***Short communication***

**Legal Perspectives on the Sustainable Utilization of Biological and Zoological Diversity through the lens of Human Welfare and Intellectual Property Rights**

## ABSTRACT

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| Biodiversity, encompassing both biological and zoological diversity, is essential for the survival of life on Earth. It plays a pivotal role in sustaining ecosystems and ensuring human welfare through the preservation and sustainable use of natural resources. As a mega-diverse nation, India holds 7-8% of the world’s recorded species, with approximately 45,000 plant species and 90,000 animal species, 28% of which are endemic to the country. This rich biodiversity is deeply intertwined with India's traditional practices, which emphasize sustainable use and substantially benefit humanity. However, climate change and human activities have posed significant threats to biodiversity, requiring new approaches to conservation. Intellectual Property Rights (IPR) offer a balanced mechanism to protect biodiversity while encouraging innovation in sustainable practices. This study explores the association among biodiversity, sustainable use, human welfare, and IPR in India, emphasizing the need to address these challenges in the context of globalization. |

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*Key Words: Sustainable Utilization, IPR, World Intellectual Property Organization (WIPO), The International Plant Protection Convention (IPPC), Sustainable Development Goals (SDGs)*

**1.INTRODUCTION**

Biodiversity refers to the vast variety of life on Earth, encompassing diverse habitats, millions of species, countless individuals, and a wide array of characteristics. As defined by Article 2 of the “*Convention on Biological Diversity*”, *it includes “the variability among living organisms from all sources, including terrestrial, marine, and aquatic ecosystems, and the ecological complexes”.* Zoological diversity, a subset of biodiversity, focuses specifically on the diversity of animal species and their ecosystems. The immense biodiversity on Earth is essential for the stability and sustainability of life, including human existence. Greater biodiversity ensures a more resilient and secure environment. Intellectual Property Rights (IPR) provide a legal framework for protecting innovations related to biodiversity, such as new plant varieties and other life forms. IPR serves two key functions: it protects products derived from raw materials found in biodiversity and secures those based on traditional knowledge. Biodiversity offers essential ecosystem services, including food, water, and medicinal resources, that are vital for all living beings. In India, with its vast biodiversity and rich traditional knowledge, there have been significant efforts to protect indigenous species. However, cases of biopiracy, such as the misappropriation of neem, turmeric, and basmati rice, highlight the challenges India faces. This is where IPR plays a critical role in safeguarding indigenous species and protecting the rights of local communities. **2.INDIA’S BIOTIC DIVERSITY**

Under “*Section 2(b) of the Biological Diversity Act, 2002,* biological diversity" is defined as “*the variability among living organisms from all sources, including the ecological complexes of which they are part”.*India, with its unique geographical location, enjoys a wide range of biodiversity. The country spans both temperate and tropical regions, contributing to its immense variety of ecosystems and species. Over 103,257 species of fauna and 55,049 species of flora have been recorded across India's 10 biogeographic zones, with approximately 12,095 species endemic to the country. This diversity is spread across a vast array of landscapes, from the towering Himalayas in the north, which host rare and medicinal plant species, to the ancient Deccan Plateau in the south, and extensive coastal plains that stretch from Gujarat to West Bengal. These coastal areas are home to vital marine ecosystems like mangroves, which play an essential role in nutrient cycling and coastal protection. In the west, the Thar Desert supports an array of vibrant and resilient flora, while the east is dotted with smaller hills rich in unique plant and animal species. The fertile northern plains, fed by the Indus, Ganga, and Brahmaputra rivers, are central to India’s agricultural output and overall economy. India's diverse climates, from the snow-covered peaks to tropical coasts, create a rich and varied natural environment.

**3.EXPLORING RICHNESS OF WILDLIFE DIVERSITY IN INDIA**

This rich biodiversity is largely due to the country's diverse climatic conditions. India boasts around 91,036 species of fauna, with insects alone comprising 30,375 of these species. India's rivers and lakes are habitats for crocodiles and gharials, while the saltwater crocodiles thrive along the eastern coast and in the Andaman and Nicobar Islands. The Great Himalayan Range presents a distinct wildlife ecosystem, with species such as tapirs, markhor, ibex, shrews, and various wild sheep and goats. The higher altitudes are known for housing elusive creatures like the snow leopard and the red panda, further showcasing India's remarkable biodiversity.

