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ECONOMIC VALUATION OF BIO-RESOURCES FOR ACCESS AND BENEFIT SHARING

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ECONOMIC VALUATION OF BIO-RESOURCES FOR ACCESS AND BENEFIT SHARING (ABS)

1. Introduction

Biodiversity has significant economic value that is both implicit and explicit. Most of these values are often not captured by the market. Hence, the potential of biodiversity is often underestimated. Such an underestimation is considered as one of the factors for rapid depletion of biodiversity and loss of habitats and species. Most of our biodiversity is on common land and its property rights are not clearly defined. Hence, the goods and services derived from biodiversity experience market failure. Even if biodiversity goods (bio-resources) have a market, they are imperfect and experience market distortions. The demand, supply and price mechanisms of biological resources do not function effectively as they do in the case of other commodities. Hence, the existing "price" of bio-resources at the collection point does not reveal its real "value".

Even if valuation of ecosystems has been highly debated during the last two decades, economists are involved in developing valuation methodologies considering the increasing role of biodiversity goods and services in natural resources management and policies. Further, the report of The Economics of Ecosystems and Biodiversity (TEEB) that was launched during the tenth Conference of Parties to the Convention on Biological Diversity (CBD-COP 10) in 2010 raised a lot of awareness among policy makers on the need to look at economic valuation of biodiversity in a broader sense.

During the same meeting of the CBD, countries also agreed for a legally binding Protocol to deal with issues of access to genetic resources and benefit sharing. Named the Nagoya Protocol on ABS, the Protocol aims to operationalize the third objective of CBD on fair and equitable sharing of benefits of use of genetic resources. The principle of an ABS mechanism is to ensure the resources are accessed and used according to set principles of prior informed consent from the providers and when benefits accrue to the user of resource who accessed the material such benefits are shared fairly and equitably with the provider. It is pertinent to mention that such benefits could be both monetary and non-monetary.

One of the key issues that will emerge as a critical challenge for countries intending to operationalize the Nagoya Protocol on ABS at national level would be to assess the economic and related potential of resources before arriving at an appropriate mechanism of benefit sharing. In the absence of knowledge on the economic potential of resources, it is possible that the negotiations on benefit sharing between the provider and user

could be skewed and biased putting the fairness and equity elements within an ABS process at risk.

At the National Biodiversity Authority (NBA), through the UNEP-GEF ABS Project, work has begun in 2012 towards developing an appropriate method/model for valuation of bio-resources for operationalization of the ABS mechanism in an effective manner. India is currently a pioneer in national level implementation of the ABS mechanism through the Biological Diversity Act that was enacted in 2002. As of October 2013, the NBA has entered into more than 110 ABS agreements that specifically include benefit sharing components.

2. Classical Approach Followed by Environmental Economists in Valuing Ecosystems

Ecosystems and biodiversity present within such ecosystems are providing innumerable services and goods that underpin human survival on the Planet. Ecosystem services include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual and recreational aspects and supporting services like nutrient cycling that maintain the health of this Planet (MA, 2003). In addition, a suite of ecosystem goods such as food, medicinal plants, construction materials and wild genes for improving domestic plants and animals and others also emanate from the ecosystems.

Conceptually, Total Economic Value (TEV) of an environmental resource (ecosystem) consists of its Use Value (UV) and Non-Use Value (NUV). A use value is a value (in the form of commodities and services) arising from an actual use made of a given resource. This might be the use of a forest for timber and non-timber forest products, or of a wetland for recreation or fishing, and so on. Use values are further divided into Direct Use Values (DUV), which refer to actual uses such as fishing, timber extraction and others; Indirect Use Values (IUV), which refer to the benefits deriving from ecosystem functions such as a forest's function in protecting the watershed; and Option Values (OV), which is a value approximating an individual's willingness to pay to safeguard an asset for the option of using it at a future date, like an insurance value.

