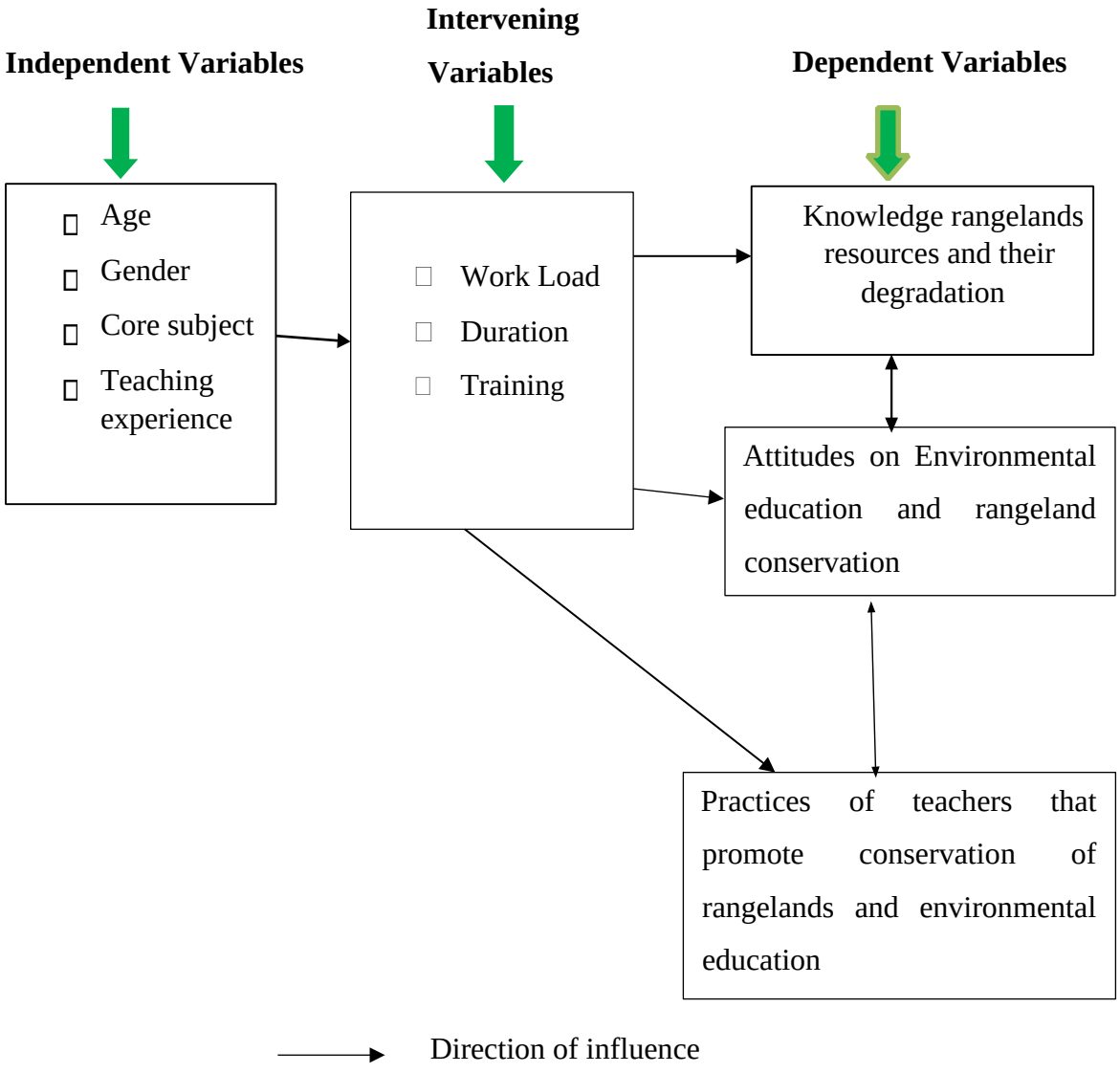

Figure 2.1: Conceptual Framework

Source: Author

CHAPTER 3: RESEARCH METHODOLOGY

3.1Study location

Lower Yatta Sub-County is part of Kitui County which is positioned between latitudes 0º3.7' S and 3º0' S and longitudes 37º45' E and 39º0' E (CGoK, 2018) as shown in Figure 3.1. It borders Yatta Sub-County in Machakos County to the west, the Central division to the east, the Athi division to the south, and Masinga Sub County to the north. Some portion of this Sub-County is located in the Yatta plateau which was formed as a result of lava flows from the Oldonyo Sabuk mountains and has an area of 1176.8 km^2. The Yatta plateau is the dominant relief feature in this locality that stretches from the North to the south of the Sub County. The land slopes from an average altitude of 1800m to 400m above sea level. River Tana and Athi are the dominant rivers flowing in this Sub-County (Mutavi, 2022). The sub-County comprises Yatta and Nthongoni locations (CGoM, 2018).

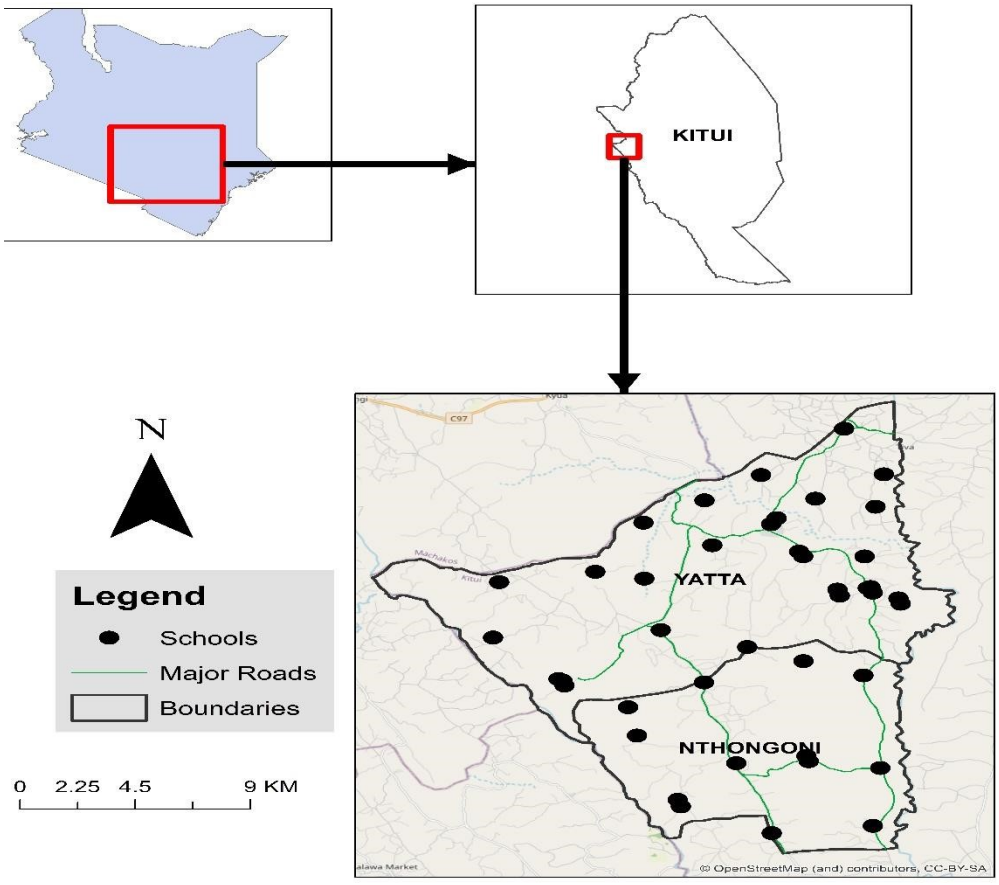

Figure 3.1: Map showing the study location in Kenya and Kitui County

Source: Author

3.2 Geology and soils

The geology of this sub-County is identical to the basement complex system that is dominant in most parts of Eastern Kenya. As such the igneous and metamorphic rocks dominate this landscape. Lithisols, Ultisols, Alfisols, Oxisols, Acrisols, Ferralsols, and Luvisols are the dominant soils. Fluvisols occur in isolated patches across the landscape and especially along the hilltops and rivers. The textures of these soils are mainly sandy to loamy sand. They are thus highly erodible and or have low fertility (CGoM, 2018).

3.3 Climate

The county experiences a bimodal rainfall distribution with short rains being received in October and December. Long rains on the other hand begin from March to May. The long rains in this Sub County and the whole county by extension are highly erratic and very unreliable while the short rains are, however, a little reliable. Three agroecological zones are found in the subcounty, agroecological zones IV, V and VI. A large proportion of the area is however mostly semi-arid. The mean annual precipitation is 500-1050mm per annum. Average temperatures on the other hand range from 14-34^{o}C (CGoK, 2018).

3.3.1 Hydrology and drainage system

Due to the erratic and unpredictable rainfall, all the sub-Counties of Kitui County have limited sources of surface water. The seasonal rivers that form during the rainy seasons are the leading sources of water in the sub-County. The Tana and Athi rivers are the only permanent rivers flowing in the sub-County. These are shared with the surrounding counties. The seasonal rivers in Kitui County flow in a North West direction and drain into River Tana. The seasonal rivers are Tiva, Mwitasyano, and Thua (CGoK, 2018)

3.3.2 Biodiversity

In this semi-arid environment, grass species such as *Acanthospernum spp.* and *Dactyloctenium spp* in conjunction with shrubs such as *Orthosiphon spp, Gnidialatifolia,* and *Indigoferaspicata* dominate the landscape. The indigenous plants comprise *Commiphora spp* formation intermixed with scattered trees comprising *Acacia mellifera*, *Acacia tortilis, Terminalia brownii, Delbegia melanoxylon*, and *Acacia xanthopholea.* The latter dominates areas near the seasonal river banks.

