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Women as Stewards of Biodiversity: A Review

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Abstract
Biodiversity, also known as biological diversity, refers to the range of life on Earth. One of the main objectives to ensure food security and long-term economic viability is to safeguard biodiversity, since ecosystems with higher biodiversity are considered to be healthier. The conservation of biodiversity involves managing and preserving plants, animals, and their ecosystems. Indigenous people have played a vital role in this effort. The species that comprise their ecosystem are well understood by ethnic groups, and they are well-versed in plants as vital resources. Thus, the key to maintaining life on Earth lies in the involvement of indigenous populations in biodiversity conservation initiatives. Here, we investigate the way India's indigenous people contribute to biodiversity conservation through their traditions.

Keywords: Biological diversity, Safeguard, Indigenous people, Conservation. Tradition

Introduction

The wide variety of life forms, such as bacteria, plants, and animals, is known as biodiversity (Saini *et al*, 2019) [37]. An estimated 8.7 million species currently exist on Earth, with many more still to be found and classified (Mora *et al*. 2011) [29]. Biodiversity is an important property of an ecosystem for sustain production of services and resources (Costanzo,1996) [15]. Biodiversity plays a vital role in meeting basic human needs, including clothes, food, and shelter. The knowledge of biodiversity and its use are intertwined with the traditional, cultural, and spiritual practices of human beings (Natarajan,2012) [30]. For example, plant diversity produces essential elements like dyes, resins, recreational activities, pharmaceuticals, a stable climate, and oxygen that is necessary for life. Rich biodiversity is vital to human life, but it is in danger due to a number of anthropogenic activities, including mining, urbanization, and deforestation. Biodiversity offers various benefits, including monetary gains, recreation, and essential ecological functions like flood control, climate maintenance, and nutrient cycling. It helps ecosystems adapt to disturbances and environmental changes, providing long-term benefits. The economic value of these benefits can be 10 to 100 times higher than the cost of maintaining biodiversity. Because of this, almost a million species are at risk of going extinct. Human being in fading challenges for sustainable management of the environment (Halim *et al*,2012) [20].

India is a mega-diverse country with tremendous biodiversity that accounts for about 11% of all biodiversity worldwide, but only making up 2.4% of the world's total land area (Sinha *et al*. 2010) [39]. India is home to a variety of habitats, from the southern coastal regions to the snow-covered Himalayan Mountain ranges in the north, from the densely forested northeastern parts that receive a lot of rainfall to the arid northwest (Sinha *et al*. 2010) [39]. A botanical assessment indicates that there are 47,513 plant species in India. India's four biodiversity hotspots—the Himalayas, the Western Ghats, the Indo-Burma region, and the Nicobar Islands—are home to 147 endemic taxa from 47 distinct higher plant groupings (Arisdason & Lakshminarasimhan 2016)[5]. Of the 45,000 species of wild plants, 9,500 are important to ethnobotany. Indigenous people use plants for a variety of purposes, including medicine and health (7,500 species), fiber (525 species), fodder (400 species), insect and pest repellent preparation and extraction (300 species), gum, resins, dyes, and perfume extraction (300 species). Approximately 700 species are significant in terms of culture and religion (Jain 1996) [22].

India's biodiversity is also influenced by its diverse ethnic people and natural resources. Globally, there are about 300 million tribal people. India has 104.2 million tribal people, or 8.6 percent of the total population, according to the 2011 census (Chandramouli 2011) [11]. They make up around 15% of the land area that is abundant in natural resources. The tribal people are considered to be the original inhabitants of India and constitute an essential part of its social fabric. Each of the around 645 tribes have its own distinct language, customs, and culture. Because of their connection to nature, tribal people have developed strategies for coexisting peacefully with it. The most impressive thing about these tribal people is that they live in places with a lot of plants and animals, so they are familiar with the economically important plants that grow there and use them sensibly and responsibly. Furthermore, these indigenous people are crucial to the development and management of the environment because they transmit the traditional knowledge that is necessary for eco-restoration from one generation to the next. The strongest instances of indigenous ecological knowledge are found in the management practices used for these woods, including harvesting, regeneration, and conservation.

