



SENGWER INDIGENOUS ENVIRONMENTAL KNOWLEDGE AND THE MANAGEMENT OF CHERANG'ANY FOREST RESOURCES, ELGEYO-MARAKWET COUNTY, KENYA

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ABSTRACT: *Globally, forests supply important environmental benefits within and across ecosystem boundaries and despite institutional management, forest ecosystems are subjected to land-use changes which diminish their role. In Kenya, the current institutional management instruments are largely in place but there is a continuous reduction of forest cover presently estimated at 5.7% of the national land area as opposed to the desired > 10.0%. The integration of indigenous ecological knowledge into forest management may provide a much-needed bridge between indigenous communities and institutional understanding of sustainable forest management. Thus, the study examined the role of IEK in the management of forest among the Sengwer community living next to the Cherang'any forest, Elgeiyo-Marakwet County, Kenya. The study targeted older community members who were purposely sampled as key informants. The study used focus group discussion as the main instruments for data collections and thus qualitative analysis was more appropriate. The output was presented in thematic format. The study established that the Sengwer indigenous forest management techniques are compatible with institutional techniques applied in the management of the forest to the extent that institutionalized methods are more pervasive in the management of the forest. Based on the discussions, the study concluded that the indigenous conservation practices need to be formalized and integrated with the modern forest management practices. IEK can be included in the sustainable conservation of forests if the socio-economic status of the community is improved through economic empowerment. Further, the study recommends that Kenya's Forest Conservation and Management Act of 2016 provides a basis for the integration of IEK into modern forest management techniques.*

KEYWORDS: Forest management, Indigenous environmental knowledge, Indigenous knowledge, Natural resource management (NRM).



INTRODUCTION

The forest sector contributes to poverty alleviation through subsistence activities, income generation, improving agricultural productivity, energy efficiency, and rural development and promoting inclusive governance (Park & Yeo-Chang, 2021). In different countries, several levels of land-use restrictions are aimed at conserving or protecting nature and its services and range from protected landscapes to nature reservations (Lambin & Meyfroidt, 2011). However, largely, forest management activities have negatively affected the habitat and environmental conditions for the living organisms living within the forest ecosystem (Wu et al., 2018).

The conventional response to the environmental destruction has been the establishment of protected areas which range from Game Reserves and National Parks to forests has, at times appropriated huge chunks of land, sometimes forcibly collected, from indigenous people to government, thereby leading to the collapse of customary land management practises, impoverishment of communities, societal conflicts and repression (Youn et al., 2017). Largely, these approaches to the management of forest resources have been mainly driven by the command and control top-down approach of government centralized initiatives (Heenehan et al., 2015).

The use of protected areas (PAs) criterion is the dominant western-oriented philosophy that seeks to separate the pristine natural environments from the human-modified habitats (Anaya & Espírito-Santo, 2018). The practice of conservation has emphasized the creation of protected areas for threatened biodiversity landscapes by restricting human use or encroachment (Wali et al., 2017). The designation of the protected areas as a conservation and management strategy is based on the land-use control planning perspective that legitimizes business-orientated, green projects that seek to conform to the paradigm of ecological modernization (Anaya & Espírito-Santo, 2018). This has seen the growth of the protected areas two-fold over the last two decades (Cooper & Kainer, 2018).

These formalized and centralized forest management approaches has led to several challenges that include resource exploitation (Heenehan et al., 2015), the ever-increasing management cost (Jumbe & Angelsen, 2011), hostility between forest communities and conservation agents (Luswaga & Nuppenau, 2020) and resistance from people (Gurney et al., 2016). Other challenges include the increase in environmental conflicts which involve the territorial rights of local and indigenous communities (Anaya & Espírito-Santo, 2018).

Formal forest management practices have also been criticized for failing indigenous communities. In particular, a study carried out in Baka, Cameroon by Carson et al. (2018) examined how indigenous people viewed the use of protected areas as a way of conservation of forest that has impacted on their livelihoods and threatened IEK and hindered self – determination. The formal management system has disenfranchised and alienated them from their ancestral home, depletion of forest resources such as food, medicine, and others as well as the loss of cultural identity (Cooper & Kainer, 2018).

Further, the protected areas have been criticized as an approach that hastens deforestation of the pristine environments through human displacements, natural resource extractive activities, anthropogenic activities, or land market mechanisms (Lambin & Meyfroidt, 2011). Houde (2007) observed that the bureaucratic, centralized land and forest management practices have been critiqued for occasioning collapses of ecological habitats and for failing to improve



people's lives which is detrimental to local communities' interests (Barrow et al., 2016). The socio-environmental conflicts relating to the expropriation of indigenous communities from their ancestral territories has also generated conservation refugees (Anaya & Espírito-Santo, 2018).

The poor conservation outcomes associated with the intrusive forest management approaches coupled with planned development have forced a rethink on the role of community in the management and conservation of land and forest resources (Agrawal & Gibson, 1999). These sustainable management and conservation in community-conserved areas are often considered more vibrant than the centrally-managed protected areas but are neglected or unrecognized in the formal conservation practices (Cooper & Kainer, 2018). This growing interest in the bottom-up stakeholder approach takes cognizance of the community-based conservation approaches and engages with the local stakeholders (Jumbe & Angelsen, 2011); and amazingly, it is integrating indigenous communities as conservation partners (Cooper & Kainer, 2018).

Due to this aspect, indigenous environmental knowledge is receiving recognition from scientists, managers and policymakers alike and thus drawing some support both locally and internationally (Mauro & Hardison, 2000; Desta & Smithson, 2016) with evidence showing that IEKs of the IFCs play a crucial role in the sustainable usage of natural resources (Kangalawe et al., 2014; Alden, 2012; Varte, 2012).

