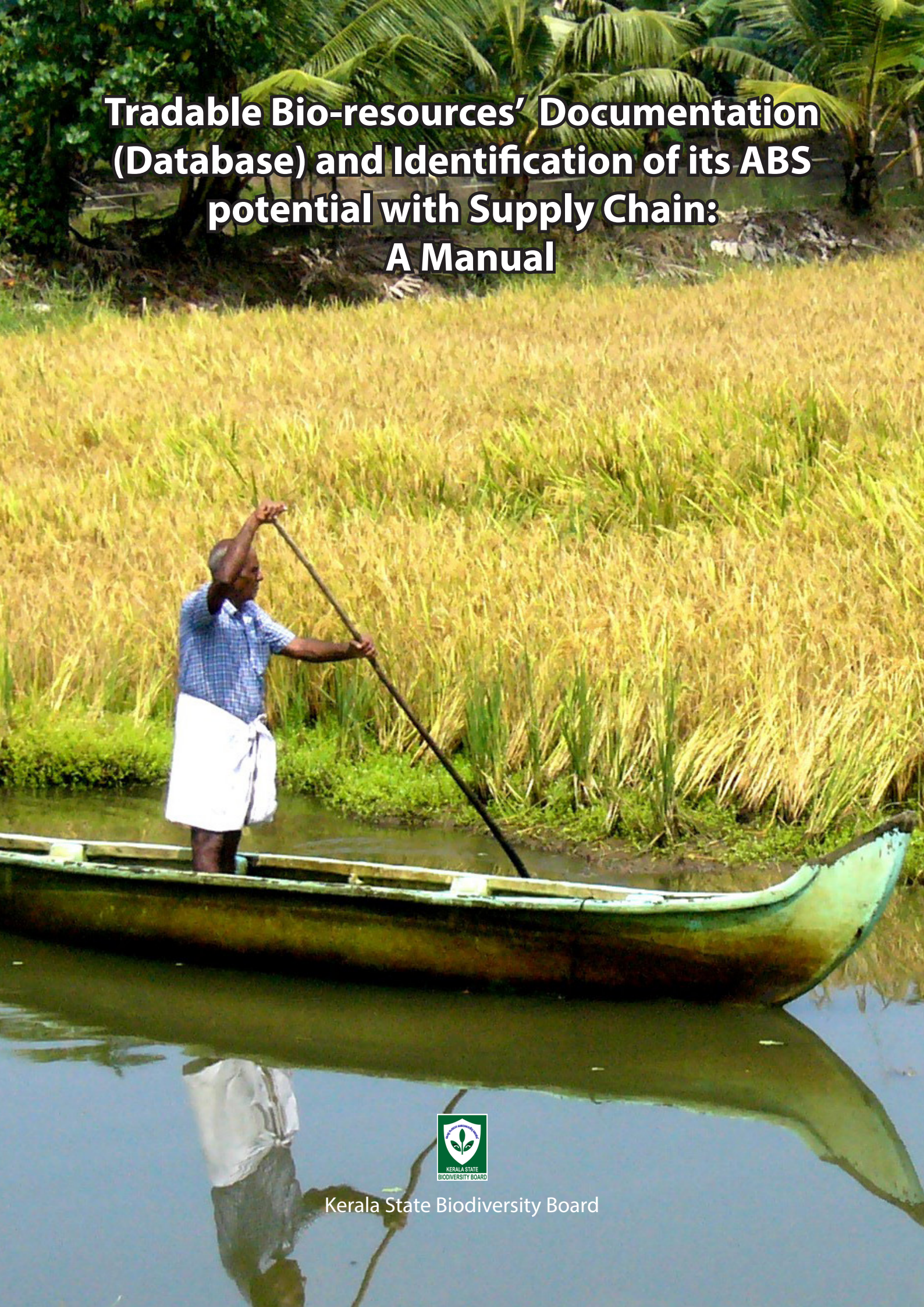
Tradable Bio-resources' Documentation (Database) and Identification of its ABS potential with Supply Chain: A Manual



Kerala State Biodiversity Board

KERALA STATE BIODIVERSITY BOARD

UNDP - India Sponsored

High Range Mountain (Munnar) Landscape Project

Tradable Bio-resources' Documentation (Database) and Identification of its ABS potential with Supply Chain: A Manual

Prepared by

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September, 2020

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Acknowledgements

I wish to thank Dr. S. C. Joshi. IFS (Retd.) Chairman, Kerala State Biodiversity Board (KSBB) for his encouragement and guidance in preparing this manual and Dr. V. Balakrishnan, former Member Secretary of the Board for his suggestions on designing the report. I am thankful to Dr. Preetha Nilayangode, Scientist KSBB, for the valuable discussions on major issues at different stages of the report preparation and her suggestions on most of the thematic issues. My sincere gratitude is due to Dr. S Rajasekharan, Consultant, KSBB, for the insightful discussions on the Munnar project and tradable bio-resources documentation during the initial stage of the report preparation.

My thanks are due to the entire research team (Dr. A L Aneesh Kumar, Mrs. Bindya, Mr. Anand, Dr. Justin, and Mr. R S Reshnu Raj) of the UNDP India sponsored "High Range Mountain (Munnar) Landscape Project" for sharing with me various information about the bio-resources of Munnar and their experiences in the study area. I am also thankful to the Technical Officers of the NBA and Member Secretaries and staff members of the different State Biodiversity Boards, who clarified different aspects related to the tradable bio-resources documentation.

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Executive Summary

Biodiversity is one of the unique features of the earth. It not only provides ecological stability to the universe but also guarantees life support functions to millions of people in the form of air, water, food and nutrition. Hence, health and livelihood securities depend on the richness of the biodiversity. We are depending on wild and domesticated plants and animals that contribute substantially to various economic activities and manufacturing sectors. Therefore, these bio-resources are very much in trade. Generally, these resources are obtained from different ecosystems (forest, agriculture, freshwater and marine) which are spread over various geographical locations in a country.

The Forest is the treasure house of genetic diversities and provides wild derivatives of many domesticated crops and animals including medicinal plants. The Agricultural system is preserving the traditional varieties of seed and germplasm and producing different varieties of crops, including cereals, pulses, fruits and vegetables. Similarly, wetlands and oceans also support many species (including different verities of fishes) useful for humanity. The biodiversity / bio-resources associated Traditional Knowledge (TK) related to each ecosystem is also very precious and contributes to enhance the bio-resources use as well as new innovations. No doubt that there is a lot more to be still explored, experimented and adapted from nature (biodiversity) for the benefit of humanity. Unfortunately, a comprehensive data base on the economically significant bio-resources of different ecosystems, which often enter into trade, is lacking.

Documentation of tradable producers or bio-resources of different sectors such as agriculture, horticulture, floriculture, forests (wild fruits, wild vegetables, medicinal plants, timber, honey, mushroom etc.) and aquatic and marine (fish, crabs, bivalves, sea grass, sea weeds, etc.) is of immense significance. These resources, along with the associated TK, are the base for manufacturing different consumer products to enhance human wellbeing. However, these resources are not equally or identically distributed in all parts of the world / nations / states / regions / districts / villages. The fact is that people need all or most of the resources irrespective of where they live. Hence, in the bio-resources sector trade plays a significant role even from time immemorial. One can easily realize that, the rich bio-resources, especially the spices existing in South Asian countries including India are the prominent factors behind colonialism. Even now bio-resources and related products are the major goods involved in regional, national and international trade. When the market demand for certain

bio-resources enhances, its utilization and extractions from the nature, value addition and trade will also increase considerably.

Documentation of tradable bio-resources in a State is baseline information, which has multiple uses. It helps to understand the demand and supply scenario of each species / resources, enhance the bio-resources trade and its effective management and sustainable utilization. Further, since bio-resources are renewable natural resources considering their increasing demand and trade, effective conservation measures can be designed even in a legally bound manner.

Pursuance to the Convention on Biological Diversity, India enacted the Biological Diversity (BD) Act in 2002 and notified the Rules in 2004. Further, various guidelines and regulations also came into existence for the effective implementation of the Act. The States have come up with their-own Biological Diversity Rules. However, the effective implementation of the BD Act is possible only if the validated base line data on demand, vulnerable habitats, and bio-resources / species is made available. One of the key mandates of the State Biodiversity Board (SBBs) is the fair and equitable sharing of benefits arising out of the utilization of biodiversity or bio-resources for commercial purposes. In this perspective, regulating the access of the bio-resources and the associated TK is significant. In addition, the Board should also be responsible for sustainable use and conservation. For fulfilling these objectives the National Biodiversity Authority (NBA) as well as the SBBs required a comprehensive picture about the bio-resources which have economic and commercial significance and traded from different regions. This might be possible only through the preparation of successful Peoples Biodiversity Registers (PBRs) and tradable bio-resources documentations.

Through the documentation of the tradable bio-resources (with appropriate methodology) the State Government and SBBs can understand the ecosystem wise types and volume of bio-resources existing in their respective states. This exercise (documentation) also will be beneficial to multiple stakeholders including: the providers (collectors and cultivators), of bio-resources, different types of traders involved in their business, wholesalers, industries that use bio-resources as raw-materials, and the government departments which are responsible in designing strategies on biodiversity conservation. Further, the documentation of tradable bio-resources is extremely useful for the enforcement agencies (NBA, SBBs, and Biodiversity Management Committees - BMCs) for implementing the Access and Benefit Sharing (ABS) principles prescribed under the BD Act.

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1. Background:

Biodiversity illustrates the variety of life on Earth, including millions of plant and animal species on the planet, the ecosystems that accommodate them, and the genetic diversity among them. It is a complex interdependent web in which each member/element plays a significant role, withdrawing and contributing something that may not even be visible. The air we breathe, the water we drink, the varieties of foods we eat, the medicines that save our lives, the weather that makes our planet habitable, natural disease resistance, and many products we use are from biodiversity. Further, in a country like India, biodiversity is the direct employment and livelihood option for millions of socially vulnerable (poor) communities, including farmers, fishermen, tribals and pastures. As a mega diverse country, India houses millions of bio/genetic resources within its forests, coastal and marine (wetlands) and cultivated systems that are of great importance.

