ROLE OF TRIBESPEOPLE IN THE SUSTENANCE OF BIODIVERSITY AND AGROECOSYSTEM

ABSTRACT

Most ecoregions worldwide have experienced significant habitat conversion, with high levels of transformation and inadequate protection prevalent across Europe, South and Southeast Asia, Western South and North America, Western Africa, and Madagascar. Conversely, ecoregions requiring substantial protection and minimal conversion are largely found in the Arctic, Northern Amazon, North Asia, and Central Australia. Historically, long before formal conservation strategies emerged, tribespeople developed sophisticated conservation practices that effectively preserved environmental richness. These practices included sophisticated codes to prevent overhunting and maintain biodiversity. Tribespeople, acting as guardians of wildlife, engage in diverse livelihoods that include agriculture, hunting, and gathering edible plants. They also contribute to genome conservation at both community and individual levels. However, tribal communities face significant challenges such as eviction for conservation purposes, loss of control over natural resources, displacement, and legal issues. Solutions to these challenges have been explored through isolation, assimilation, and integration approaches. To reconcile conservation with tribal rights, it is crucial that conservationists protect the land rights of tribespeople, consult them on their needs, and support their traditional practices. Evidence increasingly shows that tribespeople, who manage a wide range of species crucial for their food, health, and economic security, are exceptionally skilled at environmental stewardship. Thus, conservation efforts should focus on upholding tribal land rights as a cost-effective solution, leveraging the tribes' deep-rooted knowledge and practices for better environmental outcomes.

Key words: Tribespeople; Agroecosystem; Biodiversity; Conservation

1. INTRODUCTION

Humans have reshaped patterns and processes in ecosystems across the terrestrial biosphere, both intentionally and unintentionally for millennia (Ellis *et al*., 2010; Dirzo *et al*., 2014). This reshaping has accelerated over time (Steffen *et al*., 2015), with a human footprint now obvious in most parts of the terrestrial realm (Sanderson *et al*., 2002). One of the more severe impacts of this anthropogenic transformation of the biosphere is the loss of natural habitats. Protected Areas (PAs) spearhead global efforts to conserve nature, and when properly managed they are particularly effective for combating habitat loss (Bruner *et al*., 2001; Gaston *et al*., 2008). The vast majority of ecoregions have very high levels of habitat conversion compared to their overall areal protection. These highly converted and poorly protected ecoregions occur across all continents and dominate Europe, south and south-east Asia, western South and North America, western Africa, and Madagascar. The small number of ecoregions that contain high levels of protection and low levels of conversion are primarily located in the Arctic, the northern Amazon, North Asia and central Australia. Most agroecosystems are disturbed more frequently and with greater intensity than natural ecosystems resulting in reduced biological diversity (Gliessman, 2015).Long before the concept of conservation was formally defined, indigenous tribes developed highly effective practices for maintaining environmental richness. They implemented sophisticated conservation codes to prevent overhunting and safeguard biodiversity

2. AGROECOLOGY

Agroecology is the study of the interactions between plants, animals, humans and the environment within agricultural systems (Dalgaard*et al.*, 2003). Agroecology focuses on food production systems that optimize the use of nature's resources while minimizing harm to those resources. Agroecological practices support the goals of sustainable agriculture by providing adequate food for a growing global population, protecting the environment and natural resources, reducing reliance on non-renewable

energy, and ensuring economic viability for farmers and their communities.Agroecology is key to transforming food and agricultural systems and achieving the sustainable development goals (FAO, 2018).

3. AGROECOSYSTEM

An agroecosystem is an ecosystem under agricultural management, connected to other ecosystems (OECD, 2001). Agroecosystems are complex systems in which many species interact with ecological processes that take place at different spatial scales, and with strong interactions between ecological and management processes (Loeuille*et al.*, 2013).

Agroecosystems comprise 30 per cent of the earth's surface. They provide various ecosystem services and management practices used in the agroecosystems determine the state of the global environment (Alhameid*et al.*,2017).