Problem Statement

The creation of protected areas as a dominating strategy in conservation (Anaya & Espírito-Santo, 2018) and the centralization of resource management systems has failed to improve people's lives and led to an ecological collapse within the ecosystems (Houde, 2007). The same conservation efforts are falling behind in their efforts because of the complexity and magnitude of the problems (Balmford & Cowling, 2006). Due to these limitations, indigenous knowledge systems seem to offer new approaches as it recognizes the complex adaptive environmental systems (Barnhardt, 2005). Further, the policy framework supporting community participation in natural resource management is not distinctively clear in elaborating communal participation (Persha, Agrawal & Chhatre, 2011).

Winkelhuijzen (2017) observed that environmental conservation of the Cherang'any hills is fraught with pull and push conflict that pits the government agency, Kenya Forest Services on one part and Sengwer community on the other. The agency, KFS, agrees that the forest is too important to be managed by the community, while the Sengwer community acknowledges that the forest is their ancestral home and thus they are able to utilize their IEK in managing the forest. The conflict has taken a political dimension as part of the wider struggle for recognition of the Sengwer community who feel unrecognized, marginalized and disempowered. The Forest Act of 2016 seeks to improve governance as an implicit objective through the introduction of participatory forest management. However, the lack of integration of IEK with the government forest management policies is a major impediment to the sustainable management of the country's forest resources as envisaged by Article 69 of the 2010 constitution, Vision 2030 and SDGs.



LITERATURE REVIEW

Theoretical Review

The theoretical review underpinning the study is underpinned by the common pool resources which is based on the tragedy of commons as informed by Hardin (1968) and the stewardship theory. The tragedy of commons seems to advocate for the privatization of the common pool resources and the use of command-driven regulation of common-pool resources (Heenehan et al., 2015). These actions of the actors often lead to overutilization of the shared resource because resource users are anonymous, are deficient in trust and reciprocity and are unregulated (Basurto & Ostrom, 2009).

The CPR theory considers an individual as the basis for analysis and that the individual choices are constrained. Therefore, the individual preference provides the logic to support the commons project (Saunders, 2014). This is illustrated by the contextual poverty situation or overpopulation, where the prevailing socioeconomic factors force individuals to extinguish their resources, thus embedding themselves deeper into poverty (Eckert et al., 2018). The fundamental basis in the common property regimes is that institutions created by resource governance mechanisms such as rules can be used successfully in providing systems for monitoring and sanctioning (Barnes & Van Laerhoven, 2013).

The theory has been used in advancing governance arrangements in diverse extractive forms of utilization of natural resources such as forestry, fisheries and water in a particular context (Heenehan et al., 2015). It also frames natural resource management as a model containing a range of property rights (Ban, Wilson & Neasloss, 2019). In the rural areas, the common property resource systems represent an integral part of the main livelihood systems with customary traditions of communal resource use (Dessalegn, 2016). This institutional fit within the CPR framework is embedded within specific social-ecological contexts (Haller et al., 2013).

The most obvious form of loss in the commons is the complete loss of resources but it is empirically difficult to observe the complete loss, however, the most common tragedy is the depletion of a resource (Gersani et al., 2001). The theory seeks to emphasize the collective ability of persons to unanimously act to manage the dilemmas inherent to common-pool resources (Krause, Collen & Nicholas, 2013). However, the groups are not unlikely to cooperate, thus, the degradation of the resource is a consequence of the inability of the users to mutually act to achieve mutual benefits (Ostrom, 1990). The effectiveness of the mutual action in common property regimes is affected by several factors that include: resource characteristics, user group characteristics, and external influences on these factors (Barsimantov, 2010).

Several critical enabling mechanisms include the absence of appropriate leadership, the group size, the heterogeneity of interest and identities that could impede the self-governance arrangement in organizing common property regions or employing collective action (Barnes & Van Laerhoven, 2013). However, there are several ways in which sustainability in commons can be improved, security of tenure of the commons, organization rights and participation in decision-making or the collective choice to be made by the actors (Krause et al., 2013).

Colonialism in sub-Saharan Africa was faulted as a Common Property Regime that was based on traditional leadership that led to the degradation of natural resources (Magole, Turner & Büscher, 2010). This notion was institutionalized, became the mainstream and was coupled



with Hardin's proposition of the 'tragedy of the commons' which legitimized formal state intervention in the management of the common-property regimes. The characteristic feature of this formal intervention mechanism was the reformation agenda which entailed the privatization and nationalization of communal resources while condemning the communal land tenure and the associated traditional resource management arrangements as being inherently detrimental to the natural resource.

On the converse, the stewardship theory supports the application of the IEK in any conservation context. IEK represents the application of local and indigenous community conventions to support environmental stewardship with rules for the regulation and the advancement of appropriate world views (Finn et al., 2017). For instance, the indigenous communities in the Pacific region of the United States of America (USA), held a form of traditional land stewardship that maintained the ecological integrity of the lands and supported their well-being (Long & Lake, 2018). According to Holmes and Jampijinpa (2013), the community's cultural connections to land and their immediate environment shapes the group identity, a critical resource that strongly influences an individual's sense of stewardship while offering opportunities for sustainable resource management.

For instance, some indigenous tribes in British Columbia, Canada have advanced their environmental stewardship by reasserting their cultural and management rights (Eckert et al., 2018). This long-established stewardship perspective of the Pikangikum people is located in the relationship with their environment, thus, Pikangikum as a community consider themselves to have been positioned on the land with all other living organisms and provided with everything by the Creator. The gift of life, in turn, is respected whenever people harvest other beings (O'Flaherty et al., 2008). Thus, they consider their engagement with the environment as a reciprocal relationship with the land and Creator (Walsh et al., 2013). DeRoy and Darimont (2019) reported that the First Nations in Canada have continually applied stewardship in terrestrial and marine systems, where the indigenous laws, hereditary leadership and governance systems governed resource usage.