**4.SIGNIFICANT WILDLIFE REGIONS IN INDIA**

The Himalayas, which include Mount Everest, the world's highest peak, stretch across northern Pakistan, Nepal, Bhutan, and India. This temperate zone is characterized by alpine meadows and coniferous forests, home to rare and economically valuable plants such as jute, citrus, and sugarcane. The region also hosts several threatened species, including the snow leopard. The Indo-Burma region, the largest of all biodiversity hotspots, spans northeastern India, Bangladesh, and parts of Southeast Asia. The region’s ecosystems include evergreen forests, mixed deciduous forests, and semi-evergreen forests, supporting a diverse range of canopy tree species. The Western Ghats, extending from Kerala to Gujarat, is globally recognized for its biodiversity. This region’s ecosystems range from wet to dry, playing a critical role in regulating monsoon patterns. The However, the region faces significant threats from industrial forestry and international wildlife trade, with species like tigers, monkeys, and turtles being exploited for food and traditional medicines.

**5.BIODIVERSITY HOTSPOTS OF HERITAGE VALUE IN INDIA**

Biodiversity Heritage Sites, recognized under “*Section 37 of the Biological Diversity Act, 2002”*, are areas of significant ecological importance that contribute to the conservation of both wild and domesticated species. They may also hold cultural, ethical, or aesthetic value, contributing to the preservation of cultural diversity, sometimes in areas with long human association. According to the National Biodiversity Authority, India is home to 45 Biodiversity Heritage Sites, which provide important economic, tourism, and social benefits. Additionally, India has 42 World Heritage Sites, recognized under the 1972 World Heritage Convention, which are classified into cultural, natural, and mixed categories. These sites aim to fulfill *the "Five Cs"* objectives: *Credibility, Conservation, Capacity-Building, Communication*, and Communities. World Heritage Sites are crucial in promoting conservation efforts while balancing human interaction with nature. Global biodiversity, which refers to the variety of life on Earth, is a measure of the planet's ecological richness. While more than 99 percent of all species that ever existed are now extinct, current estimates suggest there are between 2 million and 1 trillion species on Earth, with most estimates pointing to around 11 million. Biodiversity hotspots—regions with exceptionally high levels of endemic plant and animal species—are critical to global conservation efforts. Although these areas make up only 2.5 percent of Earth's land surface, they support over half of the world’s plant species. Notable biodiversity hotspots include Madagascar, the Brazilian rainforests, the Himalayas, and the Horn of Africa. These regions are of immense ecological and economic importance, providing essential protection to the species that inhabit them. As of July 2024, there are 1,223 World Heritage Sites across 168 countries, categorized into cultural, natural, and mixed sites. The 1972 World Heritage Convention plays a vital role in preserving these sites and maintaining the balance between human interaction and the natural world.

**6.LEGISLATION GOVERNING BIOLOGICAL DIVERSITY AND IPR IN INDIA**

India is one of the world’s major biodiversity hotspots, home to an incredible variety of flora, fauna, and ecosystems. To protect and preserve this biodiversity, India has enacted various laws and constitutional provisions. *The 42nd Amendment of 1976 added Article 48-A*, directing the state to protect and improve the environment, and *“Article 51-A(g)”,* making it a fundamental duty for citizens to safeguard nature. Additionally, Article 21 guarantees the right to a clean environment as part of the right to life. Key legislations include the *“Wildlife Protection Act, 1972”*, which governs the conservation of wildlife and their habitats, and the *“Forest Conservation Act, 1980”,* aimed at halting deforestation. India has also launched significant conservation initiatives like Project Tiger and Project Elephant. Other important laws include the “*Indian Patent Act, 1970”*, the *“Geographical Indications of Goods Act, 1999”,* and the “*Protection of Plant Varieties and Farmers' Rights Act, 2001”*. The *“Biological Diversity Act, 2002”*, specifically addresses the conservation and sustainable use of biodiversity, with recent amendments in 2023 to streamline intellectual property regulations. India’s commitment to environmental protection is further supported by the “*National Green Tribunal Act, 2010*”, which ensures swift resolution of environmental disputes and compensation for victims of environmental harm. Through these laws and initiatives, India aims to balance development with the conservation of its rich biodiversity.

**7.GLOBAL VIEWPOINTS ON BIODIVERSITY, IT’S SUSTAINABLE UTILIZATION, AND THE INTERSECTION WITH HUMAN WELFARE AND IPR**

The IPPC plays a critical role in promoting global food security, safe international trade, and environmental protection. Similarly, the Ramsar Convention on Wetlands, signed in 1971, focuses on the conservation and sustainable use of wetlands, which are among the most productive ecosystems on Earth. Wetlands are vital for providing food, water, and medicinal resources, and they also support diverse plant and animal species. Covering about 6% of the Earth's land surface, wetlands contribute significantly to local economies, including tourism, while playing a crucial role in maintaining ecological balance.