As a party in the Convention on Biological Diversity (CBD), India's initiatives in fulfilling its objectives the conservation of biological diversity, the sustainable use of its components and, the fair and equitable sharing of benefits arising from the utilisation of genetic resources) were appreciable. India ratified the Nagoya Protocol on Access and Benefit Sharing (ABS) on 12th October 2014, and implementing the protocol's provisions through well assigned legal and decentralized institutional measures. India enacted the Biological Diversity Act in 2002 and notified the Rules (Biological Diversity Rules) in 2004 to give effect to the provisions of the Convention including those relating to ABS. For the implementation of various provisions of the BD Act, several notifications have been issued so far. The Guidelines on the Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulations (2014) is a landmark, which prescribe the scheme of processing the applications, along with templates and terms for benefit sharing.

The Biological Diversity Act is implemented through a three-tier institutional mechanism: The National Biodiversity Authority (NBA) at the national level; State Biodiversity Boards

(SBBs) at the provincial (State Government) level; and the Biodiversity Management Committees (BMCs) to be set up by the elected bodies at the local level. While all the state Governments (28) have set up SBBs, setting up of BMCs is an ongoing process. So far more than 2.75 lakh BMCs have been constituted by the local bodies in the country.

Bio-resources-based industries are using genetic/biological resources (plants, animals, micro-organisms and genetic materials) from the forests, agriculture, wetlands and marine ecosystems, as inputs or raw-materials and manufacturing different consumer products and acquiring benefits. The BD Act and Rules have prioritised conservation and ABS of genetic resources and associated traditional knowledge (TK). The ABS arrangements can provide opportunities to the traditional communities, knowledge holders and the Biodiversity Management Committees (BMCs) to enhance and explore economical opportunities.

The documentation of known and unknown biodiversity is necessary for biodiversity conservation. Hence, efforts will be needed to identify and document as many species as possible irrespective whether it documented earlier or not. The documentation of species in People Biodiversity Register (PBRs) is an important activity as per the mandate of the BMC and will be a continuous process. In the PBRs all the elements of biodiversity and associated TK will be recorded and updated periodically. Unfortunately, The PBR documentation has number of constrains including the lack of scientific approach. Hence, a very close and systematic monitoring of biodiversity including the tradable bio-resources on regular basis will keep the community informed about the existing bio-resources and threats to biodiversity. Documentation of biodiversity will help the commercial users to understand its locations and access the bio-resources. The same will be the case for traditional knowledge and indigenous knowledge.

For the successful ABS operation, as the first step, all the ABS stakeholders need a clear understanding on the types of bio-resources available in different geographical areas and their economic potential. Further, proper knowledge about the level and nature of each resource's extraction and its trade is required. This could facilitate in enforcing the effective ABS mechanism and conservation and sustainable utilization of biodiversity. Of course, the PBR may carry some information but it may not be comprehensive. In this regard, a systematic documentation of the tradable bio-resources in the state focusing on different administrative units is a prerequisite for ABS and designing effective conservation measures including the Local Biodiversity Strategy and Action Plan.

The Kerala State Biodiversity Board is engaged in assessing and quantifying the economically potential (tradable) bio-resources present at the local level, which will help in better implementation of the Biological Diversity Act, 2002 and the Kerala Biological Diversity Rules, 2015.

In this context, the tradable bio-resources' documentation must be a first step facilitation towards the ABS implementation. The following are the objectives of tradable bio-resources documentation:

- Document bio-resources (economically important plants, animals, microbes, insects, etc.) and associate TK with their commercial use and those that are under trade and/or potential for trade (through this exercise one can get an overview of the various bio-resources presently traded as well as those that could be traded in the state).
- To understand the stock and markets of various bio-resources available in particular geographical areas.
- Identify the bio-resources which have current and future prospects for the ABS mechanism.
- To understand the parties involved in trading and industries engaged in commercial utilization of the bio-resources.
- Document the financial transactions (value addition of bio-resources at each stage of trade) involved when individual bio-resources are used in commercialization.

The report is prepared under the UNDP - India Sponsored "High Range Mountain (Munnar) Landscape Project" coordinated by the Kerala State Biodiversity Board. Information has been gathered from the available published documents related to tradable bio-resources presented by SBBs and the relevant information from the reports published by the NBA, MoEFCC, GIZ, and UNDP. Detailed discussions with the experts in the NBA, SBBs, BMC, academic and research organizations, and consultants and NGOs who work in the areas of biodiversity were also carried out at different stages, as well as with the Chairman, Member Secretary and other officials of Kerala State Biodiversity Board (KSBB) and the UNDP - Munnar project team and the relevant information obtained.

The contents of this report (Tradable Bio-resources Documentation – Database - and Identification of its ABS potential with Supply Chain: A Manual) include: executive Summary, background, biodiversity: challenges and need for conservation, bio-resources:

economic significance and market distortions, bio-resources categorization and emerging concerns, tradable bio-resources documentation in India, Tradable bio-resources database: key aspects, methodology and database for tradable bio-resources documentation, supply chain analysis of ABS potential bio-resources, Tradable bio-resources documentation in Munnar landscape, Munnar landscape and its bio-wealth, Bio-resources in the Munnar region and its trade potential, ABS potential bio-resources and its supply chain and conclusion.

This report will be a guideline to the agencies and researchers, who document the tradable bio-resources in a particular jurisdiction with respect to its ABS potentiality or scope for successful ABS operationalization.

2. Biodiversity: Challenges and Need for Conservation:

Biological diversity (biodiversity) represents the variety of life on earth, which include species diversity (the numbers and kinds of living organisms), genetic diversity (genetic variations within species) and ecosystem diversity (the variety of habitats, biological communities and ecological processes). The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent a significant part of the total economic value of the planet (Costananza et al, 1997). Bio-diverse ecosystems provide vital services such as; the regulation of water flows and levels, protection against extreme weather conditions, the purification of air and water, the prevention of soil erosion, and opportunities for recreation and spiritual reflection. Besides, biodiversity offers essential resources and goods, such as food, fibre, and medicines (CBD, 2011). In brief, biodiversity is a global asset with tremendous value to the present and future generations.

However, biodiversity faces multiple challenges from various factors that include: habitat fragmentation, degradation and loss, over-exploitation of resources, shrinking genetic diversity, spread of invasive alien species, declining forest resource base, climate change and desertification, and impacts, of various development projects including pollution. The loss of biodiversity constitutes a concern for human welfare, especially for the well-being of the poorest, since it acts as a major livelihood option for them. Hence, biodiversity loss presents significant economic challenges.

Since biodiversity or biological resources are unequally distributed in the world, their supply is restricted. On the other hand, their demand is escalating universally particularly in the globalized era. Broadly, biological resources business (collection, transfer, and exchange) is progressing at an alarming rate in biodiversity rich areas of the world. This business trends on biodiversity has led to the transformation of biodiversity more from a global public good to a regional / local public good or as state property and viewed as national sovereignty (Nelliyat and Pisupati, 2013).

In this context, the Convention on Biological Diversity (CBD) insisted their parties to follow ABS through legal and institutional arrangements for the conservation and sustainable use of their biodiversity. ABS, one of the key objectives of the CBD, refers to the way in which genetic resources may be accessed, and how the benefits that result from their use are shared between the people or countries using the resources (users) and the people or countries that provide them (providers). ABS is an incentive mechanism for local communities in biodiversity conservation and its sustainable use. ABS provides for the use of natural resources in an efficient and sustainable manner for various purposes, including commercial ones. It is a tool which simultaneously enables the national mandates of biodiversity conservation and economic development in a sustainable way.

However, a comprehensive picture about the bio-resources availability (stock) in a particular jurisdiction, the resources that have economic potential and value, trade channels of bio-resources and their ABS potential are not available. Hence, the operationalization of ABS principles prescribed under the BD Act and the sustainable utilization of biodiversity and the management of bio-resources become a huge challenge.

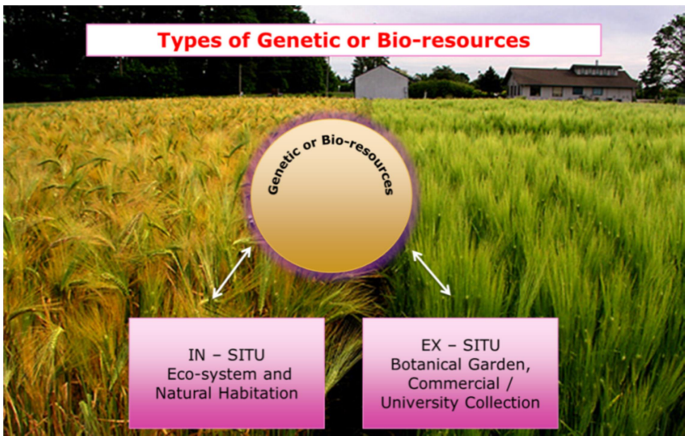
3. Bio-resources: Economic Significance and Market Distortions:

Biological resources are the fundamental source for bio-prospecting, which has been described as 'the exploration of biodiversity for commercially valuable genetic and biochemical resources'. The Convention on Biodiversity defined: '*Biological resources'*: which include genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity. "*Genetic material*" means any material of plant, animal, microbial or other origin containing functional units of heredity. "*Genetic resources*" means genetic material of actual or potential value (CBD, 2011). According to India's Biological Diversity Act (2002), "*Bio-resources / Biological resources*" means: plants, animals and micro-organisms or parts thereof, their

genetic material and by-products (excluding value added products) with actual or potential use or value, but does not include human genetic material" (NBA, 2010).

Origin of the bio-resources is from nature and is considered as the free gifts of nature or in other words it has manufactured by nature with its unique and intrinsic ability. Biodiversity exists in *in-situ* and *ex-situ* situations. In *in-situ* conditions, genetic/bio resources exist within ecosystems and natural habitats. *In-situ* conservation is important, where conservation of ecosystem and natural habitats and the maintenance and recovery of viable population of species in the natural surroundings and in the case of domesticated and cultivated species, in the surroundings where they have developed their distinctive properties. In the case of *ex-situ* conservation, conservation of the components of biological diversity take place outside their natural habitants such as zoos, botanical gardens, and seed banks (see Figure 1). Normally, the bio-resources exists in *in-situ* condition are entering into trade, commercial utilization and in ABS stream. Hence, these resources play a significant role in the tradable bio-resources documentation.