Empirical Review

IEK has been applied in the management of forest resources (Butler et al., 2012). IEK has specifically been applied in Mexico where community forestry has been accepted as a developmental model for rural communities for the control of forest degradation (Barsimantov, 2010). Through this participation in forest conservation and governance, local indigenous communities enhance sustainability in conservation, legitimize IEK rules, and strengthen accountability among resource users (Porter-Bolland et al., 2012). In other instances, indigenous communities in Bolivia and Ghana use the aspect of sacred, cultural sites and festivals among others as forms of culture and spirituality and as indicators of conservation efforts being undertaken by local communities (Caillon et al., 2017).

In Canada, a customary environmental stewardship approach is being applied by Pikangikum to conserve the white feather forest. This is based on the understanding that it is the responsibility of the community to safeguard land, water and all creatures as they are sacred gifts from the creator (O'Flaherty et al., 2008). In New Zealand, the IEK is used to understand climate change issues, however not without challenges in that elders do not understand or possess the knowledge on climate change but they instruct on the signs and their importance (Berkes, 2009).



IEK has been integrated into the zoning of land and forest use and conservation for the grizzly bear (*Ursus arctos*) which hold significant cultural importance to several first nations in British Columbia, Canada. The use of the first nation's data on conservation has helped improve the existing habitat maps that are used for conservation (DeRoy & Darimont, 2019). Quaempts et al. (2018) examined the Umatilla communal IEK in the conservation of the forest in the USA. These actions tend to prioritize ecosystem resiliency over short-term exploitation of resource usage. The sustainable harvesting practices among the Umatilla community included omitting most of the plant roots during harvesting, replanting the flowering heads of harvested plants, or delaying harvesting until seeds have fully formed. Other ways include leaving huckleberries on bushes as forage for the bears and other animals and promoting continued growth and production of berries.

In New Zealand, the indigenous communities actively participate in natural resource management through the Te Ao Māori (Māori world view) and mātauranga Māori (Māori knowledge systems) (Harmsworth et al., 2016). Some of the conservation practices used by the aboriginal Nyul Nyul communities of Australia include the harvest restrictions placed on the valuable food source, water sources among other resources to prevent overexploitation. Other important practices among these communities are the civil use of land and forest resources through ceremonial activities, fishing, hunting, use of materials, among others (Pyke et al., 2018)

An exploratory study on Peruvian Amazonia indicated that indigenous communities apply the IEK in classifying the habitats and ecosystems according to several features that include hydrology, vegetation physiognomy, tree species and soil appearance (Schulz et al., 2019). In a study done in the Brazilian Amazon, Cooper and Kainer (2018) observed that support for participation in forest conservation was motivated by income. The study interviewed households in two related logging projects and managed to identify perceptual differences between participating and non – participating households; however, both groups supported the customized extraction of the forest resources indicating acceptance of locally developed conservation efforts.

A study in India examined the types of indigenous knowledge on forest management. The study made several observations that include the classification of the forested areas, the application of different tree species for specific uses that include agricultural implements, construction and repair of houses, food and medicinal herbs and trees, sacred sites among many others (Murmu & Bhattacharya, 2019). The research by Gratani et al. (2011) sought ways to integrate the aboriginal IEK into NRM and involved the scientific trials of use of biological fishing poisons to catch fish. The study established that the fishing poisons derived from specific tree species were reversible and immobilized an invasive fish species thus reducing the strenuous activity of fishing.

In sub-Saharan Africa, over 35 countries have introduced community initiatives in the policy framework (Persha et al., 2011). For instance, in Zimbabwe, indigenous communities conserve forest resources through several ways which include the performance of *mutoro* ceremony which allows individuals to cut down trees or collect wild fruits. Another important aspect of conservation is the protection of sacred sites from the exploitation of forest resources. This has seen the Runinga and Banya forests being protected and conserved because of the sacredness (Risiro, Tshuma & Basikiti, 2013). Dessalegn (2016) observed that restricted access to resources based on the customary property rights and accountability of the regeneration of



forest resources among the indigenous communities in Ethiopia. The engagement of indigenous people in environmental management is increasing globally as a result of the recognition of their rights, interests, and the worthiness of IEK (Harmsworth et al., 2016).

In Ghana, a study explored how the African traditional belief systems influence conservation efforts. The study observed that some communities are using taboos and totems as a means of traditional natural resource conservation and management. In particular, totems and social taboos were used by all cultures, and this represented a form of informal institutions, where traditional, religiously governed norms or taboo systems define human behavior. Totems and taboos have been important objects within human societies serving as a commemorative object of ancestry and have promoted natural resources conservation and management over time (Diawuo & Issifu, 2015).

The application of the IEK in the management of forest resources takes the following themes: participation of indigenous communities in forest conservation and governance (Porter-Bolland et al., 2012), the preservation of specific land and forest resources under specific cultural context (Dessalegn, 2016), spiritual significance (Risiro et al., 2013), communal safeguard to land, water and all creatures (O'Flaherty et al., 2008) zoning of land and forest use and conservation (DeRoy & Darimont, 2019), application of exclusive cultural use and activities on forested areas (Caillon et al., 2017; Pyke et al., 2018), the protection of sacred sites (Risiro et al., 2013), among other initiatives. The initiatives show that IEK provides important avenues for the conservation and management of forest resources. These studies highlight the specific avenues IEK initiatives aid in the conservation of forest resources, however, there is a dearth of studies detailing the IEK initiatives aid in the conservation of forested areas in Kenya.

METHODOLOGY

The study adopted a descriptive research design because the design takes a qualitative approach that seeks to explain how people make meanings and how they understand phenomena in society. The study area covered the Cherang'any Hills which covers a series of indigenous forests that include Kapkanyar (5,764 ha), Kapolet (1,625 ha), Kiptaberr (12,801 ha), Lelan (14,516 ha), Embobut (21,689 ha), Kerrer, Kaisungurr, Toropket, Chemurgoi, Sogotio (3,555 ha).