The genus *Commiphora* is made of species like *Commiphora holtiziana*, *Commiphora myrrh*, and *Commiphora africana*. These are common dryland tree species that are used in the production of gum. Unfortunately, the residents of the county are not exploiting these tree species due to a lack of awareness (Mutua *et al.*, 2019). In the study area, *Commiphora myrrh* and *Commiphora holtiziana*, which can be vegetatively propagated through cuttings, are used as a live fence. Prominent wildlife in this Sub-County includes monkeys, snakes, dik-diks, hippopotamuses, and elephants (Mutavi, 2022).

3.4 Demographic and economic profile

The Kenya National Bureau of Statistics reveals that the Subcounty has a population of 63,329 constituting 50.06% males and 49.94% females (KNBS, 2019). The majority of this population, like in the other counties, is composed of youths with ages ranging from 20-35 years. The majority of these people practice small-scale mixed farming. The prominent crops grown are drought-resistant maize, beans, cassava, millet, and sorghum. The Sub County also practices apiculture which earned farmers an estimated Ksh.42 million in 2017 (CGoK, 2018).

3.4.1 Education

The reconnaissance survey conducted before the start of data collection revealed that the sub-County has 70 registered secondary schools. In 2018, the public secondary schools have a total student population of 11,750 students. The enrolment however varies per school with a high of 759 students and a low of 35 students (Nzuki, 2018). The Sub County, however, suffers from high levels of school dropouts leading to low transition rates. The number of registered private primate secondary schools is 15 while the public primary schools are 134 (Nzuki, 2018). This disparity between the number of primary and secondary schools is a significant cause of the low transition rates. The Constituency Development Fund is trying to rectify this by constructing more day schools.

3.5 Research design

This research study utilized a cross-sectional research design to understand the relationships that exist between the attitudes, knowledge, and practices of teachers in secondary schools and the implementation of environmental education.

3.5.1 Sources of data, target population, and sampling strategy

The study utilized both secondary and primary sources of data to provide answers to the four objectives. Primary data was obtained through interviews with secondary school teachers and

field observations. Interviews collected both quantitative and qualitative data while key informants were also interviewed to give a better understanding of the key themes that emanated from the interviews. In addition to this, the socioeconomic characteristics of the respondents were also collected. This included the age, gender, and education of each respondent. Additional data such as teaching experience, workload (lessons/week), and core subjects were also collected. This provided an understanding of how the school environment affects teachers' knowledge and perceptions of EE.

The target population and sampling unit were secondary teachers in Lower Yatta Sub-County. Since the total number of teachers in all the schools in this Sub-County are unknown, the researcher utilized the following formula as proposed by Cochran (1977) to determine the sample size. This yielded a sample size of 68.

$$n = \frac{Z^2(p \times 1-p)}{e^2}$$

Where:

n = Sample size.

Z = The standard normal deviation at a 90% confidence interval

(1.645).

p = Standard deviation (0.5).

e = Error margin (0.1)

$$68 = \frac{1.645^2(0.5 \times 1-0.5)}{0.1^2}$$

This research employed an error margin of 0.1 due to the limited availability of resources for a large sample size. The method chosen to sample respondents ensured that time was efficiently utilized during the data collection process.

During the pilot phase, a list of 18 secondary schools present in the Sub-County was developed. One school was eliminated from this list because of student unrest. The Census was therefore applied by visiting all these schools. The researcher visited the schools and sought permission

from the school administrator to conduct the interviews. After getting the approval, the research entered the staffroom and randomly selected a teacher based on the sitting position in the staffroom.

3.6 Data collection

3.6.1 Reconnaissance

Before the collection of the primary data, a reconnaissance study of the study area was conducted in November 2021. The purpose of this visit was for the researcher to familiarize herself with the study area, to identify the ecological characteristics of the sub-County, and to get the sampling frame of the secondary schools of the areas. The researcher also developed a data collection schedule.

3.6.2 Questionnaire administration

3.6.2.1 Contents of the questionnaire

The study employed one questionnaire to answer the research questions. The Teacher Survey Questionnaire targeted teachers in selected secondary schools. This questionnaire was divided into four sections; knowledge, attitudes, practices, barriers, and socioeconomic characteristics as highlighted in Annex one. The first section pursued to understand the level of knowledge of the teachers on rangeland conservation principles, local rangeland ecosystems, and their benefits and threats. The second section sought to understand the attitudes of teachers on rangeland ecosystems, their benefits, and the need for their conservation. This section also extracted the attitudes of teachers on environmental education and competency-based curriculum. The third section, on the other hand, extracted the environmental practices of teachers. The last section contained questions on barriers affecting environmental education in the county and the socioeconomic characteristics of the respondents.

The questions in the attitude and practice sections utilized Likert scales to extract the attitudes and practices of the respondents. The use of Likert scales in KAP surveys has grown in popularity due to their ability to rate the attitudes, opinions, and behaviours of respondents (Markus *et al.,* 2022; Milfont & Duckitt, 2010). Data was collected from 5th December 2020 to 15th January 2021.

3.6.2.2 Pilot survey

Before commencing the collection of data, a pilot survey was conducted to test the efficacy of the research instrument in providing answers to the research questions. The research instruments were tested on 5 teachers from Athi Central Sub-County on 1st December 2021. After analysis of the responses and sentiments, the research was shortened to reduce the time taken to complete the questionnaire. Other questions were also rephrased to ensure quick comprehension by the respondents.

3.6.3 Key informant interviews

The role of the Key Informant interviews (KII) was to collect information on the study objectives so as to ascertain and obtain clarity on the issues raised during the questionnaire survey. KIIs were conducted targeting five school deputy school administrators in the sampled schools. Initially, the researcher had set an objective of interviewing all deputy principals from each of the 17 schools visited. However, most of the administrators were not available for interviews due to other engagements. This limited the ability of the researcher to interview all the sampled schools. The interviews were conducted on the same day the teacher survey was conducted. The deputy principals were requested to elaborate on the challenges faced by teachers in implementing EE. This was to get an understanding of these challenges from the perspective of the school administrators. They also provided information on how schools support teachers in the conservation of rangeland both in the school compound and outside the school compound.

3.7 Data management and analysis

3.7.1 Data management

The data was entered into Excel 2016 and checked for completeness and accuracy. New entries were created to record the knowledge, attitude, and practice scores. These were computed based on the respondent's responses to the Likert scale questions. The responses in the Knowledge section of the questionnaire were converted into scores based on the Likert scale used. For instance, the questions assessing the familiarity of the respondents on rangeland conservation principles and concepts were scored 0 when the respondent was unfamiliar with the concept,1 when he or she was somewhat familiar, and 2 when the respondent was familiar. This scoring of the KAP responses mirrored the approach taken by Chi-Chung Ko & Chi-kin Lee, (2003) and Nyangweso, (2018). The respondent was asked to explain the meaning of the term in his or her own words. Scores were then awarded based on the response. It allowed the conversion of the

categorical responses into numerical values that could allow the calculation of descriptive statistics such as the mean score. This was then used to provide an understanding of the KAP levels in the Sub-County in relation to other studies from other places (Zachariou *et al.*, 2019). The knowledge of ecosystems, their services, and threats were scored 0 when the respondent was unaware or did not provide an answer and 1 when the respondent was aware and provided an answer. The same was done for the remaining questions. All these scores were summed up and the mean was calculated for each respondent. This formed the knowledge scores. The scores were categorized based on three knowledge levels; good, moderate, and poor. Scores were graded as 'good' if the knowledge scores were above 80%. They were graded as moderate if the scores were between 60-79% and poor if they were less than 60% following the work of Seid & Hussen, (2018). This was repeated for the attitude and practice questions. In the attitude, section scores were allocated from 0 to 4 for Likert responses of strongly disagree to strongly agree. The scoring system was reversed when the question was negative.

3.7.2 Data analysis

The facts were imported to R statistical software for analysis. The research employed descriptive statistics involving the use of frequencies, percentages, and to check for the presence of errors. Descriptive statistics provided an explanation of the distribution of the variables. The teachers' scores on the knowledge, attitudes, and practices sections of the questionnaires were presented using the mean and standard deviation. The use of measures of central dispersion such as the mean, mode, median, and standard deviation is common in the statistical analysis of KAP questionnaires (Pe'.er *et al.*, 2007; Sadik & Sadik, 2014; Seid & Hussen, 2018; Zachariou *et al.*, 2017, 2019). These were presented using tables and charts while the levels of knowledge, attitudes, and practices were presented using pie charts.

A Chi-square test was used to investigate the association between the knowledge, attitudes, and practices of teachers and their sociodemographic variables (age, gender, marital status, subject, duration of stay, and training)

$$\chi^2 = \sum \frac{(f_0 - f_e)^2}{f_e}$$

where:

$\mathbf{f_0}$ represents the observed frequencies in the contingency table for the two variables

$\mathbf{f_1}$ represents the expected frequencies in the contingency table under the assumption that no association exists between the two variables

The Chi-square test is appropriate due to its robustness, computational easiness, and its application to categorical data. It is also a non-parametric test and was, therefore, there was no need to assess the distribution of the variables. As the study variables had unequal sample sizes, the Chi-square test was suitable over other statistical tests that required the study variables to have equal sample sizes. (Mchugh, 2013). The biggest limitation of chi-square is its sample size requirement. The association between the knowledge, attitude, and practices of teachers on rangeland conservation and the sociodemographic variables of teachers was tested at a confidence interval of 95%.

CHAPTER 4:RESULTS AND DISCUSSION

4.1Introduction

The study findings are shown here. The data from the interviewed samples are first summarized. Findings on teachers' rangeland conservation knowledge, attitudes, and behavior are then presented in a logical order. A literature-based analysis of the findings is also provided.