**8. REGULATIONS ON INTERNATIONAL TRADE IN ENDANGERED PLANT AND ANIMAL SPECIES.**

This agreement is one of the oldest and largest multilateral efforts aimed at protecting endangered plants and animals from the threats of international trade. It categorizes species based on their risk of extinction and regulates international trade to prevent overexploitation. CITES also supports habitat protection, encourages research, and promotes community engagement through education and awareness. The CBD has become a cornerstone for national and international biodiversity policies, establishing legally binding commitments for ecosystem conservation. This framework sets global biodiversity conservation and sustainability targets to be achieved by 2030, addressing the urgent need to reduce species extinction risks, promote sustainable use of biodiversity, and strengthen implementation and monitoring efforts.

**9.SDGs OF THE UNITED NATIONS**

SDGs are commonly known as the global goals, these 17 goals tackle a broad spectrum of challenges related to the environment, society, and the economy, with the aim of fostering equality, prosperity, and sustainability for all. While all the SDGs are interconnected, some specifically focus on biodiversity. For instance, SDG 14 is dedicated to life below water, and SDG 15 focuses on life on land. Each goal includes specific targets to be achieved by 2030. Only 16% of the SDG targets are expected to be met by 2030, with key goals such as SDGs 2, 11, 14, 15, and 16 particularly off track. This framework is aligned with the 2030 Agenda’s key pillars—people, prosperity, planet, and participation—and emphasizes the localization of the SDGs, ensuring their integration into national frameworks and encouraging community participation at the local level.

**10.WIPO AND TRIPS**

WIPO is a United Nations agency that focuses on advancing and safeguarding intellectual property rights worldwide. The organization also supports research and provides information to enhance the protection of intellectual property services. By simplifying the IP application process, TRIPS facilitates trade and attracts investment, ultimately driving economic growth. The agreement also aims to prevent piracy and combat intellectual property infringement while ensuring transparency, fairness, and predictability in IP protection. Regarding biodiversity, its sustainable use offers numerous benefits that contribute to human welfare across economic, social, environmental, and health sectors. Economically, biodiversity provides vital resources such as crops, livestock, and fisheries, ensuring food security. Key ecological processes, such as pollination, seed dispersal, and nutrient cycling, are supported by diverse plant and animal life, which also contributes to food security through a variety of crops. Biodiversity is critical for disaster risk management; wetlands and forests, such as mangrove ecosystems, help mitigate flood impacts and stabilize soil to prevent landslides. They enhance water retention, which reduces drought issues. In terms of human health, biodiversity offers substantial benefits, with over 50% of medicines derived directly from natural sources. Healthy ecosystems provide fresh air and water, while nature contributes to mental well-being by reducing stress. Additionally, certain rare species are essential for treating specific diseases. By mitigating disaster risks like floods, droughts, and storms, biodiversity ultimately saves lives and provides livelihoods through forests, timber, and non-timber products.

**11.JUDICIAL RESPONSES CONCERNING BIODIVERSITY AND INTELLECTUAL PROPERTY RIGHTS**

Several notable Supreme Court judgments have addressed the intersection of biodiversity and intellectual property rights in India.

***“Turmeric Patent Case (1995)”:*** This landmark case involved the U.S. patent on turmeric, which was revoked due to evidence of prior art, highlighting issues of biopiracy.

***“Neem Patent Case (2000)”:*** This case centered on a dispute between India and the European Patent Office over the patent on neem oil, which was challenged on the grounds that it lacked novelty.

***“Basmati Rice Patent Case (2001)”:*** This issue involved the biopiracy of basmati rice by the U.S., leading to diplomatic tensions between India and the U.S. and efforts to protect traditional knowledge associated with this valuable crop.

***“Monsanto Wheat Patent Case (2013)”:*** This case focused on the patenting of wheat varieties and its implications for biodiversity, raising concerns about the effects of patenting on genetic resources.

The judicial responses to these cases have played a crucial role in protecting and preserving biodiversity, reinforcing the importance of safeguarding traditional knowledge and ensuring the welfare of communities reliant on these resources.

