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The Sustainability of the Science in the Productive Cultural Instruments of African Ancestors for Natural Resource Management

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Abstract

The cultural practices in many African societies are often misconstrued as idolatrous practices. While some of the cultural practices are counter-productive, many others intelligently showcase the science of the African forebears in the field of nature conservation, specifically, the sound management of landmass, water bodies, flora, fauna, and aquatic species. Adopting the PRISMA systematic review, Ninety-Six published literature on cultural practices and traditional ecological knowledge for natural resource management such as taboo systems, cosmological belief systems, and totems in some African ethnic societies were scholarly analysed and interpreted, with inferences drawn for contemporary use in the management of the scarce resources in Africa. The findings indicate that these productive cultural practices were cleverly formulated by the African forebears to prevent the wanton looting of nature's resources while jealously and sustainably protecting them for the current and future generations.

The study contends that the restricted times, number, and aspects of nature's resources for harvesting, the affiliation of nature's resources to vengeful deities and respected ancestors in the society as well as the earmarking of particular spots as sacred groves are scientific strategies set by the African forebears to sustainably manage the resources in their environment for posterity. Therefore, such traditional instruments for nature resource management must be constantly included in policies and strategies in modern biodiversity and environmental policies for African countries.

Keywords: cultural practices; traditional ecological knowledge; natural resource management; biodiversity; African ancestors

1. Introduction

The biodiversity resources in nature play quintessential roles critical to life sustenance on the earth (Adom et al., 2019). Biodiversity undergirds human food security by nourishing the soil and recycling its nutrients (Garbach et al., 2014). Also, biodiversity supplies humans with natural products used for the preparation of drugs to combat diseases (Business Today, 2020). In addition, the biodiverse systems offer humans nature-based solutions that safeguard them from natural disasters such as floods, droughts, storms, and climate change (Quinney, 2020). Unfortunately, the high rate of biodiversity loss globally is worrying and might cripple the life-supporting natural products and services. Business Today (2020) reports that approximately one million plant and animal species are on the verge of extinction. Quinney (2020) admits that humans are the cause of the 83% global loss in wild animals and half of all plants. Statistically, it is estimated that 6,419 animals and 3,148 plants in Africa are threatened with extinction (IPBES, 2018).

The sorry state of Africa's natural resources has been attributed to many factors such as deforestation, and degradation (Yu, 2013), inappropriate harvesting procedures (Mohammed, 2014), overexploitation of the resources (Ghana News Agency, 2013), wrong application of chemicals as well as wildfires caused by unbridled agricultural and hunting activities (Kanbur & Aryeetey, 2017). In managing Africa's natural resources, scientific models have been used such as the use of wildlife corridors, gene banks, species data analysis, animal translocation, the use of botanical and zoological gardens (Adom, 2018a). While these scientific approaches are contributing their quota in reversing the deteriorating state of Africa's natural resource management, they have not fully remedied the situation

(Adom et al., 2016). Therefore, there is the need to search for other alternatives to managing Africa's natural resources (Wilder et al., 2016). Recent studies in nature resource management have shown that the scientific approaches are not the only knowledge and wisdom for sustainable resource management but also traditional ecological knowledge (Sinthumule & Mashau, 2020; Adom et al., 2020). Cultural practices as part of the traditional ecological knowledge (Hereafter, referred to as TEK) of the African forebears have a track record of success in managing natural resources (Meyer-Rochow, 2009). Cosmological belief systems, totems, taboos, and sacred groves create environmental and ethical behaviours that regulate human interactions with the resources in nature (Shastri et al., 2012). Gao et al. (2013) assert that the majority of natural sites managed using cultural practices have remained in their pristine forms without any abuse. The TEK in these cultural practices has sound conservation ethics that promote sustainable natural resource management (Adom, 2017) and they are rooted in ecophilosophy (Ikeke, 2018). The TEK of Africans assists residents in shunning negative behavioural patterns that could have negative ramifications for the resources in the environment (Essel, 2020). Their viability in preventing the wanton abuse of the natural resources is because they are incorporated in the cosmo-vision or beliefs of the people ((DeGeorges & Reilly, 2008). The intelligent forebears developed them from personal experience and critical observations of nature via systematic procedures by analyzing, and series of experimentations (Ajani et al., 2013; Rigsby, 2006). The relevance in the wisdom of the cultural practices to natural resource management has been attested by project officers who work as project leads in funded conservation projects (Materer et al., 2002; Abdullahi et al., 2013).

