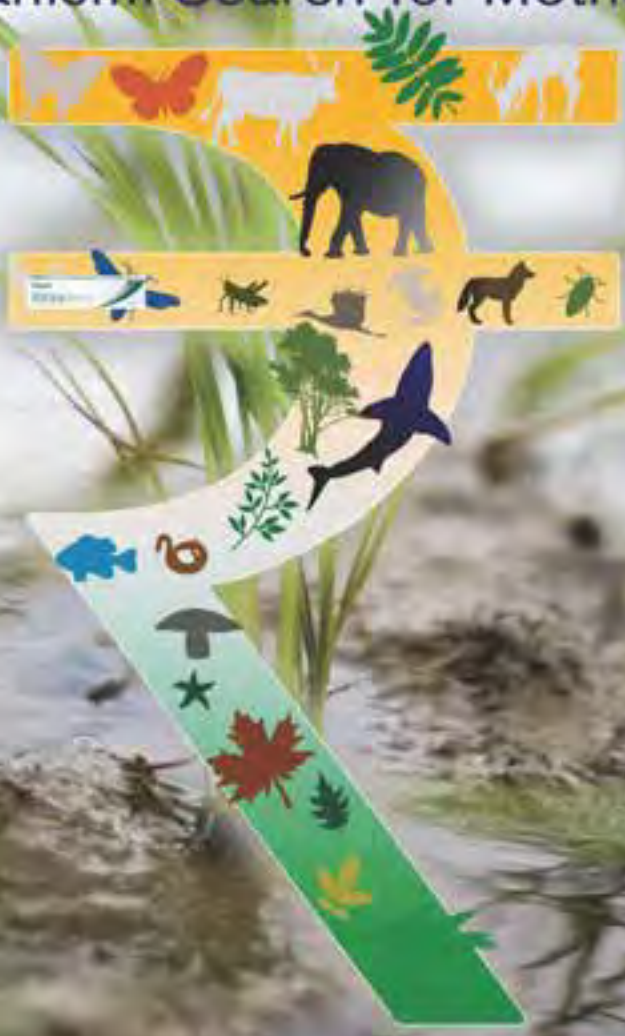
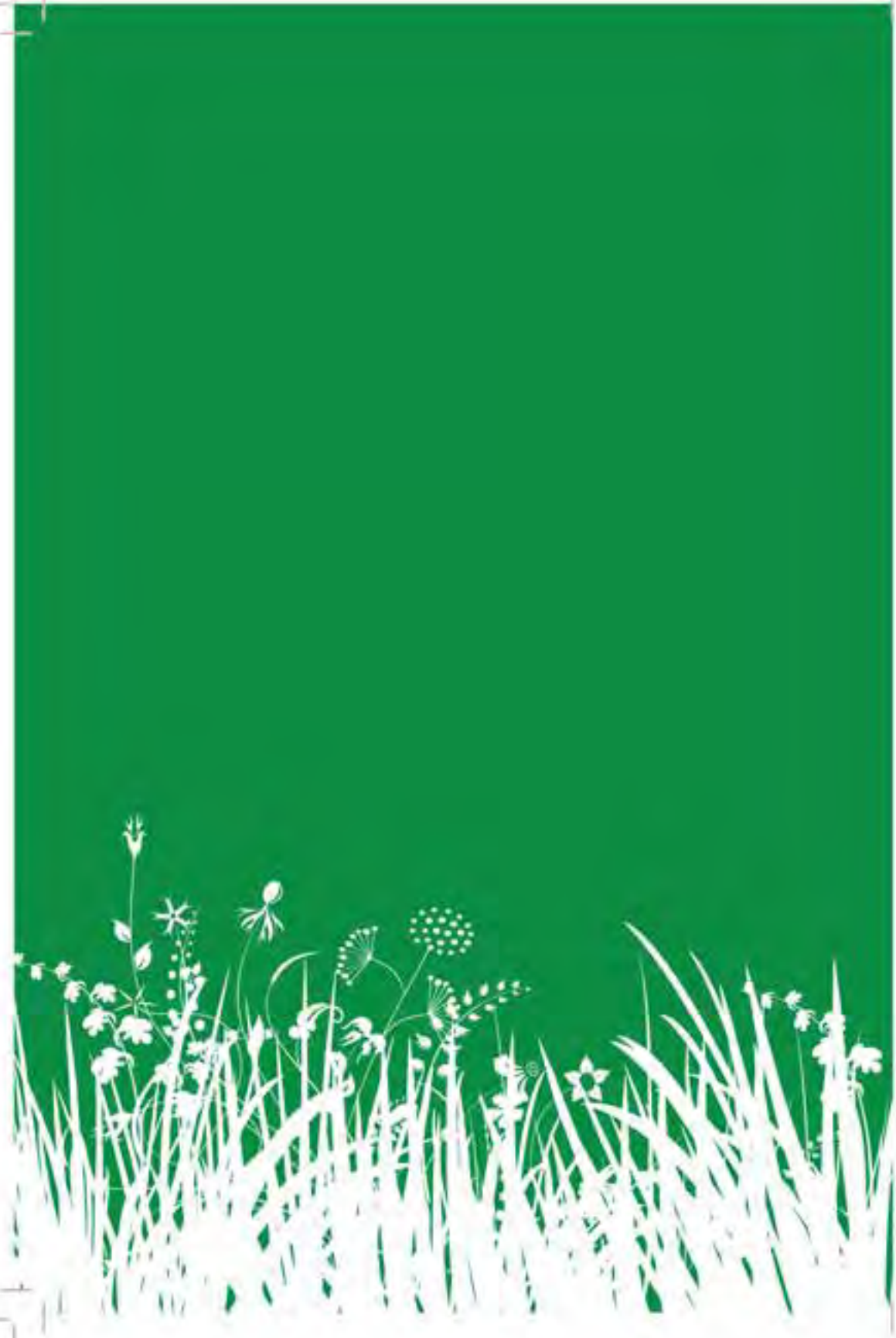
VALUATION OF BIODIVERSITY

Dissemination Paper - 2

Valuation of Bio-resources for Operationalizing Access and Benefit Sharing Mechanism: Search for Methodology





Valuation of Bio-resources for Operationalizing Access and Benefit Sharing Mechanism: Search for Methodology

Authors
Prakash Nelliyat and Balakrishna Pisupati

Acknowledgements

The authors wish to thank the members of the expert committee on 'Economic Valuation for ABS' who helped and guided us in preparation of the three reports. Thanks are also due to participants at the Group Convergence Method workshop on "Recalculation of Net Present Value (NPV) rates for forest diversion in India" in Bhopal who provided insightful comments on the points elaborated in this report.

Design & Layout
D. Muthukumaran, NBA

Printer

FOREWORD

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.

At the National Biodiversity Authority (NBA), we have been focusing on designing an appropriate benefit sharing mechanism related to implementation of the Biological Diversity Act for the past two years where the intention was to understand the economic potential of biodiversity goods for determining suitable benefit sharing plans. We realized, in pursuit of the above, that there are no standard methods to do the same nor there is appropriate understanding of economic valuation for ABS purposes.

