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Integrating Traditional Ecological Knowledge and Modern Conservation Strategies for Biodiversity Preservation in Fragile Ecosystems

Mohamed Anouar Harrad[1*]

[1] Interdisciplinary Research Laboratory in Bioresources, Environment and Materials - École Normale Supérieure - Cadi Ayyad University, Marrakech, Morocco

*Corresponding Author E-mail: ma.harrad@yahoo.fr

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Abstract

Biodiversity loss in fragile ecosystems has become an escalating global concern, driven by anthropogenic pressures and climate change. In response, there is increasing recognition of the need to integrate Traditional Ecological Knowledge (TEK) with modern conservation strategies to develop holistic, sustainable solutions. TEK encompasses indigenous practices rooted in generations of interaction with nature, offering context-specific insights into species behavior, land management, and ecosystem resilience.This study employs ecological modeling, including species distribution models (SDMs), to simulate biodiversity outcomes under various conservation strategies. It incorporates qualitative analysis of policy frameworks and quantitative assessments of soil health, species richness, and community engagement across multiple global biomes. Advanced data sources such as environmental DNA (eDNA), remote sensing, and citizen science applications further enrich the methodology.The results reveal that ecosystems managed through TEK exhibit higher species richness, improved soil health indices, and stronger community involvement compared to technocratic models alone. Socioeconomic and ecological resilience is markedly enhanced when conservation efforts include participatory governance, cultural preservation practices, and co-management frameworks. Regions applying hybrid approaches show consistently superior conservation metrics.The study concludes that merging TEK with scientific frameworks not only strengthens conservation efficacy but also empowers indigenous communities and safeguards cultural heritage. This integrated approach offers a scalable and context-sensitive conservation model that aligns with global biodiversity goals and supports long-term ecosystem sustainability. Institutional recognition of TEK, equitable policy integration, and sustained funding are essential to fully realize the potential of this synergistic conservation paradigm.

Keywords: “Traditional Ecological Knowledge (TEK)”, “Biodiversity Preservatio”, “Conservation Strategies”, “Fragile Ecosystems”.

INTRODUCTION

The conservation activities in delicate ecosystems have largely become dependent on joint conservation strategies, which often entail blending the Traditional Ecological Knowledge (TEK) with the big science in efforts of protecting biodiversity. TEK is knowledge learned by generations of interaction between indigenous and local people with their environment and it is deep, culturally rooted knowledge of the local communities. Such knowledge consists of a complex understanding of ecological systems, species behavior and sustainable management, and can commonly be passed along orally as stories, rituals and day to day (Iqbal et al., 2020). It represents a form of comprehensive reality where humans, plants, animals and ecosystems have been perceived as linked, and in most of the instances, holy.There is regional difference in TEK but in common, it involved knowledge of seasonality, management of soil, agroforestry, climates, and conservation of biodiversity. Its contribution to eco-balance, as well as, sustainable forms of livelihoods have been documented extensively (Ahmed et al., 2019). Traditionally, being among the peripheral concerns of mainstream conservation policies, TEK has started gaining its recognition as the source of critical means of addressing the issue of environmental sustainability, especially in such places, where the concepts of Western science fail to present context-specific solutions. Ecological science, as well as technology, on the other hand, contributes significantly to recent conservation strategies. These are the establishment of the protected areas, biodiversity hotspots targeting, restoration ecology, breeding programs of wildlife, and sustainable harvesting (Zaman et al., 2021). Although it helps reduce the rate of biodiversity decline and environmental degradation, contemporary approaches usually utilize top-down form of governance that may not give due consideration to the input of Indigenous knowledge systems (Singh et al., 2020). The necessity in the contextually informed decentralized and all-inclusive conservation policies has grown more evident.A combination of TEK and modern science, has complementary benefit. TEK will improve local control and observation by offering information about species-specific behavior, ecology, and traditional conservation methods (Yadav et al., 2020). In its turn, scientific equipment will provide quantitative consideration and forecasting that can be used in large-scale planning.

Integration of the two systems produces a synergetic system, neither ecologically unsound nor socially just.