4.2 Demographic characteristics of respondents

4.2.1 Age and gender

The majority of the respondents to the survey were male (60%) while women comprised 40% of the entire sample size. This disparity can be attributed to the low ratio of male to female teachers employed by the Teachers Service Commission (TSC). Agewise, more than half of the respondents were between 25 to 35 years. The second most dominant age group among the teacher respondents was 36-45 years. Less than 15% of the teachers were aged 25 years and below as shown in Figure 4.1.

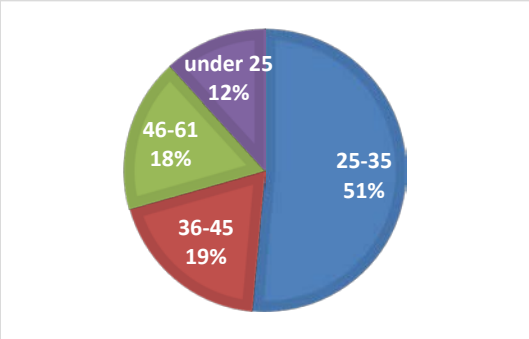

Figure 4.1: Proportion of Age group of respondents

Source: Author

More than a third of female interviewees were aged on the range of 25 and 35 years (37%). The 36-45 age group was the second dominant among females (with less than 30% of the female respondents) while the 46-61 age group was the least dominant age group among female respondents with only 11% of female respondents. Similarly, 25-35 years was the dominant age group among male respondents (61%). Unlike female respondents, the 46-61 age group was the second dominant age group among male respondents. Less than 5% of the male respondents had ages below 25 years. This was the least dominant age group among male respondents. There

were significant differences between the age groups and gender (χ^2 = 9.6475, df = 3, p = 0.02181).

Half of the total respondents were married, while less than a quarter were single (24%). Respondents who were divorced comprised 10.3% of the total sample as shown in Figure 4.2. More male respondents than female respondents were married (56% as compared to 41%) while more women respondents were divorced than male respondents (18% as compared to 5%). Less than a quarter of the male respondents were single (24%). Women respondents who were single formed 22% of the total women respondents. There were no significant differences between marital status and gender (χ^2 = 6.9325, df = 3, p = 0.1395).

With regards to subjects,18% of the total respondents taught physics and mathematics in their respective schools. They were closely followed by biology/mathematics (15%) and C.R.E/history (12%). The subject combinations with the fewest number of respondents were; biology/geography and geography/kiswahili with 3% of the entire interviewees. This was a defect in the smapling design as the researcher mostly selected teachers that she found in staffroom during the data collection phase.There were significant differences between gender and teaching subject (χ^2 =39.561, df = 12, p = 0.0000). Subjects like physics and mathematics were mostly dominated by male respondents, while combinations such as biology and chemistry, and biology and geography were dominated by female respondents as highlighted in Figure 4.2.

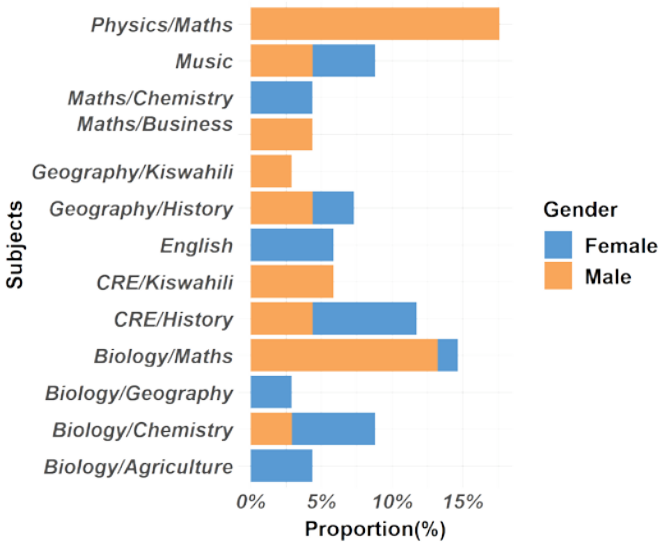

Figure 4.2: Distribution of subject combinations and gender

Source: Author

More than a third of the respondents reported that they had been in their current school for 2 to 5 years (38%). Only 7% of the interviewees had lived in their current schools for 21 years and more as shown in Figure 4.3.

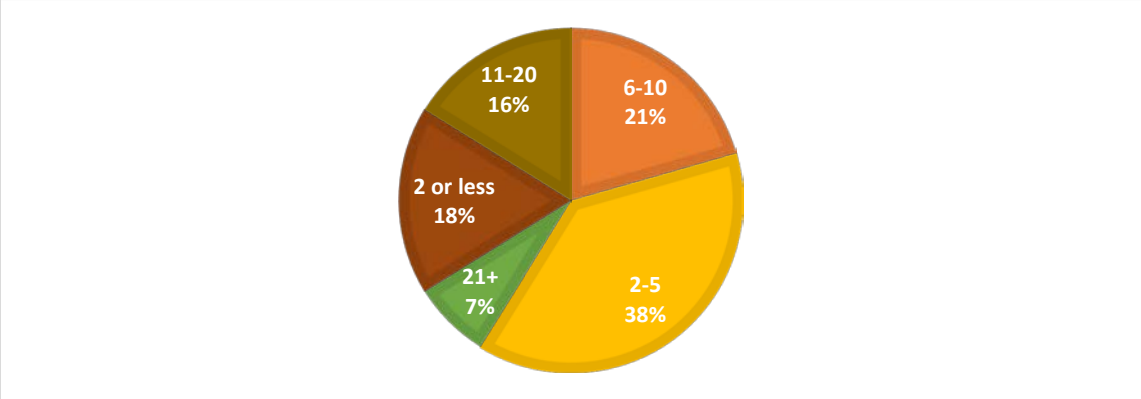

Figure 4.3: Proportion of length of stay in the current school.

Source: Author

On average most of the teachers had a teaching experience of 7.2 years (SD=6.9). Teachers who taught non-environmental-related units like CRE and maths had the same teaching experience as teachers who taught environmental-related subjects (mean = 7.2 years).

4.3 Assessment of teachers' knowledge

4.3.1 Knowledge of rangeland conservation terminologies

To assess the level of knowledge of environmental principles, the research sought to understand whether respondents were aware of the key rangeland conservation terms such as sustainable development, ecology, ecological services, greenhouse emissions, inter-generational equity, and the precautionary principle. A respondent was asked to explain each term. The interviewer awarded marks based on the response given. A respondent scored a 2 if he or she expressed an understanding or familiarity with the terminology based on his or her response. The respondent was given a score of 1 if the response given showed a partial understanding of the term. If the respondent openly expressed a lack of understanding of the term, he or she scored a zero. More than half of the respondents (63%) were aware of these terms while only 37% were not familiar with these principles The concept of greenhouse effects was the most familiar term of the six terminologies (82.4% of the respondents were familiar with this concept) while the concept of ecosystem services was not familiar to most of the respondent (only 38% of the respondent were familiar with this concept). Less than half of the respondents were familiar with biodiversity (45.6%) and the precautionary principle (45.6%). More than half of the teachers showed knowledge of sustainable development, ecology, and intergenerational equity as summarized in Table 4.1.

Table 4.1: Respondents familiarity with conservation terms

Terminology	Familiar	Somehow familiar	Unfamiliar
Sustainable development	54.41%	13.24%	32.35%
Biodiversity	45.60%	17.70%	36.80%
Intergenerational equity	75%	4.40%	20.60%
Precautionary principle	45.60%	14.70%	39.70%

Ecosystem services	38.20%	25%	36.80%
Greenhouse effect	82.40%	2.90%	14.70%
Ecology	61.70%	14.70%	23.50%

Source: Author

The most familiar term was greenhouse effects (mean score of 2.70) followed by intergenerational equity (mean score of 2.59) and ecology (mean score of 2.53). In contrast, the least familiar terms were precautionary principle (mean score of 2.21), ecosystem services (2.26), and biodiversity (2.26). The aggregation of these scores showed that the teachers had a good understanding of these rangeland conservation terminologies.

4.3.2 Knowledge of ecosystem features in the Sub County

The majority of the respondents (77%) were not able to identify the specific features of the rangeland ecosystems present in their sub-County. Prominent aquatic ecosystem features identified by the respondents included; the Athi River, Tiva River, Thwake Dam, Kanyangi Fish Farm, and Mwitasyano freshwater. Forest ecosystem features identified included; the Kavonge Forest, Kavingo Forest, Syomunuy Forest, Matulani, and Tiva Forest. Other respondents also identified the Yatta Plateau which connects the sub-County to Machakos County to the West. Many respondents were not able to identify the specific names of some of the ecosystems. Instead, they responded with generic examples of these features. Examples included; terrestrial ecosystems, forests, aquatic, grassland, and freshwater as shown in Figure 4.4. More than 15% of the respondents identified forest ecosystems and terrestrial as the general components of the rangeland ecosystems in the sub-County. Athi river was identified by more than 10% of the respondents.

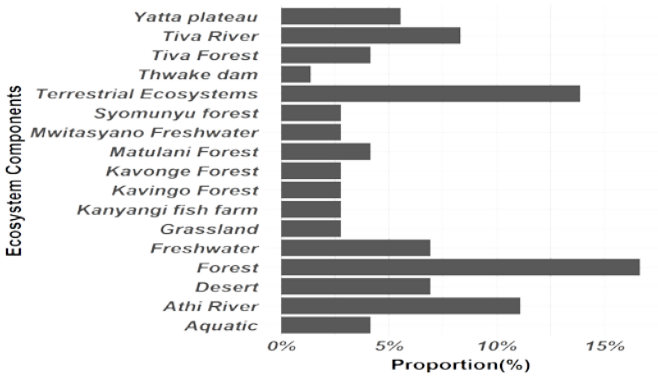

Figure 4.4: Proportion of ecosystems identified by respondents

Source: Author

4.3.3 Knowledge of the benefits of local ecosystem benefits

As with the knowledge of local ecosystems, almost three-quarters (74%) of the respondents could not provide any benefit of the local ecosystems to the County. This could be connected to the actuality that most of the same respondents couldn't identify local ecosystems. They could thus not identify the benefits of these ecosystems. There were significant differences between the knowledge of ecosystem benefits and the teaching subject (χ^2 = 29.432, df = 12, p = 0.0034). More teachers who taught environment-related subjects were able to name the benefits of local ecosystems than teachers who taught physics, Mathematics, History, and Languages as shown in Figure 4.5.