Tribal communities and forests

Local and indigenous communities are actively involved in biodiversity protection because they understand the

potential applications and importance of hundreds of species (Raj *et al*. 2018) [35]. Tribal people have evolved a relationship with the trees since they have lived there for many genrations. Since they consider trees to be a gift from nature, they stop the deterioration of nearby delicate and biologically diverse ecosystems. For their everyday needs, they collect forest products. Tribal people's lives and economics depend heavily on the forests, which have an impact on their socioeconomic and cultural well-being (Gurung 2017) [19]. Communities also use cultural norms and regulations to manage their natural resources. In India, members of many different religions worship a number of gods, and they are offered flowers, fruits, seeds, bark, twigs, leaves, and other plant material. Additionally, many ethnic groups protect the plants that are cultivated close to places of worship since they are considered sacred and can be used in a variety of rituals. As a result, even though environmental degradation and deforestation are happening at an alarming rate worldwide, many natural vegetation patches are kept almost in pristine shape by the tribal people of India (Arora 1991; Chacko 2021) [6, 10]. Sustainability can only be achieved when natural resource conservation is implemented (Allen & Vandever 2012) [2].

Tribal women in particular play a vital and significant role in the preservation of biodiversity. Because they are in charge of running the home, women are more important in tribal societies than in other social groups, although making up around half of the population. Gathering edibles from forests, such as fruits, flowers, berries, tubers, and vegetables, is mostly the responsibility of women and children. Approximately 70% of the tribal economy's total revenue comes from minor forest products (Menon 2016) [27]. Despite their active participation in biodiversity protection, indigenous women's contributions are mostly ignored. A global society must acknowledge women's contributions if it hopes to achieve sustainable development (Mago and Gunwal 2019) [25]. The Millennium Development Goals include environmental sustainability and gender equality. Women's contributions to environmental conservation would significantly aid communities in developing the sense of accountability required to preserve a just equilibrium between people and the planet's resources. Women can be considered as managers of natural resources (Gupta *et al*,2014) [18]. Indian women are custodians of biodiversity, and they incorporate culture into their offspring. Most plant biodiversity use, management, and conservation occur within the domestic realm (Howard,2003) [21]. Here, we highlighted the role of women from the past to the present period in conserving biodiversity.

Women's participation can significantly improve biodiversity conservation in several ways

1. **Traditional Knowledge:** Women possess extensive traditional knowledge about local species and ecosystems, which is crucial for sustainable resource management.
2. **Resource Management:** Women are often responsible for managing natural resources at the family and community levels, ensuring prudent use and conservation.
3. **Sustainable Practices:** Women develop and implement sustainable farming and resource management practices that help maintain genetic diversity and ecosystem health.
4. **Community Involvement:** Women's involvement in community activities and decision-making processes can lead to more effective and inclusive conservation strategies.
5. **Environmental Movements:** Women have historically led and participated in environmental movements, advocating for the protection and sustainable use of natural resources.

Encouraging women's participation in biodiversity conservation can lead to more effective and sustainable environmental management practices.

India is a highly diverse country with various natural habitats such as the Himalayas, sea coasts, rainforests, deserts, forests, marshes, islands, and oceans.

The purpose of this essay is to highlight how Indian women contribute to the preservation of biodiversity. In India, women from many backgrounds have made and still make contributions to the preservation of India's forests and wildlife. Humans have fought to maintain and safeguard the environment since the dawn of time.

By optimizing the use of natural resources and conserving biodiversity, significant environmental problems can be partially resolved.

Even in the absence of mass extinction, the environment is losing biodiversity at a surprisingly rapid rate.

Anthropogenic activity is the main cause of biodiversity loss. Aside from anthropogenic activities, the main factor causing the impacts on biodiversity is the growing human population. Growing demand leads to the overexploitation of natural resources, which increases economic activity in society. As the world's population grows, so does the strain on agriculture.

