

Assessing the Impact of Anthropogenic Activities on Biodiversity and Ecosystem in the Western Ghats

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ABSTRACT

Human activity poses serious risks to the Western Ghats, a UNESCO hotspot for biodiversity. This study looks at how human activity affects the ecosystem health and biodiversity in this environmentally delicate area. Changes in land use, such as deforestation for plantations, agriculture, and infrastructure development, will be examined in the research. The assessment will focus on how these activities jeopardize endemic species, cause habitat disruption, and fragment ecosystems. Acclaimed for its ability to unite economic growth and conservation, ecotourism is becoming recognized as a potentially bright future for areas in the Western Ghats, known for their abundant biodiversity. These abstract analyses about how the growth of ecotourism has affected the way of life for the locals in the region. It looks at the possible advantages, such as generating cash and jobs, as well as the possible disadvantages, including resource pressure and displacement. A UNESCO-designated hotspot for biodiversity, the Western Ghats are home to remarkable endemism and species richness. However, a variety of human activities pose serious challenges to this natural treasure trove. The influence of human pressures on the Western Ghats' biodiversity and ecological function is examined in this research. Certain species are on the verge of extinction due to overfishing and poaching. Water sources are contaminated by industrial effluents, agricultural runoff, and overuse of pesticides, which impacts aquatic life and interferes with ecosystem functions. We will investigate the ways in which habitat loss, species decline, and disruption of ecosystem services are caused by deforestation, urbanization, agriculture, and other human-driven processes. The aim is to comprehend how the Western Ghats' natural integrity may be preserved while local populations are empowered through ecotourism.

Key words: Ecotourism development, Local livelihoods, Socio-economic impact, Sustainability, Biodiversity.

Introduction

Running parallel to the western coast of the Indian peninsula the Western Ghats mountain range is located in the states of Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. With an astounding range of plant and animal species, this UNESCO World Heritage site is among the world's most ecologically varied regions. As a series of

mountains, it runs parallel to the west coast of Indian Peninsula.

The Western Ghats is thought to be home to at least 7,402 species of blooming plants, 1,814 species of non-flowering plants, 508 species of birds, 179 species of mammals, 695 species of reptiles, and 292 species of freshwater fish (Daniels, 2020). Numerous species exhibit high degrees of endemism, making them only rooted in the Earth. For example, 62% of

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all species of evergreen plants and 63% of all species of amphibians are found in this area (Vidyasagaran and Parthasarathy, 2014). According to the IUCN Red Data List, the Western Ghats is considered to be home to at least 325 species that are vulnerable worldwide.

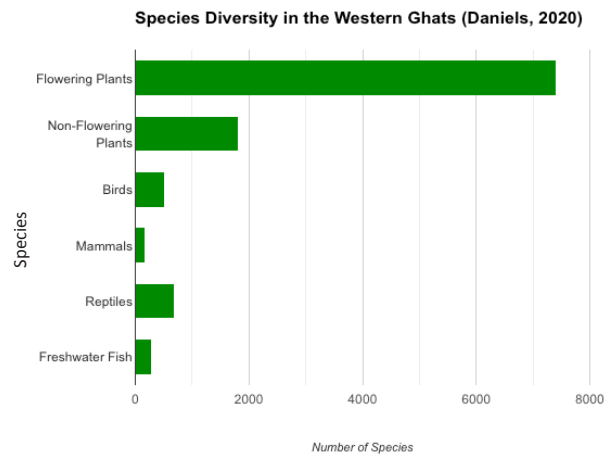


Fig. 1.

Source: Daniels, 2020.

The Western Ghats are home to at least 325 internationally endangered (IUCN Red Data List) species, according to UNESCO: 51 species are classified as severely endangered, 129 endangered species, including 145 vulnerable species. An in-depth analysis shows that it includes 229 plant species and 31 species of mammals, 15 species of birds, 43 species of amphibians, 5 species of reptiles, and 1 species of fish.

