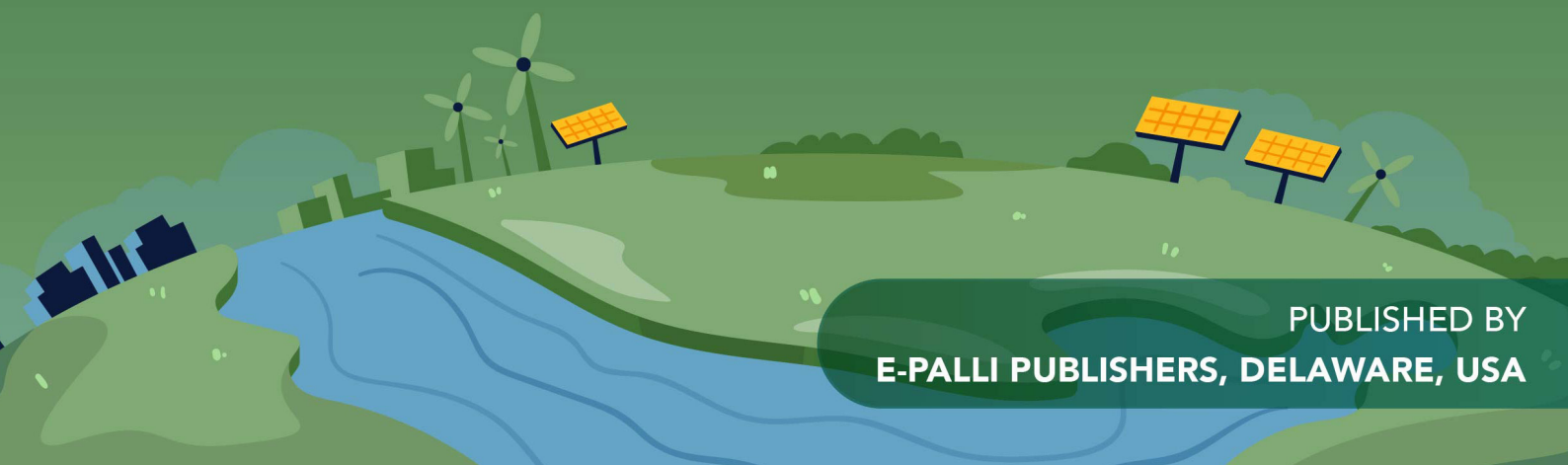




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Utilizing Indigenous Knowledge Systems on Climate Change for Forestry Conservation in Kenya

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ABSTRACT

Forest conservation is important in climate change mitigation. The Indigenous Knowledge (IK) or Indigenous Knowledge System (IKS) has recently been recognised in forest conservation for climate change mitigation. The potential use of IKS in climate change management in Sub-Saharan Africa including Kenya is unknown. Numerous analytical postulations detailing how to integrate IKS in climate change management have been formulated. However, this information is fragmented and mostly lost in sociology literature. This paper briefly reviews the indigenous knowledge related to different aspects of forest resource management. This review delves at in-depth information on the IKS and climate change management in Sub-Saharan Africa, emphasizing Kenya. For this review, the scooping review methodology was used to describe the state of knowledge and map the available evidence of the role of IKS for forest conservation and climate change adaptation. It discusses the role of IKS in climate change management in Sub-Saharan Africa and the potential application of the IKS in preventing adverse climate change effects. The integration of IKS to guide the climate change management have been evaluated and the threats to IKS and their conservation deliberated. It is generally observed that in many rural communities in Kenya, IKS is useful for enhanced food production, forest conservation and natural disaster management. But being culture-specific, IKS can be adopted across communities in SSA for real time management of climate change.

INTRODUCTION

The late Anthropocene epoch has been marked and shaped by the environmental crisis that stems from human activities on earth. The increasing concentration of greenhouse gas (GHG) emissions such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) blanket the earth and trap the sun's radiation and heat leading to global warming and climate change (Abbass *et al.*, 2022; Mokhov, 2022). The warming phenomenon over a period of time (Akinrinwoye *et al.*, 2023) change weather patterns and disrupt the usual balance of nature, posing risks to humans and all other forms of life on earth through heat waves, disturbance events such as droughts, erratic rainfall, severe storms, and loss of biodiversity (Dilangalen, 2022; Lahsen and Ribot, 2022). The negative impacts of climate change is greatest in the African region due to extreme global warming than in other continents (Nyiwl, 2021; Kwakye, 2023). In Kenya, climate change is characterized by large variability in temperature and rainfall with occurrence of extreme events in terms of droughts and floods for which there are long term records (Kalele *et al.*, 2021).