In rural and tribal communities, women gather firewood and other forest materials for use in building homes, making paint, making medicine, and making food (Uniyal and Zacharia, 2001) [43]. Women also perform a number of agricultural tasks. The stalks are planted, hoed, weeded, and tied. They also grow a wide range of sauces, relishes, and vegetables in their kitchen gardens. They also gather medicinal plants to treat various ailments. They are in proximity to the natural resources because of their traditional wisdom. For them, nature fosters society since they rely on the natural resources to provide for their family. Women are the real biodiversity experts. When it comes to forests and forest products, women know a lot.

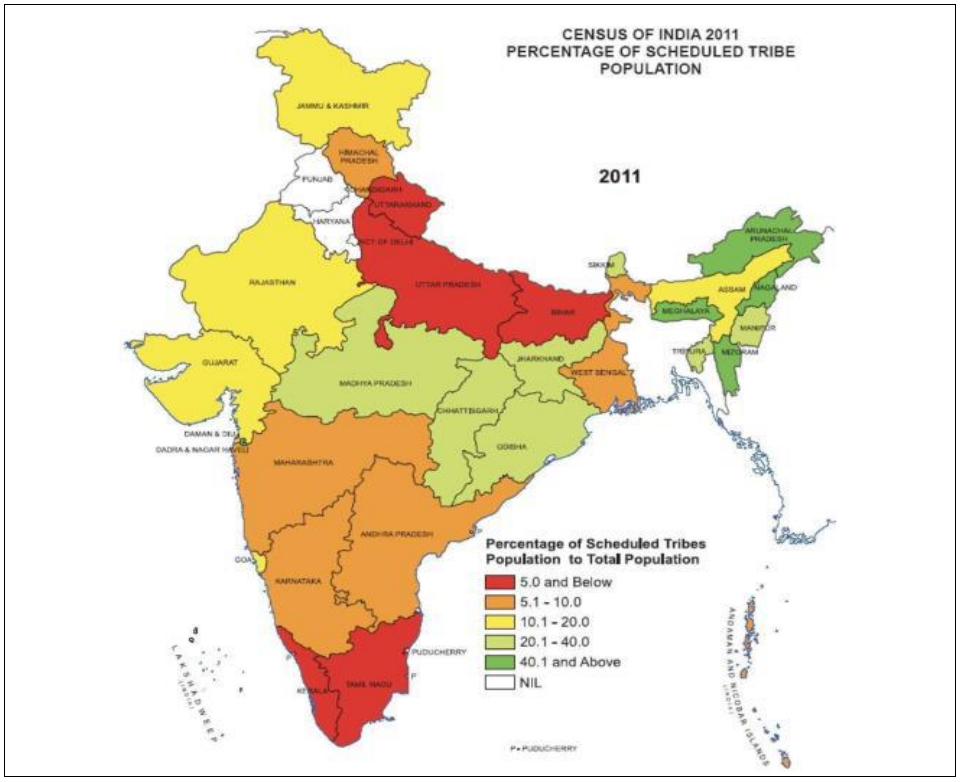

Fig 1: Tribal population in India (https://tribal.nic.in/ST/Tribal%20Profile.pdf.)