Figure - 1



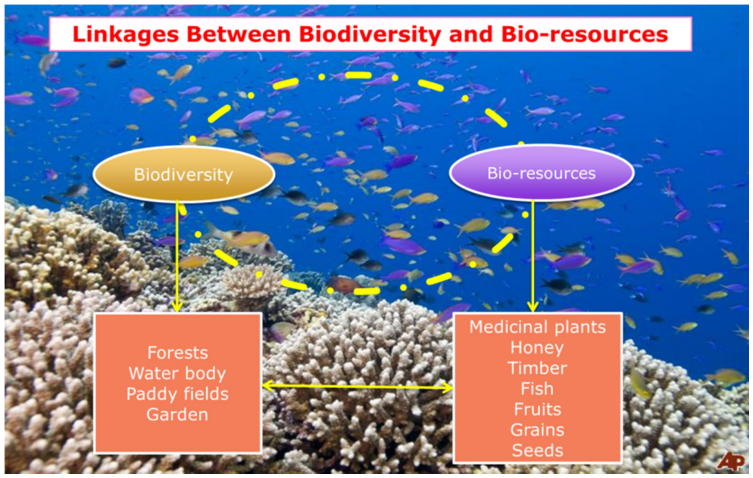
Source: Nelliyat and Pisupati (2013)

In the modern global economy bio-resources are utilizing in produce energy, fuels, chemicals, and different consumer products. 'Bio-resources based Industries' with advanced biomass processing are emerging in a significant level. Agricola (2012) indicated that "If the 20th century can be called 'the age of geology', with tremendous growth in prosperity built on the exploitation of fossil fuels, then the 21st century will be called 'the age of biology'. Powerful drivers are fuelling unprecedented interest in applying emerging technologies to the manufacture of energy, fuels, chemicals and materials from renewable resources – transforming biomass into the new staple goods of the modern global economy".

Bio-resources plays significant role in economic development through income and employment generation, particularly in a developing country like India. The resources coming out from the biodiversity or ecosystems are having huge economic potential. Unfortunately this element is still poorly understood and accounted for. Globally more than 1.3 billion people depend on biodiversity and on basic ecosystem goods and services for their livelihoods (CBD, 2008). Biodiversity is base for many manufacturing sectors such as pharmaceuticals, agriculture, horticulture, cosmetics and biotechnology (TEEB, 2010).

Bio-resources are renewable and can consider as a subset of biodiversity. Bio-resources and biodiversity are highly interlinked. One can interpret biodiversity as a stock and bio-resources as the flow from it; they are mutually interrelated in their existence and function as interpreted in the following figure (figure 2). Hence, the earth's biodiversity stock should be maintained intact through its sustainable utilization (extraction should be less than or equal to its regeneration) for fulfilling various human requirements for ever.

Figure - 2

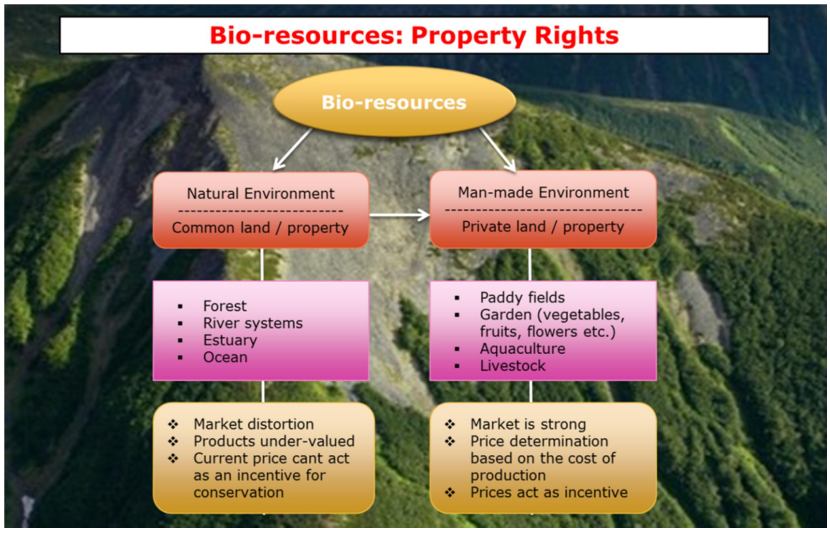


Source: Nelliyat and Pisupati (2013)

Normally, only the bio-resources having economic / commercial significance are in demand and get into trade. When these resources are extracted intensively, their stock may be affected and the possibilities of the species' extinction become high. However, through a proper documentation of tradable bio-resources one can get a clear picture about its demand, status of stock (depletion or flourish or unchanged), and design a sustainable resources' extraction strategy and biodiversity conservation measures.

Bio-resources exist in a natural environment (common lands) as well as manmade environment (private lands) as indicated in figure 3. For example, forest, river, estuary, ocean, etc. are common properties. Hence, the bio-resources from these sources experience market failure or distortions and the current market price at its collection point does not represent its real or true value. The community, who have the traditional rights on these resources are, historically collecting these resources and provide to the immediate users (traders, industries, research organizations, etc.) at meagre amount. On the other hand, bio-resources such as grains, cereals, vegetables, fruits, fishes from aquaculture ponds and life stocks, that exist in manmade environment or private lands (fields and gardens) are controlled by private entrepreneurs. Generally, both the resources arising from public and private lands are entering into trade.

Figure - 3



Source: Nelliyat and Pisupati (2013).

According to OECD, only a limited number of biodiversity products and services are traded in the marketplace, mostly at prices that do not reflect their full value. Many biodiversity products and services display some public good characteristic; they are either non-rival in consumption, or non-excludable, or both. Non-rivalry in consumption means that one person's consumption of the good does not reduce its availability to anyone else. Non-excludability entails that once the good is provided, the provider is unable to prevent anyone from consuming it. The public good characteristics of biodiversity induce market failure by precluding its products and services from being easily traded in markets; therefore, prices do not reflect the full value of biodiversity to society (OECD, 2003).

In other words, the market for bio-resources at this stage (first stage of transaction) is weak or highly imperfect. The non-excludability character of open access resources, like bio-resources, will often make a market price close to zero, when the actual value is quite large. Since the bio-products are non-rivalry in character, there is no (not much) competition of these resources, hence the market price will be inaccurate. Non-excludability is the essence of a public good. If the good is freely available to one person, it is freely available to all. In such a situation, the question will arise why would a consumer pay to acquire this particular good or service? Further, the Non-excludable and non-rivalry characters of bio-resources reflects the "off-site effects" and the resources often flow to wider communities to different provinces and countries skewing the well below market prices than the actual value (Nelliyat, 2017).

In brief, bio-resources values are implicit rather than explicit, and thus are often not captured by markets. In the case of biological resources, the absence of apparent values combined with their "public good" characteristics in the absence of well-defined property rights, have created problems of over-exploitation and unregulated use. Moreover, increasing development pressures have led to an unprecedented rate of biodiversity loss. All these facts lead to information asymmetry and lack of transparency in bio-resources market and trade. This will become a real challenge in bio-resources' documentation. As illegal and unauthorised markets also exist in many bio-resources' case, the actor's involvement in trade may not reveal authentic information. Hence, providing a clear picture about the tradable bio-resources (with authentic data) requires extraordinary efforts.

4. Bio-resource Categorization: Emerging Concerns:

Bio-resources are free gifts of nature. Earlier, bio-resources extraction and use were limited in volume, and does in an environmentally sustainable manner. Bio-resources related economic activities were then at a subsistence level, and mainly confined to certain regions. Since the providers and users are not divergent, bio-resources trade and benefit sharing was not a serious concern.

But over time, population growth, rapid economic development, progress in trade, globalization and the emergence of intellectual property regimes changed the scenario. Bio-resources are extensively extracted and used for divergent purposes, and have become emerging commercial products for entrepreneurial development. Bio-resources are the base

for several industries (such as pharmaceuticals, agro-processing, textiles, fisheries, cosmetics, bio-technology etc.) contributing to the global economy and human welfare. In this context global food and health securities depend on biodiversity. Further biodiversity or bio-resources is the source of employment and livelihood for millions of poor in developing countries like India.

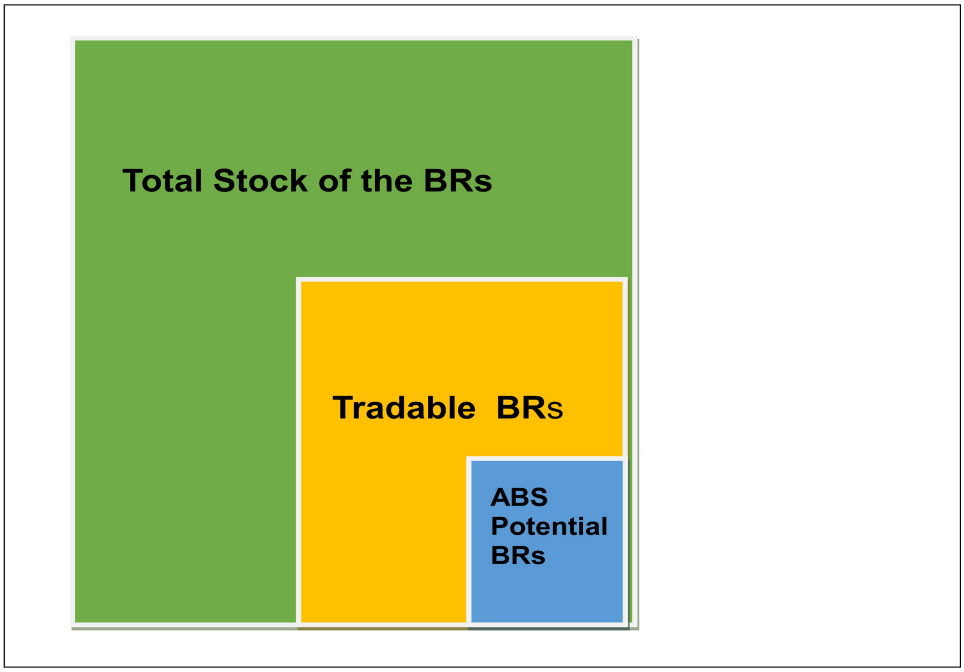
A large part of the world's biodiversity is in the developing world. Huge quantities of bio-resources from these parts of the world are being collected for meeting the global requirements. Local and indigenous communities are involved in the collection with their hard work and unique knowledge. However, the transaction of bio-resources at the collection point is does in the traditional fashion. Provider/sellers and traders have limited knowledge and information about the end product derived from the bio-resources.