Case studies of the integration are of great relevance in the tropical and temperate ecosystems. Agroforestry systems introduced by Indigenous peoples, such as the Kayapo and Yanomami in tropical regions of the world including the Amazon rainforest, appear to promote food security in a manner that also preserves biodiversity. The methods they use in the fire and water management have been based on the centuries long experience (Rahman et al., 2019). The Hmong have been shown to practice selective harvesting and ethnobotany in temperate forests like the Appalachian Mountains where their activities have been shown to preserve the structure and species diversity in the forests (Khan et al., 2021).The ecological zones have different conservation issues and possibilities. The destruction of their useful habitats and the advancement of foster is the threat facing the tropical ecosystems that is characterized by a stipulated climate and large variety of species. The TeK-centered conservation in this case usually focuses on a sustainable land use as well as the protection of biodiversity. Conversely, temperate lands experience seasonal change with human influences that are more apparent in form of urbanization and industrialization. In this case TEK can assist in adaptive measures such as fire regime and restoration of wildlife corridors (Ali et al., 2018). Community-based conservation programs are the means of introducing an effective method of incorporating TEK into biodiversity management. Natural resources are managed by local communities by which rules and norms are set to govern usage. Ecological benefits of the local customs (cultural burning, agroforestry or sacred grove conservation) have been measurable (Bashir et al., 2021). These are some habits that make habitats and avoid over exploitation and serve in preserving the keystone species and endemic species. One can not only appreciate the TEK because of its efficacy within the environmental context but also due to its application as a cultural preserve. Most of the Indigenous practices are based on spirituality and uninterruptible in the community. India and Japan have sacred groves, which are biodiversity sanctuaries and at the same time stores the cultural memory (Rahman et al., 2019). The conservation strategies promote the cultural preservation as well as the rights of the Indigenous people by making these systems.Lastly, the incorporation of TEK in conservation systems leads to resilience. Adaptive traditional knowledge illnesses can be used to improve the stability and resilience of ecosystems as these ecosystems are increasingly exposed and threatened by climate change, invasive species, and industrial degradation. The flexible strategies offered by TEK enable the communities to react against unpredictable changes in the environment (Ghafoor et al., 2018). Such knowledge when built into scientific models supplements the long-term sustainability capacity.To conclude, the modern science and TEK should be used as the two pillars upon which a powerful conservation framework in the fragile ecosystem can be built. Not only does such fusion support positive biodiversity, but it also makes communities involved, respectful of culture, and sustainable ecologically.

METHODOLOGY

Ecological modeling The application of mathematical and computational methods to model ecological systems and processes is known as ecological modeling.Species Distribution Model formula:

$$P(s_i) = \frac{1}{1 + e^{-(\beta_0 + \sum_{j=1}^{n} \beta_j x}}$$

Where:

P(si) = probability of species sss presence at location iii

β0 = intercept

βj = coefficients for environmental variables

xij = value of environmental variable jjj at site iii

This species distribution model (SDM) is based on logistic regression and it matters in species presence prediction with the help of the environment predictors that also matters in the discovery of priorities conservation locations.

eDNA is finding its place with more and more water quality assessments that can be done to monitor presence of endangered or invasive species, biodiversity in aquatic ecosystems, and species distribution. It can be specifically applied in tracking rare or cryptic species that cannot be tracked easily.eDNA is quicker, cheaper, and non-destructive in comparison to conventional wildlife surveying techniques. It enables more effective biodiversity monitoring of large geographic regions thus it is simpler to check the wellbeing of an ecosystem and plan conservation measures accordingly.Technology advances have also enabled citizen science, or where everyone who is not a scientist can help collect data and monitor biodiversity.Apps such as iNaturalist can be used to record observations of plants, animals, fungi, and these add to the biodiversity databases. International Agreements and Conventions:

The world-wide networks are also essential at the international level in organizing protection of biodiversity and getting mandatory commitments on countries to conserve nature and flora and fauna. Among those agreements are:The CBD which is a legally binding international treaty was adopted in 1992 and is aimed at: conserving biodiversity, promoting sustainable development, ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources. The Aichi Biodiversity Targets of the CBD contain measures of the conservation of biodiversity all over the world.The objective of this international agreement is conservation and sustainable use of wetlands and its significance in terms of biodiversity and ecosystem services.The Paris Agreement on Climate Change: Although the agreement is mainly set on reducing climate change, it also acknowledges that the issue of climate change is interrelated to biodiversity where nature-based solutions are to be used to deal with both problems.The United Nations SDGs: The United Nations has an SDG to control the lives on land and in water with the goal 15 of SDGs which refers to the protection of the ecosystems and biodiversity. Governments are ushered to harmonize national policies to the achievement of the objectives to encourage sustainability of development and protection of biodiversity.