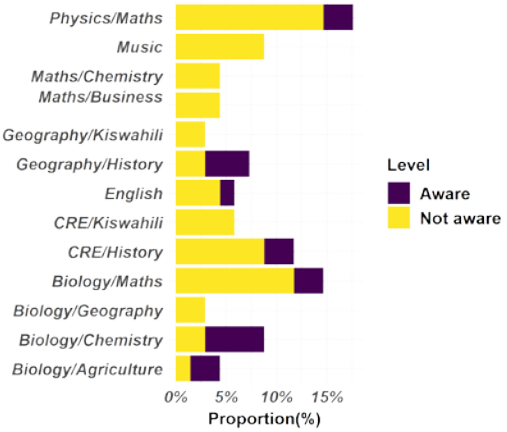

Figure 4.5: Distribution of awareness of benefits of local ecosystems by subject

Source: Author

The most frequent ecosystem benefit identified from the responses was food provision followed by the provision of timber and charcoal and refuge for animals as shown in Figure 4.6. The results show that a significant number of teachers only perceive the importance of ecosystems based on the goods that humanity derives from them. The hidden benefits that fall under regulating services were not perceived by a majority of the teachers. This is the instrumentalist attitude and has been attributed to the cause of environmental degradation. There were significant differences between the knowledge of ecosystem benefits and gender (χ^2 = 6.965, df = 2, p = 0.0307). More men than women identified the ecosystem benefit of food provision and carbon sequestration. More women on other hand identified the provision of water and refuge for animals than men. There was no significant difference between the knowledge of ecosystem benefits and the age group of the respondent (χ^2= 10.491, df = 6, p = 0.1054).

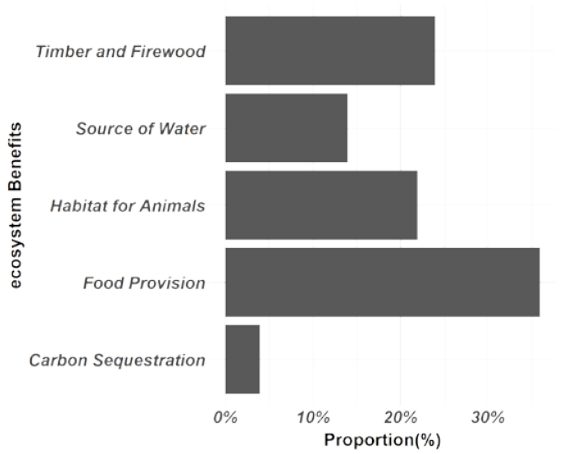

Figure 4.6: Proportion Ecosystem services identified by respondents

Source: Author

4.3.4 Knowledge of threats

More than half of the respondents were aware of threats facing ecosystems in the Sub-County (63%). The main threats identified from their responses were pollution and deforestation as shown in Figure 4.7

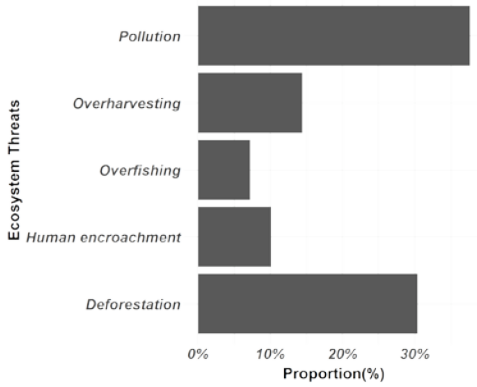

Figure 4.7: proportion of ecosystem threats identified by respondents

Source: Author

4.3.5 Knowledge of environmental awareness creation strategies in the community

This question sought to determine if teachers are aware of the various methods that can be implemented to increase environmental awareness in society. The majority of the respondents (76%) recognized the inclusion of environmental education in the secondary school curriculum as one of the key methods of increasing environmental awareness. Other methods selected by the respondents included; utilizing media such as TV and radio (selected by 17% of the respondents. The remainder identified other methods such as using the scouts' movement in schools and the elderly members of the community to create environmental awareness. In Namibia, teachers identified discourse internet (63%), radio and television, and textbooks (40%) as some of the main ways of promoting environmental awareness.

4.3.6 Summary of teachers' knowledge scores on rangeland conservation

Almost half the respondents (44%) of the respondents displayed a good level of knowledge of rangeland conservation and environmental education concepts as shown in Figure 4.8. Less than a third (31%) of the respondents displayed moderate knowledge as shown in Figure 4.16. Based on the median and mean knowledge scores, the majority of the respondents had moderate knowledge.

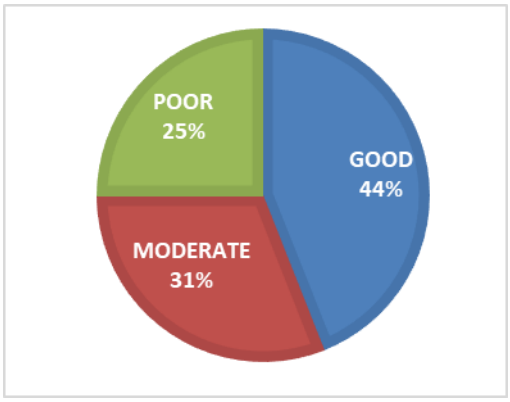

Figure 4.8: Proportion of the level of knowledge of respondents

Source: Author

4.3.7 Teacher attributes and rangeland knowledge level

There was an insignificant relationship between the gender of the respondents and the level of knowledge (χ^2 = 5.029, df = 2, p = 0.0809). Women respondents showed higher levels of knowledge compared to male respondents. Male respondents had three times more poor knowledge levels than their female candidates as shown in Table 4.2. Since the p-value was higher than 0.05, there was insufficient information to reject the hypothesis that there are gender disparities in the levels of knowledge among secondary school teachers in the Yatta sub-County.

There were significant differences between the age group of the respondents and the level of knowledge (χ^2 = 32.554, df = 6, p = 0.0000). Respondents aged between 25 to 35 years were associated with more moderate and poor attitudes. Few of them displayed good levels of knowledge. All the Respondents aged between 56 and 61 years demonstrated good levels of knowledge as shown in Table 4.8.

Table 4.2: Results of the Chi-Square tests

	χ^2	df	p-value
Gender	5.029	2	0.0809
Age group	32.554	6	0.0000*
Marital Status	24.22	8	0.0021*
Duration of stay in the current school	23.436	8	0.0028*
Subject	67.401	24	0.0000*

Training	19.43	2	0.0000*

Source: Author

The level of knowledge also differed significantly with marital status (χ^2 = 24.22, df = 8, p =0.0021,). More respondents who were divorced and or had lost their spouse showed good levels of knowledge than respondents who were single or married. A high number of single respondents showed poorer levels of knowledge than the other marital status categories. All respondents who were separated exhibited moderate levels of knowledge as highlighted in Table 4.2.

The level of knowledge did not significantly vary with differences in the duration of stay in the school (χ^2 = 23.436, df =8, p = 0.0028). All respondents who had stayed for more than 21 years in their current school had good levels of knowledge. More than 80% of respondents who had stayed 11-20 years in their current schools also had good levels of knowledge. This is understandable as the longer a person stays in a particular place, the more he or she can accumulate knowledge on issues be it environmental, social, or economic about the given place. In contrast, respondents who had stayed for less than five years in the current school showed more poor levels of knowledge than those who had stayed for ten years and above.

The knowledge level is also associated with subject combinations (χ^2 = 67.401, df = 24, p = 0.0000). Respondents teaching subjects related to the environment showed better knowledge levels than teachers of non-environmental related subjects. Teachers of subjects such as CRE, history, and Kiswahili, mathematics and business had more poor levels of knowledge than teachers of the other subjects. Among environmental-related subjects, more teachers who taught physics showed poor knowledge levels compared to the other environmental subjects like biology, geography, chemistry, and agriculture. Lastly, respondents who revealed that they had received training in environmental education showed a good level of knowledge than respondents (85%) who had not been trained (27%). The difference between the level of knowledge and training in environmental education was significant (χ^2 = 19.43, df = 2, p = 0.0000).

4.4Analysis of environmental attitudes

4.4.1 Attitudes toward the enjoyment of nature

A third of the respondents (33.9%) strongly agreed that they would rather spend time in the city than in the rangeland ecosystems of the county. Almost a third (31%) of the respondents, however strongly disagreed with this statement as tabulated in Table 4.3. In response to the statement," Sometimes when I am unhappy, I find comfort in the ecosystems of this county", 43% of the respondents disagreed with this statement while 21% were in agreement. Lastly, 31% of the respondent's perceived spending time enjoying nature as boring while a quarter disagreed. There was little variation in these attitudes as shown in Table 4.3.

Table 4.3: Respondents attitudes on the enjoyment of nature

	Strongly Disagree	Disagree	Agree	Strongly Agree
I would rather spend my time in the city than in the rangeland ecosystems of this county	30.9%	20.6%	14.7%	33.9%
Sometimes when I am unhappy, I find comfort in the ecosystems of this county	19.1%	42.7%	20.6%	17.7%
I think spending time	23.5%	25%	30.9%	20.6%

in nature is boring				

Source: Author

The aggregation of the attitudes of respondents to these statements revealed that more than half of the respondents (52%) showed poor attitudes toward the enjoyment of rangeland nature while only 13% displayed good attitudes as shown in Figure 4.9. The mean of the scores was 2.46 (SD=1.10). Teachers, therefore, had relatively moderate attitudes toward their ability to enjoy their local environment. This can be associated with their poor knowledge of the local ecosystems and their benefits.