The set of three reports compiled through the UNEP-GEF ABS Project is an attempt by NBA to raise the understanding on issues above for suitable determination of benefit sharing under the access and benefit sharing regime.

We are aware that some of the ideas and approaches presented here are not particularly mainstream thinking of environmental economics or economists but we are placing before the readers a perspective that needs attention now. Your comments, if any, are welcomed by the authors.

Happy reading!

Balakrishna Pisupati
Chairman,
National Biodiversity Authority

Chennai
September, 2013

Table of Contents

Introduction

The concerns over the indiscriminate exploitation of biodiversity, due to the increasing demand for the biological resources and the problem of possible misappropriation *inter alia*, have led to the adoption of the Convention on Biological Diversity (CBD), an international treaty to sustain the rich diversities of life on earth, at the Rio-Earth summit in 1992. The Convention, with a near universal membership of 193 countries as contracting parties, has the following objectives: (a) conservation of biodiversity, (b) sustainable use of its components and (c) the fair and equitable sharing of benefits arising from the use of genetic resources. CBD expressly calls for the rights of recognition of indigenous and local communities in conserving the biological diversity and in protecting the traditional knowledge associated with genetic resources. The international community has adopted the legally binding Nagoya Protocol (2010) to ensure fair and equitable sharing of benefits, arising from the utilisation of the biological resources. India is one of the leading countries advocating for its early enforcement. Access and Benefit Sharing (ABS) is a mechanism by which the providers and users of biological resources agree on provision of access to resources and associated knowledge besides sharing benefits of such resources.

ABS is emerging as an innovative approach as well as an incentive mechanism in biodiversity conservation and its sustainable

utilization. The ABS framework provides a formal guidance for the way in which biological or genetic resources are accessed, and the way benefits are shared between people or countries using the resources (users), and the people or countries that provide them (providers). The ABS philosophy proposes: (a) providers of bio-resources are entitled to receive fair benefits from the users, (b) balances the rights of the users of bio-resources with the rights of the providers of such resources and, (c) management of biodiversity as a community asset, and support biodiversity-based enterprises in an effective and sustainable manner.

It is vital that both users and providers understand and respect the legal, administrative and policy frameworks at the national and local levels, as well as those outlined in the CBD and the Nagoya Protocol on ABS. The negotiation between a provider and a user of resources should be based on the true/actual value of the resources. Hence, understanding the real value of bio-resources is a pre-requisite, for the equitable benefit sharing and signing of ABS agreements.

As a party to the CBD and as one of the mega-diverse countries, India enacted the Biological Diversity Act in 2002, and notified the Biological Diversity Rules thereunder in 2004. The objectives of the Biological Diversity Act are similar to those of the CBD and "fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge associated thereto" is the key. The National Biodiversity Authority (NBA), the State

Biodiversity Boards (SBBs) and the Biodiversity Management Committees (BMCs) oversee the implementation of the Act and Rules at the national, state and local levels respectively. In India so far, more than 100 ABS agreements have been signed by NBA and the benefit sharing process is being actively implemented.

Increasingly it is being recognized that for determining appropriate benefits, especially monetary benefits, there is a need to suitably value the biological resources. The real / true value of such resources need to be ascertained for fixing suitable benefit sharing components that does not look purely arbitrary. At present, the NBA is following the criterion of fixing 2-3 % of the sale value of the final products derived from the bio-resources, as royalty for benefit sharing. NBA is currently re-examination of the criterion for fixing the royalty or assessing the value of bio-resources for purposes of ABS, through the on-going UNEP GEF MoEF Project on ABS.

The project on "Strengthening the Implementation of the Biological Diversity Act and Rules with focus on its Access and Benefit Sharing provisions" deals with assessing and quantifying the economic value of biological resources, using appropriate methodologies to determine benefit sharing, which will help in better implementation of the Biological Diversity Act, and inform national decision makers on prioritizing conservative action. In other words, the project is an attempt towards mainstreaming and strengthening the ABS process in India. The project is

implemented in 5 states in India (Andhra Pradesh, West Bengal, Sikkim, Himachal Pradesh and Gujarat) in collaboration with the State Biodiversity Boards and Biodiversity Management Committees.

2. Paradox in Valuation

Biodiversity or ecosystems have significant economic values, which are implicit, in general, rather than explicit. Most of these values are often not captured by the market. Hence, their economic potential is unidentified, which is considered as one of the factors for the rapid depletion or degradation of biodiversity, and the extinction of species. However, understanding the benefits of biodiversity (goods and services) is critical for initiating effective policies towards the conservation and sustainable use of ecosystems.

The Total Economic Value (TEV) of ecosystems consists of use values and non-use values. Use value (direct or indirect uses) is associated with trade and commerce, or cultural and spiritual aspects. Non-use value is derived from the inherent nature of ecosystems and aims to maintain the flora and fauna and ecological balances. Methodology development, particularly for valuing the non-marketed services of the ecosystem has progressed substantially in the last two decades. Methodologies, such as market prices, replacement costs, avoidance of damage cost, production function, hedonic price, travel cost, contingent

valuation, participatory environmental valuation and benefits transfer are well established, and widely used in valuing ecosystem services in different parts of the world.

However, we need to re-examine the valuation process adopted on 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, prescribed above. Here the paradox is; when the ecosystem/biodiversity services are valuing with the help of appropriate methodologies, the ecosystem/biodiversity goods value is determining with the help of existing market prices, which are arbitrarily fixed.

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

Generally, large quantities of divergent "ecosystem goods" are collected or extracted from ecosystems, which human beings can directly or indirectly use either as food, medicines or biomass. These goods are also used in research and development (which lead to the innovation of new products) and trade, and act as the basic raw-material or input factor in manufacturing many products. However, most of our ecosystems (forests, rivers, estuaries, oceans, etc) are common properties. Hence,

the goods from these sources experience market failure or distortion, and the current market price at their collection point does not represent their real or true value or price but only an exchange rate that is too arbitrarily assessed or fixed. In other words, due to the market imperfections, ecosystem goods are 'under-priced'. This might be the reason for the less percentage (negligible share) of goods' value in the TEV of ecosystems, in most of the empirical studies.

In the case of ecosystem goods, particularly those obtained from common property like forests and oceans, 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. Normally, information is disclosed by both the parties (sellers and buyers). In the exchange, the users of ecosystem goods / bio-resources (the companies or their representatives) have better knowledge about their significance and value than the providers. However, the providers (local communities) are being exploited (obtaining only a meagre price), by the traders and companies, who make substantial profits from the business.

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 the CBD Biological Diversity Act of India.

4. Development Process of the Valuation Methodology of Bio-resources

The economic valuation component in the ABS project (estimation of the real value of the bio-resources) is an innovative aspect and a process, since the existing literature on environmental economics is scanty with ABS related experiences. We realized that for ABS purpose, we need to follow a different approach in valuation than the traditional ecosystem valuation - where the non-marketed services of biodiversity were emphasized through the estimation of "Total Economic Value". In this regard, the following steps and process were followed towards the methodology development for bio-resources valuation.