**12.FINDINGS, CONCLUSION AND SUGGESTIONS**

In conclusion, biological and zoological diversity is crucial for human welfare, sustainable development, and the protection of intellectual property rights. However, despite existing legal frameworks aimed at the protection and conservation of biodiversity, losses continue at an alarming rate, revealing significant gaps in these efforts. The fragmentation of laws often leads to overlaps and confusion, while ineffective implementation due to resource limitations exacerbates the issue. Additionally, the lack of strict penalties undermines enforcement. Current trends indicate that we are lagging significantly in achieving global targets related to sustainable development goals. For instance, the Wildlife Protection Act of 1972 focuses primarily on species protection rather than the conservation of entire ecosystems and provides inadequate provisions for managing human-wildlife conflicts. Similarly, the Forest Conservation Act of 1980 lacks community involvement in forest management, has a slow clearance process, and is often underfunded. The Geographical Indications (GI) Act of 1999 has a limited scope for protecting traditional knowledge, along with high registration fees and a complex application process that discourage individuals from registering their GI tags. The Indian Patent Act of 1970 raises concerns about biopiracy and features inadequate enforcement mechanisms, a lack of transparency, and convoluted procedures. The Protection of Plant Varieties and Farmers’ Rights Act of 2001 falls short in compensating farmers for their varieties, imposing high registration fees, and presenting conflicts with other laws, along with limited access to benefit-sharing and scrutiny of variety applications. The Biological Diversity Act of 2002 suffers from unclear provisions regarding intellectual property rights, weak enforcement, insufficient funding, and inadequate representation of local communities, leading to delays and a lack of transparency in decision-making. While India’s laws aim to protect biodiversity, intellectual property rights, and promote sustainable development, they face numerous challenges that necessitate urgent reforms. First, fostering international cooperation in national laws regarding biodiversity and intellectual property rights is essential. An interdisciplinary approach to policymaking should be adopted, accompanied by adequate funding. Awareness initiatives, such as workshops focused on biodiversity and intellectual property rights, are necessary to clarify these laws. Streamlining the registration process and reducing fees can promote sustainable agricultural practices at the local level and enhance community engagement. A dedicated act to protect traditional knowledge is vital in addressing biopiracy, one of the major threats today. Moreover, incorporating artificial intelligence into biodiversity monitoring can improve conservation efforts. Promoting global forums on biodiversity and intellectual property rights will facilitate practical solutions to protect and conserve novel plant varieties and other essential resources. Ultimately, the successful implementation of laws and sustainable development goals, particularly concerning biological and zoological diversity, relies on coordinated efforts among national and international communities, including governments, NGOs, institutions, and individuals. Timely action at the grassroots level is imperative for safeguarding human existence, preserving biodiversity, and ensuring the health of our planet, which is essential in today’s rapidly changing and globalized world.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declared 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.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