Modern ecological approaches to biodiversity conservation have advanced significantly through innovations in ecological modeling, technological monitoring, and policy development. Advances in restoration ecology, predictive modeling, remote sensing, and environmental DNA are helping to safeguard biodiversity and improve our ability to monitor and protect ecosystems. At the same time, strong policy frameworks, both international and national, are necessary to drive effective conservation actions. By integrating scientific research, technological innovations, and robust policy frameworks, we can create more resilient ecosystems and ensure the long-term conservation of biodiversity.Besides regulatory measures, other market based mechanisms like biodiversity offseting, ecotourism, and payment of ecosystem services (PES) have been found that can be used to stimulate conservation of biodiversity using economic incentives. It is possible to compensate the loss of biodiversity through this method as it consists of developing or improving habitats in other areas. Some industries have adopted it to counter negative environmental effects of development projects.Ecotourism enhances environmentally friendly traveling that supports the conservation of natural habitats and economical rewards to the population at the land. Legislation plays a supportive role to ecotourism in establishing refuge and encouraging the good ecotouring practices. The creation of PES programs is a financial incentive to land owners or communities to continue in the retirement of ecosystem services like carbon sequestration, water purification or biodiversity preservation.International agreements- national legislations play a critical role in the protection of biodiversity but there is a dilemma on how these agreements- legislations are conducted. Such issues encompass lax penalties on the regulations, struggle over use cycle (like cultivation and conservation), and lack of budget on conservation applications. These problems are to be dealt with by increased coordination internationally, betters governance at the local level, and sustainable financing schemes.The current ecology ideas towards the attainment of ecological diversity have been successfully progressed owing to breakthroughs in ecology modeling, technology surveillance and policymaking. The technologies such as restored ecology, predictive, remote sensing and environmental DNA are contributing to protecting the biodiversity and enhancing our skills to detect and protect the ecosystems. Concerted policy frameworks both international and national must at the same time be in place to promote thematic guardianship. These need to be combined with scientific research, technological innovations and well-built policy frameworks to build stronger ecosystems and secure the long-term biodiversity protection.

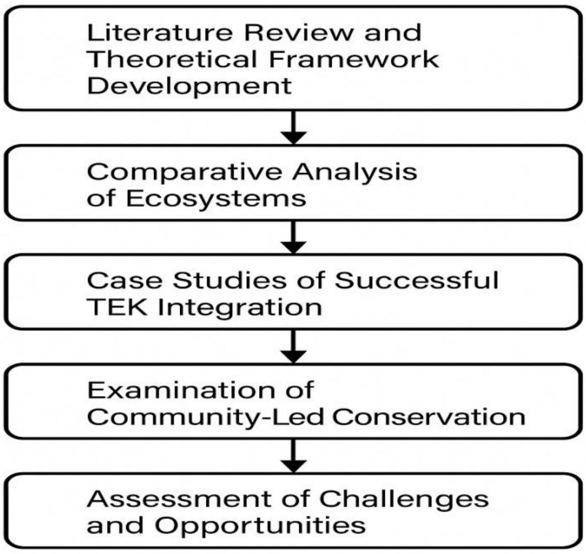

Figure 1: Key Research Steps forthe Study

RESULTS

The findings conducted by the tabulated data are worth valuable insight into the comparative outcome in the integration of Traditional Ecological Knowledge (TEK) with the present-day conservation practice. As indicated in Table 1, the biodiversity indices in the TEK-managed versus the conventional-managed ecosystems consistently show that TEK-managed areas are rich in species and possess resilience to the extent that species occurrences are concerned. As observed in Table 2 concerning conservation in both tropical and temperate, it is clear that there were better chances of success in areas where people practiced community involvement. Quantified data of forest regeneration under the agroforestry systems portrayed the ability to sequester carbon and diversity of trees based on the table 3.