The role of forest conservation in climate change is well established (Walker *et al.*, 2020; De Frenne *et al.*, 2021). There is a deep interconnection between forest conservation and climate change since forest loss and degradation is both a cause and an consequences of changing climate (Siyum, 2020). Forest also plays a crucial role in climate change mitigation by absorbing about one-quarter of the carbon emitted by humans in

the past five decades (Harris *et al.*, 2021). Across Sub-Saharan Africa, forests are closely intertwined with the indigenous cultures where a significant fraction of the forests are found within or overlaps with indigenous lands, territories and aboriginal resources (Pelletier *et al.*, 2019; Turner *et al.*, 2022). Thus, faced with the challenge of climate change and its unknowns, decision makers have often encouraged the use of existing and traditional knowledge base in enhancing forest conservation (Fletcher *et al.*, 2021).

Indigenous knowledge refers to the understandings, skills and philosophies of indigenous peoples, developed through long and multigenerational histories of interactions with nature (Battiste, 2016; Ford *et al.*, 2016). In addition, indigenous peoples' traditional ecological knowledge, traditional systems of control, use and management of lands and resources, and traditional institutions for self-governance also contribute substantially to conservation (Ingty, 2017). Notably, the term "indigenous knowledge" is generally used refer to how members of a community perceive and understand their environment and resources, particularly the way they convert those resources through labour. This has seen an increasing utilization of knowledge of local and indigenous people, often referred to as indigenous knowledge systems (IKS) in forest conservation for climate change mitigation (Kavu *et al.*, 2022; Kugara *et al.*, 2022). The IKS is based on facts that are known or learnt from experience or acquired through observation and practice, and is handed down from generation to

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generation (Lipe, 2023). Communities identify easily with IKS systems, which are imbedded in their culture to enable them to live in harmony with the forest.

The IKS is still important among local communities in many parts of Sub Saharan Africa, but it is not well documented (Edgar *et al.*, 2022; Balogun, 2023; Bol and van Niekerk, 2023). Instead, it is often undervalued in favour of western scientific knowledge by environmental planners, managers and sometimes the local communities themselves (Ens *et al.*, 2021) and is in danger of being lost. In this paper, we review an array of IKS used by communities in Kenya to conserve forests and hence boost climate change mitigation.

METHODOLOGY

For this review, the scoping review methodology (Tricco *et al.*, 2016) was used to describe the state of knowledge and map the available evidence of the role of indigenous knowledge for forest conservation and climate change adaptation. Scoping review is an established method for evidence synthesis, and are also increasingly applied in climate change adaptation research (Peterson *et al.*, 2017). The objective of scoping reviews is to provide a broad overview of the literature on a specific topic and identify patterns, trends, knowledge clusters, and gaps. While a scoping review approach usually does not include a critical appraisal of individual studies' results and their impacts, it is 'particularly valuable for broad, multi-faceted questions, and provides the basis for in-depth follow-up research on specific subsets of the identified evidence (Munn *et al.*, 2018).

In this study the scoping review is based on the coverage of indigenous knowledge in academic journal articles, book chapters, conference papers and recent IPCC reports, as well as selected review articles with direct relevance to the research. A pilot search in the Web of Science resulted in 737 results (search string: TOPIC: climate change AND TOPIC: forest conservation AND TOPIC: indigenous knowledge OR traditional knowledge OR local knowledge OR Indigenous knowledge systems). In so doing, we hope the review will support policymakers and practitioners in applying and engaging with indigenous knowledge to improve adaptation efforts.