**REFERENCES**

1. Biological Diversity Act, 2002
2. The Constitution of India Indian Forest Act, 1927
3. Forest Conservation Act, 1980
4. Wildlife Protection Act, 1972
5. Wildlife (Protection)Amendment Act 2022
6. The Geographical Indications of Goods (Registration and Protection) Act, 1999
7. Indian Patent Act, 1970 and Amendment 2005
8. Protection of Plant Varieties and Farmers’ Rights Act, 2001
9. National Green Tribunal Act, 2010
10. International Plant Protection Convention, 1951
11. Convention on Wetlands, 1971
12. International Union on Conservation of Nature, 1963
13. Conservation on Biodiversity Act, 1992
14. Kunming-Montreal Global Biodiversity Framework 2022
15. United Nation Sustainable Development Goals 2015
16. World Intellectual Property Organization (WIPO)
17. Trade Relate Aspects of Intellectual Property Rights (TRIPS)
18. Indian Patent Act, 1970
19. Convention for the Protection of Animals from 1988
20. Chan KMA, Balvanera P, Benessaiah K, Chapman M, Díaz S, Gómez-Baggethun E, et al. Why protect nature? Rethinking values and the environment. Proc Natl Acad Sci U S A. 2016;113(6):1462-5. <https://doi.org/10.1073/pnas.1525002113>.
21. Cocks ML. Biocultural diversity: Moving beyond the realm of ‘indigenous’ and ‘local’ people. Hum Ecol. 2006;34(2):185-200.<https://doi.org/10.1007/s10745-006-9013-5>.
22. Crowl TA, Crist TO, Parmenter RR, Belovsky G, Lugo AE. The spread of invasive species and infectious disease as drivers of ecosystem change. Front Ecol Environ. 2008;6:238-46. <https://doi.org/10.1890/070151>.
23. Díaz S, Demissew S, Carabias J, Joly C, Lonsdale M, Ash N, Zlatanova D. The IPBES Conceptual Framework- Connecting nature and people. Curr Opin Environ Sustain. 2015;14:1-16.
24. Gavin MC, McCarter J, Mead A, Berkes F, Stepp JR, Peterson D, Tang R. Defining biocultural approaches to conservation. Trends Ecol Evol. 2015;30(3):140-5. DOI: <https://doi.org/10.1016/j.tree.2014.12.005>.
25. Hill R, Cullen-Unsworth LC, Talbot LD, McIntyre-Tamwoy S. Empowering indigenous peoples’ biocultural diversity through World Heritage cultural landscapes: A case study from the Australian humid tropical forests. Int J Herit Stud. 2011;17(6):571-91.
26. <https://doi.org/10.1080/13527258.2011.618252>.
27. Rotherham ID. The implications of perceptions and cultural knowledge loss for the management of wooded landscapes: A UK case-study. For Ecol Manage. 2007;249:100-15.DOI: <https://doi.org/10.1016/j.foreco.2007.05.030>.
28. Karanth KK, Naughton-Treves L, DeFries R, Gopalaswamy AM. Living with wildlife and mitigating conflicts around three Indian protected areas. Environ Manage. 2013;52(6):1320-32.https://doi.org/10.1007/s00267-013-0162-1, 2-s2.0 84889884999.
29. Vaske JJ, Beaman J, Barreto H, Shelby LB. An extension and further validation of the potential for conflict index. Leis Sci. 2010;32:254. https://doi.org/10.1080/01490401003712648, 2-s2.0-77951927321.
30. Karanth KK, Gopalaswamy AM, DeFries R, Ballal N. Assessing patterns of human-wildlife conflicts and compensation around a central Indian protected area. PLoS One. 2012;7(12) https://doi.org/10.1371/journal.pone.0050433, 2-s2.0-84870812512.
31. Kumar R, Verma RK. Meninism and preconceived ideology with specific Indian dimension of human rights in today’s changing globalized scenario: A critical appraisal. Legal Res Dev. 2022;7(1):27-9. DOI: <https://doi.org/10.53724/lrd/v7n1.10>.
32. Yap JQ, Lim E. A legal framework for artificial intelligence fairness reporting. Camb Law J. 2022; Cambridge University Press, Faculty of Law, University of Cambridge. doi:10.1017/S0008197322000460.
33. Kumar R, Verma RK. Human rights of men in the world of globalization—an essence of time: A critical appraisal. Jai Maa Saraswati Gyandayini. 2022;8(2):1-6. <https://doi.org/10.53724/jmsg/v8n2.02>.
34. McInerney-Lankford S. Human rights and development: A comment on challenges and opportunities from a legal perspective. J Hum Rights Pract. 2009;1(1):1-5. doi:10.1093/jhuman/hun005.
35. Kumar R. State human rights commissions as enforcement system in India: A critical appraisal. Res Inspir. 2022;7(2):1-17. doi: <https://doi.org/10.53724/inspiration/v7n2.02>.
36. Chandrappa R, Das DB. Environmental health - theory and practice. In: Introduction to Medical Sciences. Cham: Springer International Publishing; 2021. p. 175-216.<https://doi.org/10.1007/978-3-030-64480-2_5>.
37. Kumar R, et al. Justice accessibility in perspective of juristic rational science with specific dimension of medical and forensic science. Jai Maa Saraswati Gyandayini. 2023;9(1):10-3. <https://doi.org/10.53724/jmsg/v9n1.03>.
38. Abubakar A, Tariq, Kumar R. Implementation of women’s human rights in Dar Es Salaam with special reference to domestic violence: A critical appraisal. Rev Gestao Social Ambient. 2024;18(5):1-14. doi: <https://doi.org/10.24857/rgsa.v18n5-038>.
39. Abubakar A, Tariq, Kumar R. Laws relating to women human rights and domestic violence in Tanzania. Pak J Life Soc Sci. 2024;22(2):366-73. doi: <https://doi.org/10.57239/PJLSS-2024-22.2.0027>.
40. Jackson R., V. R. Squires, Fostering community-based stewardship of wildlife in Central Asia: transforming snow leopards from pests into valued assets, Rangeland Stewardship in Central Asia, 2012, Springer, Berlin, Germany, 357–380.
41. Ogra M. V., Human-wildlife conflict and gender in protected area borderlands: a case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India, Geoforum. (2008) 39, no. 3, 1408–1422, https://doi.org/10.1016/j.geoforum.2007.12.004, 2-s2.0-42649119432.