ECONOMICS AND VALUATION OF BIODIVERSITY

Thematic Working Group Report

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National Biodiversity Strategy and Action Plan

ECONOMICS AND VALUATION OF BIODIVERSITY
THEMATIC WORKING GROUP REPORT

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Abbreviations

AIJ :Activities Implemented Jointly
AnGR: Animal Genetic Resources
ASDP: Adjusted State Domestic Product
AUSAID: Australian Agency for International Development
BCPP: Biodiversity Conservation and Prioritization Plan
BOD: Biological Oxygen Demand
BPL: Below Poverty Line
BPM: Ballarpur Paper Mills
BV: Bequest Value
CBA: Cost Benefit Analysis
CBD: Convention on Bio-Diversity
C&I: Criteria and Indicator
CISMHE: Centre for Indian Studies on Mountain and Himalayan Ecology
COD: Chemical Oxygen Demand
CPR: Common Property Resources
CR: Contingent Ranking
CSE: Centre for Science and Environment
CVM: Contingent Valuation Method
DANIDA: Danish International Development Agency
DC: Damage Cost
DFID: Development Fund for International Development
DFO: Divisional Forest Officer
DUV: Direct Use Value
EEC: European Economic Commission
EIA: Environmental Impact Assessment
ENDP: Environmentally Adjusted Net Domestic Product
ESDP: Environmentally Adjusted State Domestic Product
ETS:
EU: European Union
EV: Existence Value
FAIDA: Food and Agricultural Integrated Development Action
FAO: Food and Agriculture Organisation
FD: Forest Department
FDES: Framework for the Development of Environmental Statistics
FPC: Forest Protection Committee
GDP: Gross Domestic Product
GEF: Global Environmental Facility
GIS: Geographical Information System
GTZ
GW: Giga Watts
HFD: Haryana Forest Department
HH: Household
HP: Himachal Pradesh
HRMS: Hill Resource Management School
ICRISAT: International Council for Research in Semi-Arid Tropics
IIHR

ILRI
IOC: Indian Oil Corporation
IPR: Intellectual Property Rights
ITC: Indian Tobacco Company
ITDG
ITCM: Individual Travel Cost Method
IUCN: International Union for Conservation of Nature
IUV: Indirect Use Value
IVI: Importance Value Index
JFM: Joint Forest management
JVS
KFW
KM: Kilometer
M: Metric Cube
MBI: Market Based Instruments
MNC: Multi-national Corporations
MoEF: Ministry of Environment and Forests
MPI: Market Price Index
MPTDC: Madhya Pradesh Tourism Development Corporation
MSY: Maximum Sustainable Yield
MT: Metric tonne
NAEDB: National Afforestation and Eco-Development Board
NBSAP: National Biodiversity Strategy and Action Plan
NCA: Net Cropped Area
NCT: National Capital Territory
NDP: Net Domestic Product
NGO: Non-Governmental Organisation
NPV: Net Present Value
NSDP: Net State Domestic Product
NTFP: Non-Timber Forest Product
NWDB: National Wastelands Development Board
NUV: Non-Use Value
OECD: Organisation of Economic Cooperation and Development
OECF:
OV: Option Value
PE: Preventive Expenditure
PV: Present Value
R&D: Research and Development
RLC: Relocation Cost
RPC: Replacement Cost
RSC: Restoration Cost
SA: Stakeholder Analysis
SAP: Structural Adjustment Programme
SC/ST: Schedule caste and schedule tribes
SDP: State Domestic Product
SEEA: System of Environmental and Economic Accounts
SIDA: Swedish International Development Agency
SM: Simulated Market

SNA: System of National Accounts
TCM: Travel Cost Method
TD: Tourism Department
TERI: Tata Energy Research Institute
TEV: Total Economic Value
TVS: TV Sundaram
UK: United Kingdom
US: United States
USA: United States of America
UNDP: United Nations Development Programme
UNSTAT: United Nations Statistics
UV: Use Value
VFC: Village Protection Committee
WRI: World Resources Institute
WWF: World Wildlife Fund
WUA: Water Users' Association
WTA: Willingness to Accept
WTP: Willingness to Pay
ZTCM: Zonal Travel Cost Method

LOCAL TERMS USED IN THE REPORT

Chapters				
Three	Four	Five	Six	Five

Rampatre Mohuva Karanji Singli-mingli Dhup Amla Anar Katha Arya Vaidya Pharmacy Ltd. Adivasi Tendu leaf Mahuva flower Kadikal Pungam kernels Poochakai Chikakai Anola Chironji Oppage Janapara vigyana samsthe Bhabbar Patta Balwadi	Kendu Sal Dhir Khair(kil) Salar Bel Sisham Khera Fir Deodar Oak Sain Axe hewn (karries) Dimdimas Side slabs (passellas) Hakares Round ballis Logs geltus Khair billets Kail Chil Kokat Simbol Neeja Popular Sirse Kikar Goldmore Mulbery Talaabs Haigad Tarai Bhiga	Trapa Malbar kino Fir/spruce Bank oak Mohru oak Karsu Maple Katha (acacia katechu) Chil (pinus roxbughis) Deodar (cedrus deodar) Venchur	Ayurvedic Panchayat Cenchuriyia and sutan Chakriya vikas pranali	

EXECUTIVE SUMMARY OF BSAP ON ECONOMIC VALUE OF BIODIVERSITY

1. Brief introduction about biodiversity theme

1.1 *Constitution of the Group*

The Thematic Working Group on Economics and Valuation of Biodiversity (TWGEVB) was constituted as part of the NBSAP process in India. It had nine regular members; several special invitees joined the Group from time to time. They included coordinators of several other Thematic and Regional Groups and TPCG Members, and two external advisors who are linked to this Thematic Group.

1.2 *Functioning of the Group*

The Group carried out extensive literature search and reviewed the methodologies of valuation. It held consultations with a large section of scientists, researchers, policy makers and representatives of corporate sector etc. Since the report should have an Action Plan, a case study approach is adopted. For this purpose, several case studies are invited from among the practitioners and researchers from India and abroad.

1.3 *Links between the Groups*

The thematic Group on Economics and Valuation had direct links with several other Thematic Working Groups, the major ones are Livelihood and Life Styles, Domesticated Biodiversity, Wild Animals, Wild Plants, Terrestrial Ecosystems, Natural Aquatic Ecosystems, Micro-organisms, Access, Benefit Sharing, and Education and Training.

2. Brief Description of major biodiversity related issues of the theme

2.1: What is Economics of Biodiversity?

The discipline of economics is commonly understood to deal with production, consumption, generation of wealth and welfare to humankind. Hence valuation is part of its methodology. Biodiversity is enabled by a number of resources, renewable and non-renewable ones. But attributes of biological diversity are often seen as secondary as they have no immediate productive values; and their loss or gain are seen to represent no immediate costs or benefits. What is new in this Economics of Biodiversity then? Essentially, it is introducing the appropriate economic methods and tools to deal with natural and biodiversity resources and to redress some of the new concerns in the emerging world today. Three major concerns are dealt under this theme.

- First, the effects of structural adjustment (SAP) and economic reforms process that India has launched since 1991: The major ones that affect biodiversity at large are:
  - Resource allocation on biodiversity related activities (such as forestry and wild life protection, eco-development and restoration, advocacy, research, training and so on);
  - The growth of MNC's in the pharmaceutical and drug sector overshadowing Indian medicinal system;
  - liberalisation affecting the export and import of biodiversity linked products; hence a new domain of pricing mechanisms;

- Structural change in domestic food processing (from traditional to modern food processing as an industry); changes in quality and styles of life; and
- Growth of corporate culture.

✶ The second concern is about the '*break away state'* in the relationship between biodiversity and economics or between ecology and economics. Apart from *economic functions*, natural and biological resources also contribute in several other ways to the ecology, briefly termed as *ecological functions*. As part of NBSAP, they need to be valued together. Furthermore, in decision-making regarding the management of natural resources, the values that communities and individuals put to biodiversity on cultural, livelihood, survival and spiritual aspects of life need to be accounted for.

✶ Thirdly, in every society, there are many stakeholders who are involved in production, distribution and consumption. When it comes to biodiversity, they are local communities, small business dealers, state agencies, corporate sector, tourists, multi-national corporations, scientists, exporters and importers, and many more. The relationship between different stakeholders can also be asymmetric, depending upon the political and money powers, and other social relations. Thus the concern is identification, prioritisation and budgeting for stakeholders.

3.0 On Going Initiatives as part of the NBSAP Process

The Working Group basically addressed to these three basic concerns of the NBSAP process in India. The major steps or initiatives from this Working Group are summarised below:

3.1: Budget allocation: In the central and state government budget presentations in India, there are no exclusive financial resource allocations under the heading 'biodiversity'. However, both at the central and state government levels, several budgetary allocations are made which have indirect and to some extent direct bearings upon biodiversity. Such budgetary methods have no positive influence on biodiversity conservation. The state biodiversity resources in India has been severely affected by the Economic Reforms Process, as evident from the falling rate budget allocations on biodiversity conservation.

3.2: WTO and Biodiversity Conservation

The WTO Final Act contains the following four major agreements, which have relevance to environment and trade. They are:

- Agreement on Agriculture
- Agreement on trade related aspects of Intellectual property rights (TRIPS)
- Agreements on Subsidies and Countervailing Measures, and
- Agreement on Technical Barriers to Trade (e.g., SPS).

Among them, the most relevant Agreements directed for biodiversity conservation are on Agriculture, Intellectual Property Rights (IPRs), and on Sanitary and

Phyto-Sanitary (SPS). The 1988 New Policy on Seed Development (NPSD) liberalised import of high quality seeds, which in conjunction with the general economic liberalisation regime has opened the Indian seed market to foreign seed producers. The ostensible strategy of the NPSD can affect the farmers in India. TRIPs Agreement of GATT 1994 provides much stricter patent protection to the intellectual properties related to trade; but Indian farmers are not given sufficient information, education and time to get on to this new culture.

3.3: *A Barriers to forest products trade*

In recent years there has been a proliferation of additional policies and regulations that have the potential of becoming new barriers to the forest products trade. These barriers include:

1. Export restrictions by developing countries to encourage domestic processing of tropical timber for export;
2. Environmental and trade restrictions on production and exports in developing countries that affects international trade patterns;
3. Quantitative restrictions on imports of unsustainably produced timber products, and
4. The use of eco-labelling and green certification as import barriers.

3.4: *Command and Control Methods:*

Pollutions affect the biodiversity resources very adversely. In India the Central and State Pollution Control Boards are established after 1986 Environment Protection Act, to stop and reverse the process through technically established (and not society based) environmental standards (e.g., MINAS). Such command-and-controls (CAC) instruments are in the form of fines, penalties and threats of legal action for closure of the factories and imprisonment of the owners who violate the environmental laws and regulations. They have not worked at all, despite of several orders from Supreme and High Courts.

3.5: *Market Based Instruments in India*

Market based instruments such as tax-standards approach or incentives for establishing combined effluent treatment plants, introduction of user charges or prices, deposit refund schemes, incentives for relocation etc., are being introduced, but rather too slowly.

The price based instruments are in the form of taxes and subsidies to deal with detrimental and beneficial environmental externalities in production and consumption. The pricing system for most of the biodiversity products does not function well. Under the NBSAP process, for several reasons, it is intended to bring transparency and 'rights to information' on the margins between the collectors' price and the market price:

- For the collectors and local communities it should be an empowerment and income avenue,
- Even the local communities should realize its true worth or value,
- The gains from the natural resource extraction and use should by and large be based on in-situ distributional benefits,
- It should be corrective for sustainable rates extractions (based on the concept of carrying capacity), proper use of land and water resources and ecological conservation.

3.6: Key Gaps in Economics of Valuation of Biodiversity

The first revelation was the fact that even the *economic valuation* are not being carried out on biodiversity resources, leave the issue of *ecological valuations* apart. After surveying a large number of existing case studies the Group reached to the conclusion that there is a need to fill this gap very significantly. Specifically the areas to be addressed are:

- Valuation of wetlands, marine and coastal resources
- Valuation of Water and budgeting of water resources
- Valuation of Forest as a biodiversity resource: Redefining JFM
- Teaching of the techniques of valuation: Gap between research and practice
- Data base on biodiversity resources
- Redefining Community based strategies such as stake holder analysis
- Specifically addressing to the issue of medicinal plants and domesticated animals
- Introducing multi-disciplinarily in valuation approaches

4. Proposed Strategy and Action Plans

4.1: On Budget Allocation:

Government Budget allocation for the Ministry of Environment and Forests is at present a mixed bag. It be related to biodiversity areas and activities, and not based on anthropogenic activities. In order to work out the specific rates of resource allocation for various components, an Expert Group may have to go in to these. The degree of criticality of these areas, the livelihood dependency on them, the long term sustainability of those resources etc., will have to be used as the relevant criteria. Budget allocation can be based on (i) research and development, (ii) for protection and conservation, (iii) for promotion and awareness, (iv) for short term and long term planning etc.

Till such time a formula is worked out, the present Thematic Working Group recommends maintaining a 3% share of total revenue expenditure and another 3% share in capital expenditure exclusively for natural resource development in the states. At the MoEF level, at least 6% of GDP be allocated for all activities including biodiversity, and 3% exclusively fro forestry and wildlife preservation, but addressed to biodiversity.

4.2: Sharing the Responsibility on Resource Mobilisation

The responsibility of resource mobilization is not only with the government abut also lies with the corporate sector, external donor sector and public at large This sharing mechanism also need to be fully understood and worked out at least once in five years. There is the need to introduce proper market based instruments to budget and regulate the use of biodiversity related resources. Specifically in the area of water resource management, use of forest resources and marine resources, the types of market based instruments would differ. Separate studies are required to be carried out on this issue of appropriate instruments, to look in to who gains and who loses from such market based instruments.

4.3:Action and strategy regarding WTO-GATT matters

1. A share of profits made from the new variety goes, on behalf of the communities, into a

National Gene Fund. The Gene Fund should be the recipient of all revenues payable to the farming communities under various heads. The use of the money should not be restricted to conservation or for maintaining ex situ collections only.

2. The attempt at global standardization and uniformity by way of TRIPs agreement is in conflict with the main thrust of the Rio Earth Summit of 1992 that set out the conditions for sustainable development. These two reveal two contrasting types of international approaches and norms. While the 1992 Earth Summit and the 1993 convention on bio-diversity (CBD) focused on 'diversity' as being fundamental to sustain life and development, TRIPs and WTO are pushing for 'conformity' to international standardized norms on patents, services, labour, investment and what not, irrespective of their history, ecology, level of economic development, etc. The areas of intellectual property that the TRIPs agreement cover are: copy right and related rights; trademarks including service marks; geographical indications including appellations of origin; industrial designs; patents including the protection of new varieties of plants; the layout-designs of integrated circuits and undisclosed knowledge including trade secrets and test data. There is the need for perfect transparency in the patent and TRIP regulations down to the farmer levels.

4.4: Action Oriented Role for the Corporate sector

A key entry point for corporate sector is through NBSAP where its knowledge and expertise can be utilized effectively. It should form part of its legitimate interests in its representation to the government on polices and programs, guidelines and other management supports. It should also respect and support the livelihoods and rights of communities dependent on biodiversity, and promote cultural diversity and values relevant to biodiversity. In fact, the companies may develop a formal biodiversity policy or incorporate biodiversity into its existing environmental policies. They should keep abreast of the discussions and developments relating to national guidelines for incentive measures, biosafety, equitable benefit-sharing, intellectual property rights, monitoring of biodiversity indicators and other related topics.

Several action components are proposed to achieve these.

- ✶ Act together with the farmers on at least two counts. First, they will have to get to the business of investing on 'seed development and supply of infrastructure'; second, they should enter in to a clearly defined ' buy back system, ensuring the right price.
- ✶ Interact closely with the state and central governments to pickup the threads hand in hand to promote biodiversity conservation. Financial resource pooling is one such approach. This is a matter of sharing responsibility in financing biodiversity conservation between the corporate sector state and central government, a process initiated by CII already.
- ✶ Develop in-house biodiversity policies and strategies to manage the biological resources the company affects and also respect the concerns of local communities and other stakeholders. Methods for education and training to instill a biodiversity conscious culture within company management should be explored.
- ✶ Share information, knowledge and practices with the local communities to develop a herbal based drug sector.
- ✶ Adopt measures, which ensure sustainable use of biological resources. The measures

may be explored for the moral responsibility of corporate sector going beyond monetary and material consideration such as respecting the sanctity of critical natural habitats and threatened species.

- ✶ Create awareness regarding the need for appropriate intellectual rights regimes, respecting the knowledge, innovations and practices of indigenous and local communities and ensuring that collection and use of biological and genetic resources is done within a framework/guidelines of such respect.
- ✶ Engage in active partnership amongst corporate sector, research institutions and biodiversity conservation organizations as well as with the general public and with local communities for the management of important species and ecosystems.
- ✶ Instituting incentives and awards for members of the corporate sector who adhere to a definition of "progressive" in terms of being biodiversity-friendly and respectful of local community livelihood rights.

4.5 : Action on pricing policies

Under the NBSAP process it is intended to reduce the gaps and margins between the collectors' and the market price on biodiversity related resources. A direct approach of transactions from farmer to consumer should be developed (as is being done in Karnataka state). Other measures required are:

- o The local collectors and communities should be the price setters, and they should be educated to realize its true worth or value,
- o The gains from the natural resource extraction and use should by and large be based on in-situ distributional benefits,
- o It should be corrective for sustainable extraction rates (based on the concept of carrying capacity), proper use of land and water resources and ecological conservation.

4.6 Strategy and Action Plan on Valuation

The major recommendations for the NBSAP process based on the experience with the methodology of Valuation are:

Studies on economic valuation of various ecological functions of biodiversity should be encouraged. There should be more research on methodologies for estimating non-use values.

The economic benefits of biodiversity enjoyed by the private sector companies including MNCs require special attention and there should be some mechanism to capture a portion of these benefits for investing biodiversity conservation programmes.

A Social Science based research institution be identified by MoEF, which can undertake studies on valuation on a continual basis, almost on the lines of EIA for project clearance. It should initiate to bring out a publication on rapid and cost effective valuation methodologies for valuing biodiversity.

Some of the specific actions required in valuation are:

- For assessing ecological losses, the structure of the forest ecosystem is to be estimated by three main ecological attributes viz. Importance value Index (IVI), population dynamics and species diversity, where as the functioning of the ecosystem is to be ascertained with the help of bio mass studies, litter fall and transfer of mineral within the various biotic and abiotic compartments of the ecosystem.
- All the forest types, as classified by Champion and Seth, the major ecological

function(s) and appropriate methodology of valuation be identified and demonstrated.

- Specific attempts be made to bridge the data gaps on all types of biodiversity resources.
- Precisely developed model studies of ecological valuation be developed (to explain the problems of double counting, problems of benefit transfer methods, contingent valuation method, cost benefit analysis etc.).

4.7 Action/Strategies on Natural Resource Accounting.

The progress on this at the national scale is very much limited. Some of the lessons fro the on-going exercises are listed here for further actions.

- ✶ The data base requirements for Natural Resource Accounting are quite high. Central Statistical Organisation should have a separate wing to collect the necessary data exclusively for natural resource accountings.
- ✶ More and more studies on valuation be built-in the NBSAP process to address to aspects such as depletion, degradation, preservation, inter-generational values, dose-responses etc.
- ✶ Environmental economists and statisticians should continue to demonstrate the possibilities to adjust the domestic products for all the natural resource related issues, some of which may not directly appear in the traditional income accountings (e.g., biodiversity).

4.8: Strategy/ Actions on Indian medicinal systems

Under the NBSAP process, special attention must be given to develop Indian medicinal system. Several newer directions of actions and strategies are required for this:.

- Regular assessment of demand from the Ayurvedic and cosmetic sectors;
- A comprehensive study needs to be undertaken on the economic impact of *ayurvedic* industry on biodiversity conservation (using green accounting principles).
- A forum to bring together industry, Forest Department, NGOs and others needs to be established. They should deliberate upon the matters such as rates of extraction, federating on processing standards and management, pricing system etc.
- Finally, the legislation should distinguish different intermediaries and collectors of medicinal plants from forests. Sale of such products by cooperatives such as Girijan Co-operatives and other federations should not be equated with private contractors and middlemen of drug companies. Accordingly, 'prior intimation' provision of clause 7 of the proposed Biodiversity Legislation Bill should not apply to the former. Furthermore, the question of them being subjected to producing 'legally procured certificates' prior to transacting the raw materials to the Ayurvedic industry directly be examined again.

4.8: Strategy/Action regarding Joint Forest management

Considering that JFM already covers over 13 percent of the recorded forest area of the country and the area is likely to increase even more in the future, attempt should be made to include biodiversity conservation as one of the explicit objectives of the JFM programme. Some of the major actions needed are:

- There is the need to explore the link between biodiversity conservation and long term sustainability and community linkages of JFM.

- For this, the JFM Cell in MoEF should be restructured. There are a large number of studies on the performance of JFMs all over the country. Therefore, the National JFM Network and News Letter should carry the messages on biodiversity related issues and findings. Training programmes on alternative economic valuation methods should be organised for the officials of the Forest Department as well as NGOs active in the field of JFM.

- At the time of JFM micro-plan preparation, biodiversity conservation strategy should also be included in the micro-plan. Instead of using the standard Cost-Benefit Analysis, Stakeholder and Multi-criterion Analysis are to be introduced in the NBSAP process.

CHAPTER ONE

THE THEMATIC GROUP IN ACTION

1. Constitution of the Group

The Thematic Working Group on Economics and Valuation of Biodiversity (TWGEVB) was constituted as part of the NBSAP process in India. Based on a request from TPCG, Prof. Gopal K. Kadekodi agreed to be the Co-coordinator of this thematic working group. The Group was constituted after taking into account of the suggestions made by TPCG. The originally constituted group co-opted additional members as and when felt the need. Prof. Kirit Parikh and Prof. Jyoti Parikh are invited as Advisors to the TWG. The Members constituting the Group as on November 2001 are as follows:

Dr. Ashish Kothari: TPCG Representative for the Group
Prof. Gopal K. Kadekodi: Coordinator
Dr. Ramachandra Bhatta: Member
Prof. Kanchan Chopra: Member
Prof. A. Damodaran: Member
Dr. Joydeep Gupta: Member
Dr. J. B. Lal : Member
Dr. T.R. Manoharan: Member
Dr. M.K. Pandit: Member
Dr. Sushil Saigal: Member

Advisors: Prof. K.S. Parikh and Prof. Jyoti Parikh

Addresses of the members are given in Annex ii

2. Method of Functioning of the Group

The Group adopted the following major course for it's functioning:

- A Secretariat of the Working Group was set up at Centre for Multi-Disciplinary Development Research, Dharwad. They coordinated the entire activity of the Working Group, including maintaining liaison with Kalpavriksh and BCIL.
- Regular meetings once in every three months: Five meetings held in the course of one and half years. They were held primarily in New Delhi and Bangalore and Goa.
- The Group invariably invited additional participants to each of the meetings. Among

them are coordinators of several Thematic and Regional Groups and TPCG Members, who are linked to this thematic group.

- The Group also held consultations with a large section of scientists, researchers, policy makers and representatives of corporate sector etc. A list of them is presented in Annex iii.
- The Group also carried out extensive literature search and review on the methodologies of valuation. They are reflected in the large Bibliography presented at the end of the report, along with the major web-sites browsed.
- Since the report should have an Action Plan, a case study approach is used. For this purpose, several case studies are invited from among the researchers from India and abroad.
- The thematic Group on Economics and Valuation had direct links with several other Thematic Working Groups. The other major Working Groups closely linked with this TWG are Livelihood and Life Styles; Access and Benefit Sharing; Education; Terrestrial Biodiversity; and Agri-Biodiversity. Constant interaction with these groups were maintained by (a) inviting them to the deliberations of the Group, (b) exchanging the documents with them, (c) requesting them on specific inputs.
- Constant link was maintained with TPCG Coordinator Dr. Ashish Kothari, who also happens to be the representative of TPCG on the TWGEVB for all links.
- Participated in the annual NBSAP meetings held at New Delhi and made presentations on the activities and progress of the Working Group.

CHAPTER TWO

BRIEF DESCRIPTION OF THE THEME

2.1: About the Theme

The theme to be addressed by this Working Group, is, in some sense, wrongly titled. NBSAP in India has labelled it as Economics and Valuation of Biodiversity. Let it be clear at the outset that Valuation also involves economics. Otherwise, the discipline of economics is commonly understood to deal with production, consumption, generation of wealth and welfare to humankind. This is enabled by a number of resources, renewable and non-renewable ones. Biodiversity is defined as the totality of genes, different taxa and ecosystems in a region of the world where each organism has its own function in the natural scheme of things but all are dependent on each other for their survival. In this context, elements of biological diversity are often seen as secondary as they have no immediate productive value; and their loss is seen to represent no immediate cost. However, basic economics has much to contribute to the understanding of biodiversity concerns and conservation, as was the case with land (dealt by David Ricardo, or his student T.R. Malthus).

What is new in this Economics of Biodiversity then? Essentially, it is introducing the appropriate economic theories, methods and tools to deal with natural resources and to redress some of the new concerns in the emerging world today. Three major concerns are dealt under this theme.

- First, with the process of structural adjustment (SAP) and economic reforms process that India has launched since 1991, various economic changes have taken place in the country. The major ones that affect biodiversity at large are:
    - Resource allocation on biodiversity related activities (such as forestry and wild life protection, eco-development and restoration, advocacy, research, training and so on);
    - The growth of MNC's in the pharmaceutical and drug sector overshadowing Indian medicinal system;
    - liberalisation affecting the export and import of biodiversity linked products;
    - Structural change in domestic food processing (from traditional to modern food processing as an industry);
    - Growth of corporate culture;
    - and many more.

- The second concern is about the 'break away state' in the relationship between biodiversity and economics or between ecology and economics. The recent SAP and Economic Reforms processes all over the world have brought challenges to economists and ecologists to think differently to develop means of integrating concerns about biodiversity into the calculation of economic wealth/well-being of a nation. Apart from *economic functions*, natural and biological resources also contribute in several other ways to the ecology, briefly termed as *ecological functions.* Both need to be valued together. Furthermore, in decision-making regarding the management of natural resources, the values that communities and individuals put to biodiversity on cultural, livelihood, survival and spiritual aspects of life need to be accounted for. Such an integrated approach rarely finds a place in the usual economic systems. Numerous methods of Valuation and Natural Resource Accounting have been evolved by now. The existing methods of valuation are to be tested, improved, put on the ground and used for redressing the adverse effects of SAP.

- Thirdly, in every society, there are many agents who play the game of production, distribution and consumption. When it comes to biodiversity, it is extremely difficult to define the stakeholders in any unique manner. They are local communities, small business dealers, state agencies, corporate sector, tourists, multi-national corporations, scientists, exporters and importers, and many more. The relationship between different stakeholders can also be asymmetric, depending upon the political and money powers, and other social relations. Thus the concern is identification of the orderings of stakeholders, based on certain economic concepts (such as Game theory).

The Working Group basically addressed to these three basic concerns of the NBSAP process in India. The details of the theme, in terms of individual issues are listed in Annex 1.

2.2: Contribution to NBSAP Process

The theme of Economics and Valuation has been identified as one of the many other themes to be addresses for the NBSAP process. This is not the place to define or redefine the aims and objectives of NBSAP process. But, with the overall aim of a Strategy and Action Plan on Biodiversity, the need to work within an integrated framework with most other thematic groups was felt. The links between various thematic groups was discussed among the Coordinators of all the Groups in a meeting held at New Delhi early in the NBSAP process. The other major thematic groups with whom TWGEVB kept close links are:

- Livelihood and Life styles
- Access and Benefit Sharing
- Agri-biodiversity
- Environmental Education

Table 2.1 shows the possible links between an elaborated list of thematic working groups.

Table 2.1: Linkage between Economic and Valuation and other Thematic Working Groups

Thematic Group	Types of linkages
Livelihood and Life styles	Livelihood value of biodiversity
Domesticated biodiversity	Valuation of agro-biodiversity
Wild animals	Valuation of wild species
Wild plant	Plant use values
Terrestrial ecosystems	Valuation of ecosystems
Natural aquatic ecosystems	Valuation of eco-systems
Micro-organisms	Valuation of micro-organisms
Policies, Laws etc.	Macro-economics
Access benefit sharing etc.	Valuation and IPRs
Education, Training etc.	Educational component on economics and valuation

Apart from these linkages between the thematic working groups, constant links were also established with regional and sub-regional working groups as well.

The specific issues on which the TWGEVB interacted and contributed to their deliberations are on identification of livelihood linkages between biodiversity changes, the effects of changing life styles on biodiversity status in the country, the role of WTO, various protocols and international conventions on Indian biodiversity status, effects of various IPRs and growth of globalisation upon the status of biodiversity, relevance of domesticated animals and agricultural species and traditional knowledge, training and educational needs of different sections of the society and developing teaching materials.

Many of these have closer links with the various components discussed in Section 2.1.

NBSAP process is participatory. There are again, a large number of stakeholders in the process. It is part of the process to carry them along and make them responsible to act towards the process. Who are these stakeholders for the theme of Economics and Valuation of biodiversity? They are policy makers and development administrators in the government, researchers, teachers, NGOs, corporate sector, enlightened politicians, donor agencies and so on.

Accordingly, the following are identified as the major steps or contributions from this Working group towards this target group:

- Training and educating in basic economics and valuation techniques;
- Developing case studies to demonstrate the valuation methods step by step;
- Carrying the methodology up to policy level (e.g., strategy of budget allocation, mandatory green accounting, compulsory EIS, participatory approach, widening the stakeholder groups); and
- linking with the BCPP process.

C H A P T E R - T H R E E

ECONOMICS OF BIODIVERSITY

3.1: What is Economics of Biodiversity ?

It is said that Economics is what economists do. But the same can not be said about economics of biodiversity. It is beyond what ecologists and specialists in biodiversity do. Rather when ecology ends, economics begins. In traditional view of biodiversity, it is an 'umbrella term covering the totality of species, genes and eco-systems' (MacNeely et al.,1988). Norton (1988) calls biodiversity as 'every thing there is'. Just as human beings are identified by races, biodiversity is a collection of species as natural communities. They are generally identified by location (just as human races) as texa. The major link between them is through energy and food chains or web.

The oldest economic link between biodiversity and human existence was through a system of free services that they provide. With the advent of economic thinking as distinct from free services, other notions of value of biodiversity and their links with human society emerged.

The relevance of economics today is towards conservation of natural resource; develop methods towards its use up to the carrying capacity. Natural resources are wealth of the nations. It is considered as a natural capital or wealth of nations. But traditionally they are taken as the free gift of nature. Karl Marx thought that till it is extracted by the use of labour, the in-situ value of coal is zero. Ricardo based on the assumption of indestructible quality of land in developing the theory of rent. This notion of free gift together with traditional (and often constitutional) rights on natural resources have made the development and use of these resources on economic principles very complex. However, the traditional economics grew out of Ricardo, in the grab of neo-classical economics to introduce natural resources as 'natural capital', in a competitive form with 'man-made capital' and other resources. This led to the conception that natural resources can be subjected to modifications (depletion, degradation, attrition or regeneration) with human interference based on the principle of utility maximization (Swanson, 1992). Theory of value that emerged then follows the principle of 'willingness to pay' (Freeman, 1993, Norton, 1988). Recent theories of economics however, have propagated the theme of 'keeping natural resources in tact' (Boulding, 1971;Pearce,1992). This revelation

of biodiversity as a wealth of nation may have to evolve some now processes of conservation and preservation of biodiversity. That is the direction of modern Ecological Economics (Aleiz, 2000).

It is equally complex from the point of ecological theories. How much do we know about the ecology, ecological systems and ecological functions? As will be elaborated later, even the traditional ecological theories do not provide all the answers till such time the links between different ecological services and functions are well understood. Furthermore, the understanding of social norms, conventions, traditions, beliefs and culture are equally import, which brings additional plurality to the complexity of conserving natural resources. The disciplines of sociology and social anthropology are also aiming at some convergent solutions towards the complexity of natural resources.

The natural and biological resources have strong links with the entire habitat, generally in both directions. For instance, forests provide a service such as nutritional recycling, which in turn promotes forest growth. Such two-way direct linkages are generally rare in other man-made capital. Secondly, more often, natural resources do not have well developed markets to provide information on demands, supply and prices. Therefore, quite often conventional economic principles breakdown when applied to these resources. Similarly, economics has to enter in to a discourse on the social behaviour and conflicts between different social groups (to be designated as stakeholders). Natural resource economics or economics of biodiversity has brought in new theories and methodologies. Just to cite a few are, concepts of opportunity costs, shifting from static to dynamics, neoclassical models being replaced by game theory, going beyond revealed preference to stated preference and so on.

The application of such new economic thoughts and concepts to the challenges that natural resources pose is the Economics of Biodiversity.

3.2: Economic Reforms and Structural Adjustment Programme (SAP) in India

3.2.1: What are the aspects of SAP that are relevant for biodiversity conservation?

One can identify at least three different aspects of SAP and economic reforms in India

that have direct relevance to biodiversity conservation (or degradation). They are:

I. Emergence of new market and management methods for biodiversity resources;

II. From domestic or local linkage to international linkage via export orientation;

III. The role of the state diminishing in biodiversity conservation;

This report is not the place to talk more about SAP and economic reforms (in any detail). But the direct and indirect effects of the economic reforms process on biodiversity action plan are relevant. Of these, the first two are briefly dealt in this section, addressing to the third in the next section (also bit more elaborately).

Certainly, with the economic reforms process, newer market avenues have arrived for biodiversity resource related products. For instance, in the recent years one notices significant switching from consumption of raw food and vegetable to processed foods and vegetables in India. Being a tropical country, fresh vegetables and cereals are available in India on a day-to-day basis. Therefore, habitually Indians are used to cook fresh vegetables and cereals. But with the changing economic scene, partly due to development in general and partly due to effects of economic reforms (e.g., coming of MNC's in food processing, government having set up a separate ministry of Food Processing away from Ministry of Agriculture), a concept of home meal replacement is coming in. The upper middle class Indians (with a large percentage families of both husband and wife working out side of home) on average have been switching on to processed foods. The Food and Agriculture Integrated Development Action Report (FAIDA) estimates the processed food market to be of the order of Rs. 22504 billion. Clearly, the mushrooming of food processing industries both by the national companies and MNC are round the corner. Also mention can be made about the significant shift from traditional medicinal system to more and more processed medicinal system (but still the base being herbal and medicinal plants). More about this will be dealt in Section 6.1.

Added to this is the major shift in the trend of Indian exports of products based on natural resource extraction, having implications to biodiversity. Take the case of exports of culture shrimps from India, as shown in Table 3.1. Nearly 50% of culture shrimps produced in the country are exported. The external market prices have been playing havoc in the sense that, though the export quantity of these exotic species have not been rising faster, the income from such activities have been going up significantly. In a study on the ecology of Chilika lake, Kadekodi and Gulati (1999) show that the ratio of prices of shrimp and crab in the export trade market is 3-4 times higher than the local collector's prices.

Table 3.1:Share of Cultured shrimps to the total export of shrimps from India

Year	Total Quantity of Shrimp Exports (MT)	Total Value (Rs. million)	Percentage of Culture Shrimp Exports	Percentage pf Value of Culture Shrimp Exports
1988-89	56,835	4703.3	33	48.78
1989-90	57,819	4633.1	33.72	59.57
1990-91	62,395	6633.2	36.98	56.77
1991-92	76,107	9761.6	34.16	55.81
1992-93	74,393	11802.6	41.06	64.93
1993-94	86,541	17707.3	47.14	72.79
1994-95	1,01,751	25102.7	52.92	74.35
1995-96	90,000	24290.0	50.96	63.05
1996-97	1,05,429	27017.9	43.57	60.81
1997-98	1,00,000	31213.5	43.04	66.83
1998-99	1,02,484	33349.1	52.00	74.49

Source: Marine Products Export Development Authority, 1999.

Another case to cite is on exports of spices from India. Recent trends in export of biodiversity related product such as spices can be viewed from Table 3.2.

Table 3.2:Export of various spices from India

Year	Quantity (000' Metric tonne)	Value (Rs. Million)
1995-96	203.40	8044.30
1996-97	225.30	12307.18
1997-98	242.07	14668.19
1998-99(Provisional)	231.39	17580.22
1999-00 (Estimated)	208.83	18610.28

As can be seen from the table, in the recent years the export of spices has been quite steady and its value is increasing at an alarming rate of about 25%.

3.2.2: Macro view on government resource allocation on biodiversity conservation

When it comes to natural resource management and biodiversity conservation, what has been the role of the state in the process of economic reforms in India? Has it got any link with the conservation objectives? Has the government reduced the resource allocation for this sector as a result of economic reforms process in India? These questions can be analyzed by looking at the budgetary allocations by the central and state governments.

In the central and state government budget presentations in India, there are no exclusive financial resource allocations under the heading 'biodiversity'. However, both at the central and state government levels, several budgetary allocations are made which have indirect and to some extent direct bearings upon biodiversity. The Ministry of Environment and Forests (MoEF) uses the following major heads, which can be considered as relevant for looking at the implications for biodiversity conservation. They are:

I. Ecology and Environment

II. Forestry and wildlife

III. Grand total for MoEF

Each of the broad headings has been further disaggregated in to several sub-headings. In Table 3.3 the details of these budget allocations under various sub-headings from 1986-87 to 1998-99 are summarily shown. In order to make meaningful comparison over time, the actual budget allocations have been converted in to constant 1993-94 prices. The same table also shows the aggregate Gross Domestic Product (GDP) of India for each of those years. In the most recent year of 1998-99 for which data is shown, the allocation for Ecology and Environment was Rs 198 crores, where as the same for Forestry and Wildlife was Rs 185 crores (both in constant 1993-94 prices).

Among many alternative ways of looking at these allocations, two specific indicators may be most relevant here. First: to take a look at the budget allocation as compared to the GDP; second, to compare them on per unit of '*appropriate land, geographical area or biodiversity resource'*. The first indicator is a reflection on resource allocation linking it to welfare, with GDP as the overall or catchall welfare indicator (typically known in Economics as 'investment output ratio' or incremental capita-output ratio). But more appropriate will be to consider resource allocation per 'appropriate land or biodiversity resource'. For this, the following categories of land or land use may be most relevant for biodiversity assessment. They are:

(a) Wetlands, (b)Coral reefs, (c)Protected forests, (d) Water bodies, (e) Cultivated land,

(f) Glacier mountain areas and (h) Biosphere reserves

Interestingly enough, till date, in the debate and actions regarding environment and ecology, a concept of 'appropriate geographical area' has not been developed. When it comes to biodiversity, the above mentioned land categories have direct links with biodiversity resources. The rough estimated land areas on these are shown in Box 3.1.

Box 3.1: Relevant Land Resource for Linking with Budget Allocations

Land Category appropriate for Biodiversity	Land Area
Wetlands (including mangroves)	3.90 million ha (of which mangroves of 0.48 million ha)
Coral reefs	2329.90 sq. kms.
Protected forest areas	15.60 million ha
Tiger Reserve area	33050 sq. kms.
Biosphere Reserves	49485 sq. kms.
River lengths (12 major ones)	13087 kms.
Area under lakes and reservoirs	0,021 million sq. kms.
Area under rivers and streams	0.084 million sq. kms.
Cultivated land	123.10 million ha
Snow and glacier areas	55788.49 sq. kms
Total coastal length	7515 kms.
Total sandy area (1988-89)	0.56 million sq. kms.

Apart from these, the following major aspects of biodiversity can also be considered in making the allocation of resources. After all, under the plans, resource allocations are normally done on the basis of population. Then why not also on the basis of biodiversity?

Box 3.2: Population of Biodiversity

Aspects of Biodiversity	Their magnitudes
Total number of plant species (1998)	45,000
Total threatened species (1997)	583
Total animal species (1998)	81,000
Total threatened vertebrates (1997)	158

Tiger population (1993)	3750
No. of Biospheres	12

At present budget allocation for conservation of biodiversity are being made both at the central and state governmental levels. The consolidated budget allocations from fourteen major Indian states are analyzed here for the period 1986-87 to 1999-2000. Since the states maintain the budget accounts under two categories as Revenue expenditures and Capital Expenditures, the allocations can be looked into accordingly. Among many, they contain only a few items, which fit some what closer to biodiversity conservation. They are shown in Box 3.3. The items of allocations under revenue and capital expenditure categories differ marginally. Furthermore, the states maintain these accounts under two separate groupings as *Development and Non-development Expenditures*. Being quite insignificant and having much less relevance to the analysis of resource allocation for biodiversity conservation, the latter category is not analysed here. What should be the appropriate indicator to analyse the state level resource allocation on biodiversity conservation? They are best analysed by comparing them with the corresponding total budget allocation for all sectors taken together.

All these indicators of budgetary allocations are shown in Table 3.3 as well as Figure 3.1 to 3.5. From the graphical analysis as well as the Tables presented here, it is revealing that:

I. At the national level:

II. The MoEF's budget allocations to ***Ecology and Environment*** have been going down, more conspicuously from 1991-92 onwards. It is also showing quite a bit of fluctuations, suggesting lower considerations on sustainability of budget allocations in the long run.

III. The allocations on ***Forestry and Wildlife*** also have been going down, but at much lesser pace till 1995-96. But in the most recent years of 1996-97 onwards they have dropped very significantly.

IV. At the States level:

A. The Revenue development expenditures on biodiversity related activities (as a ratio of

Total Revenue Expenditure on all sectors taken together) have been declining, but at a much lesser rate, declining from 2.99 percent in 1986-87 to 2.20 percent by 1998-99.

B. The Capital development expenditures on biodiversity related activities (as a ratio of Total Capital Expenditures on all sectors taken together) have shown a sudden decline from 2.27 percent in 1986-87 to 1.81 by 1994-95, but have shown a reverse trend from 1995 on wards, retaining an average around 2.5 percent.

C. Among the states, as far as revenue expenditures are concerned, except for states such as Karnataka, Kerala, Madhya Pradesh and Orissa, all other states have registered fast declining rates of resource allocations.

D. Similarly, as far as capital expenditures are concerned, most states have very low rates of allocations (except perhaps Maharashtra, Gujarat, Kerala, Tamil Nadu); besides they have been invariably declining.