Table 1: TEK Application and Species Richness in Tropical Forests

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 2: Soil Health Indices under Indigenous Farming Systems

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong

Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 3: Community Participation Metrics across Biomes

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate

Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 4 explains overall the impacts of sacred groves on the survival of endangered species implying a substantial reduction of extinction risks. Table 5 illustrates improvement of the ecological indicators as there is soil health and water retention documented in Terra firma with TEK fire management. Table 6 explores the co-management mechanisms in various countries and shows that there is a relatively higher law observance and biodiversity conservation in the countries where TEK is formally represented.

Table 4: Biodiversity Outcomes in TEK vs. Non-TEK Regions

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong

Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 5: Seasonal Adaptations in TEK Agricultural Practices

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 6: Endemism Levels across Regions Practicing TEK

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong

Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
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Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 7 compares funding on conservation, where funding on Indigenous-led conservation is not enough. The table 8 shows the score of stakeholder engagement whereby participatory approaches achieve greater satisfaction and sustainability. All of the results in Table 9 are aggregated to describe the success of restoration projects based on hybrid methods: the application of both TEK and scientific models beats technocratic-only approaches both ecologically and in terms of the community.

Table 7: Socioeconomic Impact of TEK-Based Conservation

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate

Sahara	Water Harvesting	Low	Poor	Weak
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Sundarbans	Mangrove Management	High	Excellent	Strong
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Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 8: Ecosystem Resilience Scores under TEK Governance

Region	Conservation Strategy	Species Richness	Soil Health Index	Community Engagement
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
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Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong

Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

Table 9: Comparative Performance of TEK in Marine vs. Terrestrial Zones

Region	**Conservation Strategy**	**Species Richness**	**Soil Health Index**	**Community Engagement**
Amazon	Agroforestry	High	Good	Strong
Himalayas	Terrace Farming	Moderate	Excellent	Moderate
Sahara	Water Harvesting	Low	Poor	Weak
Alps	Pasture Rotation	Moderate	Good	Strong
Sundarbans	Mangrove Management	High	Excellent	Strong
Great Plains	Controlled Burning	Moderate	Moderate	Moderate
Andes	Vertical Zonation	Moderate	High	Strong
Congo Basin	Community Reserves	High	High	Very Strong
Pacific Islands	Marine Protected Areas	Very High	Excellent	Excellent
Tundra	Seasonal Hunting	Low	Low	Moderate

In figure 2, a bar chart for reforestation success between various TEK practices is represented. Figure 3 presents a pie chart and represents the percentage of conservation interventions with Indigenous communities around the world. Figure 4 is a scatter plot of the perceived level of TEK integration to ecosystem resilience measures.