Unfortunately, the TEK in the cultural practices of the various African ethnic communities have been unjustly labelled as idolatrous, satanic, primitive, uncivilized (Wilder et al, 2016), unsystematic (Ayaa & Waswa, 2016), dwells on spiritual variables (Tomalin, 2002) and retrogressive in today's efforts in managing nature's resources (Gbolonyo, 2009). Others have posited that these indigenous conservatory methods (Awuah-Nyamekye, 2013) have no scientific basis and may not be corroborated by scientific evidence (Meyer-Rochow, 2009). Yet, evidence shows that the TEK in cultural practices have scientific underpinnings and are reliable and accurate (G'Nece, 2012). UNESCO (2003) admit the worth of the TEK in cultural practices such as taboos, festivals, myths, institutions of sacred groves, totems, and cosmological belief systems as having the potential of preventing habitat and species destruction. They are environmentally friendly and sustainable forms of nature resource management (IIED, 1992;

Ayaa & Waswa, 2016). There are instances where TEK in cultural practices is found to be as accurate and even cheaper to produce and record in comparison to the purely scientific knowledge (Ramstad et al., 2007; Anado´n et al., 2009). The rejection and failure to consider the TEK in cultural practices in biodiversity management in Africa have partly contributed to the abuse of biodiversity (Adom, 2016). To better manage the natural resources in Africa, various scholars of TEK such as Bonye (2007), Adu-Gyamfi (2011), Awuah-Nyamekye (2013), Ngara and Mangzivo (2013), Diawuo and Issifu (2015) as well as Adom (2018b) advise project officers and managers in charge of natural resource management to incorporate and utilize the rich TEK in the cultural practices in the African countries. However, such persons and agencies in charge of natural resource management in Africa must be helped to recognize the wealth of TEK in the cultural practices through a rigorous and down-to-earth search (Presby, 2000). Therefore, the study aimed to conduct a systematic review on scholarships in cultural practices, TEK, and indigenous knowledge in Africa for natural resource management to show the conservation ethos evident in them to prove the worth of the science of the African forebears who instituted them. The study was carried out to:

1. Discuss the use of TEK in the cultural practices for natural resource management among some countries in Africa?

2. Analyze the TEK in the cultural practices to unearth their scientific underpinnings to prove the worth of the science of the African forebears.

2. Community-Based Natural Resource Management Theory

The study is theoretically rooted in the principle of community-based natural resource management theory by Armitage (2005) where communities utilize local workable strategies and workforce in managing nature sites in their jurisdiction. This theory posits that local communities across the globe have relied solely on the wisdom of TEK in the cultural practices instituted by their forebears. In most African communities, indigenous institutions spearheaded by the chiefs, elders, and traditional priests oversee the formulation and implementation of the TEK in the cultural practices with the entire community actively engaging in the monitoring of the implementation (A in Figure 1). The TEK is evident in cultural practices such as cosmological beliefs, social norms, moral values, taboos, totems, festivals, and sacred groves (B in Figure 1). The

implementation of these cultural practices that have ramifications for natural resource management is carried out using instruments for traditional checks and balances such as monetary sanctions, ritual performances, sacrifices, banishment, spiritual and physical ailments (C in Figure 1). These traditional instruments are resilient enough in preventing the abuse of natural resources such as plants, fauna, and aquatic species as well as water bodies (D in Figure 1).

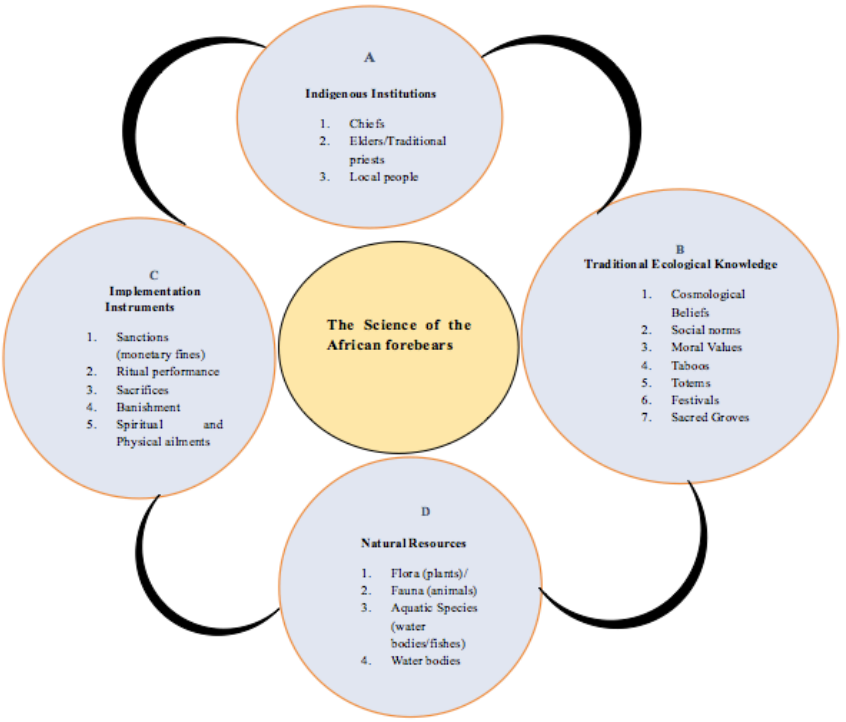

Figure 1: TEK in Cultural Practices for Natural Resource Management

Source: Adapted from Armitage (2005)