Box 3.3: Categories of budget allocations considered for state level biodiversity activities

Developmental Budget Headings	**Items considered**
Revenue Expenditure	Soil and water conservation; Fisheries; Forestry and Wildlife; Plantations
Capital Expenditure	Crop Husbandry; Soil and Water conservation; Fisheries; Forestry and Wildlife; Plantations

Table 3.3: Major Budget Allocation for MOEF in 1993-94 Prices (Rs. In crores)														
Major Head	**1986-87**	**1987-88**	**1988-89**	**1990-91**	**1991-92**	**1992-93**	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-2000**	**2000-2001**
Ecological and Environment														
Botanical & Zoological Survey	15.355	10.090	15.411	16.801	15.281	15.343	14.930	15.298	14.965	14.458	17.710	17.370	16.914	16.549
Env. Education/ trai]ning/extension	2.309	3.434	3.128	4.044	3.891	5.636	6.400	5.924	5.601	5.410	4.552	4.230	4.598	4.733
Conservation Programme	0.885	1.239	3.194	3.063	4.152	3.830	7.000	5.933	5.039	5.441	4.736	4.220	5.370	8.004
Environmental planning &														
Coordination	5.888	4.125	4.422	5.609	4.627	5.198	7.180	4.856	4.845	5.612	4.994	5.450	5.486	5.187
Research & Ecological														
Regeneration	13.758	11.471	11.300	9.421	10.974	11.753	12.700	12.066	10.254	9.802	10.090	9.260	10.869	11.018
International Cooperation	0.635	0.584	0.540	0.749	0.914	1.094	1.350	1.552	1.629	1.531	1.449	1.480	1.518	1.436
Prevention of Pollution of														
Ganga/National River	49.644	80.545	93.351	84.411	64.658	53.940	60.000	34.456	35.186	94.986	78.672	72.940	128.626	78.964
Prevention of Air and Water pollution	15.220	17.083	17.900	24.125	21.521	36.047	46.250	19.168	45.180	75.150	64.566	62.680	51.386	47.241
Impact assessment	0.539	0.354	0.655	0.817	1.910	4.355	4.950	4.965	2.511	3.187	5.501	1.870	4.624	2.504
Total prevention & control of pollution	65.403	97.982	111.906	109.353	88.089	94.342	111.200	71.166	82.877	173.323	148.739	137.500	184.636	128.709
Other programmes	0.000	1.894	2.653	3.717	4.971	5.373	30.840	55.705	16.720	29.732	24.682	11.550	64.602	35.474
Capital outlay on Ecology & Env.	0.000	0.460	2.358	2.900	3.381	4.848	5.570	5.805	3.737	4.508	4.523	6.700	6.528	6.875

Total-Ecology and Environment	**104.426**	**135.351**	**154.913**	**155.657**	**136.280**	**147.417**	**197.170**	**178.304**	**145.667**	**249.817**	**221.475**	**197.810**	**300.521**	**254.816**
Forestry and Wildlife														
Research	4.810	11.489	14.494	16.079	28.841	30.072	35.070	43.510	48.665	53.517	49.835	57.630	52.833	37.321
Education and training	13.392	8.037	7.403	8.877	6.086	7.135	8.030	8.844	7.457	7.765	7.987	9.690	9.673	8.379
Survey and utilisation of Forest														
Resources	5.157	5.682	5.241	4.221	3.168	4.049	9.950	9.073	10.035	3.521	4.391	4.890	4.759	4.794
Forest conservation &Develop.														
Regresstion	6.446	4.072	7.042	5.882	6.228	8.777	6.900	5.203	6.004	5.791	5.589	8.300	8.875	6.507
Wildlife	14.989	18.729	16.885	28.496	31.629	20.103	25.560	27.254	26.176	24.710	383347.000	43.010	68.564	49.979
NWDB/NAEDB	100.981	106.798	13.348	103.458	144.133	116.174	98.030	94.907	88.117	69.810	55.049	50.320	62.319	60.469
Capital outlay on Forestry & Wildlife	0.000	0.690	2.457	3.000	2.930	1.379	1.650							
Total-Forestry & Wildlife	**146.700**	**156.506**	**165.657**	**176.310**	**223.526**	**210.000**	**198.750**	**201.899**	**170.012**	**173.012**	**172.406**	**184.500**	**216.966**	**179.854**
Grand Total	**254.474**	**295.008**	**323.649**	**335.126**	**362.795**	**360.440**	**398.980**	**383.288**	**345.902**	**426.242**	**397.977**	**386.760**	**521.886**	**439.414**
GDP at factor cost at 1993-94 prices	**500354.000**	**521962.000**	**577550.000**	**650462.000**	**655764.000**	**690261.000**	**732874.000**	**861064.000**	**926412.000**	**998978.000**	**1049191.000**	**1112200.000**		
Source : RBI Bulletin, various issuing; Expenditure Budgets of MoEF														

Table 3.4: A Macro Picture of Budget Allocations on Biodiversity Conservation

YEAR	AT THE NATIONAL LEVEL;MOEF			AT THE ALL STATES LEVEL ($$)	
	Ratio of Total MOEF Annual Budgetary Allocation/ GDP (%)	**Ratio of Forestry +Wildlife Budgetary Allocation/ GDP(%) (*)**	**Ratio of Ecology +Env. Budgetary Allocation/ GDP (%) (**)**	**Ratio of Revenue Expenditure on Env. +Forest+ Ecology/Total Revenue Expenditure (%)(***)**	**Ratio of Capital Expenditure on Env. +Ecology+ Forestry/Total Capital Expenditure (****)**
1986-87	5.1	2.9	2.1	2.99	2.27
1987-88	5.7	3.0	2.6	3.03	2.90
1988-89	5.5$	2.9$	2.5$	2.81	1.95

1989-90	5.3$	2.8$	2.4$	2.66	1.65
1990-91	5.2	2.7	2.4	2.60	1.56
1991-92	5.5	3.4	2.1	2.16	1.70
1992-93	5.2	3.0	2.1	1.93	2.06
1993-94	5.4	2.7	2.7	2.30	1.77
1994-95	4.5	2.3	2.1	2.17	1.81
1995-96	3.7	2.1	1.6	2.20	2.49
1996-97	4.3	1.7	2.5	2.08	2.84
1997-98	3.8	1.6	2.1	2.01	1.93
1998-99	3.5	1.7	1.8	2.20	2.10

Notes: 1. All computations are in constant 1993-94 prices.

2. (*):Forestry +Wildlife Budget=Research on forestry and wildlife +Education and training +Survey and utilization of forest resources +Forest conservation, development and regeneration + Wildlife +NWDB +NAEBD +Capital outlays on forestry and wildlife

3. (**):Ecology and Environment= Botanical and Zoological Survey +Env. Education, training and extension +Conservation programme +Env. Planning and coordination +Research in Ecological Regeneration +International cooperation +Prevention of pollution in Ganga +Prevention of air and water pollution +EIA +Other programmes +Capital outlays on Ecology and Env.

4. (***): Soil and water conservation +Fisheries +Forestry and wildlife +Plantations

5. (****): Crop husbandry +Soil and water conservation +Fisheries +Forestry and wildlife +Plantations

6. ($): These are indirectly estimated values, in absence of actual

7. ($$):The All states' revenue and capital expenditures are invariably the 'Actual', but in few years they are Revised estimates (rather than actual estimates). Moreover, these ratios are computed the most important fourteen states only.

The fact that the role of the state in the management of biodiversity resources has been severely affected by the Economic Reforms Process is evident from the macro-budgetary analysis. The objectives of the states, in the past also has been, by and large, revenue from natural resources, as can be seen from the Table 3.5. Other than minerals (including crude oil and gas), one of the most revenue raising resource at the state levels has been forest. Most of

the forest rich states have used this as an economic instrument of raising revenues. States such as Andhra Pradesh, Arunachal Pradesh, Kerala, Madhya Pradesh, Orissa and Punjab continue to raise lot more revenue from forests than the investments on that sector.

Table 3.5: Statewise Forest Revenue & Expenditure (1994-95 and 1995-96)				
				Rs. Lakhs
State/UT's	1994-95		1995-96	
	Revenue	Expenditure	Revenue	Expenditure
1	2	3	4	5
Andhra Pradesh	10285.35	6640.58	14405.26	8750.46
Arunachal Pradesh	3488.77	2095.35	4904.39	2416.67
Assam	1692.40	5212.27	1726.50	5467.83
Bihar	4615.61	4915.64	4721.00	NA
Delhi	0.06	13.86	0.06	30.29
Goa	138.87	300.44	138.82	293.22
Gujarat	2344.31	12007.09	2545.87	19850.77
Haryana	1442.31	4845.68	1956.68	5461.43
Himachal Pradesh	4711.00	8524.00	4494.00	9607.00
Jammu & Kashmir	1141.83	4861.00	3315.81	5945.42
Karnataka	9478.00	15047.10	10573.00	16515.90
Kerala	13688.49	6662.88	16076.54	7812.05
Madhya Pradesh	49936.00	36127.00	55716.60	40278.72
Maharashtra	14785.70	22402.61	13729.29	23165.27
Manipur	197.84	1136.18	223.48	1303.56
Meghalaya	450.77	499.87	514.64	639.23
Mizoram	1697.47	1741.29	1571.53	1570.90
Nagaland	220.75	482.21	275.10	997.83
Orissa	NA	NA	6807.43	5718.84
Punjab	525.05	1878.08	668.51	2147.33
Rajasthan	1337.63	3555.99	1317.67	3453.37
Sikkim	125.00	325.00	190.00	425.00
Tamilnadu	6481.00	8653.37	5796.59	9367.05
Tripura	290.04	502.16	303.82	652.96
Uttar Pradesh	7760.01	13161.55	9846.70	15219.32
West Bengal	4497.89	8630.93	4351.56	9128.95
A & N Islands	2984.72	2565.98	2815.68	2807.51
D & N Haveli	26.63	191.19	23.36	128.28
Chandigarh	8.04	111.77	18.61	185.03
Lakshadweep	---	---	---	---
Pondicherry	---	---	---	---
Total	**144153.64**	**173091.07**	**169028.44**	**199340.82**
Source: Forest Statistics of India, 1996				

Comments: The aggregate budget allocation (as a ratio of GDP) by MOEF was fairly constant till 1993, but started declining since then.

Comments: Till about 19991, the budget allocation (as a ration of GDP) on forestry and wild life was fairly constant. But since then, it has been declining steadily.

Comments: On ecology and environmental heads, the allocations have been fairly constant, though fluctuating from year to year.

Comments: Till about 1992, the state revenue budget allocations were steadily declining. They have remained fairly constant since then.

Comments: The capital expenditures by the states do not seem to follow any rational pattern of resource allocation.

3.3: World Trade Organisation (WTO) and Biodiversity Conservation

The WTO was established on January 1, 1995 and the implementation of the Uruguay Round results began from the same date. India became an initial member of the WTO, just as it was an original signatory of the General Agreement. It was an active member of the GATT but had not made significant contributions, except in rhetoric, towards trade liberalization. Prior to 1995, India's exports had benefited from progressive reduction of tariff levels in the developed countries (Bagchi, 2001).

General Agreement on Trade and Tariff (GATT in 1947 as well as in the latter modification in 1994) calls for protecting human and nature interests alike. Article XX of GATT reads as:

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:….
(b) necessary to protect human, animal or plant life or health;
(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.

WTO also reiterated this stand in its Preamble concerning the establishment of the WTO as:
"Expanding the production and trade in goods and services, while allowing for optimal use of the world's resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development." (Preamble in the Final Act of the Uruguay Round, 1994, p.9)

WTO had constituted the Committee on Trade and Environment (CTE) aiming at discussing the interface between of trade and environment. In the WTO, the mandates given to the General Agreement on Trade in Services (GATS) and agreement on trade in goods are:

I. *To find out the relationship between trade measure and environmental measures in promoting sustainable development, and the need for rules to enhance that positive interaction.*
II. *The relationship between the multilateral trading system and trade measures*

used for environmental purposes, including multilateral environmental agreements.

III. *The relationship between the multilateral trading system and environmental measures with significant effects on trade*
IV. *The environmental effects of trade liberalization, and*
V. *The relationship between the dispute settlement mechanism of the WTO and those found in multilateral environmental agreements.*

The WTO Final Act contains the following four major agreements, which have relevance to environment and trade. They are:

A. Agreement on Agriculture
B. Agreement on trade related aspects of Intellectual property rights
C. Agreements on Subsidies and Countervailing Measures, and
D. Agreement on Technical Barriers to Trade.

Among them, the most relevant Agreements directed for biodiversity conservation are on Agriculture, Intellectual Property Rights (IPRs), and on Sanitary and Phyto-Sanitary (SPS).

3.3.1: Agreement on Agriculture :

On environmental side, the major benefit of this agreement is the reduction of subsidy under "Amber Box", which will reduce incentive for intensive farming in ill-suited areas. In this agreement, several exemptions are allowed for agricultural operations consistent with the environmental objectives under "Green Box" and "Blue Box". One such exemption is for direct payments under environmental programmes up to the full cost/loss of income involved in complying with the programme. Another is for price support under production limiting programs. The implication of these concession can be enhanced land prices artificially.

On 9th August 2001, the Lok Sabha passed the Plant Variety Protection and Farmers Rights Bill. The bill passed by Lok Sabha recognises the farmer not just as a cultivator but also as a conserver of the agricultural gene pool and a breeder who has bred several successful varieties. The bill makes provisions for such farmers' varieties to be registered with the help of NGOs so that they are protected against being scavenged by formal sector breeders. The rights of rural communities are acknowledged as well. The final version of the much fought over clause on what constitutes a farmers' right (Section 39, clause (iv), now reads:

The farmer...shall be deemed to be entitled to save, use, sow, exchange, share or sell his farm produce including seed of a variety protected under this Act in the

same manner as he was entitled before the coming into force of this Act;

Provided that the farmer shall not be entitled to sell branded seed of a variety protected under this Act. Explanation: for the purpose of clause (iii) branded seed means any seed put in a package or any other container and labeled in a manner indicating that such seed is of a variety protected under this Act.

This formulation allows the farmer to sell seed in the way he has always done, with the restriction that this seed cannot be branded with the breeder's registered name. In this way, both farmers' and breeders' rights are protected. The breeder is rewarded for his innovation by having control of the commercial market place but without being able to threaten the farmers' ability to independently engage in his livelihood, and supporting the livelihood of other farmers (Sahai, 2001).

3.3.1.1: Farmers' Rights

The agreement also provides legal rights to the farmers to sell seeds (not save, not exchange, but sell). In India, the farming community is the largest seed producer, providing about 87 per cent of the country's annual requirement of over 60 lakh tonnes. There are also provisions for acknowledging the role of rural communities as contributors of land races and farmer varieties in the breeding of new plant varieties. Breeders wanting to use farmers' varieties for creating Essentially Derived Varieties (EDVs) cannot do so without the express permission of the farmers involved in the conservation of such varieties. This way it protects the farming community.

According to Sahai (2001) any person or governmental or non-governmental agency is entitled to register a community's claim and have it duly recorded at a notified centre. This intervention enables the registration of farmer varieties as sources of germplasm, even if the people themselves cannot do this themselves due to illiteracy or lack of awareness. If the claim on behalf of the community is found to be genuine, a procedure is initiated for benefit sharing so that a share of profits made from the new variety goes, on behalf of the communities, into a National Gene Fund. But it is very much poorly, even incompletely, written. The Gene Fund should be the recipient of all revenues payable to the farming communities under various heads. The use of the money should not be restricted to conservation or for maintaining ex situ collections. That would mean that the revenue generated from the use of farmer varieties would partly be used to maintain the National Gene Bank in Delhi.

3.3.2: Biosafety Guidelines:

India does not have a biosafety legislation. However a mechanism has been set up under the department of biotechnology based on a three-tier mechanism to look into safety aspects of transgenic plants. These relate to: (1) the Institutional Bio-Safety Committee (IBSC) whose clearance is a must for any research institute undertaking transgenic research; (2) the Review Committee on Genetic Manipulation (RCGM), a national committee with mandate to monitor national research in India in GMOs; and (3) a genetic engineering approval committee based in the Ministry of Environment and Forests with authority to approve commercial use of Genetically Modified Organisms and re-combinant DNA products. These safeguards apart, the establishment of two transgenic containment facilities by the ICAR and the department of biotechnology in 1999, could provide operational infrastructure for biosafety. (Damodaran, 1999).

The 1988 New Policy on Seed Development (NPSD) liberalised import of high quality seeds, which in conjunction with the general economic liberalisation regime has opened the Indian seed market to foreign seed producers. The ostensible strategy of the NPSD can affect the farmers in India as they are exposed to quality seeds from a wide variety of sources including international sources. However transgenic plants and seeds bring about problems in the form of sanitary and phyto-sanitary related diseases and pests (Damodaran, 1999); and it can also affect the growth and sustenance of indigeneous varieties.

3.3.3: The Agreement on trade related intellectual property rights (IPRs:

TRIPs Agreement of GATT 1994 provides much stricter patent protection to the intellectual properties that is related to trade. Intellectual property right (IPR) is a right on new inventions and is recognized by laws relating to copyright, trademark or patent. The patent right endows its holder a time-bound monopoly on the given product. During this specified time period no one else can produce the patented product without his permission. The patent-holder can exercise his right in a number of ways. He can sell, transfer, lease, gift or otherwise dispose of his intellectual property. Such rights continue only during the patent period; at the end of which anyone can produce it without his permission (Dasgupta, 1999).

3.4.3.1: Patents in India

Patent legislation has a long history in India. Beginning in 1856, the Indian patent law has been revised a number of times (Keyala, 1999). The Indian Patent Act of 1970, recognizes patent rights for a period of seven to fourteen years. In Indian patent legislation a distinction is made between 'product' patent and 'process' patent. The Indian Patent Law of 1970 allowed process patent but not product patent, for food, medicine, agro-chemicals, etc. 'Process' means, say for a medicine, the combination of various ingredients – chemicals, medicinal plants, herbs and other biological products and so on – in specified proportions, and by using a technique or a way of combining those, that makes the production of such medicine possible. Even in areas where patent is permitted, the government is empowered to reject patent application in national interest. Further, to prevent acquiring patent rights solely with the objective of keeping the rivals out, the government retains power to reject patent and/or to make patented products compulsorily available to users (Dasgupta, 1999).

It is, therefore, possible for an Indian pharmaceutical company to buy a 'process' of making a particular medicine, in exchange of royalty paid to the patent-holder in a foreign country, but then to produce the medicine by using cheap, local material. This way life saving drugs can be sold in India at a price that is one-twentieth of their price in the developed countries (Dasgupta, 1999).

Whereas life forms are not patentable under the 1970 law, after it is amended in line with the TRIPs agreement, by 2005 AD, it would have to provide patent protection for the plant and animal varieties or to take recourse to a sui generis system that would serve more or less the same objective (Schott ,1994).

3.3.4: Agreements on Sanitary and Phyto-Sanitary (SPS) Measures

As far as SPS Agreement is concerned, it has the following features:

Broadly defined, the sanitary measures are those related to human or animal health, while health of the plant is dealt by the phyto-sanitary measures. The protection of fish and wild fauna, forest and wild flora are included and the protection of the environment per se and animal welfare excluded. This is strange indeed! The SPS Agreement again narrows down the definition into a very limited range of solutions. SPS can take place in many forms viz., requiring products to come from disease free areas, inspection of products, specific treatment or processing of products, setting of allowable maximum levels of pesticide residues or permitted

use of only certain addition in food, quarantine requirements, import ban etc. Though the measures use outside of the territory, but its very objective is to protect health within the territory of the importing country.

Though basic objective of the SPS agreement is to address environmental concern by setting appropriate standards, it is emerging as major NTBs in restricting trade. This is because of its technical complexity and particularly deceptive barrier, which is difficult to challenge. SPS is getting more protectionist under WTO. A WTO member, who is not a party to International Plant Protection Convention (1951) is affected by trade provisions of the Multi-lateral Economic Agreements (MEA) through SPS. It says "parties are required to regulate very strictly the import and export of plant and plant products, by means, where necessary of prohibitions, inspections, and destruction of consignment:" (Article 6).

3.3.5: Issue of Biopiracy

A major issue concerns patent rights on seed varieties. Under the TRIPs agreement, plant varieties are expected to be protected in one of the following three ways – by patents, by a *sui generis* system, or by a combination of the two (Dasgupta, 1998).

Recently Biplav Dasgupta (1999) has gone into this issue in great detail. His arguments are summarised in the following paragraphs.

Many multinational agri-business and pharmaceutical firms are descending on India and other countries that are economically poor but rich in biological wealth, and are scouting the countryside, forests and bushes for plant varieties. These MNCs are taking selected specimen out of the country, by means legal or illegal, and then, after some tinkering and cross-breeding with other varieties, produce new varieties that they are claiming to be unique and distinct, and then patenting those in their own countries. Once patented such varieties become the private property of the patent-holder until the time when the patent right expires. Under Exclusive Marketing Rights (EMR), if the amendment discussed above is passed, the patent-holders of a product patented anywhere in the world would drive out indigenous competitors from the Indian market.

This process of stealing and plundering the biological wealth of the third world

countries, which accounts for nearly two-thirds of the total, by the multinational firms originating in the west, has come to be known as 'biopiracy'. The countries rich in biological wealth and poor in economic terms account for top ranks in terms of mammal, bird and plant varieties. India figures eighth in rank in terms of both mammal and bird species, but no developed country figures among the first eight (Swanson, 1997).

The most talked about case of biopiracy has been the patenting of neem tree, which is a part of the Indian folk culture and whose medicinal and other properties had been known to the Indian people from time immemorial. The irony of such patenting is that patented products, processed by the foreign companies, would now have to be purchased by Indians who are used to getting those free in nature (Shiva and Holla-Bhar, 1993). Similar patent rights have been claimed on other medicinal plants – e g, haldi, salal, dudhi, gulmendhi, bagbherenda, karela, amla, jar amla, anar (pomegranate), rangoon ki bel, castor, vilayeti sisham, chamkura (Shiva, 1997) , whose properties had been known to Indians, as in the case of neem, from time immemorial. However, in case of haldi, another highly important plant with medicinal properties, the US medical school was forced to revoke patent on its use for healing wounds, in 1987, after Indian protest.

Recently Ricetec, a Texan seed breeding company, collected some specimen of the Basmati rice plants from India and Pakistan, then cross-bred those with some high-yielding varieties, and claimed that it had produced a new rice variety. This company is making two contradictory claims: first, what they have produced is unique, non-obvious and of practical use, and distinct from Indian and Pakistani Basmati, which justified their patent application, and second, their variety is an exact replica of Basmati when it comes to taste; one eating their Basmati rice would not know the difference between the two. However, the claim that the Ricetec Basmati is novel can only sustain on the ground that it can now be grown outside India and Pakistan.

The developed countries demand that all germplasms be recognised as a public resource and a part of the heritage of the mankind. That would give them the right to collect germplasm in the wild or as landrace varieties without compensation on the ground that these belong to the 'common heritage of mankind'. But, after improving the variety through research and experimentation, they do not hesitate to sell these against payment to countries including those from which such germplasm had been originally collected (Lesser, 1991). This attitude of

developed countries has led the less developed countries to make two specific demands: first, that the companies collecting those germplasms should pay to the local communities to which they belong, and, second, in line with the 1993 convention on biodiversity, these should be treated as coming under the sovereign right of a nation and not as something 'international' and belonging to nobody in particular.

The major difficulty here is that the US courts insist on documentary evidences of such 'prior art' that is difficult to find in a society where 'oral tradition' dominates. Another solution to the problem of biopiracy that suggests itself is to patent the Indian plant varieties in India itself, before it is done by anyone else and thus save them from poaching.

3.3.6: Implications of Uruguay Round for the Forest Product Trade

The Uruguay Round Agreement signed in Marrakesh, Morocco, in April 1994, has a number of implications for trade in forest products. Canada, United States, European Union and several other major importers agreed tariff elimination for pulp and paper items. Using the 1986 level of tariffs as base rate, these countries will have reduced tariffs by the year 2000 and phase them out completely out by 2004. In case of furniture some major importers such as European Union, Japan and United States have agreed to eliminate tariffs completely over the next eight to ten years. Most of the other countries have agreed to reduce tariffs for solid wood products and furniture, or at least to declare bound rates (Barbier, 1998).

As a result of the Uruguay Round Agreement on a trade-weighted basis forest products have the highest percentage of all imports (85 percent) without duty in developed country import markets – almost double the proportion of imports of all industrial goods that have zero tariffs. The major contribution of the Uruguay Round has been to reduce the degree of tariff escalation faced by forest products in developed country markets. For solid wood products, tariff escalation for wood-based panels has been reduced by 30 percent, semi-manufactures 50 percent and wood articles 67 percent (Barbier, 1998).

The implications of the Uruguay Round for non-tariff barriers faced by forest products are less clear. However two special agreements – the Agreement on the application of Sanitary and Phyto-sanitary (SPS) Measures and the Agreement on Technical Barrier to Trade (TBT) –

do provide the basis for tackling certain non-tariff measures that have been used as trade barrier against forest products. The SPS agreement could increase the use of inspection, quarantine and treatment of imported forest products as prohibitory measures beyond what is necessary to protect domestic human, animal and plant population from pests or diseases. The TBT agreement could limit the use of technical regulations on forest products as non-tariff restriction rather than for legitimate purpose of protecting human healthy and safety, preventing environmental degradation and ensuring adequate product quality and design standards (Barbier, 1998).

3.3.6.1: New Barriers to Forest Products Trade

In recent years there has been a proliferation of additional policies and regulations that have the potential of becoming new barriers to the forest products trade. These barriers include:

I. Export restrictions by developing countries to encourage domestic processing of tropical timber for export;
II. Environmental and trade restrictions on production and exports in developing countries that affects international trade patterns;
III. Quantitative restrictions on imports of unsustainably produced timber products, and
IV. The use of eco-labelling and green certification as import barriers.

Many developed countries are beginning to employ variety of environmental regulations in their forest industries – both alone and in conjunction with export restriction-that may have significant trade implications (Barbier, 1994). The developed nations also under pressure to adopt quantitative restrictions to limit the import of unsustainably produced forest products or to impose countervailing duties on imported products that benefit from an environmental export subsidy- unsustainable forest management that leads to lower harvesting costs and thus lower export product prices. (Barbier, 1998)

3.4: The Role of the Corporate Sector

3.4.1: Why the corporate sector is important in biodiversity conservation?

A wide range of biological resources is used in industry to provide foods, medicines, fabrics and an assortment of other products. For all these, they rely on natural resources of one type or another. Further, biodiversity is of great importance for sectors such as pharmaceuticals and agro-industry, as it provides them with rich source of genetic materials. Some of these materials are likely to contain unique compounds or properties, which may even provide remedies for currently untreatable diseases. It is therefore, in their best interest to sustain in the long run that the supply of those resources is not interrupted, diminished or lost forever. Conservation of biodiversity is therefore important in economic as well as ecological sense.

Box 3.4: Biodiversity linked corporate sectors

Biodiversity related natural products/ resources	**Name of the final products**	**Major industries involved**
Acacia	Chewing stuffs	Pan-Supari
Rampatre	?	?
Soapnut	Soap	Soap industries
Mohua	Wine	Liquor
Karanji	?	?
Singli-mingli	?	?
Dhup	Insence	Perfumeries
Amla	Pickles, medicines	Food processing and pharmaceuticals
Anar	Jam	Food processing
Neem	Toothpaste, medicine	Pharmaceuticals,
Turmeric	Cosmetics	Cosmetic industries
Lemon grass	Aromatic perfumes	Cosmetic industries
?	Codeine	Drug
Spices	Preservatives, Processed foods	Food processing industries

3.4.2: In what way the corporate sector can and do act?

The corporate sector can and do act on conservation of biodiversity, partly on regulatory basis and partly on voluntary basis.

Five broad lines of actions can be noted here.

First, A set of 'voluntary initiatives undertaken by the corporate sector leaders to achieve social excellence. For instance, TVS Clayton played a very positive role in Eastern

Ghats of Tamil Nadu, by indulging in participation on JFM and eco-development. A summary version of the involvement is presented in Box 3.4.

Box 3.5: Corporate sector in Joint Forest Management in Tamil Nadu: The Case of TVS Clayton

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The Srinivasan Services Trust (SST), an organization initiated by Sundaram Clayton Limited and TVS-Suzuki Limited, has recently taken up an endeavour to facilitate sustainable forest management in Tamil Nadu. It is a pioneering attempt, which could well serve as model for other corporate sectors. The efforts are currently concentrated at Padavedu-Renugondapuram in Tiruvannamalai district and at Thirukkurungudi in Tirunelveli district. SST's interventions in forest regeneration, in areas under either the JFM or eco-development project, fall into three main categories: community development, alternative income generation and empowerment of women.

SST's Activities

I. Involvement in Eco-development in Thirukkurungudi in Tirunelveli district:

This village is located in the neighbourhood of the Kalakad-Mundanthurai Tiger Reserve (KMTR), one of the two protected areas selected for bio-diversity conservation through FREEP's (Forestry Research Education and Extension Project) pilot eco-development project funded by World Bank.

II. Involvement in JFM in Padavedu-Renugondapuram in the Santhavasal Range in Tiruvannamalai district :Situated on the fringe of the Eastern Ghats, Padavedu-Renugondapuram is one of the 1000 villages where the TNFD is implementing the JFM programme under the Japan Bank of International Cooperation (JBIC) assisted Tamil Nadu Afforestation Programme (TAP).

III. Developing social fencing-the story of Vattakulam village

Nearly 15 years ago, 29 professional woodcutter and grazer families settled at Vattakulam village in Thirukkurungudi panchayat. the SST provided 37 bags of cements to complete the construction of a road; with the constant persuasion by SST personnel with the District Collector, 29 families of Vattakulem were also given the *patta* by the administration in January 2001.

Recently, the SST constructed a new concrete room for the *balwadi* centre, which can accommodate 30 children below three years age. One teacher and an assistant have been appointed to look after the children in the absence of their mothers. While the salary of the teacher is paid by the SST community pays the salary of the assistant. The SST has already approached the Integrated Child Development Scheme (ICDS) for providing a mid-day meal to these children.

I. Development of the agro-ecology of the village

Around 460 saplings have been planted at Renugondapuram for avenue plantation. The pitting and planting cost of avenue trees has been borne by the forest department while the cost of Rs 15000 for tree guards has been borne by the SST group.

Confederation of Indian Industries (CII) has recently initiated a scheme in which both the public and private sectors work towards re-greening of degraded private/revenue and forest lands. The proposal is under consideration by the government.

Second, Mandatory compliance by companies to put in an 'Environmental Accounting framework'. There are two dimensions to this. One, companies having to do Environmental Impact Assessment on a compulsory basis. The Ministry of Environment and Forestry has identified 29 sectors/ industries to get EIA clearance before seeking approval for setting up factories requiring natural resource based resources and adding to environmental pollution and waste. Second, companies to undertaking 'Environmental Auditing' as part of their general financial auditing. Centre for Science and Environment had developed a ***Green Rating Scale*** on the basis of possible Environmental Auditing for the companies in India. For a sector such as Paper and Pulp, they have arrived at Green Ratings for a large number of companies as reproduced in Box 3.6 . According to CSE, only three companies are just about above average rating.

Box 3.6: GREEN RATINGS: The Indian Pulp and Paper Sector*

With a score of 42.75 per cent, J K Paper Mills takes the lead in environmental performance, followed by Andhra Pradesh Paper Mills Ltd with 38.50 per cent. Both these mills have been given three leaves rating. The best company would have received five leaves rating, but sadly no one deserved it. At least, not yet. Mukerian Paper Mills and Amrit Paper Mills are the tailenders but with a neck and neck race between the poor performers.

Company	Score	Rank	
J K Paper Mills, Orissa	42.75	1	
Andhra Pradesh Paper Mills Ltd, Andhra Pradesh	38.50	2	
Sinar Mas Pulp & Paper (India) Ltd, Maharashtra	37.40	#	
BILT-Ballarpur Unit, Maharashtra	33.44	3	
Hindustan Newsprint Ltd, Kerala	33.30	4	
South India Viscose Industries Ltd, Tamil Nadu	31.73	5	
Pudumjee Pulp & Paper Mills Ltd, Maharashtra	31.44	6	
Tamil Nadu Newsprint & Papers Ltd, Tamil Nadu	31.40	7	
ITC-Bhadrachalam Paperboards Ltd, Andhra Pradesh	31.15	8	
Century Pulp & Paper, Uttar Pradesh	31.07	9	
Nagaon Paper Mills, Assam	28.70	10	
Seshasayee Paper & Boards Ltd, Tamil Nadu	28.20	11	
West Coast Paper Mills Ltd, Karnataka	27.67	12	
BILT-Asthi Unit, Maharashtra	27.10	13	
BILT-Yamunanagar Unit, Haryana	25.70	14	
Central Pulp Mills Ltd, Gujarat	25.35	15	
Star Paper Mills Ltd, Uttar Pradesh	24.76	16	
Shree Vindhya Paper Mills Ltd, Maharashtra	24.70	17	
BILT-Sewa Unit, Orissa	23.75	18	
Orient Paper Mills, Madhya Pradesh	22.10	19	
Mysore Paper Mills Ltd, Karnataka	21.60	20	
Cachar Paper Mills, Assam	21.43	21	
Rama Newsprint & Papers Ltd, Gujarat	21.10	22	
BILT-Chaudwar Unit, Orissa	21.06	23	

Third, there are environmental regulations on companies on pollution and disposal of waste etc. For instance, the Central Pollution Control Board has identified 18 categories of major polluting industries for priority action. In addition, they have listed 64 types of polluting industries/industrial activities as "Red Category". The stipulated control measures to reduce the extent of pollution and disposal of hazardous waste and chemicals require the industry to comply with the regulations. For instance the 1974 Water Act and 1981 Air Act and 1986 Environment Protection Acts empower the state and central pollution control boards to design and implement all such regulations.

Fourth, the corporate sector may even indulge in several voluntary measures on environmental conservation and preservation to portray their concern about the society, but also achieving 'Market Access' and to get Forest Stewardship Council's Certificate. Examples of several large companies (e.g., Asia Brown Boveri) providing tree covers on urban and metropolitan cities (say on road side, in parks etc.); fertilizer companies (e.g., Coromandel Fertilizers) taking up green belt plantations on large scale; steel plants like Tata Steel talking of maintaining parks in Jamshedpur; ICI recycling solvents; Bayer India and Gujarat Ambuja Cements undertaking recycling of waste water etc., are visible examples.

Finally, by now about thirteen major industries have joined hands to form a Corporate Round Table on Development of Strategies for the Environment (CoRE), under the overall guidance of Tata Energy Research Institute. This CoRE has identified for itself the following activities as part of corporate responsibility. They are:

I. Green-belt Development
II. Development of Eco-villages
III. Hazardous waste inventory and management
IV. Tissue culture application in Afforestation activities
V. Biotechnological methods to reduce pollution

In all the above situations or modalities, companies do show the implied costs in the usual on financial auditing. But showing them exclusively as Environmental Audit, in addition to Financial Audit will be useful. On similar lines, Energy Audit can also be introduced.

3.4.3: What has been the progress so far?

Despite the resource dependency, the corporate sector has not so far actively involved itself in biodiversity conservation process on a large scale. More often one comes across of the largely negative impact in terms of over-exploitation (e.g. of medicinal plants), habitat destruction by diversion and pollution, displacement of rural livelihoods based on bio-resources, and so on. As society becomes increasingly aware of the critical need to protect the natural environment, public intolerance on the rate of over-exploitation is on the increase. Sooner or later, the corporate sector has to move towards more responsible and just modes of functioning. Further, a number of national actions are following up the Convention on Biological Diversity, launched in 1992 and ratified by most countries of the world including India. Amongst these are the proposed Biological Diversity Bill, and the ongoing National Biodiversity Strategy and Action Plan. These and other moves will affect several business sectors involving the use of biological sources.

3.4.3.1:Likely effects of recent moves

Some of the areas, where the effects are likely to be felt are as follows:

Restrictions on long-term access to, and availability of, biological resources

Restrictions on land and water access for exploration and development: Water and Land Acts of 1974, amended in 1988.

More stringent requirements for environmental impact assessments

Restrictions on trade in products determined to be "biodiversity unfriendly", including threatened species: Anti-dumping laws, Export ban on animal hides and skins (reference to Response of the Government on starred question 151 in Lok Sabha on 06-03-2000)

Voluntary and legislative measures to protect biodiversity: Public interest litigation rights

Liability for not protecting biodiversity

Strict codes for ensuring safety in biotechnology

Public support to "biodiversity friendly" products. Green labeling and rating

3.4.3.2:Sectoral responsibilities

Although biodiversity has a broad impact on all business operations, it is an essential

foundation for development in many sectors, e.g. the seed industry, pharmaceutical companies, beauty product companies, agro-industries, and others. Some considerations are common to all sectors such as research and training, financial measures for environmentally friendly operations, and the conservation of land around operations, whereas a few issues are specific to a particular sector. Biodiversity related issues in some of these sectors are shown in Box 3.7.

Box 3.7: Production Sectors Relevant for Biodiversity Conservation

Pharmaceutical	Equitable sharing of benefits from the use of bio-resources and related knowledge Access to biological resources for collection, use, and transfer Technology transfer
Agriculture	Use of genetic resources for agriculture Minimizing the use of agrochemicals affecting biodiversity Use of living modified organisms from biotechnology determined to be safe

Forestry	Use a diversity of native species, rather than monocultures and exotics, in afforestation Avoidance of chemicals Linking industries with farmers, for provision of raw materials in ways that are sustainable and do not displace small farmers or food-producing lands R&D for non-wood alternatives to reduce demand on forests
Fishery	Sustainable use of marine resources and 'mariculture' practices. Priority to small-scale fisherfolk over large-scale commercial ventures.
Petroleum	Access to land, marine and coastal areas Detailed environmental impact assessments (EIAs)
Manufacture/Retail	Public interest in biodiversity-friendly products. Appropriate technology transfer Pollution control measures in manufacturing process Boost to small-scale biodiversity enterprises

3.5: Market Based Instruments in India

Pollutions affect the biodiversity resources very adversely. In the state of environmental management, traditionally only the non-market policy instruments are talked about. They include command-and-controls (CAC). The CAC instruments are in the form of fines, penalties and threats of legal action for closure of the factories and imprisonment of the owners who violate the environmental laws and regulations. In India the Central and State Pollution Control Boards are established after 1986 Environment Protection Act, to do this job. They can be used either for facilitating the use of specific technologies for the environment management or for the realisation of specific environmental standards. However, in most countries it is found that often the cost of imposing and implementing compliance are generally higher. Also their effectiveness is not certain.

Alternative to these are the Market Based Economic instruments. They can be divided in to three categories: price based instruments, quantity based instruments and hybrid instruments. Together with supply-demand forces of the market they achieve efficiency even with the presence of environmental externalities like air and water pollution.

The price based instruments are in the form of taxes and subsidies to deal with

detrimental and beneficial environmental externalities in production and consumption. Instances are pollution taxes on a polluting commodity either through its production (paper, leather, electricity etc.) or consumption (cigarette, packed food etc.) or on a polluting input (fuel inputs, chemicals etc.). Also, there can be subsidies on the commodities the production of which generate environmental benefits (e.g., neighbor's rose garden giving one the free benefit of beauty).

An alternative to the price based method is the quantity approach. Here, the permissible total pollution load in a region or area is first established. Then, a system of tradable pollution rights is introduced. Tradable permits are issued to the concerned producers, who have the rights to sell the extra pollution allowances if their individual emissions are lower than the minimum limit, or they have to buy the extra permits from others. In any case the total emissions would not have gone beyond the quantity established on a minimum tolerance basis.

In practice, neither the economic instruments alone nor the command and control measures alone feasible. A hybrid approach is feasible. Fixation of pollution standards (e.g., MINAS) apriori by Pollution Control Boards and using either pollution tax or marketable permits instrument to induce the polluter industry to meet those standards is a hybrid method using regulatory and economic instruments.

A community based method is yet another alternative. Under this approach, producers can pool their pollution loads and share to establish a combined effluent treatment plant (CETP) and manage the pollution complying with the regulations at the minimum cost. This type of CETP has been established by now in the textile, leather sectors in India (e.g., in Tirpur for textiles, in several places in Tamil Nadu for tanneries).

In India at present, no major innovations on the market based or the hybrid approach are implemented. The community approach however has been introduced on an experimental basis in sectors such as textile, chemicals, and leather manufacturing. It is time that a separate Working Group is established to go into the feasibilities of the various market based approaches, sector by sector, and come up with recommendations on their introductions and action plans.

3.6: Links with External Donor Agencies

3.6.1: Externally-aided projects under implementation and in the pipeline

India always had a number of bilateral donor agency development aid for biodiversity conservation. In the early phase of their involvement, the Social Forestry was the focus. With very limited involvement of the people of the region wherever the projects were introduced, very little success was realized. With the lessons form Social Forestry, the door agencies took up Joint Forest and Eco-Development Programmes in India. Some of the recent trend in these biodiversity conservation activities are summarised in Table 3.5.

Table 3.5: Involvement of Donor Agencies in Biodiversity Conservation/Restoration

A. Projects under implementation

Sl. No.	Name of Project	Funding Agency	Project Cost (in million Rupees)	Duration of the project in years	Physical target (000 ha.)
1.	Maharashtra Forestry Project	World Bank	4315.1	8	369
2.	Andhra Pradesh forestry Project	World Bank	3539.2	6	355
3.	Tamil Nadu Afforestation Project	OECF (Japan)	4992.0	6	405
4.	Capacity Building Project for participatory Management	SIDA (Sweden)	85.0	2	19
5.	Dungarpur Integrated Wastelands Development Project	SIDA (Sweden	282.1	7	47
6.	Rehabilitation of Common Lands in Aravali's	EEC	481.5	10	33

7.	Afforestation & Pasture Development along in Indira Gandhi Canal	OECF (Japan)	1075.0	10	61.5
8.	Afforestation of Aravali Hills	OECF (Japan)	1766.9	7	115
9.	Western Ghat forestry Project	DFID (U.K)	842.0	7	61
10.	Forestry and Eco - development Project in Changer	GTZ (Germany	187.0	5	11
11	Forestry Project Kullu- Mandi	DFID (U.K)	139.2	6	7
12.	Uttar Pradesh Research Project	World Bank	2720.0	4	160
13.	Madhya Pradesh Forestry Project	World Bank	2459.4	5	235
14.	Rajasthan Forestry Project	OECF (Japan)	1391.8	5	55
15.	Integrated Gujarat Forestry Development Project	OECF (Japan)	6085	6	230
16.	Eastern Karnataka Afforestation Project	OECF (Japan)	5655.4	6	171
17.	Punjab Afforestation Project	OECF (Japan)	4420*	8	59
18.	Kerala Forestry Project	World Bank	1830	4	54
19.	Capacity Building Project for Rehabilitation of Degraded forests through Land Scape Participatory Programme	AUSAID (Australia)	11.7	3	
	Grand Total		42,278.3		2447

Note: Invariably these are the projects funded in the 90's

*Loan amount has been provided for four years only in the first phase.

Comment:

The average plantation cost of external agencies funded projects is about Rs. 16911.32 / ha. as compared to Rs. 4806.00 / ha. for social forestry projects by the external agencies in the 80's.

B: Projects in the pipeline

Sl. No.	Name of the project	Funding Agency	Project Cost (Rs. Million)	Project Period
1.	Eco-Conservation and Re-afforestation of Shifting Cultivation, Nagaland	EEC	412.5	5 Years
2.	Aravali Forestry Project	OECF (Japan)	5630.8	4 Years
3.	Madhya Pradesh Forestry Project Phase –II	World Bank	13800	5 Years
4.	Arunachal Pradesh Forestry Project	World Bank	3600	5 Years
5.	Institution Building and Integrated Natural Resource Development in the Aravali Region, Haryana.	EEC	2630	10 Years

Source: Government of India, 1999

3.6.2: Experience with Donor Agency Involvement

A number of donor agency supported or funded watershed and social forestry projects have been evaluated by governmental and independent agencies . Since the eco-development and forestry project listed in Table 3.5 are of very recent origin, they are yet to be evaluated. Invariably, most of the donor supported projects are very effective for the goals and objectives set out by the agencies. They are also governed by several conditionality, and the impacts are generally above average. A summary of three projects in the past is presented in Table 3.6.

