Protecting India's Biodiversity: The Role of the Biological Diversity Act 2002: A Review

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10.18805/BKAP788

ABSTRACT

India's rich biodiversity holds a great significance in country's agricultural, economical and social growth. However, biodiversity is severely threatened by various factors such as population growth, urbanization, deforestation and climate change. In India, the Biological Diversity Act of 2002 has been framed for addressing these threats through a structured framework for conservation and sustainable use of biological resources. The Act establishes a three-tier structure composed of the National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs) and Biodiversity Management Committees (BMCs). The NBA and SBB oversee and regulate biodiversity management, while also empowering local BMCs to actively participate in bio-resources conservation efforts at the grass root level. It is crucial to sustain India's rich biodiversity for future generations through effective implementation of the Biological Diversity Act and related policies. Sustainable and equitable use of biological resources is the only way to protect the rights of indigenous communities and it requires a balance between the IPR and the CBD principles which is aptly attained through BD Act, 2002.

Key words: Agriculture, Biodiversity, Climate change, Conservation, Sustainable use.

All life forms including humans are heavily dependent on the biological diversity for their survival which necessitated conservation of various ecosystems of the world for the benefit of mankind. There are eight sanctuary regions of International Union for Conservation of Nature (IUCN), of which South Asian Region requires the greatest ecosystem conservation as per the report of the Commission of Ecosystem Management of IUCN. The economy of countries is also dependent on the biological diversity. The loss of biological diversity in past 200 years has degraded many local ecosystems and endangered several species. The situation demanded an international treaty on various aspects of biological diversity. Consequently, a multilateral dialogue was held in 1992 in Rio de Janeiro at the Earth Summit and an agreement was reached as the Convention on Biological Diversity (CBD). The CBD assures the sovereign rights of states on their biological resources and associated Traditional Knowledge (TK). Furthermore, it advocates for sharing of economic benefit among the local communities preserving the TK's and biodiversity. The Convention also requires the member nations to protect and conserve assets of TK at national level. Subsequently, in India, Biological Diversity Act 2002 was implemented for the conservation and documentation of biodiversity and sharing economic benefits to the original holders of the biological resources/ knowledge upon whose primary knowledge innovation it is commercially exploited. As per the definition given in Biodiversity Act 2002, "Biodiversity means the variability among living organisms from all sources and the ecological complexes of which they are part and includes diversity within species or between species and of eco-systems biological diversity" (https://www.indiacode.nic.in/bitstream/123456789/2046/4/a2003-18.pdf). In simpler terms, all kind of life including plants, animals, microorganisms (fungi, bacteria *etc.*) in a particular habitat form the biodiversity of that habitat. Bio-resources are essential for human survival. Recognizing biological diversity as a global asset is of immense value to current and future generations and considering the threat of species extinction. United Nations Environment Programme (UNEP) convened a group of experts on Biological Diversity in November 1988 to assess the need for an international convention on biological diversity. By February 1991, the *Ad hoc* working group had evolved into the Inter-governmental Committee. Its efforts culminated in the Nairobi Conference on 22 May 1992, where the agreed text of the Convention on Biological Diversity was adopted. Overall, 168 countries including India signed on this convention. It officially came into force on 29th December 1993.

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How to cite this article: Ghritlahre, S., Kumari, N., Datta, D., Kumar, A., Sahay, G. and Bhatore, A. (2025). Protecting India's Biodiversity: The Role of the Biological Diversity Act 2002: A Review. Bhartiya Krishi Anusandhan Patrika. 40(1): 23-29. doi: 10.18805/BKAP788.