NUV are more problematic in definition and estimation since these are non-marketed services of ecosystem. NUV are usually divided between a Bequest Value (BV) and an Existence or `passive' use Value (EV). The former measures the benefit accruing

to any individual from the knowledge that others might benefit from a resource in future. The latter are unrelated to current use or option values, deriving simply from the existence of any particular asset (Pearce and Dominic, 1994). Thus total economic value is generally calculated using the formula:

$$TEV = UV + NUV = (DUV + IUV + OV) + (EV + BV)$$

Ecosystem valuation methods consider market prices, replacement costs, damage cost avoided, production function, hedonic price method, travel cost method, contingent valuation method, choice experiments, participatory environmental valuation and benefits transfer (mean value, adjusted mean value, benefit function) (TEEB, 2010).

Here, we need to re-examine the valuation process adopted for goods derived from the ecosystem. At present, environmental economists are assigning the values of ecosystem goods, based on their current exchange rate or price (multiplying the quantity of goods with the price) at their collection point, such as the forest gate or the nearby local market. On the other hand, the non-marketed benefits (values) of ecosystems are estimated based on the standard valuation tools.

However, the paradox is that when the ecosystem/biodiversity services are valued with the help of appropriate methodologies, the ecosystem/biodiversity goods value is determined with the help of existing market prices that are completely arbitrary or do not have well functioning markets. Considering such prices does not consider the true or actual value of such biodiversity goods.

3. How Bio-resources Valuation for ABS Differs from the Ecosystem Valuation?

In the ABS perspective, we are not using the TEV estimation of a particular ecosystem. Here the direct use value of the ecosystem or biodiversity, particularly the goods that have market potential and business scope, is significant. In brief, from an ABS perspective, use value - particularly direct use values - in the form of goods / resources which are tangible or visible is significant and should be considered as paramount in working on valuation related processes rather than using the tradition valuation methodology.

Historically these resources, which include different genetic materials, are extracted by local communities with the help of their unique traditional knowledge on their use and sold to prospectors at low or negligible prices. Since there are no proper markets for such resources at its collection point, the existing price for the product is not revealing its actual value. Actual value may be more than the existing market price. Valuation of bio-resources

would facilitate in identifying the real value of bio-resources and obtaining a reasonably better share of the overall benefits of bio-resources related economic activities to the local communities, who are involved in its management. If the underlying premise of an ABS mechanism is to recognise and reward communities for their conservation and management action and to equitably share the benefits of using such resources, then we need to develop such parameters that capture the real value of resources facilitating better ABS mechanisms.

4. Why the Real Value Estimation of Bio-resources is Significant?

Generally, large quantities of divergent “goods” are collected or extracted from ecosystems. Such goods form the basis of research and development (which lead to the innovation of new products) and used as commodities in trade.

In the case of ecosystem goods, particularly those obtained from common properties, the demand, supply and price mechanisms do not function effectively as they do in the case of other commodities. Providers/sellers and buyers have limited knowledge and information about both the “price” and “value” of a product. In exchange, the users of bio-resources (those prospecting resources including commercial agencies) have better knowledge about their potential value than the providers. However, the providers (local communities) are often exploited since they are little aware of the potential of resources for value addition, product development and subsequent commercialisation. Thus, the negotiations on determining the benefit sharing element could be potentially compromised where the provider is unaware of the potential use and value while the user has specific use and potential market in mind.

In this context, the valuation of biodiversity/ecosystem goods is a fundamental step towards determining the real value of bio-resources, and operationalizing the ABS provisions under Nagoya Protocol on ABS to capture the ‘fair and equitable’ provision of the ABS negotiations appropriately with full and informed participation of the local people and/or providers of the resources.

5. Need for a Paradigm Shift in Valuation for ABS

The valuation of bio-resources for ABS differs from the normal ‘ecosystem valuation’ which is emphasized on specific site (such as areas covered with forests, mangroves, corals, wetlands etc.) with TEV approach where the goods and services provided by an ecosystem are taken in to account. But the valuation required for ABS is primarily for the visible and tangible goods or products, which are coming out from the ecosystem.

From the ABS perspective, the use value of tangible and visible bio-resources is significant, since it is directly involved in prospection and trade and acts as the basic raw-material or input factor in manufacturing. In brief, many value added products are derived from bio-resources. Current models of benefit sharing are generally based on fixation of a percentage of gross sale of products that may be questioned both by users and providers of such resources. The estimation of the real value of bio-resources will help in determining the realistic benefits, which should be shared by the providers or local communities.