Table 3.6: Performance of External Donor Supported Watershed Projects

Aspects	Watershed project aided by		
	DANIDA	**EU**	**KFW**
Name of the project	Karnataka Watershed Dev. Project	The Doon Valley Integrated Watershed Project	Integrated Watershed Dev. Project
Location ; agro-climatic condition	Belgaum, Dharwad and Uttara Kannada Bijapur and Gulbarga Districts; Dry-cum-Hilly	Dehradun, Tehri Gharwal; Hilly	Bijapur, Bellary Chitradurga Districts; Dry
Years of operation	1991-1996	1993-2001	1994-2000

No. of watersheds covered	14	7	5
Area covered;treated (000 Ha)	41 ;25	185.4;	54;30
Project objective achieved	B	B	B
Project Conditionality	B	B	B
Benefits to small and marginal farmers	B	B	B
Benefits to landless, SC/ST	C	C	C
Livelihood impact on women	C	C	C
Degree of decentralization	C	C	-

Note: A= Substantially positive; B=Moderately positive; C=No change or negligible; D=Negative
Source:Ninan (1998)

3.7: Monetisation and Pricing of Biodiversity Products and Services

Products of forest and land resources are not always priced. Under the traditional systems the local communities and tribal have always had the usufruct rights on fuelwood, forest flowers biomass and medicinal products (See Forest Policy Resolution, 1988). In such situation, local conventions and rules regulated the extraction and use of those resources and products. One did not require any monetisation or pricing system to regulate the supply and demand for those products. But the marketisation and commercialization of these have led to some market avenues and hence some price formation. In the process the present market mechanism has become exploitative of the locals, huge margins for the middlemen, traders and exporters, as illustrated in Figure 3.6 and Table 3.7.

Table 3.7: Marketing Channels and Share of Collector's Income in NTFPs.
Data from Areyapalayam and Devanatham villages in Tamil Nadu

NTFP	Channels	Collector's income	
		Price Rs/Kg	As % age to consumer/ market price
Broom stick	Society/Retailer	0.36/No.	9.00
Stone & Treemoss		1.50	24.44
Amla (dried)		1.50	15.00
Kadikal		2.00	25.00
Pungam kernels		2.00	28.57
Wood-apple (dried)		4.00	26.67
Poochakai		3.60	27.69
Chikakai		6.00	21.43
Neem seeds		2.00	50.00
Comments: The average income from NTFP collection per family was Rs. 2800 per year.			
Data from Raipur district			
NTFP	**Channels**	**Collector's income**	
		Price Rs/qtl	**as % age to consumer/ market price**
Aonla	I	185.71	46.43
	II	185.71	47.62
	III	260.00	65.82
	IV	213.61	56.96
	V	257.60	67.79
Chironji	V	6000.00	60.00
Mahua Flower	III	300.00	60.00
Lac	II	5800.00	58.00
	IV	6000.00	60.00
	V	6200.00	62.00
Tamarind	I	600.00	60.00
	III	700.00	63.64
	IV	600.00	53.34
Tendu Leaf	VI	250.00	10.00
(Standard bag)			(only labour income)
Market Channels :			
I. Collector - Tribal Agent - Primary Wholesaler cum Retailer - Consumer			
II. Collector - Tribal Agent - Secondary Wholesaler cum Commission Agent - Consumer			
III. Collector - Primary Wholesaler cum Retailer - Consumer			
IV. Collector - Primary Wholesaler cum Retailer - Secondary Wholesaler cum Commission Agent - Consumer			
V. Collector - Secondary Wholesaler cum Commission Agent - Consumer			
VI. Nationalized			
Source : Shiva and Mathur (1993), Marothia and Gauraha (1992) and Chopra (1994)			

One can cite hundreds of such case studies to elaborate the point that the pricing system for most of the biodiversity products does not function well (including the cereal crops and some non-cereal crops whose prices are regulated by the Commission on Agricultural Costs and Prices of the Ministry of Agriculture). Under the NBSAP process it is intended to reduce such gaps and a margins between the collectors' price and the market price. For three

reasons:

I. First, for the collectors and local communities it should be an empowerment and income avenue,
II. Second, even the local communities should realize its true worth or value,
III. Third, the gains from the natural resource extraction and use should by and large be based on in-situ distributional benefits,
IV. Fourth, it should be corrective for sustainable rates extractions (based on the concept of carrying capacity), proper use of land and water resources and ecological conservation.

3.8: Links with Livelihood and Life Styles

As much as proper monetisation and pricing is important for conserving biodiversity resources, their links with livelihood and emerging life styles of the people should be looked in to in the NBSAP process. Two major statements can be made here. First, even at this stage of SAP and Economic Reforms in India, considerable degree of dependency of the local communities on the common property resources exist (Kadekodi, 2001). Second, the life styles of urban and semi-urban communities have been shifting considerably towards using the biodiversity related products, but more and more in processed forms. As stated elsewhere (Section 3.2.1), food processing has emerged as a major industry in India, in addition to, of course, cosmetics and pharmaceuticals based on herbal and medicinal plants.

A number of case studies elaborate these two points. According to the World Resources Institute (1990), nearly 500 million people in India depend upon on non-timber forest products (NTFP) for their livelihood. NTFP collection generates about 1063 million man-days of employment in India (Khare, 1989). In other words, common property resources provide a significant component of income and growth of the masses. According to him at the national scale, about 50% of income of about 20-30 % of rural population comes from NTFPs. At the micro-level, Saxena et al (1997) have identified income from an NTFP product such as *oppage* collection as Rs. 250 per day during June-September in Uttara Kannada district of Karnataka. *Janapara Vigyana Samsthe*, an NGO have estimated the NTFP links in Uttara Kannada as shown in Table 3.8.

Table 3.8: NTFP-Livelihood Linkages

	Income from NTFPs	Income from NTFP for Siddi & SC community	Number of economically significant NTFPs	Av. No. hours spent on NTFP collection
Yellapur	31%	78%	30	4 per day
Haliyal	24%	40%	29	4 per day

The famous Sukhomajri-Nada Hill Resources Management Society's data reveals a very fascinating picture of livelihood linkages of the local communities with bhabbar grass protection and rope making activity by the communities (Kadekodi, 2001). Almost all the families of Nada village are engaged in rope making from bhabbar grass. The summary of the livelihood support computations are:

I. Imputed wage income from bhabbar harvesting= Rs. 543 to 747 per hectare

Imputed wage income from bhabbar grass activity up to rope making= Rs. 12281 to Rs. 13585 per hectare. I. Imputed wage income from bhabbar grass harvesting and rope making = Rs. 12281 to 13585 per hectare

II. Net income from rope making (after allowing for capital charges, cost of bhabbar as input etc.)=Rs. 391.86 per quintal of rope
III. Net income from rope making per hectare of bhabbar grass activity=Rs. 18 to 19 thousand.
IV. Even if one family has access to one hectare of forest area, it would give sufficient income for a family for over 6 months.

Talking of livelihood and equity, there is a revealing linkage between CPR and the poor. The poor people in India highly depend upon the products of CPR significantly. Good examples are collection of fuelwood, fodder and non-timber forest products, water. According to Jodha (1986) about 30% of landless labor and small farmers in Rajasthan consume only CPR food items. In Madhya Pradesh this dependency is 50%. In Rajasthan about 42% of household income is from CPR only. According to him, about 80% of rural poor depend on CPRs for food and almost 100% for fuel, fodder and fibre.

Because of its nature as direct or home-grown or collected consumption and income in kind, CPR products enjoyed by the rural poor do not show up in their incomes and livelihood status. But if one accounts for these, it amounts to a significant portion of their incomes and consumptions, thereby making their livelihood income respectable. Among the rural population therefore, the actual disparity in consumption is much less than as being reflected in the official

statistics of income and consumption. This fact is also revealed through various NSS surveys on consumer expenditures. This fact is very significantly shown by Jodha (1994). To quote him:

"Certain inferences can be drawn from this Table [Reproduced here as Table 3.9]. The rural poor receive the bulk of their fuel supplies and fodder from the commons, which make them important sources of employment and income, especially when other opportunities are nonexistent. Income from common lands is likely to be significantly underestimated. Nevertheless, products of the commons account for 14 to 23 percent of household income .....More importantly, if incomes from the commons is included in total household income, the gap between rich and the poor groups is reduced."

Jodha (1994), p. 341

Table 3.9: Livelihood Linkages with Common Property Resources

							Gini coefficient on income	
No. of	Household						from[g]	
Districts	by income				Annual	% income	All	All sources except
and villages	categories[b]	Fuel[c]	Animal	Employment[e]	income[f]	From	sources	CPRs(%)

by state		(%)	grazing	Days	(Rs)	CPRs		
Andhra	Poor	84	-	139	534	17	0.41	0.50
Pradesh (1,2)	Others	13	-	35	62	1	0.41	0.50
Gujarat (2.4)	Poor	66	82	196	774	18	0.33	0.45
	Others	8	14	80	185	1	0.33	0.45
Karnataka	Poor	-	83	185	649	20	-	-
(1,2)	Others	-	29	34	170	3	-	-
Madhya	Poor	74	79	183	733	22	0.34	0.44
Pradesh (2,4)	Others	32	34	52	386	2	0.34	0.44
Maharashtra	Poor	75	69	128	557	14	0.40	0.48
(3,6)	Others	12	27	43	177	1	0.40	0.48
Rajasthan	Poor	71	84	165	770	23	-	-
(2,4)	Others	23	38	61	413	2	-	-
Tamil Nadu	Poor	-	-	137	738	22	-	-
(1,2)	Others	-	-	31	164	2	-	-

Source: Jodha 1986

a. CPRs include community pasture, village forests, waste land, watershed drainage, river and stream banks, and other common lands. Data indicate average area per village.

b. The number of sample households from each village varied from 20 to 36 in different districts. "Poor" house-Holds are defined as agricultural laborers and small farmers (< 2 ha dry land equivalent). "Others" includes large Farm households only.

c. Fuel gathered from CPRs as proportion of total fuel used during three seasons covering the whole year.

d. Grazing days per animal unit on CPRs as a percentage of total grazing days per animal unit.

e. Total employment from CPR product collection.

f. Income derived mainly from CPR product collection. The estimation procedure underestimated the actual Income derived form CPRs.

g. A higher Gini coefficient indicates a higher degree of income inequalities. Calculations are based on income

Data for 1983-84 from a panel of households covered under ICRISAT's village level studies

The panel of 40 households from each village included 10 households from each of the categories, Namely large, medium, and small farm households and laborer households.

Statistics apart, for NBSAP process, the significance of the livelihood linkage should be completely understood. The dependency on such biodiversity resources is partly to supplement

the income, and partly they play the role of risk aversion under various exigencies such as floods, draughts and calamities. That is why the local communities always maintained all such resources as sacred.

3.9: Strategy and Action on Economic Aspects

3.9.1:On Budget Allocation:

Government Budget allocation for the Ministry of Environment and Forests is at present a mixed bag. It be related to biodiversity areas and activities, and not based on anthropogenic activities. O For this purpose, the identification of biodiversity related areas as shown in Box 3.1 can be used. In order to work out the specific rates of resource allocation for various components, an Expert Group may have to go in to these. The degree of criticality of these areas, the livelihood dependency on them, the long term sustainability of those resources etc. will have to be used as the relevant criteria. Budget allocation can be based on (i) research and development, (ii) for protection and conservation, (iii) for promotion and awareness, (iv) for short term and long term planning etc.

Till such time a formula is worked out, the present Thematic Working Group recommends maintaining a 3% share of total revenue expenditure and another 3% share in capital expenditure exclusively for natural resource development in the states. At the MoEF level, at least 6% of GDP be allocated for all activities including biodiversity, and 3% exclusively fro forestry and wildlife preservation.

3.9.2: Sharing the Responsibility on Resource Mobilisation

The responsibility of resource mobilization is not only with the government abut also lies with the corporate sector, external donor sector and public at large This sharing mechanism also need to be fully understood and worked out at least once in five years. The same Expert Group also can look this in to. Finally, there is the question of introducing proper market based instruments to regulate the use of biodiversity related resources. Specifically in the area of water resource management, use of forest resources and marine resources, the types of market based instruments would differ. Separate studies are required to be carried out on this issue of

appropriate instruments, to look in to who gains and who loses from such market based instruments.

3.9.3: Action and strategy regarding WTO-GATT matters

1. A share of profits made from the new variety goes, on behalf of the communities, into a National Gene Fund. But it is very much poorly, even incompletely, written [Section 46 (2) d]. The Gene Fund should be the recipient of all revenues payable to the farming communities under various heads. The use of the money should not be restricted to conservation or for maintaining ex situ collections. That would mean that the revenue generated from the use of farmer varieties would partly be used to maintain the National Gene Bank in Delhi (Sahai, 2001).

2. The attempt at global standardization and uniformity by way of TRIPs agreement is in conflict with the main thrust of the Rio Earth Summit of 1992 that set out the conditions for sustainable development. These two reveal two contrasting types of international approaches and norms. While the 1992 Earth Summit and the 1993 convention on bio-diversity (CBD) focused on 'diversity' as being fundamental to sustain life and development, TRIPs and WTO are pushing for 'conformity' to international standardized norms on patents, services, labour, investment and what not, irrespective of their history, ecology, level of economic development, etc. The areas of intellectual property that the TRIPs agreement covers are: copy right and related rights; trademarks including service marks; geographical indications including appellations of origin; industrial designs; patents including the protection of new varieties of plants; the layout-designs of integrated circuits and undisclosed knowledge including trade secrets and test data (Dasgupta, 1999).There is the need for perfect transparency in the patent and TRIP regulations down to the farmer levels.

3.9.4: Action Oriented Role for the Corporate sector

Keeping in view the above, it is vital that the corporate sector should actively participate in biodiversity conservation initiatives by accepting responsible roles in implementing and managing various conservation and sustainable use programmes. A key entry point for corporate sector is through the country's national biodiversity planning process

where its knowledge and expertise can be utilized effectively. It would also help corporate sector as its legitimate interests would be represented in the development of government polices and programs, guidelines and other management tools. Conservation of biodiversity should be at the heart of the company's management strategy. This means, it should help to try to retain natural areas wherever possible, to restore degraded areas and to harvest resources sustainably. It should also respect and support the livelihoods and rights of communities dependent on biodiversity, and promote cultural diversity and values relevant to biodiversity. In fact, the companies may develop a formal biodiversity policy or incorporate biodiversity into its existing environmental policies. A stress on labour-intensive methods would be one step in this. Biodiversity strategy and policies of individual companies should reflect or recognize the national biodiversity strategy, and should adhere strictly to existing and proposed laws on wildlife and biodiversity. They should keep abreast of the discussions and developments relating to national guidelines for incentive measures, biosafety, equitable benefit-sharing, intellectual property rights, monitoring of biodiversity indicators and other related topics.

In light of the above, it is proposed that corporate sector may be involved in a two-way process in the NBSAP: to provide inputs into the process, and to learn from it to imbibe and integrate biodiversity concerns into corporate attitudes, programmes and policies. This can be attained in one or the other ways listed below:

I. As part of the action plan, the corporate sector will have to act together with the farmers on at least two counts. First, they will have to get to the business of investing on 'seed development and supply of infrastructure'; second, they should enter in to a clearly defined ' buy back system, ensuring the right price.
II. They should interact closely with the state and central governments to pickup the threads hand in hand to promote biodiversity conservation. Financial resource pooling is one such approach. This is a matter of sharing responsibility in financing biodiversity conservation between the corporate sector state and central government, a process initiated by CII already.
III. Corporate sector can develop in-house biodiversity policies and strategies to manage the biological resources the company affects and also respect the concerns of local communities and other stakeholders. Methods for education and training to instill a

biodiversity conscious culture within company management should be explored. An example is that of TVS Suzuki cited earlier.

IV. They can share information, knowledge and practices with the local communities (lessons from examples such as the benefit-sharing arrangement between the *Kani* tribe, the Tropical Botanic Garden Research Institute, and the Arya Vaidya Pharmacy Ltd, to develop a herbal drug based on *adivasi* knowledge, can be learnt from).

V. They should adopt measures, which ensure sustainable use of biological resources. The measures may be explored for the moral responsibility of corporate sector going beyond monetary and material consideration such as respecting the sanctity of critical natural habitats and threatened species.

VI. They should create awareness regarding the need for appropriate intellectual rights regimes, respecting the knowledge, innovations and practices of indigenous and local communities and ensuring that collection and use of biological and genetic resources is done within a framework/guidelines of such respect.

VII. Engage in active partnership amongst corporate sector, research institutions and biodiversity conservation organizations as well as with the general public and with local communities for the management of important species and ecosystems. In this, the corporate sector needs to accept the guidance of biodiversity specialists and local communities. The research collaborations should be encouraged to have appropriate financial agreements, training of/by scientists, and transfer of appropriate technologies.

VIII. Instituting incentives and awards for members of the corporate sector who adhere to a definition of "progressive" in terms of being biodiversity-friendly and respectful of local community livelihood rights.

3.10: From Economics to Valuation

Biodiversity is not only an ecological and intrinsic entity but it has to exist amidst a social fabric. The intrinsic value of biodiversity (values in themselves and, nominally, unrelated to human use) may be unique for all societies. But different societies look at them differently from social perspectives, depending upon their social values and relevance. Value to a society depends upon on many things, besides its ecological significance. Biological resources therefore can have, apart from an **intrinsic value**, another values, to be loosely called as

Economic value.

Intrinsic values *are* relevant to conservation decisions, but they generally cannot be measured (Pearce and Moran, 1994). Therefore, at this stage it is important to note that biodiversity valuation normally entails measuring the economic value of biological resources**,** not holistically the intrinsic value of biodiversity. However, valuing biodiversity should ***further*** be extended to get some idea of people's preferences (willingness to pay) for 'intrinsic values'. As a result, biodiversity valuation focuses on biological resources such as forests, wetlands, mangroves, water bodies and marine habitats (undisturbed or sustainably managed) that maintain current or potential human uses. Such a focus is more tractable for an action oriented process such as NBSAP. It is equally important to note that biological resources are also subject to human preferences, which places them firmly within the purview of economic analysis.

Valuation can also do several other things. Firstly, it is a tool that can be used to gauge the performance of this so call biodiversity sector in the overall economic settings. Secondly, it can enable the policy makers to design and correct the kinds of interventions required. Thirdly, it brings in transparency among the various stakeholders. Needless to claim that it can add to sustainability of the resources.

C H A P T E R - F O U R

VALUING BIODIVERSITY

4.1: Why do we have to value biodiversity?

It is already stated in Section 3.10 about the need for valuation of biodiversity resources. The argument is further strengthened here. The starting point is that there can be a difference between **value** and **price**. Value of a commodity is a complex entity based on some theory, some philosophy and concepts of rationality. The theory can be utilitarian or intrinsic. The *philosophy* can be existence (say, right to exist). The *rationality* can be equity (say, inter and intra-generational). For various reasons this value is not always revealed by people. Price of a commodity (or service) on the other hand, reflects a balance between what a buyer or a consumer is 'willing to pay' and a seller is 'willing to accept'. This is commonly (or some times loosely) called supply-demand analysis. This is based on an assumption of existence of a market. When it comes to biodiversity resources, many have no market; hence they may not have a price. But they may still have a value. In the absence of a market, the governments of the nations may fix a price administratively. Such a price also may not reflect the value. Typical examples of such a situation can be with the price of kerosene fixed by the government, but not reflecting its value. Most of the biodiversity linked resources have significant divergence between value and price. Under certain special conditions, the value can also be equal to price, and vice-versa.

Therefore, when it comes to natural and biodiversity resources, economic values as measured conventionally using market prices are inadequate in themselves in that they fail to reflect environmental impacts and the true costs. This is basically due of the fact that markets are imperfect and externalities arising out of the use of a resource are not captured in the market price, undervaluing a resource below what its price should be.

There are at least six reasons for valuing biodiversity resources separately.

- **First**, there is the situation of *missing market*. In the absence of market, values of goods and services are not revealed. For instance, there are no markets for eco-system services such as nutritional cycle, watershed functions, temperature

control, soil conservation etc.

- **Second,** even if there are markets, they do not do their job well. For instance, market may be a regulated one. There may be restrictions on one's entry into it either to buy or sell. An example of entry barrier is 'the State Forest Trading Corporations' having the exclusive rights to sell forest products. An example of regulated market is *kendu* leaves prices fixed by the cooperatives in Madhya Pradesh. One may say that there is a market for carbon sequestration. But the so called 'market for carbon trading" is very restricted and regulated by international politics and relations. Various possible cases of market failures are shown in Box 4.1.
- **Third**, for most biodiversity goods and services, it is essential to understand and appreciate its alternatives and alternative uses. For instance, alternative to fuelwood can be kerosene. Alternative uses of bhabbar grass (a biodiversity produce for sure) can be for making ropes or pulp making in a paper mill. Because of this, alternative value or opportunity costs are also relevant.
- **Fourth**, uncertainty involving demand and supply of natural resources, especially in the future. Most economic markets capture, at best the current preferences of the buyers and sellers. But when it comes to biodiversity resources, there are several types of uncertainties about the future demands and supplies. Therefore, valuation beyond the present is also necessary as an option.
- **Fifth**, government may like to use the valuation as against the restricted, administered or operating market prices for designing biodiversity conservation programmes (including inviting external donor agencies and corporate sectors and for negotiating carbon credits and so on).
- **Finally**, in order to arrive at natural resource accounting, for methods such as Net Present Value methods, valuation is a must.

Box 4.1: Types of Market Failure

Externalities are the effects of an action on other parties, which are not taken into account by the perpetrator. For example, a private industry releasing effluent into a river used for bathing and drinking is causing externalities by reducing the welfare or increasing the costs for others, since these repercussions do not enter into the **private** calculations of the firm. The task of policy makers is to **internalise** externalities by imposing on offenders themselves the **full costs** of their actions on others.

Many environmental assets valued by society, such as clean air, attractive landscapes and biological diversity, are not bought and sold in markets. As a result **many environmental assets are unpriced**. Unless restrained by other measures, individuals have no incentive to reduce their use of these assets, still less to invest in their preservation and growth.

A public good is one that is available to everyone and which cannot be denied to anyone - they are therefore **open access resources**. Under such circumstances it is unprofitable for a private party to invest in the protection or enhancement of the resource - because of the impossibility of recovering costs from other users (free riders). There is also no incentive for a user to abstain from consumption - since someone else would step in instead. This quality of public goods is sometimes called *non-exclusivity*.

Markets to perform well, need to be supported by institutions and, specifically, a system of **property rights**. An obvious case is the farmer. A farmer who owns his/her land, or has secure and long term tenure, has an obvious incentive to look after it and reinvest in it, especially if it is also possible to sell it and realise those investments. Tenant farmers, squatters, and those enjoying only the right to use land (*usufruct*) have much less incentive to mange their land or invest in it, and indeed have every reason to squeeze as much as possible from the soil while they still occupy it.

Incomplete information (ignorance and uncertainty) also hinder the functioning of markets. In such cases markets are imperfect. The function of markets is to signal emerging scarcities, such as environmental resources. Because environmental processes are badly understood, changes (and their implications) may not be perceived in time for prices to operate.

Markets fail when environmental processes are irreversible. Where the future is uncertain, there is value in keeping future development options open. Where an attractive valley is flooded to create a hydro-electric scheme society losses the option of preserving that landscape for future generations. Generating the same power from a thermal power station would retain that option, yet the market would point to the hydro project if it were cheaper. In other words the market would ignore the option values, which are destroyed by building the dam.

Source: adapted from OECD, 1995.

4.2: Ethics and eco-systems

Possibly, the strongest argument that can be given for the conservation of biodiversity, is on the **ethical** lines. Environmental ethics find a place in the value systems of most religions, philosophies and cultures.

*******add a quote from Sanskrit on value as seen from ethics**********

Broadly they appeal to have reverence for the living world, a respect for life and a sense of intrinsic value in nature. It is very important to inculcate in everyone respect for such an

intrinsic value of biodiversity. The ethical arguments can be elaborated as follows :

- **Each species has a right to exist.** Each species has value for its own sake, an intrinsic value unrelated to human needs.
- **All species are inter-dependent.** Species interact in many complex ways in a natural community. Extinction of one species is likely to destabilise the entire community and cause the extinction of other species.
- **Humans must live within the same ecological limitations as other species do.** Technology has enabled us to break free of environmental limitations imposed on us as a species, but perhaps only temporarily. We need to recognise the need for a more sustainable lifestyle, which will reduce our impacts on other species. To that end, the supply-demand approach to valuation is deficient.
- **People must take responsibility for their actions.** Most people ignore the effects of their actions on the environment and on other species and fellow human beings. Ecological degradation including species extinctions deprives future generations of their right to inherit a wholesome earth to live in. Though economists internalise this aspect through an analysis of externality, it is not covering the changes in intrinsic and existence values as much as option values of the future of biodiversity.
- **Resources should not be wasted.** Though all efforts, including technological and policy initiatives, should be directed towards using natural resources in the most efficient manner possible, there is an ethical angle to it also.

*******quote from Sanskrit on waste*******

- **A respect for human life and human diversity is compatible with a respect for biological diversity.** It is important for all of us to appreciate the complexity and diversity of human culture as this will enable the appreciation of the diversity of the natural world and also to respect this diversity.
- **Nature has spiritual and aesthetic values that transcend economic value.** Numerous writers, poets, artists and philosophers have been inspired by nature. A loss of biodiversity will reduce the ability of people to experience nature and to be inspired by it.

Against this background, the development of methods to value specifically for biodiversity is to be judged and put to action under NBSAP.

4.3: Valuation should begin from ecosystem functions

4.3.1: What have Ecosystem functions got to do with valuation?

It is the ethical principles laid above that lead us to take the course of eco-system approach to valuation of biodiversity. One of the most basic problems with which we are faced today is where to begin from, when it comes to valuation of biodiversity, particularly in monetary terms. Closest to existence, intrinsic and option values of biodiversity is the *approach of eco-system functions* that biological resources perform and their valuation as non-use values. Most of the existing methodologies begin and end up from valuation of environmental goods and services that they provide attributing them through demand-supply interactions. These, at best capture the use values. But when it comes to ecosystems, even the demand and supply curves themselves are non-existent. Therefore, there is little understanding on the methodologies of valuation among economists and ecologists (Markandya & Costanza, 1993).

Attempts have been on to develop methodologies using ecosystem approach to resource accounting and valuation (Pandit, 1997). The ecosystem approach (see Fig. 4.1) envisages preparing physical accounts of biological resources by quantifying the various natural ecosystem services, which directly or indirectly enter the market economy, yet no organism figures individually. This can help us avoid the apprehensions that both ecologists and economists have in general about the value of an individual plant or animal species. Some of these, if not all, could be monetarily accounted for. However many others can not be. In such a methodology one may require to go for indirect valuation techniques such as shadow pricing, opportunity costs, willingness to pay (WTP), willingness to accept (WTA), travel cost method, etc. (Mitchell & Carson, 1989; see also Pearce & Moran, 1994). But it is understood that only the ecosystem as a whole that needs to be valued, and not by segments, parts or bit by bit.

The logical approach is to assign value to the ecosystem uses/functions as a whole, rather than its individual components that constitute it. In the process, the constituents will automatically get reflected and accounted for. By adopting this approach conservation becomes not only justifiable, but also economically viable. With the tools of information technology available, data can be obtained and processed at much higher speeds and with greater accuracy than ever before. For instance, we can collect data on forests, forest types, their density classes and other land-uses using the combination of remotely sensed data and geographic information system (GIS) coupled with most important ground truthing. These technologies allow us to

make data available in various formats at local, area, regional, district or state level, which otherwise took years to complete and was not even dependable. With the availability of this data on digital format and also at phenomenally high resolutions, land based resource inventorisation has become much easy.

A Simplified Version of Anthropogenic Pressures on Terrestrial and Forest Ecosystem and their Natural Functions

PRESSURES

NATURAL

Leaf litter
Grazing
Fodder
Grasses
Lopping
Fruit/seeds
Agri. Expans.
Forest fires
Stream hydrology
Urbanisation
Assimilation
Interception
Soil protection/ formation/rejuvenation
Regeneration
Habitat structuring
Fauna fish
Micro-climate
Food for downstream
Food for wildlife/birds
Diversity

4.3.1.1: A Case study of physical accounting of biodiversity in Yamuna Basin

At this stage it is better to illustrate the methodology with a case study. Table 4.1 gives a set of such data, which was collected by the combination of randomly sampled field studies, primary and secondary literature sources and the analysis of remotely sensed data for a large river valley basin in India.

Table 4.1: Natural resource accounts (biological) of Yamuna sub-basin (Source: CISMHE, 1997).

Flora (higher plants)

Total no. of species	=	3121
Medicinal plants	=	912
Timber species	=	79

Fauna

Mammals	=	109
Birds	=	436
Reptiles	=	24
Amphibians	=	11
Fishes	=	89
Others + microbes	=	??

Ecosystem diversity

Total forest types	=	54
Forest cover (total area)	=	8440 sq km (8%)
Dense Forest	=	4571 sq km
Open Forest	=	2252 sq km
Scrub Forest	=	1617 sq km

Annual forest cover change (1989-90 - 96)

Dense	=	(-) 214.78 sq km
Open	=	(+) 78.31 sq km
Scrub	=	(+) 251.05 sq km

Growing stock	=	84.2 m cu.m
Standing crop biomass	=	92.8 million tonnes
Carbon stock	=	43.6 million tonnes

Carbon dynamics

Net carbon production =	2.72 million tonnes/year	
Net release	=	1.13 million tonnes/year
Net accumulation (excluding losses to soil)	=	1.27 million tonnes/year

O_2 dynamics

Total production (1996)	=	6.52 million tonnes/year

Soil loss*

Forest areas	=	0.44 million tonnes/year
Agriculture lands	=	5.97 million tonnes/year
Miscellaneous land use	=	15.17 million tonnes/year
Total	=	21.58 million tonnes/year and

*Calculated on the basis of existing literature on the subject as: Open forests = 380 kg/ha; Degraded / Scrub = 2340 kg/ha; and Agriculture fields = > 2340 kg/ha

Following from this example, a rough format for physical accounting for renewable and non-renewable natural resources can be suggested fro NBSAP process.

Box 4.2: Physical Accounting of Non-renewable resources	
	Year-wise Values in physical units
Opening Stock	
Additions	
Growth (natural)/Exploration	
Regeneration / Recovery	
Reductions	
Harvesting / Mining	
Degeneration/Erosion	
Damage / Waste in Extraction	
Natural Damage	
Net Change	
Closing Stock	

Box 4.2: Physical Accounting of Degradable Resources	
	Value/Year-wise
Additions (by pollutant)	
SO_X/ BOD	
NO_X/ COD	
PM_X/ Metals	
Exposure of Popln. (dose-response)	

By concentration	
By time period of exposure	
Extent of Degradation	

4.3.2: Action needed to get physical accounts of biodiversity

Exercises similar to the one summarized in Table 4.1 could be started at regional levels. As the technologies and methodologies get more accurate and easy to adopt more ecosystem functions could be brought in the process of valuation. At present we may like to have district-level or state-level data on the following parameters for the purpose of accounting and valuation:

- Taxonomic and ecosystem diversity (animals, plants and lower organisms, if possible)
- Forest types and forest density classes, forest cover and annual change
- Standing crop biomass (primary productivity)
- Carbon sequestration
- Oxygen production
- Assimilative capacity of forests/vegetation
- Forest cover and correlation with hydrology and flood control
- Forest cover and prevention of soil loss
- Other direct benefits (fuel wood, grasses, timber, first resource, fisheries in aquatic ecosystems) to the users of biological resources in a natural ecosystem

Next to recording of the inventory of biodiversity is assessing its changes as a step towards valuing them. For instance, the role of vegetation in temperature regulation can be directly converted in to services by knowing as to what degrees does a particular vegetation cover in an area alter temperatures during summers or winters. This can then reflect in the amount of electricity saved in a region/area for heating or cooling as the case may be. Such exercises are available and have been successfully conducted in the USA (Botkin & Beveridge , 1997). Some authors have reported that in Los Angeles city with average increase in temperature by 5 ^{o} F since 1940 additional demand for electricity rose by 1.5GW and there are estimates that to mitigate the result of heat island effect it would cost US additional burden of $ 1 billion per year (Akbari et al., 1992). Rowntree at al., (1982) have demonstrated that proper planting of vegetation in urban areas can save electricity consumption up to 24% in semi-arid areas. Let us demonstrate the same with a case study from India.

4.3.2.1:A Case study of measuring changes in biodiversity

Table 4.2 below gives an example that how can we ascertain the value of a terrestrial ecosystem in the event of its loss.

Table 4.2: The loss of Carbon sequestration from destruction of forest areas of NCT Delhi since 1940s.

Forest Status	Type	Area (ha)	Rate of CO_2 sequestration (tonnes/ha/yr)	Total (million ton)
Reserved (Potential)	Dense	7800	13.11	0.10
Existing	Dense	1800	13.11	0.024
	Open	1600	7.87	0.013
	Total			0.037

- Reduction in potential CO_2 sequestration = 0.063 MT/yr

Source: CISMHE, 1997

A study conducted in Delhi shows that vegetation can act as effective temperature regulation system in urban areas thereby saving electricity used for bringing down room temperatures with the help of air-conditioners and water coolers. Summary of the results on temperature regulation by vegetation in Delhi are as follows:

- Urban settlements on the forest fringes or with good vegetation cover recorded 1.5 – 2.8^{o}C lower temperatures than the open areas with little vegetation cover;
- The vegetation comprising broad leaf, dense canopy trees had up to 3^{o}C lower temperatures than the areas with scrub vegetation;
- The thorny scrub forest of (*Prosopis juliflora*) was not as effective as indigenous broad leaf vegetation like *Terminalia* spp. (Arjun), *Ficus* spp. (Peepal, bargad, pilkhan), and *Azadirachta indica* (Neem) in lowering ambient temperatures;
- n; and
- The scrub forest could only affect the temperatures by 0.7 – 1.0^{o}C depending upon the canopy.

Cost of abating such temperature changes in terms of increased electricity and other energy

costs can be computed.

By now it is clear that such an inventory of physical stocks and the changes there in such physical information in itself is typically insufficient to promote biodiversity conservation policy agenda. It is here that the recognition that biodiversity and biological resources have **economic value** can be the basis of a compelling case for conservation action. ***Economic value information can therefore be considered as an important addition to the stocktaking process. Such values can be more easily integrated with other development activities.***

4.4: What is the value of biodiversity?

There has been a great debate (perhaps it is a softer word for battle) among economists and ecologists about the best possible mode of valuing a particular resource. Going by the complexity of valuing biodiversity, as stated in Section 3.10 and 4.1, what we need are practical solutions so that a beginning is made at least in incorporating environmental and ecological resources in the system of national accounts. Ecologists on the one hand need to realize that if ecological theory is extended into an unending dialogue no body is to gain anything from the war of attrition. There is everything to loose, for the process of development will not stop and wait for ecological discipline to set its house in order. In absence of proper valuation of biodiversity, ecologists may be faced with a situation where we end up with more depauperate ecosystems; lesser diversity and the worst fears of a doom may come true. Instead of expressing strong opinions that economists cannot and should not value biodiversity, ecologists must strengthen them with such data that may be useful in initiating the exercise of evaluation. That is why we need action oriented valuation methods, however imperfect they are.

That brings us to theories of valuation. Keeping the Figure 4.1 and Box 4.1 and 4.2 in mind, there are ***basically three approaches to valuation*** under which we can classify the different techniques that have been evolved by economists and ecologists :

Market valuation of natural resource stocks and use*:* Under this category, market prices play an all-important role in the determination of the value of the resource in question.

Maintenance cost of natural asset depletion and quality degradation*:* Costs that are required to maintain the resource in question in their pristine state, as they should be in

their natural form shall be termed as Maintenance cost. The methods of valuation under this can be divided into (a) *objective valuation technique, and (b) subjective valuation technique.* Techniques under this category can be broadly categorised as 'replacement or repair cost', or 'treatment or pollution abatement cost' approaches.

Contingent and related valuations of welfare effects and environmental degradation: This involves valuing a resource by putting a monetary value on the response of the people affected by the change in the state of the resource. It may even include untreated or un-noticed resources. This category involves methods like 'loss of earnings' or contingent valuation approach.

It should be borne in mind that all the valuation techniques can not be used simultaneously for imputing monetary value of a resource. Application of the appropriate method will depend upon :

- the type of the resource,
- the nature of degradation and extent of depletion,
- the data available on the extent of degradation or depletion,
- the market price of the product in various economic activities,
- the cost involved in the process of regeneration of the resource,
- the rent accruing in similar economic activities,
- the exposure of population to pollutants,
- the treatment cost of upgrading a resource for different economic activities,
- the stakeholders involved,
- and many more

In the case of natural and biological resources a concept of **Total Economic Value (TEV)** is developed after a great deal of discussion and exchange of ideas among the *pundits*. Basically, it is understood that these resources provide several **Use values and Non-use values** to enhance human welfare and provide sustainability to all species. Conceptually, it is the sum of Use values (UV) and Non-use values (NUV) which constitutes the Total Economic Value. Some further elaboration of these is given below.

Use Values (UV)

Natural resources provide a variety of goods and services to the users for their current or future benefits or welfare. Hence they are said to have use values. Examples are, use of fuelwood from forests, water from rivers or underground, NTFPs from forests and so on. The current use (consumption) of these goods and services can be either direct or indirect. Accordingly, the use values can be further broadly classified into three groups: *direct, indirect and option values*.

Direct Use Values (DUV)

Direct use value can be either consumptive or non-consumptive. They refer to the current use (consumption) of the resources and services provided, directly by natural and biological resources. Examples are use of timber and non-timber forest products (NTFPs) and services. Forests provide fuelwood, fodder, medicinal plants, fruits, poles, etc., to the people particularly local communities and thereby generate direct consumptive use values. Recreation (e.g., tourism to wildlife sanctuaries or Himalayan glaciers, mountains) etc., are examples of direct non-consumptive use values, i.e., pertaining to those outside of the locals. While viewing elephants in wild is the best example of direct non-consumptive use, hunting elephants for ivory is, on the other hand, is a direct consumptive use.

Of all types of values, atlest when it comes to forest and water resources in India perhaps the direct consumptive use value dominates, This is because of water being basic to living and forest dependency being quite high. In many parts of the world wild foods constitute still over 40% of the peoples' consumption, and about 80% of medicines come from plants and animals.

An alternative to '*consumptive use value*' is the '*productive use value*'. It constitutes values of products that are harvested from the wild and sold in commercial markets, at both the national and international levels. Thy include construction timber, fuelwood, fish and other marine products, medicinal plants, fibres, rattan, honey, bees wax, natural dyes, natural perfumes, plant gums, resins and many others. Wild species are also periodically collected for use in scientific and medicinal research and agricultural breeding. Most of these products are typically undervalued as the 'collector's remuneration' alone is treated as its productive use value, and not its final market price. See Section 3.6 for examples of divergence between collector's price and market prices.

Indirect Use Values (IUV)

Indirect use values generally are referred to the ecological functions that natural

resource environments provide, but without harvesting, depletion or degradation. It can be broadly classified into three groups: watershed values, ecosystem services and evolutionary processes. Watershed values include flood control, regulation of stream flows, recharging of ground water, effect of upstream or downstream etc.; the ecosystem services include fixing of nitrogen, assimilation of waste, carbon sequestration, gene pool etc.; and evolutionary processes include global live support, cultural and aesthetic concerns, biodiversity preservation etc.

Natural environments and landscapes have been the inspiration for many works of art and literature. Traditional communities everywhere continue to find their closest cultural and spiritual links in nature. The peace and solitude offered by these environments have enabled even many 'modern' people to seek spiritual enlightenment and solace. Many species serve as early warning systems of environmental quality. Lichens are a good indicator of air quality and molluscs of water quality. By careful monitoring we can take the required actions to prevent the pollution from endangering human life. Increasingly natural environments are also used for a variety of recreational activities such a hiking and wildlife watching. These activities are also the basis for a fairly large industry. Genuine eco-tourism is increasingly proving to be a good earner for developing countries and there are many examples where revenue generated from eco-tourism has served to protect critical habitats and populations of endangered species, apart from boosting the local economy.

The educational and scientific values of natural landscapes are enormous. The extinction of species and destruction of habitats will limit our efforts to explore nature and understand its implications for the human knowledge and scientific system.

Option Value (OV)

Option value (OV) relates to the welfare benefits of conserving natural assets including biodiversity for being able to use them in the future, irrespective of their current use. It refers to the benefits received by retaining the option of using a resource (say a river basin) in the future by protecting or preserving it today, when its future demand and supply is uncertain. Take the

example of Silent valley. The people of that region of Kerala can perhaps vote (or willing to pay or an option) to say whether to postpone the setting up of a hydel power plant. The option value here is the amount that individuals would be willing to pay to postpone the decision on building a dam and power plant, or any other future use.

Option value is one of the most compelling reasons advocated for biodiversity conservation all over the world. The argument for keeping options open is often couched in terms of the precautionary principle. For lack of perfect information, caution is needed in the use of plant and animal genetic material for drug and agricultural development. There are also uncertainties related to the prospecting processes, e.g., the probability of discovering a useful compound, research and development costs and market prices.

Non-use Values (NUV)

Non-use values (NUV) are entirely different from use values and are generated without any direct link with the use of natural resource under question. An example can be the kinds of values people of a southern state, say Kerala, will put for the Himalayan mountains. These values are often revealed through people's perceptions and concerns towards conservation, culture, aesthetics and so on. For instance, *Existence values (EV) and Bequest values (BV)* are the two significant non-use values of forests. Option value and quasi option value are generally considered as future use values (Dixon and Sherman, 1990)

Bequest Value (BV)

The bequest value originates when people are willing to pay to conserve a resource for the use of future generations. By doing so, these people do not have an intention to 'use' the benefits during their own life span, but are bequesting those benefits for the future generations (Swanson and Barbier, 1992).

Existence Value (EV)

Existence value is a concept associated with peoples' willingness to pay simply for the pleasure they derive from knowing that a natural area is preserved or particular species of flora and fauna are retained irrespective of any plans they may have to hunt, observe or otherwise use these resources (Swanson and Barbier, 1992). People's willingness to pay for the preservation of endangered species is an example of existence value.

Weisbrod (1964) first introduced the term 'existence value'. It indicates that people value existence of things like unspoiled wilderness as a 'passive use value' similar in kind to, and directly comparable with, the value from active use of wilderness area for tourism, logging and so on. The 'non-use value' highlights the distinction between the 'use value' by visiting an area for recreation and the values expressing willingness to pay for preservation of an area they will never visit. Thus, existence value is the individual derives from the knowledge that the site exists, even if he/she never plans to visit it. According to John V. Krutilla (1967), existence value is the value derived from the sheer contemplation of the existence of ecosystem, apart from any direct or indirect uses of goods and services they provide. This

can include a pure biodiversity component, the appreciation for the variation or richness in the ecosystem. This is based on the contemplation of the ecosystem as a whole (entirety, ensemble) vs. appreciation for each of its members individually.

Quiggin, J. (1998) has subdivided the existence value into subcategories, (i) psychic or vicarious consumption, (ii) option value (iii), altruism, (iv) bequest value, (v) intrinsic value and (vi) stewardship value. Option value, is the value obtained from keeping the option of taking advantage of a site use value at a later date (similar to an insurance policy). Quasi-option value is due to the possibility that even though a site appears un-important now, information received later may help us to re-evaluate it. There are two types of values attached to altruisim, the paternalistic and the non-paternalistic.

Altruism is paternalistic if an individual A has positive willingness to pay for changes in B's consumption, irrespective of what B thinks. This implies that A makes judgements about what is good for B, irrespective of what B things. Thus individual A pays to B, but individual A decides what is good to individual B.