Submitted: 12-09-2024 **Accepted:** 24-02-2025 **Online:** 26-03-2025

Biodiversity in India

Out of 195 countries in the world, there are only 17 mega diverse countries accommodating 70 per cent of biodiversity and India is one of them hosting 7-8% of the world's species which includes 45,000 plant species and 91,000 animal species. The other mega diverse countries are: Brazil, China, Indonesia, Colombia, Mexico, Ecuador, Kenya, Peru, Venezuela, Costa Rica, Bolivia, Malaysia, Philippines, South Africa, Democratic Republic of Congo and Madagascar. However, species are not evenly distributed and some regions provide habitat to a high number of endemic species (species found exclusively in those areas). For example, *Citrus indica* is an endemic species of Nokrek valley, Garo hills, Meghalaya, India (Fig 1). Many of these species face threats from habitat loss and other human activities. Similarly, other species to be conserved and facing threats from habitat loss and other human interference are shown in pictures (Fig 2-4). Biological diversity in agriculture crop has also been declined tremendously due to advent of the new high yielding varieties. It has introduced new rice and wheat varieties which has a very narrow genetic base. During 1970, India had nearly 1,10,000 varieties of rice and this diversity has been lost as a result of green revolution, since it was primarily focused on mono-culture and hybrid crops. Now, just 6,000 varieties of rice is available (Deb, 2012). High yielding varieties (HYVs) and more particularly hybrids, lost their viability and become vulnerable to pest and diseases infestation, after few years of its introduction. This demands the inclusion of new genetic materials, which is again made available from existing traditional cultivars. Hence the introduction of these HYVs is a major cause of the reduction of traditional crop diversity (Kavitha and Chandran, 2017). About 95 per cent of rice crop diversity has been lost from the Godavari district of Andhra Pradesh. Similarly, several varieties of sugarcane have been replaced by a single hybrid in northeast region of India. Farming of some of the Kalo Damgo, Kalo Novan and Bello have been losing due to introduction of new high yielding rice varieties (Kavitha and Chandran, 2017). On introduction of exotic plant species have often lead to the loss of native species which can be rare and well localized in their distribution, causing loss in local biodiversity (Pagiola *et al.*,1997). For instance, to assure the need of pulpwood for paper industry-planting of exotic plants like eucalyptus and wattle gained popularity over local timber use after Indian independence. Several internationally recognized society forestry programmes and central and state forest conversion scheme in the 1970s reinforced the planting of these tree species in India. In 1976, the National Commission on Agriculture recommended some species of eucalyptus as the most suitable for paper industry. As a result, 90 per cent of the eucalyptus seedling planted as a part of the Karnataka State Social Forestry Project of 1983 in Karnataka. Similar shifting in agro-forestry has been observed in Jeypore of Odisha, India where eucalyptus is inhabited in traditional landscapes. Now a day's eucalyptus is becoming serious concerns in India, as it have been extracting more ground water from soil, leading to very poor crop growth. In a single day, a tree can extract 20-40 litres of ground water (Divya, 2014) and thus it competes for water with local plants/tree species of the Western Ghats. Likewise Koli hills of Tamil Nadu, cassava cultivation has gained momentum over the local millets cultivation. About 7000 ha. of farmland is dedicated for cultivation of a variety H 165 (a non edible variety), preferred by industry for its



Picture courtesy: Chetry *et al.* (2021).

Fig 1: *Citrus indica* is an endemic species of Nokrekvalley, Garo hills, India.



Fig 2: Conservation of wild species is the key for introducing resistance genes in improved varieties.

better starch quality (King *et al.*, 2014). These regions are known as biodiversity hotspots.

Conservation and judicious utilization of biodiversity is important to us as a large population is dependent on natural bio-resources. Twenty-eight countries including India are losing original virgin forests and are facing severe threat of ecological imbalance, thus conservation efforts are needed to be taken urgently. The biodiversity of India is under threats because of various factors *viz*, population explosion and urbanization, poverty and illiteracy, over exploitation of natural resources and destructive practices, illegal mining and poaching, deforestation, irresponsible industries, habitat alteration and global climate change. This has created huge ecological imbalance and it necessitates immediate control measures. We have almost lost the wetland ecologies not only from cities but also from the adjoining rural areas. Under the present situation Biological Diversity Act and rules along with other related laws and policies enable us to conserve the bio-resources and facilitate the local communities to sustain their resources. The primary objectives of the biological diversity act 2002 are to conserve biodiversity, sustainable use of bio-resources and equity in sharing benefits from use of bio-resources.