The negotiation between a provider and a user of resources can never be entirely based on the nature and quality of resources to be used. Both user and provider need to know the potential value of the resources that is in discussion to meaningfully arrive at a conclusion on the quantum of benefits that can be generated and subsequently shared. However, many times, the real economic value of biological resources is hardly understood by the providers as well as users, primarily due to the complexity in valuation and methodology deficiencies. This becomes a fundamental problem in arriving meaningful and suitable ABS agreements. In general, the provider (either the local community and indigenous group or the country) many times believe that they obtain a meagre share of the real resource value since they don't have a proper base value to bargain or negotiate the benefits with the users.

6. Development Process of the Valuation Methodology of Bio-resources in NBA

The estimation of the appropriate value of the bio-resources for ABS purposes is an innovative aspect, since the existing literature on environmental economics is scanty with ABS related experiences. We realized that for ABS purposes, we need to follow a different approach in valuation than the traditional ecosystem valuation. In this regard, the following steps and process were followed towards the methodology development for bio-resources valuation: (a) Interview / discussions with the experts (b) Literature collection and review (c) Capacity building through participation in events (d) Consultation workshops and stakeholder analysis (e) Consultation with bio-prospecting and crop protection products manufacturing industries and (f) Expert committee meetings and guidance.

7. Possible Approaches / Methodologies for Valuation of Bio-resources Drafted by NBA for ABS Purposes

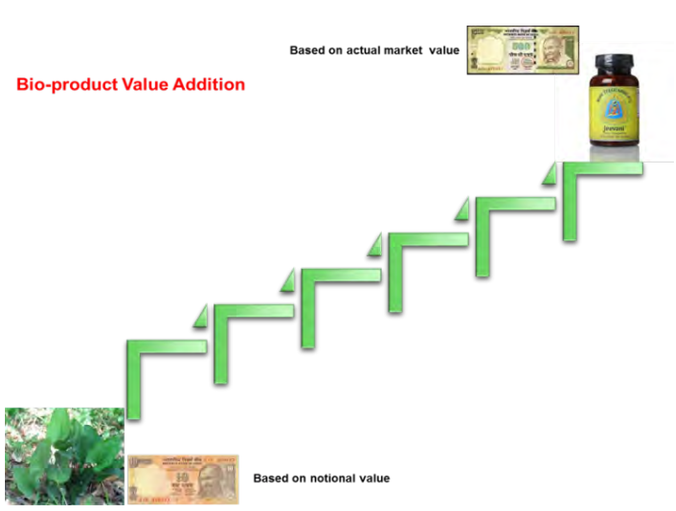
The economic valuation or estimation of the value of bio-resources at their collection point is an important aspect and a pre-requisite in operationalizing the ABS mechanism. Since the existing literature on environmental economics has not debated much on this issue, we do not have any standard reference for framing the methodology. However, based on the

rough insights from selected literature and experts' (environmental economists, ABS specialists, statisticians, industrial consultants, NGOs, community representatives etc.) opinion, the following methodologies or approaches for valuing bio-resources have been drafted.

Value Chain Analysis: Generally, value addition for bio-resources (raw) and bio-resources based products occurs either through transaction costs or / and processing or manufacturing costs. Transaction costs are the costs of particular bio-resources' movement from their collection point to the company gate, and occur through transportation charges and brokers or dealers' profits. Normally, the bio-resources transaction may take place through different agencies such as federations, wholesalers, and retailers at different locations before reaching to the final consumer and the price spread for the resources will occur. The ABS concern is whether the price spread is reasonable or not, and if not, what are the abnormalities, and how will it bounce back to the communities or providers of the resources. Further, certain bio-resources are basic raw-materials for manufacturing final consumer products. Besides, many other products (inputs) and knowledge/ skill (research and development) also contribute to an output production. Hence, the processing or manufacturing costs at different stages are significant. Through an amortised (remunerated) pricing technique, one can estimate the real price of the bio-resources. The same approach is applicable in the case of bio-prospecting based research and development. The following figure (Figure 1) is an example of the bio-resources value addition through transaction cost and production cost.

Figure 1

Value Addition of Bio-resources through Transaction and Production Costs



For a value chain analysis, a series of steps are proposed with reliable information sources (Table 1). It is important to have the active participation of various stakeholders for the successful estimation of the value of bio-resources.

