

Biodiversity impact from ethnobotany in Kenya

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Introduction

Throughout human history different cultures have utilized plants and their practical uses for medicine, food, and energy. This utilization of traditional knowledge is called ethnobotany. A country that emerges as a good example of ethnobotany is Kenya. Kenya has a rich botanical heritage and the locals have historically used their indigenous plants and the nature around them to their advantage. The people of Kenya have traditionally valued the nature around them and seen the importance in using it as their primary resource. This has led to a lot of the old practices being vital in protecting life and nature on land. However, as Kenya strides forward on the path of economic growth the country faces challenges in trying to find the balance of preserving its cultural traditions in the face of modernization. These challenges align closely with SDG 15, which aims to protect, restore, and promote sustainable use of terrestrial ecosystems. The modern methods do not lean on practices that are native to the land which in the long run will not be sustainable and can potentially harm Kenya's biodiversity. In this paper we explore the important role of ethnobotanical knowledge, sustainable and unsustainable practices as well as preservation of traditional knowledge. Moreover, we will discuss challenges and solutions in traditional versus modern practices.

Sustainability vs unsustainability

There are emerging challenges when it comes to the balance between ethnobotany and modern innovation, regarding sustainability. [1] The 2030 agenda for sustainability consists of 17 goals that provides a shared blueprint for peace and prosperity for all people and the planet. Ethnobotany plays a vital role in achieving SDG goals, but most importantly SDG15 which aims to protect, restore, and promote sustainable use of terrestrial ecosystems [2]. The use of ethnobotanical knowledge in Kenya promotes sustainability by utilizing indigenous crops and farming methods which improves food security while also preserving agricultural biodiversity. Furthermore, with SDG3 "Good health and well-being" the use of traditional medicinal plants provides important healthcare to many, especially in rural areas where modern medicine is limited.

However, as Kenyan society shifts towards modernization challenges pertaining sustainability occur. Modern agriculture often utilizes monocultural practices and the habitat in Kenya favours polyculture agriculture. This indicates that the modern practices lead to degradation and loss of indigenous crop varieties. This reduces biodiversity in crops as well as destroying the land which naturally will not be sustainable. Furthermore, the overharvesting of medicinal plants does not give the ecosystem time to regenerate which also results in biodiversity loss. Overall, these modern influences fail to be sustainable.

On the other hand, ethnobotanical practice can become unsustainable, as seen with charcoal production. As the population grows so does the demand for food and energy. In Kenya a big part of the population remains poor and rely on charcoal as their most affordable energy source, resulting in excessive harvesting of trees to meet the demand. This is where ethnobotanical knowledge and modern technology can collaborate to find a solution. By combining the native Kenyans traditional knowledge about tree species with modern practices and inventions like renewable energy, the impoverished can still access affordable energy. This is a way to find a balance between ethnobotany and modernization while ensuring sustainability.

[1] SDG definition: <https://sdgs.un.org/goals>

[2] SDG15 definition: <https://www.globalgoals.org/goals/15-life-on-land/>

Food usage

Kenya has a lot of indigenous food crops that has played a crucial role in providing food security and combat malnutrition for communities all over the country for generations. The role of ethnobotany is, in this context, multi purposed – it involves not only the identification of traditional flora, but also providing an understanding of their nutritional value and cultural significance (Kimondo et al., 2015; Medley and Kalibo, 2007; Muthoni and Nyamongo, 2010; Mutie et al., 2020; Rajat, 2021). Through ethnobotanical research, indigenous crops such as cowpea, pigeon pea, mung pea, finger millet, amaranth, cassava and sorghum have been found to be resilient to adverse environmental conditions, while also being rich in nutrients (Kathambi et al., 2020; Muthoni and Nyamongo, 2010, 2008). By promoting both the cultivation and the consumption of these crops, ethnobotany contributes to diversifying diets and enhancing food security among Kenyan communities.

However Indigenous ecological knowledge (IEK) and practices face challenges caused by modernization – adoption of industrial agriculture characterized by monocultures. This, in combination with land degradation and destruction of habitats, poses a threat to traditional agricultural systems and indigenous crop varieties (Kathambi et al., 2020; Muthoni and Nyamongo, 2010, 2008). The potential damage to Kenya’s valuable genetic resources in the form of biodiversity loss is the opposite of sustainable development and further threatens the ecological integrity and long-term resilience of the nation’s natural heritage.