Normally information is disclosed by both the parties (sellers and buyers). In the exchange, the users of bio-resources (the companies or their representatives) have better knowledge about their significance and value than the providers. However, the local communities are being exploited by providing only a meagre price by the traders and companies who make substantial profits from the business. At this stage, the current price represents only an exchange rate and not the real value of the resources, and does not act as an incentive in its conservation. Consequently, it leads to over-extraction and extinction of species, becoming a threat to biodiversity. But local communities may be the only stakeholder directly involving in the bio-resources conservation, management and sustainable use.

It is also important that we should have clarity on the total stock of the bio-resources, tradable and the ABS potential out of it (figure – 4). The total stock of the bio-resources available in the country may not come under the purview of trade or ABS (first box in the figure). Some of the bio-resources don't have *'use value'* and are not being used by humans for their own-consumption or other purposes. Hence, these resources are untouched from nature or not traded at all.

Figure – 4

Bio-resources at Glance



Normally, the tradable bio-resources (which are having demand) are a small part of the total stock of the bio-resources (second box in the figure). The resources which have demand or those active in the trade may be in domestic and commercial (with consider the economic potential of a particular resources) use. Hence, the tradable bio-resources documentation needs to capture both these sets of resources.

Even if the genetic / bio resources have 'use *value'* their entire utilization will not come under the domain of ABS. Generally, only the bio-resources used with commercial intention come under the purview of the ABS and it will be only a portion of the total tradable bio-resources (third box in the figure). Further, India's Biological Diversity Act provides exemption for: human genetic material, 421 biological resources notified as 'normally traded as commodities', and resources used by local communities (for self consumption) and *vaids* and *hakims (*for practicing indigenous medicine).

However, in reality all the ABS potential bio-resources that exist in India are not utilized fully or the current utilization of bio-resources for commercial purpose may be limited. Besides, most of the industries that use the bio-resources with commercial intent or come under the purview of ABS are not on board. The NBA and the SBBs are trying their best to

bring all these users including bio-resources based industries under the ambit of ABS or the BD Act. In brief, for materializing these objectives, one should get a clear idea about the bio-resources stock as well as its tradable and ABS potential. In this regard appropriate database is a prerequisite, which is possible only through a comprehensive documentation of the bio-resources in the state.

5. Tradable Bio-resources' Documentation in India:

India is one of the 17 mega biodiversity countries of the world. Even if India accounts for only 2.4 per cent of the world's total land area, the country possesses 8 per cent of the recorded species of the world, with around 45,000 species of plants and 91,000 species of animals. Of the 34 global biodiversity hotspots, four are in India: the Himalayas, the Western Ghats, the North-east region and the Nicobar Islands (Ministry of Environment, Forests and Climate Change, 2014). The rich biological/genetic resources and the heritage of traditional knowledge in the country obtained global attention long ago. Even now large quantities of bio-resources are legally and illegally transferred to other countries. In India, large sections of the rural population are heavily dependent on biodiversity and biological resources for their livelihood.

India is bestowed with a diversity of natural and agro-climatic zones along the rising altitudes that provide a favourable micro-environment that gives rise to a diversity of bio-resources. The local and indigenous people of India have rich TK of cultivation, collection, protection and use of their bio-resources. A majority of these bio-resources have adapted to the different micro-climatic conditions existing in the country and contribute to the livelihood of the people in different terrains. However, the identification and documentation of the potential bio-resources and the products coming out of them, and knowledge associated with each bio-resources is conspicuously lacking.

The major threats to biodiversity in India are degradation, deforestation and fragmentation of habitats due to rapid industrialization, urbanization, mining, agriculture and aquaculture and conversion of forest areas including coastal forests. Increasing population aggravates pressure on the available bio-resources and leads to its overexploitation. Developmental activities including construction of major multipurpose dams leads to the submersion of large areas of forests which ultimately affects the flora and fauna including rare, endangered, threatened and endemic species whose value is yet to be assessed and tapped. Construction of roads through biodiversity rich forest areas leads to further exploitation of pristine and rich

resources. Moreover, indiscriminate exploitation of water bodies drastically affects the keystone ecosystem.

The degradation of bio-resources in a country like India also leads to the loss of traditional knowledge (TK) associated with it. The TK being area and tribe specific varies from place to place and tribe to tribe. Therefore, the loss of species or reduction in its population leads to erosion of knowledge available with the particular community. There is lack of information on the value of resources, the type and quantity of resources, and the ones that can be utilized for availing the ABS provisions to derive monetary and non-monetary benefits. The focal ecosystems and their bio-resources need to be valued with the help of appropriate valuation methods to facilitate fair and transparent benefit sharing.

It is very clear that a huge number of bio-resources are collected by the local communities from different ecosystems (forests, wetlands, agriculture etc.) in India and supplied to different users (industries, research organizations etc.) at the domestic and international levels. However, perfect knowledge regarding the bio-resources, its trade and markets, and economic potential is not revealed mutually by the buyers and sellers. Most of the time the transaction takes place through brokers / traders. The peculiar functioning of the bio-resources market may lead to huge information asymmetry and the exploitation of local communities who are paid a negligible or low price for the resources. However, local communities normally put in their hard work and unique knowledge in mobilising the resources.

A Majority of the bio-resources (those coming from forests and marine ecosystems) are public goods belonging to the state and the local communities are involved in their collection. They are facing problems in trading the bio-resources and bargaining and obtaining a fair price from the user. However, in certain areas cooperative societies are functioning in a transparent and effective manner in marketing the bio-resources. Broadly, bio-resources are the base for manufacturing different consumer products. Further bio-prospecting is a multi-billion business and a profit option for a large number of businesses.

The Indian Biological Diversity Act and Rules have prioritized the conservation, sustainable use and ABS of bio/genetic resources and associated TK. Therefore, for the conservation of the rich biodiversity and bio-resources, including the local and traditional cultivators and associated TK, documentation of the existing bio-resources including the germplasm is very important.

The traditional and indigenous communities, especially in the Himalayas and Western Ghats, are rich with huge forest biodiversity related TK. The knowledge associated with bio-resources is improved, , tested and practiced by the indigenous communities since time immemorial resulting from generations of direct interaction, observation and learning-by-doing. Even though a large number of bio-resources in the country have been traded from time immemorial, a majority of the economically important bio-resources are yet unexplored and undocumented. BMCs are responsible for the documentation of genetic or bio-resources and associated TK in PBR. Even if many BMCs in different states prepared the PBRs through the support of SBBs, this process should accelerate further in a more systematic and scientific manner.

It is very clear from the above discussion that the rich biodiversity (bio-resources) and associated TK in India is not properly accounted for, particularly for enforcing the BD Act and initiating the biodiversity conservation measures. As India is one of the pioneering countries who initiated the ABS mechanism, a complete picture about the bio-resources which enter into trade and /or commercial utilization is urgently required. Tradable bio-resources documentation is an ideal database for linking with different stakeholders who are involved in the bio-resources supply chain, such as bio-resources providers (collectors and cultivators), traders, wholesalers, and end users (industries). In this regard, the Kerala State Biodiversity Boards Initiative in documenting the tradable bio-resources in the Munnar region is highly appreciable.

6. Tradable Bio-resources' Database: Key Aspects:

We have already observed that, India possesses around 8% of the world's biodiversity including large varieties of plants, animals and micro-organisms. The plant genetic biodiversity of the country consists of high medicinal properties and other commercial significance including food, and fibre and as raw-materials for the industry. Similarly, the rich animal (exists in landscape and seascape) and microbial resources also have high commercial significance. Hence, India is becoming a major global player in markets for tradable bio-resources mainly through bio-resources based formulations, medicines and many other products. Besides, the rich TK associated with bio-resources is alive with traditional communities, practitioners, and healers and passed down to the new generations since time immemorial (Sikkim Biodiversity Board, 2017). The traditional communities in India use a large number of medicinal and aromatic plants in their daily life.

Generally, the geographical areas consist of forestry and agro-forestry systems, timber and non-timber forest products including different medicinal and aromatic plants, which make up a significant percentage of the bio-resources trade. Further, the scope for entering new bio-resources (potential resources) in the trade is also high in these areas.

Bio-resources obtained from cultivation (which depends upon the local agro-climatic conditions), include cereals such as rice, maize, millet, oil seeds, pulses and beans, different species of vegetables, landraces of tubers and root, and varieties of fruits and spices. Most of the bio-resources are having commercial value and play a significant role in local consumption and production. However, some of it may be ignored by the researchers, development agencies and commercial companies. What is needed is, the bio-resources wealth of an area should be captured fully. Hence, the awareness raising and documentation of tradable bio-resources and associated TK is very important, particularly in the context of globalization and emerging threats of bio-piracy.

Broadly, bio-resources may be used as: food, edible fruits and seeds, leafy vegetables, oil seeds, fermented food and beverages, flower and flower buds, medicines, dyes, fibres and large number of goods used in the household sector. Some of these bio-resources may be sold in the weekly markets and others are exchanged in distant places through traders. Hence, the complete structure and history of these markets and the trade networks need to be explored through a supply chain analysis. As a majority of the bio-resources are seasonal, their commercialization, marketing and trade progress only in certain periods.

Edible horticultural plants (vegetables, spices, cereals, medicinal plants and aromatic plants), different species of domesticated and wild animals, different species of agro-forestry trees and non-timber forest products, crops with high social and cultural values and other species of plants used by indigenous communities are the major bio-resources traded through the market. Besides, a high diversity of animal genetic resources with different local and indigenous species, microbial bio-resources in a variety of ethnic fermented fruits and beverages are also active in trade. Microbial resources, including those that exist in meat products, have high potential for several industrially significant values. However, not much scientific research has been undertaken in this regard.

The ethno-cultural diversity of a region plays a significant role in bio-resources related trade and is represented by a diversity of ethnic food and beverages, including vegetables, milk, fruit and fermented beverages. The local and indigenous communities also have sound

knowledge of the treatment of several human and animal diseases and ailments such as: foot and mouth diseases, food poisoning, ring worms, bone fracture, stomach disorder, injuries, conjunctivitis, , liver flu, and muscular swelling, diarrhea, bone dislocation, snake bite, and lice, which are common among the local communities, especially those who live in hill stations. The TK of ethno-veterinary medicines is now confined only to a limited number of survivors of the older generation (Sikkim Biodiversity Board, 2017).