1. Interview / discussions with the experts
2. Literature collection and review
3. Capacity building through participation in events
4. Consultation workshops and stakeholder analysis
5. Consultation with bio-prospecting industries
6. Expert committee meetings and guidance

Interview / Discussions with Experts

As the first step, a detailed discussion or interviews was carried out with the experts on various issues related to valuing biodiversity and bio-resources. Experts includes: Environmental Economists, Ecologists, Biologists, Forest Officials, Agriculture Scientists, Bio-Technologists, Wetland Specialists and SBB

Officials from institutions such as: Madras School of Economics - Chennai, Madras Institute of Development Studies - Chennai, Indian Institute of Technology - Mumbai, Indira Gandhi Institute of Development Research (IGIDR) - Mumbai, Centre for Environment and Development - Kolkata, National Centre for Sustainable Coastal Management – Chennai, FRLHT - Bangalore, Bio-prospecting companies - Chennai, Care Earth - Chennai, United Nation University - Japan, State Biodiversity Boards – Andhra Pradesh, Gujarat, Sikkim, Himachal Pradesh, West Bengal, Kerala etc. The discussions covered the following broader areas and issues:

Valuation Exercises in ABS Project: The major issues discussed in connection with valuation includes literature to be collected and sources, ABS related valuation methods and the need to explore overseas studies and findings, development of methodology (design the study) in Indian context, and examine the NBA's activities in ABS including the agreement processes.

Biodiversity and its Degradation: Discussion under this head emphasized on the reasons and impacts of biodiversity degradation, need to conserve biodiversity and ecosystems in sustainable manner: (ecosystem development as well as human welfare perspectives), traditional *vs* modern approaches and challenges on biodiversity, traditional

knowledge associated with biodiversity, institutional and legal frameworks in biodiversity management, role of local communities in biodiversity management and sustainable use.

ABS as an Innovative Option for Biodiversity Conservation: The issues discussed includes ABS as an economic instrument – incentive mechanism, emergence of the ABS principles under CBD provisions under Nagoya Protocol, Biological Diversity Act and Rules and institutional structures for its implementation in India (NBA, SBB, and BMC), practical constrains and challenges in operationalization of ABS from a corporate perspective, need to understand the real value of bio-resources for signing ABS agreements and need for a comprehensive data base for ABS related information like PBR.

Valuation of Ecosystem / Biodiversity vs Valuation of Bio-resources: The main issues include interlinks of biodiversity and bio-resources and their significant in ABS mechanism, Total Economic Value of ecosystems (direct and indirect values), methods, TEEB study reports, public good character of biodiversity and market distortions assessments, market imperfection analysis, analysis of ABS related bio-products valuation which is differ from the mainstream ecosystem valuation.

Valuation Approach / Methodology: The major issues covered includes valuation methods for non-marketed goods and services of ecosystems, ABS and requirement of market based valuation approach, value addition / value chain analysis of a product derive from bio-resources and bottom-up and top-down approaches in valuation of bio-resources.

Limitations in Biodiversity Valuation: Issues such as uncertainties, complexity in applying valuation methodology, good data base and accuracy of the results are major challenges were assessed.

These discussions provided a better clarity in the kind of valuation required for ABS and insights in developing the standardized economic valuation methods for valuing bio-resources, particularly in ABS perspective.

2. *Literature Collection and Review:*

Relevant literature was collected from various sources include United Nations Environmental Programme (UNEP), Convention of Biological Diversity (CBD), The Economics of Ecosystem and Biodiversity (TEEB), International Union for Conservation of Nature (IUCN), Organization for Economic Co-operation and Development (OECD), South Asian Network for Development and Environmental Economics (SANDEE), Academic and Research Institutions etc., and a review was carried out.

Information analysed includes: (a) Biodiversity and Ecosystem in General - significance, threat, need for conservation, (b) Economics of Biodiversity – Applications of economic principles and instruments in biodiversity management, (c) Access and Benefit Schering – innovative incentive mechanism or financial option in biodiversity management, (d) Biodiversity valuation on different ecosystems: Forest, Agriculture and Wetlands (e) Valuation methodology or tools for different ecosystems, (f) Bio-resources: nature, characteristics, and economic significance, (g) Bio-resources based economic activities and production, (h) Economic valuation of bio-resources, (i) Methods for bio-resources valuation and (j) Data base and limitations.

All these information (literature) is compiled in an auto-run CD and has been distributed widely. Most of these studies attempted valuation, but predominantly on ecosystem / biodiversity valuation. This exercise helped us to understand the methodologies of economic valuation of biodiversity in more systematic and efficient manner and the kind of valuation required for the bio-resources valuation, particularly for the ABS.

Further certain specific literature on bio-resources valuation was collected. A thorough review of these literature revealed that, some of the environmental economists attempted to value bio-resources such as medicinal plants and genetic and microbial resources. The intention of these valuation studies was to assign

a value to cultivatable lands, and forests where the plants or resources are growing or derived from. The major findings of the studies are given in in Appendix 1. The authors of these studies argued, that through estimating and assigning a value to these ecologically fragile lands like forests, considering their resources (such as medicinal plants) may help in conserving the land or resources and overcome the threats of different land use changes.

The following are the emerging inferences from the literature reviewed and the significance in the ABS for process.

Biological resources have huge economic potential through bio-prospecting, and are capable of enhancing human welfare in multiple ways.

The loss of a species is a major concern. Various developmental activities and land use changes are the main causes of biodiversity destruction.

The lack of understanding of the 'Economic Value' of a species is a major lacuna for policy making.

For preserving a species, its habitants (biodiversity hot spots) should be conserved. In this regard, the value of the species and ecosystems (forest areas and agriculture lands) has to be estimated and projected for decision making.

Studies have not emphasized the valuation of non-marketed ecosystem services.

The literature considered the bio-resources (such as medicinal plants, microbes, genetic resources), bio-prospecting, and the products' (drugs, cosmetics, food items etc.) manufacturing capacity in valuation, which is significant for ABS.

Some of the studies distinguished the market value of bio-resources from the economic value.

All the studies used sophisticated statistical models for deriving the economic values of different bio-resources.

The need for a comprehensive data base on bio-prospecting and taxonomy is highlighted.

A majority of the studies attempted to value medicinal plants in the forests, based on the plant's drug manufacturing potential. This type of valuation could create a better understanding of the economic significance of bio-resources (medicinal plants) among the policy makers and the public, and in designing appropriate strategies for the conservation and sustainable utilization of the resources.

Different studies followed different methodologies that emphasized the field level circumstances and data availability, and arrived at different values.

Broadly the values assigned by these studies to bio-resources, like medicinal plants, are low.

Some of the studies strongly indicated the diminishing values

of the marginal species, and the issues of redundancy in bio-prospecting. This is clearly revealed from the probability of new drug manufacturing from the marginal species.

Certain studies advocated that the income derived from bio-prospecting is an ideal source of revenue for the conservation of biodiversity.