Despite these challenges, there are exciting opportunities in Kenya to combine their indigenous traditional Knowledge with modern conservation strategies. By understanding the value of IEK in protecting nature and farming sustainably, Leaders are hopefully more interested in working with conservationists. This will make it easier to involve local communities in projects, regarding the sustainable development agenda, like plant breeding programs and building seed banks.

Medicinal Plants

Among the world’s population, over eighty percent rely on traditional medicine. The use of traditional medicine is common among most populations in developing countries such as Kenya (Mwarua et al., 2020). This is due to the inability to access modern medicine due to availability. The traditional medicine is mostly composed of medicinal plants that are indigenous to Kenya, with 270 species classified as medicinal (Muthaura et al., 2007). Parts of the plant such as the root, stem, or bark are used to create the herbal medicine which is used to treat diseases such as constipation, hepatitis, allergies, and Malaria (Mahomoodally, 2013).

Due to the need of the root, stem, or bark of the medicinal plants, the harvesting of them can be a threat to biodiversity (Mwarua et al., 2020). The overexploitation of these plants, lack of medical knowledge from Kenyan healers, and deforestation is causing an erosion in diversity (Bernard et al., 2020). Due to the lack of education of Kenyan healers, the entirety of medical plants is not used and are disposed of (Bernard et al., 2020). The harvesting of these plants causes partial or complete damage of trees, as well (Mwarua et al., 2020). Nationally and internationally protected plant species trade has been prevalent and recorded which can cause the further depletion of already endangered species (Mwarua et al., 2020).

The collection of data of medicinal plants within the entirety of Kenya needs to be performed to further regulate the harvest and use of them. With further education provided to Kenyan healers, plant species identification can be more accurate which can protect endangered species as well as the use of the entirety of medicinal plants for diseases. The domestication of popular medicinal plants can also prevent the loss of biodiversity within Kenya, as well.

Charcoal production

As stated, the usage of local plants is crucial for Kenya's inhabitants, and amongst these plants the usage of wood for charcoal production is vital. They utilize different parts of a tree such as the branches and trunk that have undergone burning in a regulated amount of oxygen (Siko, 2019). In Kenya, charcoal is widely used in urban areas and its use has risen by 64 percent in two decades. Most of the users are poor and middle-income populations who cannot afford to use modern electricity. Furthermore, its advantages such as its capacity to burn for a longer period and its reduced smoke emission makes it more optimal for poorer communities. (Njenga et al., 2013).

Despite these advantages, Kenya's biodiversity is under threat from this charcoal manufacturing. Dry forest is a type of forest characterized by its limited availability of water, and it is here that Kenya gets a lot of their wood for charcoal production. A study by *Kiruki et al., 2019* shows that only ten tree species dominate the dry forest as well as irregular size class distributions of wood observed in species *C. abbreviata* and *S. spinosa*. This is an indicator of overexploitation by charcoal production and weak regeneration. Regeneration is the process where trees replace themselves naturally in a forest. The excessive harvesting of trees beyond what the ecosystem can naturally replenish can weaken the regeneration rate and reduce the abundance in species of trees, which the study shows.

The overexploitation by charcoal production is not sustainable and needs to be alleviated to restore the ecosystem. This could be achieved by building the technical capacity of charcoal producers, increasing microfinance programs that would enable the adoption of appropriate technologies supported by effective governance systems. In addition, the work of research and development bodies or associations such as Community Forest Associations (CFA) could help to advise farmers on the tree and shrub species to use and on optimum management through rotation periods, but also provide socio-economic benefits (Njenga et al., 2013).

Discussion

Ethnobotany offers valuable insights into local and traditional sustainable living practices. It further highlights the importance of biodiversity by showcasing a range of different plant species being, not only beneficial, but crucial in securing food, providing healthcare, and meeting energy demands. The indigenous crops in Kenya are both resilient and nutritious, thus providing food security and a healthy diet. In areas with limited access to modern medicine, it's the traditional medicinal plant knowledge that provides essential healthcare.

However, ethnobotany also has its downsides. Traditional knowledge, which is valuable locally, may lack the scientific insight for it to be applied on a larger scale. By relying solely on these practices, without integrating modern conservation strategies, the SDG 15 goals of protecting ecosystems and biodiversity can be undermined. For example, continuously harvesting of medicinal plants without surveying their abundance in an area, can lead to species going extinct and thus a loss of biodiversity.

Both modern agriculture and industrial practices still, for the most part, regard efficiency and economic profit as its goals, rather than sustainability, which can lead to habitat destruction and loss in biodiversity. Local crops, although nutritious, can be replaced by cash crops harming local food security. Large scale charcoal manufacturing can lead to monocultures and habitat destruction which again harms ecosystems. So, although modernization can boost productivity and economic growth - it must be balanced with IEK and practices to protect life on land.