It is very clear that the extent of tradable bio-resources in a particular geographical location depends upon many factors including: the availability (stock) of the bio-resources and associated TK, its understanding to the local people, procurement (collection and cultivation) of the resources, its value to the local community and others who live in various regions or the country, local market and its functions, traders and their accessibility to different levels of markets, scope of bio-resources and their movement, and consumers' willingness to accept the bio-resources (demand). It is not clear, how these factors are influencing each region in determining the tradable bio-resources' number and volume. Hence, tradable bio-resources are not the mere list of bio-resources available, as documented in the PBR.

In brief, the tradable bio-resources are something beyond the flora and fauna in a particular area. It is basically those flora and fauna influenced by the above indicated factors. Hence, tradable bio-resources are to be explored through the resources' demand, values as well as their trade perspectives. Here, a comprehensive understanding of the entire process and the reliable data is a challenge. Since it is primarily a local level exercise, consultations with different stakeholders who are involved in the entire chain of activities is required. No doubt obtaining reliable data about the tradable bio-resources in a geographical area is always a cumbersome activity.

7. Methodology and Database for Tradable Bio-resources Documentation:

No doubt a huge quantity of bio-resources has been collected by local communities from different ecosystems based on their accessibility. Besides, they are also cultivating in their own or leased land. Bio-resources hold exceptionally high potential to establish the economic base for the local communities and their prosperity. Large numbers of traders are involved in transferring the collected / cultivated bio-resources from their origin to various locations, where the demand exists. Further, bio-resources act as raw-materials for many industries who manufacture different consumer products. However, the development of a database on bio-resources is still lacking in India.

Bio-resources are mostly found in different ecosystems, including the forests and their adjacent areas, cultivated (agriculture) systems, coastal, marine and freshwater systems. Since the bio-resources' market is highly unorganized and imperfect, the availability of authentic information is always a constraint. Hence, the documentation becomes an extremely difficult task. In this context, a systematic and a scientific approach with innovative ideas and multi-stakeholders' participation is required for undertaking the documentation process and generating an authentic database on bio-resources, which are under trade and ABS mechanisms.

Steps or Methods for Documentation

For the proper documentation of tradable bio-resources the following steps or methods have been proposed.

1. Selection of an area (village or district) for conducting the documentation.
2. Appoint a Technical Support Group (TSG) for initiating the documentation. Based on the ecosystems and the nature of the bio-resources that exist and are to be documented, well trained and technically sound staff should be involved in data collection, verification and compilation.
3. Follow the ecosystem approach (forest, agriculture, coastal and marine, freshwater etc.) to collect the information (database).
4. SBBs should provide the financial, institutional and organizational support to the team members for understanding the study.
5. Preparation of a detailed wok plan with a time line and modalities for data collection from appropriate sources.
6. Collect the relevant literature addressing the biodiversity and the bio-resources issues in the study area.
7. Review the literature and prepare notes and segregate the data.
8. Collect all the relevant secondary data from various government departments and research institutions.
9. Collect primary data from the local community and other stakeholders through the application of appropriate data collection tools including PRA.
10. Study the existing markets, weekly markets, seasonal markets, road side markets, and festival markets in the study area and assess the resources and nature of exchange / trade. It is also important to take photographs of the bio-resources exchanged.

11. Understand the nature of trade and supply chain of the bio-resources involvement from its origin to the end user.
12. Form a Steering Committee with experts to guide the study. Experts from academic, research, and policy background specialized in biodiversity/environmental economics, marketing/trade, agriculture, marine sciences, fisheries, forestry, microbiology, biotechnology, anthropology, and traditional knowledge may be an ideal group to guide the study.

Database and Data Collection:

For tradable bio-resources' documentation the following criteria are proposed for data collection:

1. Prepare a prescribed format for the tradable bio-resources' documentation and a questionnaire for data collection. Colour photos of the bio-resources to be incorporated in each case (**Annexure 1 and 2**).
2. Each area has the TK related to biodiversity conservation and its sustainable use. It also has the scope of national / international commercial utilization and benefit sharing therein. This should be explored and appropriately incorporated in the database. Hence, the TK associated with the bio-resources should be recorded in detail with photos in a prescribed format **(Annexure 3).**
3. If any Rare / Endangered / Threatened plants or animals are traded it should be noted separately.
4. The tradable bio-resources (database) documented should be authenticated and validated by the technical experts.

Stages in Data Collection and Documentation:

The process of documentation undergoes different stages. As the first step all the available information (secondary data) from the literature including the government records needs to be collected. This might be a baseline data for further investigation on each bio-resource. For understanding the comprehensive picture of bio-resources and their commercial significance, several departments / sectors' (stakeholders) involvement is needed. These departments / sectors include: forestry, agriculture, rural development, health, fisheries, animal husbandry, science and technology, industry, trade, planning, earth sciences, non-conventional energy, customs and excise, wetlands, marine and coastal ecosystem, natural resources and environment.

Since these agencies are responsible for bio-resources' conservation, enhancement, value addition, and management, they may have data related to biodiversity and bio-resources. The departments of industry, rural development and health may play a role in linking the livelihoods of rural communities with infrastructure development. This can, in turn, help in the value addition of the bio-resources available in that region. Hence, all these sectors and/ departments' continuous support (provision of relevant data and insights) is extremely important in completing the documentation.

In the second stage, the private sector and civil societies need to be considered as they are also the important stakeholders of biodiversity. The private sectors (companies) are responsible to the Corporate Social Responsibility (CSR), providing livelihood opportunities to the communities, and in addressing ABS issues. These companies need to be identified for getting the relevant information.

One can observe that many corporate sectors are actively involved in the conservation of biodiversity, such as: mangroves, agro-forestry, rare and endangered plants and animals, and medicinal plants, as part of their CSR. Further, waste management, water body reclamation, river cleaning, etc. is also progressing. Even if the provision of livelihood opportunities to the local communities is the primary objective behind the above attempt, it also helps in enriching the biodiversity wealth in the region in the form of more bio-resources, their value addition and trade. The industries which come forward for ABS also should be approached and the relevant data related to bio-resources used in their production process, collected. The regional NGOs and the academic institutions which work on environment, biodiversity, and natural resources also need to be involved in the documentation of tradable and/or ABS potential bio-resources.

In biodiversity and bio-resources management, another key stakeholder is the local community and BMCs, who by virtue of living closer and in harmony with nature, play an important role in biodiversity management. Hence, the maximum primary data needs to be collected from the local community.

As bio-resources availability and trade is a variable phenomenon, the available secondary data needs to be verified with the latest (current) information from the field. For the collection of primary data, extensive field surveys among the farmers who cultivate and manage agro-biodiversity, tribes who gather the resources from the forests, fishermen engaged in fishing in inland water bodies and sea are required. The research team also can

collect primary data through field observations, application of appropriate PRA tools, and interviews with knowledge holders and elders. Information about bio-resources associated TK including the local and traditional system of medicine practice from the healers belonging to different ethnic communities also should be collected. Ecosystem based survey is proposed through which one can generate more systematic information.

Data collected from different sources needs to be pooled, organized, and analysed and presented in ecosystem (sector)- wise for easy understanding. Data may be organised under the following heads / categories. .

(A) Forest biodiversity / ecosystem

1. Timber
2. Fuel wood
3. Fodder
4. Weeds
5. Broom grass
6. Non timber forest products (honey, mushroom, medicinal plants, gum, wild edible fruits, etc.)
7. Genetic resources
8. Cultural resources

(B) Agro-biodiversity / ecosystem

1. Agricultural crop plants (wild and cultivated)
2. Paddy cultivation
3. Vegetable plants
4. Fruits plants (wild and cultivated)
5. Spices (wild and cultivated)
6. Tea, coffee, cocoa
7. Ornamental plants (local and highbred)
8. Fibre plants
9. Rubber
10. Fodder crops
11. Weeds
12. Cultivated medicinal plants
13. Genetic resources
14. Cultural resources

15. Livestock (animals, skin, hair, etc.)

(C) Livestock

1. Animals
2. Animal products (skin, hair, etc.)
3. Animal meat
4. Meat products
5. Milk
6. Milk product
7. Eggs

(D) Coastal and Marine biodiversity / ecosystem

1. Fish and shell fish
2. Fish products (meat and oil)
3. Fish meal (animal feed)
4. Sea weeds (for food and industrial purpose)
5. Sea grass
6. Mangrove (wood and medicinal plants, etc.)
7. Coral reefs and associated bio-resources.
8. Genetic resources
9. Cultural resources

(E) Freshwater biodiversity / ecosystem

1. Fish
2. Aquatic plants
3. Freshwater animals (other than fish)
4. Genetic resources
5. Cultural resources

8. Supply Chain Analysis of ABS Potential Bio-resources:

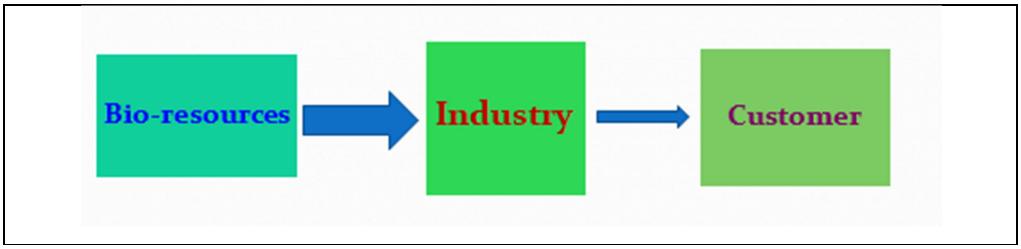
We have already discussed that, after documentation of the tradable bio-resources, the ABS potential resources should be identified for examining their supply chain. If this process could be achieved, the implementation of the ABS mechanism becomes easy for the enforcement agencies. The criteria for identifying the ABS potential resources from the tradable bio-resources' lists were discussed in the earlier part of this report. Through the examination of the supply chain of particular bio-resources, its movement from the provider to the end user

as well as the input output transformation in the manufacturing sector with value addition may be captured fully.