None of the studies approached or discussed the ABS type of valuation. These are primarily the 'gap filling' type with academic and research interests, rather than the "valuation for commercial purpose" like the ABS. Hence, according to the studies, whatever the final figure (value) arrived at is not a big concern, since it is not directly used for any policy decisions.

However, some of the methods or approaches used by certain studies are very promising, and can be considered for the valuation we are seeking for ABS, with the required modifications based on the field level realities.

3. Capacity Building Through Participation in Events

The staff involved in the valuation exercises participated in various events / programmes related ABS. These programmes include:

Capacity-building workshop on Access and Benefit-sharing was organized by CBD from 30 June to 1 July 2012, New Delhi.

Training on National Legislation on Biodiversity for Government Officials of SAARC Member States, on 29 – 31 August, 2012. Mahabalipuram.

Capacity Building Workshop on Access and Benefit Sharing and Traditional Knowledge for ASEAN Countries, 04-05 September, 2012, New Delhi.

COP 11, 15 - 19 October, 2012, Hyderabad.

National Biodiversity Congress – 2012, 28th and 29th December, 2012 at Trivandrum and

Indian Science Congress – 2013, 5 - 7, January, 2013, at Calcutta.

These events help in enhancing the staffs' knowledge (capacity) in ABS, biodiversity management strategies and bio-resources valuation.

4. Consultation Workshops and Stakeholder Analysis

A series of national / state level workshops on "Strengthening the Implementation of the Biological Diversity Act and Rules with Focus on Access and Benefit Sharing Provision" was conducted. This project events has completed in the states like; Sikkim (6 – 8 December, 2012), Andhra Pradesh (14 – 15 December, 2012), West Bengal (8 - 9 January, 2013), Gujarat (19 - 20 March, 2013) and Himachal Pradesh (9 – 10 April, 2013). This workshop was targeted for State Biodiversity Board and other government officials, experts from academic and research

organizations members from the Biodiversity Management Committees, and other stakeholders. "Economic valuation of bio-resources" was one of the major components discussed and debated in the workshop. The progress and issues on the bio-resources valuation was presented in the workshops (which is a real multi-stakeholder forum) and obtained the participants feedback and suggestions. This attempt helped substantially in smoothen the development process of methodology for bio-resources valuation for implementation perspectives.

5. Consultation with Bio-prospecting Industries

Since the role of industries is significant in the ABS process, we paid preliminary visits to Chennai based bio-resources / bio-prospecting industries, and carried out interviews with the managements. Various bio-resources used for Research and Development (R&D) and manufacturing, the economics of R&D, the production process and its cost, stake in biodiversity management etc. were the major topics discussed. These attempts were immensely useful in understanding the need for industries' cooperation in the operationalization of the ABS, and their willingness in sharing the required information and data for estimating the real value of bio-resources, when they are obtained from the community. For reasons of confidentiality, the details are proposed here as clusters (company A, B, C and D). The discussions revealed the following nature of activities.

Company A: Company A is a leading R&D Company involved in the inspection, verification, testing and certification of pharmaceutical samples. It has capabilities in analytical, bio analytical and clinical trial testing along with process management, which helps pharmaceutical companies to achieve maximum safety and cost effective production. Further, Company A is a nationally and internationally recognized agency for quality checking, and certification of pharmaceutical products and drugs. The company's rough cost distribution allocates 50% to R&D, 30% towards administration charges and 20% as profit.

Company B: Company B is a government of India undertaking, which has partnered with the Ministry of Health and Family Welfare, to set up a premium facility for production of vaccines for the National Immunization Programme and other new generation vaccines. The main objective of Company is to ensure safe and effective vaccines at affordable prices. They purchase microbial strains from the National Centre for Cell Sciences (NCCS), which collects and isolates the strains from nature in a limited quantity. Using the very small quantity of the initial collection of the strain, the required amount is cultured and maintained by the company for further use. Company B also seeks to develop a strong R&D base for the development of futuristic vaccines, apart from manufacturing and

supplying vaccines required for the Universal Immunization Programme (UIP) in India. The major steps involved in the vaccine manufacture include: identification and sourcing of seed materials, process standardisation and development, testing and procedures – human and clinical, production and manufacturing, and marketing. The cost distribution pattern of the company includes 30% for R&D, 50% for the production including the capital and variable costs, and the balance 20% as profit.

Company C: Company C is to discover and provide innovative, sustainable ingredients for health, nutrition and wellness, with limited dependence on nature. Company C uses biosynthetic and evolutionary technologies to create and optimise small molecular compounds and their production routes. Company C is actively involved in consumer healthcare and nutrition, as well as in pharms. This company uses yeast as its resource to make new ingredients by using new technology. Yeast can be used in pharmaceutical products and vaccines. The discovery and implementation of new ingredient production routes, as well as the discovery of novel functional ingredients are Company C's major role. The major steps involved in the company include: Yeast synthesis in the laboratory, developing new technology (R&D), and new novel ingredients, such as saffron crocus from saffron, stevia glycosin from the stevia plant, pomcins from pomegranate, and vanilla from vanilin.

Company D: Company D is a bio- fertiliser, and a bio-pesticide manufacturing and supplying company. This company is registered under the Central Insecticide Board and Indian Institute of Horticulture and Research. The basic culture required for manufacturing (tricoderma viride, tricoderma harzianum, pseudomonas flurescens azospirillum, gluconacetobactor, phosphobacterium, rhizobium, vesicular arbuscualr and mycorrhiriza) was procured from the Tamil Nadu Agriculture University. The estimated cost distribution of the company includes 30% for administrative charges, 50% for processing, (culture, multiplication, packing and stripes) and transport charges, and 20% as profit.

The major lessons learned from the interaction with the industrial experts are:

The use of bio-resources by companies varies substantially, depending upon the purpose for which the company is seeking bio-resources, such as R&D and raw-material for production.

Some of the companies collect bio-resources, such as strains from the authorized culture centres, and propagate them as per their requirements.

According to these companies they are not 'destroying the bio-diversity', since their initial collection from the parent institutions is negligible.

In bio-prospecting, the role of R&D is crucial, where the human brain and technology are the key factors.

According to the R&D companies, even if they fail in their research, this could be a lesson for avoiding further failures.

In R&D, a company may target some objective or product but may achieve some other things. In these circumstances, the correct judgement of success and failure is a challenge.

In certain companies, the success rate of R&D is only 10%. But in bio-prospecting, the general success rate is indicated as 50%.

In a broader sense, the bio-prospecting industries' R&D cost should cover only 20 to 30% of the total production cost. Hence, any achievement at a lower cost might be a big gain or benefit to the company.

The detailed cost information of companies can be obtained through a questionnaire survey. However, the willingness to share information from the company's side is important.

Companies do not think or anticipate resource crises or scarcity in future; hence their priority for biodiversity conservation is insignificant.

6. Expert Committee Meetings and Guidance

For obtaining the expert guidelines on "Development of Methodology for Economic Valuation of Bio-resources" an expert committee was formed (Appendix 2)

The first meeting was conducted on 12th December, 2012 at NBA. The major issues or points discussed in the meeting include:

Significance of valuation of bio-resources in piloting ABS agreements and complexities in valuation.