Significance of biodiversity in agriculture

In agriculture, biodiversity is important because it affects sustainability, climate resilience and productivity of crops. Crop species that exhibit genetic diversity are better able to withstand pests, diseases and unfavorable environmental circumstances. Crop failure risk is decreased by introducing varieties with diverse genetic backgrounds because they can withstand new threats and adjust to changing weather. Breeding programmes can obtain genes for biotic and abiotic resistance from crop wild relatives and traditional landraces. Utilizing these genetic resources, new crop types with desired characteristics like increased nutrition, stress tolerance and yield can be created. For example, pigeonpea (*Cajanus cajan*) originated from its wild progenitor (*Cajanus cajanifolius*) in central India around 3500 BC (Fig. 5), likewise *Lens orientalis* is considered as the wild progenitor of cultivated *Lens culinaris*.

Indian Biodiversity Act 2002

The Biological Diversity Act, 2002, is a comprehensive framework established by the GOI for regulating the conservation of biodiversity, sustainable use of bio-resources and fair distribution of benefits resulting from the use of bio-resources. To monitor implementation, the act establishes State Biodiversity Boards (SBBs) at the state level and the National Biodiversity Authority (NBA) at the national level. In order to encourage preservation and the sustainable use of bio-resources, it contains provisions for the establishment of Biodiversity Management Committees (BMCs) at the local level. The structure and functions of these authorities are given below. The Act prohibits any person or organization, whether based in India or abroad, from obtaining biological resources from India, transferring research results related to these resources or claiming intellectual property rights based on such research without prior approval from the NBA. Indian researchers do not need prior approval or notification to the State Biodiversity Board (SBB) for obtaining biological resources for research to be conducted in India. However, if the research results are used for commercial purposes, prior notification to the SBB is required. Local residents and communities, cultivators of biodiversity, as well as Vaids and Hakims are exempted from restrictions on the use of biological resources. Commodities that are normally traded may be exempted from the Act through specific notifications. Collaborative research conducted through government sponsored or government approved institutions is exempted, provided it adheres to overall policy guidelines and receives approval from the Central Government. The BD act exempts those plants that are registerable under the Protection of Plant Varieties and Farmers' Rights (PVPFR) Act, 2001.

Key provisions of the Biological Diversity Act, 2002

1. Approval for genetic material transfer

The Indian Government's approval is required for transferring Indian genetic material outside the country and for anyone seeking to claim Intellectual Property Rights



Fig 3: *Diospyros peregrine,* a tree with medicinal properties, is found in the coastal areas.



Fig 4: Wetlands provide shelter to many plant and animal species.

(IPR) such as patents, over biodiversity or associated knowledge.

2. Regulation of biodiversity use: All Indian nationals except local communities are regulated concerning the collection and use of biodiversity resources.

3. Benefit sharing: The Act outlines measures for sharing benefits derived from biodiversity use, including technological transfer, financial rewards, cooperative research and development and joint IPR ownership.

4. Conservation and sustainable use: It mandates measures to conserve and sustainably use biological resources, including habitat and species protection, conducting Environmental Impact Assessments (EIAs) for projects and integrating biodiversity considerations into departmental and sectoral plans and policies.

5. Local community involvement: Local communities are given a role in the use of their resources and knowledge and are entitled to charge fees for such use.

6. Protection of indigenous or traditional knowledge.

7. Regulation of genetically modified organisms.

8. Biodiversity funds: National, State and local biodiversity funds are established to support conservation efforts and benefit-sharing initiatives.

9. Biodiversity management structures: The Act establishes Biodiversity Management Committees (BMCs) at the local village level, State Biodiversity Boards (SBBs) at the state level and a National Biodiversity Authority (NBA) to oversee and implement biodiversity conservation and management.

Implementation and regulation of Bio-diversity Act 2002

National Biodiversity Authority (NBA)

It was established in 2003, has headquarters in Chennai, Tamil Nadu.

Structure

1. One Chairperson
2. Sixteen ex officio members from the Ministries dealing with-
(i) Agricultural Research and Education;
(ii) Agriculture and Farmers Welfare;
(iii) AYUSH
(iv) Biotechnology
(v) Environment and Climate Change
(vi) Forests and Wildlife
(vii) Indian Council of Forestry Research and Education
(viii) Earth Sciences
(ix) Panchayati Raj
(x) Science and Technology
(xi) Scientific and Industrial Research
(xii) Tribal affairs.
3. Five non-official members, appointed from among specialists and scientists with expertise in relevant fields.
4. Four representatives from the State Biodiversity Boards on a rotational basis.