A supply chain is a network between a company and its suppliers to produce and distribute a specific product to the final buyer. This network includes different activities, people, entities, information, and resources. The supply chain also represents the steps it takes to get the product or service from its original state to the customer. Broadly, the functions in a supply chain include product development, marketing, operations, distribution, finance, and customer service (United Nations, 2010). However, in the ABS context, our concern is the movement of bio-resources from the providers (local communities) to the end user (industry) for commercial utilization or product development (see Figure 5). Generally, the ABS amount will be fixed based on the ex-factory sale value by the enforcement agencies (NBA and SBBs). Hence, the product movement from the industry to the customer is insignificant in the ABS based supply chain.

Figure - 5

Supply Chain: A broader Picture



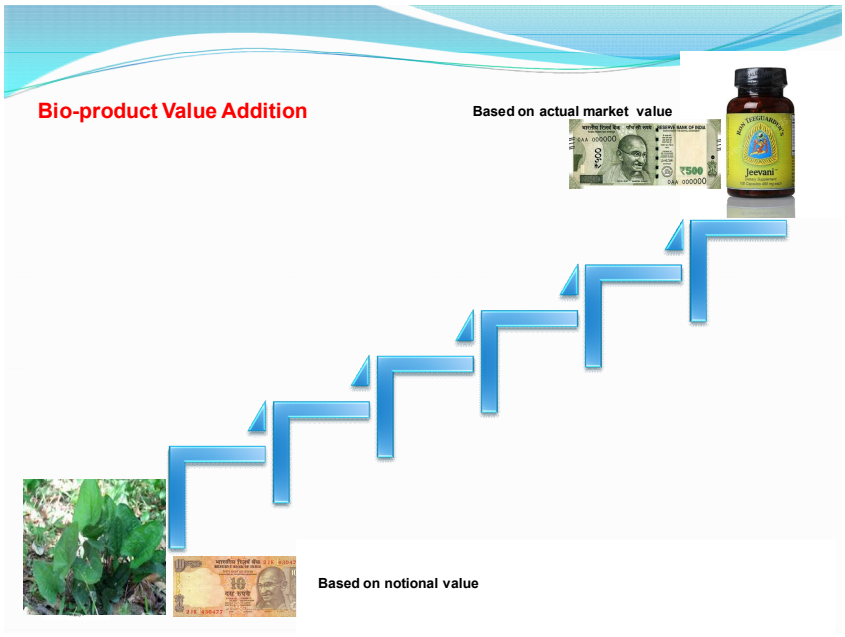
Generally, value addition for bio-resources (raw) and bio-resources based products occurs either through transaction costs or / and processing or manufacturing costs. Transaction costs are the costs of particular bio-resources' movement from their collection point to the company gate, and occur through 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 (Nelliyat and Pisupati, 2014).

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 6) is an example of the bio-resources value addition through transaction cost and production cost.

Figure - 6

Value Addition of Bio-resources through Transaction and Production Cost



For a supply (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 supply chain 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

Source: Nelliyat and Pisupati, 2014.

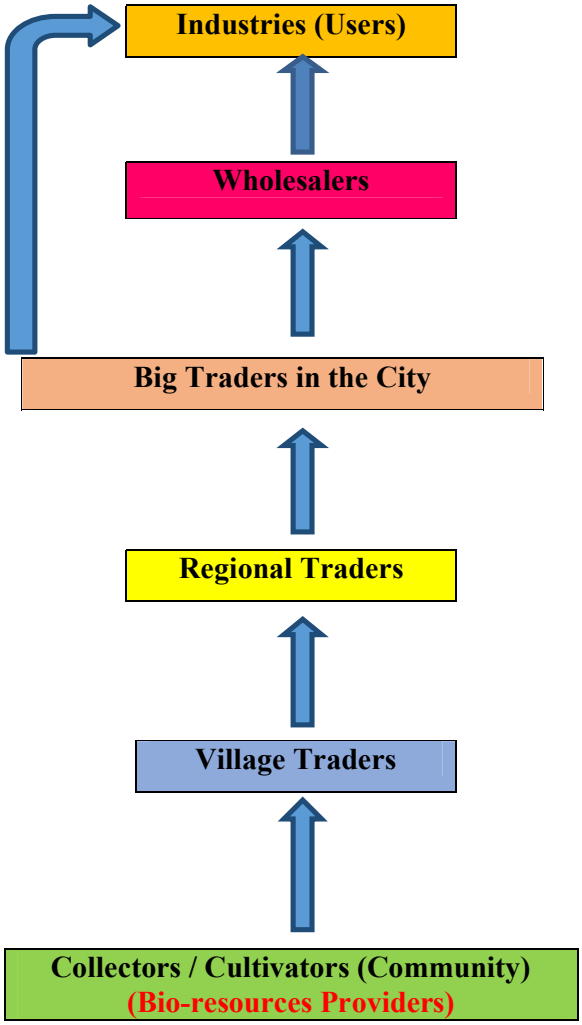
The Following are the steps of the bottom-up approach (provider to the user) proposed to understand the supply chain of bio-resources.

- Select a bio-resource (from the forest or agriculture or wetland ecosystems) which has high economic as well as ABS potential.
- Understand the status of the bio-resources (rare, endangered, threatened, endemic or abounded) and their potential.
- Examine the bio-resource's movement from its origin (local Community) to the end user (bio-resources based manufacturing company). In this regard, the movement of bio-resources from the collector/cultivators (community) to the local/village trader or SHGs (if any) to big traders (in the city) to wholesale marketers, then to bio-resources based manufacturing industry (which uses bio-resources as basic raw-materials) is to be explored in a systematic manner with the support of different stakeholders.
- Further, the assessment of the bio-resources based manufacturing companies' production steps and R&D (if applicable) with complete cost details would be helpful in understanding the value addition of the bio-resources. However, determination of ABS is based on the norms prescribed in the ABS Guidelines (2014).
- Similarly, the backward chain (from the user to the primary provider) of the bio-resources is also to be explored by the above indicated method.

Considering the present condition of the bio-resources market; it is extremely difficult in tracing the bio-resources as most of their supply to the consumer industries is through the trade channel. Along this trade channel, the bio-resources could be exchanged several times (figure 7), which should be captured. The transaction cost of the bio-resources should be estimated through the hands it is transferred. Hence, the need to bring traders and collect information is important to unravel the entire supply chain.

Figure – 7

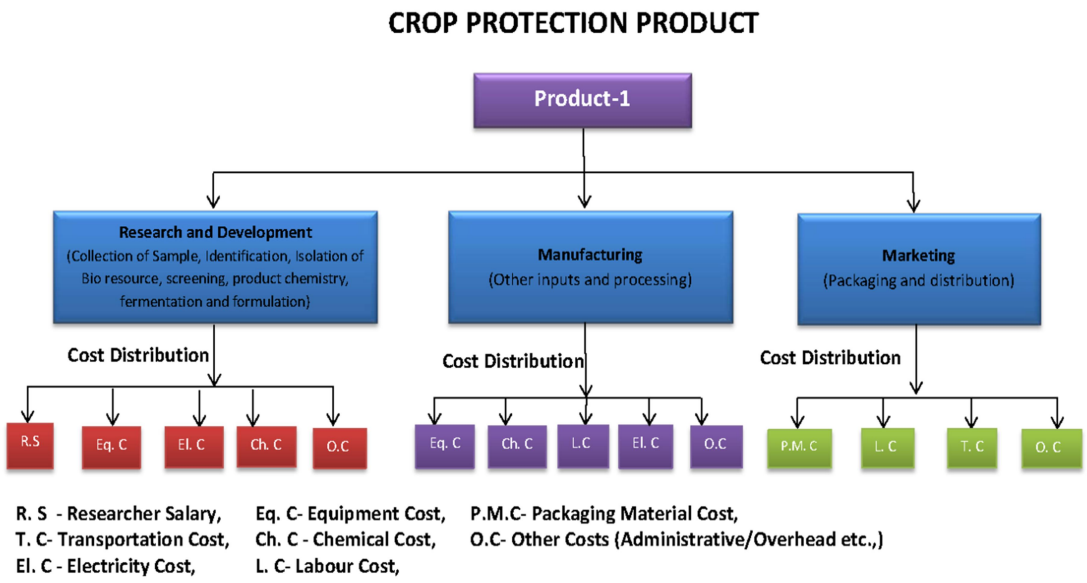
Supply Chain of Biological Resources



In the supply chain analysis of bio-resources, estimating the value addition in the production stage is an important, but complicated, task. A research carried out on a microbial resource based crop protection produces value addition estimation. The cost escalation ismainly under 3 heads: research and development, manufacturing, and marketing. Under each head different cost distribution criteria were indicated (figure - 8).

Figure 8

Value Addition in Manufacturing



Source: Nelliyat and Juliet (2016)

In brief, the supply chain analysis of an ABS potential bio-resource gives a comprehensive picture about its origin to the end product. It can explain the complete history of the bio-resources' movement, production process and steps, various stakeholders involved in the process, and value additions at each stage. Through the supply chain analysis one can successfully find out the real / true value of the bio-resources, which is not captured by the imperfect market, generally existing for the bio-resources which are collected from the common property ecosystems. In this context, a supply chain analysis is an ideal valuation method / approach for bio-resources' valuation.

9. Tradable Bio-resources Documentation in Munnar Landscape:

One of the tasks under the UNDP - India Sponsored "High Range Mountain (Munnar) Landscape Project" is 'Tradable Bio-resources Documentation - Database - and Identification of its ABS potential with Supply Chain'. After the commencement of the project a detailed work plan for the tradable bio-resources documentation has been designed. Accordingly, the study (research) team has completed the following tasks.

1. Collected relevant literature and reviewed and come up with insights on tradable bio-resources' documentations.
2. Reviewed the PBRs prepared in the Munar region and extracted the marketed or traded bio-resources and prepared Panchayat level lists. However, this might be an old database, which should be verified with the current data collected from the field.
3. Collected certain secondary data about the bio-resources in the Munar landscape. More data is anticipated from the departments of agriculture, forest, livestock / veterinary and fisheries.
4. Collected relevant data from the tribal federations / societies (who mobilize the bio-resources from the collectors and cultivators) and check posts (through which bio-resources are transferred to other regions) and compiled the information.
5. Visited some of the industries (which use bio-resources) from the Munar landscape and collected information regarding the bio-resources' demand and their production process.
6. Reviewed the ABS application received by the KSBB and examined the bio-resources used by the different industries. Further, the availability of the same bio-resources in the Munnar landscape is examined.
7. Carried out field visits in the study area and collected preliminary information. Focus group discussions and interviews were carried out with different bio-resources' stakeholders including bio resources' collectors/cultivators, tribes, farmers, local communities, traders, bio-resources sellers and wholesalers, TK holders, BMC members, Panchayat officials, and elected representatives.
8. Designed a plan for collecting more primary data from different stakeholders for accessing the tradable bio-resources status in Munar region.