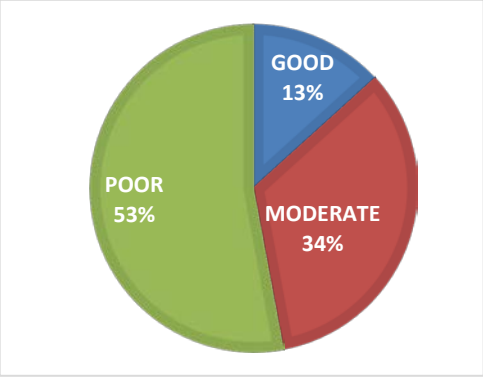

Figure 4.9: Proportion of respondents' attitudes on the enjoyment of nature

Source: Author

4.4.2 Attitudes on recycling of waste materials

The respondents' attitudes are shown in Table 4.4. A third of the respondent (34%) disagreed while a quarter strongly disagreed that government agencies should not force industries to use recycled materials. A quarter of the interviewee, however, were in agreement with the statement. More than a quarter of the respondents agreed (28%) and firmly agreed (22%) that industries should use recycled material even if it meant that the price of the final product will be higher. More than a quarter of the interviewees disagreed with the statement. In regards to the plastic ban, 37% of the respondents stated that they were strongly opposed to it while 29% supported the ban.

Table 4.4: Teachers' attitudes toward recycling

	Strongly Disagree	Disagree	Agree	Strongly Agree
Government should not force industries to use recycled materials	25%	33.8%	25%	16.2%
Industries should use recycled materials even if the final product will cost more	23.5%	26.5%	27.9%	22.1%
I am opposed to the plastic ban	17.7%	29.4%	16.2%	36.7%

Source: Author

The means show that on average most of the respondents had moderate and positive attitudes toward the recycling of waste. This was also confirmed when all the scores were aggregated and the attitude levels computed as shown in Figure 4.10.

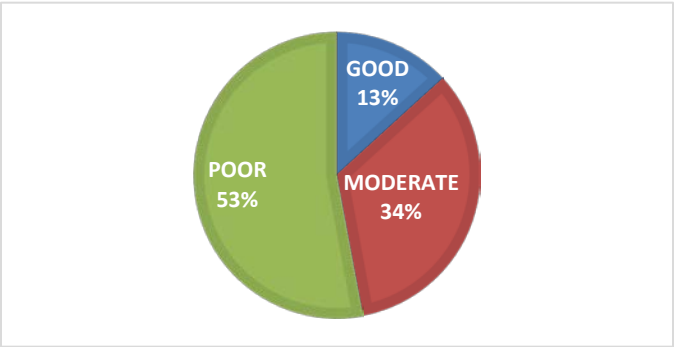

Figure 4.10: Proportion of respondents' attitudes toward recycling

Source: Author

Overall, 53% of the respondents had poor attitudes toward the recycling of waste. Only 13% of the respondents displayed good attitudes toward recycling.

4.4.3 Biodiversity conservation attitudes

More than half of the respondents (59%) supported the eviction of people from forests while 41% did not support the eviction. On the loss of iconic species such as elephants and rhinos, 34% of the respondents expressed fear that their future generation may not have the opportunity to see these animals. In contrast, 24% were not afraid that their future generation will be able to see these iconic species. The conversion of rangeland into agricultural farms was supported by 34% (agreed) and 12% of the respondents (strongly agreed). Half of the respondents, however, did not support their conversion. The result is presented in Table 4.5

Table 4.5: Attitudes of the respondents on rangeland conservation

	Strongly Disagree	Disagree	Agree	Strongly agree
I support the eviction of people from forests	16.2%	25%	35.3%	23.5%
I am afraid that the future generation will	23.5%	20.6%	22.1%	33.8%

not see iconic animals such as elephants and rhinos				
I would support the conversion of most of the rangelands in this county into agricultural farms	22.1%	32.4%	33.8%	11.8%

Source: Author

The aggregation of these responses based on the attitude scale is shown in Figure 4.11. Almost half of the respondents (41%) displayed moderate attitudes toward the conservation of rangelands. Only 19% showed good attitudes toward the conservation of rangelands.

Figure 4.11: Proportion of respondents' conservation attitudes

Source: Author

4.4.4 Respondents' attitudes on environmental education

More than a third of the respondents believed that they had sufficient knowledge to teach environmental education units. A third of the interviewee however disagreed while only 7% firmly agreed. On the inclusion of EE in the school curriculum, a third of the respondents agreed (38%) and strongly agreed (12%) that the inclusion of EE in the school curriculum was justified. More than a quarter, however, were not convinced that the inclusion of EE was justified (28% disagreed). The majority of the respondents strongly disagreed (34%) and disagreed (27%) that

students usually ask many questions on environmental issues. Only 15% of the respondents strongly agreed with these statements. More than half of the respondents strongly agreed (29%) and agreed (25%) that removing EE units from their syllabus would ease their workload. The other half disagreed (24%) and strongly disagreed with this statement as shown in Table 4.6.

Table 4.6: Respondents' attitudes on EE

	Strongly Disagree	Disagree	Agree	Strongly agree
I believe I have sufficient knowledge to teach students about the environment	22.1%	33.8%	36.7%	7.4%
The inclusion of environmental-related units in the secondary school curriculum is justified	22.1%	27.9%	38.2%	11.8%
Students in my class often ask a lot of questions about environmental issues	33.8%	26.5%	20.1%	14.7%
Removing environmental-related units will greatly reduce my workload	22.1%	23.5%	25%	29.4%

Source: Author

Overall, none of the respondents displayed good attitudes toward environmental education, while a majority showed (52%) showed moderate attitudes. Respondents with poor attitudes toward environmental education comprised 48% of the total sample size.

4.4.5 Respondents' attitudes on competency-based curriculum

More than half of the interviewee agreed (35%) and firmly agreed (28%) that they had not received adequate training on CBC. Only 7% and 29% disagreed and strongly disagreed respectively. On the relevance of CBC to learners, 40% of the respondent believed that CBC was good for learners in terms of EE while 38% disagreed. Most of the respondents agreed (50%) and firmly agreed (27%) that CBC would assist in the teaching of EE-related units while 385 disagreed. The mean scores show that on average, teachers had moderate attitudes toward the Competency-Based Curriculum. The respondent attitudes are summarized in Table 4.7.

Table 4.7: Respondents attitudes toward CBC

	Strongly Disagreed	Disagreed	Agreed	Strongly agreed
I have not received adequate training on CBC	29.4%	7.4%	35.3%	27.9%
CBC is good for my learners	14.7%	38.2%	39.7%	7.4%
CBC will assist in the teaching of environmental units	5.9%	17.7%	50%	26.5%

Source: Author

Half of the respondents (CBC) displayed poor attitudes toward CBC while 28% had moderate attitudes toward CBC as shown in Figure 4.12. As CBC represents a paradigm shift in education in Kenya, the lack of experience and knowledge might have led to moderate attitudes. During the interviews, most respondents complained of not receiving adequate training on this new curriculum

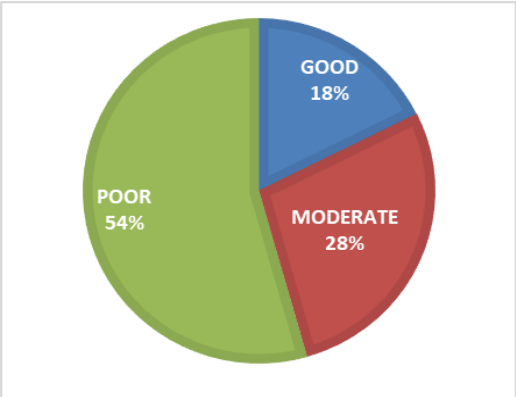

Figure 4.12: Proportion of respondents' attitudes on CBC

Source: Author

4.4.6 Summary of attitudes score

The mean attitude score was 0.61, the median score was 0.63 (SD=0.09). Overall, 62% of the total respondents displayed moderate attitudes toward rangeland conservation and EE. None of the respondents showed good attitudes while the rest (38%) had poor attitudes. There were significant differences between the attitudes and teaching subjects (χ^2 = 29.326, df = 12,p = 0.0096). Teachers teaching combinations involving biology showed better attitudes than the other subjects (mean attitude score of 0.67). They were followed by mathematics, physics (0.63), and geography teachers (0.61). Language and religious education teachers showed the poorest attitudes as per the illustration 4.13.

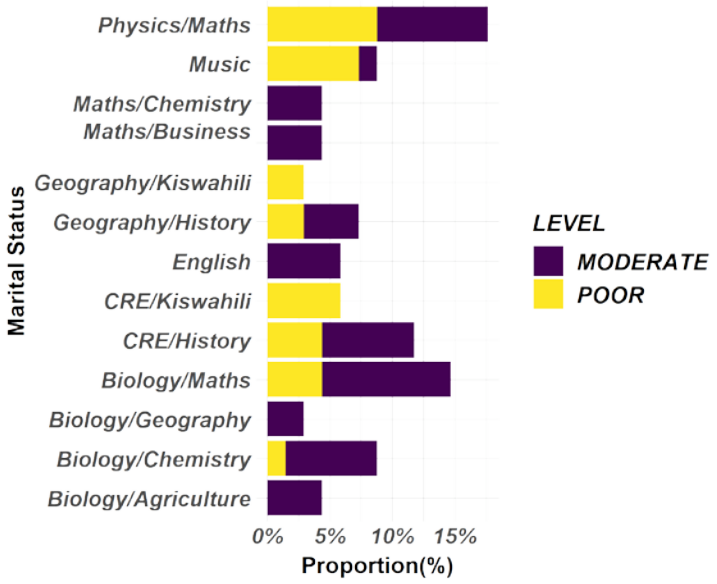

Figure 4.13: Distribution of subjects and attitudes (Source: Author)

Female teachers showed better moderate attitudes than male teachers (mean attitude score of 0.64 compared to 0.60 for males). Chi-Square test revealed that the difference in attitudes was not significant (χ^2= 3.803, df = 1, p = 0.0512). Attitudes differed significantly over the various age categories of the respondent (χ^2 = 13.987, df = 3, p = 0.0030). The 46-61 years had poorer attitudes as compared to the other age groups. The results are presented in Table 4.8.