The common property and public good character of bio-resources.

Importance of Traditional Knowledge (TK) and its inclusion in valuation.

Need of quantitative data for valuation with a focus on variety of bio-resources collected from a geographical area, quantity of collection, methods of collection, middle man's role in the process of collection, time and efforts required for collection etc.

'Scarcity value' of the resources should be considered in the valuation exercises.

Negotiation between NBA and company.

Knowledge of the users about the value better than the sellers.

NBA has supposed to collect more economic information about the companies for processing the ABS application. This information includes: firm's turnover, number of employees, incorporation year, nature of the firm: products manufactures, investment in Research and Development,

the purpose for which the raw material is used for, financial details: profit before tax, after tax, from which state do they procure bio-resources etc.

Such information has thus been collected now.

The Second Expert Committee meeting on "Development of Methodology for Economic Valuation of Bio-resources" was held at National Biodiversity Authority (NBA) on 13th July, 2013. Following are the issues emerged from the meeting:

Uncertainty and Information Gap

There is huge uncertainty in the entire process of bio-resources valuation and benefit sharing. However, one can overcome these issues through the "probability" considerations and estimations. Further information asymmetry plays a significant role and became a major constraint in bio-resources valuation.

NBA should develop and manage "taxonomic database" for all biological resources in the country. These database should contain the information on current status of bio-resources, its sustainability, users' rights etc.

For handling the ABS application, NBA should follow a parallel approach, which followed by the Pollution Control Boards on industries. Bio-resources come for ABS agreements which need to be categorised based on the nature of the resources and its purpose of usages in the company.

Nature of Valuation Method and Benefit Sharing

There is no generalised formula for valuing bio-resources. Based on the product and situations in the state, separate formulas need to be developed. Value/supply chain analyses for bio-resources have high scope and considered as a broader framework. Bio-resources valuation approach should be based on; product, market alternative, monopoly rent, and factor cost method. Marginal value of the input into the final product through factor cost analysis is an appropriate approach.

Methodology adopted for the estimation of Net Present Value (NPV) of the forests conversion in India, can also considered for bio-resources valuation,.

Bio-resources used for Research and Development (R&D) and commercial uses need to be considered differently. Generally, R&D collection would be in a limited quantity and should not affect the sustainability of the resources and its stock. Hence the value for the bio-resources collected for R&D can be brought under the flat-rate. But bio-resources used for commercial use should be valued through the "value chain analysis".

There is a need to consider the non-negotiable aspects of ecosystems too in the valuation exercises.

Benefit sharing should be emphasised in both monetary and non-monetary terms. The non-monetary benefits and its sharing are more significant in certain cases.

Clarity is required on what formula would be used to share resources with the community. For this we need to answer questions such as; whether existing laws would give communities enough rights to claim benefit sharing? What about protected areas and the bio-resources prospecting within these areas?

Knowledge about the Value of the Resources

Providers are not aware about the potential value and commercial scope of bio-resources. Scientists and industries are more aware about the potential value of bio-resources. Negotiation between the providers and users of bio-resources is more important. Further they should also share the risks mutually. Providers can demand an exclusive price for bio-resources, which they exchange.

Certain bio-resources (species) are unique and traditional knowledge plays a significant role in its identification and extraction. Sellers' or providers' "Traditional Knowledge" aspects should consider in valuation.

Government Monopoly and Rent

Government monopoly on bio-resources should be emphasized. Bio-resources are state resources; hence state

is having a monopoly on the resources. This monopoly rights may help in demanding better price for resources. State should follow an approach; "bio-resources is state (my) resources, you are using hence you pay for it". Most of the bio-resources do not have substitutes. Hence a scarcity rent and information rent play a crucial role in real value estimation.

For estimating information rent details on cost of production, financial revenue for the bio-prospecting and probability hit are required.

Institutional Collaboration

For identifying and determining the future potential value of the resources, institutional collaboration is required. Concerned government organizations on biodiversity management, researchers and users (companies and other business entrepreneurs) should come together in the negotiation process.

Current Practice of Bio-resources Extraction

Bio-resources, particularly forest products are under-priced. Bio-resources extraction from common lands is taken place legally as well as illegally. For legally collected forest products, prices were fixed by the Forest Department. However this price does not represent the economic value or the true value of the resources.

ABS as an Incentive Mechanism

ABS agreements can be consider or make as an incentive mechanism. The companies who complies the ABS norms can give tax exemptions and other appropriate incentives. Further certification and labelling can be used as a criteria.

5. Possible Approaches / Methodologies for Valuation of Bio-resources

The economic valuation or estimation of the bio-resources at their collection point is an innovative 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.

A. Value Chain Analysis

Many value added products are derived from bio-resources. Generally, value addition for bio-resources (raw) and bio-resources based products occurs either through transaction costs or / and processing / manufacturing costs. Generally, the markets for bio-resources at their collection point are highly uncertain. A number of unexpected factors play a role at this

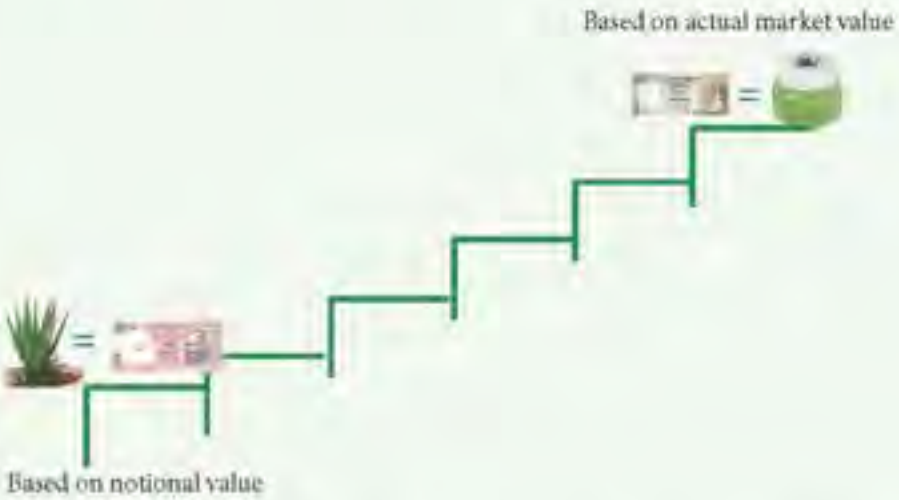
stage, which makes for market imperfections. Transaction costs are the costs of particular bio-resources' movement from their collection point to the company gate, and occur through transportation charges and brokers or dealers' profits. For example: in the case of honey, the collection price at the forest gate may be Rs. 50.00 per kg, and its final consumer price at a distant city may be Rs. 200.00, transacted through different agencies such as federations, wholesalers, and retailers at different locations. Hence, the price spread is Rs. 150.00 (Rs. 200 - 50). The ABS concern is whether the price spread is reasonable or not, and if not, what are the abnormalities in, and how will it bounce back to the communities or providers of the honey?