RESULTS AND DISCUSSIONS

Background of Indigenous Knowledge Systems (IKS) in Forest Conservation

The conception of IKS refers to long-standing traditions and practices of indigenous or local communities (Ford *et al.*, 2016; Whyte, 2017). It is synonymous with local knowledge, indigenous knowledge, indigenous skills, traditional knowledge (TK) or cultural knowledge (Tynan, 2021), although in strict sense each definition is slightly different from the other. Even so, IKS is not limited to indigenous peoples and may comprise knowledge derived from elsewhere and internalized and adapted by local people (Weaver, 2023). The IKS encompasses wisdom, awareness, teachings, skills, experiences and

insights of people, and is orally passed on from person to person over generations (Shizha, 2017). The IKS are mainly expressed through stories, myths, traditional laws, legends, folklore, rituals, songs and sacrifices (Su *et al.*, 2020). It also encompasses the social reality, cultural practices, values and traditions of peoples. This long-term experience means that IKS cannot be quickly replaced by other knowledge systems. The interaction with this knowledge at the spiritual level develops a depth into a unique cultural norm and epitomizes their belief system and functional values.

In relations to forests, the IKS is the accumulated knowledge, skills and technology of local people derived from their direct interaction with the environment (Borona, 2017; Wang *et al.*, 2021). Indigenous people usually have a vast knowledge of, and capacity for, developing innovative practices that are of importance to coexistence with the forests (Diver, 2017). Therefore, there is continued recognition that local people are more knowledgeable on forests than outsiders because of their long association with and use of the forest resource that is firmly ingrained in their local cultures and values (Kohsaka and Rogel, 2021). Thus, the maintenance of cultural diversity, recognition and protection of IKS can immensely benefit forest conservation. Subsequently, there are thousands of studies available that have looked at how IKS is useful in forest management in various parts of the world. Most of these studies focus on local culture and interactions with forests (Chanza and de Wit, 2015; Ajadi, 2021; Zerbe, 2022).

Despite repeated calls for increased use of IKS in conservation, integration of indigenous knowledge in natural resource planning and management remains undervalued. This stems from insufficient attention being paid to IKS in informing forest policy decisions, contributing to its lack of development and integration within modern society (Balogun and Kalusopa, 2021). Various reasons have been proposed for this omission, including the perceptions of indigenous knowledge as being of lesser value and legitimacy than knowledge deriving from dominant societies and cultures, and because some of the underlying belief systems and environmental ethics are at odds with capitalist economic systems. A further reason could be the accessibility of indigenous knowledge to scientists and policymakers, and the associated lack of indigenous knowledge holders during formulation of various documents (David-Chavez and Gavin, 2018).

Utilization of IKS in Forest Conservation among Communities in Kenya

In the past, IKS remained largely ignored and untapped in Kenya, but in more recent times, the use of IKS by local communities are increasingly being recognized as important ingredients for crafting viable forest conservation strategies (Borona, 2019). Integration of IKS in community participation for forest resource management in Kenya is in the constitution (Chapter 5

Article 69(1c) and Forest Conservation and Management Act 2016). Accordingly the IKS should be incorporated into forest research and education while safeguarding their traditional interests and cultural practices (Mutoko *et al.*, 2015). Integration of such indigenous knowledge into conservation programs facilitates knowledge sharing, ownership, responsibility, trust-building and enables constructive engagement among stakeholders towards the achievement of forest conservation goals (Terer *et al.*, 2012).

In using indigenous knowledge in Kenya in forest conservation, there is massive use of taboos and totems (Maseno, 2021) beside other methods. A taboo is social or religious custom that prohibits, ban, or restricts a particular practice or forbidding association with a particular person, place, or thing. In some cases, a taboo is an action that is frowned upon and considered inappropriate to practice or even talk about within a cultural group (Gathogo, 2013). A totem is a natural object, an animal or plant regarded as a symbol by a given tribe or family (Mandillah and Ekosse, 2018). In relation to this study, a totem is a plant that people regard with special awe, reverence, and respect. It is a class of plants regarded with superstitious respect believing that, there exists between individual members of the society an intimate obligatory and altogether special relationship.