Unfortunately due to the lockdown related to the Covid-19 pandemic, further field visits and data collection has not progressed from March, 2020. For tradable bio-resources'

documentation most recent field (primary) data and cross verification of the secondary information, including from the PBRs, with field information is extremely important. The following part of this report is about the bio-wealth of Munar and its market (trade) and the ABS potential with supply chain based on the insights and data collected so far.

10. Munnar Landscape and its Bio-wealth:

The Munnar landscape (consists of 11 Panchayats - Adimali, Munnar, Devikulam, Marayoor, Kathalloor, Vattavada, Chinnakanal, Mankulam, Edamalakudy, Kuttampuzha, Athirapilly - spread in Idukki, Thrissur and Ernakulum districts in Kerala) represents a large number of species (flora and fauna) of the Western Ghats, which have tremendous significance on human needs, and hence enter trade and business. These precious bio-resources consist of valuable bio-physical components, which play a significant role in the ecologically sustainable economic development in the region.

However, this fact is not fully understood either by the indigenous and local communities in the region or the government (including the local administration) and policy makers. Further, the biological resource stock in this landscape is deteriorating due to its over extraction and the drastic land use changes experienced in the last three decades. Hence, there is an urgent need for the convergence of all sectoral and/ or sub-sectoral approaches for biodiversity management and various bio-resources' sustainable utilization and management in this landscape.

Biological resources available in Munnar areas are broadly from forest landscapes, ecotypes represented by traditional cultivators and landraces, and wetland ecosystems. These resources really represent a rich *ex- situ* gene bank, which has great economic importance.. The unique agro-ecological system of Munnar landscape is famous for widely available medicinal plants, which can cater to the demand for herbal medicines by domestic, national and international companies. Besides, the different varieties of spices and other agriculture crops cultivated in this landscape are traded to different locations, even in the international markets. The wetland ecosystem primarily consists of freshwater lakes, ponds, streams, and rivers rich in aquatic flora and fauna, and has significant use value. Fishes and Tortoises have high commercial value. The traditional/local communities, most of them empowered with bio-resources based TK in the landscape also use the locally available medicinal and aromatic plants and different agricultural produces for their day-to-day life.

The vegetation of Munnar Landscapes consists of sholas, grasslands, dry mixed deciduous forests, moist deciduous forests, forest plantations (eucalyptus, wattle, pine, teak, and sandal), commercial plantations, agri-horticultural fields and mixed farms. The Munnar, Marayoor, Mankulam, Malayattoor, and Kothamangalam areas are predominantly Protected Areas including: Eravikulam, Anaimudi, Pampadum shoal, and Mathikettan shoal; National Parks: Chinnar, Idukki, and Kurinjimala: Wildlife Sanctuaries and Thattekkad Bird Sanctuary. Besides, these areas are famous for commercial plantations like tea, cardamom, coffee, and human dominated home gardens (Kerala State Biodiversity Board, 2019).

Sandal reserves of Marayoor are the compact tracts of sandal forest with mature sandal trees in the country. The Chinnar WLS, located in the rain shadow region of the Western Ghats represents a large number of flora and fauna unique with thorny vegetation. It is the only habitat in the state where the endangered grizzled giant squirrel and Indian star tortoise were seen. It is an abode of reptilian fauna and the richest in Kerala in terms of the number of species. Eravikulam National Park is located in the High Ranges (Kannan Devan Hills) of the Southern Western Ghats in the Devikulam Taluk of Idukki district, having grasslands sholas and shrub forest. Sholas are highly fragile and endangered in the tropics; they have been referred to as living fossils. The shola habitat of Anamalai Bio-geographical region of Western Ghats has high amount of diversity, richness and endemism, and it is threatened by anthropogenic pressure. The floral habitats of sholas comprise of stunted tress with an umbrella shaped canopy, epiphytic mosses, ferns, lichens and orchids and faunal habitat consisting of insects, amphibians, birds, reptiles and mammals, many of concern regarding conservation (Kerala State Biodiversity Board, 2019).

The agro-climatic conditions in the hilly areas of Munnar are conducive for the growth of highly diversified floral species which are ecologically and economically vital for the day-to-day livelihoods of natives. Broadly, the protected areas are managed through stringent legal and institutional measures with limited public accessibility, especially for extracting/accessing the resources. However, with the advent of the Convention on Biological Diversity (CBD) and the Nagoya Protocol on Access and Benefit Sharing (ABS), the traditional approach to protected area management needs to be re-examined. Broadly, the genetic/biological resources are renewable in nature; hence, their utilization within their regeneration capacity is an opportunity rather than a scare. In this context, protected areas are sources of genetic materials for bio-prospecting for users/industries and the money derived through ABS becomes an effective and sustained financial source for the protected area's

management. Hence, a win-win situation for both the parties will emerge through the implementation of ABS in protected areas (Nelliyat and Meenakumari, 2019).

In brief, the unique landscape and the agro-climatic conditions in the Munnar region enrich the forest ecosystem, wetland ecosystems and agro-biodiversity, which is the buffer zone of a large number of bio-resources having significant commercial value. Therefore, a systematic documentation of the biological wealth in this region, which are entering trade and manufacturing as raw-materials and ultimately entering the ABS compliance, is extremely important. The documentation of commercially important bio-resources (which enter into trade) is important in understanding the nature and stock of each resource and designing the appropriate management strategies. Further, the ABS agreements can provide opportunities to the local communities, traditional knowledge holders, and the BMCs to conserve the biodiversity and enhance and explore further the economic opportunities of the rich biodiversity of Munnar.

11. Bio-Resources in Munnar Region and its Trade Potential:

As the Munnar landscape is a hilly region in the Western Ghats and one of the biodiversity spots in India, there are a large number of unique plant species having high market demand. Most of these plants are having medicinal importance. Almost all the medicinal plants found in this area have curative properties due to the presence of various chemical substances of different composition. However, not much scientific research has been carried out. The only source of information is the ethno-botanical / ethno-medicinal knowledge that exists with the traditional practitioners of medicine and elder communities. This knowledge serves as a base for bio-prospecting companies to explore new components with active use of phyto-chemicals, for pharmacological and clinical reasons. Apart from the medicinal plants, different varieties of wild edibles and aromatic plants are also collected from the forests by the local communities. There are a large number of plants still in use with the indigenous communities in their traditional systems for medicines for treating a number of ailments. It is evident that the market potential for such drugs -yielding plants is high, but investigation on their properties with scientific research and evaluation is required.

Apart from the medicinal plants in the forests, a large number of agricultural products are emerging from the cultivated system. This includes a large number of spices and aromatic plants (which has huge international markets). Tradable bio-resources in the Munnar landscape or region play an important role in the socio-economic development of the

communities. The Livelihood of the local communities not only depends on agriculture and animal husbandry but the forest resources also.

The Tribal Federations / Society are mobilizing the forest resources. There are 3 such societies in the Munnar region. Besides, there are medium and small towns where a large number of bio-resources are sold in the local markets on a daily basis. These towns are the only available markets for sellers from this region. Various species with ethno-biological utilities are sold at the local level and a few items flow out of the region in other market areas as well as international markets. The income level of most of the rural communities is determined by the availability of the bio-resources, access to markets, the value or price of the bio-resources and their supply and demand.

However, there are several constraints in the bio-resources market in the Munnar region, which include: lack of infrastructure facilities, lack of backward and forward linkages of the market, and lack of popularization of the markets. Some of the forest products and medicinal plants collected by the tribal and other local communities are marketed through private sectors where intermediates or middlemen keep a strong hold or control on the market. The Middleman's role is in controlling and managing the orders from the disbursed producers particularly from the remote areas of the Munnar region. However, sometimes it leads to exploitation of the tribal communities. Broadly, the lack of market linkages and local popularization of bio-resources which has high market potential can bring down the economic benefit to the communities.

12. ABS Potential Bio-resources and their Supply Chain:

Munnar region is the treasure house of biodiversity and the traditional wisdom associated with it. Hence, its commercialization and the ABS process is a window of opportunity for both the providers and users of bio-resources and their associated traditional knowledge and ultimately for their economic prosperity. In this regard, it is important that we should have a clear picture about the ABS potential bio-resources existing in the Munnar region through a detailed and scientific documentation.

The Munnar region of the Northern Western Ghats is rich in endemic and endangered species of flora and fauna. Due to the charismatic nature and interest in animals and plants, some of them have been researched in the region. But the majority of them have neither received the same kind of attention nor has their real commercial value been studied or reported.

However, the local communities have been traditionally using plants at the household level for various purposes like food and medicines. For example, a number of plants have found a place in the commercial medicinal plants trade. However, there is a huge potential to tap other natural resources for their importance in commercial trade, of both medicinal and edible plants. It is also important to note that if there is a use and value attributed to the plant or its part, there are greater chances of their conservation and protection by local people. Bringing value to the natural resources and capacity building for green enterprises are key pointers for the success of these value chains.

In the ABS process, the BMCs, as local level statutory bodies, have a significant role. They are the formal institutions for the implementation of the Biological Diversity Act at the lowest level. BMCs are constituted at the Gram Panchayat units or Municipalities for promoting the sustainable use and documentation of biological diversity including the preservation of the habitats of plants, animals and microbes and chronicling knowledge related to biological diversity.

In Munnar region 11 BMCs have been constituted and 11 PBRs have been prepared during the period 2013-14. At present, under the Initiative of the SBBs, PBR updating is progressing in the Munnar region. The PBRs are the authentic documents which report the bio-resources with their market and trade potential and associated traditional knowledge. Hence, PBRs might be an ideal platform and base information for initiating the documentation of the tradable bio-resources as well as the ABS potential for avoiding bio-piracy.