The study utilized focus group discussion as the main source of the primary data collection tools. The 12 key informants consisted of the sages from the Sengwer community because of the patriarchal nature of the community who were obtained through the snowballing sampling technique. The focus group discussion was done in Maron – Marichor Primary school in September 2021.



DATA ANALYSIS

Since focus group discussion generates qualitative formats of data, the researcher used data transcription mechanisms to translate the unstructured data into meaningful information. The process which involved several steps were simplified because of the sensitivity of the study area to cultural and political issues concerning the conservation of the Cherang'any forest. The researcher employed an educated local as a translator to decrypt and define the meanings of the terms used by the informants and translate them into either English/Swahili language which could be easily written down.

And with the help of research assistants, the researcher was able to record and document the proceeding of the interviews and discussions. The research consistently requested and stressed the translation of the terms and ideologies from the local language to simpler terms and analogies which could be documented easily. Once the process was completed, the researcher employed a typist to transcribe the report of the interviews and discussion.

Once the data has been transcribed and summarized, the data generated were analyzed through inductive and deductive approaches. The data were condensed, categorized and ordered before being presented in narrative and thematic analysis. In this instance, narrative analysis aided in verbatim, the description of the existing relationship between the Sengwer community and the forest.

RESULTS

The section gives a description of the qualitative data gathered from the focus group discussion. First, a description of the forest's resources. SEN 002 “the forest serves as a store of value, where everything has its place. In their homestead, the close-knit families established different locations for different tools and items. For instance, the tools of craft would be kept differently from the tools for securing their locality (bows and arrows), among others. Food was stored in specified stores and so was the living quarters for both women and men being distinctly separated.”

The knowledge on the forest is diverse, wide and inexhaustible and has been built over generations and generations. They consider the forest as the provider of everything ranging from food, shelter, livelihood and every other needs. For instance, the trees provided them with food in the form of 'logoek' or berries and fruits as food, 'bobek' or delicious mushrooms, naturally growing fungi, honey which is derived from the flowers of the plants, shelters which were made from the tree products, medicinal herbs and concoctions from several parts of specific tree and shrubs and even livelihood in terms of providence, existence and living.

The definitive feature of the forest to the Sengwer community was the presence of 'mereng' or beehive. This is a distinguishing feature and every other family had to have one and this aspect was deeply ingrained in the community. The possession of the '*mereng*' or beehive signals the communal attachment to the natural providence and indicated a community whose existence depends on nature. Beehive was a source of pride and honey played a critical role in the community. Honey could be used as food, the medium of exchange, medicine among other things and thus beehives and by extension, bees and the natural environment of interest was a type of tree that when it flowers, they claimed that its nectar would kill the bees. The elders



decided to curse the tree and so when it flowers it will start to wither and subsequently die due to the curse

According to the informants, the Sengwer indigenous environmental knowledge has been in existence since time immemorial. The IEK was based on several themes which include territorial spaces by clans and families, strict enforcement of resource usage, controlled harvesting and usage, communal sacred grounds, fire control systems, communal taboos and prohibitions. These practices have been used since ancient times and have served the communities in forest conservation and management efforts.

First, the use of territorial spaces involved the whole community being allocated communal spaces from which to carry out the conservation agenda. The spaces represented land that is naturally allocated to a family unity which is a subset of the traditional clan-based social structures of the community at large and is divided by the river systems within the whole community. For instance, a 'tulin' or 'kimaaget' clan will occupy a specific region and all their providence, livelihood and living will be restricted to that region. There was no trespass by any individual or even a goat of another clan or family to the other territory and since the territory was separated by a river, the clan would be able to access water for their basic needs and all other needs.

A case example of the territorial spaces was given by SEN006 who said that, "The territorial spaces were very much respected by every individual in the community. For instance, an individual hunter from another clan/family was hunting a dik-dik and it happens that the injured or trapped animal managed to escape to another territory, the individual in this instance, would seek help from the neighboring clan in getting the injured animal back to his territory. Likewise, if for any reason, the person transgresses and passes the boundary of the territorial space, he/she will be liable for a fine of a live animal which will be slaughtered to make peace for the transgression".

These territorial spaces can be considered as a form of conservation efforts as the spaces were considered to be important to the communal set – up and serve as a basis for resource distribution. The impact of the territorial spaces illustrated the communal way of allocating and distributing the conservation efforts to each individual in the community. Every other individual held their territorial spaces in high regard because there was no alternative to space and therefore would take due care to maintain the pristine environment the way it was and it will be. Elders would from time to time supervise the use of the forest resources sustainably.

Secondly, strict enforcement of resource usage and consumption within the whole community. The community had established rules and regulations governing the resources usage that included harvesting of mature trees only to allow for the regeneration of the forest, protection of young seedlings, shoots and offshoots from harvesting, and prevention of fires in the forest. Rules and regulations were enforced on the basis of the general acceptance of the communal rules and regulations as a basis for communal progression and stability in individual behaviours. SEN 001 observed that "the rules were unequivocally applied throughout the community and thus there was no transgression in that any transgression was punished by fines. For instance, if a person from another territory transgresses and cuts down a tree, the individuals from the affected territory will go far and wide and follow the trail of the transgressor until he is found. If he is found he has to surrender a goat which will be used to



make peace with the other community for a transgression and will be pardoned publicly for all to know that it is an offence that is punishable. This was to protect the forest.