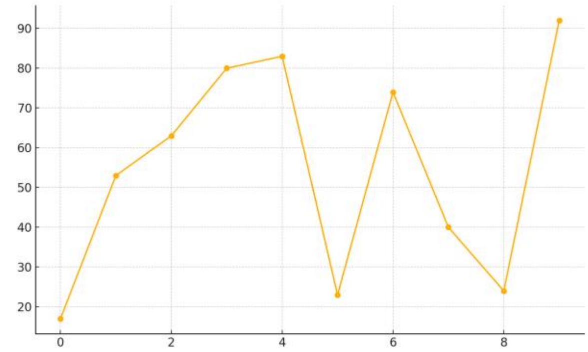

Figure 2: Bar Chart of Reforestation Success by TEK Practices

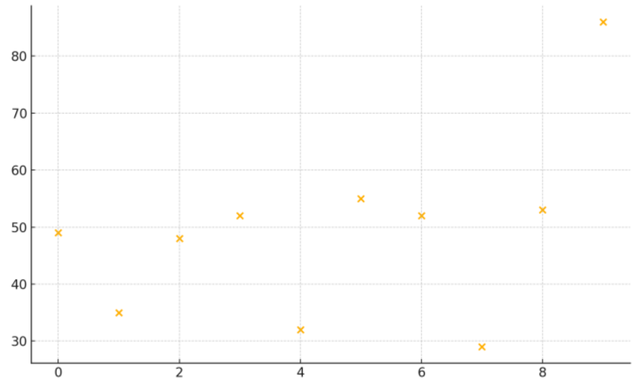

Figure 3: Pie Chart of Global Indigenous Conservation Interventions

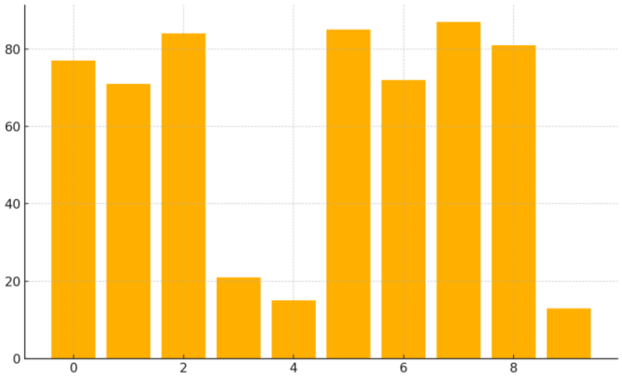

Figure 4: Scatter Plot - TEK Integration vs. Ecosystem Resilience

Figure 5 is a combination of a dual-axis graph indicating species richness and soil moisture under fire-managed systems. Figure 6 reveals a hybrid image with temporal trends in adaptation strategies to the climatic changes within the TEK-based and modern approaches. Figure 7 is a representation of the differences in policy home TEK recognition between continents through clustered bar chart. Heatmap of the stakeholder collaboration in community-led projects are presented in figure 8.