3. Methodology

The study is a scholarly review of published literature that involved interpretation, synthesis, and assessment of scientific reports ad studies published by scholars experienced in the field. Published online articles on the subject were thoroughly searched to thoroughly find conclusive answers to the research objectives (Moher et al., 2009). The articles sampled are case studies from West Africa (Ghana, Nigeria, Cote d'Ivoire, Gambia), Central Africa (Cameroon), East

Africa (Kenya, Tanzania), and Southern Africa (Zimbabwe, South Africa). Root words and other additional words and phrases were used for the searching of online databases for suitable scientific published articles on the theme of the study (Table 1). The conservation value analysis criteria (Alvard, 1998; Smith & Wishnie, 2000) was used in unearthing the scientific underpinnings of the TEK in the cultural practices across Africa discussed in the study. The criteria include:

1. Ensuring harvesting restraints
2. Protecting resource species from exploitation
3. Avoiding harmful habitat destruction and/or modification
4. Regulating the onset or duration of harvests
5. Patch-switching to maximize overall returns

The cultural elements, as well as cultural practices and performances, directly and indirectly, possess traditional ecological knowledge that advocates the judicious use and management of the natural resources in the country. These include cosmological belief systems, taboos, totems, cultural festivals, sacred grove, and proverbs. Other cultural elements indirectly promote the awareness of the need to protect and sustainably use nature's resources such as folklores and myths. However, only four of these productive cultural elements, namely, cosmological belief systems, taboo systems, totemic practices, and sacred groves.

Table 1

Keywords and association of words chosen for the systematic review

Root keywords	Additional keywords
Traditional ecological knowledge, indigenous knowledge, local knowledge, culture and nature conservation, taboos, cosmological belief systems, totem, myth, sacred groves	Local community participation, community-owned nature reserves, biodiversity, natural resource management, conservation

The systematic review critically followed the four main stages in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 2) namely identification of the published articles, screening of the articles, eligibility of the published articles detailing inclusion and exclusion criteria and finally, the published articles that were included in the review (Selcuk, 2019).

Figure 2: PRISMA flow diagram

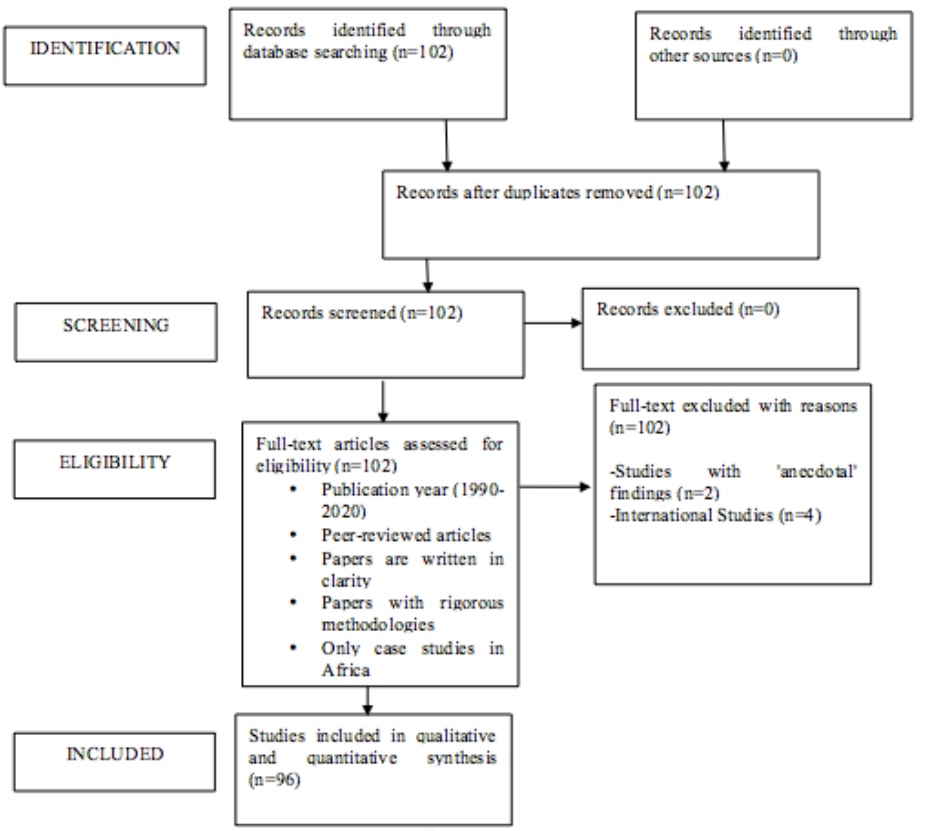

Figure 3: PRISMA Flowchart describing the included and excluded literature for the review