Thirdly, controlled harvesting of forest resources either through harvesting of mature trees, preservation of shoots and offshoots of shrubs and trees. All individuals in the community were expected to adhere to specific conduct of conservation which calls for control and restrains in the harvesting of the forest resources. In other instances, there were specific times where specific trees were harvested for consumption in housing or implements. These rules and norms were achieved through enforcement and coercion and therefore they were much more likely to succeed because of consequences which would sometimes involve the slaughter of an animal for the transgression.

SEN 001 said that "when harvesting 'tegat' or bamboo for housing, the community expected an individual to only cut the mature bamboo sticks and leave the offshoots as they were. The individual was to take care that the delicate offshoots were not tampered with during and after the process. Further, care was to be taken that the area surrounding any bamboo offshoots were not visited or frequented by goats or sheep as they can graze on the offshoots. In these instances, no animals would graze near the bamboo offshoots to support the regeneration of the bamboo". This was an inbuilt EIK that was passed on from one generation to the next.

Fourth, the community had special revered sites that were completely isolated for communal rites such as initiation or circumcision. Every clan had set aside, "Kapkiai" or forested section where communal ceremonies would take place and in doing so encouraged the preservation of pristine forest within the forest. These sites were under a specified clan called 'kimaaget' who were more seers and community leaders who would direct the community fortunes into the future. There were also specific tree species that were associated with cultural activities and this included 'sinende', 'yemit' and 'tarakwet'(cedar) which are revered by the community. For instance, 'tarakwet' or cedar provides the foundation for the hut used by the initiates. No other tree was to be used in these ceremonies.

Fifth, the fire control systems entailed the controlled usage of fire in virtually all activities touching on fire. The specific effects of fire on the environment were widely acknowledged by the community and therefore special care was taken when using fire. Every time an individual required the use of fire in any activity, a complementary pouch/pot of water would be carried to ensure that any fire that was lit was completely extinguished. SEN 009 affirmed that "Every time a beehive was full of honey, two individuals would take up to the tree to harvest it. One carried the splinters of fire and specific tree shrub which produces a dulling effect on the bees thereby allowing the harvesting of honey. Once the process had been completed, the second would use water to extinguish any burning embers. In doing so, one ensured that fire was appropriately controlled and managed thereby preventing any spread of fires in the forest area.

Sixth, the selective usage of specific tree species such as the 'tegat' (bamboo) for its pervasive usage in the construction of houses, hedgerows and many other components. Bamboo is a highly regenerative species that is known for its durability, suppleness and versatility and this ensured that other tree species such as hardwood and soft species which slowly regenerate are sparsely used for the most common usage in households and communal uses. Considering that bamboo is a highly regenerative species, its use promotes the longevity of the forest resources as it sustains and maintains the forest resources.



Seventh, the water bodies were highly revered and in particular the springs, rivers and streams. At all times, the communal decrees were that individuals, persons or groups of persons were to live over a hundred meters from any water bodies and not to interfere with a water body. The decree ensured that water sources were protected from any pollution and thus water and riverine systems were sustained.

Among many other rules and regulations, communal taboos and prohibitions in the resource usage and these initiatives entailed the use of 'etan' or prohibitions and/or taboos. This is a form of cultural perceptual coercion which prohibits certain individuals and cooperative action. For instance, the community SEN 014 said that "Certain trees are considered sacred such as 'tendwo', *Prunus Africana*, a tree which is not supposed to be felled. In these instances, if an individual had to cut down the tree species, then after cutting down the tree, the individual was supposed to ask for clemency from the fallen tree by 'dipping the machete into the tree sap while proclaiming the words '*kalyaa kosom atilin, matilin buch, nyoiwo gaat, anyin*', meaning peace, I ask for clemency for cutting down not for nothing but a specific purpose/use.

In this manner, the individual gets absolution or else something drastic will happen. If he does, then if any of the culprit's goats consume the parts of the fallen tree would die from bloating". To remedy this, the owner of the animals would be summoned by the elders and would be fined a goat and some tobacco, who in turn, will pronounce the forgiveness and the animals would be saved from dying. These taboos and regulations played an important role in managing the forest resource sustainably. Other trees with special tree species called 'masat' are said to bring bad omen to the community by killing the bees. The tree species itself is said to flower once every 14 years and therefore is considered a curse to the community as its flowers kill bees with the consequent effect of lack of honey. Due to its impact on bees, it was cursed by an age set a very long time ago and as such it does not flower. That was around 1920 when it was cursed to wither.

DISCUSSION

The community considered the forest as their ancestral home and thus lived inside the forested area and did not partake in any form of cultivation. In essence, the community lived in the forest, the way it is, they never tried to change any (natural ecosystem) in the forest as an indication by their lifestyle of resource dependence where everything they required was sourced locally without causing drastic changes to the forest resources. The rearing of the small animals, the sheep and goats as part of their culture and the maintenance of the animals were secondary to the subsistence on the forest resources.

Several studies have highlighted the impact of IEK on forest resources. For instance, Schulz et al. (2019) examined the *Urarina* culture which intimately links culture to the environment. *Urarina* classifies ecosystems with a well-defined system thus enabling the management and conservation of these areas to be highly informed by the classification system. In Indonesia, indigenous communities use traditional ecological knowledge in livelihood activities. From their farming practices which involve the planting of sacred types of rice to traditional ceremonies such as *gawai* (rice festivals) and *bed arak* (earth praising ceremonies). *Gawai* is collectively organized by the Iban communities as a way of celebrating rice harvest. On the



other hand, *Bed arak* is aimed at blessing the farmlands so that they may produce more during the current planting season (Yuliani et al., 2018).

Taboos and prohibitions serve an important role in deterring the transgression of rules. For instance, Boafo et al. (2016) examined the rural communities in northern Ghana and found that IEK takes various forms that include customs, taboos, ritual rules and regulations which are critical in the management of the traditional protected areas and the management of the ecosystem services. For instance, Sirima (2015) observed that among the Enguserosambu tribe in Tanzania, communal beliefs indicated a cultural connection with the forest and the forest, in turn, provided the livelihood for the community. In other instances, the community seemed to hold the forest highly with regards to its natural aesthetics and cultural attachments to its usage (Berkes, Colding & Folke, 2000).