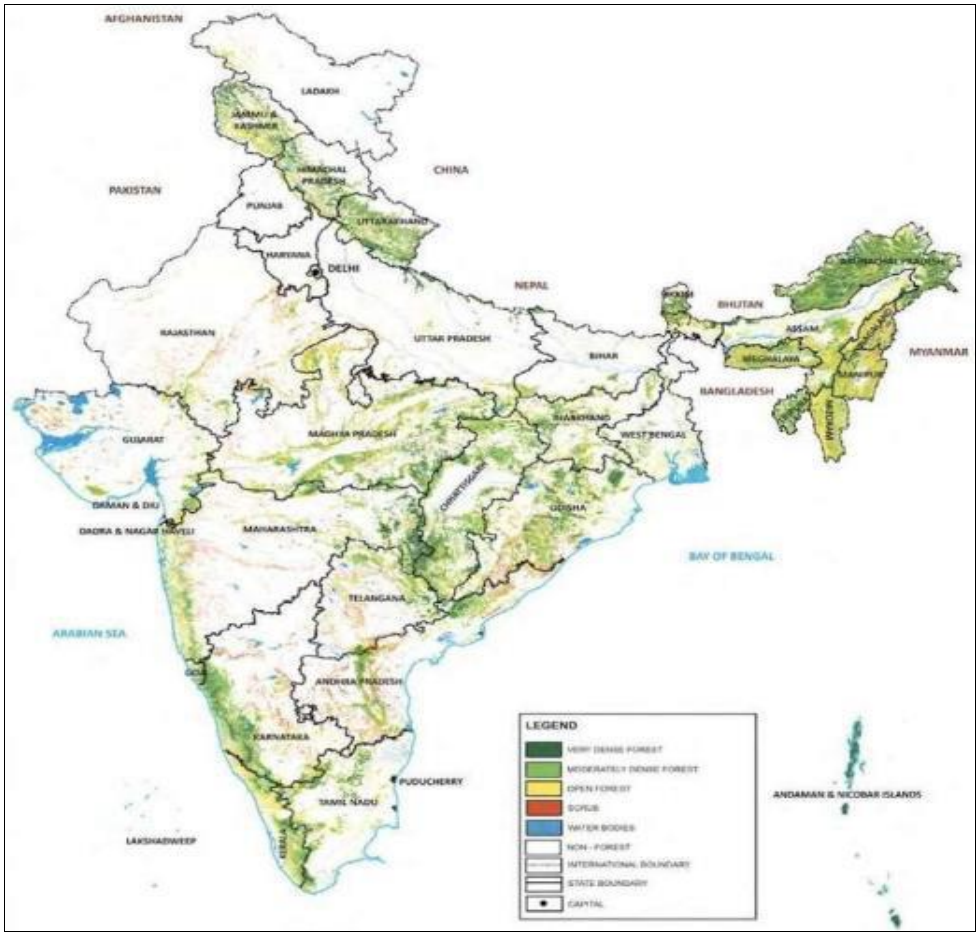

Fig 2: Forest cover in India (https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc20221207001.pdf)

Materials and Methodology

Indian women are regarded as the guardians of their culture and biodiversity. Indian women view forests as a gift from nature to humanity and a source of food, fodder, fuel wood, honey, resins, gums, and other minor forest products for their livelihood, particularly those from tribes and rural areas (Awais *et al*., 2009) [7]. Their ancestors taught them how to recognize the economically important plant species

in their area, use those plants responsibly, and teach their children about these practices. This traditional knowledge aids them in gathering forest resources. In India's tribal and rural areas, women play an active role in collecting seeds, grains, rhizomes, tubers, and seedlings of different kinds of cereals, vegetables, fruit trees, medicinal plants, spices, condiments, etc. from the forests and cultivating them on their land plots. These plots serve as local biodiversity repositories of useful plants near human habitations.

India is a large country with many different ethnic groups, and its population is diverse due to its great wealth. There are over 45,000 species of wild plants, with 9,500 species being especially important. For traditional Native American medical treatments, 7,500 of these are utilized medicinally. More than 3,900 plant species were used by tribal people for food, 525 for fiber, 400 for fodder, and 300 for the preparation and extraction of chemicals used as pesticides and insecticides. Three hundred species are utilized to extract gum, resins, colors, and fragrances. A wide range of plants is also used for social, religious, and cultural purposes.

Plants are conserved as a source of Food

Indigenous people have evolved different ways to use natural forest resources to satisfy their requirements over time. The diverse ethnic and indigenous groups' sociocultural and physical well-being is greatly impacted by their reliance on wild plant species for food, medicine, and shelter (Prabha *et al*. 2010) [34]. Indigenous people collect edible plants in accordance with conservation regulations to preserve biodiversity. Wild edible plant species have been an essential component of daily living for tribal cultures all across the planet. More than 20,000 edible wild plant species have been documented worldwide, with 1532 of those being found in India. Wild plants contain more minerals than cultivated ones (Thakur *et al*. 2020) [40]. These types of plants have shown promise as a consistent supply of food for daily use. Although the name "nutraceuticals" is relatively new, it has been used for a long time in tribal groups in India (Oak *et al*. 2015) [31].