Table: 1

Major Steps in Value Chain Analysis

Steps	Tasks	Sources of Information
1	Identification of the key bio-resources (having economic and ABS potential) extracted from a geographical area / ecosystem	Local communities, biodiversity data at local level, forest departments and others
2	Understand the status of the bio-resources (Rare Endangered and Threatened – RET, Abundant, Endemic). For providing a weightage in valuation process (rent)	Local communities, biodiversity data at local level, forest department and others including taxonomists and ecologists
3	Understand its potential / purpose / usage	Local communities, traders, research organizations, government departments, industries
4	Identify its leverage / movements: local → regional → state → national → international	Local communities, traders, industrial association, companies, exporters, customs department
5	Prioritize the promising uses of bio-resources based on value addition (ranking)	Industries, traders, research organizations.
6	Select any manufacturing company, who use the bio-resources	Appropriate industry
7	Estimate the transaction cost of bio-resources: from forest gate to company gate.**(Price at company gate – price at forest gate)**	Forest dwellers, traders, industries
8	Identify the major production steps	Company management and production manager
9	Identify the different factors of production involved in each stage and its cost / remuneration (Factor cost method)	Company management, production manager and labourers
10	Identify the abnormal benefits and rates **(differences between company rate with general market rate)**	Company management, production manager, labourers, industrial/govt. departments.
11	Fix the optimum benefit and share the surplus to local communities who preserve the bio-resources (**Royalty;** institutional mechanism for distribution)	Company management, production manager, labourers, industrial/govt. departments and Local communities

The "Maximum Willingness to Pay" Approach: In bio-resources based economic activities and exchange, the provider or community may not know the actual value, since they are not involved in or aware of the potential use and the production processes and costs. But the buyers (industries and the prospectors) are fully aware about the value of the resources. Hence, the maximum willingness to pay for bio-resources by the user at their collection point will reveal their possible 'real value'.

In this process, the community (as a custodian of resources) with appropriate information about the potential value of the resource can demand a higher price for each bio-resource it exchanges at its collection point. Automatically, the industries will come forward for negotiation, since these bio-resources may be an unavoidable input factor in their production. In this regard, the negotiated value will act as the "real value" for the resources. Through this method one can confine the value of the resources at their source, rather than targeting the final products percentage share.

Application of the Appropriate Economic Instruments: (tax, cess, charges, royalty etc.): The bio-resources which come under the purview of the ABS are predominantly the public owned resources or common property resources. Bio-resources have multiple uses and diverse product manufacturing capacity and value generation (it is not a uniform resource like water). With this consideration one can fix a 'tax' or apply any other appropriate instrument for the extraction of the particular resources. These instruments can also act as an economic disincentive in the unsustainable extraction of bio-resources and in saving the biodiversity. However, as the money derived through tax goes as public revenue, the possibility of its direct application for the conservation of biodiversity needs due consideration.

Minimum Support Price for Bio-resources: The authority concerned (at local and national levels) can fix a support price (with the consultation of experts) for the bio-resources prevailing in their jurisdiction. The availability of the resources, demand, purpose of collection, usage in industries, value generation capacity etc., may be considered as the criteria for fixing the support prices. However, for this to be pursued, the authority should know the price of such goods / commodities.

Collectors' "Willingness to Accept" Approach and "Minimum Livelihood" Approach: Generally, the local communities put in their hard work and unique knowledge in collecting the bio-resources from the wild. But in most cases, they are compelled to exchange the resources at negligible prices. Market imperfection, lack of ownership

rights of the resources and the least bargaining ability contribute to the lowering of the prices. Hence, the communities' willingness to accept should also be considered. Further, a minimum or standard amount for rural livelihood or wage can be considered in the bio-resources collectors' case, and that amount fixed as the value of the bio-resources that he/she collected per day.

Based on the above methodological inference, the expert committee on the "Development of Methodology for Economic Valuation of Bio-resources" established at NBA, proposed the concept of rent and its recovery for benefit sharing.