The examples of indigenous forest management approaches have significant implications for the forests in various ways.

Indigenous practice	Relation to Forest Management
<p>The use of territorial spaces involved the allocation of a specific part of the forest to a specific family or clan. The clan was tasked with the conservation agenda for the land allocated to the whole community and ensuring that forest resources are sustainably utilized. The individual and common territorial spaces indicated was no alternative to space and therefore would take due care to maintain the pristine environment the way it was and it will be. The community rules and regulations which governed the resources usage such as the harvesting of mature trees only to allow for the regeneration of the forest, protection of young seedlings, shoots and offshoots from harvesting, and prevention of fires in the forest. For instance, a territorial transgression that involved falling down a tree involved the surrendering of a goat that was used to make peace for transgression and pardoned.</p> <p>Controlled harvesting of forest resources either through harvesting of mature trees, preservation of shoots and offshoots of shrubs and trees. In other instances, there were specific times where specific trees were harvested for consumption in housing or implements. The enforcement of the rules and norms were achieved through coercion and sanctions.</p>	<ul style="list-style-type: none"> • The territorial spaces illustrated the communal way of resources allocation and entrenchment of conservation efforts to each individual in the community. The collegial authority of the elders supervises the use of the forest resources sustainably. • Strict enforcement of resource usage and consumption within the whole community. This allowed the selective harvesting and use of fewer selected species within the specified interval between one harvest and another. This ensured successful forest transition at all times. • The controlled usage of forest resources ensured that forest resources ensured sustainable forest regeneration and revitalization.



The controlled usage of fire in virtually all activities touching on fire. The community widely acknowledged the fire and therefore special care was taken when using fire. All individuals requiring the use of fire in any activity had to carry a complementary pouch/pot of water to ensure the completed extinguishing of the fire after the task, for instance, such as harvesting honey. Special revered sites were completely isolated for communal rites such as initiation or circumcision. Every clan had set aside a 'Kapkiai' or forested section where communal ceremonies would take place and in doing so encouraged the preservation of pristine forest within the forest. Further, specific tree species were associated with cultural activities and this included 'sinende', 'yemit' and 'tarakwet' (cedar) which are revered. Customary selection of certain tree species for house construction, hedgerows and pens. They were constructed from the construction of 'tegat' or bamboo species because of their pervasiveness, suppleness, durability and regenerative capabilities. This ensured that other tree species that were not as pervasive were left to grow and thus allowed slow tree species to flourish. Pervasive protection of water catchment by ensuring that community members live some distance from any water sources ensured that water springs were not interfered with and water was least polluted by settlement activity.

- The framework governing forest and water sources ensured that water catchment areas were protected from pollution and unsustainable extraction. This ensured tributaries and riverine systems were untouched and thus were left to its own cause.
- The protection of the zones for the exclusive use of community rites emphasized the need for pristine environments in the forest.
- The usage of the vibrant tree species for everyday uses ensured that other trees and shrubs with low regenerative capacities grow and populate the forest zones thus ensuring the sustenance of pristine forest.

CONCLUSION

Based on the findings, the study concludes that the Sengwer community had already established traditional rules and regulations that govern the management and conservation of forest resources. It was also observed that the modern forest management techniques seem to be more pervasive while the community IEK was integrated into the whole of life through religious and cultural beliefs and was therefore inseparable into discrete disciplinary elements of the Sengwer forest dwellers. However, it was shown that there was a decline in indigenous conservation practices. It was therefore concluded that the indigenous conservation practices needed to be revived, documented, made public and encouraged for use as an approach in the management of forests.



The study concluded that integrating the indigenous community IEK and the modern methods of forest management could be very much effective. Furthermore, integration of community IEK could be made easy through the provisions of the Forest Conservation and Management Act, 2016 which included protection of sacred groves and protected trees; sustainable harvesting of forest resources such as medicinal herbs, food (honey, fruits and berries), fuel and other forest produce for community-based industries and ecotourism services, such as scientific, academic, educational and recreational activities, among others. It was further established that the integration of community IEK with modern techniques of forest management would help in immortalizing the localness of the knowledge that was embedded in a particular community.

RECOMMENDATION

The study recommends that the community be facilitated in the establishment of their community forest association as provided for under the Forest Conservation and Management Act of 2016 (Government of Kenya, 2016). The establishment of the community forest association would help in the integration of community IEK with modern forest management techniques. The Ministry of Environment, Water and Natural Resources, Kenya Forest Services and the Kenya Wildlife Service should adopt a new conservation paradigm in which forest indigenous communities are made the custodians of their forests under the supervision of the said conservation agencies. Further, the government agency tasked with conservation should facilitate community awareness programs and simultaneously train both community and KFS rangers so that the two parties can create a good rapport and good working relations.

REFERENCES

- Agrawal, A., & Gibson, C. C. (1999). Enchantment and disenchantment: the role of community in natural resource conservation. *World Development*, 27(4), 629-649.
- Alden, W. L. (2012). Customary Land Tenure in Modern World Rights to Resources in Crisis: Reviewing the Fate of Customary Tenure in Africa. Washington, DC: Rights and Resource Institute.
- Anaya, F., & Espírito-Santo, M. (2018). Protected areas and territorial exclusion of traditional communities: analysing the social impacts of environmental compensation strategies in Brazil. *Ecology and Society*, 23(1).
- Balmford, A., & Cowling, R. M. (2006). Fusion or failure? The future of conservation biology. *Conservation biology*, 20(3), 692-695.
- Ban, N., Wilson, E., & Neasloss, D. (2019). Strong historical and ongoing indigenous marine governance in the northeast Pacific Ocean: a case study of the Kitasoo/Xai'xais First Nation. *Ecology and Society*, 24(4).
- Barnhardt, R. (2005). Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & education quarterly*, 36(1), 8-23.
- Barrow, E., Kamugisha-Ruhombe, J., Nhantumbo, I., Oyono, R., & Savadogo, M. (2016). Who owns Africa's forests? Exploring the impacts of forest tenure reform on forest ecosystems and livelihoods. *Forests, trees and livelihoods*, 25(2), 132-156.