Plants used in daily life

In order to use forest resources in their daily lives, societies that live in forests have evolved specific skills over time. The indigenous people are totally dependent on the nearby forest for their survival, except for a few commodities. Many domestic items, including brooms, ropes, mats, baskets, grain storage containers, and more, are made from the leaves, stems, and wood that are readily available all year round. Additionally, the market sells the eco-friendly, non-toxic home décor items created by tribal artists, boosting household economies. These are valued because they are safe, distinctive, and meticulously handcrafted.

Sacred Symbolic Trees and Plants Worshipped by Rural Women

TULASI (*Ocimum sanctum*) is worshipped in the folklore of Bengal. The women of Bengal pour water on this plant throughout the Bengal month of Baisakh (April-May) of every year.

BILVA (*Aegle marmelos*) is one of the sacred trees. This plant is associated with lord Shiva. This tree is chiefly used in Shiva worship (Bhowmik, 2003) [8].

DHAN (*Oryza sativa*) Rice is the staple food crop of Bengal. According to Hinduism, Lakshmi is symbolized by the paddy plant. The worship of the paddy plant takes place on different occasions throughout the year.

AMLAKI (*Emblica officinalis)* tree is considered a sacred tree and worshipped by women for various purpose specially praying for offspring in the months of Kartik and Phalgun with flowers, sandal paste, and vermillion, etc. The worship of Amlaki takes on the day of Shivaratri.

BANS/bamboo (*Bambusa arundinacea*) is prevalently worshipped in Bengal. Bamboo is a symbol of Vastu Devata. The ceremonial worship is scheduled on the last day of the month pous.

DUMAR (*Ficus glomerata*) is a conspicuous sacred tree. It is strongly believed that this tree is worshipped by barren women for getting offspring.

SAL (*Shorea robusta)* is also a sacred tree that plays a significant role in the tribal religious culture of frontier Bengal as well as eastern India. The sal tree is in full blossom and was worshipped in ancient India for the removal of barrenness in women.

MAHUA (*Madhuca indica*) is also considered as racred tree. The tree is known as the marriage tree among tribal. A branch of this tree is placed in the hands of the bride during the marriage ceremony. This custom indicates the fertility and reproductive nature of the tree.

KARAM/KADAM (*Anthocephalus Cadamba)* is a tree worshipped by the aluorigines of the western part of West Bengal. Karma Devata is worshipped with a branch of the karma tree. The tribal community was believed to have power over both human fertility and natural productivity.

PALASH (*Butea Monosperma*) Both Hindu and tribal people considered this tree sacred. The tree is sacred, partly on account of its use in producing the sacred fire, and partly because of its orange blossom, which is used to dye the colored dust and water thrown about at the Holi festival.

ASOKA (*Saraca asoca*) –since early times Asoka tree considered to be sacred. The Asoka tree in Bengal is sacred to God Shiva. It was worshipped in ancient India, particularly for its fertility character. There are numerous sculptures in Mathura and Lucknow museums where the Asoka tree is shown associated with a female figure. The bark of this tree is believed to have medicinal ailments. In natural Bengal, its bulbs are eaten by women on the tithi of ASOKA SASTHI in the month of Chaitra for wellbeing and prosperity of the family.

DURVA GRAS (*Cynodon Dactylon*) has its sacred place in the Hindu religion and culture. This plant is associated with lord Vishnu. Perhaps this plant is essential for each puja. The married women are chief performers of “Durvastami” in the Bengal fork fore in the month of Bhadra.