4. Results and Discussion

4.1 Traditional ecological knowledge in the African culture for natural resources management

4.1.1 Cosmological belief systems and nature resource management

Many Africans believe that there are a host of spirits residing in the cosmos that influence their activities (Nwosu, 2010; Kehinde, 2013). These spirits are believed to occupy special positions. The supreme deity (God) occupies the highest position in the hierarchy of spirits, followed by the divinities or lesser gods believed to be emissaries or messengers of the supreme deity. Interestingly, these divinities are believed to oversee the resources in nature, using these natural resources as their abodes or dwelling places (Obeng, 1991). The ancestors, who are believed to be living shades or spiritual guardians of societies, occupy the third position. The ancestors are dead forebears of ethnic societies who led exemplary lives and have been rewarded with the prestigious position as ancestors- agile spiritual beings who are very interested in the affairs of members in their respective ethnic societies, jealously guarding nature's resources, ready to reward or punish persons depending on how they treat the resources in their environment (Adom, 2014). Animism, the belief that the supreme deity has endowed some resources in the natural environment with spiritual potent and as such could be tapped for man's use after some rituals have been performed. Yet, it is believed among the people that the powers (medicinal, spiritual protection, success, and favour) in these natural resources such as plants, animals, rivers, and many others can only be tapped if the laws governing their use such as not abusing them, allowing a part of the resource to be taken and used, amongst many others, are followed meticulously. Generally, Africans believe that the earth is a mystic force, a mother of fertility (Abayie-Boaten, 1998; Adom, 2018c) that should not be abused. Therefore, instead of cultivating the same piece of land continually, measures are put in place to minimize the agricultural activities undertaken on it. Africans engage in inter-cropping, crop rotation, and shifting cultivation (Hilhorst et al., 2015) all in the attempt of maintaining the fertility of the earth to appease mother Earth (Ayaa & Waswa, 2016). Lastly, it is believed that witches and sorcerers occupy the bottom position in the hierarchy of spirits. The latter spirits are feared in African societies because they are believed to cause evil amongst the people.

These cosmological belief systems indirectly promote traditional ecological knowledge that ensures the sustainable management of nature's resources. Generally, Africans believe that they are accountable to the supreme deity, the ancestors, and the divinities in the way they use the resources in nature (Awuah-Nyamekye, 2013). For instance, it is believed that when one abuses the resources in nature, s/he would incur the wrath of the supreme deity who is the overlord of the biological diversities in nature. It is believed that the wrath incurred could result in very severe physical and spiritual consequences on the culprit and even extend to his or her family, lineage, and the entire society (Shastri et al., 2002; Boamah, 2015; Adom, 2016; Adom et al., 2016). Likewise, it is believed that the immediate divinities overseeing the various resources in nature, even residing in them as abodes, would instantaneously punish anyone who abuses the resources (Gyekye, 1996). Amponsah (1977) and Adom (2017) cite the Bosomtwe deity as the overlord of the Bosomtwe Lake. It is believed that when water bodies and rivers are abused by throwing garbage, washing utensils, clothes, and bathing in them would anger the divinity or lesser deity residing in the river who is charged with the power to punish the culprit with sickness, madness, bad luck or even death (Taringa, 2006; Museka & Madondo, 2012; Adom, 2017). The ancestors who are guarding their respective ethnic societies also detest persons who wantonly loot, destroy, or selfishness use nature's resources by punishing them. Aside from the spiritual and physical punishments that are believed to issue from them, it is believed that they could seize the opportunities of such culprits from becoming ancestors after their deaths. Such persons will never be welcomed into the spiritual world, becoming 'restless ghosts'(*Saman twentwen*). The belief in the accountability to the spirits in the cosmos, as well as the attraction of blessings or punishments from the way the resources are managed and used, promotes the sustainable management of natural resources (Adom, 2018c).