Altruism is non-paternalistic if A has positive willingness to pay for consumption of B, because it makes B better off in B's own judgement. Thus individual A pays to B and individual B decides to use the payment considering what is good/bad for himself. Stewardship value reflects a concern towards preservation of a resource in a manner to empathize with the posterity.

With these definitions, therefore, the Total Economic Value can be expressed as:

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

The above classification helps the analyst to estimate the total economic value of natural and biological resources. However, when some of the goods and services may fall in more than one category, attention is required to avoid double counting. Therefore, classification of goods and services into the above framework is an important aspect in estimating TEV. An illustration of TEV is presented in Box 4.3.

Box 4.3: Total Economic Value of Biodiversity Resources

Use Values			Non Use Values
(1) Direct Value	(2) Indirect Value	(3) Option Value	
Sustainable timber; Non timber forest products; Recreation and tourism; Medicine; Plant genetics; Education; Human habitat	Watershed protection; Nutrient cycling; Air pollution reduction; Micro climatic functions; Carbon store; Biodiversity	Future use as per (1) and (2)	Existence value: Cultural heritage Biodiversity

Source: Pearce and Moran (1994)

4.5: Methods of Valuation: A Tour

For the NBSAP process introducing the actual methods of valuation is not an easy task. Some basic conceptual starter is any way needed. This will be followed by brief descriptions of the various methods, descriptions of the steps involved in carrying out the exercises (along with introducing model questionnaires to elicit information to derive biodiversity values as defined in Section 4.4).

4.5.1: Some basic Economics

Whenever market exists for any natural or environmental resource, the prices as revealed from the market can be an indicator of the value of those resources. The basic economic concept behind the market based values is the 'Willingness to pay' by the demanders, who reveal their preferences based on their income and other considerations (Samuelson, 1948). Examples are timber prices, mineral prices or water prices (wherever water market exists). Willingness to pay does not necessarily mean the actual price, which an individual (or a society with some special characteristics) will be willing to pay for the current rate of its purchase. It all depends upon the shape of the demand curve (or the preferences).

As shown in Figure 4.2, the amount of money income BC (i.e., willing to give up an income from M_0 to M_1) which an individual is willing to pay in order to enjoy $E_0 - E_1$ of an environmental good or facility, but staying at the same old preference curve U_0 is the estimate of maximum marginal willingness to pay for a marginal environmental gain. This is the Hicksian compensated consumer surplus (Hanemann, 1991; Shogren et al, 1994). Similarly, GF can be argued to be the estimate of willingness to accept a marginally lower environmental good or service. It can be further shown that only under a perfect substitution situation between income and environmental good, the WTP and WTA would be equal for the same level of marginal environmental change. With lesser and lesser degree of substitution, the two would differ, which is perhaps is the real life situation in India and elsewhere.

What does one do if there is no market for a particular use of the resource under question? But the resource may have alternative uses with revealed market prices or may have alternative resources to substitute for. Examples are market for fuelwood may not exist for household consumption, but it exists for industrial uses. Or there are substitutes such as kerosene for fuelwood in household uses. Then, other methods are possible. Methods such as

opportunity or replacement costs basically draw upon market data and information on prices and values for such alternative, replacement or substitute. Surrogate prices are hypothetical market prices taken from such goods and services, which are close substitutes for those resources. A good example can be value of herbal medicinal plants can be the prices of non-herbal chemical based products such as synthetic creams or perfumes.

What if there are many substitutes, or replacements possibilities? Economic theory can also provide information on values for resources having many alternatives or substitutes. The shadow prices are supposed to reflect the optimal values of resources, by taking in to account all those alternatives and their combinations. These can be derived only from an empirical model of optimisation of consumption or welfare, in which the resources enter as inputs. It may be possible to derive the shadow price of water or minerals in a model of production based on such resources.

How to go about valuing resources for which there are no markets and no surrogates either? It is here that alternative user or non-user based methods are to be devised. The users or non-users of such resources may have to be brought to a homogeneous situation in which they may agree to pay for the use or existence of the resource. Or at least state or reveal the preferences on such natural resources assuming artificially created market situation. If an individual is then made to state her or his preferences, it only reflects a statement of value; hence it is a stated preference method. Contingent valuation method is one such method. With all the developments in valuation methods, it is still not easy to assign values to biodiversity especially in terms of monetary values as the role played by the various species are many, complex, and often hidden or insufficiently understood by humans.

4.5.2: Valuation Techniques

The actual methods of estimating values will have to follow the above mentioned conceptual framework, as well as the empirical feasibility. Three different approaches can be mentioned here.

Figure 4.3: Conceptual Representation of Total Economic Value

***Market approach*: Productivity change, opportunity cost, replacement cost, shadow price etc.**

- ***Surrogate market approach***: Property value or hedonic prices, travel cost method, etc.
- ***Artificial market or stated preference approach***: Contingent value method, bidding games etc.

The different valuation techniques in common uses are listed below. They can be categorised as:

Market Valuation of Natural Resource Stocks and Changes

1.1. Depreciation Method
1.2. User Cost Method
1.3. Avoidance Cost Approach
1.4. Market Price or Consumer Surplus Approach
1.5. Opportunity Cost or Substitution Approach
1.6. Shadow Price Approach

2.1. Maintenance costing of natural asset: *Objective Valuation Method*

2.1.1. The Replacement/Relocation/Restoration Cost Approach
2.1.2. The Change in Productivity Method
2.1.3. The Welfare Method

2.2. Maintenance costing of natural asset: *Subjective Valuation Method*

2.2.1. The Hedonic Price Method
2.2.2. The Travel Cost Approach
2.2.3. The Property Value Approach
2.2.4. The Production Function Approach

3. Contingent Valuation Technique

These valuation techniques are elaborated to make the NBSAP process more communicative, transparent and purposive.

1. Market Valuation of Natural Resource Stocks and Changes

Market valuation methods are used when market prices are available for natural resources. Among them, the depletion of natural capital is of some special interest, but not quite relevant for biodiversity resources (which may have degradation, if not depletion in short time period). There are primarily two methods for valuing such depleting resources:

1.1: The Depreciation Method or the Net Price Method utilizes economic techniques similar to those used to value the decline in productivity of fixed capital in valuing national capital depreciation. Standard calculations of national income impute and subtract fixed capital depreciation from GDP to arrive at NDP. Similarly, the economic value of natural capital depletion is subtracted from NDP in estimating environmentally adjusted net domestic product (ENDP). The net price method is based on the Hotelling (1931) rent assumptions, which claims that in a perfectly competitive market, the price of a natural resource rises at the rate of interest of alternative investment, offsetting the discount rate. According to Hotelling, the rent defined as the difference between the price of the resource and the marginal cost of extraction, would reflect the unit value of the natural resource stock.

Various steps involved in this method are:

Step 1: Estimate the marginal cost (different from average cost) of extraction of using the resource. This requires some economic model of production (with scale effects etc.);

Step 2: Get the Competitive market price of the resource.

Step 3: If the resource extraction is over a long period of time, then work out he discounted sum of the difference between the price and marginal cost as the net price of the resource. The choice if the discount rate is crucial here.

This method is more appropriate for depleting natural resource such as coal, cure oil etc. For an illustration of the method, see Section 4.8.1 for a case study from Goa.

1.2:The User Cost Method (proposed by El Serafy, 1989) is an alternative method to Depreciation method. The user cost approach does not address the valuation of the stock or reserve but focuses on potential income that can be generated from the extraction (sales). The basic idea here is to convert a time bound stream of net receipts from the sales of an exhaustible resource into a permanent income stream (X) by investing a part of the receipt, i.e., the user cost allowance (R-X) over the life time of the resource. Only the remaining amount X of the receipts should be considered "true income". This method thus takes into account the exhaustible nature of natural resources in valuation. This method is illustrated in Section 4.8.1 with a case study from Goa on mineral resources.

1.3: The Avoidance Cost Approach: This approach is used for assessing quality changes in the natural assets by estimating the cost of avoiding such changes. This method is used mainly for valuing degradation of environmental resources. For instance, if a wetland protects adjacent property from flooding, the flood protection benefit is the cost of avoiding the damage to the property by the owner by alternative methods. In the case of water and air pollution, the price is estimated on the basis of what it would cost to reduce such pollution to acceptable levels. Some time these are referred to as Defensive expenditure approach, or substitute cost method.

The computation of cost of avoidance may require sample surveys (among the households or affected people) to establish an average damage or avoidance cost.

1.4: The Market Price or Consumer Surplus Approach is relevant only in the situations of well-developed markets. Only with a good market survey on a variety of consumers it may be possible to deduce the demand curve and hence estimate the average consumer surplus or 'willingness to pay'. For most biodiversity resources, such markets do not exist. In such cases simple market price approach may be used. The consumer surplus approach has already been explained in Section 4.5.1. None-the-less, both the methods are best understood with illustrations.

Box 4.4: Valuation of Environmental Products Using Market Prices

For environmental products that have a market price, their monetary value may be estimated as follows:

Total Value = Unit Market Price * Quantity

Where:
Market Prices are corrected for any known market and policy failures (e.g., externalities, taxes and subsidies).
Harvesting and transport costs are deducted from the gross value in order to derive the net value of a product. Account is taken of seasonal changes in market prices
Quantity harvested is based on maximum sustainable yield (MSY)
Market price analysis will tend to underestimate value since it does not account for consumer surplus.

Box 4.5: Valuation of Timber Through Markets: Case Study from Himachal Pradesh

Market mechanism for timber in India be understood before examining and interpreting market prices of timber.

In India forest coupes are generally disposed of through auctions. The price is determined not for any individual tree but for the whole group of trees within a forest coupe. Prior to auctioning, a variety of logging operations are involved. The logging operation includes felling, delimbing, topping, cross cutting, debarking, fashioning and transporting. The wood is then graded, arranged in lots and auctioned after determining the cubic content of the material in each lot. The following categories of timber are commonly distinguished between in the pricing process:

(1) logs, which are round woods having a mid girth of 45 cms with any length.
(2) poles are also round woods but they have a midgirth of 25 to 45 cms and a length of 3 m and over.
(3) posts have length of 2 m to 3 in and a mid girth of less than 45 cms.
(4) the rest, classified as twigs and braches and sold as firewood for preparing a rab.

The important timber species, which are prevalent in the Himachal region, are sal, dhir, khair (kil), salar, bel, sisham, khekra, oak, fir, deodar etc. The forest auction division in the southern part of Himachal Pradesh is Sawra. Chopal Rampur and Shimla in Shimla circle, and Solan and Nahan in Nahan in Nahan Circle. The important marketing centres in South zone are Turuwall (Poanta Sahib), Parvano, Badi, Dhantu, and Badhoria.

Table 4.3 shows the specie wise average price per cubic meter (after taking in to account other characteristics as size, length, girth, pole etc.) for two years. The different classes of timber are sawn timber, Axe Hewn (karries), dimdimas, side slabs (passellas), hakares, round ballis, logs geltus, khair billets, pulpwood etc. The highest price, recorded for deodar timber is Rs. 11780 per cubic meter during the period 1995-96. The other species in order of per unit value are kail, fir, chil, sal, shisham and Sain, with per unit prices of Rs. 6839, Rs. 4666, Rs. 3481, Rs. 3272, Rs. 2846, and Rs. 2702. respectively during the same year. However, the prices for sal, shisham and sain at Rs. 5192, Rs. 3908 and Rs. 2821 per cubic meter, respectively are higher during the previous year, namely 1994-95. The prices of the remaining species in 1994-95 are lower than those prevailing in 1995-96.

Table 4.3: Prices of Important Timber Species in South Zone of Himachal Pradesh (Rs. Per cu.m)

Species	**1994-95**	**1995-96**
Deodar	9502	11780
Kail	5442	6839

Source: Chopra and Kadekodi (1997)

Box 4.6: Demonstration of Consumer surplus Approach: Gain from fishing in Chilika Lake after deweeding the lake

Chilika is a well-known brakish water eusterine wetland in Orissa state. As compared to the polluted weed infected situation, with deweeding the catch of fish would have gone up. The consumer surplus in the catch and sale of fish from the lake is different in the two situations. The incremental consumer surplus between the two situations is the net value of deweeding operation in the lake (and not the cost of deweeding).
The steps involved in the computation this value are illustrated with a straight-line demand curve.
Step 1: After de-weeding: the price of fish= Rs. 50 per kg; amount of catch per fisherman=20 kg per day; price at no catch =Rs. 100. Therefore consumer surplus= Rs (100-50)*20kg/2=Rs.500 per fisherman per day.
Step 2: Before de-weeding: Price of fish Rs. 75 per kg; catch per fisherman=15 kg per day; Consumer surplus= Rs (100-75)*16 kg/2=Rs 200 per fisherman per day.
Step 3: Net consumer surplus =Difference between the two consumer surpluses=Rs.500-Rs. 200=Rs. 300 per fisherman per day.
Step 4: Total consumer surplus= Total number of fishermen (=1500)* Consumer surplus per fisherman (Rs. 300)=Rs. 450,000 per day.

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The value of deweeding operation is Rs. 450,000 per day. But the actual cost of deweeding may be quite different! May be Rs. 10,000.

1.5: The Opportunity Cost or Substitution Approach

Biological resources may have alternative use and relevance. For instance, a waterfall in a forest may mean only water to some, aesthetic beauty for some one else, yet may be a source for hydro-electricity generation for some one else. Hence there are alternative uses or perceptions and hence alternative values. Only when, all the alternative values are looked in to, the true value of the resources is properly understood. Secondly, only some biodiversity resources do have alternatives. An example is dung manure (a biodiversity produce) to be replaced by chemical fertilizer in agriculture. Then, the value of the biodiversity resource will have to note of the value of the alternative substitute resource. Once again, a case study is more illustrative.

Box 4.7: Value of manure in terms of equivalent chemical fertilizer

Consider the situation of Sukhomajri, the famous watershed experiment carried in the early 80's in lower Shivaliks hills in Haryana state. Under an integrated watershed programme, the villagers of Sukhomajri (and later on many other villages) took to stall feeding the cattle, thereby reducing the pressure on forest slopes. This activity alone enabled them to collect dung at their door step, usable as manure for their crop cultivation. Stall-feeding has reversed the process of forest degradation. What is the value of stall-feeding then? It is evaluated in terms of the amount of chemical fertilizer saved in maintaining the crop agriculture. That is the value of the substitute for manure.

The computation follows as:

- ♣ The equivalence of manure per cattle per year is 30 kg of nitrogenous and 4 kg of phosphate fertilizer.
- ♣ As compared to the pre-watershed (and stall feeding) situation, the amount of dung collected has doubled (as per the survey in the villages).
- ♣ This is equivalent to 17 kg of fertilizer per year (15 kg of nitrogeneous+ 2 kg of phorsherous fertilizer), per animal per year.
- ♣ Going by the market price of fertilizer, the value of this fertilizer saved is Rs. 37.40

Summary based on :Chopra et al., 1990

1.6: Shadow Price Approach

In this method, essentially an optimizing model of alternative technical, social and ecological options is set up. With an objective or welfare function then the model tries to identify the best options of resources uses, technology, social institutions etc., to be adopted. In doing so, the optimum value of various resources to be used or released is revealed. They are called the shadow prices. There are no known good studies in the shadow price estimates of

biodiversity resources from India. But consider this hypothetical case of clearing a forest area: The options can be listed as:

- ♣ 20 year clear cut Total harvestable area is cut over 20-year period, once only cut
- ♣ 30 year clear cut Total harvestable area is cut over 30-year period, once only cut
- ♣ 30 year clear cut / 80% selective cut 80% of total harvestable area (192,000 ha) is cut in perpetuity in 30-year rotation
- ♣ 30 year rotation/ 40% selective cut 40% of harvestable area (96,000 ha) is cut in perpetuity on 30-year rotation
- ♣ 30 year rotation / 25% selective cut 25% of total harvestable area (60,000 ha) is cut in perpetuity on 30-year rotation
- ♣ Cutting ban Entire mangrove area is maintained in natural state

Under such a mix of alternatives, the optimum method can be deduced using a suitable welfare function (say value of local users benefits). Then the shadow price of forest resource can be deduced from such a model.

2.1: Maintenance costing of natural asset: *Objective Valuation Method*

The Maintenance Cost Valuation Methods **are those, which involves valuing resources with the objective of maintaining them in their pristine state.** Objective Valuation Methods **primarily are about valuation of physical changes in the quality and quantity of resources by valuing physical damage caused by offending economic activities. There are three major categories of these methods.**

2.1.1: The Replacement Method or the Maintenance Cost Method: According to this method the value of a natural resource is determined by the restoration cost of produced and non-produced natural assets. This method defines cost of a natural resource as the cost that would be incurred to maintain the original level of the resource at the beginning. For example, the replacement cost of ground water resources would be equal to the cost of recharge of this water to its original level. This approach has been widely used in the literature mainly for renewable natural resources. For instance, restoration cost of a forest compartment whenever, some replacement or alterations are to be done in forest areas is a common example in mining areas.

2.1.2: The Change in Productivity Method: This method estimates the environmental costs in terms of loss of production arising from depletion of water resources is likely to reduce productivity in crop cultivation by (a) reducing the area under cultivation, (b) changing cropping pattern or (c) reduction in the yields. Or, degradation of land is likely to reduce yield per hectare in the similar way. Other applications can be on measuring the costs of soil erosion based on crop lose, or water pollution based on fish stock damage. The technique is most appropriate when the environmental change directly causes an increase or decrease in the output of a good (or service), which is marketed.

The steps involved in this approach are: (i) Identification of the physical effect of the change in environmental quality on the economic activity concerned; This may require specifying a production function between the output and the inputs, including natural resources. (ii) estimating what difference this physical effect will have in terms of output or costs; and, (iii) estimating the market value of this change in output. The application is limited whenever there are difficulties in identifying the physical effects; presence of distorted and missing markets or, in situations where the environmental change has a sizeable impact on market making a more complex view of market structure necessary.

2.1.2.1 : A Case study on productivity based valuation of agricultural land

In valuing agricultural land we want to value it as a productive asset. Land is used to produce agricultural output, to grow crops on it. ***Value of land here refers to productive asset for agricultural purposes only.***

When it comes to land, other values that can also be considered are emotional, and cultural or religious, and other externality values (e.g., land may be precious to a person because it has belonged to his ancestors or is associated with family history). Sometimes a piece of land may provide other services. It may be a part of a beautiful landscape and when we change its use we may alter the beauty of the landscape. When we change its use, it may alter erosion or sedimentation on other lands. Such aesthetic or environmental (dis)services provided by a piece of land are external to the piece. If sufficient data exists, these can also be valued. But in the case study presented here they are not included.

If land were actively traded and land markets are efficient, then the market would determine the loss in the value of soil due to degradation such as salination, water-logging or erosion. Unfortunately, agricultural land is hardly traded in India, and cannot provide information about the loss in value of its soil. It is, therefore, necessary to develop alternative method to value changes in soil quality. A farmer would like to know the trade offs between intensive cultivation and resulting soil degradation that would reduce their future yields. He may like to know the value of degradation of his land without going to market. Or policy makers would like to know these trade offs before promoting a new agricultural technology. It may also be in the society's interest to induce farmers to change land use and one should know how much the change is worth.

Apart from using market prices, a number of other approaches are possible to value changes in soil quality. The productivity approach estimates the present value of the loss is production now and in future. This is a physical linkage approach and Box 4.8 illustrates it.

Box 4.8: Valuing Agricultural Land for India

The approach is illustrated with an application to the state of Haryana in India. Farm land information on soil quality parameters was collected by a survey, which covered 21,500 farm households across India for two consecutive years – 1975-76 and 1976-77. The survey collected information on the following soil parameters for each farm.

- Soil type (sand, lawn, light clay, heavy clay).
- Soil colour (red, black, grey and yellow)
- Soil depth (< 1 foot, 1-3 feet, > 3 feet).
- Soil solemnity (nil, moderate, high).
- Surface drainage (good, moderate, poor)
- Rate of percolation (high, moderate, low).

Along with this, the survey also asked the respondents to rank their land quality. This was used as the dependent variable. The following functional form was estimated using above data for each state (See Parikh and Ghosh (1995)).

$$\text{Soil Quality Index} = + \sum_i {}_i Q_i$$

Where Qi is the dummy for the different soil quality parameters. Parikh and Ghosh show that the state level average soil quality is given by

$$g^{state} = + \sum_i {}_i A_i$$

where A_i is the proportion of area under each type of soil quality parameters.

The following exercise demonstrates the use of the above function in estimating changes in land value. For this exercise, the Indian State of Haryana was chosen as an example

The estimated coefficient ($_I$'s and the proportion of area under each attribute in the state are given below. The table also shows how the area under different soil quality classes change over the year in a hypothetical situation. We have assumed that 10% additional land becomes highly saline and 10% additional land gets eroded. The table below is constitutes a physical account of soil quality change.

Box 4.9: Physical Accounts of Agricultural Land

		Percentage of Cultivable area under different Categories	
Physical and Chemical Property	Coefficient	Year t	Year t+1
Intercept	2.344		

Soil Texture			
Sand	-0.074	17.9	17.9
Loan	-0.017	68.3	68.3
Light clay	-0.007	13.5	13.5
Heavy clay	0	0.3	0.3
Soil Colour			
Red	0.006	24.7	24.7
Black	-0.000317	1.9	1.9
Grey	-0.085	69.7	69.7
Yellow	0	3.7	3.7
Soil Depth			
< 1 foot	-0.069	29.8	39.8
1-3 feet	0	27.7	27.7
> 3 feet	0.009	42.5	32.5
Salinity			
Nil	0.032	67.9	57.9
Medium	0	31.5	31.5
High	-0.079	0.6	10.6
Drainage			
Good	0.132	79.1	79.1
Medium	0	19.5	19.5
Poor	0.65	4.1	4.1
Percolation			
Fast	0.364	40.1	40.1
Medium	0	57	57
Slow	0.268	2.4	2.4
g(Q)		12.505	12.266
Percentage change in g(Q)			-1.91

Box 4.10: Productivity Linked Value of Land

Economic Value Accounts of Agricultural Land in Haryana in a Hypothetical situation in which additional 10% of the state's land is eroded and additional 10% becomes highly saline.		
Net cultivable land	=	3792000 hectares
Value added in agriculture in 1995	=	59722.2 Rs. Million
Net cropped area (NCA)	=	3575000 hectares
Net productivity (value added) Per unit NCA	=	16705.50 Rs.
Net present value (NPV) of a Unit hectare in 1995 (Using 10% discount rate)	=	183760.50 Rs.
Initial value of total land	=	183760.50 x 3792 = 697 Rs. Billion.
Depreciation due to change in Productivity	=	697 x 1.91/100 = 13 Rs. Billion.
Final value of total land	=	69.7 x (1-0.0191) = 684 Rs. Billion.
Value of land after accounting for Change in productivity	=	180250.67 Rs./ha
Land value has gone down due to soil erosion.		

Summary based on: Parikh (2001)

2.1.3: The Welfare Method: One major impact of environmental depletion and degradation is on health and welfare of people in terms of increased sickness (morbidity) and increased premature death (mortality). For example, lack of adequate water supply or non-potable drinking water may lead to increased incidence of water borne diseases or in some cases to premature deaths. The cost of morbidity can be computed by estimating the medical expenses – expenses on medicines, admission etc., for the patients. This cost will also include (a) loss of wages of the patients, (b) loss of wages of the attending persons to the patent as well as (c) the cost of discomfort and dis-utility. These can be estimated through a primary survey (the last is difficult to measure one can use contingent valuation here). The value of premature death can be computed based on the value of a statistical life, as determined by either a human capital approach or by a willingness to pay approach. The former method values on individual's life according to the net present value of his/her productivity. The willingness to pay approach measures the value which society places on an individual as distinct from an individual's wage earning capacity. The first approach tends to give a lower value than the second approach.

The total welfare cost can be computed by adding the cost of morbidity and the cost of

morbidity. This cost should be treated as defensive expenditure and should be subtracted from the GDP. The method of linking morbidity and mortality status (as a result of environmental degradation to socio-economic status, causes of the events and possible remedies and policy instruments is generally called as a Dose-Response Analysis. Box 4.11 summarises one such case study from the city of Mumbai.

Box 4.11: Estimating Health Effects of Environmental Changes

It was found from a study of Chembur area of Mumbai that due to severe air pollution, several health related effects are observed. The major ones are: cough and dyspnea. They result in loss of work, hospitalization and even mortality. Using the field level (cross section of 300 households) data collected by Dr. S.R. Kamat of KEM Hospital, several dose response logit models were estimated (Jyoti Parikh, 2001). The chance (probability of occurrence) of cough and dyspnea are related to total expenditure (on curing), sex of the individual, habit of smoking, degree of exposure etc. Mortality is related to population, slum characteristics, hospital wards and emission of SO_2. Using such models, and the data on costs of curing and abatements, loss of work, and loss of income due to death etc., the cost of occurrence, abatement, and cost of loss of life are estimated. The costs include medical expenses, hospital charges, transport costs, accommodation costs, and loss of work, loss of income from the productive life etc. It was then found that for an increase of 10 units of SO_2 the number of excess death projected is 325. The implication of this is a loss of income to the family. This is estimated using a Human Capital approach to be of the order of Rs. 383433 per life. It will be worth noting that under Workers' Compensation Act the average compensation is Rs. 213144, a gross under valued effects of health effects due to air pollution. Likewise, the annual average expenditure on account of asthma and bronchitis are estimated to range from Rs. 83 (mild attach) to Rs. 5885 (severe attach).

Such dose response models can therefore are useful to value to health effects of environmental changes.

Source: Jyoti Parikh (2001)

2.2. Maintenance costing of natural asset: *Subjective Valuation Method*

Subjective Valuation Methods **measure possible environmental value as expressed or revealed in real or hypothetical markets. These methods can be broadly divided into Surrogate Market Valuation and Contingent Valuation.**

2.2.1: Surrogate Market Valuation approaches use information relating to market goods to infer the value of an associated non-market good. The different valuation techniques used here

are:

(A) The Hedonic Price Method: Next to Option value this is another important method relevant for biodiversity conservation. This method is based on the assumption that the value of a resource is related to net benefits derived from it. In other words, *it uses a related market approach and direct observations are used to value an environmental amenity.* The basic premise is that consumers can reveal their choice of consumption of environmental goods, through their choice of related market goods and services (typically property prices or wages). A person may choose a home where air/environment is good, and may pay more for this environment (for example, fresh air, vicinity of parks/rivers etc.). The Hedonic price method employs statistical techniques to isolate-environmental values, which contribute to an observed difference in product prices.

Various steps involved in this method are:

- Identify a well-functioning market in the first place.
- Compare market values for identical properties (in terms of rooms, size etc) and see whether the presence or absence of the favourable environmental attribute is reflected in any price difference.
- Observations on many properties with and without the identified attribute to be valued. Need to have detailed descriptions of properties in order to rule out the effect of structural differences as opposed to the environmental attribute sought.
- Establish a statistical relationship - define the hedonic price function to show how price changes with the environmental attribute holding other things constant;
  $P = P(S, N, E)$; where
  P = property price, S = Structural characteristic of housing, N = neighbourhood characteristics (e.g. safety, transport, employment), E= environmental factor.
- From information on the price function calculate the marginal WTP for the environmental factor or slope of the WTP curve that gives us the additional marginal WTP for an increase or decrease in environmental attribute E.
- Finally it is also worth mentioning that the method has some interface with the valuation of plant genetic resources for agriculture. The steps for conducting this research are similar to the property example although the data requirements are just as onerous. The following description summarises the only available research in this area as described by Evanson and Gollin (1998). The steps allow the direct estimation of the contribution of germplasm of original landraces to rice productivity

  - For a crop – e.g., rice, divide gains in output into gains from yield and gains from increased area under cultivation
  - Disaggregate rice yield gains into gains attributable to varietal improvement, other technological advances and other sources of change
  - Assume varietal improvement is dependent on stocks of advanced crossing

material from different sources and other research resources

- The stocks of advanced material depend on the existence of traditional landraces and wild species.
- Link productivity to original germplasm, its origins and ownership
- Note finally that the data requirements are onerous. In short detailed information is required on the productivity of all factor inputs in all the above stages

The method is demonstrated with a case study from India.

Box 4.12: A Case study of Bhoj Wetland of Bhopal

Bhoj wetland is large lake, commonly known to the people of Bhopal as a pride recreation lake. But due to increasing pollution of the lake, not only the tourist and aesthetic value of the lake is reducing; it is also affecting the property prices around the lake, particularly in the Upper lake area. The changing property price is a reflection on the value of pollution effects on the lake.

This was studied in two steps. In the first step attitudes of the people were studied as to what are the factors that people consider to be important while buying a piece of property. In the second step property prices in different areas of the city were obtained and ranked and correlated with the parameters of neighbourhood, proximity to markets, ease of access, the environment, housing density and presence and absence of lake (preferred to be clean).

Major factors people normally use in buying property in the city of Bhopal are shown in Table 4.4 (as composite relative indices).

Table 4.4: Ranking Of Various Factors Considered while Buying Property

S. No:
Factor
Scores

1.
Drinking Water
0.99

2.
Safety
0.94

3.
School
Quality of Construction
Hospital
0.88
0.87
0.87

6.
Age of House
0.85

7.
Park
Market
Air Pollution

(B): The Travel Cost Approach: The Travel Cost Method (TCM) is typically used to capture the recreational value of sites, such as national parks and sanctuaries. Sometimes, though less often, it has also been applied to problems like finding the value of collected forest products (not routed through the markets) for villagers, by examining the travel and time costs involved in collecting them. In general, the method can be used in the following situations:

- Changes is access costs for a recreation site;
- elimination of an existing recreation site;
- Addition of a new recreation site;
- changes in environmental quality at a recreational site.

Here the expenditure incurred on visiting a site is treated as a revelation of consumer's preference for the environmental services provided by it, and derives the value placed on these services. The basic philosophy is to use the cost of travel as surrogate for the willingness to pay for using the recreation site. Travel costs would include actual transportation costs, fees paid at hotels and at times the opportunity cost of travel time spent on journey. It is most commonly used for assessing the value of national parks meant for preservation of flora and fauna.

The method is based on the assumption that that people's preferences for the environment can be 'revealed' indirectly by examining their behaviour in markets that are linked to the environment. It is assumed that travel costs to a site can be regarded as a proxy for the value of the non-market asset.

The travel cost method focuses on estimating the following demand function:

V = f (TC;X); where V = number of visits to the park, TC = travel cost to reach the park, X = vector of the relevant socio-economic variables.

Two Variations of the Travel Cost Method:

There are two approaches commonly used. – the Zonal Travel Cost Method (ZTCM) and the Individual Travel Cost Method (ITCM). Let us examine the difference between the two approaches.

Box 4.13: Two methods compared

S. No.	Point of comparison	ZTCM	ITCM
1	Unit of observation	The zone	The individual visitor
2	The dependent variable	The visitation rate	The number of visits made by each visitor per period
3	The nature of the independent variables	Only those characteristics which can be described at the zonal level are included	Individual-specific characteristics can be included
4	Sample size requirements	The sample size should be large, so that several zones can be constructed	Sample size can be relatively smaller

The choice of which of the two methods to use will depend upon the situation at hand. If the site is one that offers a unique recreation experience, then, typically, visitors will come from even far-away regions to visit it. However, visitors who come from longer distances are generally not able or willing to visit the site more than once or twice in a year. In such a situation, if we were to use the ITCM approach, then the dependent variable (the number of visits made by each respondent), would not exhibit sufficient variation to make regression analysis possible. In that case, it is advisable to use the ZTCM. Note that a fairly large sample size is needed to make zoning feasible.

Various steps involved in a TCM study are:

Divide the visitors in to different distance or population zones as locals, domestic, foreigners and so on and treat them additively separable.

If necessary (depending upon the site), mark out geographical zones as wildlife area, water bodies, flora area and so on.

Obtain visitation rates for each distance or population zone, by sampled questionnaire method.

Estimate travel costs on the basis of (a) entry fees (EF), (b) time spent in the area (T) (c) various travel costs (TC), (d) boarding and lodging costs (e) socio-economic status of the visitor (social status, education (ED), income (INC), age, interest in and perception about environment (PE), etc.). Costs should include: direct expenses incurred by visitor getting to and from the site; the opportunity cost of time spent traveling (say, income foregone) at the site; and any entry fees and other incidental expenses.

Statistically derive or construct a demand curve; estimate consumer surplus; estimate benefits of environmental improvement at the site:

An example of the demand curve :

$Vi = a + b\text{TCi} + c\ \text{INCi} + d\text{EDi} + \text{e}\ \text{PE}_i + f\text{STC}_i + \ldots\ldots\ldots$

where: V = the number of visits to the site; TC = total travel cost per visit; INC =

individuals income; ED = respondents educational level; STC = the travel cost to substitute sites; i = the respondent as a visitor or geographical zone or both; *a*, *b*, *c*, *d* etc., are the coefficients to be estimated.
The Consumer Surplus (CS) is the estimate of the Willingness to pay for zone i is estimated as:

$$CS_i = \int_{T_{min}}^{T_{max}} V_i \; TC_i \; ,$$ where i= geographical zone i.

For the whole site, the sum of the consumer surpluses over all zones will be the total value.

A case study from a sacred lake from Sikkim will be useful here.

Box 4.14: Valuing eco-tourism in a sacred lake of the Sikkim Himalaya, India

Sacred lakes of the Himalayan region attract visitors and pilgrims from all over the world for their aesthetic, cultural and spiritual importance, The Sikkim Himalaya has more than 150 lakes at different altitudes and most are considered sacred. The recreational biodiversity and sacredness values of Khecheopalri, a lake situated in the west district of Sikkim State, India is presented here.

Visitor numbers began to increase in Sikkim in 1990 as a result of a relaxation of regulations that opened a number of new areas to both domestic and foreign tourists. Until 1980, the state hosted only 15454 visitors, but this had increased five-fold by 1990, and reached 143410 in 1998. The number of visitors to Khecheopalri lake has grown rapidly from 16068 in 1997 to 18713 in 1998. In 1998, 7800 visitors arrived at the lake from Sikkim as pilgrims. About 78% of the pilgrims visited the lake for religious purposes, while the majority (85%) of the domestic visitors came for recreation. Most (65%) of the foreign visitors came to the lake for recreation, but 19% came for religious purposes and 16% cited the rich biodiversity of the area as their purpose in visiting. Approximately 56% of foreign visitors, 43% domestic visitors, 35% of local community members and 28% of pilgrims showed some interest in conservation and maintenance of the lake and its surrounding watersheds.

The salient features of the study are:

- ♣ A sample survey of 360 visitors, consisting of 50 members of the local community, 140 pilgrims, 95 domestic and 75 foreign visitors was carried out.
- ♣ Only 180 respondents (20 community members, followed by 34 domestic, 51 foreign visitors and 75 pilgrims) showed their willingness-to-pay (WTP) for conservation and protection of the lake, while others refused to participate.
- ♣ Method of collecting information: (a) a structured questionnaire, (b) random sampling at different times of day and during all days for one week, (c) only adult visitors, who had a defined source of income, were interviewed
- ♣ Data collected per visitor are: travel cost, number of visits per year, distance travelled from the origin of stay, income, age, sex, education and density
- ♣ Regression model of visitation rate with travel cost and distance was estimated.
- ♣ The travel cost for local pilgrims was positively related to visitation rate. TC model was used to calculate the consumer surplus. The estimated consumer surplus for visits to Khecheopalri lake was US$ 661 and US$ 1562 from the first and second consumer surplus, respectively. Recreational/sacredness value per visitor was US$ 3.87 as calculated from the consumer surplus.
- ♣ The total number of local pilgrims to Khecheopalri lake was 7800 in 1998, the aggregate annual recreational/sacredness value amounted to US$ 430186 for pilgrims. The higher cost of travel and distance of the lake from various zones of Sikkim restricted the visitation rate by pilgrims.

The Property Value Approach: The property value approach or the wage differential approach assumes that the changes in land or property price due to a change in the environmental amenity reflects the value attached the amenity. This method evaluates best the differential advantage obtained from extended residence in certain spatially performed locations. All the steps involved for Hedonic price method are relevant here.

The Production Function Method: The production function method or the alternative technology approach is used for valuing indirect ecological function of environmental assets. The first method views the contribution of a natural resource to economic activities in terms of substitute inputs. For example, soil conservation may result in saving the amounts spent on chemical fertilizer. The alternative technology approach can also be classified as a cost based valuation as the contribution of the natural resource is viewed in terms of the saving effected by not having to resort to the alternative technology. Soil conservation in upstream forest, for example, results in a saving in the cost of de-silting of down stream water bodies using mechanical dredgers.

3. Contingent Valuation Technique

Contingent Valuation Methods are used when markets do not exist for environmental resources. The valuation is done here in hypothetical markets. The valuation task here is to determine how much better or worse off individuals will be as a result of a change in an environmental resource/asset. This is computed by asking how much people are willing to pay for an environmental benefit (WTP) or how much are they willing to give up to have a specified environmental quality improvement happen. This method is also used in terms of how much people are willing to accept as a compensation (WTA) for an environmental resource. The price that people are willing to pay (a weighted average is computed) is taken as the price, and valuation of the asset or the resource is done using this price. This approach is used for valuation of wilderness, as well as of common environmental facilities like forests, common lands, common water bodies etc.

A particular advantage of CVM over other valuation techniques is that the method can be designed specifically to identify non-use values. CVM responses of users of a resource (e.g., park visitors who are currently in a park) are statements of their total economic value. When CVM is conducted among populations who are or who never have been users, then their

responses can be interpreted as non-use value statements.

Various steps involved in a CVM are:

- Preparing the individuals or households in terms of their framework of mind about a hypothetical market situation to conserve, preserve or promote natural resources, for which they have to pay or spend. They should be fully convinced that there are no markets on such non-consumptive activities, but they are benefiting from such preservation.
- There are two basic alternative approaches to CVM. First, a dichotomous question method, second open-ended question method. In the first instance, either a range or a binary choice is given to the respondents to state their preference. In the later case, they are asked to state their preference out of an open-ended range, say any thing more than Rs 5. Invariably, the open-ended question methods underestimate the WTP.
- Give them an option of choosing from (a) a random set of values reflecting willingness to pay, or (b) an ordered set of values (preferably in a range or band).
- After interacting with them further on the need for conservation and preservation of biodiversity, asking if they would revise their earlier preferred number or value (on WTA),
- Also ascertain if they are willing to pay in labour time, in kind etc.
- Collecting various socio-economic attributes about the individuals being interviewed,
- Formulating a model (using a regression technique) of linking the WTA with the social-economic attributes of the individuals.
- Simulating the model to arrive at a stable value for WTA (alternatively for the average individual).

The same technique can be used to assess the Willingness to Accept (WTA) a price or reward to stay away from using the natural resource. This however, is much less likely in biodiversity related resources, as the locals prefer to stay in the vicinity of the resource and continue to use it, rather than being isolated or displaced from it.

The method is demonstrated with a case study form Kumaon region of India

This is a case study on valuing water in the Kumaon mountain region of India. Though it is a major region as the source of water for the plains of northern India (origination from the glaciers and rivers such as Kali, Alaknanda, East and west Ramganga, Kosi and Gaula. Kumaon is always suffering from water scarcity (Kadekodi et al., 2000). Relevance of water varies based on the altitude and use patterns. In the high altitudes it is mainly for drinking, in the middle timberlines it is mainly for drinking, livestock rearing and marginally for irrigation, and in the Tarai region, mainly for irrigation and marginally for drinking. Hence, the value of water would differ depending upon the nature and extent of demands. This case study will demonstrate a

CVM methodology for eliciting value of water in this region, from the Munsiari glacier to the Tarai area.

The steps involved in the study are briefly mentioned now:

- Six villages each in three different watershed areas (representing the high altitude glacier region, middle timberline Ramganga region, and Tarai region were selected randomly.

- Village and household level questionnaires were canvassed covering aspects such as (i) Background information about the village, (ii) Awareness of watershed function,(iii) Land ownership, (iv) Water supply, consumption and Quality, (v) Community participation, and (vi) Willingness to pay

- Typical questions asked are: name of the respondent, status within the household, caste, and some information about his/her economic, educational, demographic status, about the infrastructures available in the village and duration of living in the village, perceptions about natural resource endowments (change in forest spread, change in rainfall, cause of changes, effects there after etc.), contingent plans to mitigate drought and floods, agricultural status(ownership status, irrigation facilities, crop yields, capital investments on irrigation etc.), water resources (utilization pattern and sources, consumption per day for irrigation, household and livestock uses, the distance to travel to fetch water in different seasons, the seasonality of scarcity of water, and alternative methods that are adopted in case of deficit or bad quality of water). Questions on community participation in case of water shortage and the preference of the villagers regarding the manner in which such community management can be effected are sought.

- As part of CVM, the details of the presently working agency if any, and who they would prefer to manage the water sources, and the degree of respondent's own participation in the same have been posed to know the interest of the villagers in the management of water resources. Through interactions and questions, after building some idea in the minds of the villagers about the need to improve water supply, questions on 'willingness to pay' have been asked. For this, a statement has been prepared and posed to them:

  > "Suppose, some agency of the village manages the water system in your village, so that you get sufficient water for irrigation/drinking purposes throughout the year and your crop productivity increases by 20 percent per year. This is an agency elected by the village and responsible for it. To maintain the water system (springs, *talaabs*, canals, wells etc,) and extraction, the agency needs some capital for installation, and monthly maintenance and running expenditure (labour cost, electricity etc). If so, what are your contributions in terms of money and labour time for construction, maintenance of such water works."

- The respondent's willingness to pay in terms of money and labour time for both irrigation and drinking water facilities as one time payment or regular payments annually (as user charges) are solicited.

- If any household is not willing to pay in terms of money, the reasons are sought. If the income is the constraint for them they have given another option as:
  (a) possible increase in land productivity up to 20 percent and (b) increase in monthly income by Rs.100 per family.

- From the above statement some of the villagers who are reluctant to previous statement, showed enthusiasm and expressed their willingness to contribute. Like wise the problems and thoughts of the villagers regarding hardships, willingness to pay and participation in water management are gathered. A structured questionnaire of this type is put in Annexure to this report.

The study revealed that the villagers are willingness to pay for water as:

(a) one time payment towards capital investment to development water extraction system on a sustainable basis
(b) for maintaining the water system
(c) for irrigation purposes and
(d) for drinking purposes.

The responses are quite mixed. Some people are not willing to pay at all for one, or some, or all of the above. From the survey it was observed that 23.72 percentage of households were not willing to pay for one reason or other; 64.62 percent were willing pay for drinking water, and 58.33 percent for irrigation; on average 59.61 percent of households expressed their willingness to pay for maintenance only, and not for construction of water harvesting structures. Clearly, those who are not willing to pay could have some reasons. As much as 30 percentage of households reasoned income as the constraint to pay for preservation.Table 4.5 summarily shows the estimates of values.