Sacred groves and indigenous people

Sacred groves are woodland places that the villagers have safeguarded and kept undisturbed (King *et al*.1997). Since anthropogenic operations are forbidden in these places, the groves have been able to mature into old-growth forests. Protecting sacred groves is a long-standing custom that dates back to a period when tree worship was very common. This long-standing, religiously motivated custom in India has made a substantial contribution to the preservation of nature. Indigenous peoples continue to attach spiritual value to sacred woods. In addition to having therapeutic uses, these plant species are necessary for their festivals,

ceremonies, and rituals. Sacred groves and forest regions support religious beliefs, which aid in biodiversity conservation (Amirthalingam 2016) [3]. A centuries-old ecological tradition, in-situ conservation in the sacred groves protects many species in their natural habitats and the entire ecosystem. Preserving and sustaining the gene pool is another benefit of the sacred groves' abundance of plant diversity (Amirthalingam 2016) [3]. The sacred groves offer essential ecological functions. They stop soil erosion and act as water catchments. The densely vegetated sacred groves have a great capacity to sequester carbon, which helps to reduce atmospheric CO2 (Rana *et al*. 2016) [36]. Indigenous groups are aware that the holy groves include plants with religious and therapeutic value that must be preserved.

Women in Ethnobotany

In ethnobotany, women are essential to the preservation and dissemination of traditional plant knowledge, particularly in rural and indigenous populations (Howard, 2003) [21]. They actively participate in the identification, gathering, cultivation, and usage of plants for domestic uses, fuel, medicine, food, and fodder. Women make substantial contributions to basic healthcare and nutritional security due to their vast knowledge of medicinal plants and herbal treatments (Cotton, 1996) [16]. They can comprehend plant life cycles, sustainable harvesting techniques, and conservation strategies because of their everyday interactions with local ecosystems. Oral traditions passed down through the centuries are how women farmers, midwives, and healers in nations like India retain ethnobotanical knowledge (UNESCO, 2017) [41]. Women's responsibilities in ethnobotany are still underappreciated in formal research, despite their crucial contributions. Sustainable resource management, equitable development, and biodiversity protection all depend on recording and incorporating women's ethnobotanical expertise.

Women in Agro diversity and plant Genetic Resources

Women are essential to the management and preservation of plant genetic resources (PGRs) and agrodiversity, especially in smallholder and traditional agricultural systems. They actively participate in seed selection, saving, storage, and exchange, which maintains genetic variability within crops, and they are the main guardians of landraces and traditional crop types (Howard, 2003) [21]. Indigenous knowledge held by women helps to preserve a variety of characteristics, including crop cultural appropriateness, nutritional value, pest resistance, and drought tolerance (FAO, 2011) [17]. Women farmers play a key role in home gardens and mixed cropping systems, which serve as in situ reservoirs of PGRs in India and other developing nations (Brush, 2004) [9]. Women's contributions to agricultural biodiversity decision-making are often overlooked, despite their substantial contributions. In order to preserve agro diversity and guarantee sustainable food systems, it is essential to increase women's access to land, seeds, and extension services.

Conclusions

Women play a critical role in biodiversity conservation through their traditional ecological knowledge, sustainable resource use, and active participation in the management of forests, agroecosystems, and local biodiversity. Women play a major role in the conservation of food diversity, medicinal plants, and plant genetic resources as primary caregivers and resource managers in many rural and indigenous communities. Research has demonstrated that conservation efforts led by women frequently lead to better ecological results and increased community resilience (Agarwal, 2001; FAO, 2011) [1, 11]. However, their potential contributions are nonetheless limited by structural obstacles such as restricted access to education, limited property ownership, and exclusion from decision-making processes (UNEP, 2016) [42]. Therefore, attaining sustainable development goals requires incorporating gender perspectives into biodiversity policies and conservation initiatives. More successful and equitable biodiversity conservation outcomes can result from empowering women through inclusive governance, capacity building, and recognition of local knowledge systems (CBD, 2020) [14].

We have covered a range of topics about women's participation in small- to large-scale biodiversity conservation using numerous examples. In conclusion, it would be accurate to state that humans and nature have always been closely related. The survival of biodiversity is becoming more and more important to a robust and healthy life on Earth. Man-made challenges to nature have led to the extinction or endangered status of more plants and animals in recent years. If this keeps happening, human society's ability to endure will become more challenging. With this degree of knowledge, people are effectively working to protect biodiversity on a global scale. Particularly, women speak out for environmental protection and make important contributions.

In rural areas, women participate more actively than men in the use and preservation of natural resources. Every day, they come into contact with wildlife, forests, water, and land.

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