References

- Kathambi, V., Mutie, F.M., Rono, P.C., Wei, N., Munyao, J.N., Kamau, P., Gituru, R.W., Hu, G.-W., Wang, Q.-F., 2020. Traditional knowledge, use and conservation of plants by the communities of Tharaka-Nithi County, Kenya. *Plant Diversity, Ethnobotany: the Future of Plant Conservation* 42, 479–487. <https://doi.org/10.1016/j.pld.2020.12.004>
- Kimondo, J., Miaron, J., Mutai, P., Njogu, P., 2015. Ethnobotanical survey of food and medicinal plants of the Ilkisonko Maasai community in Kenya. *Journal of Ethnopharmacology* 175, 463–469. <https://doi.org/10.1016/j.jep.2015.10.013>
- Kiruki, H.M., van der Zanden, E.H., Gikuma-Njuru, P., Verburg, P.H., 2017. The effect of charcoal production and other land uses on diversity, structure and regeneration of woodlands in a semi-arid area in Kenya. *Forest Ecology and Management* 391, 282–295. <https://doi.org/10.1016/j.foreco.2017.02.030>
- Mahomoodally, M.F., 2013. Traditional medicines in Africa: an appraisal of ten potent african medicinal plants. *Evid Based Complement Alternat Med* 2013, 617459. <https://doi.org/10.1155/2013/617459>
- Medley, K.E., Kalibo, H.W., 2007. Ethnobotanical Survey of “Wild” Woody Plant Resources at Mount Kasigau, Kenya. *eanh* 96, 149–186. [https://doi.org/10.2982/0012-8317\(2007\)96\[149:ESOWWP\]2.0.CO;2](https://doi.org/10.2982/0012-8317(2007)96[149:ESOWWP]2.0.CO;2)
- Muthaura, C.N., Rukunga, G.M., Chhabra, S.C., Mungai, G.M., Njagi, E.N.M., 2007. Traditional antimalarial phytotherapy remedies used by the Kwale community of the Kenyan Coast. *Journal of Ethnopharmacology* 114, 377–386. <https://doi.org/10.1016/j.jep.2007.08.033>
- Muthoni, J., Nyamongo, D.O., 2010. Traditional Food Crops and Their Role in Food and Nutritional Security in Kenya. *Journal of Agricultural & Food Information* 11, 36–50. <https://doi.org/10.1080/10496500903466745>
- Muthoni, J., Nyamongo, D.O., 2008. Seed Systems in Kenya and Their Relationship to On-Farm Conservation of Food Crops. *Journal of New Seeds* 9, 330–342. <https://doi.org/10.1080/15228860802492273>
- Mutie, F.M., Gao, L.-L., Kathambi, V., Rono, P.C., Musili, P.M., Ngugi, G., Hu, G.-W., Wang, Q.-F., 2020. An Ethnobotanical Survey of a Dryland Botanical Garden and Its Environs in Kenya: The Mutomo Hill Plant Sanctuary. *Evidence-Based Complementary and Alternative Medicine* 2020, e1543831. <https://doi.org/10.1155/2020/1543831>
- Mwaura, A., Kamau, J., Ombori, O., 2020. An ethnobotanical study of medicinal plants commonly traded in Kajiado, Narok and Nairobi counties, Kenya: Medicinal Plant Species Traded in Kenya. *EAJSTI* 1. <https://doi.org/10.37425/eajsti.v1i3.153>
- Njenga, M., Karanja, N., Munster, C., Iiyama, M., Neufeldt, H., Kithinji, J., Jamnadass, R., 2013. Charcoal production and strategies to enhance its sustainability in Kenya. *Development in Practice* 23, 359–371.
- Rajat, J., 2021. PLANT BIODIVERSITY AND ETHNOBOTANICAL APPLICATIONS IN TWO KAYA FORESTS IN KILIFI COUNTY.
- Siko, O.I., n.d. Assessment of Sustainable Charcoal Production in Kenyan Drylands: a Case of Marigat Sub County.
- Wanjohi, B.K., Sudoi, V., Njenga, E.W., Kipkore, W.K., 2020. An Ethnobotanical Study of Traditional Knowledge and Uses of Medicinal Wild Plants among the Marakwet Community in Kenya. *Evidence-Based Complementary and Alternative Medicine* 2020, e3208634. <https://doi.org/10.1155/2020/3208634>