There is no doubt that bio-resources are having huge economic potential and are the base for many manufacturing sectors such as pharmaceuticals, nutraceuticals, agriculture, horticulture, cosmetics and biotechnology. Markandya (2008) provided a rough estimate for various categories of products derived from bio-resources (Table 2). In the output value a certain amount may be in the form of rent or as abnormal profits.

Table 2

'Ballpark' Estimates for Various Categories of Product Derived from Genetic Resources

Sector	Size	Comment
Pharmaceutical	US $640 bn. in 2006	25-50% derived from genetic resources
Biotechnology	US $70bn. in 2006 from public companies alone	Many products derived from genetic resources (enzymes, microorganisms)
Crop Protection Products	US $30mn. in 2006	All derived from genetic resources
Agricultural Seeds	US $30 bn. in 2006	All derived from genetic resources
Ornamental Horticulture	Global import Value US $14 mn.	All derived from genetic resources
Personal Care, Botanical and Food & Beverage Industries	US $22 bn. for herbal supplements US $12 bn. for personal care US $31 bn. for food products	Some products derived from genetic resources. Represents "natural" component of the market.

(Source: Markandya A, 2008)

Rent for the bio-resources is the difference between that resources value (to the users) and the costs of obtaining/exploiting the resources.

Therefore, Rent (R) = Value (V) – Cost (C). In bio-prospecting rent is a surplus value that remains with the industries after deducting all costs of production including the raw-material costs, labour costs, building and machinery costs, and costs for entrepreneurial skills (normal profits). This surplus value is the major concern in ABS and the argument is 'why can't this surplus value (abnormal benefits), or at least a reasonable share of it, be shared with the concerned persons / original owners / providers of bio-resources, who are the local and indigenous communities'.

After extensive consultations and studies, NBA arrived with case specific and / or separate formulas for valuing bio-resources. The sectors indicated in table 2 were considered and based on the nature, availability, and potential uses of bio-resources appropriate rent (scarcity rent, information rent and endemic rent) were suggested (Table 3 and Table 4).

Table: 3

Bio-resources Categorization for Valuation

S. No	Category of Bio-resources
1	Bio Pharmaceuticals (modern drugs)
2	Bio-technology (Seed / Agriculture Related), Land races, Microbes
3	Crop protection products
4	Botanicals (AYUSH)
5	Nutraceuticals / Personal care & cosmetic products

Table: 4

Economic Valuation Methods and Payment Details for ABS

Possible Methodological Approach	Payment Detail
Scarcity Rent (SR) + Information Rent (IR) or share a proportion attributable to the product + Endemic Rent (ER)	Initial payment + payment at the time of product development + payment at marketing stage.
Or	
Based on the proportion of Net Present Value (NPV) of the profit x the contribution of input to the output	Monetary + Non-monetary (for endemic and RET)

The above model proposed to consider Scarcity Rent (SR), Information Rent (IR) and Endemic Rent (ER) according to the type of final products derived from the bio-resources.

SR is the value derived from the limited stock of resources compared to its demand. Here those resources are entitled for a special rent due to its limited availability with the assumption that if these resources stock is not available for a company they cannot proceed with their production.

IR is significant in bio-prospecting and information is a valuable economic resource. Any bio-prospecting research starts with prior information which makes the discovery easy and achieve huge time and cost saving. Therefore, the value / profit acquired through relevant prior information (high probability leads) command information rent. Generally the traditional knowledge (TK) about bio-resources (such as availability, season and location; collection, storage, packing and transportation procedures; sustainable extraction; different / promising users; harvesting practices etc.,) exists with local communities is the key for bio-prospecting.

ER is the value derived from an endemic species; they are unique and regional specific.

Based on the above, the NBA has come up with a suggestive valuation method for biological resources that could be used for purposes of determining fair and equitable sharing of benefits under the ABS mechanism. The following table (Table 5) reflects the rationale and methodology suggested for the same.