4.1.2 Taboo systems and nature resource management

Taboos are prohibitions set out by the forebears of societies in an attempt to place restrictions on certain activities carried out in the society (Colding & Folke, 2001; Khan & Parvaiz, 2010). Taboos in African communities are ethical instruments used in maintaining a peaceful relationship between humans and nature (Ababio, 2014) and serve as a resilient indigenous biodiversity conservation method (Ntiamoa-Baidu, 2000; Osei, 2006). Some practices are tabooed in some African communities in relation to the use of nature's resources. For instance, farmers whose farmlands are close to water bodies are prohibited

from removing the forest cover around water bodies (Abayie-Boaten, 1998; Osei, 2006). Farmers are expected to leave a 30 metres vegetation bank around water bodies and farmers who cut off the forest around rivers and streams are believed to receive both spiritual and physical punishment from the deities and ancestors and the traditional court in their jurisdiction (Abayie-Boaten, 1998; Miller, 1999; Eshun, 2011). Likewise, unfriendly environmental activities such as the throwing of refuse and other forms of waste into water bodies, open defecation, urinating, bathing, or washing in water bodies, and many others are tabooed in many African communities (Anoliefo, Nwokeji & Ikhajiagbe, 2015). Among the Shona in Zimbabwe, urinating into water bodies is an abominable act, and is believed culprits will be punished with severe forms of Bilharzia by the vengeful river deity (Chemhuru & Masaka, 2010). Likewise, the Shona believes that their water bodies will be dried up by the ancestors if they failed to heed hygienic practices.

Also, there are taboos against the hunting of young fauna species as well as female pregnant fauna or those nursing their young ones in some African communities during open seasons (Boafo et al., 2016; Adom, 2019). The killing of these categories of fauna species is considered an act of wickedness punishable by the deities and ancestors. This hunting taboo is practiced in over twenty-six rural communities in the Sekyere-East district in the Ashanti region of Ghana (Adom, 2018c) and Tanzania (Kideghesho, 2008).

Moreover, there are some days and periods within the year set aside when no farming, fishing, or hunting activities are supposed to be carried out. For instance, in most African societies, no farming activity is supposed to be carried out on Thursdays (Adom, 2016). Likewise, hunters are banned not to engage in hunting activities on Fridays while Tuesdays are days no fishing activity is to be undertaken (Boafo et al., 2016). Fishing communities around Central, Ashanti, Western, and Greater Accra Regions of Ghana observe the Tuesday taboo day on fishing (Alexander et al., 2017). Aside from the single tabooed days within the week, there are also periods within the year when none of these activities are supposed to be carried out. Some of these periods often range from two months to four months. For instance, in many African societies, such as Ghana, Nigeria, Tanzania and Kenya from August 1 to December 1, hunting activities are completed banned. Likewise, in most fishing communities in Africa, fishing is banned from March 1 to June 1. The times and durations may differ from one African community to the other. These days are often referred to as *Nnabone* (Bad days) and/or rest days. The days are believed to be the days for the respective

deities in charge of the respective natural resources such as water bodies, forests, and the land (earth). It is asserted that the deities on a tabooed day engage in some purification and cleansing activities which must not be interrupted by any activity. Those days are labelled as bad days because they are days the deities in charge of the resources vent their wrath on persons who ignorantly breach the taboo day and engage in the banned activity, be it farming, hunting, or fishing. Such persons are punished with blindness, deafness, madness, epilepsy, infertility, and even death (Eshun, 2011). Aside from the spiritual punishment meted out to such persons, they and their families are also charged huge monetary fines to pay as well as offering pacification items such as Schnapps, goats, sheep, and cow (in Northern Ghana its called *Zebu*) to the traditional court to petition and soften the faces of the deities so that their punishment will not extend to the other members of the family or the whole community (Adom, 2018; Boafo et al., 2016). These punishments, according to Sinthumule and Mashau (2020) have prevented the abuse of the forest, wiildlife and natural resources in the Thathe Vondo in the Limpopo Province of South Africa.These examples clearly show that the bi-fold consequences of breaching the taboo are very resilient enough in preventing resource exploitation in many African communities where these cultural elements for nature conservation are held in high esteem.