Table 4.5: Estimated Willingness To Pay for water backed up by ability to pay

Watershed region	**Willingness to pay per Year (Rs./HH)**			
	For capital cost[1]		**For maintenance**	
	Irrigation	**Drinking Water**	**Irrigation**	**Drinking Water**
E.Ramganga	50.58 {1.33)	23.94 [7.48]	58.70	24.22
Haigad	73.92 {1.49}[2]	14.39 [7.91][3]	70.95	12.85

Tarai	128.82 {14.93}	25.35 [7.44]	283.40	28.21
Combined	80.88 {5.63} (228.07)[4]	21.09 [7.61] (34.20)	127.03 (394.63)	21.49 (49.96)
Among those who have stated that they are not willing to pay due to income constraint, revised opinion about paying for Maintenance attributable to income incentives/changes				
Watershed region	**If crop productivity increases by 20%**	**If monthly income increases by Rs. 100**		**Overall positive willingness to pay**
	For irrigation (Rs/HH)	**For irrigation (Rs/HH)**	**For drinking (Rs/HH)**	**Percentage of responses**
E.Ramganga(High altitude area)	16.36	25.29	6.82	80.2
Haigad(Middle range)	28.45	35.74	8.40	76.4
Tarai(Plains)	48.26	48.11	8.15	71.6
Combined	32.08	37.15	7.84	76.3

Notes: 1.The capital costs are annualized costs with 12% discount rate.
2. These figures in { } stand for average size of land holdings in bigha (as if all the ownership land would be irrigated some time.
3. The figures [ ] are the average household sizes.
4. The figures in ( ) are std. dev. of the estimates.

What follows are some policy implications for designing improved water system in Kumaon region are:

- As far as the one time construction cost is concerned, people are willing to pay quite high a price for irrigation than for drinking water constructions. Clearly, the expected increase in income from agriculture is getting reflected in these preferred payments.
- On average, people are willing to pay about Rs.208 per household per year for irrigation use (both for construction and maintenance taken together) as against Rs.43 for drinking water supply.
- The average consumption of water for drinking and other household purposes for the entire region is 106.58 litres per family per day (which is quite low).
- The annual willingness to pay for drinking water is Rs. 42.58 per family per year. In other words, people are willing to pay for drinking purposes, just about Rs.1.0945 per thousand litre of water supply.
- It is somewhat difficult to assess their valuation of water for irrigation purposes. This is

because the extent of water used in irrigation could not be ascertained through the interview method. But given the fact that the average land considered in their mind as potential for irrigation is known (5.63 bigha), the average willingness per bigha of irrigated land works out to Rs.36.93 per year.

4.5.3: Transferring Benefits Theory and Practice

For the NBSAP process, we may find that it is indeed difficult to actually carry out fresh case studies on the valuation of biodiversity. This is hardly surprising since environmental valuation methodology is still developing and most of the existing studies concentrate on keystone biological resources. It is nearly always the case that even the early studies carried out so far are demonstrative of the methodology with limitations in terms of the number of dimensions valued as part of the study. Moreover, new studies are costly and time consuming to conduct and it certainly would not be advisable for all NBSAP exercises to undertake extensive valuation programmes that would most likely end up duplicating existing information from other countries. One short cut to overcome this information gap is to borrow and transfer valuation/benefit estimates from existing studies to the new or subject study site, an approach known as *benefits transfer*. This approach is essentially the second best option when data is unavailable. Most of the NBSAP economic valuation process is likely to take some form of benefits transfer and different degrees of rigour can be applied to the transfer process.

There are serious concerns over the legitimacy of transfer of values from one site to other for various reasons:

- The reliability of the original estimate itself is doubtful. This may be an estimate of WTP per household per year for say, conservation of a species, which is borrowed but totally unreliable;

Box 4.15: Bad Example of Benefit Transfer

As an illustration, take the following example:

The average rate of soil erosion in Europe is assumed to be 17 tonnes/ha/year (Pimental, 1995). How and where did this estimate come from? Look at the following table:

Quoted/used in studies by whom
Erosion rate
Area covered
Source quoted

Barrow(1991)
10-25
Belgium
Lal (1989)

Lal(1989)
10-25
Belgium
WRI(1986)

WRI(1986)
10-25
Central Belgium
Richter(1983)

Richter(1983)
10-25
Central Belgium
Bollinne(1982)

Billinne(1982)
Not stated
12 plots in Sauveniere
Field experiments

How did the field experimental information got itself transformed into an estimate for Europe as a whole? Do they have any reliability as original estimates?

- The similarity of the environmental characteristics of the target site to which the value is applied is doubtful. That is, is the value going to be used for the same species in the target site?

In essence it is difficult to separate the reliability of the resulting numbers from the underlying or original studies from which they are drawn. There is every likelihood of some

resulting bias in benefit estimates, which are a product of bias in the original studies and those arising from the transfer process itself. To understand this process it is necessary to have a rudimentary understanding of methods that give rise to original estimates.

Some recent developments in this methodology may be summarily stated here.

♣ *Benefit transfer functions:*

The basic idea is to 'borrow' an estimate of WTP in context i and apply it to context j, but after making adjustments for the different features of the two contexts. For example, if incomes vary between the two situations, we might have

$WTPj = WTPi\ (Yj/Yi)^{e}$

where Y is income per capita, WTP is willingness to pay, and `e' is the income elasticity of demand. i is usually called the *study* site and j is the *target* or *policy* site.

A more sophisticated approach is to transfer the *benefit function* from i and apply it to j. Thus if we know that WTPi = F(A,B,C,Y), where Y is income and A,B,C are factors affecting WTP at site i, then we can predict WTPj using the coefficients from this equation but using the values of A,B,C, Y at site j. A further sophisticated approach will take random draws from the confidence intervals associated with the coefficients. The important step to note here is that comparison of the socioeconomic characteristics of the two valuing populations must be similar.

Comparing like with like

Remember that transferring benefit values between different countries often requires a currency conversion and - if the valuation data is from previous years – some allowance for inflation. It is important to accommodate for inflation over time and maintain the real value of willingness to pay in purchasing parity terms. Thus if our original study to protect a forest is £20 in 1980 prices (as measured by the market Price Index, MPI 1980), the a transfer to forest y in 1998 might be achieved by deriving a factor z which is simply:

Benefit transfer in 1998= MPI (1998)/ MPI(1980) * WTP £(1980)

Validity testing in benefits transfer

The following cautions are warranted before adopting this technique:

- Adequate data from those studies included in the analysis

- Sound economic and statistical techniques in both original study and transfer
- Studies with regressions of WTP on determining variables
- Similar population in the compared sites
- Similarity of the environmental good to be valued
- Similar sites
- Similar distributions of property rights

4.5.4: Comments on Valuation methods: Towards actions

Brief comments are offered here on the lines of clarification, precaution and limitations of the approaches presented to NBSAP process.

- ✶ Valuation techniques are not entirely able to capture the exact value of biodiversity and environmental resources. Non-market products of nature, which are largely used by indigenous people, are difficult to value since there does not exist a market for these products. In cases, such as these, there is a strong need to device mechanism for valuing these products that are not marketed.

- ✶ There does not exist a clear ranking of methods of valuation that are known so far. All methods are not equally relevant for all resources either. Each technique requires a variety of assumptions depending upon the method being applied and of course the resource being considered for valuation. What clearly emerges from the various studies of the use of valuation techniques is that key modeling assumptions do have an important influence on estimates of valuation. The inconsistencies in the maintained assumptions of both direct and indirect methods, as they were applied to each of the problems considered in comparative evaluations, would seem to be sufficient to account for any observed difference between them (Kopp and Smith, 1993).

- ✶ There is an unresolved methodological puzzles that still remain and relates to the consistency of different valuation techniques. Alternative techniques can be categorised as those that are based on revealed preference and stated preference. Market price based mechanism can be grouped in the first category and CVM and related techniques can be categorised into the second type. A fundamental question is about additivity of revealed preference values to stated preference values to arrive a total economic value. A good example is about additivity of use value of timber (a revealed preference value) to nutritional cycling value (a stated preference value). However, there seems to be some kind of strong correlation between these values as shown in Figure 4.3 for a sample of studies.

Figure 4.4

- A further problem that arises while valuing a resource is on additivity of different kinds of values. It is often debated that such kinds of values accruing from a resource constitute a part of the so-called total economic value. Will different values assigned to a particular situation or resource be double counting for total economic value? See the Box 4.16 for an illustration on this. However, on a practical basis, all values accruing from a resource cannot be accounted any way; and hence there seems to be an agreement to add whatever is accountable. But such a state of current knowledge makes this valuation a somewhat hazardous enterprise. So, as has been said before in out discussion on the techniques for valuation, it is the assumption in the methods being applied that account for the difference in the results between two estimates, which might have been arrived at using two different methods. And the choice of a method for valuation is dependent upon the resource in question, the data availability and the judgment of the evaluator. It is the last, which is the cause of all contentions.

Box 4.16: Case of possible Double Counting of Eco-system values

Take as an illustration, the case of eco-system value of coral reefs in an area of 62 million hectares.

The following are independent eco-systems and their estimated values per hectare per year.

Disturbance regulation	$2750
Waste treatment	$ 58
Biological control	$ 5
Food production	$ 220
Raw materials	$ 27
Total eco-system value	***$3060***

But, independently, there is also an estimate of the Recreation value, based on Travel cost method.

Recreation	***$3008***
TOTAL	**$6068**

Note that the value of eco-system services is just about the same as that of Recreation benefits (based on Travel cost method).

SHOULD THE ECO-SYSTEM VALUE BE ADDED TO THE RECREATION VALUE?

Isn't true that the recreation value is just about the total of eco-system values? Is it not true that recreation value is due to all those eco-system values? Have we not double counted the eco-system values of the coral reef?

- The physical and monetary valuation of a resource is of utmost importance in order to value natural resources. The actual valuation of any resource is contingent upon many aspects. An alternative way to view the problem of environmental degradation and their valuation is to look at them from the perspective of different stakeholders, in terms of :
  - the activities of the stakeholders which affect the resource,
  - the resulting change in the environment as a result of the activities – the stressors,

- the impacts of the change in the state of the environment impacts receptors due to change in exposure to stressors and
- the response of individuals to impacts.

This method, commonly known as Stake holder analysis is dealt separately in Chapter Seven.

✶ Finally, there is always a question on the valuation methodology vis-à-vis cost-benefit analysis. It can be argued, it is not really so, that they are two alternatives. Rather, they are mutually dependent method. After all, benefits and costs comprise of both the physical attributes and their values. But it is a matter of the NBSAP process to take the exercise well up to cost-benefit analysis or not.

4.6: Economic Incentives, Methods and Instruments for Valuation

Economic incentive measures and instruments aim to reflect the economic values of biodiversity in sectoral activities that have the greatest impacts on biodiversity. Instruments are varied and it is difficult to generalise about applicability for a large country such as India. With many of the mattes related to biodiversity being a state subject, modification may be necessary for specific instruments to suit the states specifically. Note that the issue of value capture can be addressed in this section.

Box 4.17 summarises the available instruments and incentive measures commonly used by economists. They will have to tailored for different states, under NBSAP process specifically, depending upon the applicability and experience with instruments and incentives.

Box 4.17: Classification of Incentive Measures

Positive Incentives	Disincentives	Indirect Incentives	Removal of Perverse Incentives

• agricultural land set-aside schemes • public or grant-aided land purchase • wetland reserves • oven-ants/ conservation easements • cost-sharing/ management agreements • species enhancement schemes • customary cultivation of biodiversity • international biodiversity transfers • incentive payments for organic farming • taxation and fiscal measures	• user fees • non-compliance fees • fines for damages • environmental liability • performance bonds • habitat mitigation schemes • marine pollution liability	• individual transfer-able fishing quotas • tradable development rights • property-right mechanisms • species commercialisation • biodiversity prospecting deals • forestry offsets • air emission trading • effluent discharge trading • tradable water entitlements • wetlands mitigation banking • joint implementation • debt-for-nature swaps • international franchise agreements • eco-labeling	• reduction and restructuring of agricultural support harmful to biodiversity • introduction of agricultural conservation compliance measures • reform of public forestry concession pricing, licence fees, reforestation fees, and royalties • full appraisal of forest benefits • discontinuation of below-cost timber sales • reform of tax structures • full cost pricing for water services • appraisal of biodiversity impacts in the transport sector • road pricing • costing of biodiversity loss in energy investment appraisal

Source: *Saving Biological Diversity: Economic Incentives OECD (1995)*

4.7: Economics and valuation : A summary of select Indian case studies

The purpose of this section is to highlight various ranges of values and methodologies applied in different valuation studies pertaining to forest and related biodiversity studies in India. The list is not exhaustive by any means, and more often they are illustrative in nature only. It will however help the NBSAP process to understand and appreciate the efforts that have gone in so far and the possibilities to refine the estimates.

In India, attempts to estimate economic values for non-market benefits of bio-diversity

have increased since early nineties. In the case of tangible benefits, especially in wood products methodologies were readily available. Therefore, the interest of researchers and academicians focused on valuing intangible benefits of biodiversity. Though it all got started with forest based resources, the arena has moved to wetlands, water bodies, wild life, marine life, minerals, pollution and many more.

A good number of studies attempted to value forest benefits and services (timber, NTFP, ecotourism/ recreational benefits). Most of the studies have used Contingent Valuation (CVM) and Travel Cost Methods (TCM). The total values as well as their components vary considerably across locations, which is understandable from the fact that India has sixteen major agro-climatic and eco-regional configurations. For instance, the value estimated for a particular recreational feature for local residents (e.g., Periyar) can not be compared with the value derived on the basis of WTP of international or urban visitors to a park located near a mega city (e.g., Keoladeo National Park in Delhi or Boriveli National Park in Mumbai). Similarly, some natural areas have unique features and are attached with special values (e. g., The sacred lake in Sikkim Himalaya).

There are also many attempts to value various watershed benefits. In some cases, specific watershed functions (e. g., Value of water supply in Almora) are estimated. In other cases, economic value of various watershed benefits is estimated collectively (e.g., in Sukhomajri village). Methodologies such as reduced or changed cost of alternative technologies, replacement cost approach, opportunity cost, productivity (loss or gain in productivity(approaches, contingent valuation method (CVM) etc., have been applied to estimate various watershed benefits.

Some methodological studies are now available on valuation of water pollution (based on willingness to pay for cleaning polluted or waste water, e.g., Ganga Action Plan, or water pollution due to leather industries, James and Murty (1998); Sankar, 2000), health effects of indoor and outdoor air pollution (Jyoti Parikh, 2000, Dasgupta, 2001, solid waste (Reyer et al., 1999). Invariably, methods such as CVM, dose-response analysis are used in assessing these costs or benefits. Still lacking are good methodological studies on urban environment (transport congestion, air pollution, slum clearing etc.).

There are not many studies on ecological valuation of Indian forests. A study by Kadekodi and Ravindranath (1997) and another by Haripriya (2001) presents estimates of carbon sink values of Indian forests by analysing the inter-linkages between forestry and other sectors of the Indian economy. The studies on economic value of nutrient fixing, pollution control, and other ecological functions as result of biodiversity are limited. However, attempts have been made to derive these values by applying indirect methods to estimate aggregate values of forests/ biodiversity in a particular state or region (Verma, 2000).

Several studies that attempted natural resource accounting, have also estimated several benefits of biodiversity in economic terms (Parikh and Haripriya, 1998; Chopra and Kadekodi, 1997; Verma, 2000).

Attempts to estimate option value and non-use values such as existence value and bequest value are also seen in some studies (Chopra, 1993). However, the reliability of these values in the Indian context has not been discussed extensively.

A bird view of select list of major Indian studies on aspects of biodiversity and their estimated values are shown in Table 4.7.

Table 4.7: Economic value of the components of Natural Resources: Some Select Indian Studies

Goods and services valued	Annual Value	Location	Methodology applied	Source
Recreation/ Ecotourism	Rs.16197 per ha. (Rs.427.04 per Indian visitor Rs.432.04 per foreign visitor)	Keoladeo National Park, Bharatpur	Travel Cost Method	Chopra (1998)
Recreation/ Ecotourism	Rs.20944 per ha. (Rs.519 per Indian visitor and Rs. 495 per foreign visitor)	Keoladeo National Park	Contingent Valuation Method	Murthy & Menkhuas (1994)
Recreation/ Ecotourism & other benefits	Rs.23300 per ha. (Rs.90 per household. (Rs.7.5/month/household);Rs.240 Million/year	Boriveli National Park, Mumbai	Contingent Valuation Method	Hadker et.al (1995)

Ecotourism	Rs.676 per ha . (for locals); (Rs3.2 million total per year)	Periyar Tiger Reserve	Contingent Valuation Method, Travel cost Method	Manoharan(1996)
Ecotourism	Rs 2.95 million total; (Rs.34.68 per visitor)	Kalakadu Mundanthurai Tiger Reserve, Tamil Nadu	Contingent Valuation Method	Manoharan and Dutt (1999)
Ecotourism/ recreational/ pilgrimage/ sacred grove	WTP for maintenance and preservation of the lake by: Local community= US $ 0.88 (Rs.36.08) Local pilgrims = US$ 2.2 (Rs90.2) Resident visitors=US$ 2.5 (Rs102.5) Non-resident visitors=US$7.2 (Rs.295.2) (Aggregate WTP = US $46940 based on total visits per year (Rs1.92 million) Per hectare value = Rs.1604	Recreational value of a sacred lake in Sikkim Himalaya (Khecheopalri lake)	TCM & CVM	Maharana et.al. (2000)
Ecotourism	WTP for the management of the park: By foreign tourists: $8.84; by domestic tourists:$1.91; by local community:$6.20 per year. WTP total for annual maintenance works out to $87,777.	Khangchendzonga National Park, Sikkim	CVM	Maharana et al. 2000
Wetland	Additional value of property around the lake is Rs. 186 per sq. ft.	Bhoj Lake, Bhopal	Hedonic pricing	Madhu Verma (2000)
Soil conservation	Cost of soil erosion: Rs.21583 per hectare	Doon valley	Replacement cost approach	Kumar, P. (2000)
Soil conservation	Decline in Value of land due to soil degradation is Rs.3510 per hectare.	Haryana agricultural land	Productivity approach	Kirit Parikh (2001)
Urban water pollution	Av. Cost of illness per household per year: Rs. 1094	City of New Delhi	Production function	Dasgupta, P. (2001)
Biomass/dung/ watershed	Value of additional dung collected due to stall feeding is Rs.34.40 per cattle per year	Sukhomajri village	Opportunity cost	Chopra et al., 1990
Water supply	Rs.4745 per hectare	Almora Forests	Indirect Methods	Chaturvedi, 1993
Water supply	Annual willingness to pay for water: Rs. 109-410 for irrigation purposes; Rs.27-53 for drinking purposes	From glacier to Tarai mountain region of Kumaon valley	Contingent valuation method	Kadekodi, 2000
Ecological functions (use value) for local residents.	Rs.624 per hectare	Yamuna Basin	Contingent Valuation method	Chopra and Kadekodi, 1997
Carbon store	Rs. 1,292 billion for total Indian forests) & Rs.20125 per hectare	Indian Forests	Species wise forest inventory data	Haripriya (1999)
Carbon Store	Rs.1.2 lakh per hectare	All India forests	Biomass estimation	Kadekodi & Ravindranath (1997)
Urban Air pollution	Statistical value of life affected:Rs. 2.87 lakhs per life; Human capital value affected: Rs. 3.83 per life	Mumbai city	Dose –response model	Jyoti Parikh (2000)

Water pollution	WTP for best quality: Rs. 500; for 1995 quality: Rs. 200; for 1985 quality; Rs. 100 (all these are median values)	River Ganga	CVM for non-user benefits	James and Murty, 1999
Water pollution	Economic cost of pollution abatement per kilo-litre wastewater per day in tanneries: Rs.20-66	Tanneries in Tamil Nadu	Cost-benefit model	U. Sankar (2000)
Fishery resources	Willingness to pay for conservation: Rs. 859 per year on average	Coastal Karnataka	Stakeholder Analysis and CVM	Bhatta (2000)
Watershed Values (Soil conservation)	Rs.2.0 lakh per hectare meter of soil	Yamuna Basin	Indirect method (Reduced cost of alternate technology)	Chopra & Kadekodi,1997
Forests in Himachal Pradesh	*The total economic value of forests in HP is estimated as Rs.106664 Crores, which is 2.61 times the value of the growing stock. * The contribution of forestry as a percentage of corrected GSDP is 92.40% instead of recorded 5.26%.	Himachal Pradesh State	TEV approach	Verma (2000)
Forests in Maharashtra	*Contribution of forests is estimated as Rs.35,245.65 millions as against Rs.14,080 millions shown in SNA. (i.e. it is 3.56 % of adjusted NSDP and not 1.46 % recorded) *Value of depletion (difference between the value of opening stock, other volume changes and the closing stock in forest accounts) = Rs.6.989 millions. (this is 19.8 % of the estimated value added) *Estimated asset values of forests = 28.6% of net fixed capital stock.	Maharashtra state	Physical accounting (tools employed: net price method, present value method, etc)	Parikh and Haripriya (1998)
Forests in Yamuna Basin	*Use Value of timber: Rs.8,279 to Rs.18,540 per cubic meter of extracted timber *Annual Value of main non-timber forest products (NTFPs): Rs.7509 per sq. km in Hills and Rs. 558 per sq. km in Plains *Use value of ecological functions and unrecorded production: Rs.176 per hectare in Himachal Pradesh Rs.3509 per hectare in Haryana Average: Rs.624 per hectare *Value of preservation as contributing to national output: Rs.576lakhs per year *Household willingness to pay in rural areas for use value of forests: Rajasthan: Rs.1072 per hectare Uttar Pradesh: Rs.360 per hectare Himachal Pradesh: Rs.176 per hectare Haryana: Rs.3509 per hectare	Yamuna Basin	CVM Direct market valuation Multi-criteria analysis & Travel cost	Chopra and Kadekodi (1997)
Iron ore	User cost per tonne: Rs. 8.63 per tonne	Goa	User cost method	TERI (2000), NBSAP

The Ministry of Environment and Forests, Government of India, constituted a committee in 1998 to workout methodology for quantifying economic value of intangible benefits of forests. Following are some recommendations of the committee:

Box 4.18: Recommendations of the Committee for Working out Methodology for Quantifying Intangible Benefits of Forests, constituted by the Ministry of Environment and Forests, Government of India, 1998.

1. The committee after recognising the fact that very little work has been done in economic valuation of intangible benefits of forests, recommends that there is an urgent need to take studies on various aspects of forest valuation.

2. For assessing ecological loss, the committee recommended to analyse the structure and functioning of the forest ecosystem. The structure of the forest ecosystem is to be estimated by three main ecological attributes viz. Importance value Index (IVI), population dynamics and species diversity where as the functioning of the ecosystem is to be ascertained with the help of bio mass studies, litter fall and transfer of mineral within the various biotic and abiotic compartments of the ecosystem.

3. The committee recommends that the methodologies identified for quantifying intangible benefits of forests should be used selectively depending upon the characteristics of the forests to be valued. For this purpose, it recommends that first of all the forest types, as classified by Champion and Seth (1968) be identified. After having identified the forest type, the next step would be to identify the major ecological function(s) the particular forest type is performing at the particular site. Having identified the major ecological function(s) the appropriate methodology is to be selected and applied….

4. It is noticed that total economic value (TEV) which is the sum of use values (UV) and non use values (NUV) shows the true economic value of full range of tangible and intangible benefits of forests. However, appropriate methodologies are not readily available to quantify the benefits of some components of TEV. Similarly, the committee noticed the problem of double counting during the aggregation of various benefit estimates. Therefore, the committee recommends that the quantification of various intangible benefits of forests should primarily based on the major ecological functions of the forests.

The summary of the various estimates of value of forests from India presented in Table 4.7 gives us a mixed picture. In Table 4.8, all the estimates are used to show the tangible and intangible values of forests in a range. In most of the cases, the range is quite large for any generalisation.

Being a mega biodiversity country, the type and density of forests in India vary considerably across regions and locations. Therefore, economic values of tangible and intangible benefits will also vary accordingly. Champion and Seth (1968) classified Indian forest in to various types and sub types and those classifications have been extensively used in the preparation of working plans of forests. Similarly, Rodgers and Panwar (1988) classified Indian forests to identify representative network of Protected Areas for in-situ conservation of biodiversity. According to density, forests are mainly classified into open forests and dense forests.

Table 4.8: Annual Values of Selected Benefits of Forests

Sl. No.	Economic benefit	Nature of Benefit	Value of annual flow of goods & services per hectare (Rs.)	
			Minimum	Maximum
1	Timber	Tangible	2701	9270
2	Non-timber forest products	Tangible	538	2957
3	Ecological Functions (Watershed)	Intangible	624	2.0 lakh
4	Eco-tourism	Intangible	676	20,444
5	Carbon store	Intangible	20125	1.2 lakh
Source:	Manoharan (2000)			

Therefore, in order to generalise to some extent, from the available estimates of values from case studies shown in Table 4.7, forest lands of India have been categorised into four groups and the range of values are summarised, as shown in Table 4.9. They are (1) plantation forests/ single species forests (such as teak, sal forests, etc.); (2) open forests having density between 10 per cent and 40 per cent including multi-species plantations; (3) dense forests having more than 40 per cent and (4) Protected Areas such as National Park and Wildlife Sanctuaries.

Table 4.9: Economic values of various kinds of forest land in India						
Sl. No.	Nature of forest land	Selected economic benefits	Value of annual flow of goods & services per hectare (Rs.)		Present value* of goods & services per hectare (Rs.)	
			Minimum	Maximum	Minimum	Maximum
1	Plantations/Single species forest	Timber	2701	9270	33660	115525
	(teak, sal forests, etc)					
	(crown density < 40%)					
2	Multispecies plantations/ open	Timber + NTFP	3239	12227	40365	152375
	Forests					
	(crown density 10-40%)					
3	Dense forest	NTFP + Ecological	21287	322957	265283	4024758
	(crown density>40%)	Functions + Carbon				
		Store				
4	Protected Areas	Eco-tourism +	21425	340444	267003	4242685
		Ecological Functions +				
		Carbon Store				

* As 5% rate for a period of 20 years.
Source: Manoharan (2000)

In the case of intangible benefits, the attention has to be paid for the last two categories of forests, viz. dense forests and protected areas. Estimates show that value of annual flow of goods and services of dense forests varies from Rs. 21287 per hectare to Rs. 3.2 lakhs per hectare. In the case of Protected Areas, the value is from Rs. 21425 per hectare to Rs. 3.4 lakhs per hectare. The present values (PV) of the forest flows have been worked out at 5 per cent rate of discount for a period of 20 years. The PV of dense forests varies from 2,65 lakhs to 40 lakhs and that of Protected Area varies from 2.67 lakhs to 42 lakhs. Once again, one finds it difficult to generalize the forest values.

4.8: Beyond Valuation:

For the NBSAP process, a basic question is about the use of valuation of biodiversity. Briefly stated, it is relevant for decision and policy making on biodiversity conservation. Two major uses that can be highlighted are:

- ✶ Natural resource accounting (as against national income accounting)
- ✶ Cost benefit analysis of resource development and use.

These will be very briefly dealt here with illustrations from India.

4.8.1: Natural Resource Accounting

With the valuation exercise completed for natural resource stocks and flows, it is then logical to use these values to integrate the flow of natural and environmental resources in measuring the welfare of a nation. This branch of enquiry is generally termed as Natural Resource Accounting.

Natural resources are wealth of a country. Natural Resource Accounting is a revaluation of the National Income Accounts of a country, adjusting for the values of natural resources used in various economic activities during the past 'fiscal year'. Natural resources, as they appear in nature, get degraded in quality and depleted in stock due to economic and human activity (e.g., hazardous chemicals polluting ground water or over-extraction of minerals or forest resources leading to depletion). They also go through natural decay (such as earth quakes or cyclones) and regeneration (e.g., in protected areas). They may also have been enhanced due to plan interventions such as plantations (e.g., social forestry). Therefore, being part of the wealth of the nation, there is a need to integrate the resource accounting along with the System of National Accounts (SNA). United Nations Statistical Division (UNSTAT) labelled this as System of Environmental and Economic Accounting (SEEA). In some sense it is often referred to Green GDP.

The main objectives of integrated environmental accounting are segregation and elaboration of all environmental and economic accounting, linkage of physical resource accounts with monetary environmental accounts and balance sheets, assessments of environmental costs, benefits and accounting for the maintenance of the tangible wealth. It is, thus, a complete accounting procedure for environmental assets. Natural resource accounting involves three steps:

- physical accounting,
- monetary valuation and
- integration with national income accounts.

The required physical accounting has already been emphasized in Section 4.3.1.1 (with a guideline to prepare the same with a case study as an example). Physical accounting is very important to determine the state of the resource. ***However, physical accounting is only a part of the entire process of resource accounting.***

The valuation methods presented in Sections 4.4 and 4.5 are the next steps to be followed. Only after a monetary valuation has been done, it will be possible to integrate the net change in natural resource sectors to the gross domestic product of the nation/state/region. The net change in monetary terms, arising out of the change in state of the resource, is added or deducted from the GDP to arrive at the ***Adjusted Net Domestic Product or Green GDP.***

Several alternative ways have been suggested for India on this business of integration. The most useful document on this is by Parikh and Parikh (1997), in which all the details are talked about. Integration of accounts requires to account all aspects of natural resource uses and abuses, as indicated in Box 4.19

B0x 4.19: Input-Output Based SEEA

Net National Product = Value of consumption of normal goods and services
+Value of production of nature collected (such as fuelwood, biomass)
+Value of environmental amenities provided by environmental resource stocks (such as clean air, top soil)
+ Value of leisure enjoyed (say in enjoying aesthetic beauty of a wildlife reserve)
+Value of net additions to production capital
+Value of net additions to natural capital stocks (such as plantations in forests, or depletion of exhaustible resource)
+ Value of additions to stock of defensive capital(such as water purifier).

On practical terms this process is too complicated and the kinds of data and information on these are not easily available for all the resources of the nation. Therefore, different alternative methods are also suggested for the NBSAP process on Natural Resource Accounts.

First, UNSTAT proposed the satellite system for environmental accounting that does not make any change in the core system of SNA, but proposes establishing linkages between the SNA and the integrated economic and environmental accounting. There is a new guideline on this system of accounting prepared by UNSTAT in 1993. As part of the NBSAP process action

plan, this should be incorporated in Indian national income accountings. The values of the biodiversity resources and their changes can be shown along with the ususal national income accountings, as a satellite statement. It is essentially a modified income accounting system, showing environment related sectoral activities separately along with their physical accounts of flow changes, valuations and possible links to the main SNA. Figure 4.5 demonstrates this.

The second way is to treat natural resources as a separate set of activities (loosely to be termed as industries) in an Input-Output table (which is an input for national income accounts, commonly used by the Central Statistical Organisation). Then the outflows from such natural resource sectors will have been absorbed by other sectors of the economy. For instance, water production from Water Resource Sector would flow to many industrial sectors, household sector and of course to agriculture sector as irrigation. But there are many more difficulties in completing the task of flows form natural resource sectors.

Take forestry as an example for a sector or activity. Even for this sector, the difficulties in accounting are:

- Distinguishing between depreciation and depletion. In the case of depreciation, it can remain as a notional value judgment. The same can not be said about natural resources when they actually degrade and deplete.
- Secondly, accounting for additions to forest stock is not easy. It takes place both through natural regeneration and plantation.
- Thirdly, the flow from forest stocks is only partially accounted as legal extractions: much of it is not. Then there are several natural phenomena such as forest fires, landslides, earthquakes, floods etc., on account of which there are changes in this natural capital. In short, physical accounting of forest stock and flows is a complex task.

Yet, as an example the valuation of forests from Himachal Pradesh to deduce the adjusted green accounting is shown in Section 5.3.4 of Chapter Five.

The third way of arriving at the Green GDP is to account for depletion of natural resources using either the Use Cost method or Depreciation or Net price method (all of which have been talked about in Section 4.5). It will be useful for the NBSAP process to understand

the method with a case study.

Box 4.20: Case Study on Accounting for Iron Ore Depletion

Goa is a rich iron ore mining region of India. In terms of its importance, this state produces about 33 percent of total iron ore production in India, and about 40 percent of iron ore exports from India. The depletion of iron ore reserves in India in general, and in Goa state has been of major concern for the nation. Are we properly accounting this depleting resource?

Starting with the data on physical accounts an estimate of iron ore depletion and the corresponding adjustment in the state domestic product of Goa are made and shown here in Table 4.10.

The present rate of extraction of iron ore from Goa is about 1.9% of the stocks. Following the ***Net Price Method*** (see Section 4.5.2) , the per tonne rent or net price is Rs. 190 per tonne of extracted ore (or Rs. 292632 million in total). With this net price, the adjusted state domestic product (ASDP) of Goa i.e., net of this 'Net price', is Rs. 1158.368 million in 1996. Using the ***User Cost method*** (see Section 4.5.2),with expected life of the resource as 51 years, social discount rate of 6.12%, the total User cost works out to Rs. 133.132 million, making the ASDP of Goa as Rs. 1317.868 million. As can be seen from the above computations, in both the methods, the adjustments have taken note of depletion of the iron ore resource from Goa. The Net Price method would however, make the situation look very dismal. This is precisely because of basing depletion computations on a stock basis, and not on actual flow basis.

Table 4.10: Adjusted Income for Goa State on account of iron-ore mining (depletion accounting)

Unit
1996

Physical Accounting

Opening stock
000 tonnes
805923

Production
000 tonnes
15381

Closing stock
000 tonnes
790542

Lessons for the NBSAP Process

- ✶ First, the data base requirements for Natural Resource Accounting are quite high. Central Statistical Organisation should have a separate wing to collect the necessary data exclusively for natural resource accountings.
- ✶ Second, more and more studies on valuation be built-in the NBSAP process to address to aspects such as depletion, degradation, preservation, inter-generational values, dose-responses etc.
- ✶ Third, the National Sample Survey, having engaged in a survey of environmental status of the economy, together with demographic and health status data from various other sources can be used to develop some of these parameters.
- ✶ Fourth, environmental economists and statisticians should continue to demonstrates the possibilities to adjust the domestic products for all the natural resource related issues, some of which may not directly appear in the traditional income accountings (e.g., biodiversity). Certainly, a long way to go further before a complete SEEA is available for policy planning for India.

4.8.2: Project evaluation for biodiversity conservation: Cost-Benefit Analysis

An application of valuation is for project designing and evaluation towards biodiversity conservation. Take the case Eco-development projects in the protected areas as an example, or developing fishing in a mangrove. Cost Benefit Analysis (CBA) is the most common method of economic project and policy appraisal. CBA is a decision tool, which judges projects according to a comparison between their costs (disadvantages) and benefits (advantages). If a project shows a net benefit, it can be approved, and different projects can be ranked according to the size of their net benefit.

Since it is a very widely known and used method, no further elaboration of steps involved for a CBA is presented here. Two basics should be remembered however. One, fundamental for CBA is to recognize that all costs (direct and indirect) and all benefits (direct and indirect) are to be valued (using valuation techniques discussed earlier). Second, The technique is useful only when there are alternatives to be examined (be they ecological,

commercial, technical).

As an example, consider two alternative mangrove management strategies. Option A -- conversion to aquaculture, and Option B -- sustainable traditional use. If the mangrove is to be cleared for aquaculture (Option A), the direct costs of conversion (e.g., clearing the mangrove area and setting up ponds) and the foregone benefits (opportunity cost) of the converted mangrove should be included as part of this option's costs. Without conversion, the mangrove could have been conserved closer to its natural state through limited and sustainable use (Option B). Foregone benefits associated with Option A may include the loss of important environmental functions (e.g., support to near shore fisheries and shoreline stabilisation) and resources (e.g., forest products and wildlife).

After accounting for all costs and benefits, they must be discounted so that they can be compared on an equal footing, allowing for the years in which they occur -- and reducing both streams to a single figure, namely present value. The CBA rule incorporating time is:

$$(Bt-Ct)\ (1+r)^{-t} > 0 \quad (3)$$

where

subscript t refers to time.

B - benefits (including environmental benefits)

C - costs (including environmental costs)

All the costs and benefits are to base on the valuation studied carried out, along with the usual shadow pricing for other inputs such as labour, man-made capital etc.

4.9: Strategy and Action Plan on Valuation

The following can be some of the major recommendations for the NBSAP process based on the methodology of Valuation and the experience so far in India.

Studies on economic valuation of various ecological functions of biodiversity should be encouraged. The comparison of values estimated from various sites/areas has to be done with caution.

There should be more research on methodologies for estimating non-use values in India.

The MoEF should initiate to bring out a publication on rapid and cost effective valuation methodologies for valuing biodiversity.

The economic benefits of biodiversity enjoyed by the private sector companies including MNCs require special attention and there should be some mechanism to capture a portion of these benefits for investing biodiversity conservation programmes.

5. A Social Science based research institution be identified by MoEF, which can undertake studies on valuation on a continual basis, almost on the lines of EIA for project clearance.

C H A P T E R - F I V E

LESSONS FROM ON-GOING STUDIES ON VALUATION OF BIODIVERSITY

5.1: Experience of Wetland Valuation studies-worldwide

5.1.1: Relevance of valuation of wetlands in India

India has a rich variety of wetland habitats. The total area of wetlands (excluding rivers) in India is 58,286,000ha, or 18.4% of the country, 70% of which comprises areas under paddy cultivation. A total of 1,193 wetlands, covering an area of about 3,904,543 ha, were recorded in a preliminary inventory coordinated by the Department of Science and Technology, of which 572 were natural (Scott, 1989). Six sites - Chilika Lake (Orissa), Keolaodeo National Park (Bharatpur), Wular lake, Harike Lake, Loktak Lake (in Manipur) and Sambhar Lake have been designated under the Convention of Wetlands of International Importance (Ramsar Convention) as being especially significant waterfowl habitats. The country's wetlands are generally differentiated by region into eight categories (Scott, 1989): the reservoirs of the Deccan Plateau in the south, together with the lagoons and the other wetlands of the southern west coast; the vast saline expanses of Rajasthan, Gujarat and the gulf of Kachch; freshwater lakes and reservoirs from Gujarat eastwards through Rajasthan (Keolaodeo Ghana National park) and Madhya Pradesh; the delta wetlands and lagoons of India's east coast (Chilika Lake); the freshwater marshes of the Gangetic Plain; the floodplain of the Brahmaputra; the marshes and swamps in the hills of north-east India and the Himalayan foothills; the lakes and rivers of the montane region of Kashmir and Ladakh; and the mangroves and other wetlands of the island arcs of the Andamans and Nicobars.

Because of such a large segment of landscape having some significance for its biodiversity conservation, in this section, special attention is given to elaborate the need to value such wetlands, the alternative methods of valuing, and experience in applying them all over the world, so that for the Indian NBSAP, we should be able to arrive the precisely relevant methods. Some of the major wetland functions relevant for India are summarised in Table 5.1.

Table 5.1

Wetland functions, the associated economically valuable goods and services and the names of variables that capture the presence of these in the data

Function	Economically valuable good(s) and/or service(s) (variable names)	Technique(s) typically used to quantity the value of the service(s)
Recharge of ground water	Increased water quantity (quantity)	Net factor income or replacement cost
Discharge of ground water	Increased productivity of downstream	Net factor income, replacement cost or
	fisheries (com.fish)	travel cost
Water quality control	Reduced costs of water purification	Net factor income or replacement cost
	(quality)	
Retention, removal and transformation	Reduced costs of water purification	Net factor income or replacement cost
of nutrients	(quality)	
Habitat for aquatic species	Improvements in commercial and/ or	Net factor income, replacement cost,
	recreational fisheries either on or offsite	travel cost or contingent valuation
	(com.fish and rec.fish). Nonuse	
	appreciation of the species (habitat)	
Habitat for terrestrial and avian species	Recreational observation and hunting of	Travel cost or contingent valuation

	wildlife (bird watch & bird hunt). Nonuse	
	appreciation of the species (habitat)	
Biomass production and export (both	Production of valuable food and fiber	Net factor income
plant and animal)	for harvest (bird hunt & com.fish)	
Flood control and storm buffering	Reduced damage due to flooding and	Net factor income or replacement cost
	serve storms (flood)	
Stabilization of sediment	Erosion reduction (storm)	Net factor income or replacement cost
Overall environment	Amenity values provided by proximity	Hedonic pricing
	to the environment (amenity)	

5.1.2: What are the advantages and disadvantages of valuation techniques in Wetland studies?

For the NBSAP process in India, it is important to identify the major relevant valuation techniques, to understand their limitations and also propose the remedial activities to improve the estimates. Table 5.2 lists the same.

Table 5.2: Valuation Techniques as Applied to Wetland Studies

Valuation technique	Advantages	Disadvantages
Market prices method. Use prevailing prices for goods and services traded in domestic or international markets.	Market prices reflect the private willingness to pay for wetland costs and benefits that are traded (e.g., fish, timber, fuelwood, recreation). They may be used to construct financial accounts to compare alternative wetland uses from the perspective of the individual or company concerned with private profit and losses. Price data are relatively easy to obtain.	Market imperfections and/or policy failures may distort market prices, which will therefore fail to reflect the economic value of goods or services to society as a whole. Seasonal variations and other effects on prices need to be considered when market prices are used in economic analysis.

Efficiency (shadow) prices method. Use of market prices but adjusted for transfer payments, market imperfections and policy distortions. May also incorporate distribution weights, where equality concerns are made explicit. Shadow prices may also be calculated for non-marketed goods.	Efficiency prices reflect the true economic value or opportunity cost, to society as a whole, of goods and services that are traded in domestic or international markets (e.g., fish, fuelwood, peat).	Derivation of efficiency prices is complex and may require substantial data. Apparently decision-makers may not accept 'artificial' prices.
Hedonic pricing method. The value of an environmental amenity (such as a view) is obtained from property or labour markets. The basic assumption is that the observed property value (or wage) reflects a stream of benefits (or working conditions) and that it is possible to isolate the value of the relevant environmental amenity or attribute.	Hedonic pricing has potential for valuing certain wetland functions (e.g., storm protection, groundwater recharge) in terms of their impact on land values, assuming that the wetland functions are fully reflected in land prices.	Application of hedonic pricing to the environmental functions of wetlands requires that these values are reflected in surrogate markets. The approach may be limited where markets are distorted, choices are constrained by income, information about environmental conditions is not widespread and data are scarce.
Travel cost approach. The travel cost approach derives willingness to pay for environmental benefits at a specific location by using information on the amount of money and time that people spend to visit the location.	Widely used to estimate the value of recreational sites including public parks and wildlife reserves in developed countries. It could be used to estimate willingness to pay for eco-tourism to tropical wetlands in some developing countries.	Data intensive; restrictive assumptions about consumer behaviour (e.g., multifunctional trips); results highly sensitive to statistical methods used to specify the demand relationship.

Production function approach. Estimates the value of a non-marketed resource or ecological function in terms of changes in economic activity by modeling the physical contribution of the resource or function to economic output.	Widely used to estimate the impact of wetlands and reef destruction, deforestation and water pollution, etc., on productive activities such as fishing, hunting and farming.	Requires explicit modeling of the 'dose-response' relationship between the resources and some economic output. Application of the approach is most straightforward in the case of single use systems but becomes more complicated with multiple use systems. Problems may arise from multi-specification of the ecological-economic relationship or double counting.
Related good method. Uses information about the relation-ship between a non-marketed good or service and a marketed product to infer value. The *barter exchange approach* relies on actual exchange of non-marketed goods. The *direct substitute approach* simply assumes that a marketed good can be substituted for a non-marketed good. The *indirect substitute approach* also relies on a substitute good, but if the latter is not exchanged in the market its value is inferred in terms of a change in economic output (i.e., the direct substitute approach combined with the production function approach).	These approaches may provide a rough indicator of economic value, subject to data constraints and the degree of similarity or substitutability between related goods.	The barter exchange approach requires information on the rate of exchange between two goods. The direct substitute approach requires information on the degree of substitution between two goods. The indirect substitute approach requires information on the degree of substitution and on the contribution of the substitute good to economic output.
Constructed market techniques. Measure of willingness to pay by directly eliciting consumer preferences.	Directly estimates Hicksian welfare measure - provides best theoretical measure of willingness to pay.	Practical limitations of constructed market techniques may detract from theoretical advantages, leading to poor estimates of true willingness to pay.