4. BIOLOGICAL DIVERSITY/ BIODIVERSITY

Biological diversity is the variability among living organisms inhabiting all environments and ecological systems (CBD, 1992). Biodiversity can be considered at genetic, species, and ecosystem levels. In agroecosystems, it serves three primary functions: genetic, agricultural, and ecological. The genetic function involves preserving the gene pool of species, especially those that are endangered. The agricultural function focuses on enhancing the resilience of agroecosystems to both abiotic and biotic stresses while sustaining their productivity. The ecological function supports the overall health and balance of the ecosystem.Biodiversity has also ecological functions, for example, creating habitats withdifferent flora and fauna species that have specific significance in agroecosystems (Clergue *et al.*, 2005).The loss of biological diversity is a critical global issue and a significant threat to our civilization. The destruction of primary ecosystems, coupled with intensive farming, urbanization, and infrastructure development, leads to the depletion of species and

undermines the stability and resilience of ecosystems. This loss not only diminishes the variety of life on Earth but also impairs ecosystem functions that are vital for human survival, including climate regulation, clean water supply, and food security. The degradation of these systems can have far-reaching impacts on both the environment and human societies.

5. INDIGENOUS AGROECOLOGY

This concept, proposed by political ecologist Josep Gari, aims to recognize and uphold the integrated agroecological practices of many indigenous peoples, who manage and use ecosystems in a sustainable manner for agricultural, food, biodiversity, and cultural purposes simultaneously (Gari, 2016). Indigenous agroecology is not a static system but continuously evolve with new knowledge and resources, including those from development projects, research initiatives, and agro-biodiversity exchanges. Historically, indigenous peoples were among the first agroecologists and have advocated for development policies and programs that support their traditional practices rather than replace them. The term 'indigenous' has been used generically for many years, but in different regions, alternative terms may be preferred, such as tribes, *First Peoples/Nations, Aboriginals, ethnic groups, Adivasi, or Janajati*. Occupational and geographical terms such as hunter-gatherers, nomads, peasants, and hill people may also be used to describe these groups.

Many areas inhabited by indigenous people coincide with some of the world's remaining major concentrations of biodiversity. Traditional indigenous territories encompass up to 22 percent of the world's land surface and they coincide with areas that hold 80 percent of the planet's biodiversity (Claudia, 2008). Also, the greatest diversity of indigenous groups coincides with the world's largest tropical forest wilderness areas in the Americas (including Amazon), Africa, and Asia, and 11 percent of world forest lands are legally owned by indigenous people and communities (White *et al.*, 2004).

5.1 Indigenous People of India

In India, 461 ethnic groups are officially recognized as Scheduled Tribes, representing the country's indigenous population. In mainland India, these Scheduled Tribes are commonly referred to as Adivasis, a term that literally means 'indigenous people.The population of Scheduled Tribes (STs) in the country is 10.45 crore which constitute 8.6 percent of the country's total population and 11.3 percent of the total rural population (GOI, 2011).

The largest concentrations of indigenous peoples are found in the seven states of north-east India, and the so called central tribal belt stretching from Rajasthan to West Bengal. Table 1 shows major tribes residing in the different states or union territories of India (GOI, 2011).

Table 1. Major tribes of India

Top 5 States/ UTs: Major Tribes	
Lakshadweep	*Aminidivi, Koyas, Malmis and Malacheriis*
Mizoram	*Chakma, Dimasa, Khasi, Kuki, Lakher, Pawai*
Nagaland	*Angami, Garo, Kachari, Kuki, Mikir, Nagas*
Meghalaya	*Chakma, Garos, Hajong, Jaintias Khas*
Arunachal Pradesh	*Patanis, Abor, Dafla, Galong, Momba*
Bottom 5 States/ UTs: Major Tribes	
Uttar Pradesh	*Bhotia, Buksa, Jaunsari, Kol, Raji, Tharu.*
Tamil Nadu	*Adiyan, Aranadan, Eravallan, Irular, Kadar*

Bihar	*Asur, Baiga, Birhor, Birjia, Chero, Gond*
Kerala	*Adiyan, Kuruchiyar, Paniyar, Kurumbas*
Uttarakhand	*Bhotias, Buksa, Jannsari, Khas, Raji, Tharu*