A detailed process document (demonstrating the implementation) of 6 ABS potential bio-resources and their value chains from Munnar Region (Mankulam Panchayat) have been planned. The resources include:

1. Kattupadavalam (*Trichosanthes cucumerina L cucurbibitaceae*)
2. Karikurinji (*Nilgirianthus ciliates (Nees)Bremek Acanthaceae*)
3. Pinari (*Nothapodytes nimmoniana (J.Graham) Mabb Icacinaceae*)
4. Marotti (*Hydnocarpus pentandrus - Buch Ham* Oken Icacinaceae)
5. Pachottitholi (*Symplocos cochinchinensis (Lour) S Moore, Symplocaceae*)
6. Makkumkaya (*Entada gigas (L) Fawc. & Rendle, Leguminosae*)

Any value chain analysis of a resource needs to consider the bio-resources' ecological, economic and social sustainability of operations with transparency of sharing benefits and effective documentation and monitoring. It is not only the product that needs to be identified

but the collectors, and processors as well as resource areas required to be assessed and documented. The stakeholders include: collectors, collector associations/cooperatives, manufacturers, NGOs, contracting collectors, processors from the country of origin, traders and exporters in the country of origin, importers, processors and even marketing companies in the consumer countries (GIZ, 2019).

Data collection from the above indicated stakeholders is progressing. The use of social science research methodology tools like: village resource mapping, transect walks with knowledge holders and focus group discussions, proved very effective both for collecting and documenting the information as well as for enhancing the understanding of the community members towards the supply chain.

13. Conclusion:

No doubt the rich biodiversity wealth of India plays a significant role in enhancing the life and livelihood of millions of people who directly or indirectly depend on bio-resources' collection from the common property areas, cultivating in private lands, trade and marketing, and manufacturing different consumer products. Bio-resources related trade and manufacturing is the profit or benefit option for traders and industrialists. In this context only the ABS principle emerged. However, the major lacuna in India is the lack of an adequate database on bio-resources and associated traditional knowledge, which affect the enforcement of the ABS mechanism as well as designing the appropriate biodiversity conservation strategies.

Therefore, generating a biodiversity database, including the tradable bio-resources' data, becomes an unavoidable need. There are a number of agencies like the Botanical Survey of India, Zoological survey of India, Indian Council of Agriculture Research, Indian council of Medical Research, Central Marine Fisheries Research Institute, Forest Research Institute, and Wild Life Institute of India, as well as a number of State Departments and Research Institutes generating databases on their own area. Further, after the introduction of India's Biological Diversity Act, the PBR preparations are also progressing. Even if different data sources are available we don't have an authentic data base on the tradable bio-resources as well as ABS potential ones. Hence, we strongly propose, comprehensive tradable bio-resources documentation.

This manual has discussed in detail the current status of the biodiversity database in India, need for strengthening the database in the context of the Biological Diversity Act and ABS mechanism, methodology for data collection, format for reporting the tradable bio-resources and biodiversity associated traditional knowledge, identification and reporting of the ABS potential bio-resources, assessment of the supply chain of the bio-resources which have ABS scope. The last part of the report is focused on the ongoing initiative on tradable bio-resources documentation progressing in the Kerala State Biodiversity Board through the UNDP India sponsored "High Range Mountain (Munnar) Landscape Project". However, as the Covid-19 pandemic continues, the field work is not yet completed as we decided.

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Annexure - 1

Format for Tradable Bio-resources' Documentation

S. No	Bio-resources	Origin (location where collected / cultivated)	Exchanged (name of the market or trader)	Tradability (Local / National / International	End user (company and location)	ABS Potential
A.	**Agriculture**					
1	Cereals C1 C2 C3					
2.	Pseudo cereals PC1 PC2 PC3					
3.	Rice R1 R2 R3					
4	Vegetables V1 V2 V3					
5	Pulses / Beans PB1 PB2 PB3					
6	Tubers T1 T2 T3					
7	Fruits F1 F2 F3					
8	Spices S1 S2 S3					
9	Flowers F1 F2 F3					
10	Ornamental Plants OP1 OP2 OP3					
11	Medicinal Plants (Cultivated) MP1 MP2 MP3					

12	Tea/Coffee/Cocoa TCC1 TCC2 TCC3					
13	Fibre F1 F2 F3					
14	Fodder Plants FP1 FP2 FP3					
15	Tobacco/cannabis T/C 1 T/C 2					
16	Genetic Resources GR1 GR2 GR3					
17	Cultural Resources CR1 CR2 CR3					
18	Any others ….					
B.	**Livestock**					
1	Animals A1 A2 A3					
2	Animal Products (skin, hair etc.) AP1 AP2 Ap2					
3	Animal Meat AM1 AM2 AM3					
4	Meat Products MP1 MP2 MP3					
5	Milk M1 M2 M3					
6	Milk Products MP1 MP2 MP3					

7	Eggs E1 E2 E3					
8	Any other					
C	**Forest**					
1	Timber / Wood T1 T2 T3					
2	Fuel wood FW1 FW2 FW3					
3	Fodder (wild) F1 F2 F3					
4	Aromatic plants (wild) AP1 AP2 AP3					
5	Medicinal Plants (wild) MP1 MP2 MP3					
6	Wild Fruits WF1 WF2 WF3					
7	Wild Vegetables WV1 WV2 WV3					
8	Honey H1 H2 H3					
9	Mushroom M1 M2 M3					
10	Gum G1 G2 G3					

11	Bamboo Products (Handicraft) BP1 BP2 BP3					
12	Wood Product (Handicraft) WP1 WP2 WP3					
13	Broom Grass / Product BP1 BP2 BP3					
14	Wild Animals and its parts WA1 WA2 WA3					
15	Genetic Resources GR1 GR2 GR3					
16	Cultural Resources CR1 CR2 CR3					
17	Any other					
D	**Coastal and Marine**					
1	Fish F1 F2 F3					
2	Shell Fish SF1 SF2 SF3					
3	Fish Meat FM1 FM2 FM3					
4	Fish meal (Animal Feed) AF1 AF2 AF3					

5	Sea weeds SW1 SW2 SW3					
6	Sea grass SG1 SG2 SG3					
7	Mangrove Resources MR1 MR2 MR3					
8	Coral reefs Resources CR1 CR2 CR3					
9	Genetic Resources GR1 GR2 GR3					
10	Cultural Resources CR1 CR2 CR3					
11	Any other					
E	**Freshwater**					
1	Fish F1 F2 F3					
2	Aquatic Plants AP1 AP2 AP3					
3	Genetic Resources GR1 GR2 GR3					
4	Cultural Resources CR1 CR2 CR3					
5	Any other					
F	**Microorganisms** M1 M2					

Annexure - 2

Each Tradable Bio-resource Database (Questionnaire)

Tradable Bio-resources Name with Picture: ……

S. No	Details	Remarks
1	Local Name	
2	Botanical Name	
3	Nature of Species (physical)	
4	Used part	
5	Available season	
6	Source of the resource (cultivated or collected)	
7	Category of the resource (rare / endangered / threatened)	
8	Availability (locations in this region / Village)	
9	Availability in other areas (outside this village)	
10	Purpose / commercial use	
11	Usage among the local communities	
12	TK associated with the resource among the local communities	
13	Value / Price of the resource in the local market	
14	Market leverages / nature (local, state, national, international or any combinations)	
15	Usages in other places (state, national, international)	
16	Mode of exchange or transportation	
17	Value / price of the resource in other markets (state, national, international – if available)	
18	Any processing of the resource is taking place in the local areas / collection place?	
19	If so, what it is and its value addition - explain	
20	About the trade and trade channels of the resource	
21	Total volume of the trade (quantity and price)	
22	Supply and competition	
23	Changes on the availability of the resource (past, present and future)	
24	Sustainability of the plant / resource	
25	Any conservation measures for this resource from community / any other agencies	
26	Final/end commercial user of the resource (company and location)	
27	ABS scope / potential	
28	Any other information	

Annexure - 3

Bio-resources Related Traditional Knowledge Database (Questionnaire)

S No	Details	Remarks
1	Name of the respondent:	
2	Age	
3	Address	
4	Family members	
5	Occupation	
6	Education	
7	Name of the local community/tribe which you belong?	
8	Which language you are speaking?	
9	How long you are residing this area / region / village?	
10	Are you / your family migrated? If yes When? From where? What was the reason?	
11	Sources of income for your family?	
12	Are you a practitioner of Indian/Indigenous system of medicine? (Ayurveda/Siddha/Unani) If yes, how long you are practicing	
13	What are the bio-resources based traditional practice you are carryout?	
14	Which one is the unique practice?	
15	Is this you initiated or your elders?	
16	If elders, how many generations that the knowledge/information has passed on to	
17	Why you are interested in this TK issue (current practice)? Explain the reasons	
18	What are the key bio-resources used in this practices?	
19	How they are using?	
20	Locations from where the bio-resources obtained?	
21	How you are getting the resources? Collecting form the local areas by yourself or buying	
22	If buying: From where? How much the cost?	
23	Whether those bio-resources are traded from this area to other places? If so: Who involved in it? Where it goes? For what purpose?	

24	Whether the trade affects its local availability?	
25	Availability trend of the bio-resources over a period: 30 years before Now Future	
26	How you/elders developed the interaction or relationships with bio-resource	
27	Any cultural norms associated with the bio-resources and the TK	
28	Please indicate the potential use/value of bio-resource which you prefer: Ethnomedicinal use and/or application: Name of the ailment/disease: Ethnoveterinary use and/or application: Nutritional use and/or application: Agricultural use and/or application: Others:	
29	How is the local people's / public response on the TK application for treatment?	
30	Why they do not prefer the modern medicines or treatment?	
31	Did you disseminated / propagated your TK with a wider group in this area? If yes, Whom and what was your intention If no; specify the reasons	
32	Can you explain some of the success stories about the disease cured by you or any other traditional healers in this area and the role of bio-resources in it?	
33	Are you willing to share your TK to the next generations in your family? If so, why? If no; specify the reasons	
34	Did you interact with any company representative or researchers? Yes / No	
35	If so when? what was your discussion (explain)? Any further contact with them?	
36	Whether the TK has been shared/revealed to the third party? If yes, whether consent/permission was taken? If no; specify the reason	
37	What about your willingness to give consent/permission to share TK with third party? Explain	
38	What about your opinion about the sustainability of the TK	
39	Do you think any bio-resources associated new knowledge will emerge among the local community? If yes, explain	
39	Any other information	

Kerala State Biodiversity Board