Further, certain bio-resources are basic raw-materials for manufacturing final consumer products. For example: Jeevani an immuno-modulatory product (ayurvedic medicine) is manufactured from the plant known as Arogyapacha. Here the Arogyapacha (required for manufacturing one bottle of medicine) may be provided by an indigenous community for Rs. 108.00 and a bottle of Jeevani (450 grams) may cost Rs. 900.00. In this production process, Arogyapacha is an unavoidable input factor, but not an exclusive one. Many other products (inputs) and knowledge/skill (research and development) also contribute to Jeevani production. Hence, the processing / manufacturing costs at different stages are significant. Through an amortised (remunerated) pricing technique, one can estimate

the real price of Arogyapacha. The same approach is applicable in the case of bio-prospecting based R&D. But the probability of success and failure and their prediction, is a key factor.

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, the following steps (general as well as specific) are proposed with reliable information sources (see Tables 1 and 2). However, substantial support from various stakeholders, who are part of this exercise, is required for the successful estimation of the value of bio-resources.

Table: 1

Bio-resources real price estimation : basic/general steps		
Steps	***Tasks***	***Source of information***
First	Identification of the the key bio-resources (having economic and ABS potential) extracted from a geographical area /ecosystem	BMC, PBR, local community, indigenous group, forest department
Second	Understand the Status of the bio-resources (Rare Endangered and Threatening-RET, Abundant,Endemic), for providing a weightage in valuvation process (rent)	BMC, PBR, local community, indigenous group, village taxonomists, forest department
Third	Understand its potential / purpose / usage	BMC, traders, research organizations, government departments, industries
Fourth	Identify its leverage/ Movements: Local –» Regional –» States –» National –» International	BMC, traders, industrial association, companiesm exporters, custom departments
Fifth	Prioritize the promising uses based on value addition (ranking)	Industries, traders, research organizations.

Table: 2

Bio-resources real price estimation : specific steps		
Steps	***Tasks***	***Source of information***
First	Select any manufacturing or bio-resources processing company	Appropriate industry
Second	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
Third	Identity the major production steps	Company management and production manager
Fourth	Identify the different factors of production involved in each stage and its cost / remuneration (Factor cost method)	Company Management, production manager and labourers
Fifth	Identify the abnormal benefit claimers and rates (differences between company rate with general market rate)	Company management, production manaer, labourers, industrial/govt. departments
Sixth	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 BMC

In brief, the value chain analysis is applicable where bio-resources are used an input factor in production, or considered as a commercial product. Here, the input output process and the value additions at different stages of production with cost accounting is the key to value chain assessment.

B. 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 he is not involved in or aware of the potential use and the production process. But the buyers (industries and the R&D companies) 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 'real value'. For arriving at this strategy, the following pre-conditions and assumptions are necessary.

The final users of the bio-resources (industries or R&D sectors) need to directly procure the resources from the community. In other words, the exchange should not be through traders (who are not aware of the potential use of the resources).

The community's empowerment in bio-resources should be sensitized. Only then can the communities' active involvement in the exchange process (like auction) materialise, and fair prices obtained.

In empowering communities, the role of different local institutions like panchayats and Biodiversity Management Committees (BMCs) is significant.

In this process, the community (as a custodian of resources) 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, which is becoming more controversial.

C. 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 state property. Here, communities obtain the privilege of the users' right. Since it is a state property, any resource-based management issues (such as scarcity, extension and unsustainability) should come under the purview of the Government. Bio-resources have multiple uses and diverse product manufacturing capacity and value generation (it is not a uniform resource like water). With this consideration the government authority concerned, can fix a 'tax' or apply any other appropriate instrument for the extraction of the particular resources.

The following criteria need to be considered, before selecting the appropriate economic instruments and fixing the tax rate. Further, this information needs to be carefully analysed.

(a) An inventory of bio-resources in a particular collection point

(b) Bio-resources' current stocks, volume of extraction, sustainability rate, extinction level

(c) Anticipated changes in the resources in future (positive and negative).

In brief, these instruments can also act as an economic disincentive in the 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, may be an issue that need consideration.

D. Minimum Support Price for Bio-resources

The authority concerned (Biodiversity Management Committees) 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.

E. Collectors' Willingness to Accept and Minimum Livelihood

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 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.

6. Conclusions

Developing an appropriate methodology for valuing bio-resources, which are used for commercial purposes, is extremely important for signing the ABS agreements, and charging the 'real value' for bio-resources from the users. In this respect, it is significant that to develop case specific and / or separate formulas for valuing bio-resources. Hence bio-resources are categorised under 6 heads and separate possible methodologies / approaches was drafted (see table 3) and the trial valuation exercise is progressing at NBA.

Table 3 - Valuation Methods Derived from the Expert Committee Meeting (13th July 2013)

Category of Bio-resources		Possible Methodological Approach	Payment Detail
A	Bio Pharmaceuticals (modern drugs)	Scarcity Rent (SR) + Information Rent (IR) (share a proportion attributable to the product).	Initial payment + payment at the time of product development + payment at marketing stage.
A1	(Population status, Rare Endangered and Threatening (RET), Abundant, Endemic)	Endemic Rent (ER)	Monetary + Non- Monetary (for endemic and RET)
B	Bio-technology (Seed / Agriculture Related), Land races, Microbes,	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).	One time
D	Botanicals (AYUSH)	Based on the proportion of Net Present Value (NPV) of the profit x the contribution of input to the out put	One time
E	Nutraceuticals / Personal Products cosmetics	Based on the proportion of NPV of the profit x the contribution of input to the out put	One time
F	Academia / R&D (non-commercial scientific research)	Onetime fee + renegotiation change in intent	One time

Appendix 1

Selected Studies in Bio-resources Valuation and Major Findings Analysed for this Report

S.No	Author and Year	Study	Major Inferences
Microorganism			
1	Masahiro Miyazaki (2006)	Economic value of Microbial Resources	* Microbial resources were used as screening materials for developing new pharmaceuticals * For valuation sum of an initial charge and expected royalties obtained from pharmaceutical companies were considered. * Values vary from US$2-60/strain, depending on their quality and value added capacity. * Microbes from natural habitants have low value * For source countries to gain a greater share of the benefits from microbial resources, they should, build human and technological capabilities to isolate, preserve and characterize microorganisms and provide users with more value-added resources.
Genetic Resources			
1	Douglas Gollin and Robert Evenson (2003)	Valuing Animal Genetic Resources: Lessons from Plant Genetic Resources	* There are strong similarities between plant and animal genetic resources * From methodological standpoint many of the technique developed for assessing the value of PGRs seems to be appropriate for animal genetic resources as well * Hedonic pricing, simulation techniques and production function estimates all seem to be pertained in the case of animal genetic resources. * The challenges in these areas of research are primarily empirical rather than theoretical.
2	Eric Rutos, Guy Garrods, and Riccardo Scarpab (2008)	Valuing Animal Genetic Resources: A Choice Modeling Application To Indigenous Cattle in Kenya	* Loss of traditional livestock breeds could result in the loss of an important genetic resource as a variety of important genetic traits adapted to local conditions. * For investigate buyers' preferences for indigenous breeds, choice experiment approach has used. * The study suggested that some form of intervention may be required to ensure the preservation of animal genetic resource.
Marine / Coral			
1	Jack Ruiten beek and Cynthia Cartier (1999)	Issues in Applied Coral Reef Biodiversity valuation: Results for Montage bay, Jamaica	* Most valuation techniques fail to adequately come to grips with issues of system complexity; these include issues such as non- linear ecological-economic linkages, interdependencies and redundancy in the species discovery process, cost interdependencies in the R&D process of bringing new products to market, and ecosystem yield in terms of species-area relationships for coral reef systems.
2	Cartier.C, and Ruiten beek. (2000)	Montego Bay Pharmaceutical Bioprospecting Valuation	* Utility, production and rent valuation approaches can be used to estimate the value of the marine products through bio-prospecting. * Successful data is required to translate sampling information (species type and count) into final consumer product.