6. CULTURE-BIODIVERSITY CONNECTION

Cultural elements such as traditions, beliefs, practices, and celebrations are closely linked to environmental conservation. The knowledge, innovations, and practices of tribal communities reflect their cultural heritage and are integral to their conservation efforts. This biodiversity-based culture embodies indigenous agroecological practices.Gari (2016) conducted field research in the indigenous communities of Curaray, Pastaza, Ecuador showed that, a correlation trend between cultural values and genetic agrobiodiversity for the 53 main cultivated species in the indigenous agroecosystems (Fig.1). In essence, the indigenous cultural frame drives the conservation, use, selection, and production of biodiversity. Biodiversity conservation and indigenous cultural systems are inextricable. The cultural dimension fosters the selection and maintenance of biodiversity, which is also associated to ecological, nutritional, gastronomic and medicinal values (Garí, 2016).

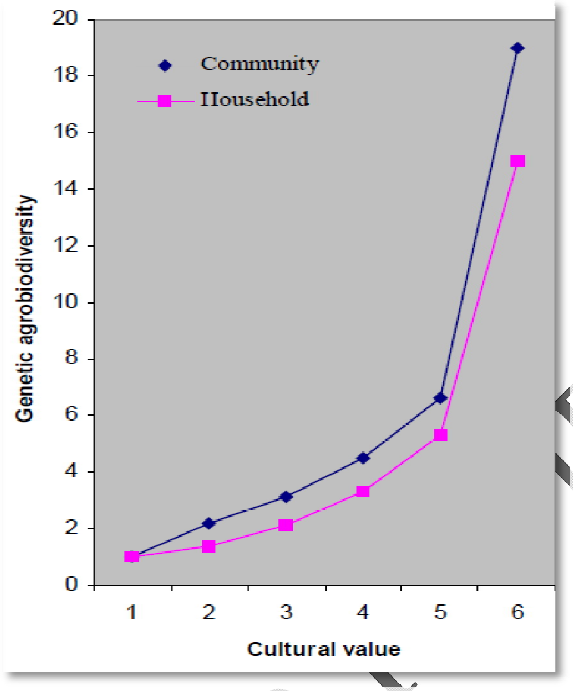

Fig. 1Culture-biodiversity curve

7. TRIBESPEOPLE AS GUARDIANS OFWILDLIFE

7.1. Plant utilization for food

Ethnic and indigenous communities have preserved numerous plants and endangered cultivars of agricultural crops, including rice, maize, millets, grains, legumes, fruits, and vegetables. These crops have originated in diverse agroecological climates across the northeastern, central, and peninsular regions of India. Ethnobotanical investigation performed during 2003 and 2005 to collect, identify and document information on the wild food plants traditionally used by the tribes in the Parambikulam Wildlife Sanctuary in Palakkad district of Kerala state, India. Eighty three species are used by tribes as vegetables, wild fruits, beverages or in other preparations. Wild vegetables formed the largest group which include roots, tubers,

young leaves and buds, inflorescence, unripe/ ripe fruits and seeds (Fig 2) (Yeshodaran and Sujana, 2006).