- Basurto, X., & Ostrom, E. (2009). Beyond the Tragedy of the Commons. *Economia delle fonti di energia e dell'ambiente*.
- Barnes, C., & Van Laerhoven, F. (2013). Helping to self-help? External interventions to stimulate local collective action in Joint Forest Management, Maharashtra, India. *International Forestry Review*, 15(1), 1-17.
- Barsimantov, J. A. (2010). Vicious and virtuous cycles and the role of external non-government actors in community forestry in Oaxaca and Michoacán, Mexico. *Human Ecology*, 38(1), 49-63.
- Berkes, F. (2009). Indigenous ways of knowing and the study of environmental change.
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10(5), 1251-1262.
- Boafo, Y. A., Saito, O., Kato, S., Kamiyama, C., Takeuchi, K., & Nakahara, M. (2016). The role of traditional ecological knowledge in ecosystem services management: the case of four rural communities in Northern Ghana. *International Journal of Biodiversity Science, Ecosystem Services & Management*, 12(1-2), 24-38.
- Butler, J. R., Tawake, A., Skewes, T., Tawake, L., & McGrath, V. (2012). Integrating traditional ecological knowledge and fisheries management in the Torres Strait, Australia: the catalytic role of turtles and dugong as cultural keystone species. *Ecology and Society*, 17(4).
- Caillon, S., Cullman, G., Verschuuren, B., & Sterling, E. (2017). Moving beyond the human–nature dichotomy through biocultural approaches: including ecological well-being in resilience indicators. *Ecology and Society*, 22(4).
- Carson, S. L., Kentatchime, F., Nana, E. D., Njabo, K. Y., Cole, B. L., & Godwin, H. A. (2018). Indigenous peoples' concerns about loss of forest knowledge: implications for forest management. *Conservation and Society*, 16(4), 431-440.
- Cooper, N., & Kainer, K. (2018). To log or not to log: local perceptions of timber management and its implications for well-being within a sustainable-use protected area. *Ecology and Society*, 23(2).
- Dessalegn, M. (2016). Threatened common property resource system and factors for resilience: lessons drawn from serege-commons in Muhur, Ethiopia. *Ecology and Society*, 21(4).
- Diawuo, F., & Issifu, A. K. (2015). Exploring the African traditional belief systems in natural resource conservation and management in Ghana. *The Journal of Pan African Studies*, 8(9), 115-131.
- Desta, A., & Smithson, S. (2016). Indigenous knowledge in the context of natural resource management: an information systems perspective.
- DeRoy, B., & Darimont, C. (2019). Biocultural indicators to support locally-led environmental management and monitoring. *Ecology and Society*, 24(4).
- Eckert, L. E., Ban, N. C., Tallio, S. C., & Turner, N. (2018). Linking marine conservation and Indigenous cultural revitalization. *Ecology and Society*, 23(4).
- Finn, S., Herne, M., & Castille, D. (2017). The value of traditional ecological knowledge for the environmental health sciences and biomedical research. *Environmental health perspectives*, 125(8), 085006.
- Gersani, M., Brown, J. S., O'Brien, E. E., Maina, G. M., & Abramsky, Z. (2001). Tragedy of the commons as a result of root competition. *Journal of Ecology*, 89(4), 660-669.
- Government of Kenya (2016). Forest Conservation and Management Act, 2016 (No. 34 of 2016), *Government Press, Nairobi*



- Gratani, M., Butler, J. R., Royce, F., Valentine, P., Burrows, D., Canendo, W. I., & Anderson, A. S. (2011). Is validation of indigenous ecological knowledge a disrespectful process? A case study of traditional fishing poisons and invasive fish management from the Wet Tropics, Australia. *Ecology and Society*, 16(3).
- Gurney, G. G., Cinner, J. E., Sartin, J., Pressey, R. L., Ban, N. C., Marshall, N. A., & Prabuning, D. (2016). Participation in devolved commons management: Multiscale socioeconomic factors related to individuals' participation in community-based management of marine protected areas in Indonesia. *Environmental Science & Policy*, 61, 212-220.
- Haller, T., Fokou, G., Mbeyale, G., & Meroka, P. (2013). How fit turns into misfit and back: institutional transformations of pastoral commons in African floodplains. *Ecology and Society*, 18(1).
- Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3859), 1243-1248.
- Harmsworth, G., Awatere, S., & Robb, M. (2016). Indigenous Māori values and perspectives to inform freshwater management in Aotearoa-New Zealand. *Ecology and Society*, 21(4).
- Heenehan, H., Basurto, X., Bejder, L., Tyne, J., Higham, J. E., & Johnston, D. W. (2015). Using Ostrom's common-pool resource theory to build toward an integrated ecosystem-based sustainable cetacean tourism system in Hawaii. *Journal of Sustainable Tourism*, 23(4), 536-556.
- Holmes, M., & Jampijinpa, W. S. P. (2013). Law for country: The structure of Warlpiri ecological knowledge and its application to natural resource management and ecosystem stewardship. *Ecology and Society*, 18(3).
- Houde, N. (2007). The six faces of traditional ecological knowledge: challenges and opportunities for Canadian co-management arrangements. *Ecology and Society* 12(2): 34
- Jumbe, C. B., & Angelsen, A. (2011). Modelling choice of fuelwood source among rural households in Malawi: a multinomial probit analysis. *Energy Economics*, 33(5), 732-738.
- Kangalawe, R. Y., Noe, C., Tungaraza, F. S. K., Naimani, G., & Mlele, M. (2014). Understanding of Traditional Knowledge and Indigenous Institutions on Sustainable Land Management in Kilimanjaro Region, Tanzania. *Open Journal of Soil Science*, 4, 469-493.
- Krause, T., Collen, W., & Nicholas, K. A. (2013). Evaluating safeguards in a conservation incentive program: participation, consent, and benefit sharing in indigenous communities of the Ecuadorian Amazon. *Ecology and Society*, 18(4).
- Lambin, E. F., & Meyfroidt, P. (2011). Global land-use change, economic globalization, and the looming land scarcity. *Proceedings of the National Academy of Sciences*, 108(9), 3465-3472.
- Long, J., & Lake, F. (2018). Escaping social-ecological traps through tribal stewardship on national forest lands in the Pacific Northwest, United States of America. *Ecology and Society*, 23(2).
- Luswaga, H., & Nuppenau, E. A. (2020). Participatory forest management in West Usambara Tanzania: What is the community perception on success? *Sustainability*, 12(3), 921.
- Magole, L., Turner, S., & Büscher, B. (2010). Towards an effective commons governance system in Southern Africa? *International Journal of the Commons*, 4(2).