One area in Kenya which has immensely benefited from the IKS is Mt. Elgon forest ecosystem, which is under threat by anthropogenic activities. There are reports of use of IKS to understand the forest landscapes, biodiversity, ecosystem services and conservation values to the forest among the local people (Fredrick, 2020; Downing *et al.*, 2023). There are also reports of using indigenous knowledge to manage medicinal plants in the region which contribute to forest conservation (Okello *et al.*, 2010). The utilization of woody and non woody vegetation within the forest and its surroundings have also been achieved through application of indigenous knowledge (Kiprop *et al.*, 2017). The use of indigenous knowledge in the management of the Forest Biodiversity in Kaptama Division in the region has also been documented (Wambua, 2010). The Ogieks within the Mt. Elgon region has wide range of indigenous knowledge systems that they use in managing forests given the long period of time that they have lived in forests (Kenrick *et al.*, 2023). There are even recommendations to incorporate indigenous knowledge into legal systems in management of forests and biodiversity in the region (Mogeni, 2017). The Kakamega Forest is an area partly conserved and managed through taboos, informal institutions in which norms, rather than governmental judicial laws and rules determine human behaviour (Ouma *et al.*, 2016; Ondiba and Matsui, 2021; Kilonzo, 2022). There is sufficient indigenous knowledge among the community around the Kakamega forest about medicinal plant species, to contribute not only to conservation of these plant species but also help in to share this knowledge beyond western Kenya (Otieno and Analo, 2012b; Otieno and Analo,

2012a; Mukungu *et al.*, 2016). Ancestral spirits in the Kakamega Forest region act as mediators between their living relatives and the supernatural powers. Much of this knowledge is still held mainly by a few elderly people though financial inducements are said to be motivating a growing interest in the acquisition of knowledge among the wider community about these medicinal plants.

The Tiriki sub-group of Luhya in Western Kenya have conserved forests for generations due to their traditional practices (Darr *et al.*, 2009). Circumcision, especially in the Luyha sub-tribe of Tiriki, was performed inside the Kakamega Forest. The Forest provided a safe sanctuary where the boys were secluded from the rest of society while they learnt the traditional ways and values of the forest. The Forest provided access to medicinal plants, which were used for healing the circumcised. As a result the local people attached a lot of importance to the conservation of the Forest and especially the circumcision sites. Another designated area within the Forest considered as sacred was the Lirhanda Hill. The Hill is still being used for prayers to date. In this way sacred sites have experienced less ecological disturbance compared to non-sacred sites (Ouma *et al.*, 2016). Some of the local people give examples of a spiritual link to their ancestors through certain tree species, the most common being the murembe tree, (*E. abyssinica*) and the mukumu tree (*F. thonningii*). For example, local people believe that the spirits of their ancestors reside in the mukumu tree. The community pray there for societal deviants, such as those who have committed incest, murder or are under a curse. The spirits residing in the tree could also be consulted whenever the community experienced adverse weather conditions such as drought. The planting of and care for the mukumu tree is a privilege for the males in the community. The tree remained protected because of the reverence attached to it.

In the same locality, there are reports that the Isukha use their traditional knowledge fused with religion in conserving forests (Omare, 2011). The community members have devised various methods of regulating utilization of vegetation. Such ways include; totems, taboos, knowledge of sacred and profane, use of religious specialists. Some of these include: The Isukha do not cut trees found at sites called Khuluhya. Khuluhya are sacred sites where elders sit to solve communal issues. If one does it is believed to run mad as a punishment from the ancestors. The community taboos the cutting of trees by women where only men could cut trees and more especially trees permitted by the clan elders. By employing the preceding taboos, some tree and places where the trees are found were protected. Isukha religion through its methods creates environmental awareness that facilitates natural environment resource conservation through oral traditions such as, riddles, proverbs, tales, legends, songs and myths (Amutabi, 2013). The religion governs the use of the forest by use of stipulated rules and regulations. These rules and regulations can be seen in taboos, the idea of sacred and mundane and the attachment of

nature to mystical powers. Rules and regulations govern contact with specific natural environmental resources and their utilization. They further stipulate a hierarchy in terms of power concerning the use of specific resources and solving of disputes involving the forest.