Crops			
1	Michael Salassi et al., (2000)	Valuation of Perennial Crops Associated with Agricultural Land Sales: The case of sugarcane in Louisiana	* Value of the perennial crop (sugarcane) has estimated. Same methods would also be applicable to other perennial crops such as fruit, nut, spice, and ornamental crops. * Three valuation procedures were followed: the sales comparison approach; the cost approach; and the income capitalization approach.
2	Diwakar Poudel and Fred Johnson (2009)	Valuation of crop genetic resources in Kaski, Nepal: Farmers willingness to pay for rice landraces conservation	* Used the contingent valuation method to document the economic value of crop genetic resources based on the farmers' willingness to pay for conservation. * The mean willingness to pay was USD 4.18 for in-situ and USD 2.20 for ex-situ conservation per annum. * Landholding size, household size, education level, socio-economic status, sex of respondent, number of crop landraces grown, and knowledge on biodiversity influenced the willingness to pay for in-situ conservation. * Only landholding size and household size influenced the willingness to pay for ex-situ conservation.
Medicinal Plants			
1	Peter P Principe (1991)	Valuing the Biodiversity of Medicinal Plants	* Distinguished between the market value of a commodity and its economic value. * The market value is the value the market place attributes to a given commodity or its derivative product. * Economic value is the total benefits of a product. * With respect to medicinal plant species, two aspects of economic value are significant. 1. The economic value of the drugs derived from these plants includes not only the market value but also the societal benefits from increased good health (e.g. wages not lost, Health care costs averted the value individuals placed on the better health, (etc.) 2. The non-pharmaceutical uses and benefits that the plants provide (i.e. the informational and environmental benefits).
2	Michael Balick and Robert Mendelsohn (1992)	Assessing the economic value of traditional medicines from tropical rain forest	*Tropical forests are a rich source of unknown chemicals that may eventually prove useful to medicine and traditional medicines, currently the basis for much of the primary health cares in tropical nations. *In order to quantify the value of managing forests as a source of traditional medicines, an inventory of plant material in specific plots is a pre-request. *Systems for the sustainable collection of plant medicines and other non-timber products from the tropical forest need to be documented and developed for use on a much broader scale.
3	David Pearce and Dominic Moran (1997).	Economic value of Medicinal plants in 'The Economic Value of Biodiversity'	* The study proposed the following valuation approaches. 1. By looking at the actual market value of the plants when traded; 2. By looking at the market value of the drugs of which they are the source material; 3. By looking at the value of the drugs in terms of their life-saving properties, and using a value of a 'statistical life'.

4	Pushpam Kumar (2014)	Valuation of Medicinal Plants for Pharmaceutical Uses	*Attempted to review the acclaimed valuation works done during 1985-2000 with emphasized on the valuation of plant diversity for pharmaceutical uses. * Since these studies were address different concerns, it is difficult to arrive at general consciences on the methodologies they developed or adapted. * The value of a medicinal plant varies from $ 0.2 to $ 340 million per annum. * The study proposed that rather than a general study, local or area based studies taking into account its features of species and genera and its ecological function should be the preferred approach
5	Haripriya Gundimeda et al (2006)	The value of Biodiversity in India's forests	* For obtain the value of genetic material from the plant-based drugs, three approaches have been proposed: (a) values arising from traded plant material on the assumption that the market value represents the true WTP, (b) uses the market value of plant-based drugs and (c) estimates the value of plant-based drugs in terms of their lifesaving properties. * Empirical studies for genetic material, revealed a low value due to market imperfections.
6	Nguyen Chinh (----)	Economics values of Conservation & Use of floral and Medicinal Plant Genetic Resources in Vietnam toward Sustainable Use	* Land uses for economic development purposes, but not conservation, are often subsidized. Therefore conservation of genetic resources of flora in general and medicinal plant in particular, has to face unfair competition. * The "public good" nature of genetic resource diversity and the economic distortions in the market place, and as a result, total economic value of genetic resource will be imprecise. This results in errors in policy making of conservation and sustainable use of floral and medicinal plant genetic resources.
Pharmaceutical Research			
1	David Simson, Roger A. Sedjo, John W.Reid (1996)	Valuing biodiversity for use in Pharmaceutical research	* Biodiversity prospecting is a mechanism for both discovering new pharmaceutical products and saving endangered ecosystems. * The value of the marginal hectare of habitat and the incentives for habitat conservation generated by private pharmaceutical research are very modest. * Pharmaceutical researchers' willingness to pay for biodiversity as an input into commercial products is the concern. * The value of the marginal species must be very small. * There are several reasons why genetic resources may be relatively redundant. First, the same species may be found over a wide range. If all representatives of a species produce a particular compound, individuals in excess of the number needed to maintain a viable population are redundant. Second, there are numerous instances in which identical drugs, or drugs with similar clinical properties, have been isolated from different species.

2	Gordon C. Rausser and Arthur A. Small (2000)	Valuing Research Leads: Bio prospecting and the conservation of Genetic Resources	* Bio-prospecting has been touted as a source of finance for biodiversity conservation * Bio-prospecting value of the 'marginal unit' of genetic resources is likely to be small, creating essentially no conservation incentive. When genetic materials are abundant, information rents are virtually unaffected by increases in the profitability of product discovery and decline as technology improvements lower search costs. * Numerical simulation results suggest that, under plausible conditions, the bioprospecting value of certain genetic resources could be large enough to support market-based conservation of biodiversity. * When R & D firms compete both in the market for leads and in the race to patent commercial discoveries, they will be willing to pay a premium for exclusive access to research options.
3	Amy R. Craft and R. David Simson (2001)	The value of Biodiversity in Pharmaceutical Research with Differentiated products	* Biodiversity prospecting (the search among naturally occurring organisms for new products of agricultural, industrial, and, particularly, pharmaceutical value) has been advanced as a mechanism and a motive for conserving biological diversity * For estimating values two models have been employed. The Salop's model, in which products are located at different places around a circle representing the space of all consumers preferences. The Dixit and Stiglitz's model of monpolistic competition between sellers of products with demands derived from constant elasticity of substitution (CES) utility functions. * Model confirms that the value to private researchers of the "marginal species" is likely to be small.
4	William H. Lesser and Anatole Kratiger (2007)	Valuation of Bioprospecting Samples Approaches, Calculations and Implications for Policy Makers	* The revenue consequences of varying collection fees and royalties with regard to germplasm prospecting contracts are demonstrated * Uncertainty of finding marketable products and the value of these products were the emphasis. * Negotiation factors are finding a good balance between collection (initial) fees as opposed to royalty (delayed) payments
5	Onofri L and H. Ding (2012)	An Economic model for Bio prospecting Contracts	* Explored the use of a micro-economic model to analyse the provisions and parties of bioprospecting contracts. * Focuses on the pharmaceutical industry as the representative biodiversity buyer * The main contractors involved in these private deals are biodiversity sellers and biodiversity buyers * Attention is devoted to the different, mixed impacts of bioprospecting contracts and patenting on social welfare. The positive welfare impacts delivered by bioprospecting contracts are associated with the potential discovery of a new drug product, i.e. productivity gains, non-monetary benefit-sharing or transfers and royalty revenues. The negative welfare impact results from the legal creation of a monopoly and the related well-known effect on the consumer surplus.