Table 4.8: Results the Chi-Square Tests on the association of demographic variables and teacher level of attitude

	χ^2	Df	p-value
Gender	3.8026	1	0.0512
Duration in school	10.885	4	0.0279*
Age	13.987	3	0.0030*
Subjects	29.326	12	0.0096*

Marital status	7.976	4	0.0925
Training	0.0066	1	0.9358

Source: Author

4.5 The environmental practices of teachers

Almost a quarter of the respondents (24%) reported that they never engage in conservation on environmental issues with their friends. More than a third (37%), however, talked about environmental issues with their friends. In regards to preventing environmental pollution and damage, almost half of the respondents (44%) seldom warned environmental offenders without hesitation. More than a quarter (28%), in contrast, cautioned people engaging in activities that are injurious to the environment without hesitation. The sharing of environmental-related media through social media was often practiced by 49% of the respondents while 34% never forwarded such content. Half of the respondents also reported that they often watched and/or listened to environmental content online on TV or the radio. More than a quarter of the respondents (29%) however did not engage in these practices. Conservation practices such as switching off water or lights and planting trees were also practiced by the respondents. The latter was often practiced by 41% of the respondent and never practiced by 15% of the respondents. The former on the other hand was often and sometimes practiced by 41% and 16% of the respondents respectively. The practices of teachers are summarized in Table 4.9. In terms of their mean scores, warning people who damage the environment and planting trees were the least pro-environmental behaviors practiced by teachers. Watching or listening to environmental videos and forwarding media on environmental issues were the most practiced pro-environmental behaviors as shown in Table 4.9.

Table 4.9: Respondents' practices in conservation

	Often	Sometimes	Never
Talking with friends about environmental issues	36.8%	39.7%	23.5%
Warn anyone who damages the environment without hesitation	27.9%	27.9%	44.1%
Forwarding mail, SMSes, memes, videos, and pictures on environmental issues on social media	48.5%	17.7%	33.8%
Watching/listening to environmental videos on TV or radio	50%	20.6%	29.4%
Switching lights/water taps when not in use	41.2%	44.1%	14.7%
Planting trees	41.2%	16.2%	42.7%

Source: Author

Watching or listening to environmental videos on TV or radio was the most widely practiced pro-conservation behavior (mean score of 2.21) followed by forwarding media on environmental issues (2.15). Preventing environmental damage through verbal warnings (1.84) and planting

trees was the least practiced pro-conservation behavior (1.98). The conversion and aggregation revealed that almost half of the respondents displayed moderate environmental practices while 26% showed good practices. The results outcomes are highlighted in Figure 4.14.

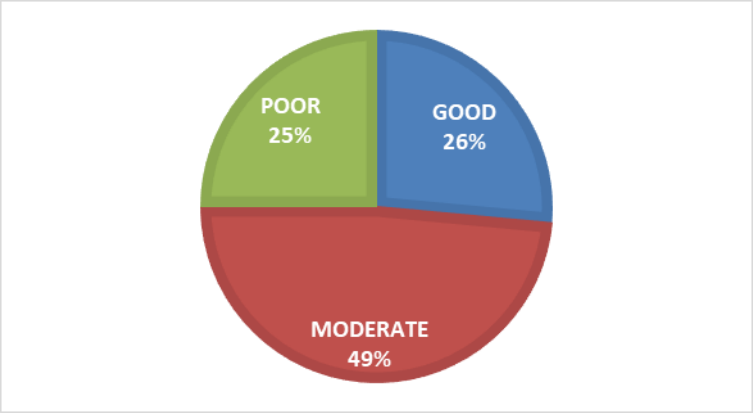

Figure 4.14: Proportion of environmental practices of respondents

Source: Author

Males however had slightly higher mean practice scores than females (0.70 compared to 0.68). However, these differences were not significant ($\chi^2 = 2.315$, df = 2, p =0.3143). No significant differences were also recorded between the practices of teachers and age groups as shown in Table 4.10.

Table 4.10:Chi-Square tests for the association between demographic variables and teacher practices

	χ^2	df	p-value
Gender	2.315	2	0.3143
Age	12.37	6	0.0542
Marital Status	18.695	8	0.0166*
School Duration	27.757	8	0.0017*
subject	41.538	24	0.0015*

Training	6.561	2	0.0376*
Experience	66.754	26	0.0000*

Source: Author

Like knowledge and attitude scores, the practices of teachers showed significant differences with the teaching subject ($\chi^2 = 41.538$, df = 24, p = 0.0015). Teachers of languages showed considerably higher practice scores than teachers of biology and geography. Biology/agriculture and biology/geography teachers had the lowest scores as shown in Figure 4.15. Considering that these teachers showed better knowledge and attitudes than language teachers, the drop in practice levels is surprising. It shows that the knowledge possessed by teachers was not translating to better practices for the environment as theorized by the theory of planned behavior.

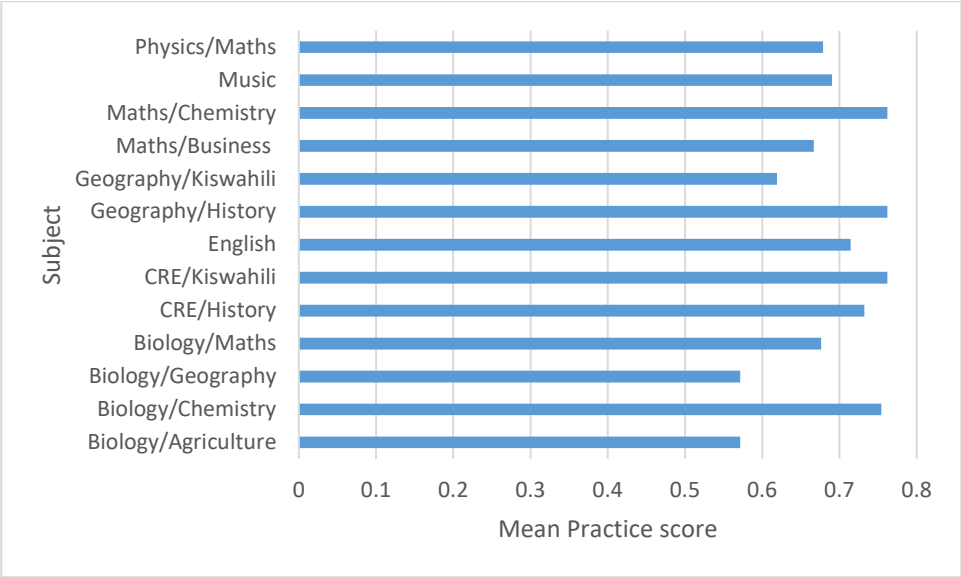

Figure 4.15: Distribution of mean practice scores per subject

Source: Author

4.6 Challenges facing environmental education

According to 72% of the respondents, the coverage of environmental units in the secondary school curriculum is unsatisfactory. Environmental is covered only in minor topics in biology, geography, chemistry, agriculture, and physics. Very few subjects have full topics covering

environmental issues. The other subjects such as languages and music do not have environmental-related units and thus teachers don't teach anything related to EE to their students. This problem is exacerbated by the limited availability of books for reference. This has limited the knowledge of teachers and some admitted that sometimes students ask questions to which they are unable to adequately provide answers or refer the student to a reference book.

The workload (total lessons per week) was seen as a challenge by 32% of the respondents. These respondents complained that the syllabus is congested which gave teachers a strenuous task struggling to complete the syllabus on time. Some of the teachers admitted that sometimes they do not have sufficient time to teach EE units well in a way that can impact their students. Time constraints sometimes forced them to skip EE units. This is because EE units are considered easier than other units. Thus, the teacher can focus on the harder units.

Students, as reported by 62% of the teachers did not pose a challenge to the teaching of environmental units. However, 38% were of the contrary view and complained that sometimes students ask tough questions on environmental issues that they are unable to answer. The majority of the respondents reported that they did not receive support from the school administration in implementing EE activities. They blamed the lack of support from the administration on a lack of finances, ignorance, and lack of concern from the school administration on environmental matters. The other respondents of a contrary opinion noted that the school administration provided support for EE activities like organizing geography field trips where students get to visit some ecosystems in the area, providing seedlings for sowing in the school, and inviting environmental experts to give a talk to the students.

Almost a third of the respondents (31%) revealed that Covid-19 had affected their teaching. The one-year-long lockdown forced learners and teachers to vacate school without having finalized their syllabus. When the lockdown was lifted, teachers had to deal with heavy workloads to finish the syllabus before the start of the new academic year. Some reported that they were unable to finish their syllabus and learners were left to read for themselves the remaining content. The isolation strategies instituted by the government meant that students and teachers could not travel freely. This affected the delivery of environmental units in geography and biology. While many schools usually organize academic trips to enable learners to visit selected ecosystems in the

country, the isolation mechanisms prevented, many schools from organizing such trips. Others lamented that the wearing of masks made teaching difficult.