4.1.3 Totemic practices and nature resource management

Most African societies have objects in nature that they believe have played crucial roles in survival. Some African societies even consider those objects in nature as their kin, a family member, one of their kind (Eneji et al., 2012). These objects in nature such as animals, plants, and many others are considered as totems and as such are not supposed to be harmed, abused, or killed. There are myths, folklores, or stories orally preserved in the communities regarding how that particular plant or animal assisted their ancestors during times of famine, war, or pestilence. There are also stories of how their forebears metamorphosed into these objects in nature to sustain their lineage or society from perishing. For instance, the researcher was reliably informed by some residents of Sampa who live on the borders between Ghana and Cote d'Ivoire that they revere monkeys because they believe in an oral tradition that the remaining remnant of their ancestors who were about to perish due to war asked a traditional priest to transform them into monkeys so that their enemies would not be able to sight them. Owing to this, in their jurisdiction, monkeys are tabooed to be killed, harmed, or abused. Likewise, monkeys are believed to be the children of the

great Tano deity among residents in Tanoboase in Ghana (Adom, 2019). As a result, monkeys are not supposed to be killed or harmed. When it is found dead, a befitting burial is given as if it was human. Similarly, the Sankana community in Northern Ghana revere the African rock python (*python sabae*) and frogs, ascribing them as their totem (Diawuo & Issifu, 2015). There is an oral tradition held among the people that a python changed into a big log that helped their early ancestors to cross a big river while escaping from war attacks by slave raiders. It is said that when all their kinsmen were able to cross the river safely, the log again turned into a python, leaving the big river as a barrier between them and their enemies. As such, pythons are not killed in the region. Also, frogs are not killed in the same community because it is believed that it was frogs that led their ancestors to a water source when their lineage nearly perished as a result of thirst.

Alexander et al. (2017) give an account of how sea turtles assisted the ancestors of Akwidaa, Winneba, and Ada in their journey to their current locations in the Western, Central, and Greater Accra Regions respectively. Because of this, sea turtles are not supposed to be harmed or killed. When the sea turtles of their hackling find their way into their fishing nets, they safely release them back into the water bodies (Alexander et al., 2017). Among the Teso people in Busia County, Kenya, birds such as the African Mourning Dove, the Half-Collard Kingfisher, the Nubian Nightjar, and the Barn Swallow known by the local people as Akabulutu, Amuruon, Asulwenyi, and Emelete, were adopted as totemic symbols of different clans in the region. Those birds were seen as instruments of good fortune and prosperity (Ayaa & Waswa, 216). Among the people of Uli in the Anambra State, Nigeria, pythons are revered as belonging to their greatest deity, Attammiri. Therefore, when pythons come to the homes, they are seen as guests who are served with Kola nuts (Anoliefo, Nwokeji & Ikhajiagbe, 2015).

The popular West African crocodile (Crocodylus suchus) is held sacred because it is the totem of the Tongo-Tengzuk communities in the Northern region of Ghana (Arhin, 2008). They believe that the crocodiles are an incarnation of their ancestors, giving rise to their rich diversities in the region (Shirley et al., 2009). The same West African crocodile is regarded as a totemic animal among residents in the Kpalgun and Yoggu villages because the people hold a sacred folktale that their ancestors were guided by the crocodile to cross a big river while migrating to their current location (Boafo et al., 2016). In a similar vein, gorillas (Cross River gorilla) in the Bechati, Fossimondi, and Besali regions of Cameroun are not killed or eaten because it is considered as a totem by the

people (Etiendem, Hens & Pereboom, 2011). Totemic animals and plants are treated with respect, awe, and reverence. The totemic animals and plants in their respective African communities are very abundant because they are not harvested, abused, harmed, or killed.

4.1.4 Sacred grove systems and nature resource management

Particular forest tracts in some African societies are reserved as abodes or dwelling places of some powerful deities and ancestors (Tengo et al., 2007). Such spots are earmarked as sacred and are often referred to as 'inner worlds' (IPCC, 2014, p. 3). The place is seen as a hub where cosmic energies are at a confluence (Rutte, 2011). Therefore in most African communities, entry to the sacred groves is highly restricted to the traditional priest and members of the traditional court (Corbin, 2008; Boakye-Danquah et al., 2014). Also, the harvesting of the biological diversities in the demarcated sacred region is prohibited. The reverential fear for the deities or deep respect for the ancestors who are believed to reside in the sacred grove prevents society members from entering the grove to harvest any of the rich biological diversities or face spiritual and physical repercussions from them (Campbell, 2005). For instance, the sacred forest where the Cross River National Park has been established in Nigeria is seen as the territory of a powerful deity and as such wildlife species in the region are not supposed to be hunted (Jimoh et al, 2012). Tengo et al. (2007) also report that there are various sacred hot spot dry forests in Southern Madagascar that have been protected in their pristine forms.

In some African communities, it is believed that all the natural resources on the sacred grove are the children of the deity who resides there and as such are not supposed to be harvested. Arhin (2008) gives an account of how the people of Boabeng and Fiema in the Central Region of Ghana treat monkeys (*Cercopithecus campbelli* and *Collubus vellerosus*) as one of their kind because they believe they are the children of their powerful deities, Daworo and Abodwo.