Simulated market (SM) constructs an experimental market in which money actually changes hands.	SM: controlled experimental setting permits close study of factors determining preferences.	SM: sophisticated design and implementation may limit application in developing countries.
Contingent valuation method (CVM) constructs a hypothetical market to elicit respondents' willingness to pay.	CVM: only method that can measure option and existence values and provide a true measure of total economic value.	CVM: results sensitive to numerous sources of bias in survey design and implementation.
Contingent ranking (CR) ranks and scores relative preferences for amenities in qualitative rather than monetary terms.	CR: generates value estimate for a range of products and services without having to elicit willingness to pay for each.	CR: does not elicit willingness to pay directly, hence lacks theoretical advantages of other approaches.
Cost-based valuation. Based on assumption that the cost of maintaining an environmental benefit is a reasonable estimate of its value. To estimate willingness to pay:	It is easier to measure the costs of producing benefits than the benefits themselves, when goods, services and benefits are non-marketed. Approaches are less data- and resource-intensive.	These second-best approaches assume that expenditure provides positive benefits and net benefits generated by expenditure match the original level of benefits. Even when these conditions are met, costs are usually not an accurate measure of benefits.
Indirect opportunity cost (IOC) method uses wages foregone by labour in production of non-marketed goods.	IOC: useful in evaluating subsistence benefits where harvesting and collecting time is a major input.	IOC: may underestimate benefits significantly if there is substantial producer or consumer surplus.
Restoration cost (RSC) method uses costs of restoring ecosystem goods or services.	RSC: potentially useful in valuing particular environmental functions.	RSC: diminishing returns and difficulty of restoring previous ecosystem conditions make application of RSC questionable.
Replacement cost (RPC) method uses cost of artificial substitutes for environmental goods or services.	RPC: useful in estimating indirect use benefits when ecological data are not available for estimating damage functions with first-best methods.	RPC: difficult to ensure that net benefits of the replacement do not exceed those of the original function. May overstate willingness to pay if only physical indicators of benefits are available.

Relocation cost (RLC) method uses costs of relocating threatened communities.	RLC: only useful in valuing environ-mental amenities in the face of mass dislocation such as a dam project and establishment of protected areas.	RLC: in practice, benefits provided by the new location are unlikely to match those of the original location.
Preventive expenditure (PE) approach uses the costs of preventing damage or degradation of environmental benefits.	PE: useful in estimating indirect use benefits with prevention technologies.	PE: mismatching the benefits of investment in prevention to the original level of benefits may lead to spurious estimates of willingness to pay.
Damage costs avoided (DC) approach relies on the assumption that damage estimates are a measure of value. It is not a cost-based approach as it relies on the use of valuation methods described above.	DC: first-best methods to estimate damage costs are useful for comparison with cost-based approaches, which implicitly assume damage is worth avoiding.	DC: data or resource limitations may rule out first-best valuation methods.

Source: Adopted from IIED (1994)

5.1.3: Wetland functions and values (Compiled from Ramsar Homepage)

A tour of some of the major wetland functions and the estimates in India or elsewhere are presented in this section as a tour to appreciate the efforts so far and the actions needed in future. Wetlands are hugely diverse. But whether they are ponds, marshes, coral reefs, peat lands, lakes or mangroves, they all share one fundamental feature: the complex interaction of their basic components - soil, water, animals and plants - that fulfils many functions and provides many products that have sustained humans over the centuries. Of course not every wetland performs all these functions - but most wetlands perform many of them.

Different wetland functions globally recognized are:

I. Flood Control
II. Ground Water Replenishment
III. Shoreline Stabilisation and Storm Protection
IV. Sediment and Nutrition Retention and Export
V. Climate Change Mitigation
VI. Water Purification
VII. Reservoir of Biodiversity
VIII. Wetland Products
IX. Recreation and Tourism
X. Cultural Value

A summary of values on some of these functions are presented below:

5.1.3.1:Value of Flood Control

Indian wetlands are very much prone to floods. Wetlands "hold" heavy rainfalls, preventing possible flooding downstream. By storing the water in the soil or retaining it in the surface waters of lakes, marshes, etc., wetlands reduce the need for expensive engineered structures. Wetland vegetation also plays a role in slowing down the flow of flood water. It is therefore useful to take a look at the values attached to this important function of wetlands.

A recent study in the USA estimated that 0.4 hectares of wetland can store over 6,000 cubic metres of floodwater. The intact 3,800 hectares of wetlands along part of the main stream of the Charles River in the USA have been valued at US$ 17 million per year, the estimated cost of flood damage that would result if they were drained. More readily available are figures on the cost of flood damage after this function has been lost or seriously eroded by unsustainable development.

The Chinese have suffered an increasing frequency of devastating floods since the turn of the last century. Their worst floods occurred in 1998, affecting several rivers including the Yangtze. The statistics were appalling - 230 million people affected, 20 million people displaced, over 3,500 killed, 7 million homes destroyed, 15 million farmers suffering loss of their crops; the estimated total economic losses exceeded US$ 32 billion. Analysis of the causes identified increasing population as the root problem, fuelling many environmental changes: an increase in settlements in low-lying areas subject to floods; reclamation of the wetlands around lakes and rivers for cultivation to feed the growing population, thus reducing their flood absorption capacity; serious deforestation in the upper reaches of the rivers for further agricultural production, causing heavy silting in the lower reaches (in lakes, rivers and other wetlands) and reducing flood absorption capacities in both areas. These problems are mirrored in other countries. The long-term response to the calamity in China was swift, with plans both to restore reclaimed land around lakes and rivers to wetland areas and to cease logging in the upper and middle reaches of rivers, turning many of the loggers to afforestation projects to protect the

watershed.

Such catastrophes may not generate quite the same level of human suffering in India. But lack of specific studies on the cost of floods and valuation of flood protection functions is needed, as part of the NBSAP process.

5.1.3.2: Ground Water Replenishment

An aquifer is a layer of rock containing water. Underground aquifers store 97% of the world's unfrozen freshwater, and they provide drinking water to almost a third of the world's people – in Asia alone more than a billion people rely on groundwater for drinking, and in Europe it is estimated that 65% of public water supplies come from groundwater sources.

The relationship between groundwater and wetlands is rather complicated. Some wetlands, such as peat lands, lie on top of an impermeable layer of rock or soil, preventing the passage of water between the aquifer and the wetland. Other wetlands owe their existence to groundwater that has come to the surface as springs, while still others occur on permeable soils overlying aquifers, allowing water to recharge the aquifer directly.

5.1.3.3:Shoreline Stabilisation and Storm Protection

India is prone to cyclones, particularly on the eastern coasts starting from Bangladesh to Andhra Pradesh. Hurricanes, cyclones, storm surges and other coastal weather disturbances can cause immense damage through flooding and direct destruction of property, not to mention the loss of human life. The loss of life of over 5000 people in the Andhra Pradesh cyclonic storm in 1997 is priceless. In Bangladesh 40,000 people were drowned in 1985 during one storm surge. Globally, an estimated 46 million people per year are currently at risk from storm surges.

Salt marshes, mangroves and other forested wetlands act as the frontline defense against incoming storms. They help minimize the impact of storms by reducing wind action, wave action and currents, while the roots of the plants help to hold the sediment in place. The 1999 super cyclone of Orissa caused extensive damage in the coastal zone. The large-scale devastation was clearly due to the near disappearance of mangroves along the coastline under pressure from growing population and the resettled Bangladesh refugees. Mangroves in the

Sundarban break up storm waves that exceed 4 meters in height, and this has encouraged the Government of Bangladesh to invest considerable sums of money in re-planting mangroves in the area to assist in storm protection.

Reforestation is a costly process: in Thailand replanting costs amounted to US$ 946 per hectare compared to only US$ 189 per hectare for protecting existing mangroves.
The value of intact mangrove swamps in Malaysia for storm protection and flood control alone has been estimated at US$ 300,000 per kilometer – the cost of replacing them with rock walls. Shoreline stabilisation is equally important in inland rivers. In the United Kingdom, the loss of vegetation along riverbanks in eastern England was coasted at US$ 425 per meter of bank – the cost of maintaining artificial bank reinforcement to prevent erosion.

Coral reefs also deliver storm protection. A recent estimate of the value of coral reefs found that the cost of destroying just 1 kilometer of reef ranged from US$ 137,000 to almost US$ 1.2 million over a 25-year period, based on the economic value of storm protection, fishing and tourism. Despite their crucial role, an estimated one third of the world's 600,000 square kilometers of coral reefs have already been destroyed. A recent survey indicates that 58% of the remaining reefs are at risk from human activities, with over fishing and destructive fishing practices, as well as coastal development and bleaching associated with climate change, identified as the major culprits. In the Andaman &Nicobar islands ,there is also some evidence of roads/coasts being eroded in places where corals have been mined for various purposes.

5.1.3.4:Sediment and Nutrition Retention and Export

Wetlands tend to slow down the force of water, encouraging the deposition of sediments carried in the water. This is beneficial further downstream where deposition of sediments may block waterways. Nutrients are often associated with sediments and can be deposited at the same time. These nutrients, mainly nitrogen and phosphorous from agricultural sources but also from human wastes and industrial discharges, may accumulate in the sub-soil, be transformed by chemical and biological processes or be taken up by wetland vegetation which can then be harvested and effectively removed from the system. This capacity for nutrient retention makes

many wetland ecosystems among the most productive recorded, rivaling intensive agricultural systems.

Using appropriate valuation techniques can save floodplains. For instance, the rich Hadejia-Jama'are floodplain in northern Nigeria has long supported tens of thousands of people through fishing, agriculture, fuelwood and fodder production, livestock and tourism. Plans to divert some of its water supply for irrigated agriculture led to an assessment of the relative benefits of the two uses of the floodplain. The intact floodplain was valued at US$ 167 per hectare, in stark contrast to the US$ 29 per hectare in benefits for the diversion option – a clear vote for maintaining the natural wetland ecosystem. Valued in another way, the water in the floodplain was worth US$ 45 per 1,000 cubic meters in contrast to US$ 0.04 for the diverted water. Of course wetland ecosystems are complex biological and hydrological systems and the retention of nutrients and sediments is often a seasonal characteristic: at certain times of the year wetlands function as a "source" rather than a "sink" of sediments and nutrients. In temperate wetlands, for example, nutrient retention is greatest during the growing season when microbial activity is highest in the water and when wetland plants are at their most productive.

5.1.3.5: Climate Change Mitigation

Wetlands play at least two critical but contrasting roles in mitigating the effects of climate change: one in the management of greenhouse gases (especially carbon dioxide) and the other in physically buffering climate change impacts. Wetlands act as significant carbon sinks and so the destruction of wetlands will release carbon dioxide, a greenhouse gas, while wetland restoration and creation will increase the sequestering of carbon.

Wetlands will play a further role as the frontline defenders of coastal and inland areas as countries deal with the full effects of climate change: increasing frequency of storms, changing rainfall patterns, rising sea-levels and sea surface temperatures. Wetlands have been identified as significant storehouses (sinks) of carbon. Using Ramsar's broad definition of wetlands this may amount to as much as 40% of global terrestrial carbon. Peat lands and forested wetlands are particularly important as carbon sinks. Although covering only 3% of the world's land area, peat lands are estimated to store over 25% of the soil carbon pool. Although wetlands are known to

play an important role in the global carbon cycle their full role is not yet completely understood. What is clear is that drainage, conversion to agricultural use and degradation of wetlands will release large quantities of carbon dioxide (which accounts for at least 60% of the warming effect) as well as other greenhouse gases contributing to global warming. It is alarming to realise that the Earth is likely to become warmer during this century than at any other time in the history of the human species.

The many environmental changes associated with climate change have serious implications for wetlands – key impacts on wetlands include the effects of sea level rise, rising temperatures, and changes in precipitation patterns, ocean currents and winds. Compounding this in certain areas will be the likely increase in tropical storms as well as heavier and more abundant rainfall bringing increased freshwater and sediment to coastal areas. Changes in the hydrological cycle will affect inland wetlands too and test their abilities to contend with increased rainfall in some areas and decreased rainfall in others as well as changes in groundwater recharge and discharge. Beaches, dunes, estuaries, mangroves and other coastal wetlands are naturally equipped to adapt to changes in prevailing winds and seas and to sea-level rises. The predicted changes as a result of climate change will, however, be increasingly rapid compared to the natural rate of change to which the systems are adapted. Coastal managers will have to assist wetlands to adapt to these changes – dune restoration and rehabilitation and re-creation of coastal wetlands will be essential in some countries.

5.1.3.6: Water Purification

Plants and soils in wetlands play a significant role in purifying water. High levels of nutrients such as phosphorous and nitrogen, commonly associated with agricultural run-off, are effectively removed by wetlands. This is important in preventing eutrophication further downstream, a process that leads to rapid plant and algal growth followed by depleted oxygen levels that affect other species. It can also be important in preventing high concentrations of these nutrients reaching groundwater supplies or other water sources that may be used for drinking water. Wetlands can be highly effective in dealing with these high levels of nutrients

In West Bengal, India, 430 members of a Fisherman's Cooperative harvest one tonne of

fish a day from ponds that receive 23 million liters of polluted water daily from both industrial and domestic sources. *Eichhornia crassipes* is used here to remove the heavy metals while other wetland plants remove grease and oil. Mercury levels, although high in incoming water, cannot be detected in the outflow, and the wetland plants remove 99.9% of the faecal coliform bacteria.

The value of the purification function of wetlands is significant: New York City recently found that it could avoid spending US $3-8 billion on new waste water treatment plants (with US$ 700 million annual operating costs) by investing just US$ 1.5 billion in buying land around the reservoirs upstate as well as instituting other protective measures to protect the watershed that will do the job of purifying the water supply for free.

Using this purification capacity of wetlands, Calcutta has pioneered a system of sewage disposal that is both efficient and environmentally friendly. Built to house one million people, Calcutta is now home to over 10 million, many living in slums and creating a sanitation nightmare. But the 8,000-hectare East Calcutta marshes, a patchwork of tree-fringed canals, vegetable plots, rice paddies and fish ponds, along with the assistance of 20,000 people, daily transform one third of the city's sewage and most of its domestic refuse into 20 tonnes of fish and 150 tonnes of vegetables. Mobilising people and wetlands here dispenses with the need for costly engineered sewage systems, brings great benefit to many local people, and solves at least part of the sanitation problem in the city.

5.1.3.7: Reservoir of Biodiversity

Wetlands support spectacular concentrations of wetland-dependent wildlife. Spectacular statistics aside, wetlands in general are home to a great diversity of species. Although freshwater ecosystems cover only 1% of the Earth's surface, they hold more than 40% of the world's species and 12% of all animal species. On the marine front, coral reefs are among the most biologically diverse ecosystems on the planet, rivalling tropical rainforests, the most diverse of the land ecosystems. Although they cover only 0.2% of the ocean floor, coral reefs may contain 25% of all marine species. The Great Barrier Reef in Australia alone is home to 1,500 species of fish and 4,000 types of mollusc. Four thousand species of fish and 800 species of reef-building

corals have already been described for reefs, but the total number of species associated with reefs is quite likely to be more than a million.

The biodiversity in wetlands is also valuable as a reservoir of genes. Rice is a common wetland plant and the staple diet for over half the world's population. Wild rice continues to be an invaluable source of new genetic material for developing disease resistance, yet many different varieties of rice have disappeared in recent years – leaving us dependent on a shrinking genetic base. A typical "lifespan" of a commercially-bred crop variety has been estimated at 5-10 years before new genetic material is required to combat pest and disease problems. The value of such traits on a global scale is counted in the billions of dollars.

Wetland species have also been extensively used in the medical industry. It is estimated that over 20,000 medicinal plant species are currently in use, some of them from wetlands, and over 80% of the world's population depends on traditional medicine for their primary health care needs. Amphibians are recognised as a particularly threatened group of wetland animals, yet current research identifies at least some species as a veritable pharmacopoeia: research on a South American clawed toad has revealed that chemicals in its skin have potential as antibiotics, fungicides and anti-viral preparations. The blood of horseshoe crabs, a species basically unchanged for 350 million years, contains a compound used by the pharmaceutical industry to test the purity of drugs and medical equipment that holds human blood.

In Chilika lake, according to Zoological Survey of India, the total number of fish species in the lake has come down from 126 in 1920's to just about 69. Annandale (1921) had recorded about 53 different species birds were observed on Barakundi island of the lake. Hussain, Mahapatra and Ali (1984) reported about 151 species of birds regularly visiting the lake during the winter season. It is predominated by 22 species of ducks and geese, 52 species of plovers and sandpipers belonging to 8 families, 14 species of gulls and terns, 13 species of eagles and 11 species of herons and egrets. Out of the 151 species, 92 are considered to be resident or local migrants. Due to severe degradation of the lake ecology, both fish and avifauna species have come down significantly (Kadekodi, 2000). The estimated lower bound value of these biodiversity losses have been put as 30 million US dollars.

Our future needs of the global gene pool are uncertain and "extinction is forever", so society ought to consider conserving biological diversity for its potential future uses as well as for its present uses. This is essentially an "option value"; losses in diversity represent a reduction in this value. Perhaps another way of looking at this value is to consider, for example, how much people and institutions are willing to pay for the conservation of species and ecosystems:

> The world's largest NGO, WWF, has an annual income of US$ 343 million; the largest proportion of this comes from individual members who pay to conserve wildlife they may never see.

The Global Environment Facility (GEF) operates the financing mechanism of the Convention on Biological Diversity (CBD). Since 1991, a total of US$ 2.2 billion from the GEF Trust Fund and a further US$ 1.3 billion through co-financing have been allocated to biodiversity activities in 334 projects in 119 countries. Significant sums are being spent specifically on wetland projects. The Ramsar Bureau is currently involved in three on-going GEF-funded projects that directly or indirectly conserve wetland biodiversity: a US$ 15.5 million MedWet project (jointly funded by UNDP's GEF, the French GEF and other sources) to conserve and manage Mediterranean coastal wetlands in 6 countries; a US$ 627,225 project to enhance the critical network of wetlands required by migratory waterbirds on the African/ Eurasian flyway; and a US$ 347,400 project to conserve some major wetlands in Iran. It is envisaged that, through the Bureau's Joint Work Plan with the CBD, more GEF funding will become available for wetland projects in the future.

5.1.3.8: Wetland Products

Besides performing the many vital functions and roles described above, wetlands provide a variety of other benefits to humans in the form of products that can be exploited for human use. The range is enormous: fruit, fish, shellfish, deer, crocodile and other meats, resins, timber for building, fuelwood, reeds for thatching and weaving, fodder for animals, etc. Exploitation is carried out at all levels – subsistence level, cottage industry, and the larger commercial scale – in all parts of the world.

A good example of wetland product, strongly linked to external market is from Chilika lake. Currently, the fish and prawn landings from the lake are of the order of 1300 and 282 metric tones. Of these, almost 80 percent of them are exported (Kadekodi and Gulati, 1999). It should also be noted that both the landings and hence the quantity exports have been going down, though not the values of exports. This is mainly due to highly elastic price increase in the international markets, as compared to the local prices.

The staple diet of 3 billion people, half the world's population, and about 80% pr Indian population is rice. Additionally Indian wetlands also have been found to be very productive in sugarcane.

The mangrove is an amazingly versatile plant from a human perspective. Growing all over the world in tropical areas, the range of mangrove products used by humans includes thatch for roofing, fibres for textile and paper-making, timber for construction, fuelwood, medicines from bark, leaves and fruits, as well as dyes and tannins used to treat leather. In the Bangladesh portion of the Sundarbans, a 650,000-hectare mangrove forest spanning the border between India and Bangladesh, exploitation of the wetlands involves a 20-year mangrove cycle producing 45% of all the timber from state-owned forests and the sole source of newspaper print in the country. It employs 45,000 people during the peak harvesting season, and a further 10,000 fisherman live in the forest for 3-4 months each year exploiting the abundant fish.

5.1.3.9: Recreation and Tourism

The natural beauty as well as the diversity of animal and plant life in many wetlands makes them ideal locations for tourists. Many of the finest sites are protected as National Parks or World Heritage Sites in India; many of them are able to generate considerable income from tourist and recreational uses. The total number of tourists to Chilika lake was about 83,000 in 1983, which swelled to 1,48,000 by 1994. But needless to mention that with the deterioration of the lake, the tourism rates come down significantly in the recent years. The valuation of tourism another wetland, namely, from Bhoj lake is shown in Box 5.1

5.1.3.10: *Cultural Value*

This is a relatively poorly documented function of wetlands, yet there are many

instances where wetlands have significant religious, historical, archaeological or other cultural values for local communities, representing a part of a nation's heritage. Some wetlands support traditional activities that represent part of the history of the nation. For instance, Chilika lake in Orissa is worshipped as Goddess of Utkal, as seen in the first four lines of a poem *Chilika,* written in 1981 by the famous poet Radhanath Ray of Orissa:

"Oh Chilika your body laced
with the garlands of ducks,
You are the luxury blue-watered
lake of the Goddess Utkal,
You are also the charming
treasure of decorations,
And splendourous wealth of
the kingdom Utkal."

_____Translated by Dr. B. Padhi of Utkal University_____

In some cultures wetlands may have deep religious significance for local people. In Tibet, pre-Buddhist belief identified various lakes as sacred, making them objects of worship as well as ensuring their protection from pollution and other harm. As Buddhism took over, these beliefs remained, albeit in a modified form, and certain lakes in Tibet are still sacred to the people with strict regulations that determine their exploitation.

It may be appropriate for the NBSAP policy formulation to take a look at some estimates of values for a small wetland in India.

Box 5.1: Multiple values of Bhoj wetland (in India) to multiple stakeholders

Different kinds of values accrue from the Bhoj Wetland to different stakeholders living around as well as away from the lake. The values so estimated using various valuation techniques are summarised in Table 5.1.

Table 5.1: Estimation of Economic Values of Bhoj Wetland (Annual for 1999-2000)

Uses / Impacts	Stakeholders	Valuation Techniques	Value (in Rs)
A. Drinking Water	Water supplying agencies		Supply Cost 9,54,13,962
B. Fish Production	Fishermen	Market Price of Existing Production	49,20,000
C. Boating	Boatmen	Income Estimation	24,37,880
D. *Trapa* cultivation	*Trapa* (water chest nut) Cultivators		Market Price of Existing Production 50,00,000
E Washing of clothes	Washer men	Income Estimation	36,00,000
F. Secondary Activities			
i.Maize cob selling	i.Maize Cobb sellers	i.Income Estimation	i.1,44,000
ii.Sugar cane juice selling	ii.Sugarcane juice sellers	ii.Income Estimation	ii. 2,73,600
iii.Snacks &cold drink stalls	iii.Individual owners	iii.Income Estimation	iii. 2,06,400
iv.Horse rides	iv.Individual owners	iv. Income Estimation	
v.MPTDC	v.MPTDC	v.	
a. Cafeteria		a.Revenue Generation	
b. Boating		b.Revenue generation	

5.2: Experience on valuation of forest resources: A case study of Himachal Pradesh Forest Accounting (* with most of the inputs from Madhu Verma)

5.2.1: Do we know all about forest in India?

India possesses a distinct identity, not only because of its geography, history and culture but also because of the great diversity of its natural ecosystems. The panorama of Indian forests ranges from evergreen tropical rain forests in the Andaman and Nicobar Islands, the Western Ghats, and the north-eastern states, to dry alpine scrub high in the Himalaya to the north. Between the two extremes, the country has semi-evergreen rain forests, deciduous monsoon forests, thorn forests, subtropical pine forests in the lower montane zone and temperate montane forests (Lal, 1989).

One of the most important tropical forests classifications was developed for Greater India (Champion, 1936) and later republished for present-day India (Champion and Seth, 1968). This approach has proved to have wide application outside India. In it 16 major forests types are recognised, subdivided into 221 minor types. Structure, physiognomy and floristics are all used as characters to define the types.

The main areas of tropical forest are found in the Andaman and Nicobar Islands; the Western Ghats, which fringe the Arabian Sea coastline of peninsular India; and the greater Assam region in the north-east. Small remnants of rain forest are found in Orissa state. Semi-evergreen rain forest is more extensive than the evergreen formation partly because evergreen forests tend to degrade to semi-evergreen with human interference. There are substantial differences in both the flora and fauna between the three major rain forest regions (IUCN, 1986; Rodges and Panwar, 1988).

The Western Ghats Monsoon forests occur both on the western (coastal) margins of the ghats and on the eastern side where there is less rainfall. These forests contain several tree species of great commercial significance (e.g. Indian rosewood *Dalbergia latifolia*, Malabar Kino *Pterocarpus marsupium*, teak and *Terminalia crenulata*), but they have now been cleared from many areas. In the rain forests there is an enormous number of tree species. At least 60 percent of the trees of the upper canopy are of species, which individually contribute not more

than one percent of the total number. Clumps of bamboo occur along streams or in poorly drained hollows throughout the evergreen and semi-evergreen forests of south-west India, probably in areas once cleared for shifting agriculture.

The tropical vegetation of north-east India (which includes the states of Assam, Nagaland, Manipur, Mizoram, Tripura and Meghalaya as well as the plain regions of Arunachal Pradesh) typically occurs at elevations up to 900 m. It embraces evergreen and semi-evergreen rain forests, moist deciduous monsoon forests, riparian forests, swamps and grasslands. Evergreen rain forests are found in the Assam Valley, the foothills of the eastern Himalayas and the lower parts of the Naga Hills, Meghalaya, Mizoram, and Manipur where the rain fall exceeds 2300 mm per annum. In the Assam Valley the giant *Dipterocarpus macrocarpus* and *Shorea assamica* occur singly, occasionally attaining a girth of up to 7 m and a height of up to 50 m. The monsoon forests are mainly moist sal *Shorea robusta* forests, which occur widely in this region (IUCN, 1991).

The Andamans and Nicobar islands have tropical evergreen rain forests and tropical semi-evergreen rainforests as well as tropical monsoon moist monsoon forests (IUCN, 1986).The tropical evergreen rain forest is only slightly less grand in stature and rich in species than on the mainland. The dominant species is *Dipterocarpus grandiflorus* in hilly areas, while *Dipterocarpus kerrii* is dominant on some islands in the southern parts of the archipelago. The monsoon forests of the Andamans are dominated by *Pterocarpus dalbergioides* and *Terminalia* spp.

5.2.2: Building up value of forests from the bottom:

One always asks a very common question, when it comes to valuation. What is the total economic value of a forest? In this Section, under NBSAP, a cases study specifically is presented drawn from Madhu Verma (2000) for the purpose of understanding and appreciating the question as well as the answer.

As presented in Chapter four, various components of Total Economic Value are identified first, estimated and used for natural resource accounting, which is the ultimate purpose of valuation studies on biodiversity. Some of the major non-tangible values or benefits are listed

in Box 5.2.

Box 5.2: Selected economic valuation methods for intangible benefits of Indian forests

Benefits	Methodology for economic valuation	
	Direct method	Indirect method
Direct – Non-consumptive		
	1. Contingent valuation	1. Travel Cost Method
(1) Ecotourism/recreation	method	
(2) Education and Research	2. Experiments	
(3) Human habitat		
(4) Other non-consumptive uses		
Indirect	1. Contingent valuation	1. Change-in-productivity
	method	approach
(A) Watershed benefits :	2. Experiments	
(1) Agriculture productivity		2. Replacement cost
(2) Soil conservation		approach
(3) Recharging of group water		
(4) Regulation of stream flows		
(5) Other watershed benefits		
(A) Ecosystem services	1. Contingent valuation	1. Replacement cost
	method	approach
(1) Nitrogen fixing	2. Experiments	2. Indirect estimates
(2) Waste assimilation		derived from experiments
(3) Carbon Store		
(4) Microclimatic functions		
(5) Other ecosystem services		
(C) Evolutionary process	Contingent valuation	Indirect estimates derived
	methods	from experimental data
(1) Global life support		
(2) Biodiversity		
Non-use values	Contingent valuation	
	methods	

5.2.2.1: ***Valuing Direct Consumptive Benefits from H.P. Forests***

The features and steps involved are summarised here:

A. The total legal forest area of the State = 36,986 Sq. Km. having tree covers on its 33.8% area only.

B. The total growing stock is 10.25 cubic meters per hectare from which various direct consumptive benefits like fuel wood, fodder, timber/salvage, timber for right holders and minor forest produce comprising of resin, medicinal herbs and katha flow. For the marketed products like timber, royalty rates fixed up by the department have been used and for the non-marketed products mainly used for self consumption, approximate price of similar goods (e.g. fuel wood, fodder) sold in the other areas is considered.

Table 5.2: Value of Growing stock in HP Forests

Name of the Species	Forest Area (Sq.km)	Growing stock (1000 Cub. Mts.)	Royalty rate of standing tree (Rs, Per cu.mt.)	Value of Growing Stock (Rs. Crores)
1	2	3	4	5
Deodar	645	14215	9762	13.87
Kail	731	13616	6360	86.60
Chil	1460	10053	2233	9158.00
Fir/Spruce	1264	41012	1867	7657.00
Sal	183	2563	3474	890.00
Bank Oak	594	7296	294	215.00
Mohru Oak	25	1206	294	35.50
Karsu	375	7435	294	219.00
Maple	NA	1703	294	50.50
Horse Chestnut	NA	1723	294	51.00
Walnut	NA	651	294	19.00
Bird Cherry	NA	1037	294	30.00
Total	5277	102511		40860

Source : For column 1 to 4 - H.P. Forest Department.

I. **Value of Salvage:** On the basis of last four years volume and royalty (at subsidized rate) collected from H.P. State Forest Development Corporation, the annual salvage quantity is 3.50 lakh cubic meter, with the collection of Rs. 32.28 crores as royalty.

A. **Value of timber drawn by right holders (TD):** Average of four years is used to arrive at volume granted for TD and the market price of timber sold in the market was considered as value. As timber rights, the value of this timber goes as effective subsidy

and as such no revenue accrues to the forest department on this account. But this source greatly supports the livelihood of rural communities. The volume extracted annually stands 1.06 lakh cubic metres, having market value of Rs. 60.25 crores, as against the FD's collection of Rs. 0.29 lakh to 0.45 lakhs. The average rate of T.D. per cubic meter ranged between Rs. 0.37 – 0.34 per cubic meter, which was almost negligible against market rate.

B. Value of fuelwood requirement : Of the total State population of 51.70 lakh, 47 lakh persons(91%) live in rural areas. There are 8.61 lakh households in Rural Himachal Pradesh, which put forward an average demand of 4 tonnes of fuelwood per year per household leading to total requirement of 34.44 lakh tones of fuelwood annually. Of this 20% of wood fuel energy is provided by on farm crop residues, dung and agro-forestry fuelwood and imports from neighbouring states like Punjab, Haryana. If the remaining requirement of 80% (27.6 Lakh Tonnes) is valued at a conservative rate of Rs. 1000 per tonne, the annual fuelwood requirement from forest shall have a value of Rs 276 crores.

C. Value of Grasses & Grazing: Himachal Pradesh is a unique state in the sense that human and cattle population are almost in equal numbers. 14,346 Sq. Kms. of area covering dense forests (9,560 Sq. Km), open forests (2,961 Sq. Km.) and scrub forests (1,825 Sq. Km.) constitutes 38.78% of forest area & 25.76% of geographical area of the state has to provide grazing support to its 51.17 lakh livestock population. This population when converted into sheep units work out to 157.69 lakhs. Each sheep unit requires on an average 2 Kg of fodder everyday and thus put requirement at the tune of 730 Kg per annum per sheep unit of which 584 Kg (80%) is required from the forestry sector as rest is provided by other sources. Thus 92 lakh tonnes of fodder is required from forests, which is rated as Rs. 750 per tonne is worth Rs. 690 crores.

D. **Value of Minor Forest Produce :** Medicinal herbs are considered as major components of non-timber forest produced. Other NTFPs are Katha (*Acacia katechu*), Resin extracted from chil (*Pinus roxbughis*) and cedar oil extracted from the stumps of the Deodar tree (*Cedrus deodar*). The flora of H.P. consists of around 3300 species of plants. Of these, about 150 species (including few exotic). Are considered to have high medicinal value. About 35 plants products of medicinal value are regularly supplied by the state. About 1161.56 tonnes of NTFPs are extracted annually, which at prevailing royalty rates generate value of Rs. 24.98 crores.

Thus the direct consumptive benefits from the Himachal Pradesh Forest add up to Rs. 1083 crores per annum as against the annual investment of Rs. 109 Crores in the forest sector to this estimated value. If we add value of indirect consumptive benefits and of environmental & ecological functions of forests, the monetary value generated per hectare of forest area shall considerably increase.

5.2.3:Valuing Direct Non-Consumptive & Indirect Benefits from Himachal Forest.

In this section an attempt is made to work out the conservation benefits of forest in order to make unbiased decision when either alternate land use options are proposed or demand for more allocation of fund is put forward. This section tries to assign approximate per hectare value of non-consumptive direct benefit (tourism, education & research)& indirect use values like watershed benefits (agriculture productivity, soil conservation, recharging of ground water, regulation of stream flows/flood control/siltation rate), eco system service or (carbon store, microclimatic functions) and evolutionary, processes (biodiversity/endangered species).

I. **Valuing Eco-tourism & Recreation Benefits:** On account of its picturesque landscape and good climate, the State receives heavy inflow of both national & international tourists every year In 1997, 38.52 lakh tourists visited HP and looking to the past trend, tourist flow is expected to increase @ 20%. `Forests' are the most important `input' on which tourism is heavily based. Besides diverse forests existent not only is demarcated forest area but also in urban areas(municipal forests) forest also a contribute to landscape values. Keeping the rate of growth of 20% per annum, 66.56 lakh tourists are expected to visit in the year 1999-2000. The total number of tourists comprise of Indian tourist & Pilgrims(49% each), 2% international tourists. Keeping a moderate expenses @ Rs. 5000 per tourist & expecting that 50% of expenses are due to forest / nature based tourism, the eco tourism value comes to Rs. 1664 crores. Using the estimated expenditure of Rs. 0.18 lakhs per hectare, which the tourists are willing to incur on account of eco-tourism in India, (Chopra 1997), the value of eco-tourism for the state come to Rs. 6657 crores (Area under forests * Annual eco-tourism value per hectare).

II. **Valuing Watershed Benefits:** The type & quality of vegetative cover on watershed lands influence run off, infiltration rates, erosion & sediment production & the rate of evapo-transpiration . A dense forest cover of vegetation is a most powerful weapon for reducing erosion. Watershed management leads to economic gain to local & regional economies in the form of productivity and hence income gains to farmers, provision of domestic water supply, irrigation, hydropower; minimisation of natural disaster such as flood, drought & landslides etc. This has been proved in many parts of the world as well as in India. Though the contribution of Himachal forests in productivity of agriculture & horticulture crops & supply of water to cities in Indo-Gangetic plain is widely appreciated, no value has been ascertained for this contribution. The following table shows geographical area of the river basin and the growing stock and annual yield from various forest divisions in H.P.

Table 5.3: River Basinwise Geographical Area, Growing Stock and Annual yield from various forest division

Name of the River Basin	Geographical area in River Basin (Km^2)	Area occupied under Forest division	Growing stock in forest ('000 m^3)	Annual yield ('00 m^3)

Sutlej	20398	1173	21154	1676
Beas	13663	1841	35006	2538
Chenab	7850	107	2518	174
Yamuna	5872	1680	35291	2525
Ravi	5528	476	8542	689
Indus	1450	-	-	-
Markandya	360	-	-	-
Ganges	290	-	-	-
Ghaggar	262	-	-	-
Total	55673	5277	102511	7602

(Source : HP Forest Statistics, 1996)

(Note : Only total values of all species of all divisions in various river basins are mentioned here)

Out of the 55673 Km^2 geographical area of the state 5277 Km^2 is occupied under forest divisions in various river basins which contain the growing stock of 1025 crore m^3 and has annual yield of 0.76 crore m^3. Using watershed value of forests from a recent study on Yamuna Basin by Chopra & Kadekodi (1997) in term of Rs./Hectare, the watershed value of entire forest area comes to Rs. 73 crores annually.

Looking from the angle of horticulture & agriculture productivity changes on an account of soil & water conservation function provided by the forests using the rule of thumb, 10% of the production can be attributed of forests. Average production of crops stood at 2362 thousand million tones in recent years has market value Rs. 1954.81 crores. Attributing 10% this due to watershed value of forests, Rs. 195 crores should be attributed to forests. Similarly if we attribute 10% production of irrigation water & power generation to forests in the watershed, the value shall stand at Rs. 61 crores (10% of the contribution of power & irrigation sector to GSDP). In other words we can say Rs. 195 crore worth of agricultural & horticultural productivity & Rs. 61 crore worth of power & irrigation benefit would have been lost without forests. In case of flood control, 2.31 lakh hectares of the area of the state is subject to yearly flood havoc. Approximate cost of works to be done under various flood protection programmes in Rs 621 crores. Using the same rule of thumb we could say the cost would have been 10% higher in case of less forests in the catchment area. Thus forests save Rs. 6.2 crores per annum in terms of flood proofing. The multiplier effects of flood control can further be calculated in terms of human lives saved, cattle heads saved, crop damage avoidance, avoidance of in undated agricultural areas & therefore production losses, avoidance of damage to public utilities such as roads bridges, water supply schemes, electricity & telephone lines etc. Further on account of existent forests, the rate of siltation gets checked. Else curative expenditure would have been incurred for dredging and sediment control. Thus contribution of forests in terms of avoidance cost must be acknowledged. Similarly ground water recharge due to water conservation function of forests could also be valued.

I. **Value of Micro-climatic Factors:** Forests in Himachal combined with the altitudinal factors contribute towards regulation of temperature, humidity, rainfall and its distribution. At this point though it is difficult to work out exact value say saving in the cost of cooling (natural air conditioning) as compared to what is spent per household in down stream cities when average temperatures are high and which further needs to be compared with cost of heating to provide warmth in winters in the hill areas. Making a rough estimate that Rs. 3000 per annum per household is spent on electricity charges on cooling devices in the plain areas, the households in Himachal save this on account of low temperatures due to forests in & around urban & rural areas. If we assign 50% of costs so saved in Himachal goes for heating devices per household to provide warmth during winter, when temperature is considerably

low, (which is not so in case of plains) taking total number of households in Himachal Pradesh (9,69,018), the value accrue to the forest shall be 145.35 crores or we can say household in Himachal worth Rs. 145 crores.

II. **Value of Carbon Sink:** The Growing stock of 10.25 crore m^3 (excluding in the protection circles) provides an excellent sink for CO_2 emission & thereby thus influence global climate. Thus it becomes essential to quantify and assess carbon stock & flows in forestry activities though the carbon sink function shall considerably vary with changing density of the growing stock but (Kadekodi & Ravindranath, 1998), taking the area only under dense, open & scrub forests i.e. 14,346 sq. km. (14,34,600 hectares) which contain the growing stock & using all India value of Rs. 1.23 lakhs per hectare for carbon store function of forests, the Himachal forest tree cover & scrub forest provide Rs. 17,645 crore worth of carbon sink function. In this case if the forest in agricultural farm land, cantonment and urban areas are also considered, the value of carbon sink shall be even more.

III. **Value of Biodiversity:** The forest of H.P. are rich in vascular flora which form the conspicuous forest cover 3,295 species constituting 7.32 % of species of the species found in the country are existent in the state. A rare plants Ginkgo biloba, which is a living fossil fuel, is found in the state. It is a conifer having on appearance of broad-leaved tree is native of China. Only two such plants are found in Manali & Kalpa region of the state. The State has six different broad types of forest. As mentioned earlier types of medicinal plants are found in the state. The state has 2 national park & 32 sancturies. The National Park are the representative of the state in terms of species richness both floral & faunal, 20 bird species, 23 animal species, 3 reptile & four vermins are found in the state. Biodiversity values are option value & provide an insight into potential future values of genetic information & organic compounds derived from wild plant & animal species found in tropical forests besides their, `row material' value for the development of new crops cultivators, pharmaceutical products and pesticides, among other use (Bishop, 1999). The value of bio diversity varies considerably according to its richness. In India it is estimated to be Rs. 0.21 lakh /hectare (Lal, 1992). Extrapolating it to the entire forest area of Himachal Pradesh, (36, 986 sq. km.) it come out be Rs. 7137 crores.

IV. **Employment generation through forestry works:** Many state and central sector schemes going on in the state's forestry sector provide employment through construction of roads, paths, buildings, soil conservation works etc. Such schemes on an average generate 48.80 lakh man-days of work which if rate at daily wage rate of Rs. 51/- generates value of Rs. 248 Crores.

5.2.4: Total Economic Value of Forest stock of Himachal Pradesh

This section attempts to provide total economic value to the forest stock of Himachal Pradesh in terms of current use values only. Option and existence values are not considered here separately mainly because of two reasons. Firstly to some extent they get covered in the biodiversity and eco-tourism benefits and secondly their close estimation is possible through primary survey using the contingent valuation method, which was beyond the scope of this study. The values in terms of direct consumptive and non-consumptive and indirect one are totalled here to arrive at the total economic value of forest stock of Himachal Pradesh. This study does not attempt to provide accurate monetary values of various benefits as, it is difficult to quantify such benefits specially the intangible in monetary terms without primary survey and more over the rate so used for converting physical contribution into monetary terms, the average values of studies conducted in India have been used. Therefore no precision is being claimed. Rather the effort is to reflect an

approximate total contribution of forestry sector into economic development of the state such that the environmental function of the forests can find appropriate place in the economic planning. Such an integrated and holistic approach for forestry sector shall in turn strengthen socio-economic development process of the state.

The values so generated above are summarized in the following table. For calculating the Rs./Hectare contribution of various benefits, the total geographical area under forests and area under actual tree cover are separately used as denominators to reflect two different values.

Table 5.4: Economic Value of Forests of Himachal Pradesh (On Annual Basis)

Total geographical forest area of H.P. : 36,986 Km^2				
Area under tree cover & Scrub Forest : 14,346 Km^2				
Goods/services from Forests	**Physical value**	**Monetary value (Rs. Crores)**	**Rs. Per ha. Value of goods/ services in terms of total geo. Area of forests**	**Rs. Per ha. Value of goods/ services in terms of area under tree cover and scrub forest**
(1)	(2)	(3)	(4)	(5)
Total growing stock	10.25 crores m^3	40860	1.10 lakhs	2.85 lakhs
Economic Value of Direct and Indirect Benefits				
I. Direct Benefits				
A. Direct Consumptive benefits				
1.Salvage	3.50 lakhs m^3	32.00	0.08 thousand	0.22 thousand
2.Timber for right holders	1.06 lakhs m^3	60.00	0.16 thousand	0.42 thousand

3. Fuelwood	27.60 lakh tons	276.00	0.75 thousand	1.92 thousand
4.Fodder	92.0 lakh tons	690.00	1.86 thousand	4.81 thousand
5.Minor forest produce	1161.56 tons	25.00	0.067 thousand	0.17 thousand
Total Direct consumptive benefits		1083.00	3 thousand	7 thousand
B. Direct Non Consumptive Benefits				
6.Ecotourism*	66.56 lakh – Tourists	6657	18 thousand	46 thousand
Total Direct Benefits(A+B)		7740	21 thousand	53 thousand
II. Indirect Benefits				
7.Watershed*	6.77crore m3 - Growing stock in river Basin Forest Circle and 36986 km2 - entire forest area	73972	2.0 lakh	5.16 lakhs
8.Microclimatic factors	969018 Households	145	0.39 thousand	1 thousand
9.Carbon Sink*	14346 km2 - Area under tree cover and scrub forest	17645	48 thousand	1.23 lakhs
10.Biodiversity*/ Endangered Species	8966- Total no. of species found in Himachal Pradesh & 125 - Endangered species	7137	20 thousand	20 thousand
11.Employment Generation	48.40 lakh Man days	25	.06 thousand	1.7 thousand
Total Indirect Benefits (7+11)		98924	2.68 lakhs	6.90 lakhs
Total Economic Value(I+II)		***106664***	***2.89 lakhs***	***7.43 lakhs***

Source: Verma (2000)

Note : (i) Values marked with asterisk (*) have been estimated using all India averages based on certain case studies.