Functions of NBA

1. Promoting the conservation and sustainable use of biodiversity as appropriate.
2. Providing advisory and regulatory functions.
3. Protecting intellectual property rights.
4. Supporting state governments.

State biodiversity boards (SBBs)

It is composed of a chairperson, up to 7 Ex-Officio members representing relevant Departments of the State Government and up to 5 expert members selected from specialists in areas related to the conservation of biological diversity, sustainable use of biological resources and equitable benefit-sharing.

Functions of SBB

1. Providing Advice to the State Government on conservation, sustainable use and equitable benefit-sharing, while adhering to guidelines set by the Central Government.
2. Issuing approvals or handling requests for the commercial utilization, bio-survey and bio-utilization of biological resources.

Biodiversity management committees (BMCs)

Every local body (Gram Panchayat/Nagar Panchayat/ Municipal Committee) shall establish a Biodiversity Management Committee (under whatever name) within its jurisdiction. The function of this committee is conservation, sustainable use and documentation of biological diversity. This includes the preservation of habitats, conservation of landraces, farmer's collection, cultivars, domesticated animal breeds, *etc.* and the recording of knowledge related to biological diversity. The State Government may also create Biodiversity Management Committees at the intermediate or district Panchayat level to further the objectives of the Act. BMC prepare the People's Biodiversity Register in consultation with local communities. This



Fig 5: *Cajanus cajanifolius*: A wild progenitor of cultivated pigeonpea.

register will provide comprehensive information on the availability and knowledge of local biological resources as well as their medicinal uses or any other relevant uses. The composition of the Biodiversity Management Committee is determined by the State Government. However, the number of members in the Committee must be between 7-11.

The State Government, in consultation with local bodies, designates areas of significant biodiversity as Biodiversity Heritage Sites (BHS) by notifying them in the official gazette. The rules for the management and conservation of BHS are established by the State Government in consultation with the Central Government. Additionally, the State Governments are required to create schemes to compensate or rehabilitate individuals or communities economically impacted by such notifications. Forty-seven BHS have been notified by different State government till date.

Summary

In the initial days, biological resources were given customary recognition and considered as heritage or matters of mankind (Bragdon, 2001). Similarly, until the end of 19th Century, genetic resources were tagged as common heritage belonging to the public domain. The common attributes of biological resources were specified due to bio-prospecting, use of genetic resources for crop improvement and recognition of intellectual property. With the inception of CBD, sovereign rights of the states were recognized over their biological resources (Hassemer, 2004). CBD is not principally opposed to granting IP rights to biological resources but it mandated the equitable sharing of benefits accrued from their use in commerce. The origin of Biodiversity Act lies in the CBD to which India is a party. It emphasized the conservation of biological diversity, the sustainable use of its components and fair and equitable sharing of benefits arising out of the utilization of genetic resources (Geertrui, 2005). Biological resources are the product of biodiversity and traditional knowledge. TK encompasses aesthetic, utility, literary, artistic or scientific creations and therefore, includes folklore, dance, song, handicrafts, designs, stories, artwork, elements of language, agricultural knowledge and medicinal knowledge as well (WIPO, 2001; Leistner, 2004). The knowledge part of TK can be delineated in to traditional medicinal knowledge, traditional agricultural knowledge and traditional ecological knowledge De Carvalho (1999, 2003).CBD recognizes the socio-economic contribution of holders of TK and made provision of benefit sharing from the commercial exploitation of in the form of article 8 (j), which advocates for respecting, protecting and rewarding the TK of local communities. Prior to the existence of Biodiversity Act, 2002 there had been efforts to document the biological resources and associated TK. 75 biodiversity registers were established in 10 states through the efforts of centre for ecological sciences at IISC, Bangalore. The knowledge about medicinal and other uses of biological resources gathered by the tribal communities like Bhils of Madhya Pradesh and the Tharus of the Terai region were documented through gene campaign. The local people of Agasthyamuni village of Garhwal, through the efforts of the Research Foundation of Science, Technology and Ecology, prepared the Community Biodiversity registers by conducting Jaiv Panchayat. The villagers in Jardhar of the Teri Garhwal were engaged in growing and conserving the local cultivars through a movement called 'Beej Bachao Aandolan'. In the past, local communities managed the biological resources through sustainable use and conservation ethics in the tropical Asia, South America and Africa. They often followed the practices that preserved the diversity of species and heterogeneity of landscapes through sustainable farming, subsistence livelihood and food habits, cultural traditions. Burgeoning population and industrial growth had disrupted the balance of sustainable and equitable use of biological resources. Conservation of biodiversity require multifarious efforts involving local knowledge, institutional mechanism, collective and coordinated approach among institutions, information sharing and creating awareness, sensitization for protecting nature and knowledge transfer. Several acts are in place (Indian Forest Act, 1927, Wildlife (Protection) Act, 1972, Forest (Conservation) Act, 1980, Patent (Second Amendment) Act, 2002, The Protection of Plant Varieties and Farmers' Rights Act, 2001) for protecting biological resources but has specific applicability in their domain. Moreover, these do not have the provision for safeguarding of traditional knowledge and equitable sharing of benefits arising out of the use of biological resources and associated TK, thereby, unable to check bio-piracy, which can be defined as claiming IPRs without acknowledging its origin and taking consent and sharing economic benefits to, the original holders of the biological resources/ knowledge upon whose innovation it is commercially exploited and hence, bio-piracy is a form of theft. The issues of bio-piracy and its implication on economic and ethical aspects were addressed in the biodiversity act.