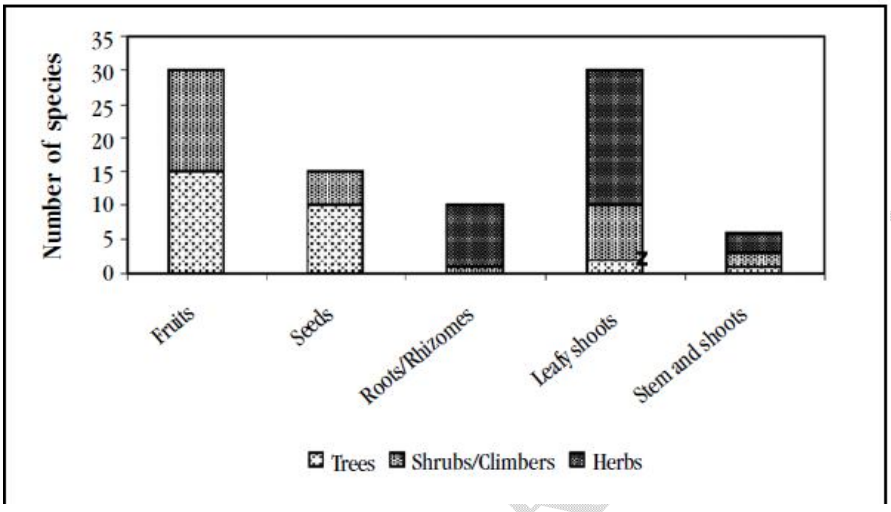

Fig. 2Number of species of each category of food use and habit

The *Kattunaikka*classified *Dioscorea* into six groups (1) *Noora–Korana,* (2) *Kavala–Shoddy*,(3) *Hekku,* (4) *Venni*, (5) *Naara* and (6) *Hendhiride* and two with single species (7) *Nara kalasu* and (8) *Salu kalasu*(Table 2). Each group is examined in terms of their characteristics, quality of the tuber, habitat and distribution within the district (Balakrishnan *et al.,* 2003).

7.2 Medicinal herbs

A total of 67 medicinal plant species belonging to 44 families used by the *Kurichiya, Kuruma, Kattunaika, Adiyan and Paniya* tribes residing at Vythiri have been recorded(Prasad and Shyama, 2013).The common health ailments treated in the study area were skin problems, wound, toothache, abdominal problems, kidney stones, diabetes, bone fracture, arthritis, piles, fits, asthma, head ache, urinary troubles etc.

Many plant species are of great economic importance to tribes as rhizomes of such plants like *Acoruscalamus*, stem bark of *Bunchanialanzan*, stem and leaves of *Moringaoleifera*, *Achyrnthusaspera*, *Gynandropsisgynandra*, *Bombaxceiba* are being used as antidote of snake - bite and scorpion sting(Rai and Nath, 2008).

7.3 Rituals and Beliefs

The tribal culture found in central India's regions, including the Dindori, Balaghat, and Mandla districts of Madhya Pradesh and the Kawardha and Bilaspur districts of Chhattisgarh, has been well-documented. Survey studies indicate that plants and flowers hold significant cultural and spiritual value for these communities and tribals often worship trees and flowers, believing that deities reside within them (Rai and Nath, 2008).

Sacred groves are found in various regions of India, including the Western Ghats, Central India, and northeastern India, particularly where indigenous communities reside. These groves are known by different names given by local ethnic groups. They serve as crucial centers for biodiversity conservation. Many plants and animals that are threatened in surrounding forests are still well-preserved in these sacred groves. Observations have shown that several medicinal plants, which are scarce in the broader forest, are abundant in these groves. Additionally, sacred groves often harbor rare, endangered, threatened, and endemic species(Khan and Tripathi, 2008). The *Santali* tribe of West Bengal worship several deities including *Marang Buru, Moreko, Jair Era, Gosain Era, Pargana, and Manjhi*. Each of these gods has a designated place in the sacred grove (Risley, 1981). For the *Khond* tribes, *GossaPennu*, the God of Forests, is particularly significant, and they maintain a sacred grove dedicated to him. This grove is governed by a set of taboos regarding resource harvesting, and offerings are made to the deities. The *Khonds* also revere other deities such as *Pitabaldi*, meaning 'Great Father God,' and *Loha Penu*, the war

God or God of arms (Patnaik, 1992). In Uttarakhand, the *Bhotiya* tribes hold a belief that *Lord Hanuman* visited their village and uprooted all their medicinal plants, which led to an outbreak of untreatable diseases among the people (King-Oliver *et al.*, 1997).

A study conducted by Nimachow*et al.*(2011) showed that *Aka* tribes of Arunachal Pradesh believe that extraction of forest materials, collection of stones, hunting, etc. from the mountain is strictly prohibited. A saying goes, *one, who plucks at mountain will lose the wayand will bleed to death*. This belief of the people is so strong that even today; no one dares to visit the mountain. Such beliefs have either directly or indirectly helped in the conservation of various forest products of the area. These people worship at the pond but plucking of any leaves near this pond is prohibited. The belief, *one who plucks would never return home, and wouldkeep returning here*. They believe that the chirping of the bird symbolizes the grief or sadness. The bird is not killed and is conserved because it signals about the approaching bad times

7.4 Hunting and conservation

Indigenous people sustain their livelihoods through various means. In addition to agriculture, they hunt wild animals and gather edible plant roots. While hunting can pose risks to the environment and disrupt biodiversity, many traditional communities are conscious of these impacts. They actively seek alternative survival strategies and adopt sustainable hunting practices. This is particularly evident among some tribal communities in our country.Sahai (2013) studied the *Onges* tribe, who are known for their hunting of wild pigs (*Sus scrofa fabianensis*). The *Onges*developed a technique to prevent over-hunting in any specific area. When an Onge killed a pig, they would break a branch of the largest tree in the vicinity, leaving it partially broken and hanging. This broken branch served as a signal to other *Onges*that a pig had been recently hunted in that location. Consequently, other hunters would avoid

the area and move to a different location. Once the branch had fully dried and fallen off after a period, the area would be reopened for hunting.