4.7 Discussion

The results showed that most of the teachers (63%) had good levels of knowledge on key conservation terms like ecosystem services, sustainable development, and intergenerational equity. Knowledge of key rangeland conservation terms is important in understanding how ecosystems function and how they relate to rangeland conservation issues. Nsengimana *et al.*, (2017) also established that secondary school teachers in Rwanda possessed a good understanding of important ecosystem conservation terms. Similarly, in Swaziland, a majority of the teachers (82.5%) demonstrated a high level of knowledge of environmental concepts.

Despite their familiarity with conservation terms, the majority of the teachers could not identify the names of ecosystems in the Sub-County. This shows that most of the teachers were not in touch with their immediate environment. This also explains why a substantial number of these teachers had poor attitudes towards the ability of the local ecosystems to give them recreational benefits. There were no significant differences between the knowledge of local ecosystems and the teaching subjects ($p = 0.106$). This was surprising as it was expected that teachers of subjects that are closely linked with rangeland resources would be most aware of local ecosystems than teachers who teach subjects not related to the environment. Some of these subjects like Biology and Geography require teachers to assist students to undertake fieldwork activities to appreciate their immediate environment. The fact that a significant portion of these teachers were not aware of their local ecosystems means that learners are not made aware of these ecosystems and the challenges that they face.

The respondents of the teachers on the benefits of the ecosystems also show that a significant number of teachers only perceive the importance of ecosystems based on the physical goods that humanity derives from them. The hidden benefits that fall under regulating services were not perceived by a majority of the teachers. Provisioning services were also the most frequently identified benefit of ecosystems in Rwanda according to the study by Nsengimana *et al.*, (2017). This is the instrumentalist attitude and has been attributed to the cause of environmental degradation. The results also show that the majority of the teachers were not able to identify the threats impacting the ecosystems in the county. This stems from the inability of the teachers to

identify local ecosystems in their school environment. Teachers are therefore not connected to their surroundings and therefore are not concerned about their state. In contrast, 57.6% of teachers in Rwanda identified key ecosystem threats facing the local ecosystems. These included habitat degradation, loss of habitats, and over-exploitation (Nsengimana *et al.,* 2017). In Namibia, many of the teachers interviewed by Siseho, (2018) were able to identify threats facing their ecosystems.

Overall the level of knowledge by the secondary teachers in the Sub-County was considerably less than Rwandan teachers interviewed by Nsengimana *et al.,* (2017). Male teachers were observed to have more poor levels of knowledge than female teachers. This is in contrast to the study by Mlipha & Manyatsi, (2005) in Swaziland where male secondary school teachers demonstrated higher levels of knowledge than female teachers. Perhaps there is an indication the many efforts to increase the empowerment of women and promote gender equity are bearing fruit in Kenya. The results also showed a significant difference between the level of knowledge and the age group of the teachers. Environmental knowledge has been assessed and found to have a curvilinear relationship with age. Knowledge increases with age, peaks in the late middle ages, and then begins to decline in the older age groups (Morrison & Beer, 2017). Other researchers have postulated that youthful people tend to be more environmentally conscious than older people due to their access to a variety of sources of information on environmental issues like the internet (Mihanpour *et al.,* 2018). Additionally, the youthful population has been found to be more receptive to social change than the elderly (Catton & Dunlap, 1978). The research papers reviewed by Morison and Beer (2017) however point out that researchers are split on whether there exist differences between environmental knowledge and age groups. Lastly, respondents who revealed that they had received training in environmental education showed a good level of knowledge than respondents (85%) who had not been trained (27%). The difference between the level of knowledge and training in environmental education was significant. Environment training has been known to increase environmental awareness. This relationship has been also confirmed by the study of Liu *et al.,* (2015) in China.

In regards to the attitudes of the teachers, half of the teachers showed poor attitudes regarding the recreational values of the local ecosystems, recycling of waste, and CBC. The greater part of

the respondents showed moderate attitudes towards the conservation of the local ecosystems and environmental education. The poor attitudes of the teachers towards the ability of the locals to offer them recreational value are in line with their lack of awareness of their local ecosystems. No study has measured the attitudes of secondary teachers on the enjoyment of nature but other researchers have highlighted that respondents who spend more time enjoying nature tend to have more positive attitudes towards them (Cheng & Monroe, 2010). Their overall moderate attitudes toward recycling can be a result of the need by the respondents to balance the environmental benefits of recycling with its economic impacts. The findings are in line with the study conducted by Ugulu, (2021) who also established that, preservice teachers in Turkey had moderate attitudes on the recycling of waste materials. He blamed this on the lack of information on recycling. Even though the teachers showed moderate attitudes towards the conservation of local ecosystems, their counterparts in Benin displayed good attitudes towards the conservation of local ecosystems (Kelani, 2017). The difference with this study is that the conservation questions asked in this study were not as radical as those employed in this study.

The respondents also demonstrated moderate attitudes toward environmental education. Even though the teachers demonstrated good cognitive skills in environmental issues, they don't feel confident to teach environmental education. Additionally, the extra workload from teaching environmental education units isn't welcomed by some of the teachers. This can explain their moderate attitudes. Chikati, (2018) assessed the perception of teachers and learners in Machakos Sub-County on Environmental Education. He established that both teachers and learners showed poor perceptions of EE. He blamed the inadequate support for EE programs, lack of appreciation of environmental literacy by teachers, heavy workloads, and the over-emphasis on passing national exams for the poor perceptions. As Machakos borders the study area, the moderate attitudes of teachers on EE can be seen as an improvement. In Swaziland, teachers demonstrated strong positive attitudes towards environmental education. This was attributed to frequent environmental awareness campaigns that were focused more on schools than on other segments of society (Mlipha & Manyatsi, 2005). As CBC represents a paradigm shift in education in Kenya, the lack of experience and knowledge might have led to moderate attitudes displayed by the teachers. During the interviews, most respondents complained of not receiving adequate

training on this new curriculum. It is anticipated that the attitude of teachers will change for the better as they gain experience and increase their knowledge through training (Ngeno *et al.*, 2021). The teachers' levels of attitudes differed significantly with the teaching subject as was also observed by Mlipha & Manyatsi, (2005) in Swaziland. Teachers of science-based subjects had better attitude scores than the teachers of non-science-based subjects. There were no significant differences between gender and the levels of attitudes. In contrast, Mlipha & Manyatsi, (2005) observed significant differences between the attitudes of male and female teachers in Swaziland. Gender is an important determinant of environmental attitudes. Women have been found to have more pro-environmental attitudes than men. This is because the cultural and social roles played by women allow them to interact frequently with the environment. They are thus more affected and aware of environmental issues than men (Weaver, 2002).

The investigation of the environmental practices shows that most of the teachers had moderate environmental practices. These practices differed significantly with marital status, duration of stay in current school, training in environmental education, and teaching subject. Teachers of languages showed considerably higher practice scores than teachers of biology and geography. Biology/agriculture and biology/geography teachers had the lowest scores. Considering that these teachers showed better knowledge and attitudes than language teachers, the drop in practice levels is surprising. It shows that the knowledge possessed by teachers was not translating to better practices for the environment as theorized by the theory of planned behaviour.

CHAPTER 5:SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1Summary of research findings

Out of the 68 teachers who take part in the interviews, 60% were male while 40% were women. The majority of these respondents were aged between 25 and 35 years (51%) while few respondents were below 25 years of age. The average teaching experience was 7.9 years. The majority of the respondents were taught environmental-related subjects.

Respondents showed a moderate level of knowledge of rangeland conservation concepts and principles, local ecosystems, their benefits, threats, and environmental policies and laws. However, the majority of the respondents were not able to give specific names of local ecosystems in the Sub-County. The prominent ecosystems identified by most respondents were the Athi River, Tiva River, and Thwake dam. The respondents identified mostly provisioning services as key benefits of the ecosystems. These included the provision of water, food, and firewood. Most of the respondents knew the threats facing local ecosystems. This included; pollution, deforestation, and overharvesting. Most all the respondents demonstrated a lack of knowledge of environmental policies and laws meant to protect and conserve rangeland resources. The role of EE in creating environmental awareness was recognized by 76% of the respondent. The bivariate analysis showed that there were significant differences between the knowledge level of teachers and the age group of the respondents, marital status, teaching subject, environmental training, and duration of stay in the current school.

The respondents showed moderate attitudes towards the enjoyment of nature, conservation of rangelands, recycling of waste materials, environmental education, and competency-based curriculum. There were significant differences between the level of attitudes and teaching subjects and age. Biology teachers showed the best attitudes while language and religious education showed the poorest attitudes. Environmental training however was not associated with better environmental attitudes. Like knowledge and attitudes, the majority of the respondents showed moderate environmental practices. These practices showed significant association with the subject combinations, training on EE, and marital status. Language teachers showed the best environmental practices than the teachers of Biology and Geography. The challenges facing environmental education identified by the respondents were; There is lack of diversity in the

school's EE reference materials, teachers have excessive workloads, and the management does not provide much encouragement or support for EE activities.

The teachers also identified key challenges facing the teaching of EE in their schools. A key one was the limited content of environmental units in the school curriculum. Whereas subjects like biology, geography, agriculture and physic have environmental related units, the coverage is limited and insufficient in comparison to the many challenges facing the rangeland ecosystems. Additionally, there is very little EE content in subjects such as english, mathematics, kiswahili and music. The teachers thus don't have enough material when teaching students. Others also decried the lack of support from the school management in organizing environmental related activities in the school. The teachers also identified heavy workloads as another significant challenge facing the conted delivery of EE in their schools.

5.2 Conclusion

Understanding the knowledge, attitudes, and practices of teachers on environmental education and environmental conservation at large is essential to the achievement of EE objectives and especially the creation environmentally conscious population. Identifying the various triggers of good environmental attitudes in teachers is important in helping teachers appreciate the environment and horn their teaching skills to ensure students are also able to appreciate the environment and can be able to come up with ways to conserve the environment. This is especially so for rangeland which is some of the most threatened ecosystems in the world.