6	Alan Harvey and Nigel Gericke (2011)	Bioprospecting: Creating a Value for Biodiversity	Bioprospecting is the exploration of biological material for commercially valuable genetic and biochemical properties. * This paper emphasised on the search for activities that could form the basis of new pharmaceuticals. * Historically, most of the active ingredients in medicines have been natural products and natural products continue to form a productive source of new drugs.

Appendix 2

Expert Committee Members for "Development of Methodology for Economic Valuation of Bio-resources"

Sl. No	Name	Affiliation
1	Dr. Balakrishna Pisupati	Chairman, National Biodiversity Authority
2	Dr. U. Shankar	Emeritus Professor, Madras School of Economics, Chennai
3	Dr. Paul Appasamy	Visiting Professor, Madras School of Economics, Chennai
4	Dr. Madhu Verma	Professor, Indian Institute of Forests Management, Bhopal
5	Dr. G. Haripriya	Associate Professor, Indian Institute of Technology, Mumbai
6	Dr. S. Suneetha	United Nations University, Japan (based in Chennai)
7	Dr. K. S. Neelakandan	Rtd. Forest Officer, Chennai
8	Dr. Ajit Menon	Associate Professor, Madras Institute of Development Studies, Chennai.
9	Dr. Hemant K Gupta	Joint Member Secretary, Himachal Pradesh Biodiversity Board, Shimla.
10	Mr. Debal Ray	Member Secretary, West Bengal Biodiversity Board
11	Dr. Ishwar Poojar	Project Manager, UNEP-GEF ABS project, NBA
12	Dr. Thomson Jacob	Consultant, UNEP-GEF ABS project, NBA

References

Amy B. Craft and R. David Simson (2001) "The value of Biodiversity in Pharmaceutical Research with Differentiated Products", 'Environmental and Resource Economics' Vol.18. page 1-17.

Cynthia Cartier and Jack Ruitenbeek (1997) "Montego Bay Pharmaceutical Bioprospecting Valuation". in Integreted Coastal Zone Management of Coral Reefs: Decisions Support Modelling, Edited by Kent Gustavson, Richard . M Huber, Ruitenbeek. J.

David Pearce and Dominic Moran (1997) "The Economic Value of Biodiversity", IUCN The World Conservation Union , Earth scan Publications Ltd, London, pp.68-69.

David Simson. R, Roger A. Sedjo and John W. Reid (1996) "Valuing Biodiversity for use in Pharmaceutical Research" Journal of Political Economy Vol.104. No.1.1996.

Diwakar Poudel and Fred Johnson (2009) "Valuation of Crop Genetic Resources in Kaski, Nepal: Farmers Willingness to Pay for Rice landraces Conservation," Journal of Environmental Management Vol.90. pp. 483-491.

Douglas Gollin and Robert Evenson (2003) "Valuing Animal Genetic Resources: Lessons from Plant Genetic Resources". Ecological Economics 45, pp. 353-363.

Eric Ruto, Guy Garrod and Scarpa. R (2008) "Valuing Animal Genetic Resources: a Choice

Modelling Application to Indigenous Cattle in Kenya". Agricultural Economics,38. pp 89-98.

Gordon C. Rausser and Arthur A. Small (2000) "Valuing Research Leads: Bioprospecting and the Conservation of Genetic Resources" Journal of Political Economy Vol.108. No.1

Haripriya Gundimeda, Sanjeev Sanyal, Rajiv Sinha and Pavan Sukhdev (2006), "The value of Biodiversity in India's forests", Green Accounting for Indian states (GAIS) project, (Monograph 4).

Harvey.L.Alan and Gerikie. N (2011) "Bioprospecting: Creating a Value for Biodiversity" in Research in Biodiversity - Models and Applications edited by Igor Ya. Pavlinov. pp 323-338.

Jack Ruitenbeek and Cynthia Cartier (1999) "Review Paper: Issues in Applied Coral Reef Biodiversity Valuation: Results for Montage Bay, Jamaica" World Bank Research Committee project RPO# 682-22 'Marine System Valuation: An Application to Coral Reef System in the Developing Topics'.- Final report, pp. 52-73.

Masahiro Miyazaki (2006), "Economic Value of Microbial Resources" Microbial cult. Coll.pp15-19.

Michael Balick and Robert Mendelsohn (1992) "Assessing the Economic Value of Traditional Medicines from Tropical Rain Forest", Conservation Biology: 6(1).

Michael E. Salassi, Lonne. P. Champagne and Grant Giesler. G (2000) "Valuation of Perennial Crops Associated with Agricultural Land Sales: The Case of Sugarcane in Louisiana", Journal of the ASFMRA pp.11-21.

Nguyen Chinh (----) "Economics values of Conservation and Use of Floral and Medicinal Plant Genetic Resources in Vietnam Toward Sustainable Use", Centre for Environmental Economics & Regional Development (CEERD) National Economics University (NEU), Hanoi.

Onofri. L and Ding. H (2012) "An Economic Model for Bio prospecting Contracts". International Journal of Ecological Economic and statistics" Vol. 26(3).

Peter P. Principe (1991) "Valuing the Biodiversity of Medicinal Plants" in the Conservation of Medicinal Plants edited by Olayiwola Akerele, Vernon Hilton Heywood, Hugh Synge pp.79-124.

Pushpam Kumar (2004) "Valuation of Medicinal Plants for Pharmaceutical Uses" Current Science, Vol.86, No.7,10 April.

William H. Lesser and Anatole krattiger (2007) "Valuation of Bioprospecting Samples: Approaches, Calculations and Implications for Policy Makers. An Intellectual property Management in Health and Agricultural Innovation: A Handbook of Best Practices.pp.861-876.

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 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.

UNEP gef

National Biodiversity Authority
5th Floor, Tidel Biopark, CSIR Road, Taramani, Chennai - 600 113
Tamilnadu, India, Ph: 044 2254 2777 / 2075 | Fax : 044 2254 1869
Web: www.nbaindia.org