Sustainable honey hunting practices, rooted in ancient traditions, reflect the deep connection between people and honeybees. For example, among the *Nilgiri*tribes, certain cliffs are deemed sacred and left untouched. Hunters collect only the honey, leaving the brood intact to maintain ecological balance. The *Toda* tribe employs a unique method, extracting honey from *Apis cerana* combs in tree cavities without smoke or tools. Instead, they gently breathe into the cavity to calm the bees and then hand-harvest the honeycomb, leaving the brood behind. This approach avoids harming the brood and maintains ecological harmony, unlike cliff hunting, which sometimes involves removing entire hives and harming all the brood.

8. TRADITIONAL AGRICULTURAL PRACTICES

Zero Valley in Arunachal Pradesh, a UNESCO World Heritage Site candidate, is home to the *Apatani* tribe, whose deep connection to their sacred landscape is reflected in their sustainable practices. They employ a unique paddy-cum-agriculture system with intricate canal networks and avoid using animals or machines in farming (Dewani, 2016). Similarly, the *Bonda* tribe uses shifting cultivation to grow diverse crops like local paddy, millets, and oilseeds without harming the climate or forest (Basu, 2019). In Madhya Pradesh's Dindori district, the *Baiga* tribe practices *Benvar*agriculture, where crops like maizeand legumes support each other, enhancing soil fertility and protecting plants (Dogra and Mayaram, 2016). Mixed cropping is employed by various tribes to meet food and economic needs, growing a range of crops including *Panivaragu, Karunsamai*, Field bean, Red gram, and Mustard (Narayanaswami, 2006). The Forest Department allocates land for farming under traditional roles such as the *OoruMoopan* (Chieftain), with support from the Bhandari (Treasurer), *Kuruthalai* (Junior Headman),

and*Mannukkaran*(agricultural expert), though the latter's role has become largely ceremonial with the shift to settled agriculture (Mathur, 1977).

9.GENOME CONSERVATION

Since 2000, the M.S. Swaminathan Research Foundation (MSSRF) has focused on revitalizing rice cultivation in Wayanad district by promoting the on-farm conservation of traditional rice varieties. In 2008, the PPVFR Authority of the Government of India recognized this effort, honoring tribal communities such as the *Kurichiya* and *Kuruma* as 'Genome Saviors' for their role in conserving twenty traditional rice varieties. The project, supported by the Department of Science and Technology, establishes 'seed villages' to preserve valuable rice gene pools and revive near-extinct varieties in Wayanad, Kerala (Smitha and Kumar, 2016).

Ravishankar (1995) studied the Malayali tribal community's cooperation in conserving traditional land races. Each family contributes a portion of their harvest to a community granary managed by the village chieftain. This stored grain can be borrowed for important occasions or regular needs and repaid later. This system helps the tribe conserve seeds even during poor harvests or when domestic supplies are depleted, thus supporting the sustainability of their livelihoods.

Cheruvayal Raman of the *Kurichiya* tribe is dedicated to preserving traditional cultivation practices. Since 1989, he has collected indigenous seeds from his uncle, tribal elders, and the *Kurichiy*a temple, amassing seeds that are around 500 years old. His collection now includes 65 varieties, such as *MannuVeliyan*, *Chembakam*, and aromatic types like *Gandhakashala and Jeerakashala*. He cultivates each variety on small plots, ensuring careful sowing and harvesting to maintain their purity and longevity.