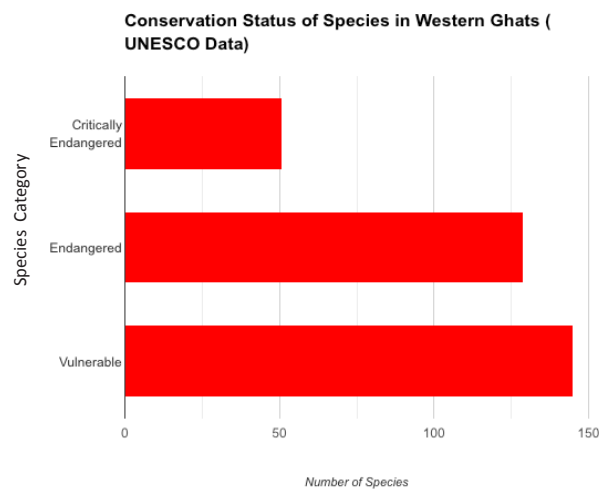


Fig. 2.

Source: UNESCO

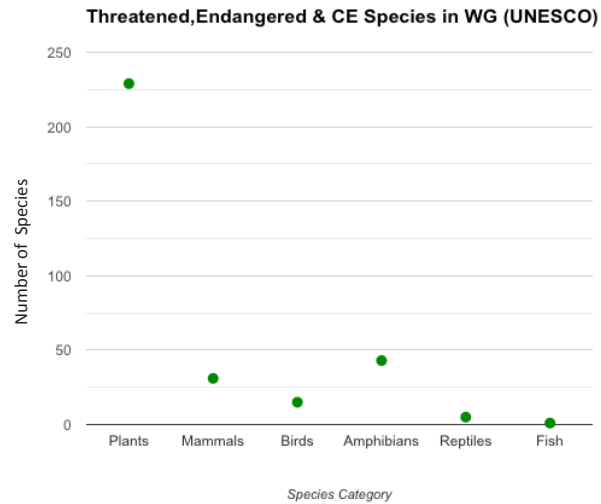


Fig. 3.

Source: UNESCO

The diverse terrain and altitudinal gradients of the Western Ghats have resulted in a range of ecosystems, including scrub forests, rainforests, and montane grasslands. Two unique ecosystems are the Shola forest-grassland mosaics found at higher elevations and the *Myristica* swamp forests of the southern Western Ghats (Nair, 1991). The Western Ghats are home to a variety of remarkable animals, including the lion-tailed macaque, Bengal tiger, Indian leopard, Nilgiri tahr, and Asian elephant. Several flagship species include the Great Indian hornbill, the Indian giant squirrel, and the king cobra (Ramesh *et al.*, 2005). The fact that these animals are well-known illustrates how important it is to preserve this region. It is acknowledged as one of the world's hottest biodiversity hotspots, home to over 5,000 different species of vascular plants, 508 different species of birds, 179 different species of animals, and an abundance of other life forms (Vidyasagaran and Parthasarathy, 2014).

Objectives

- To investigate Western Ghats in greater detail.
- Examine how pollution affects biodiversity and ecosystem functioning in the air, water, and soil.
- Determine and measure the effects of certain human actions on various components of biodiversity.

Materials and Methods

The Western Ghats offer a rich tapestry of history,

encompassing geological formations, diverse ecosystems, and human interactions over millennia. This study aims to assess the impact of human activities on the biodiversity and ecosystem of the Western Ghats. The present study is secondary in nature. Secondary sources like books, articles, research studies, internet were used in the study. R Software is used for analysis of data.

Results and Discussion

The existence of Western Ghat's incredibly biodiverse region is seriously threatened. Despite the Western Ghat's ecological significance; there are threats from deforestation, mining, hydropower projects, pollution, climate change and so on. According to Vasudevan *et al.* (2006), a variety of protected areas have been established to maintain representative ecosystems and species, including national parks and wildlife sanctuaries. However issues with enforcement, habitat degradation, and confrontations between people and wildlife persist. Integrated landscape-level conservation efforts are necessary for the Western Ghat's irreplaceable biodiversity to be preserved over the long term.

The freshwater species seen in the Western Ghats

are suffering due to industrial development and increased urbanization. According to a recent study by the International Union for Conservation of Nature (IUCN), water pollution from agricultural and urban sources, along with over harvesting, is threatening the extinction of nearly sixteen percent of freshwater fish, molluscs, dragonflies, damselflies, and aquatic plants found throughout peninsular India. In order to evaluate the state of freshwater species conservation in the major river catchments of the Western Ghats states-Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, and portions of Andhra Pradesh, Madhya Pradesh, Odisha, and Chattisgarh-IUCN and the Zoo Outreach Organization (ZOO) have collaborated on this study. 1.9% of the 1,146 freshwater taxa that were evaluated had near-threatened status (IUCN - Down To Earth, 2011).