In other sacred groves, deities who are overlords of the place often allow members of the society to do selective harvesting of some of the natural resources for medicinal purposes only (Begossi, 1992). Among the Teso people of Kenya, some plant species such as the fig tree (*Ebule*) and the Kigelia Africana tree (*Edodoi*) were seen as sacred trees that were tabooed to be cut down (Ayaa & Waswa, 2016) are said to have medicinal values such as healing mumps. In such cases, only parts of flora species, or some of the furs or feathers of some birds are allowed to be taken for medicinal or spiritual protection purposes (Msuya &

Kidegesho, 2009). In Northern Ghana, the cutting down of the shea tree (*vitellaria paradoxa*) is banned even if the tree is on individual farms. Only aspects of the tree are allowed to be harvested for specific purposes after permission has been sought from the traditional council. This includes allowing the cutting of few branches of the shea tree to light up fire used in the rites performed when a newborn is been introduced to the community (Boafo et al., 2016). The selective harvesting in this case is supervised by members of the traditional council who are expected to perform some purification rites. There are instances where full-scale harvesting is allowed for a selected number of natural resources. For instance, in some African communities, members of the society are allowed to enter the sacred groves to harvest some of the natural resources only within some periods within the year. The sacred grove arrangements in these African communities have resulted in the judicious use and conservation of the natural resources in some regions within their jurisdiction.

4.2 The scientific underpinnings of the TEK in the cultural practices as evidence of the science of the African forebears

4.2.1 Ensuring Harvesting Restraints

The selective hunting implemented by the ethnic societies in Africa has ensured the restraints in the harvesting of the natural resources in the environment. For instance, the practice of hunting for only adult animals and birds, as well as the imposition of taboos and totemic practices on particular fauna and fauna species, have resulted in the production of the sustainability base of the plant, animal, and bird species (Perez & Garcia, 2013) in many African communities.

Also, the restriction on the harvesting of particular trees, which are not to be cut down but only aspects of the trees are rather plucked and cut such as the leaves and barks also have scientific relevance. It is noted that many of the trees with a prohibition on the whole harvesting are endemic trees that have medicinal properties. For instance, plants such as *Odii (Okoubaka aubrevellei), Nufutene* plant (*Kigelia africana*), and *Kakapenpen (Rauvolfia vomitoria Afzel)* have ethnopharmaceutical properties that are effective in curing fractures, piles, fever, stomach problems, and boils (Omobola, 2015). The Kigelia Africana tree locally known as Edodoi among the Kenyans living in Busia County has been scientifically proven to offer an effective cure for mumps or parotitis (Ayaa & Waswa, 2016). Nartey (2015) notes that the strategic positioning of these trees in the community also has scientific ramifications. He argues that those trees act as ecological checkers against environmental reprisals such as erosions, storms,

and earthquakes.

4.2.2 Protecting Resource Species from Exploitation

The tactful deifying of particular natural resources such as water bodies, plants, biodiversity hotspots as abodes of vengeful deities have indirectly conserved the resources from possible exploitation. For instance, due to the great reverence Asantes have for the deities believed to reside in some water bodies, they do not engage in any unfriendly environmental activity to defile their purity (Eshun, 2011). Similarly, taboos barring against the throwing of plastic, sewage, and other industrial waste into water bodies have protected the lives of the various aquatic species from strangulation from consuming those foreign materials (Adom et al., 2019). Moreover, these taboos prevent the introduction of organochlorines and other heavy metals into the water bodies (Orighabor, 2016) which are very hazardous to the life of the aquatic species while increasing the acidity and poisoning of the water (Anim et al. 2013).

Also, the institution of sacred groves has protected many biological diversities in their pristine state, devoid of any encroachment or exploitation (Crespi & Richards, 2007). Boakye-Danquah et al. (2014) note some spots viewed as sacred in most African communities as possessing high soil organic carbon content which is a bioindicator of a healthy ecosystem.

4.2.3 Avoiding harmful habitat destruction and/or modification

The institution of sacred grove systems in African communities as forests housing the skeletal remains of respected ancestors in the society have protected forests in their pristine forms. Thus, habitats that would have been destroyed as a result of resource abuse and/or modified through the undertaking of industrial activities or construction projects. Adom (2018d) notes the sacred groves in the Kumawu, Anyinam-Kokofu, and Essumeja all in the Ashanti region of Ghana as protecting the headways or sources of the water bodies in the community. The positions of sacred groves in the heart of the communities in Africa reduces the likelihood of erosions from overflows of the water bodies (Nketiah et al., 2016). Sacred groves are biospheres that ensure the natural dispersal of seeds of important plant species and conserves rare and endemic indigenous flora and fauna species (Anim et al., 2013).