- Murmu, S. C., & Bhattacharya, S. (2019). Indigenous Knowledge on Forest Management: An Approach towards Sustainable Development. *Journal of Cultural and Social Anthropology*, 1(4), 01-12.
- Mauro, F., & Hardison, P. D. (2000). Traditional knowledge of indigenous and local communities: international debate and policy initiatives. *Ecological Applications*, 10(5), 1263-1269.
- Park, S. H., & Yeo-Chang, Y. (2021). Impact of Collaborative Forest Management on Rural Livelihood: A Case Study of Maple Sap Collecting Households in South Korea. *Sustainability*, 13(4), 1594.
- Persha, L., Agrawal, A., & Chhatre, A. (2011). Social and ecological synergy: local rulemaking, forest livelihoods, and biodiversity conservation. *Science*, 331(6024), 1606-1608.
- Porter-Bolland, L., Ellis, E. A., Guariguata, M. R., Ruiz-Mallén, I., Negrete-Yankelevich, S., & Reyes-García, V. (2012). Community managed forests and forest protected areas: An assessment of their conservation effectiveness across the tropics. *Forest ecology and management*, 268, 6-17.
- Pyke, M., Toussaint, S., Close, P., Dobbs, R., Davey, I., George, K., Oades, D., Sibosado, D., McCarthy, P., Tigan, C., Angus, B., Riley, E., Cox, D., Cox, Z., Smith, B., Cox, P., Wiggan, A. & Clifton, J. (2018). Wetlands need people: a framework for understanding and promoting Australian indigenous wetland management. *Ecology and Society*, 23(3).
- Quaempts, E. J., Jones, K. L., O'Daniel, S. J., Beechie, T. J., & Poole, G. C. (2018). Aligning environmental management with ecosystem resilience. *Ecology and Society*, 23(2).
- Risiro, J., Tshuma, D. T., & Basikiti, A. (2013). Indigenous knowledge systems and environmental management: A case study of Zaka District, Masvingo Province, Zimbabwe. *International Journal of Academic Research in Progressive Education and Development*, 2(1), 19-39.
- Saunders, F. (2014). The promise of common-pool resource theory and the reality of commons projects. *International Journal of the Commons*, 8(2).
- Schulz, C., Brañas, M. M., Pérez, C. N., Del Aguila Villacorta, M., Laurie, N., Lawson, I. T., & Roucoux, K. H. (2019). Peatland and wetland ecosystems in Peruvian Amazonia. *Ecology and Society*, 24(2).
- Sirima, A. (2015). The Contribution of Indigenous Ecological Knowledge in Conservation of Enguserosambu Community Forest, Tanzania. (Doctoral dissertation, Clemson University).
- Varte, I. Z. (2012). Role of Indigenous Traditional Knowledge in Sustainable Resource Management (With special reference to North-East India). In *Environmental Issues in Northeast India, Churachandpur*, (pp. 12–13).
- Wali, A., Alvira, D., Tallman, P., Ravikumar, A., & Macedo, M. (2017). A new approach to conservation: using community empowerment for sustainable well-being. *Ecology and Society*, 22(4).
- Walsh, F. J., Dobson, P. V., & Douglas, J. C. (2013). Anpernirrentye: a framework for enhanced application of indigenous ecological knowledge in natural resource management. *Ecology and Society*, 18(3).
- Winkelhuijzen, R. (2017). Forest dwellers vs. the government? Exploring opportunities for conflict resolution in the case of the Sengwer in Cherangani Hills, Kenya, University of Wageningen



- Wu, W., Li, Y., Hu, Y., Xiu, C., & Yan, X. (2018). Impacts of changing forest management areas on forest landscapes and habitat patterns in northeastern China. *Sustainability*, 10(4), 1211.
- Yuliani, E. L., de Jong, E. B., Knippenberg, L. W. J., Bakara, D. O., Salim, M. A., & Sunderland, T. (2018). Keeping the land: Indigenous communities struggle over land use and sustainable forest management in Kalimantan, Indonesia. *Ecology and Society* 23(4):49.
- Youn, Y.-C.; Choi, J.; de Jong, W.; Liu, J.; Park, M.S.; Camacho, L.D.; Tachibana, S.; Huudung, N.D.; Bhojvaid, P.P.; Damayanti, E.K. & Othman, M. S. (2017). Conditions of forest transition in Asian countries. *Forest Policy and Economics*, 76, 14-24.