From this research study, it can be concluded that teachers exhibit moderate knowledge of rangeland conservation concepts and principles, the importance of rangeland ecosystems, and the threats facing them. They are however not in touch with their local environment as evidenced by the lack of knowledge of local ecosystems. Almost all of the teachers were not aware of the policies and laws that help protect and conserve rangelands. This means that the knowledge of teachers of rangelands and EE, in general, is constrained by the content of their syllabuses. As EE-related content is unsatisfactorily covered in the syllabuses of these subjects, the knowledge of teachers on EE and rangeland conservation becomes limited. Teachers of sciences and geography had better levels of knowledge than the teachers of the other subjects. This is because

sciences, agriculture, and geography are the focus subjects in favor of including EE in secondary school courses.

Teachers also had moderate levels of attitudes toward the conservation of rangelands, EE, and the CBC. Most of the teachers did not appreciate their local ecosystems as being able to provide them with a feeling of enjoyment. Almost half preferred visiting the city to visiting the local ecosystems in the Sub-County. Almost half of them also support the recycling of waste products as long as it does not exert an additional cost on them. Teachers of sciences, agriculture, and geography displayed better attitudes than the teachers of the other subjects. Teachers who had stayed in their current school for more than 10 years had significantly better attitudes than those who had stayed for less.

As with knowledge and attitudes, the practices of the teachers were also moderate. Almost half of the respondents did not take steps to prevent damage to their range environment for example warning offenders. Almost half also did not plant trees. Unlike for knowledge and attitudes, teachers of environmental-related subjects showed poorer environmental practices than teachers of languages who showed the best level of practice.

Some of the obstacles to successful environmental education instruction cited by the instructors were teachers' busy workloads, Covid-19, and a lack of support from school management.

5.3Recommendations

5.3.1 Recommendations for education policy and programmes

- The Ministry of Education, Kenya Curriculum Development Institute, and other stakeholders should promote the inculcation of environmental-related issues in languages and humanities.
- The Ministry of Education and publishers of secondary school textbooks should increase the content and number of textbooks available for teaching EE. Environmental organizations should also donate books to school libraries.
- The Ministry of Education and the Teacher Service Commission should conduct continuous training of teachers on EE. With the shift to CBC, it is important that this

training also addresses how EE-related units can be effectively taught under this new curriculum

- School administrators should support teachers to implement EE-related activities in the school. Environmental organizations should also adopt schools in rangeland ecosystems to assist in their conservation and restoration.

5.3.2 Recommendations for further research

- Similar research should be conducted with a bigger sample size to investigate the differences between the KAPS of the teachers of the various subject combinations.
- A study should also be undertaken to compare the KAPs of teachers and students in these schools.
- A psychological study should be done to investigate the factors that promote the adoption of good environmental practices among teachers and students.

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ANNEXES

ANNEX ONE: TEACHER SURVEY QUESTIONNAIRE

5.4Interview Details

Zone:	
School name:	
GPS:	
Interviewer:	
Questionnaire i.d	
Date:	

CHAPTER 6: Consent

Hi. My name is_____. I am a postgraduate student at the University of Nairobi, Department of Geography and Environmental studies. As part of my degree requirements, I am conducting a research study on the perception, knowledge, and practices of secondary school teachers on Environmental education on rangeland conservation in the Yatta sub-County. The research will collect data mainly using interviews with teachers and school administrators. Respondents go through a random selection process. As you have been selected to participate in this study, I would like to ask you some questions regarding your views on environmental education. The whole interview will take 10-15 minutes. No person will be recorded and all information will be kept strictly confidential. It will only be used for academic purposes.

6.1Section I: Respondent details

Most of these questions can be completed without having to question the respondent directly. Be sensitive about the way you gather this information

1. Sex of the respondent (M or F) [_____]
2. Age of the respondent (<25, 25-35, 35-45, 45-60, >60) [_____]
3. Marital status: [_____]
4. Teaching experience (no. of years) [_____]
5. How long have you been in this school (<1, 2-5, 6-10, 10-20, >20) [_____]
6. Core Teaching Subjects [____ _]
7. Lessons per week [____ _]
8. Do you have other nonteaching responsibilities in the school? [_____]

6.2Section II: Knowledge

9. What is your familiarity with the following concepts

		Familiar	**Some how familiar**	**Unfamiliar**
#a	Sustainable Development			
#b	Biodiversity			
#c	Intergenerational equity			
#d	The Precautionary principle			
#e	Ecological services			
#f	Greenhouse effect			
#g	Ecology			
#h	Interdependence			

10. What are some examples of ecosystems found in this sub-County(List any three)?

Ecosystems

Ecosystems

11. In your opinion what are the 4 main benefits of the ecosystems you have mentioned in the last question?

Benefits

12. Are these ecosystems facing any threats? Yes [ ] No[ ]

13. If yes, what are some of the threats facing the ecosystems that you listed before?

Threats

14. In your opinion, is the local community aware of the threats facing these ecosystems? Yes[__] No [__] Don't Know [__]

15. What are some of the activities/programs being implemented to increase the awareness of environmental problems by society? (tick all that apply)

Including environmental units in the school curriculum [__]
Organizing community awareness programs on radio or TV [__]
Involving communities in conservation programs [__]

Others (Please specify) ---------- [__]

16. Are you aware of any policies and laws on the conservation and management of rangelands? Yes [__] No [__]
17. If yes, please list any policies and laws on the conservation and management of rangelands that you know:

……

……

……

……

6.3Section IV: Attitudes

18. Do you agree or disagree with the following statements?

No.	Statements	Strongly Disagree	Disagree	Agree	Strongly Agree
#a	I would rather spend my time in the city than in the rangeland ecosystems of this county				
#b	Sometimes when I am unhappy, I find comfort in the ecosystems of this county				
#c	I think spending time in nature is boring				
#d	Government should not force industries to use recycled materials				
#e	Industries should use recycled materials even if the final product will cost more				
#f	I am opposed to the plastic ban				

No.	Statements	Strongly Disagree	Disagree	Agree	Strongly Agree
#g	I support the eviction of people from forests				
#h	I am afraid that the future generation will not see iconic animals such as elephants and rhinos				
#i	I would support the conversion of most of the rangelands in this county into agricultural farms				
#j	I believe I have sufficient knowledge to teach students about the environment				
#k	The inclusion of environmental/ecology-related units in the secondary school curriculum is justified				
#l	Students in my class often ask a lot of questions about environmental issues				
#m	Removing environmental-related units will greatly reduce my workload				
#n	I have not received adequate training on CBC				
#o	CBC is good for my learners				
#p	CBC will assist in the teaching of environmental units				

19. What are the teaching strategies you use to teach environmental-related units (Tick all that apply): Why do you use this method?

No.	Teaching strategy	Use(tick all that apply)	Reason
#a	Groupwork		
#b	Demonstration/experiment		
#c	Textbook/notes		
#d	Narration		
#e	Discovery		
#f	Learner centred education		
#g	Teacher centred education		
#h	Use of technology		
#i	Others(Specify)		

20. Did CBC change the teaching strategies that you used in teaching environmental-related units?

Yes [___] No [___]

21. If yes, how did the strategies change?_____

6.4 Section Vi: Practices

22. How frequently do you perform the following activities;

No.	Statement	Often	Never	Sometimes
#a	Talking with friends about environmental issues			
#b	Warn anyone who damages the environment without hesitation			

No.	Statement	Often	Never	Sometimes
#c	Forwarding mail, SMSes, memes, videos, and pictures on environmental issues on social media			
#d	Watching/listening to environmental videos on TV or radio			
#e	Using energy-saving appliances at home			
#f	Switching lights/water taps when not in use			
#g	Planting trees			

6.5Section V: Challenges

23. Are you satisfied with the coverage of environmental units in the subjects you teach?

Yes [__] No [__]

24. Please explain if you are not satisfied:

……

……

……

……

25. Does your workload affect how you teach environmental units? Yes [__] No [__]

26. Please explain:

……

……

……

……

27. Do students pose any challenges when teaching environmental units during class? Yes [__] No [__]
28. Please explain:

……

……

……

……

29. Do you receive adequate resources and/or support from the school administration to assist you in the teaching of environmental units? Yes [__] No [__]
30. Please explain if No:

    ……
    ……
    ……

31. Have you attended any training on the environment and how you can best teach environmental units? Yes[__] When did you attend the training:_____

    No [__]

    Why?

    ……

    ……

32. Did Covid 19 pandemic affect any aspect of your teaching? Yes [__] no [__]
33. Please explain:

……

……

……

End of the questionnaire. Thank you for your responses

ANNEX TWO: KEY INFORMANT INTERVIEW CHECKLIST

1) How does the school administration promote the teaching of environmental-related units by teachers?
2) Are teachers enthusiastic about teaching environmental units?
3) what challenges do teachers face in teaching environmental-related units in the school?
4) Please elaborate on the environmental activities that teachers engage in the school and outside the school.
5) In your opinion, how will CBC affect the teaching of environmental units?

ANNEX THREE: RESEARCH PERMIT

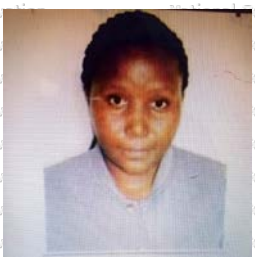
REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **370148**

Date of Issue: **10/March/2022**

RESEARCH LICENSE



This is to Certify that Ms.. Irene kanini mutua of University of Nairobi, has been licensed to conduct research in Kitui on the topic: Perception, knowledge and practices of teachers towards rangeland conservation in lower Yatta subcounty Kitui county for the period ending : 10/March/2023.

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