Average values against benefits for items 6,7,9 & 10 are calculated individually under column (5)

All calculation for carbon sink function are based on area under actual forest cover i.e. 14,436 Km^2 where the vegetative growth actually takes place but an average value is also calculated for column (4) using the estimate actually coming for area under free cover.

Figures in column (3) are rounded off, as they are broad estimates.

It is evident from the above table that actual forest cover in Himachal is 14,346 sq.km. generate annual economic value to the tune of Rs. 7.43 lakh/hectare and if the entire area under legal forests is used as denominator, the value reduces to Rs. 2.89 lakh/hectare. The maximum per hectare value is generated by watershed function followed by carbon sink, biodiversity, ecotourism (all non-marketed values). Using these annual benefit values, it is then possible to arrive at the stock value of forests. For instance, with a ten year forestry planning, assuming the discount rate to be 12 percent, the total value of forest land in Himachal Pradesh can be said to be Rs. 16.33 lakhs per hectare (Rs. Lakhs: 2.89* 5.65, the discount factor).

5.2.5: From Valuation to Natural Resource Accounting

The methodology of Natural Resource Accounting (dealt in Chapter four) is used here to derive the implication of using forest resources in Himachal Pradesh.

Table 5.5: Natural Resource Accounting for Himachal Pradesh

Forest Resource contribution vs. Investment	
Value of Growing Stock	Rs. 40860 Crore
Total Economic Value of Forests	Rs. 106664 Crore
Total Expenditure incurred in forest (Annual Budget)	Rs. 109 Crore
Revenue realised by forests	Rs. 41 Crore
II. Contribution of Forests to the GSDP	
Total GSDP	Rs.9258 Crores
Forestry as logging	Rs. 487 Crores
Forestry as % of GSDP	Rs. 5.26 %
TEV of forests of HP (as per current estimation)	Rs. 106664 Crores
Corrected GSDP	Rs.115434 Crores
Forestry as % of corrected GSDP	92.40%

Note: GSDP= Gross state domestic product

The table shows that total economic value is 2.61 times the value of the growing stock, 980 times the total expenditure incurred in the forestry sector of Himachal Pradesh and 2607 times the revenue realized by the forests annually. This comparison proves gross underestimation of forestry sector's contribution in the economy of the state. When the

GSDP of the state is corrected for Total Economic Value calculated through the current study the contribution of forestry sector increases from 5.26% of GSDP to 92.40 % of GSDP.

As mentioned earlier the benefits in the form of various values generated by the Himachal Pradesh forests are not only realised by the local communities but also by people in the state as a whole neighbouring states (watershed benefits, biodiversity, ecotourism & carbon sink) & by international communities (biodiversity, ecotourism & carbon sink). It could be seen from the table in most of the cases, the private costs associated mainly with the forest department, the social costs (to be borne by rest of the stakeholders) are low & social benefits in the form of positive externality are very high. There is no compensation paid to the forest department on account of its multi-stakeholders and multi-sectoral contribution.

This document of 35 pages will replace the original Section 5.3 in the TWG report. It needs to be edited further, for reduction etc. GKK will do that.

5.3: Marine Biodiversity: Economics and Valuation

5.3.1: Introduction

The India's marine environment consists of unique ecosystems known for their aesthetic beauty and ability to produce numerous commercially important biological species. Spread along the coastline of 7500 kilometers of the main land and island territories, the marine ecosystems also are the cultural and economic backbone of many communities that live in the region. However, the rapid expansion of industrial, urban and other land-based activities on the coast has threatened the health of some marine ecosystems and led to dramatic decline in marine biodiversity.

The significance of biodiversity in general and marine biodiversity in particular is under-appreciated because of the limited understanding of their role. Most studies on

biodiversity often focus on the number of species in an ecosystem (Tilman, 1997). The value of biodiversity arises not merely from its species richness but also from a large number of its ecosystem functions. These functions, among others, include its potential for restoring marine productivity, stability and sustainability. A conservation plan the sole objective of which is to protect species richness will unlikely stand the test of economic net benefits, when compared to alternative plans of development and ecosystem conversion. It is ironical but real that economic considerations often dominate policy discussion. Therefore, it is important to account for the economic values of the entire range of known marine biodiversity services in order to articulate more credible justification for conservation plans. The two-fold objectives of this chapter therefore are to identify the full range of services that marine biodiversity provides to human society, and to suggest ways to value these services.

While a number of studies have been conducted on the economic valuation of different attributes of marine ecosystems (Hoagland et al., 1995), no study would examine the economic value attributable to biodiversity, *per se*. We make a distinction here between the value of marine biological resources and the value of biological diversity. The former is a direct function of the physical quantity or volume of biological stocks. Therefore, conservation plans designed to enhance only the stock value of biological resource may offer protection to a limited number of commercially viable species. There have been attempts to estimate the commercial value of fish stocks based on certain market value of marine products (Polunin and Roberts, 1993). On the other hand, the latter value arises from species diversity or richness, which makes a marine ecosystem more stable, productive, ecologically functional, socially valuable, and aesthetically pleasing. We focus our discussion on the value of biodiversity not of the biological resources.

5.3.2:Marine Ecosystems and Biodiversity

Biodiversity is a key ecological attribute of an ecosystem, and the same varies widely across ecosystems. It is necessary to identify three types of marine ecosystems that have special relevance to biodiversity: estuarine, inter-tidal and coral reef. Estuarine system is a fresh water ecosystem comprising estuary, mangroves and other wetlands rich in microscopic plant life and abundant in vegetation. They are the rich breeding grounds for larvae of some commercial species, a broad range of algae, fungi and lichens among others. More than 75 percent of the commercial fish catch in India is dependent on estuaries for part of their life

cycle. India ranks 14th in the list of the world's major mangrove area and fifth in the Indo-Pacific regions. India's major mangrove areas include the northern Bay of Bengal and the Sunder Bans (approximately 690 sq km together), which is the world's single largest contiguous block of mangrove forests. India is reported to be having 6700 sq km area under mangroves, which is 7% of world's mangrove area. India has about 3.9 crores hectare (3.9 lakhs sq km) of estuarine wet lands (B Sahai, 1993). See Table 5.6 for areas under different coastal ecosystems in India.

Table 5.6. The areas under various ecosystems along the Indian coastline

Categories	**(Sq. km.)**
Mudflats	22961
Beaches/Spits	1465
Shoals/bars	93
Coral reefs	1270
Mangroves	4121
Marsh vegetation	370
Mudflats with vegetation	6125
Beach vegetation	290
Lagoons/backwaters	2132
Flood-prone areas	3437
Coastal dunes	2509
Reclaimed area	1212
Paleo - beach ridges	434
Paleo-mudflats	6821
Strand plains	1379
Salt-affected area	697
Salt pans	1617
	56933

Source: B. Sahai, 1993

The second type of coastal ecosystem is Inter-tidal ecosystems which consist of areas that are inundated by seawater during high tides comprise the inter-tidal ecosystem and the saline zone is home to crustaceans (crabs), molluscs. The third type is coral reef ecosystems in India cover less than 0.2 per cent of the world's ocean area (Table 5.7). India is reported to have coral reef area of 1270 sq kms mainly in the Gulf of Kuchchh, the Gulf of Mannar and Lakshdeep. Coral reef plays an important role in fisheries and can be 10-100 times as productive per unit area as the open seas. But they harbor a quarter of all marine species and one fifth of the known fish species thriving here. Some species have medicinal value. The utilities from these resources are varied such as medicines, nutrition, cosmetics and other industrial products apart from providing sea transport and tourism.

Table 5.7. Area of the coral reefs along the Indian coast (in sq. km)

Categories	Gulf of Kutchchh	Gulf of Mannar	Lakshadweep
Reef area	148.4	44.2	118.7
Sand over reef	11.8	41.1	13.9
Mud over reef	117.1	-	-
Corralline shelf	-	-	165.7
Sand bank	-	-	28.0
Algae	52.4	-	31.0
I. Dense 27.9	-	-	-
II. Sparse 24.5	-	-	-
Seaweeds	-	-	0.7
Sea grasses and Lagoon with sea grass	-	-	2.0
Reef vegetation	112.1	0.6	-
Vegetation over sand	16.0	0.5	0.3
Lagoon	-	1.1	-
I. Lagoon with sandy substrace	-	-	55.3
II. With live corals	-	-	43.3
III. Deep lagoon	-	-	86.3
IV. With uncertain depth/substrace	-	-	145.5
Vegetation (Coconut and others)	-	-	16.7
Total	457.8	87.5	705.4

Source: B. Sahai, 1993

Box 1.

5.3.3: Economic Exploitation and Legal Protection of Marine Biodiversity

The total marine fish production in India has more than doubled from 1.085 million tonnes in 1970 to 2.668 million tonnes in 1998. The total export earnings from marine products have reached Rs.6300 million in 2000-01 in contrast to Rs.2348 million in 1981. In terms of quantity Indian seafood exports has increased from 0.33 million tons in 1981 to 0.421 million tones by the year 1999-2000. The recent trend in production and exports are shown in Table 5.8.

Table 5.8. Production and Export of marine products of India (quantity in tones)

Products	**1992**		**1995**		**1999**	
	Production (Tons)	**% age of Exports in total landings**	**Production (Tons)**	**% age of Exports in total landings**	**Production (Tons)**	**% age of Exports in total landings**
Shrimp	278191	27.42	253142	39.88	320023	31.64
Lobster	2011	81.15	1923	65.05	2093	68.22
Fish	1830271	2.71	1790063	7.14	1925569	6.33
Crabs	26940	4.34	30610	9.14	27547	12.89
Molluscs	89493	44.96	116764	58.98	93374	74.81
Others	50102	4.03	66381	8.39	41897	10.05
Total	2299594	7.47	2258883	13.61	2417503	12.53

Note: Molluscs includes Frozen products viz. cephalopods, octopus, snail meat, mussel

Source: Calculated from the reports of Marine Products Export Development Authority, Cochin and Central Marine Fisheries Research Institute, Cochin.

According to the reports of the TRAFFIC (Trade Record Analysis of Flora and Fauna in Commerce) (Hanfee 2001), there has been a large-scale fishing of whale sharks for their meat, fins, liver, skin and cartilage. The whale sharks are found largely in the west coast. TRAFFIC India's survey revealed that between 1999-2000, 600 whale sharks were caught; smallest catch was two meters long and half ton, and the largest 14.5 meters and 12 tons. While India exports fresh and frozen meat at Rs.40 and Rs.70 per kg, Taiwan sells the same at Rs.750 per kg. India is also exporting many biologically sensitive marine species such as crabs, mussels, snail,

seaweed (agar/agar) etc in different product forms. The export of total crabmeat increased from 1844 metric tons (i.e., worth Rs.2283 lakhs) in 1994-95 to 2586 metric tons (i.e., worth Rs. 3350 lakhs) in 1999-2000. The export of shrimp in different product form has increased from 74563 metric tons in 1992-93 to 110564 metric tons in 1999-2000. The export of fresh water prawn (scampi) has doubled from 102 metric tons in 1995-96 to 217 metric tons in 1999-2000. With the result many freshwater fish biodiversity has been completely ignored since commercial aquaculture favors a few high-yielding species. Culturing commercial species might gradually eliminate all native species.

Similarly, the export of cultured tiger shrimp *P. Monodon* from coastal wetlands has increased significantly. Many local fishes such as mullets and pearl spot have to be eliminated before stocking the shrimp in coastal shrimp farms. These fishes were the staple food of the local communities. The quantity of cultured shrimp production has increased from 35,500 tons (i.e., worth Rs.3764 million) in 1990-91 to 82,000 tons (i.e., worth Rs.24918 million) in 1998-99. The contribution of cultured shrimp to total shrimp exports has increased from 36 percent to 56 percent in terms of quantity and in terms of from 52 percent in 1990-91 to 75 percent in 1998-99, respectively. This remarkable growth in cultured shrimp export indicates point to the potential loss of biodiversity and declining availability of native fishes for local communities.

International trade in many marine species is prohibited under various Acts and notifications. The exports of some of the species such as marine turtles, shells, gastropods (except the giant clams) are banned under the Wildlife Protection Act 1972 (WPA) and the Convention on International Trade in Endangered Species (CITES). The sea cucumber (Beche-de-mer) is another commercially important marine species that has very high export value. In 1982 Government of India put a ban on the export of Beche-de-mer below the size of 7.5 cm. In Andaman and Nichobar Islands fishing for sea cucumber is totally banned. Corals and associated species like sea-fans and sea-sponges are heavily exploited for their known sources of bio-active substances with wide application in the pharmaceutical industry. Especially sea-fans (Gorgonids), which constitute only source of prostoglandins and terpenoids (Hanfee, 2001). Black corals were listed in CITES Appendix II in 1981 to protect the highly exploited stony corals. However, control of coral trade is difficult since they are often collected in offshore areas not directly controlled by the coastal nations. Further, it is difficult to identify the species origin of final coral products. According to TRAFFIC reports, the species that are

protected under the CITES and WPA are given in Table 5.9.

Table 5.9. Protected Marine Species under CITES and WPA

Scientific name	Common name	CITES	WPA
Mollusca			
Tridacna spp	Giant Clam	App. II	-
Hippopus hippopus	Horsehoof clam	App.II	-
Anthozoa			
Antipatharia spp.	Black and stony coral	App. II	-
Scierectina spp.	Reef building coral	App.II	-
Hydroza			
Mileporidae spp.	Fire corals	App. II	
Alcyonaria			
Tubiporidae spp.	Organpipe coral	App.II	
Mammalia			
Dugong dugong	Sea-cow		Sch.I
Physter macrocephalus	Sperm whale		Sch. II

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora. WPA: Wild Life Protection Act 1972.

Some limitations in the current regulations are evident from the above discussion. The urgency for protecting marine biodiversity seems to have been realized at the international and national levels. However, the anthropogenic activities that lead to biodiversity losses at the local levels are often influenced by state and local decisions. Tougher standards at the local levels are lacking. Even at the national level, only high-profile species get more protection. The part of the reason for this lop-sided or inadequate legal protection is the excessive emphasis on the market or export values of marine resources. In reality, market prices, and in turn, harvesting decisions may not take into account the societal value of the impairment inflicted on the biodiversity's ecological functions while harvesting marine biota. The following is an attempt toward developing a more comprehensive valuation framework that

captures both market and non-market values of marine biodiversity.

5.3.5: Uniqueness of Marine Biodiversity Valuation

In developing a framework for valuation, it is essential to first reflect on some of the unique attributes of marine biodiversity. These attributes not only influence the scope and method of valuation, but also the way the biodiversity is used and managed. These attributes distinguish marine biodiversity from its land-based counterpart. Hoagland et al., 1995 identify the following important attributes:

I. Resource fugitivity: The mobile nature of most marine animals makes it difficult to define the geographic scope of biodiversity measurement. The specific scale of marine biodiversity, unlike forests or cropland, is less definite.

II. Nature of uses: Use of marine biodiversity is subtler than its land-based counterparts, (e.g., forests, grass, wetlands.) Uses are not direct like agricultural or pharmaceutical uses of plant diversity. Most uses are indirect, non-consumptive, and non-use nature. Also, because of its under-water nature, people do not come in direct contact with marine biodiversity in their day to day life. The lack of familiarity and understanding might greatly influence the economic value that people attach to biodiversity.

III. Open access: Both access to and the uses of marine ecosystems are difficult to control because of the problems in marking boundaries. This presents a problem for enforcement and management.

IV. Public good nature: Certain components of the benefits of marine biodiversity are of public-good nature in the sense that all potential users enjoy these benefits the same at same level without any conflict among them. Some of the benefits are global in nature. Presence of a large external benefit gives little incentive to individual users for protecting the resource. The global nature of its benefits makes valuation less reliable and more cost-prohibitive.

For the NBSAP policy formulation in India, it is important to take a look at marine biodiversity, for several reasons separately. Some are due to similarities with other resources and some are due to exclusive characteristics of them.

The Similarities between marine and other resources are:

Presence of non-market goods and opportunity costs: A large number of diverse marine resources are still out of the market framework, specifically the coral reefs.

Potential for benefit transfer application: Because of its international in character, the resources can be viewed from the international perspectives using the benefit transfer methods for valuation.

Resource pricing: Due to its nature as a renewable resource, it calls for a proper understanding of resource pricing under optimal renewability or recyclability.

Issues of geographic scale: Certainly, the resources are of massive scale in their management.

5.3.6: Valuation of marine resources

On the questions concerning valuation of marine biodiversity, the major issues are**:**

Why marine biodiversity valuation is different from valuation of other environmental resources?

What are the contexts or scope of valuation?

What are we measuring? i.e. different components or contributions of biodiversity.

Different valuation approaches?

How can we make use of these valuation results?

Barbier (1993) Suggests 3 Scopes for analyzing value of resources in general.

I. Impact analysis: an assessment of the damages inflicted on the resource system from a specific event (e.g. oil spills)

II. Partial valuation: assessment of alternative resource allocation or policy options involving marine biodiversity protection

III. Total Valuation: an assessment of the total economic value of the wetland system (e.g. the total economic value of Karnataka Marine Biodiversity)

The last framework is the most comprehensive one, which is used in this report.

Sources of Benefits from Marine Biodiversity

5.3.7: What are we measuring?

Before we approach the "economic valuation," it is important that we clearly identify the nature and type of eco-system functions that marine biodiversity makes to humanity and the ecosystem. They are summarily stated below:

Biodiversity and productivity

There are differences among species in methods of resource capture. Species of more diversity are capable of fully utilizing their limiting resources. For example, seasonal and time diversity in species. Some species do well in summer; some in winter, etc. Some are shallow water living; some are deep water.

With more diversity, it is more likely that one or more species come to dominate the ecosystem. That leads to an overall increase in the productivity. This is called "sampling competition" effect.

There is also complementarity in resource use. Different species are able to occupy different regions of the ecosystem. Regions mean area with different bio-geo-chemical

properties within a given ecosystem (e.g., BOD, pH, zooplankton, temperature, nutrients). Diverse system will fully utilize the ecosystem.

le 5.9. Yield and Effort at MSY and MEY Level, Cost at MSY, MEY of selected demersal species in Karnataka

Species	1998			Maximum Economic Level			Maximum sustainable level		
	Yield (tonnes)	Effort (A.F.H.)	Cost (‘000 Rs.)	Yield (tonnes)	Effort (A.F.H.)	Cost (‘000 Rs.)	Yield (tonnes)	Effort (A.F.H.)	Cost (‘000 Rs.)
Catfish	123	2510.96	1,274.39	340.94	1329.97	3,532.49	338.02	1512.25	3,502.20
Halibut	2510.96	1346.36	723.28	53.43	2018.90	715.70	53.05	2272.01	710.52
Lizard fishes	9664.01	108218	53,132.21	3834.48	150788.98	52,468.31	3805.74	170048.61	52,075.09
Pomfret	21483.12	3634.35	9,697.49	2640.65	8425.90	23,049.21	2617.72	9588.12	22,849.11
Rays	3634.35	2260.3	4,297.80	544.99	2495.40	6,730.65	540.29	2838.64	6,672.53
Rock	2260.3	52462.13	24,825.36	2114.78	21286.16	29,880.53	2097.05	24169.16	29,630.00
Shark	3914.41	2516.31	7,072.70	758.65	2102.53	9,809.35	752.12	2391.32	9,724.87
Shrimp	2516.31	19719.7	60,747.54	8400.42	19183.22	96,813.71	8327.48	21829.52	95,973.03

Soles	19719.7	22479.4	54,379.59	9428.73	29104.95	93,958.32	9348.36	33081.16	93,157.41
Thread fin breams	15732.56	38115 2.3	181,51 2.05	1315 2.67	14146 8.14	180,41 0.27	13042.67	16060 3.91	178,90 1.35

Bhat M and Bhatta R. 2001

2. Biodiversity and stability.

Less diverse system means less resistance to disturbance and less resilience after a disturbance.

The extinction probabilities of individual species would very high with low diversity.

Less diverse system may also be readily invaded by less productive exotic species.

3. Biodiversity and global material cycling

Marine biota serves as a vehicle for the transfer of atmospheric CO_2 to the sea floor: Atmospheric CO_2 Gets dissolved bicarbonate in rainwater Further absorbed by marine biota Converted into particulate biocarbonate Stored in skeleton and tissue Become part of sedimentary rock

I. Nutrient and organic matter transformation

Phytoplankton absorbs inorganic nutrients and organic matter released to oceans through sewer discharge, industrial pollution and rain water.

II. Detoxification

Microbial community on the ocean floor detoxify petroleum hydrocarbons and break them into CO_2 and water. Microbes need oxygen for this aerobic process since oxygen is the source of electron.

Beach and sea as a centre for tourism and recreation is a recent phenomenon in our country. It began with the Hippies during 60s with hand picked centres like Goa, Gokarna (Karnataka) and Kovalam in Kerala (Routledge, 2000: 26480). In Karnataka, the Government has identified Mangalore, Someshwar, Ullal, Panambur, Suratkal, Malpe, Bhatkal, Karwar, Murdeshwara, Kundapur, Honnavar, Gokarna, Kumta and Mulki as coastal tourism centres. The adverse effects of mass tourism on coastal ecology have many facets: construction of resorts, highways, destruction of coastal habitats like sand dunes, coastal vegetation, mangroves for landscaping and recreation, contamination of water bodies from fertilizers and pesticides, disturbing coastal and marine life by mass human pressure could affect the

livelihood of traditional communities (Routledge, 2000: 26479).

III. Source of tourism, recreation and retirment

IV. Cultural values and future scientific values

A. Basis of many cultures.

B. Cultural information regarding the habits of marine animals and ecosystem forms a center piece of traditional societies.

C. Enrich body of scientific knowledge.

V. Non-use values: Existence values

Following the environmental use value classification given by Barbier (1989) and Barton 1994, we can present the above benefits into the following chart.

Economic Contribution of Marine Biodiversity

5.3.8: Methods of Valuation

Now we will briefly present some of the valuation techniques most appropriate for estimating various benefits of marine biodiversity, and wherever available, we also present the preliminary estimates of biodiversity in Karnataka and India.

Direct Use Values

We need to remember that we are interested in estimating the value of marine biodiversity but not the value of the marine ecosystem. If one is interested in the latter, then the estimation becomes lot simpler. In the latter case, marine ecosystem can be viewed as "factories" generating fisheries and other consumptive and non-consumptive products and services. However, we are interested in the contribution of the richness of biodiversity to the ability of an ecosystem in producing different use and non-use values. Simply put, we are comparing the economic values of biodiversity-rich and –poor marine ecosystems, but not the total value of any one given marine ecosystem.

To estimate the contribution of biodiversity, we first need a good definition of biodiversity itself. Solow and Polasky (1994) have described diversity as the *joint dissimilarity* of a set of species. Dissimilarities are based upon the differences between species, known as *distances,* in genetic, behavioral, morphological, or other characteristics relevant to management or valued by society. This variable can be constructed first by defining a set of characteristics of a benchmark species and then adding up the distances of characteristics of all individual species in an ecosystem. Obviously, the higher the *distance* value, the richer the biodiversity of that system.

The different uses of marine resources that need to be values are summarized in Box 5.6

Box 5.6 Use Value of coastal resources

Use	Impacts
Extraction	
Sand mining	Erosion
Water extraction	Lower water tables salt water intrusion in to drinking water wells and crop lands lowering productivity of crops and hardships to local communities
Recreation	Damage vegetation and encourage blowouts Increased pollutions and erosion
Agriculture Cultivation/grazing	Fertilizer use and changes in the species mix
Aquaculture	Salt water intrusion, loss of biodiversity, reduction of the productivity of agricultural crops and socioeconomic instability
Development I. Military uses	May accelerate erosion due to increased traffic and decline in the fishery resources (Seabird project), displacements and cost of rehabilitation Displacement and decline in estuary fishery resources
II. Harbours and ports	Disturbances to ecosystems.
III. Transport, housing and pipelines	

5.3.9: Estimating Contribution of Biodiversity to Commercial Fisheries:

Development of a Modified Bioeconomic Model of Optimal Fishery Harvesting Modifying the classical fishery bioeconomic model, fishery

stock (X) dynamics are represented through an equation of motion,

(1)

where X is the fishery stock, H is the fishery production function, E is usual fishery inputs, and the B is the distance variable representing biodiversity richness. The biodiversity is assumed to influence both fishery growth and the fishery harvest. Assuming that the effort is uniformly distributed across space in a given period, the harvest not only depends on the level of effort but also the level of biodiversity. With larger biodiversity, you are more likely to strike fish across all sections of a fishing ground.

A fishery manager is assumed to maximize the following objective function subject to the equation of motion and other usual constraints:

(2)

where P is the periodic net profit from the given fisheries and is dependent on stock; r is the time rate of preference.

The current value Hamiltonian for problem in (2) is given by:

(3)

Applying the Maximum Principles, the following optimality conditions can be derived:

(4)

From the above conditions, we can derive that the optimal rate of change in the shadow price of fish stock, lambda-dot, depends not only the time rate of discount and stock but also on the biodiversity variable.

Intuitively, we can argue that the shadow price of stock will increase with increased biodiversity. Even though it is difficult to show analytically, one can show numerically derive the marginal contribution (change in the shadow price) of biodiversity variable to the fish stock. By integrating lambda variable from zero to a given level of biodiversity variable, one can estimate the total value of biodiversity of the given ecosystem.

Similarly, one has to find the marginal productivity of biodiversity variable in the case of other commercial products generated from the marine ecosystem and then estimate the total value of biodiversity.

5.3.10: A Case Study on the Valuation of Marine Biodiversity

The coastal ecosystem of Karnataka is a 300 km mosaic of monsoon wetlands, beaches and mountains with up to 2000 meters. The coastal eco-region of the state is separated by Western Ghats connected by a number of rivers forming estuaries. Coastal wetlands provide enormous economic benefits; direct and indirect. This coastal region provides fishery and plant products, water supply to urban and rural population, flood control, erosion buffering, wild life habitat, recreation and tourism. The combined vast natural resources of both sea and estuaries generate millions of rupees worth sustainable output, which is significantly being eroded by over exploitation and ill concerned projects. This has led to serious loss of natural resources particularly affecting rural people. For example, during the last 15 years more than 17,000 hectares of area and 50,000 people were displaced in coastal region of Karnataka due to industrial projects such as harbour, refinery, naval base (sea bird) and hydro electricity projects (Central Water Commission, 1996). Dakshina Kannada coastal eco-region consists of combined estuaries of Mulki and Pavanje rivers and Nethravathi and Gurpur rivers.

With high density of population (400 sq. km and 1500 per sq. km in Mangalore) the coastal ecosystem tend to impact closely the livelihoods of local communities living around the area. The local population both rural and urban is therefore an important stakeholder in the environmental conservation. Sturrock (1894) has recorded in his Madras District Manual on South Canara that Pomfret (black and white), seer, mullet and whiting are the favorites at European tables. All the rivers of the district close to the Western Ghats were with abundant mahsheer with a length of about 15 lbs and more. The stock would be much larger were it not for the poisoning and indiscriminate netting. It is important to note that many Hindu castes do not eat mahsheer as it is considered a sacred fish. Among the backwater fish the most important and of high value were *Lates calcarifer* (Cockup), *Sillago sihama* (whiting) (Kane) and several species of mullets. The well-known milkfish (Chanos) extensively available in Java and Philippines was found upto10 feet in the brackish waters of Kundapur. Strurrock (1894) has recorded that extensive and valuable shellfishes in the backwaters and sea and prawn and crabs and spiny lobsters are the most important. Extensive edible oyster beds existed in the backwaters of Kasargod, Mangalore, Mulki and Kundapur.

The coastal eco-region of Karnataka has been the subject of considerable studies. Most of the studies have concentrated on the diversity of flora and fauna. However, one of the major studies initiated by Centre for Ecological Sciences of the Indian Institute of Sciences,

Bangalore is a break through in the research studies. A novel experiment to study the biodiversity was initiated in 1994 when 18 colleges and NGOs joined to form the Western Ghats Biodiversity Network (Gadgil, 1996). During the 3 years period of 1996-1999 vast information on the biodiversity was collected. The studies have recorded ongoing changes in the landscape, its impact on the biodiversity and the socioeconomic forces behind these. It was observed that there has been an erosion of concern for the conservation of natural resources (Achar, 1997; Bhat, 1997) among younger generations. The preservation of natural resources as such does not generate returns and ensures little security. Further, several alternative economic options have opened up.

The importance of fish in this particular ecosystem led to studies on their composition, population dynamics and community studies. It has been well documented that the composition of fish species has been changing over the years. Some of the species such as fishing cat, otter, and estuarine-crocodiles are now rarely found and are included in Schedule I (Endangered and highly protected species) of the Wild Life Protection Act (1972). Some of the grasses grown in tidal rivers of the district are recorded as extinct and induced in IUCN Red Data Book of Rare and Endangered Plants (Hussain, 1999).

Background of the Study Area and Sampling Methodology

The narrow stretch of 30-80 km land between the Western Ghats and Arabian Sea, which extends to 150 km of coast line is part of the coastal ecosystem of Dakshina Kannada district. This area consists of 21 small and major rivers, 550 tanks, wetlands estuaries and mangrove forests, fallows etc. The mangrove forest of Gangolli is one of the 17 major mangrove forests. It has been documented that more than 310 different species of marine fish, 55 types of reptiles, 225 types of birds etc. are found in Dakshina Kannada district. In the coastal waters, estuaries more than 1.5 million tons of shells are collected annually which is used for producing lime. Annually, 151,000 tons of marine fish is landed in Karnataka.

Various valuation options exist for eliciting conservation and recreational values, including the travel cost method and the contingent valuation method. In the case of the coastal and marine ecosystems, a contingent valuation study was undertaken to determine the willingness-to-pay to conserve the non-market benefits. As the ultimate aim of a cost-benefit analysis is to assess the full net benefits of investing in coastal environmental improvement, the study can be considered within the broad framework of a total valuation. However, only the

estimates non-use values are reported here.

Of particular interest is the use of three different question formats to elicit the willingness-to-pay responses for maintaining the coastal resources in its present condition. All formats used an increase in taxes as the 'vehicle' for collection of the hypothetical payments. One technique involved an open-ended question, which simply asked the respondent how much he or she would be prepared to pay annually to conserve the area. A second question format used and 'iterative bidding' approach, providing the respondent with a range of values to choose from and asking him or her to select one. The third technique is referred to as a 'dichotomous choice' format because it involved a yes or no answer to a predetermined figure, which may be varied from individual to individual. This information is then used to determine the respondents' probability of choosing a particular value. Dichotomous choice has become a more popular format in recent times because of its supposed advantages over other techniques with respect to bias problems. Results for the three question formats are presented in the following tables

The contingent valuation survey in this case was aimed at assessing regional residents' willingness-to-pay for conserving the area by asking whether they would be willing to contribute amount to the government for the conservation of the area.

The survey covered 500 households selected from urban Mangalore city and households of 12 villages who are the main stakeholders of the marine ecosystem for various use and non-use benefits. The respondents were largely males (82%) and only 18% of the female were represented. The sampling framework did not classify the population based on gender for interview. The investigators were instructed to meet the available adult member during the field visit. Among the available member there had been some female members who opted to meet the investigators. The schedule was canvassed among people representing different classes of the society and stakeholders. In accordance with the requirements of the sampling methodology, the field investigators first introduced and explained the concept of marine ecosystem and also importance of economic growth and development to the respondents. Each team of investigators explained the impact of development on coastal ecosystem, current status and the need for the conservation to the respondents before administering the actual schedule. The schedule had questions with regard to depth of the current status of environmental awareness and laws relating to the conservation of coastal eco-regions of the region. After collecting the data through pre-tested questionnaire from 500

households of the urban and rural locations of the Mangalore, the data was post-stratified based on income classes, occupation, age and education. Thus the total number of households in each category is not uniform, but represents the total population. An ideal sampling design would have been a stratified sampling procedure where in the households are selected from each stratum (example, income class). However, this could not be pursued owing to the absence of information on the distribution of households across different income classes or occupation or education. Alternatively, since our primary motive was to make a comparison between different income classes or occupation, we have resorted to post stratification of the households. Post-stratification is a valid technique in sample surveys and in some case provide better estimates than un-stratified samples (Sukhatme and Sukhatme, 1970).

In the present study the sampled households are grouped into six categories based on their socio-economic profile. In the first group industry and business the average household size was small with minimum of 4 among nurses and 5 among business people. The educational qualifications expressed in number of school years shows that this group had highest average education and have highest household income. The average and maximum amount willing to pay for coastal ecosystem conservation shows that as education and income increases their willingness to contribute to clean environment also increases. On the other hand in the second group (fishing and farming the average and maximum WTP (willing to pay) is relatively low as their average education and household income is less. The sixth group consisting of government service personnel has moderate income and education and average WTP is also moderate.

Among the households who are not willing to pay fourth group (fishery related business) is highest (49%). This could be due to factors such as low income and low education. However, 44 percent of the government and service personnel are found to be not willingness to pay, which indicates that they consider this as an additional burden apart from the tax they are currently paying. Secondly, since their direct dependence on the ecological services of the coastal environment is relatively less, a large number of them expressed that they are not willing to pay for the conservation.

The study reveals the percentage of households willing to pay two times of the original bid amount out of those who are willing to pay. Among 122 sampled households of the industry and business group 53 were willing to pay two times with a maximum of Rs.5000 and

an average of RS.1508 per year, which is highest among all the groups. In the 4th group (workers) only a small fraction (0.82%) have agreed to pay two times, indicating that they can not sacrifice out of their very low earnings. The percentage of households who are willing to pay only half of their original bid among the non-WTP group is also brought out by the study. Again this percentage is maximum in second group (fishing and farming) another low-income group. This shows that the initial bid amount has quite high and hence they expressed their non-willingness to pay. But their concern was will revealed when the bid amount was reduced to half of the original bid.

The classification of households as WTP and non-WTP across income classes shows that as income increases the percentage of households willing to pay also increases. The classification of non-WTP households who are willing to pay at least half of the original bid across the income groups shows that as income increases the percentage of non-WTP households willing to pay at least half also increases.

The most important reason for WTP was the interest in future generation and a combination with other reasons. In terms of reasons for highest willing to pay, sustainability issue was prominent. The reasons for not willing to pay shows that polluter should pay and not enough income to pay was quoted by 15 percent of the sampled households for each conclusions of this case study very clearly establishes the relationship between the education, income and occupation on the one hand and their willingness to pay on the other hand. The direct dependence of the communities on the coastal resources also makes them to sacrifice, though with lower income. The assessment of the opinion of the state holders very clearly establishes that there exists a high non-market value for these coastal resources, which needs to be quantifies and valued in economic terms to evaluate the costs and benefits from projects. Any project, which does not consider these non-market values, is likely to under estimate the costs and over estimate the benefits.

5.3.11: Aquaculture and Biodiversity

Fish production in general and aquaculture production in particular has registered remarkable growth in recent decades. The total production from aquaculture has increased from 7,88,310 metric tons in 1987 to 17,68,422 metric tons in 1996, with a substantial growth of 124 percent. Since natural fishing in coastal waters has reached maximum sustainable yield, further growth in fishery has to come through commercial aquaculture. Technological progress in commercial aquaculture has substantially diminished the level of production risks, compared

to traditional fishery or agriculture. This has attracted big corporate companies that can easily support the high capital demands of aquaculture. Further, India's coastal and inland environment offers an amazing diversity of major carps, common carps, finfish, shellfish and seaweed resources with suitable microclimates for aquaculture production (James, 1999).

Even after two decades of rapid growth in the industry, India has exploited only 10 percent of its aquaculture potential. Farmers, traditional fishers and industries are increasingly becoming interested in exploiting the full potential of this industry. On the other hand, the world demand for protein-rich shrimp and other aquaculture products, particularly from the health-conscious, high-income consumers, has been on the rise. These market trends have put pressure on the government and the industry for expanding aquaculture production in India. However, unplanned growth of any industry may not sustain in the long run. At this stage what we need is a host of well-informed public policies in order to promote production, develop infrastructure for efficient marketing and distribution infrastructure, promote export growth, and contribute to food security and nutritional demand.

Table. 5.6. Area, production and potential of freshwater aquaculture in various states of India 1998

Sl. No.	State	Total area (lakh ha)	% of total area in India	Covered Area (000 ha)	% of state area covered	Yield (kg / ha / year)	Potential yield gap (kg / ha / year)	Production (000 tones)	Production Potential (000 tones)
1	Andhra Pradesh	517	18.11	4.12	0.80	3500	1500	14.42	2585
2	Arunachal Pradesh	1	0.04	0.57	56.70	1200	3800	0.68	5
3	Assam	23	0.81	3.16	13.75	1878	3122	5.94	105
4	Bihar	95	3.33	23.75	25.00	2174	2826	51.63	475
5	Gujarat	71	2.49	41.50	58.45	1225	3775	50.84	355
6	Haryana	10	0.35	7.79	77.90	3272	1728	25.49	50
7	Himachal Pradesh	1	0.04	0.31	31.30	2160	2840	0.68	5
8	Jammu & Kashmir	17	0.60	3.98	23.39	2200	2800	8.75	85
9	Karnataka	414	14.50	31.60	7.63	1515	3485	47.87	1760
10	Kerala	30	1.05	4.58	15.25	2115	2885	9.68	15
11	Madhya Pradesh	119	4.17	71.43	60.03	1730	3270	123.57	585
12	Maharashtra	50	1.74	17.62	35.25	1270	3730	22.38	160
13	Manipur	5	0.18	2.20	44.08	2400	2600	5.29	25

14	Nagaland	50	1.74	2.12	4.25	1800	3200	3.82	250
15	Orissa	114	3.99	29.83	26.17	2200	2800	65.63	320
16	Punjab	7	0.25	8.20	117.16	4170	830	34.20	35
17	Rajasthan	180	6.30	3.16	1.76	2053	2947	6.50	900
18	Tamil Nadu	691	24.20	8.72	1.26	1488	3512	12.97	1120
19	Tripura	12	0.41	2.32	19.33	2300	2700	5.33	60
20	Uttar Pradesh	162	5.67	84.97	52.45	2320	2680	197.14	810
21	West Bengal	276	9.67	103.72	37.58	3000	2000	311.17	1380
	India	2855	100.00	456.67	16.01	2202	2798	1006.00	1127

Source: Hand Book on Fisheries Statistics 1996, Ministry of Agriculture, Government of India, New Delhi.

It was observed that, states such as Orissa (13.56 percent), Tamil Nadu (12.60 percent), Andhra Pradesh (11.85 percent), Karnataka (8.30 percent), West Bengal (7.92 percent), Kerala (7.54percent), Uttar Pradesh (6.47percent), Gujrat (5.95 percent), Madhya Pradesh (5.93percent) and Maharashtra (4.67percent) have significant shares in the total inland fisheries area. However, the contribution of these states to total inland fish production is almost equal to their percentage in total water spread area.

Table 5.8. Potential Brackish water Area, Area Covered, Production and Yield of Shrimp in coastal states of India 1996

State	Potential area (ha)	Area covered (ha)	Percent area utilized	Production (tones)	**Yield (Kg/ha)**
Andhra Pradesh	150000	66290 (46.82)	44.19	34075 (50.96)	514.03
Goa	18500	650 (0.46)	3.51	590 (0.88)	907.69
Gujarat	37600	997 (0.70)	2.65	235 (0.35	235.71
Karnataka	8000	3540 (2.50)	44.25	2640 (3.95)	745.76
Kerala	65000	14595 (10.31)	22.45	7290 (10.90)	499.49
Maharashtra	80000	970 (0.69)	1.21	700 (1.05)	721.65

Orissa	31600	11332 (8.00)	35.86	5000 (7.48)	441.23
Pondicherry	800	22 (0.02)	2.75	20 (0.03)	909.09
Tamil Nadu	56000	670 (0.47)	1.20	1197 (1.79)	1786.57
West Bengal	405000	42525 (30.03)	10.50	15121 (22.61)	355.58
Total	852500	141591 (100.00)	16.61	66868 (100.00)	472.26

Figures in parentheses are percent of total

Source: Hand Book on Fisheries Statistics 1996, Ministry of Agriculture, Government of India, New Delhi.

Though aquaculture was expected to relieve the pressure on marine biodiversity, it did not lead to a relief of pressure. Some intensive methods of aquaculture methods have worsened the biodiversity loss through the unsustainable demand they create for water, seed and food resources and also because of wastewater releases. For example in order to produce cultured shrimp of 1 ton it is estimated that almost equal quantity of wild fish is required in the form of aqua feed. The fishmeal together with fish oil, have become major ingredients of industrially produced aqua feeds since they provide the composition of the natural food of carnivorous fish. Shrimp aqua feed-use mean, increasing competition for fishery resources notably in the form of fishmeal. The dependence on marine fish catches for producing the aqua feed and shrimp feed for aquaculture may increase the pressure on wild fish stock and there may be a risk that fish now used for human consumption will be exploited for fishmeal production (Folke and Kautsky, 1996). This gives rise to considerable concern regarding trends in 'biomass fishing' in India which involves highly non-selective fishery techniques involving small-mesh sizes for the single purpose of catching as many marine organisms as possible; after the valued commercial catches are removed the remaining majority of fish is utilised for fish meal.

Some of the major environmental concerns of aquaculture are:

I. Conversion of mangrove forests and other wetlands to aquaculture farms.

II. Eutrophication of natural waters by effluents from aquaculture operations.

III. Increased sedimentation in natural water bodies as a result of pond effluents and disposal of pond sediment.

IV. Salaniization of freshwater by pond effluents and seepage into aquifers.

V. Use of potentially toxic and bio accumulative chemicals in production.

VI. Conservation of cropland to aquaculture farms.

VII. Excessive use of resources such as freshwater, feed ingredients, electricity, Etc.

VIII. Negative effects on native fisheries and biodiversity through habitat destruction, water pollution, impingement by pumps, uses of wild-caught brood stock and larvae, and introduction of non-native species.

One issue where there ought to be no conflict between shrimp growers and non-shrimp growers is that of organic loading, pollution and enrichment. Aquaculture is unique in that unlike other industries it is also adversely and directly affected by the waste it generates. Effective waste treatment and pollution abatement can be considered the core of sustainability. It is as much to the interest of the shrimp culture industry to clean up its own wastes as it is to the community at large. This should now be increasingly clear to most growers.

Limiting the stocking density within farms or limiting the number of farms within an area will no doubt work, however there are three questions that can be raised to such move:

I. How can farms be monitored for compliance with the density limits?
II. How can the number or hectare of farms to be allowed in an area be determined?
III. Is it feasible or even technically possible to determine the carrying capacity in all the shrimp growing areas?