Table : 5

Suggested Economic Valuation Methods for ABS

	Category of Bio-resources	Possible Methodological Approach	Payment Detail
A A1	Bio Pharmaceuticals (modern drugs) (*Population status, Rare Endangered and Threatening (RET), Abundant, Endemic*)	Scarcity Rent (SR) + Information Rent (IR) (share a proportion attributable to the product). Endemic Rent (ER)	Initial payment + payment at the time of product development + payment at marketing stage. Monetary + Non- Monetary (for endemic and RET)
B	Bio-technology (Seed / Agriculture Related), Land races, Microorganisms,	Information Rent (IR) (share a proportion attributable to the product).	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
C	Crop protection products	Information Rent (IR) (share a proportion attributable to the product).	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
D	Botanicals (AYUSH)	Based on the proportion of Net Present Value (NPV) of the profit x the contribution of input to the out put	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)
E	Nutraceuticals / Personal care and cosmetic products	Based on the proportion of NPV of the profit x the contribution of input to the out put	Initial payment + payment at the time of product development + payment at marketing stage Monetary + Non- Monetary (for endemic and RET)

Currently, NBA is making use of these methods in pilot valuation exercises under the UNEP-GEF ABS project implementation portfolio.

8. Conclusions

Developing an appropriate methodology for valuing bio-resources that are used for commercial purposes is extremely important for realistically implementing the Nagoya Protocol on ABS and to make ABS as a possible innovative finance mechanism for biodiversity conservation. Since the existing literature on environmental economics is scanty with ABS related experiences, it is important to develop appropriate and workable valuation tools or case specific formulas for valuing bio-resources. For ABS purposes estimating the real value of bio-resources at its collection point based on the bio-prospecting value and value addition capacity is significant. We hope that the above methodology will be widely used and tested in the field by those implementing the ABS provisions at national and local levels to operationalize the Nagoya Protocol on ABS and related national ABS frameworks.

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About the Project

The Objective of the UNEP-GEF MoEF project on ABS is to increase the institutional, individual and systemic capacities of stakeholders to effectively implement the Biological Diversity Act, 2002 and the Rules 2004 to achieve biodiversity conservation through implementing Access and Benefit Sharing Agreements in India.

This project is implemented in the 5 states of India namely Andhra Pradesh, Gujarat, West Bengal, Himachal Pradesh and Sikkim. The executing organisation includes NBA in collaboration with 5 SBBs, Botanical Survey of India (BSI), Zoological Survey of India (ZSI), United Nations Development Programme (UNDP), United Nations Environment Programme - Division of Environmental Law and Conventions (UNEP/DELC), United Nations University – Institute of Advanced studies (UNU-IAS) and Global Environment Facility.

The main components of the project are

- Identification of biodiversity with potential for ABS and their valuation in selected ecosystems such as forest, agriculture and wetlands.
- Development of tools, methodologies, guidelines, frameworks for implementing ABS provisions of the Biological Diversity Act.
- Piloting agreements on ABS
- Implementation of policy and regulatory frameworks relating to ABS provisions at national level and thereby contribute to international ABS policy issues.
- Capacity building for strengthening implementation of the ABS provisions of the BD Act.
- Increase public awareness and education programmes.

About NBA

The National Biodiversity Authority (NBA) was established in 2003 to implement India's Biological Diversity Act (2002). The NBA is a Statutory, Autonomous body and it performs facilitative, regulatory and advisory functions for Government of India on issues of conservation, sustainable use of biological resources and fair and equitable sharing of benefits arising out of the use of biological resources.

The Biological Diversity Act (2002) mandates implementation through a decentralized approach with the NBA focusing on advising the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of benefits arising out of the utilization of biological resources; and advising the State Governments in the selection of areas of biodiversity importance to be notified under Sub-Section (1) of Section 37 as heritage sites and measures for the management of such heritage sites besides supporting conservations and sustainable management of biodiversity.

The State Biodiversity Boards (SBBs) focus on advising the State Governments, subject to any guidelines issued by the Central Government, on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilization of biological resources. The State Biodiversity Boards (SBBs) also regulate, by granting of approvals or otherwise requests for commercial utilization or bio-survey and bio-utilization of any biological resource for commercial utilization by Indians.

The local level Biodiversity Management Committees (BMCs) are responsible for promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity.

The NBA with its headquarters in Chennai, Tamil Nadu, delivers its mandate through a structure that comprises of the Authority, Secretariat, SBBs, BMCs and Expert Committees.

Since its establishment, NBA has supported creation of SBBs in 28 States and facilitated establishment of around 33,000 BMCs at local level.

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