One of the biggest risks is deforestation caused by encroachment, mining, hydropower projects, and plantations (Jha *et al.*, 2000). About forty percent of the natural vegetation in the Western Ghats was destroyed between 1920 and 1990 (Menon and Bawa, 1997). Decreases in forest cover have led to species extinction, soil erosion, fragmentation of habitats, and disruptions in the hydrological

Table 1.

Year	Dakshin Kannada Loss of Tree Cover (in ha)	Kodagu (in ha)	Udupi (in ha)	Uttara Kannada (in ha)	Total (in ha)
2001	273	145	65.2	51	534.2
2002	179	53	83.1	66.3	381.4
2003	163	249	89.7	63	564.7
2004	294	143	85.3	70	592.3
2005	328	170	240	230	968
2006	214	68	205	73.6	560.6
2007	949	368	352	173	1842
2008	638	262	241	109	1250
2009	568	329	283	174	1354
2010	325	105	93.6	0	523.6
2011	299	59.6	692	153	1203.6
2012	809	196	439	73	1517
2013	541	131	589	234	1495
2014	511	221	503	216	1451
2015	338	71.8	527	117	1053.8
2016	1011	175	740	245	2171
2017	955	160	857	236	2208
Subtotal	8395	2906.4	6084.9	2283.9	
Total					19670.2

Source: Global Forest Watch

cycle. The mining of minerals including iron ore, granite, and bauxite has increased dramatically recently, causing significant environmental impact (Krishnan *et al.*, 2019). Open cast mining cause's habitat disruption for wildlife, air and water pollution, and loss of forest land. The following data reveals about the tree cover loss in several regions of Western Ghats in India from 2001 to 2017.

The table illustrates the decline in tree cover in several Western Ghats regions of India between 2001 and 2017, as reported by Global Forest Watch. The information is divided into Uttara Kannada, Udupi, Kodagu, and Dakshin Kannada. The years 2001–2017 are displayed in the table. It reveals about the overall loss of tree cover for all four regions. A subtotal for each district and the overall total of the tree cover reduction from 2001 to 2017 are displayed at the bottom of the table. 19,670.2 hectares of lost tree cover are shown overall. The decline in tree cover seems to have been more pronounced in the earlier years (2001–2007) than in the later years (2010–2017). In terms of overall tree cover loss, Dakshin Kannada has lost the most (8,395 hectares), followed by Udupi (6,084.9 hectares) and Kodagu (2,906.4 hectares). The largest reduction in tree cover occurred in 2007 (1,842 hectares), with 2016 (2,171 hectares) and 2011 (1,203.6 hectares) following.

The scatter plot matrix showing the data on tree cover decline over time for several Western Ghats areas in India. The x-axis symbolises years, which, depending on the scale, probably covers a period of 15 to 20 years.

Kannada Loss: Exhibits the greatest fluctuation and highest values; in certain years, it can approach 8000 hectares.

Kodagu: Generally less than 2000 ha, with lower values. Udupi: Values often fall below 1000 hectares, indicating a comparatively minimal decrease of tree cover.

The plot is based on information on the decrease

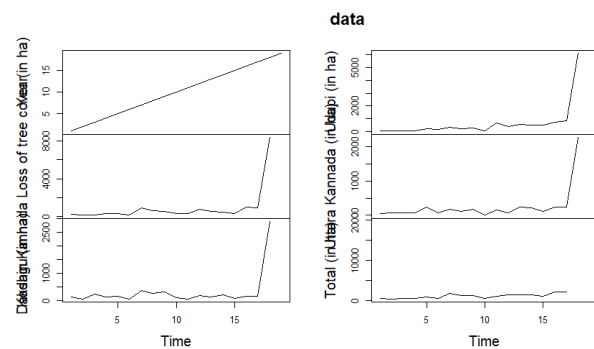


Fig. 5.