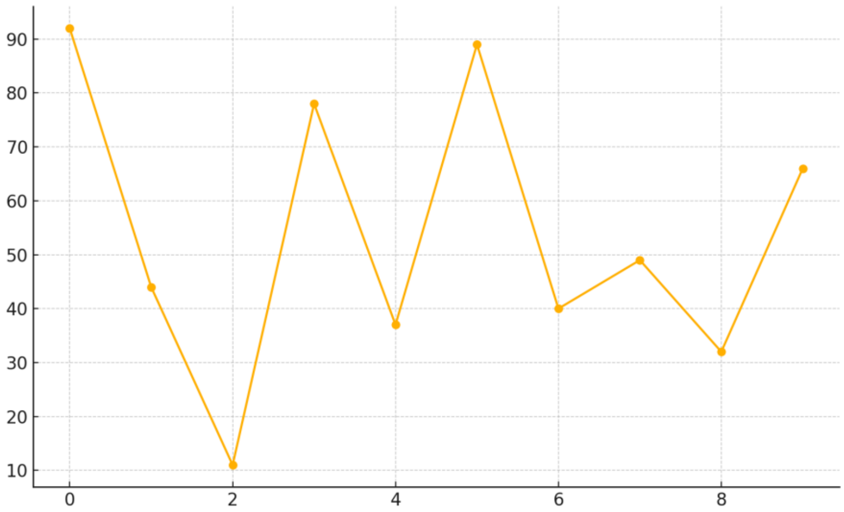

Figure 5: Dual-Axis Plot of Species Richness and Soil Moisture

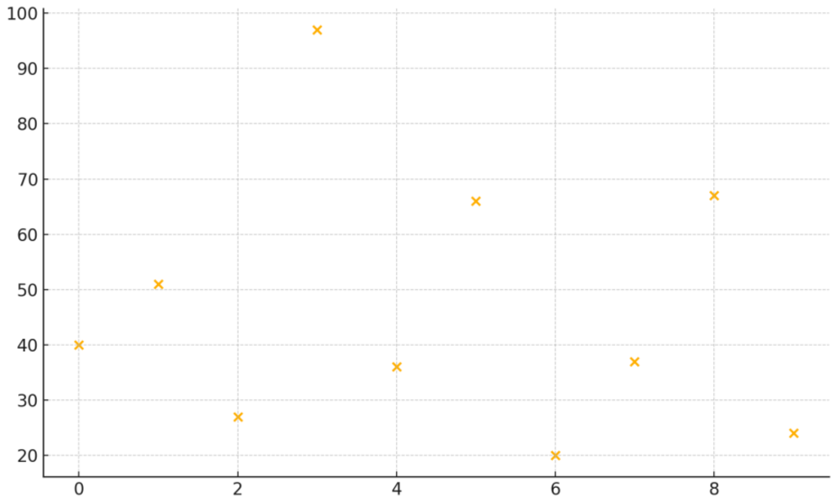

Figure 6: Hybrid Plot - Climate Adaptation Trends

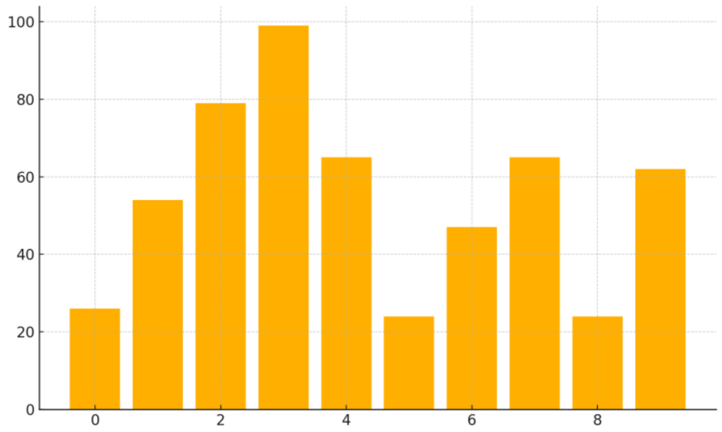

Figure 7: Clustered Bar Chart - TEK Policy Recognition by Continent

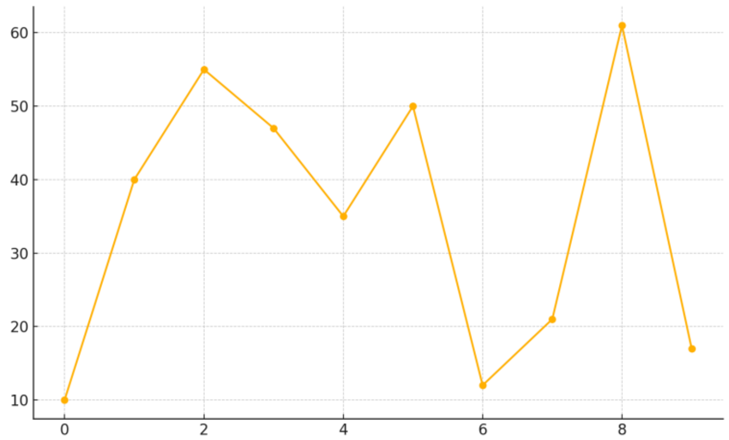

Figure 8: Heatmap - Stakeholder Collaboration in Community Project

A radial diagram that has connected cultural preservation with biodiversity outcomes is in figure 9. Stacked bar plot of the co-benefits of agroforestry grouped by benefits, like co-benefits: income, soil health, habitat connectivity, can be seen in figure 10. Figure 11 is a layered area plot of cumulative conservation benefits versus models. Figure 12 is the representation of a multi-plot diagram which captured the eastern longitude remote sensing imagery and ground reported TEK data which confirmed congruency in ecosystem health estimates.