In many African communities where, agricultural activities are concentrated around water bodies, a large forest vegetation bank measuring a minimum of thirty metres is to be left by farmers (Abayie-Boaten, 1998). Adom et al. (2016) observed this situation at the Bosomtwe Lake in Ghana. Scientifically, this forest vegetation bank prevents the possible high levels of evaporation that could have shrunk or dried up entirely (Orighabor, 2016).

4.2.4 Regulating the Onset or Duration of Harvests

In regulating the duration of harvesting of natural resources, the forebears of African ethnic societies have instituted closed seasons where no hunting, farming, or fishing activities are undertaken. These fallow periods for hunting and fishing are often slated between August 1- December 1 annually. These fallow periods are observed among the Uli people in the Anambra state Nigeria (Anoliefo et al., 2016) as well as the Asantes living in the Sekyere-Kumawu district and Anyinam-Kokofu (Adom, 2017). These fallow periods and rest/bad days (*nnabone*) often coincided with the time the fauna and aquatic species engaged in procreation activities such as mating, pregnancy, giving birth, and nursing of their young ones (Adom et al., 2019; Abayie-Boaten, 1998). The fallow periods allowed the natural resources considerable time to perform the naturally self-restorative and self-healing activities that make them perform their ecological services better (Mavhura & Mushure, 2019). Thus, the cultural closed seasons and rest days scientifically allow the natural resources to increase in their population and diversities to serve man better.

4.2.5 Patch-switching to maximize overall returns

There are cases whereby the patches of land for agricultural activities were intelligently switched to maximize the overall harvesting returns. As I have indicated earlier, the general belief in Africa is that the earth is a spirit, a fertility mother who must be respected and not abused. Therefore, care is taken by Africans not to overly use the same portion of land for farming activities. In various African communities, fallow periods lasting for six months, one year, or two years are observed on agricultural lands to help it rejuvenate its soil fertility and health are duly observed (Adom, 2018a; Ikeke, 2018). A popular land-use system similar to shifting cultivation was utilized by farmers where there is a yearly turn-over of the harvested land (Lui et al., 2000). The long fallow periods allow the land to rejuvenate its fertility levels through the regain of soil nutrients (Association of Temperate Agroforestry, 2015) that might have been replenished as a result of the year-long tilling and cultivation of the same patch

of land. Not to put too much strain on the land, culturally acceptable agronomic practices such as mixed cropping, crop and land rotations, agroforestry, and cover cropping were scientific strategies implemented by the African forebears were adopted (Cothren, 2014; Anoliefo et al., 2016). These scientific means of restoring the soil fertility of the land driven by the belief that the earth is a fertility deity who demanded respect helped in naturally enriching the soil fertility of agricultural lands for sustainable agronomic activities in the various ethnic societies in Africa.

5. Conclusions

The study has shown that the cultural practices of the African forebears are not superstitious nonsense, resting in the past but rather cultural instruments with a wealth of conservation ethos for efficient application in managing natural resources. A careful and thorough academic search into their formulation as has been exemplified in this article revealed their scientific underwritings that positively impact nature resource management. Indeed, the science of the African forebears is basked in their cultural institutions. Unfortunately, the studies reviewed have shown that the rapidly changing socio-economic and environmental conditions in contemporary Africa are influencing some members in the African communities, especially, the youth to disregard the cherished traditional ecological knowledge for the management of nature's resources. This condition may be attributed to the absence of education of the youth of the worth of TEK in nature resource management. Therefore, this dearth of knowledge must be incorporated into the education curriculum in Ghana at all levels of education by the NaCCA and the CRDD of the Ministry of Education.

Owing to the tremendous benefits TEK has in the management of nature's resources, the study recommends that cultural/TEK experts form part of the project team for all nature resource management projects in African countries so that they can ensure the smooth inclusion of TEK in their planned strategies. Also, due to their sacred office, chiefs in African communities should be empowered to implement the taboos essential for the sustainable management of nature's resources in their respective communities via the national legislature. That said, there is also the need for both the domestic and national laws to punish scrupulous and corrupt traditional chiefs and members of the traditional council who trade nature's resources for their monetary gains. Such unworthy chiefs together with some of the members of their traditional council stoop very low and compromise their spiritual position to abandon the esteemed TEK meant to

protect the environment of which they have been culturally made its stewards. This would raise the level of accountability and transparency required of the local authorities in helping in the sustainable management of the resources in the environment. Successful implementation of these recommendations would gratify the essence and successful application of TEK in nature resource management and appreciate the worth of ecological wisdom latent in the productive cultural practices of the intelligent African forebears. Future studies must investigate the significant roles the custodians of TEK in local communities, especially the traditional chiefs, could play in nature resource management in modern African societies.

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