Source: R Software

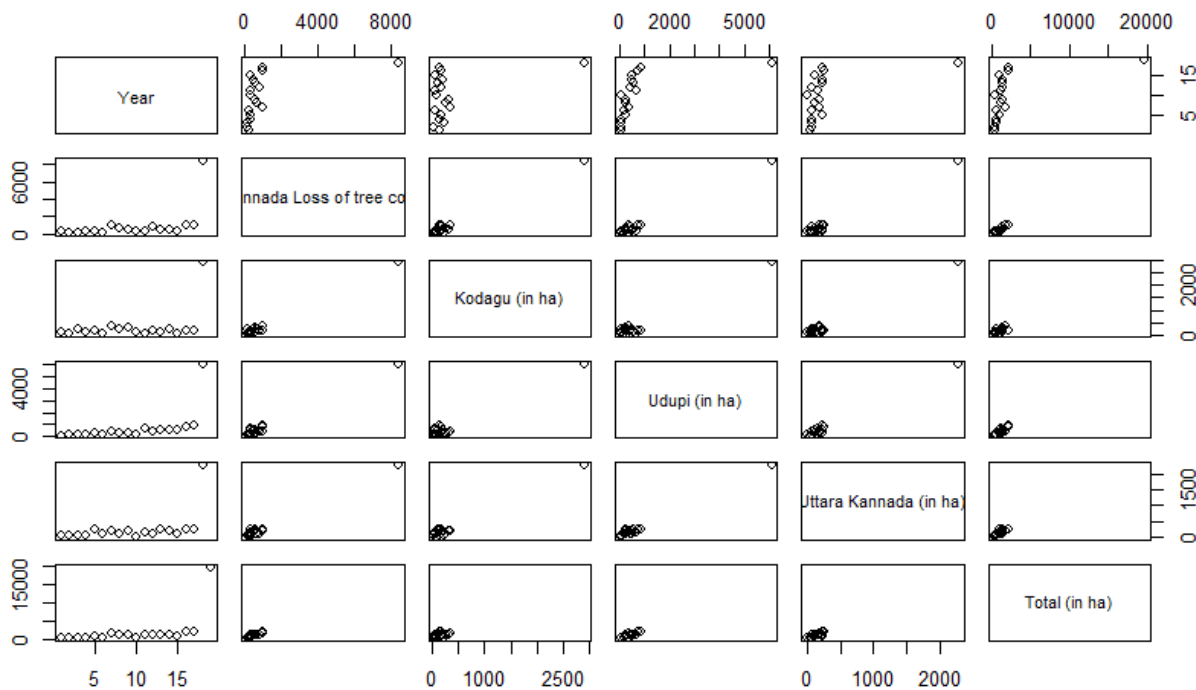


Fig. 4.

Source: R Software

of tree cover over the Western Ghats. The information covers the period from 2001 to 2017 for four regions in India's Western Ghats: Dakshin Kannada, Kodagu, Udupi, and Uttara Kannada. The decrease of tree cover seems to have been greater in the initial years (2001-2007) than in the later years (2010-2017). The largest overall loss of tree cover (8,395 hectares) is found in Dakshin Kannada, followed by Udupi (6,084.9 hectares) and Kodagu (2,906.4 hectares). The most loss of tree cover (1,842 hectares) occurred in 2007, while the largest losses occurred in 2016 (2,171 hectares) and 2011 (1,203.6 hectares).

The Western Ghats, like other biodiversity hotspots, are particularly vulnerable to the effects of climate change. Rising temperatures, erratic rainfall patterns, and extreme weather can all lead to the spread of invasive species, which can alter their geographic range and eventually lower biodiversity (Gaikwad *et al.*, 2022). Numerous initiatives have been undertaken to safeguard this natural resource. A portion of the Western Ghats is on UNESCO's list of World Heritage sites. There are more than 20 national parks and wildlife sanctuaries to protect the native plants and animals of the area (Vasudevan *et al.*, 2006). However, going forward, more comprehensive and rigorously implemented conservation rules are needed.

Long-term ecological sustainability of the Western Ghats is ultimately threatened by a myriad of human-induced pressures. Conservation efforts must employ a multimodal strategy that includes protected area management, legislation, science, and public awareness in order to preserve this globally vital biodiversity hotspot.

The major threats faced by the Western Ghats region are:

- **Unchecked mining:** The explosive expansion of mining operations, especially in Goa and sometimes in violation of the law, has caused significant environmental harm as well as social unrest. In Kerala, sand mining has become a serious concern. Unsustainable mining has harmed crops, water supplies, and landslides, making people more vulnerable and severely impacting livelihoods.
- **Animals grazing:** Degradation of habitat is caused by high populations of animals (goats and cattle) grazing in and around protected areas. Increases in livestock density frequently follow increases in human population, which causes disputes between forest department per-

sonnel and villages.