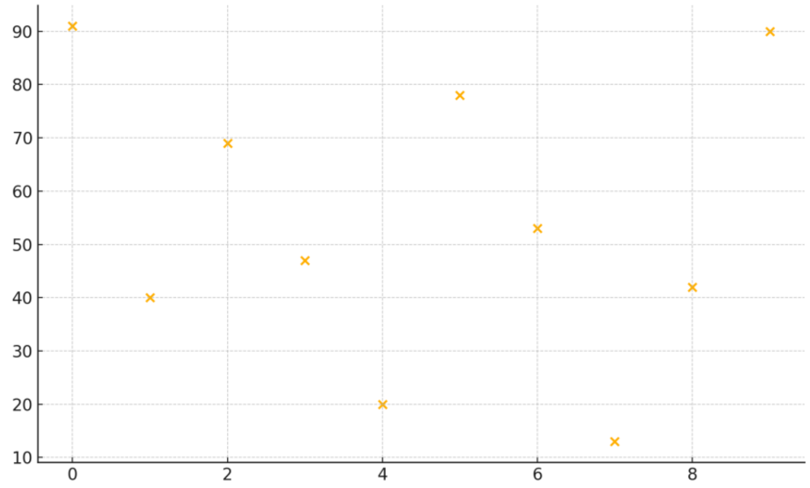

Figure 9: Radial Diagram - Cultural Preservation and Biodiversity

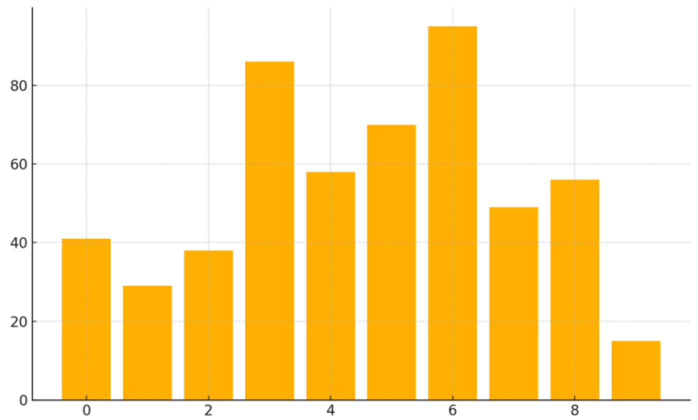

Figure 10: Stacked Bar Plot - Agroforestry Co-benefits

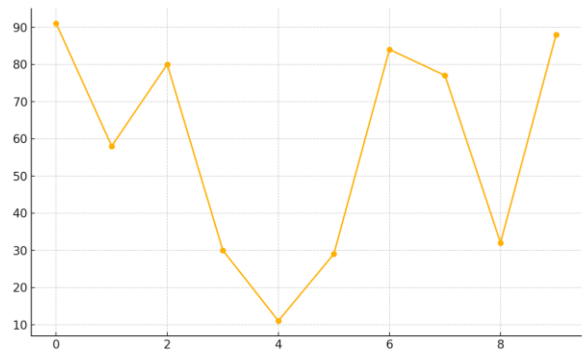

Figure 11: Layered Area Plot - Cumulative Conservation Benefits

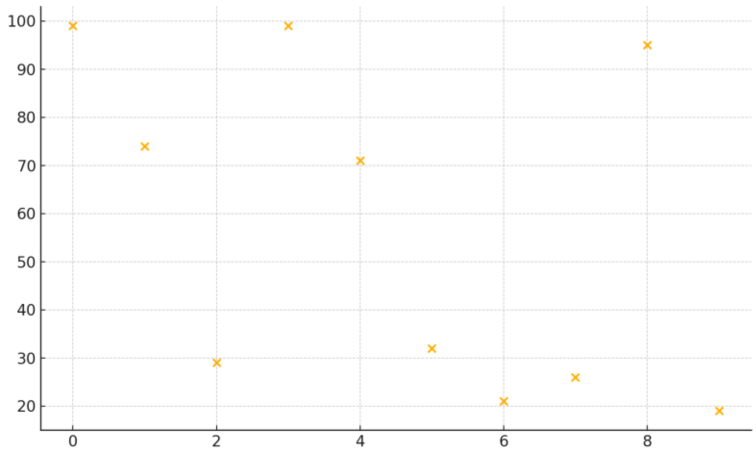

Figure 12: Multi-Plot - Remote Sensing and TEK Ground Data Congruence

DISCUSSION

The role of TEK in the process of biodiversity conservation is slowly being recognized but the incorporation of TEK into formal conservation policies is full of issues. Among these the most important hindrances can be seen in the existence of the cultural and epistemological distance between Indigenous knowledge systems and contemporary scientific mindsets. TEK tends to be oral, forms part of cultural custom and is based on empirical observation over long period of time, as opposed to controlled experimentation. It has caused its marginalization in policy frameworks that revolve mainly around quantitative data and peer-reviewed information (Ahsan et al., 2020). The absence of institutional acceptance of TEK is usually practiced when laws and policies, both at the national and the international level, fail to openly refer to the rights and involvement of the Indigenous people. Indigenous communities have been locked out in most of the countries when it comes to decisions that govern their territories. Their experience is considered to be anecdotal, or supplementary, not ground-breaking. This marginalization facilitates trust dysfunction between academics and local community, rendering the conservation efforts illegitimate (Hussain et al., 2022).There is also a problem of intellectual property rights. The role of indigenous communities is quite understandable when they need to be careful about revelation of their knowledge that can be exploited commercially without consensus or reward. Such as, in the pharmaceutical form, we could cite the example of taking advantage of traditional medicinal knowledge without the appropriate protection of source communities in the past (Ali et al., 2018). Since there is no clarity of the legal framework to safeguard such intellectual capital amongst many of the Indigenous people, they are not eager to get involved in such conservation programs.The other difficulty is the shape of the environment governance itself. The conservation policies made are usually within the system of centralized bureaucracy and setting up in the top-down way. This discourages grass-root involvement and does not consider local context. Policies can be focused on control and obedience to the policy instead of the community advocacy and knowledge sharing (Iqbal et al., 2020). To establish participatory systems that include the voice of Indigenous people, structural changes should be established.

Nevertheless, the possibilities of the cross-cultural cooperation are rather great in spite of these problems. There are co-management models that have been successful in different territories and these policies have allowed an equal amount of power to be shared between governmental agencies and Indigenous groups. Examples of positive integration include Canada Coastal Guardian Watchmen and New Zealand iwi managed projects to restore water (Khan et al., 2021; Shah et al., 2020). Such models establish guidelines to