Conserving the biodiversity will enable preservation of biological resources and associated TK. There had been instances of bio-piracy of TK, particularly medicinal use of herbs and condiments. There is need to build the data base of biological resources that are of common knowledge in a community or region. Documentation of biodiversity is the first step towards preserving biological resources and TK which provide recognition of knowledge holders in a community. However, merely documenting the biodiversity is not suffice to give legitimate share of benefits arising out of biological resources and TK though it is true that it will prevent unauthorised patenting and commercialization of biological resources and associated TK. Therefore, it necessitates some mechanism for safe guarding economic benefits from the knowledge associated with biological resources for commercial use by bringing the tools of CBD but at the same time allowing legitimate IP

rights as per TRIPS agreement by balancing the sovereign rights of States over their biological resources and intellectual property as private right. In this context, Biodiversity Act 2002 was adopted for addressing the issues of CBD for the protection, documentation and benefits sharing of biological resources and associated TK. At primary level, biodiversity is documented at the local level through BMC's. Apart from ensuring equitable share in profit accrued from bio-resources and TK through regulation of its commercial use, the SBB participates in policy decisions for conservation and documentation of biodiversity at the state level. The NBB acts as national authority in the regulated use of bio-resources and conservation and documentation of biodiversity. The Biological diversity Act has paved the way for benefit sharing arising out of biological resources and TK in several instances like auction of red sanders in Andhra Pradesh, Neem leaf extraction (Amarchinta) in Andhra Pradesh, Bacillus, use of *Psuedonomas* by Novozymes Biologicals Inc. in Kerala, use of natural herbs by Habib Cosmetics Private Limited in Uttarakhand, use of TK-based drug 'Jeevani' in Kerala and use of natural herbs by Dabur India Pvt. Ltd. in Himanchal Pradesh. Creation of IP, which includes all kins of creative works and research innovations, has been on rise since past two centuries and greatly strengthened after TRIPs agreement was in place. The core subject of IP is considered as inclusive and not exhaustive in nature. The commerce led IP has intruded the natural resources including the biological resources which resulted in the degradation of wet lands, mangroves, forests and costal lands loss and thereby, loss of biodiversity. The indigenous communities are heavily dependent on the biological resources for their livelihood. Sustainable and equitable use of biological resources is the only way to protect the rights of indigenous communities and it requires a balance between the IPR and the CBD principles which is aptly attained through BD Act, 2002.

CONCLUSION

Burgeoning population and industrial growth had disrupted the balance of sustainable and equitable use of biological resources. Conservation of biodiversity require multifarious efforts involving local knowledge, institutional mechanism, collective and coordinated approach among institutions, information sharing and creating awareness, sensitization for protecting nature and knowledge transfer. There is need to build the data base of biological resources that are of common knowledge in a community or region. The Biological diversity Act has paved the way for benefit sharing arising out of biological resources and traditional knowledge in several instances.

ACKNOWLEDGEMENT

The present study was supported by: ICAR-IIPR Kanpur.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

All authors declared that there is no conflict of interest.

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