- **Human-animal conflict:** The Western Ghats are home to a heavily populated human environment, which frequently results in confrontations between people and wildlife. For instance, the yearly grain yield of the villagers near the Bhadra Wildlife Sanctuary in Karnataka is reduced by around 11% due to elephant raids.
- **The subsistence and economic requirements of human groups residing in the Western Ghats protected areas and its environs frequently rely on the exploitation of non-timber forest products (NTFPs).** The sustainability of NTFP extraction is a crucial problem in light of shifting consumption patterns and population growth.
- **Human settlement encroachment:** Legal and/or customary land ownership rights exist across the Western Ghats, both inside and outside of protected areas, and pose a serious danger to the landscape.
- **Plantations:** The main crops in agroforestry systems include tea, coffee, rubber, and diverse species monocultures, including the recently introduced oil palm. Over time, large portions of natural forests have been replaced by cash crop plantations, which are also sometimes linked to the invasion of neighbouring forest regions.
- **Hydropower projects:** Despite government and corporate cost-benefit evaluations and environmental impact assessments, large dam projects in the Western Ghats have caused environmental and social disturbance.
- **Pollution:** The extensive use of agrochemicals close to forests, especially in tea and coffee plantations, seriously harms the aquatic and forest ecosystems. Certain Western Ghats locations, like as Munnar and Kodaikanal, have high levels of particulate matter (PM₁₀ up to 150 µg/m³) and black carbon because of biomass burning, vehicle emissions, and industrial activity (Aruna *et al.*, 2020). The Western Ghats states have 164 contaminated river segments, with organic pollution being the main problem, according to the Central Pollution Control Board (CPCB, 2018). The Chalakudy river in Kerala has high concentrations of heavy metals such as lead (1.8 mg/l), cadmium (0.13 mg/l), and chromium (0.09 mg/l) as a result of industrial effluents (Madhusudanan *et al.*, 2009). In agricultural regions of the Western Ghats, the careless use of pesticides, chemical fertilizers, and the disposal

of solid wastes have resulted in soil contamination (National Mission on Biodiversity and Human Well-Being, 2018). According to a survey conducted in many Western Ghats locales, there is a lot of plastic pollution—an average of 25.8 plastic objects per square meter—which puts animals at danger (Sajan *et al.*, 2020).

- Deforestation: Illegal harvesting for timber and the conversion of forest area to agricultural land or other economic uses, such as tourism, has had a substantial detrimental impact on biodiversity.
- Climate change: The Western Ghats are predicted to have an increase in temperature regimes, rainfall, and severe events as a result of climate change, according to the Second National Communication on Climate Change (NATCOM, 2012). There is evidence to show that during the next fifty years, climate change may significantly diminish the amount of acceptable habitats for indigenous animals found in the Western Ghats, including the Indian brown mongoose.

Conclusion

Due to human activity, the Western Ghats, a world-wide significant hotspot for biodiversity, are threatened in several ways. The region's biodiversity and ecological health have been greatly damaged by deforestation, agriculture, mining, and infrastructural development. These effects include contamination of the water and soil, loss of species, fragmentation of habitats, and changes to ecosystem processes. For the purpose of creating successful conservation plans, it is essential to comprehend the type and scope of these impacts. Thorough evaluations utilizing ecological, sociological, and geographical analytic instruments are crucial for pinpointing important hazards, susceptible regions, and possible remedies.

Collaboration and community involvement are essential for conservation projects to be effective. Decisions on policies and management that take into account local knowledge and viewpoints can result in more environmentally friendly and culturally aware strategies. Significant habitat loss has resulted from unchecked deforestation for cash crop plantations (coffee, tea, and rubber), infrastructural development, and agricultural expansion. The remnant woods are further divided by roads, mines, and dams, which isolates people and prevents gene flow.

The unsustainable harvest of fuelwood, lumber, and non-timber forest products, such as bamboo and medicinal plants, disturbs natural cycles of forest regeneration and modifies the composition of forests. In the end, safeguarding the Western Ghats necessitates a comprehensive strategy that strikes a balance between ecological requirements and human growth. To maintain the long-term resilience and health of this important ecosystem, community-based efforts, pollution control strategies, protected area management, and sustainable land-use practices are all required.

This evaluation emphasizes how urgent it is to address human influences on the Western Ghats. We may endeavour to protect this priceless hotspot of biodiversity for coming generations by realizing the difficulties and putting into practice sensible conservation measures.

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