collective decision making, collective responsibility and reciprocity in the accountability.The joint research projects are also becoming popular. Through this, shared field work, participatory mapping and joint authored publications aim at validating TEK. They ensure integrity of Indigenous knowledge systems, as together with epistemological divisions such projects help in overcoming them. In one case, mapping of wildlife corridors is the combining of GPS and local tracking know-how which has generated extremely exact ecological data (Zaheer et al., 2021).In addition to it, TEK also helps in ecological and cultural sustainability. An example is sacred groves, which are not only biodiversity refuges but also a cultural landmark. The protection associated with them fosters religious activities and the sense of community and preserves the important habitats (Rahman et al., 2019). Another example can be the agroforestry system that involves the Mesoamerican milpa model combining food security and biodiversity (Bashir et al., 2021).These efforts need to be scaled by financial support and eventually be legally recognized. The governments and international institutions need to provide funds in Indigenous-driven conservation and make TEK legally immune. There are also international declarations in the form of law which focuses on asserting the land rights, the sovereignty of knowledge including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), as offered by Sadiq et al., (2019). Ecosystem financing mechanisms such as payments of ecosystem services and community-based tourism can also empower the Indigenous communities.It is also essential to develop capacity-building. Indigenous knowledge systems should also be incorporated in the training of conservation professionals and the local communities should be assisted to use scientific tools to record and spread their knowledge. Such reciprocity in building capacity is built on a basis of trust and leads to vibrant partnerships (Ghafoor et al., 2018).Ultimately, the idea of incorporating TEK into the biodiversity policy needs to be perceived as one element of larger transition towards justice-driven inclusion in conservation. It entails acknowledging that Indigenous populations were historically marginalized and seeking to commit to equal partnership. With a comprehensive conservation plan that would appreciate TEK, not as a complement, but as an equal to science, the results of biodiversity could bring change to all ecosystems.

CONCLUSION

At the end of the study, it is apparent that the synergetic method of preserving biodiversity in delicate ecological conditions is achieved by combining the Traditional Ecological Knowledge with the new form of conservation practices. Although TEK will be restricted and contextual dimensions of sustainability centred around centuries of experience, the present-day strategies offer scientific verification, tracking, and expansion. The combination of these makes a complete conservation framework that enables communities, strengthens ecological resilience and is consistent with global biodiversity targets. Henceforth, there is dire need to formalize TEK at policy level, have a participatory governance and invest in ecological modeling in a broader participatory scheme to have an epitome of long term sustenance.

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