In Nandi forests, indigenous knowledge is used for the management (Tanui, 2011; Tanui *et al.*, 2013; Mining, 2015). Moreover, there have been application of indigenous knowledge for indigenous knowledge, uses and conservation of *Prunus africana* (hook. f.) kalkman (Koros *et al.*, 2016). This indigenous knowledge has also been extended to the utilization and conservation of medicinal plants within the Nandi Forests (Jeruto *et al.*, 2008; Kigen *et al.*, 2016).

There are numerous studies that have been conducted concerning indigenous knowledge for plant conservation among the Marakwets in different regions of Kenya (Cheserek, 2005; Wanjohi *et al.*, 2020). There is presence of IKS for the sustainable uses and management of indigenous medicinal and non-medicinal plants among the Marakwet Community in Embobut (Moore *et al.*, 2020; Wanjohi *et al.*, 2020). These authors established that presence of the IKS could be used to develop culture specific sustainable utilization and conservation strategies to preserve indigenous plants of cultural value rural communities. In Keiyo, harvesting and conservation of medicinal plants include restricted gathering by mature people and herbalists guided by social controls and taboos (Kigen *et al.*, 2014; Kurui *et al.*, 2016).

A more successful case of forest conservation is that of the sacred Kaya Forests of the Mijikenda (Mutta *et al.*, 2009; Njagi, 2019; Ndalilo *et al.*, 2020). These forests are situated on the coastal plains and hills of Kenya, and comprise a once extensive lowland forest that has been degraded into patches due to human influence. The forests have high biodiversity with many endemic and rare plants found there. There are over fifty patches of Kaya Forests in the Districts of Kwale, Malindi, Mombasa and Kilifi. The Mijikenda sacred forests have contributed to the protection of approximately 6,000 ha of valued coastal forests through traditional conservation (Andersson *et al.*, 2021). Many Kayas are preserved as sacred places and burial grounds and this has continued to date (Musila, 2011). Cutting of trees around these sites was prohibited.

Among communities in central Kenya, some of the main ways through which indigenous knowledge may be used in promoting biodiversity conservation include but not limited to: trees which were traditionally regarded as housing spirits or sacred were not be felled without performing rituals, thus achieving a protective effect on trees such as mugumo tree (*Ficus natalensis*) among the Gikuyu community of Kenya; sacred groves or forests are pieces of land set aside for spiritual purposes, as shrines; traditional farming practices are champions in sustainable land and water management as they involve land rotation and shifting cultivation allowing the land for more than 10 years to restore its natural fertility (Muhando, 2005; Borona, 2019).

CONCLUSIONS

In using indigenous knowledge in Kenya in forest conservation, there is massive use of taboos and totems. There is widespread use of traditional knowledge system in conservation of Mt. Elgon forest ecosystem, The Kakamega Forest, the Nandi Forest, forests in Marakwet and Keiyo regions, the Kaya Forests and forests in Central region of Kenya. The conservation of forest was also extended to medicinal plants. However, the indigenous knowledge and forest management objectives have not adequately complemented each other in these regions of Kenya.

RECOMMENDATIONS

There is a need to recognize protection and promotion of traditional forest related knowledge, which is closely linked with the cultural and intellectual heritage of indigenous people and other forest dwellers. Also there is a need to enhance and strengthen the existing strategies and policies to promote conservation and sustainable management of forest resources, through greater collaboration and linkages between government agencies and communities. Regular assessment, updating and compilation of indigenous ecological knowledge as a pre-requisite for its use in the management of the Forest is therefore worth considering.

In understanding how IKS for adaptation can be fostered, it is equally important to highlight policy decisions that facilitate the fullest expression of indigenous adaptive capacity. Such policies may include those that maintain the integrity of and access to traditional societies, reinforce local practices for sustaining tree diversity, and enhance transmission of IK values, attitudes and worldviews. Good policy decision processes should be coupled with local capacity building, strengthening of local institutions, the inclusion of IK holders as key partners in the development of climate change research and adaptation plans, and promoting the continued transmission of IK. There is an urgent need to enact a Protection of Traditional Knowledge and to offer opportunity for Kenya to realize the vision of the 2030 SDGs by incorporating Kenyan communities' indigenous knowledge. By including these communities and their knowledge, any development policies aimed to benefit these communities will be more likely to not only respond to their cultural needs and preferences but will also enable them meaningfully participate.

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