10. ISSUES OF TRIBESPEOPLE

Globally, tribespeople are suffering due to ineffective conservation models. In southeast Cameroon, Baka "*Pygmies*" have been evicted from their ancestral lands,

which have been turned into national parks and safari zones. They face harassment and violence from anti-poaching squads, resulting in deteriorating health conditions. Similarly, in *Botswana, Bushman* communities have been forcibly relocated despite a high court ruling affirming their rights to the Central Kalahari Game Reserve. Their removal has led to mining and tourism development in their former lands, with no evidence that their traditional hunting harmed wildlife, but significant harm to their health and community survival. In India, tribal people in tiger reserves are evicted and denied rights to manage their forests, with inadequate compensation and poor living conditions. The advent of industrialization and resource discovery has led to a loss of tribal land ownership and increased exploitation by outsiders. Government land acquisitions for projects such as dams and mining have displaced many tribes, with meager compensation and poor resettlement conditions. The number of tribal farmers is declining, with many turning to agricultural labor or informal jobs due to decreased returns from farming. Additionally, legal issues persist as tribal rights are often not recognized before eviction from Protected Areas, with incorrect interpretations of the Forest Rights Act (FRA) leading to violations of their rights (Mahapatra, 2018; NALSA, 2015).

11. SOLUTIONS

Various solutions have been presented for dealing effectively with the tribal problems. The tribal problems have been approached from three viewpoints (Beniwal, 2014). They are as follows:

11.1 Isolation

Isolating tribes in "national parks" or "reserved areas" is seen as a way to address two issues: (a) preserving their unique identity and (b) protecting them from outsider exploitation. Proponents believe that this approach allows tribes time to assimilate with broader society. However, the downside is that such isolation may lead to tribes developing vested interests in remaining separate, potentially hindering their integration with others.

11.2 Assimilation

Assimilation is one approach to addressing tribal issues, suggesting that instead of preserving tribal culture and ways of life, tribes should be integrated into the broader community. Advocates, including social reformers and voluntary organizations, argue that helping tribes assimilate into mainstream society is the key to resolving tribal problems. However, this approach has limitations. Complete assimilation is challenging, as tribes may resist abandoning their traditional beliefs and practices. Imposing external cultural norms can lead to guilt, confusion, and internal conflict, potentially causing economic, religious, and moral degradation.

11.3 Integration

The modern approach to tribal issues emphasizes integration over isolation or assimilation. Unlike isolation, which is impractical and undesirable, and assimilation, which imposes external norms, integration aims to provide tribes with the benefits of modern society while preserving their distinct identities. This approach involves relocating tribes to the plains, away from their traditional lands like hills and forests. Critics argue that this strategy serves industrial and capitalist interests and could lead to economic and moral decline among tribes. Despite these concerns, integration—championed by leaders such as Pandit Jawaharlal Nehru in his 1957 foreword to Verrier Elwin's *The Philosophy for NEFA*—advocates for a balanced approach, encapsulated in five principles known as *'Panchasheela':* (i) Tribes should be allowed to develop according to their own traditions; (ii) Tribal land and forest rights must be respected; (iii) Local administration should be led by tribal people with limited initial support from outsiders; (iv) Over-administration and excessive schemes should be avoided; and (v) Success should be measured by the quality of human development, not just by statistics or expenditure.

12. CONCLUSION

The current conservation model, which undermines tribal livelihoods, is no longer sustainable. The most effective and economical way to preserve high-biodiversity areas is to uphold the rights of tribal people. According to PPV&FR, a farmer not only cultivates crops but also enhances their value and that of their wild relatives. This is particularly true for tribal communities, who manage a diverse array of species vital for their food, health, and economic security. Therefore, conservation strategies should recognize that tribespeople are often the best stewards of their environments. Redirecting substantial conservation funds to support tribal land rights is the most cost-effective solution.

Radical transformation is urgently needed as time runs out for both wildlife and tribal communities. Conservationists must safeguard tribal land rights, actively seek their input, listen to their needs, and provide appropriate support. Despite their harmonious relationship with their land for generations, tribal people are being displaced from protected areas under the guise of conservation. The establishment of these areas, often enforced by anti-poaching squads, results in widespread eviction and abuse of tribal communities, without effectively addressing the deepening environmental crisis. It is crucial to raise awareness among tribal people about forest laws and the consequences of legal infringements through cultural programs such as dances and dramas.

13. DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of manuscripts.

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