Imposing limits on stocking density stifles productivity and efficiency. Should we be content at producing a few hundred kilograms per hectare when potential production can be several metric tons? There is also insufficient baseline data to compute carrying capacities of a given area.

Viewed objectively it is not the number of shrimps per se that impacts negatively on the environment. Instead it is the amount of waste generated by the shrimp stock, which has a negative impact. If a shrimp farm can successfully manage its waste so that it no longer affects the environment should it still be punished for exceeding the limits imposed? Just as governments do not dictate normally dictate the output of manufacturing plants leaving this to the discretion of the operator who would conceivably base this on plant capacity and market, then perhaps no limits should be imposed on shrimp stocking density. However the government, in the name of public health and safety, should have the right to impose standards on the waste discharges, be it from a manufacturing plant or a shrimp farm.

With such approach any shrimp farm can determine its own stocking density based on its capacity to manage its wastes. A zero-discharge system is technically possible. What remains is to show that such systems can also be financially viable. Even if a zero-discharge system is not yet commercially viable the technology now exists for managing such wastes so that organic loading and enrichment can be greatly minimized. Waste discharge quality, both during operation and at harvest, will definitely be easier to monitor than stocking density.

There are ample evidences to believe that the common water bodies have been shrinking through degradation and encroachment and siltation etc., which is not properly reflected in the official data. Another threat to fisheries and aquaculture is found to be from industrial pollution. Both biological oxygen demand (BOD) and total coliform are found to be on upward trend in many rivers of Karnataka (Nadakarni 1999). As reported by the Central Pollution Control Board (1997) in Andhra Pradesh out of 2466 million liters per day discharged as wastewater 2116 million liters are from aquaculture where the growth of aquaculture has been maximum (CSO, 1998).

On the other hand, the very developmental projects themselves are becoming counter productive in the management of community ponds. As mentioned earlier, these community ponds were sources of drinking water, irrigation and washing. They were managed collectively by the contribution of labour by each and every family irrespective of the income and status. However, with massive investment in public utility services such as tube-wells, electricity etc. the importance of these ponds to the villagers declined. With the result these ponds are getting encroached by the neighboring farmers since the private property rights do not exist, on these ponds and nobody is taking care of such water bodies.

5.3.12: Role of Corporate Sector

The marine resources provide lot of utilities such as medicinal, nutritional, cosmetics and industrial products. Many diseases such as tumors, cancer (ovarian, colon etc) are treated by using sea squirts, sea sponges, jellyfish, chitosan and ocean floor fungil. The extracts from marine resources such as micro algae, cyaobacteria, krill etc provide nutritional products such as vitamins and anti-oxidants, vital amino acids, proteins, gelatin and food colours. The seaweeds and micro algae are being used for manufacturing cosmetics such as toothpaste, gels lipsticks and lotions. Some of the industrial products such as paper and pulp enzymes, befouling agents and adhesives are manufactured from the extracts of marine resources such as sponges, chitosan from crustaceans and molluscans. A handful of corporate firms such as Shantha Marine Biotechnologies, Parry Nutraceuticals, Global Green (A Thapar group company) and Max Pharma are in the field of marine biotechnologies. The export market for Indian nutraceuticals (ranging from human nutrition supplements to food ingredients, aquaculture and animal feeds) is currently worth Rs.2300 crores, which is estimated to double it self to Rs.4500 crores by 2003. However, this is only a very small part of the global market, which is currently estimated to at $500 billion (K S Iyer, 2001).

Table 5.9. Marine biotechnology linked corporate sector

Biodiversity linked resources	**Utility of the of the final products**	**Major industries involved**
Sea squirts	Tumors, viruses, suppression of immune responses	Pharmaceutical industries
Encrusting invertebrates	Ovarian cancer	Pharmaceutical industries
Sea sponges	Herpes, simple, cancer, pain, inflammation	Pharmaceutical industries
Jelly fish	Neurological disorders, cancer, inflammation, anesthesia	Pharmaceutical industries
Chitosan	Burns	Pharmaceutical industries
Ocean floor fungi	Human colon cancer	Pharmaceutical industries
Micro algae and fungi	Vitamins and anti-oxidants and vital amino acids, gelatin and food colours	Nutrition related companies
cyanobacteria	Fluorescent tags and tracers	Nutrition related companies

Krill apart from fish, algae, plants	Proteins	Nutrition related industries
Seaweed (carrangenan)	Toothpaste and gels	Cosmetics
Pigments and cynobacteria	Lipsticks	Cosmetics
Sponges	Paper and pulp products	Industrial products
Chitosan and crustaceans, fungi	Bio-fouling	Industrial products
Molluscans	Adhesives	Industrial products

The marine organisms produce unique bioactive compounds for their reproduction, communication and against predation, infection and competition. This genetic material and chemicals in marine plants, animals and microorganisms constitute an extraordinary resource for pharmaceuticals, industrial enzymes, agricultural products and bioremediation and so on.

However, there is a need to evolve laws and statutes for the exploration, protection and sustainable development of marine resources. For example dredging of sea for various industrial purposes such as construction of ports, thermal power plants and other explorations severely damage coral reef and marine resources. The restrictions on tapping the wild marine resources are also required to prevent over harvesting of these resources.

5.3.13: Laws, Regulations and Institutions for conservation of Marine Biodiversity:

Various laws and regulations in India are dealing with aspects of marine biodiversity, environment protection. These are the Environment (Protection) Act, 1986, the Water (Prevention and Control Pollution) Act, 1974 as well as the Fisheries Act, 1897, the Wild Life Protection Act, 1972 and the Forest Conservation Act, 1980. For instance, it appears that under the Environment (Protection) Act, 1986, effluents discharged by commercial shrimp farms could be covered by the definition of environmental pollutant, environment pollution and hazardous substance. The Water (Prevention and Control Pollution) Act 1974 has been enacted to provide the prevention and control of water pollution and maintaining or restoring of wholesomeness of water. The term trade effluent under this Act includes “any liquid, gaseous or solid substance which is discharged from any premises used for carrying on any (industry operation, or treatment and disposal system), other than domestic sewage”. Shrimp farmers should obtain from the Pollution Control Boards an authorization to set up any treatment and

disposal system which is likely to discharge sewage or trade effluent into a stream or well or on land.

In February 1991 the Government enacted the Coastal Zone Regulation Notification. It applies to "coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action". It is further limited by boundaries, which reduce the regulated core area to the inte-tidal zone and an adjacent 500-meter wide strip of land from the high tide line. The seaward line is the low tides line. It regulates a whole series of activities and uses. India's Coastal Regulation Zone is a good example of a coastal management law, which is built around a set of exiting development realities. The core of the regulation is a moratorium on new construction, such as in ecologically sensitive area, and a prohibition of most development activities between the Low Tide Level (LTL) and the high tide level (HTL). The formulation of the rules is complex and sometimes unclear as if the Government did not want to compromise all economic development activities. The annex to the Notification classifies the inter tidal zone and the landward area from the High Tide Line into four zoning categories, with fixed upland and offshore dimensions, and with different corresponding restrictions on construction and land use. Shrimp culture activities in these categories could either be excluded or authorized under special terms and conditions. The Karnataka Land Reforms Act amended in 1995 considers aquaculture as an agricultural activity. The crop lands could now be leased out for aquaculture and the amendments further relaxed the land ceiling, income limits for purchase of agricultural land etc and thus giving scope for the entry of large enterprises for undertaking aquaculture activities.

India is the second largest producer of aquaculture products and is one of the major exporters of fish and fishery products in Asia. There are many other non-market economic benefits from the marine and aquatic ecosystem. Most of the management schemes designed to protect aquatic ecosystems suffer from the fact that the short term costs of establishing the regulations are easily recognized, whereas the costs of not protecting the environmental quality of the marine ecosystem is not readily quantified (Malone et al. 1993). For example in the absence of enough scientific information on fishery biology and fishery industry socio-economic dynamics the state Department of Fisheries can undertakes the task, with the help of experts and local people, to identify fish breeding areas. Till such time all wetlands and backwater areas could be declared as fish breeding centres. A notice to the Panchayats could be

issued indicating the reason for declaring areas as such and soliciting their co-operation in protecting the place. Perhaps the Department of Fisheries could spell out what activities will/ will not be allowed. However, political and hard work is needed to implement such policies.

5.3.14: Legal and organizational Framework For Promoting And Regulating Fisheries Development:

Central Government and State Government

I. The Indian Fisheries Act of 1897 (Government of British India)
II. The wild life (Protection) Act 1972
III. Forest (Conservation) Act, 1980
IV. The Water (Prevention and Control of Pollution) Act 1974 and amendments
V. The Water (Prevention and Control of Pollution) Cess Act of 1977 and amendments
VI. The Air (Prevention and Control of Pollution) Act 1981 and amendments
VII. The Environment (Protection) Act 1986 and its three amendments in 1987
VIII. The Coastal Regulation Zone Notification of 1991 (issued under 6 above)
IX. Environment Impact Assessment Notification 1994 (issued under 6 above)
X. Hazardous waste management rules (issued under 6 above)
XI. Public Liability Insurance Act and Rules
XII. Laws relating to water utilization
XIII. Land and land reforms legislation
XIV. Rules and regulations relating to the changes in the land use
XV. Agencies involved in charge of land use – their obligations
XVI. Coastal land as common property existing legal control and traditional mechanisms
XVII. Land acquisition laws and procedures
XVIII. Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976.
XIX. Marine Fisheries (Regulation) Act, 1986 of Karnataka.
XX. Mysore Game and Fish Preservation Regulation 1901
XXI. Karnataka Agricultural produce market (Regulation) Act 1974
XXII. The Public Liability Insurance Act, 1991
XXIII. National Environment Tribunal Act 1995

Organizational set-up

Central Government

I. Union Ministry of Agriculture, Department of Agriculture and Cooperation, Fisheries, Division.
II. Union Ministry of Commerce
III. Union Ministry of Environment, Forests and Wildlife
IV. Indian Council of Agricultural Research (ICAR), Fisheries Division
V. Council of Scientific and Industrial Research

VI. Department of Ocean Development
VII. Department of Biotechnology

Indian Council for Agricultural Research (ICAR) Fisheries Institutes

I. Central Institute of Fisheries Education
II. Central Institute of Brackish water Aquaculture
III. Central Marine Fisheries Institute (CMFRI)
IV. National Bureau of Fish Genetic Resources
V. Central Institute of Fisheries Technology

Council for Industrial and Scientific Research (CSIR) Institutes

I. National Institute of Oceanography
II. National Environmental Engineering Research Institute
III. Central Food Technological Research Institute

Ministry of Agriculture Institutes

I. Central Institute of Coastal Engineering for Fishery

Ministry of Commerce

I. Marine Products Export Development Authority

State Government

I. Directorate of Fisheries
II. Fish Farmers Development Agency (District Level)
III. Brackish water Fish Farmers Development Agency (district level)
IV. Karnataka Fisheries Development Corporation
V. Karnataka Pollution Control Board
VI. Fisheries College and University Departments

5.3.15: Strategy and Action Plan for Marine Biodiversity Conservation

I. Establishing a regulatory regime for preventing marine pollution: India lacks even the rudiments of an operational environmental regulatory infrastructure for preventing / controlling marine pollution. Though the coast Guard is vested with the mandate of identifying the marine polluters, the efforts are not satisfactory since it is vested with several other functions.
II. Resource pricing: Input price influences how efficiently a country uses its resources. The input subsidization especially fuel in the marine fisheries sector is promoting over fishing and thus undermining sustainability of marine fish production.
III. Eco-labeling programmes can provide effective incentives for producers to reduce negative environmental impacts. National eco-labeling programmes are now in operation in India like in many other developed countries. India launched its first eco-labeling program called “Ecomark” in 1991, followed by South Korea (“Ecomark”) in 1992 and Singapore (“Green Label Singapore”) in 1992. At the international level beginning with the Earth Summit in 1992, the International Organization for

Standardization (ISO) has been working to develop Environmental Management System standards called ISO 14000 series. Within this series the ISO 14024 standards, the outlines rules and procedures for eco labeling. These standards are guidelines aimed at standardizing requirements for the various world–wide eco labels which compliment national environmental regulations Grote et al. 1999). Like the ISO the Global Eco-labeling Network (GEN) is a non-profit association of eco-labeling organizations from around the world that has been established for developing criteria for certifying products and services with lower environmental burdens and impacts than comparable products and services. Financial and technical assistance would help companies, particularly small and medium enterprises to overcome the cost barrier of joining eco-labeling schemes. Further, eco-labeling is generally acknowledged by WTO as being an effective instrument of environmental policy as long as it does not discriminate between products and countries.

IV. The marine living resource extraction is controlled and promoted by several central and state ministries. There is a clear absence of intersectional policy integration defined as internalization of environmental concerns within institutions of development. Rather than addressing environmental and biodiversity concerns only through an independent ministry, intersectoral policy integration requires that organizations such as ministries of industry, agriculture and commerce also should adopt environmental performance goals as well as strategies to enhance environmental performance. For example the Ministry of Agriculture deals with food production including fisheries and aquaculture. The Ministry of Commerce deals with promoting exports of marine products. For policy integration greater decentralization of authority and management responsibility and greater dependence on community-based management practices are required. The fishery resource management plans could be prepared with the participation of local communities and authorities and in compliance with national commitments to the Biodiversity Conservation (CBD), the Convention on International Trade on Endangered Species of Wild Fauna and Flora (CITES) etc. The national ministries should also take the lead in promoting the adoption of voluntary or mandatory eco labeling schemes for both harvesting and production.

5.4: Animals as Forgotten Biodiversity

5.4.1: Marketisation and genetical diversity

Genetic erosion of domestic animal diversity has placed 30% of the world's breeds at risk of extinction. Livestock keeping by poor families in semi-commercial and subsistence agriculture is multipurpose. Improved breeds often do not have the attributes required to enable them to fulfill the multi-faceted roles they are allocated. Domestic animals supply some 30% of total human requirements for food and agriculture by providing final and intermediate outputs. In a state such as Rajasthan, the livelihood of over 30% of population depends upon the sheep and goat livestock. An estimated 90% of the total contribution to food and agriculture production comes from only 14 of these species (FAO, 1999). In Europe, where currently nearly two-fifths of existing breeds are at risk, one-third of breeds existing in the early 1900's have been already lost. In Africa, 22% of African cattle breeds have become extinct in the last 100 years while 27% are at varying degrees of risk.

5.4.2: The economics of Animal Genetic Resources (AnGR) erosion: A conceptual framework

AnGR erosion can thus be seen in terms of the replacement (not only by substitution, but also through cross-breeding and the elimination of livestock because of production system changes) of the existing slate of domestic animals with a selection from a small range of specialized improved breeds.

According to the International Livestock Research Institute, the causes of ANGR erosion often stems from the 'misguided development policies initiated in the developing countries (ignoring traditional breed of low input mix and high pastoral production capability) by introducing high yielding exotic breeds with high input and risk factors (against the environment in which they have to survive) and also high output capabilities'.

Artuso (1996) argues that establishing economic values for ANGR can contribute to policy and management decisions, introduction of economic incentives, to identify potential gainers and losers, and towards biodiversity conservation.

A range of valuation methodologies exists and can be broadly categorized into 3 groups on the basis of the practical purpose for which they may be conducted. Following the identification of a given breed being at risk, these methodologies can be applied in order to justify conservation costs by:

I. Determining the appropriateness of AnGR conservation programme costs (considering environmental values)
II. Determining the actual economic importance of the breed at risk (i.e. consider breed values) and / or
III. Priority setting in AnGR breeding programmes (i.e. consider trait values)

5.4.2.1:Relevant Valuation techniques

The Contingent Valuation Method (CVM), though considered to be the most relevant one, has never been used for valuation of genetical resources (Pearce and Moran, 1994). In this mehod, hypothetically then farmers might be asked about their WTA payment for on-farm maintenance of AnGR, and the general public might be queried on WTP for maintenance on-farm of in gene banks. In this way an upper bound to the costs that society is willing to confront for AnGR conservation could be determined.

However, an opportunity cost approach is sued by Brush et al. (1992), using the concept of option value to the maintenance of on-farm diversity in Peru. Brush and Meng (1996) propose a cost-effective strategy for crops that could be easily adapted to livestock. Instead of attempting to justify conservation programme costs on the basis of society's willingness to pay for the production losses that can be potentially avoided, they argue that once the need for conservation of a particular breed has been agreed on, the costs of such a programme can be minimized by recognizing the factors influencing farmers animal selection decisions, thereby identifying those households that most value such breeds. Since these are the households most likely to continue to maintain such breeds they will also be the least costly to incorporate in to a conservation programme.

5.4.3: Methodologies for determining the actual economic importance of the breed

Econometric estimation of aggregate demand and supply curves can be used in order to

provide a measure of consumer and producer surplus based on the fact that changes in the traits or the composition of breeds will produce shifts in the estimated functions, which in turn will bring about a change in consumer and producer surplus (ILRI,1999). Where multiple demand equations (one for each breed) can be estimated, the substitution effects across breeds can be explicitly modelled, providing the most comprehensive evaluation of breeds while capturing substitution effects as well. Cross-sectional household and farm studies can also be used to construct demand and supply functions.

The existing or potential value of Intellectual Property Rights and / or contracts for AnGR use and conservation could also be used as an indication of the economic importance of given breeds.

Brush and Meng (1996) point out that the most direct method of valuing genetic resources is to privatize them and allow the market to set a price. But there is a danger in this approach. Note that at present existing genetic resources collected before the CBD entered into force are treated as public goods. Theoretically privatization would provide compensation to those who safeguard genetic resources, thus stimulating conservation without public investment while providing an idea of genetic resource users WTP for conservation. IPRs and patents in particular, which are being promoted as the appropriate tool for the privatization of genetic resources. But they fail to reward local people for their important contribution (of Knowledge and resources) to the product for which industry is awarded patent protection. For example, the world's smallest cattle breed, the ***Vechur,*** was bred in India and needs only 1.5 kg of feed daily. It has now been patented in the UK (ITDG,1996)!

Given that the FAO recommends active and sustainable utilization (in-situ conservation) together with improving the production levels of adaptive breeds, as central to the better management / conservation of AnGR (Hammond, 1996, FAO, 1997), ensuring that conservation and their related breeding programmes are maximizing their potential benefits is important.

Breeding programme evaluation :These approaches are used to evaluate the costs and benefits of breeding programmes and / or the new animal breeds. Cervigni (1993) shows how the benefits of genetic material could be valued assuming (critically) that the yield effects of successive breeding stages and the necessary input cost information can be identified. This would require using the difference between the benefits of an

improved breed (based on price and increased yield) and the costs of all other factors employed in breeding operations (capital, labour, etc.). The value of using alternative inputs / traits could then be compared to see how they affected economic returns.

I. ***Genetic production function models:*** In this method focus is on predicting potential future values rather than using actual results of breeding programmes. In this context, existing AnGR are valued by weighting the expected value of the new breed by the probability of this being successfully developed. The expected value reflects the discounted stream of benefits of the new breed over the period in which these benefits are expected to take place (Scarpa, 1999).

5.5: Economics of Sacred Groves (*With most of the inputs from M.G. Chandrakant)

5.5.1: Why Economics of Sacred Groves Important?

Since time immemorial, forests have served the mankind by fulfilling the needs in various forms such as food, fibre, shelter, medicine, security and so on. Forests are part of a large eco-system consisting of soil, water, biomass and of course human and animal life. As a management procedure, different regulatory measures regarding the utilization of forests do exist corresponding to different types of forests. Examples are Supply or timber forests, community woodlots, reserve forests, protected forests, village buffer forests and sacred forests or sacred groves. Most traditional forest-dwelling societies however, link forests, trees, animals, and other objects associated with forests, to deities and animistic beliefs, thus attaching a sacred connotation to forests.

The concept here is that forests are the property of the Gods of the villages in which they are situated. Buchanan (1870) who traveled through Uttara Kannada district of Karnataka wrote the following:

> *"The forests are the property of the Gods of the villages in which they are situated, and the trees ought not to be cut without having leave from the Gauda or Headman of the village, who here is also the priest to the temple of the village God"*

A sacred grove is a patch of vegetation, ranging in extent from a few trees to forty or more hectares, which is left undisturbed because of its association with some deity. Such a world view of sacred groves and their characteristic feature of self-organised conservation have facilitated the conservation of extremely valuable climax vegetations and biodiversity. Tradition of sacred groves is known in the Western Ghats, spread over parts of Maharashtra

state in the extreme north, Karnataka in the central part and Kerala at the southern-most position.

A large number of studies on inventories of sacred groves in the Western Ghats concentrated on their disturbed and undisturbed flora and fauna (Vartak and Gadgil, 1976, 1981; Ghate, 1996; Kumbhojkar et al., 1986). Some have also gone in to the taxonomic inventories (Vartak et al., 1996). What is equally important is to recognise the anthropological, cultural, historical and social dimensions of preserving sacred groves (Barman, 1992, 1997). They have also been studied as a biodiversity preserve and avenue for local participation (Godbole et al., 1998).

Studies, hitherto, on sacred groves have focused on certain key areas ranging from their distribution in the country, the biodiversity they help conserve, their transition and management practices to their prospects in the future (Ramakrishnan et al., 1998). Some of them are summarized here.

(a) Location and distribution : Sacred groves occur under a variety of ecological situations across India like plains, hill slopes and hill tops. The existence of sacred groves has been widely reported from the Western Ghats, spread over Kerala in the south (approximating 240 groves), Karnataka in the central region and Maharashtra (numbering around the same as in Kerala) in the north. Such studies have also been reported from parts of Rajasthan, Himachal Pradesh, Uttar Pradesh, in the hilly regions of the states like Bihar (particularly the Chhotanagpur region), Orissa, Assam, Meghalaya (important being the Cherrapunji region), Mizoram, Madhya Pradesh (particularly Bastar region) and Tamil Nadu. A study carried out by Gadgil and Vartak (1981) presents an inventory of sacred groves in Maharashtra, covering aspects like district, taluka, nearest village, area and deity of the sacred grove.

(b) Biodiversity data : Sacred groves encompass a large variety of tree and animal species. The tree species vary from evergreen-semi evergreen, mangroves to deciduous types. A large number of food plants like mango, jackfruit, cashew, wild palm and a variety of wild fruits; spices like pepper, nutmeg, curry leaf and cinnamon; a wealth of medicinal plants; and minor forest produce like honey, mushroom and bamboo shoots. Besides these, a large number of wild relatives of cultivated plants have also been spotted. Sacred groves also provide shelter to numerous species of birds like drongos, swallows, flycatchers and orioles; fish species;

mammals like bats, primates and minor mammals; and reptiles like cobras, vipers, kraits and pythons (primarily in serpent groves). The above-mentioned and innumerable other mobile and immobile species have been spotted and documented by researchers. Studies of floral, faunal and wildlife diversity have been made by Gadgil and Vartak (1976, 1981) in the Maharashtra region of the Western Ghats, Chandrakanth and Nagaraja (1997) in Coorg, and Chandran and Gadgil (1993) in Uttara Kannada district, besides several other studies.

(c) Human-Forest linkages : The most probable rationale for the close and 'sacred' association between mankind and forests in general, and sacred groves in particular, lies in the short and long term benefits flowing from the forests. Sacred groves serve critical functions like sheltering rare plants, protection of water sources and being the only remnants of tree vegetation along the countryside are also the main sources of leaf litter. They are of significant economic and climatic importance to the people who benefit from them (Golhale, Velankar, Chandran and Gadgil, 1998).

Most sacred groves have immense watershed value since they favour the existence of water bodies like ponds, streams, springs, perennial streams or rivers. Such water bodies in turn play a catalytic role in creating heterogenous vegetational patches which in turn form congenial habitats for the rich presence of wildlife. Along with water conservation, they reduce erosion, provide rich humus and are a rich source of medicinal flora (Ramakrishnan et al, 1998).

As refugia, sacred groves help in reducing the chances of extermination of resource populations. The chances of extended preservation of exploited populations are considerably higher by providing complete immunity to parts of such populations in the protected habitats. This same feature of sacred groves also helps in constituting them as store houses of traditional seed sources. They thus facilitate regeneration and restoration of secondary forests around them by supplying seeding material. Sacred groves also play the role of a valuable mosaic of resources, otherwise undisturbed, that serve as an insurance to be exploited only in emergencies.

Besides these more tangible benefits, religion and culture constitute the over riding rationale for the existence of sacred groves in India to this date, although in a diluted form. Most sacred groves are dedicated to certain deities and the biodiversity of the grove is supposed to be under the protection of the reigning deity of the grove. Traditional folklores also uphold the existence of these groves (Vartak and Gadgil, 1981).

(d) Management and threats to sacred groves : In the past, sacred groves survived, to a large extent, due to the existence of certain basic characteristics for their sustainable use. These include a small number of parties sharing access to the resource, repeated and long-term interaction between parties sharing access of the resource, equitable distribution of harvests and reciprocal or kinship relationships between parties. Inspite of being one of the world's top 12 mega diversity countries with traditions and modern efforts of biodiversity conservation, India's biodiversity reserves are being eroded rapidly. This can be attributed to the deficiencies in the current system of forest utilisation and weakening traditions. One such factor is changing religious beliefs; for instance, the amalgamation of primitive deities into the pantheon of Hindu gods, often followed by the construction of temples. A major threat to their survival, which arose with the state under the British regime taking up control of forests including sacred groves, still continues. People's traditional rights over sacred groves have been reduced to minor concessions or privileges. With depleting resource availability, and curtailed rights and the transfer of forest resources out of community control, these resources have virtually become open access resource from being a common property resource. Contract systems and their exploitation by forest-based industries have only hastened their degradation. An important factor furthering such degradation is the narrowly focused notion of protected areas, to the neglect of neighbouring areas because no patch of vegetation can escape the effects of surrounding environmental conditions. One other factor is the emphasis on the exclusion of human use and on the use of force, particularly against local tribal and rural populations depending on the forests for their subsistence needs. A final factor is the preference of modern scientific knowledge to traditional and tenable folk ecological knowledge.

5.5.2: Valuation of sacred groves

How to value the contributions of sacred groves to the protection of forest ecology? The starting point for valuing sacred groves is to treat them as having Existence Values (in addition to Use Values). From an ecological angle, it may be measured in terms of specie distinction, specie richness, uniqueness, specie representativeness, endangeredness, and rarity. Measurement of these ecological values is not an easy one. Firstly, they are not obtainable under any ***revealed preference ordering***. After all, quite often there is no market for them. Not

only that, it is difficult to arrive at the values assigned to them by the people uniquely, as they also have some uncertainty (i.e., probability) associated with them (Brown and Goldstein, 1984; Polasky and Solow, 1995; Polasky, Solow and Broadus, 1993). This is so, because of non-uniqueness of values as viewed from the point of existence values. Usually a Contingent Valuation Method is applied to collect information about peoples' preference for such existence values(Common, Reid and Blamey, 1997).

The second methodological issue in estimating Existence value is about the level and quality of information. For instance, comparative understanding of the floral uniqueness of the sacred grove in the local area with the surrounding landscapes of similar or different vegetation may yield, at best, lower bound values for existence values. Local people ascribe certain functions to the sacred grove patches. They are food, fuel, fibre, religion, culture and so on. These functions could be utilitarian as well as cultural functions. These functions have roles to play in the social fabrics of the village and also in designing policies of conserving sacred groves. But non-locals may also value them, not so much as food, fuel or fibre but as aesthetic beauty. Many sacred groves including those in Western Ghat region are considered as resources by local people, but as biodiversity preserve by outsiders. There are no efforts to find parallels between local importance mentioned by people and regional importance of the grove, may be because of different socio-economic perceptions of people, unable to express uniquely the desire on species conservation. There are no efforts to evaluate such forest pockets, where apart from utilitarian values (by the locals) non-use values (by the outsiders) are equally important. An important question in methodology is to aggregate these values by the locals and outsiders, which is basic to understand the ecological aspects of biodiversity preservation.

The third methodological issue is designing forest management policies, taking clues from the values as viewed by the people. What are the economic incentives to preserve sacred groves and to develop an environmental education system, in which foresters, local people and interested NGOs can work together to make sacred groves as a fixed point for sustainable forest management?

5.5.3: Existence Value of Sacred Groves: A Case study from Kodagu in Karnataka

The term 'existence value', was first introduced by Weisbrod (1964). It is a 'passive use value', or the utility people attach to the existence of unspoiled wilderness, similar in kind to, and directly comparable with, the value from active use of wilderness area for tourism, logging and so on. Existence value is the individual derives from the knowledge that the site exists, even if he/she never plans to visit it. According to John V. Krutilla (1967), existence value is the value derived from the sheer contemplation of the existence of ecosystem, apart from any direct or indirect uses of goods and services they provide. This
can include a pure biodiversity component, the appreciation for the variation or richness in the ecosystem. This is based on the contemplation of the ecosystem as a whole (entirety, ensemble) vs. appreciation for each of its members individually.

5.5.3.1: The Story of Devara Kadu

Devara Kadus - sacred groves located in Kodagu district of Karnataka, in the evergreen forests of western ghats (recognized by united nations as hot spot of biodiversity).

connotes a 'religious' definition. Thus, 'reserve forest' classification in the Forest Conservation rules is a secular sanction to the preservation of Devara Kadu.
Devara Kadus of Kodagu are prevedic in origin (3000 BC). They have the deity in sanctum, temple forest surrounding the deity and the temple tank with size varying from a few trees to 1000 acres or more. The tree types include indigenous trees of all types. In some Devara Kadus we may also find exotic trees recently planted. Some of the common tree species are Canarium strictum; Tectona grandis; Artocarpus heterophyllus; Santalum album, Ficus glomerata, Ficus religiosa, Bambusa spp, and silver oak.

The sacred site is crucial rather than the species. In Kodagu, the first kingdom of Kadamba Chandravarma is named after the sacred tree Anthocephalus cadamba, as a protector of the entire kingdom. Inscriptional evidences exist to provide indications of their protection inter alia the 5th century AD inscription of Madikeri, 1278 AD Nidutha inscription, the 1372 AD Paluru inscription, the 1840 Irpu inscription.

Sir Brandis the German forester, the first Inspector General of Forests in India
Was impressed by the network of sacred groves in India and

urged a system of forest reserves modeled upon sacred groves.

The precise number and area of sacred groves in this district are not known. According to one estimate of Dr Kushalappa, Department of Forestry, Forestry College, UAS, Ponnampet, , there are
1214 Devara Kadus summing 6300 acres indicating a 42 percent reduction between 1905 and 1980 and
about eighty percent of Devara Kadus are below five acres.. According to another estimate by Nagaraja and Chandrakanth, Dept of Agri Economics, UAS, Bangalore,
there are 346 Devar Kadus in 4184 acres indicating a 60 percent reduction between 1900 and 1992.

Types of Devara Kadu

The devara kadus have of different types namely: paisari devara kadu, suggi katte, basadi kadu (maintained by jains earlier), hole devara kadu (preserved by scheduled tribes), palli kadu (preserved by muslims), mutt kadu (preserved by Veerashaiva religious institutions)
, which all have common property resource characteristics. In the Devara Kadus, there is no extraction of any kind at any time, an annual devara kadu festival is usually conducted with an average expenditure of Rs. 15,510. Devotees who come for the festival from all over Kodagu voluntarily donate an additional Rs. 13,019. The festivals are ritualistic, spiritual, and social, with a get together of village communities.

According to forest conservation act of 1980 – Devara Kadus are owned by the Forest Department of the State Government. Since the beginning the
village community takes on the stewardship role and offers social fencing to preserve devara kadus. Thus, the
strength of village community in conservation determines how sacred groves are conserved and managed for non-consumptive use and existence values.

How are they managed?

The annual devara kadu festivity is the strong binding force for bringing the village community together. The
temple committee has priest, a fund raiser (Deva Thakka, Bhandra Thakka and others) raise funds for the festival. An estimated
annual contribution for the Devara Kadu festival is around Rs. 860 per family. The
expected contribution is only around Rs. 170 per family. The
estimated annual festival expenditure per Devara Kadu is Rs.15510. In the festival the
voluntary donations (hundi contributions) from other devotees is around Rs. 13,019
from other visitors. The
management of Devara Kadu is for non-consumptive use value and existence value as nothing is extracted and mainly religious, spiritual, aesthetic purposes including ecological functions are served.

5.5.3.2: Existence value of Devara Kadu

Existence value of Devara Kadu refers to the willingness to pay for preservation of a sacred grove even when there is no physical access to the sacred grove.
Existence value is the willingness to pay even when direct on site interactions between the user and the Devara Kadu do not occur. Hence interaction is non-consumptive, indirect and off site. Since we cannot frame a question asking their willingness to pay for preservation even though there is no access, since no access to the village community is utopian,
Existence value question can be framed as the willingness to pay for preservation of some other sacred grove, which a planter does not normally visit. This is an unobtrusive proxy for existence value of a sacred grove, since the question of non-access to a sacred grove is utopian. Existence value is thus, cognitive (perceptual, psychological, mental),
independent of current and/or future use, a
non use or passive use value. Whether existence value of Devara Kadu is a paternalistic or non-paternalistic altruism is to be thoroughly discussed. Existence value is reflected in the fees and voluntary contributions by members of environmental groups for preservation of Devara Kadu irrespective of access

Coffee a major crop of Kodagu

In Kodagu, shade coffee (Coffea arabica, Coffea robusta) is the major crop. According to a study by Muthappa, Dept of Agricultural Economics, UAS, Bangalore (2000),
the Simpson's index of tree diversity ranged 0.8 - 0.89, for an average size of 41 acres of coffee

(range 6 to 300 acres). An
acre of arabica plantation had 281 trees with a stumpage value of Rs. 7.76 lakhs per acre, while one acre of robusta plantation had 120 trees with a stumpage value of Rs. 5.72 lakhs per acre. The coffee plantations had
65 tree species and 78 percent of the trees were commercial species.

The major predicament facing the preservation of devara kadu is the encroachment of sacred groves. The devara kadu committees (temple committees) are now seeking legal intervention. The encroachment is
influenced by coffee prices. Thus, it is necessary to examine whether
use values dominate
non-consumptive use and existence value or vice versa through a CVM study, which has been initiated.
The
Non-recognition of non-consumptive use and non-use values results in exploitation

Other institutions contributing to Existence value

????The 'Jamma' land tenure is the 'birth right' land responsible for preserving devara kadu. The Jamma lands cannot be sold.
The kodagu family rituals have linkages with devara kadu. For instance, the ancestral home (Iyyena mane) and ancestor memorial (Kaimada) have institutional linkages with rituals in devara kadu, which is a unique characteristic of kodagu family culture. If
jamma lands are made saleable, planters can sell the lands to outsiders, who may have no institution like devara kadu tradition to preserve and may result in large scale conversion of devara kadus.
This will obviously weaken the institution of devara kadu and leads to its degeneration. There is institutional failure to preserve the devara kadu as the sense of belongingness is diluted in some areas of Kodagu. This is reflected in
the lack of judicial and governmental support to temple committees when cases are filed in courts. Thus, the
trade off between use and non-use values is already on cards. In Garvale, Thalthare shettalli, Somvarpet, the devara kadu temple committee has exhibited a strong stewardship role and has restored the encroached devara kadu from other members of village community by
fencing the devara kadu, by imposing fines on encroachers and recording their names in the

committee meeting proceedings, by
village community's social boycott of the family functions of encroachers, which are all features of sound environmental activism.

Despite demographic and commercial pressures over time, in many areas, devara kadus have been preserved indicating 'survival value' over time and 'existence value' of the institution.

In some areas people have placed relatively little emphasis on protecting them because they have neither understood nor appreciated their value. Here perhaps the
the goods and services flowing from natural ecosystems are greatly undervalued by society.

Estimate of existence value

It was estimated that the average contribution to Devara Kadu preservation located outside their village was Rs. 1410, which is a close proxy of existence value. In addition, five families donated Rs. 22,466 for Devara Kadu and did not want their name to be documented anywhere. The temple committees are now insisting for
declaration of Devara Kadu as " reserved forest sacred grove" incorporating the religious component, rather than mere "reserved forest" which incorporates only the secular component. In addition, the
"jamma" land institution should continue and not be diluted so that the local communities who have strong institution of conserving sacred groves retain the land

C H A P T E R - S I X

ISSUES IN ECONOMIC MANAGEMENT OF BIODIVERSITY

6.1: Treatment of Indian Medicinal system (*With inputs from Damodaran and Sehgal)

6.1.1: Direct Effects of Economic Reforms Process

Ayurvedic (medicinal plants) industry is an age-old important biodiversity-dependent industry. It is estimated that around 12,000 *ayurvedic* drug manufacturing units are present in the country, half of which are unlicensed. The total turnover of the industry was estimated to be Rs. 4500 crores in 1998. The domestic market is estimated to be growing annually at 15%. The exports of *ayurvedic* formulations are also rising. The exports have increased from Rs. 66 crores in 1986-87 to Rs. 447 crores. The Planning Commission has identified *ayurvedic* herbs as a major thrust area for exports and the target is to increase the exports to Rs. 3000 crores by 2005 and 10,000 crores by 2010. This will have serious implications for biodiversity unless mechanisms are developed to ensure sustainable harvest and utilisation of medicinal plants. Currently, out of 550-600 medicinal plants used by the *ayurvedic* industry, 80 percent are procured from the wild areas and only about 10% are from cultivated areas. The industry is characterized by long supply chains, strong hold of traders. The primary collectors receive only a small fraction of the final price.

Recently the Department of Indian Medicinal System within the Ministry of Health and Family Welfare has made special allocations of Rs. 443.65 lakhs to various states for promoting 17 medicinal plant projects under the Non-timber Forest Produce Scheme for the year 2000-2001. The National Afforestation and Eco Development Board implements these projects. The scheme provides 100% financial assistance to the states for conservation, development and increasing non-timber forest produce including medicinal plants. The Department of Agriculture and Co-operation has also rolled out several schemes for the development of medicinal plants. The most recent rider on this is the Department of Biotechnology.

6.1.2: Examples of some positive initiative by the ayurvedic industry

More than 25 companies in the private sector are engaged in nursery development, generation of planting material and seeds, development of agricultural techniques for cultivation of medicinal plants and also initiating encouraged cultivation of medicinal plants by contracting them to farmers.

Table 6.1:List of Organizations engaged in cultivation of Medicinal Herbs

SN	Organization	Region of Activity	Area(Acres)	ND/FC/EC[3]	Herbs
1.	Agrotech Ltd.	Haridwar (UP)	Spread over 6 villages	ND/FC	Papaya
2.	Alembic	Gujarat, West Bengal	2000	ND/EC	Vasaka
3.	Annupurna Biotech Ltd.	Andhra Pradesh	250	ND/FC	Aswagandha, Hyoscymus, Black Musli.,
4.	Arya Vaidya Shala, Kottakal	Cayvery Basin	Spread Over	Ec/FC	Senna, Vakuchi, Shatawari, ***Coscinium***
5.	Baidyanath Ayurved Bhawan	Sivpuri, Lalitpuy, (M.P)	100	ND?FC	Aswagandha. Whit Musli, ***Sarpagandha*** Priyangu
	Baidyanath Ayurved Bhawan	Hajipur			
6.	Basils Agro Farms Ltd.	Solan (HP), Nurpur (Punjab)	50	ND/FC	Asparagus, Basils, Thyme, Parsley, Celery
7.	Burroughs welcome	Jammu & Kashmir	2500 (Spread Over)	FC/EC	Prurariatuberosa, Digitalis
8.	Chemiloids	Aswaraopet (Khammam)	700	FC	Strychnos, Sadabahar, Tylophora astham
9.	Cipla Ltd.	Karnataka & Coimbatore	2000	FC/EC	Senna, Sadabahar

	Cipla Ltd.	Rajasthan (Mangliwas)	3000 (Spread over)	ND/FC/EC	**Guggulu**
10.	Crystal Biotech Ltd.	Haryana, Uttar Pradesh	400	ND/FC	Lemon, Amla, Papaya
11.	Dabur India Ltd.	UP Hills	74	ND/FC	Taxus, Long Pepper, Saussurea, Digit lavender,
					Salvia, Aswagandha, Basils
	Dabur India Ltd.	Birganj, Lamjung, Melumchi, Kathmandu, Dolkha, Viratnagar, Hiley (Allin Nepal)	1000 (8 districts)	ND/FC	Saussurea, Mints, Lavender, Salvia, Aswagandha, Basils, Saffron, Long Pepp
	Dabur India Ltd.	Sandila (Lucknow)	200	FC (currently waste land being reclaimed)	Amla, Mentha, Acorus, Basils, Cl Lemongrass, Euphorbia, Mechandi
12.	EID Parry's	Karnataka, Tamilnadu	1200	FC/EC	Neem
13.	Enbee Plantations Limited	Budhni, Sehore, Hosur, Bhopal, Ichawar (M.P) Tirunelvelli (TN) Satara (Maharashtra)	9766	ND/FC	While Musli, Sarpgandha, Aswagandh Dan, Shatawari, Bixa, Sadabahar, Basils, G Jaiphal
14.	German Remedies Ltd.	Barabanki, Lucknow, Bareily	4000	EC/FC	Chamomile
15.	Glaxo India Ltd.	Karnataka & AP Border, Jodhpur, Pail (Rajasthan)	Spread over several districts	EC	Senna

16.	Himalayan Drug Co.	North India, Karnataka, Tamilnadu	60, 000	FC/EC	***Aloe Vera, Rauwolfia serpeer*** Brahmi, Senna, ***Saussurea lappa***
17.	Hoecht India with IIHR	Eastern UP	At some pockets	FC/EC	Coleus forskohlii
18.	Indian Herbs	Saharanpur, Rampur	ND-100 FC-2000	ND/EC/FE	Acorua, Punarnava, Kalmegh
	Indian Herbs with Horticulture Dept.	Bangalore	200 (On Govt. waste land)	FC/EC	Kalmegh, Basils
19.	Jain Irrigation	Jalgaun (Maharashtra)	1000	°'A.ºI	Papaya
20.	JVS Agrobase Ltd.	Kerala	24	ND/FC	Mints, Mushrooms, Black pepper, Ginger
21.	Lahul Potato Society (HP)	Lahul & Spiti, Kullu	1000	EC	Saussurea lappa
22.	Lucky Laboratories Ltd.	Bulandshar	50 (1000 Acres likely to be acquired)	ND/FC	Amla, Ashok, Ashwagandha, Hyoscymus
23.	Lupin Laboratories Ltd.	Rishikesh	50	ND/FC	Aswagandha, Isabgol, White Musli
24.	Mr. Girish Sharma (NGO)	Ajmer (Rajasthan)	25	EC	Aloe vera
25.	Narauandas Prajapati(NGO)	Jodhpur (Rajasthan)	400	FC/EC	Aswagandha, Aloe, Acorus, Guggulu, Sent
26.	Naturo worth Medico Plants	Uttar Pradesh, Madhya Pradesh	1500	ND/FC	Aswagandha, Ocimum, Mentha, Acorus, W Musk, Brahmi, Giloe, Curcuma, Ginger
27.	Peru Tech Ltd.	Maharashtra	2000	ND/FC	Papaya, Garlic, Ginger

28.	Pepsi Co	Punjab/HP	5000	ND/FC	Garlic, Ginger, Turmeric
29.	Proctor & Gamble	Allover India	100000	EC	Mints
30.	Save Earth Plantations	Bihar, Haryana	Spreas over several villages	ND/FC/EC	Jawa, Lemon, Mints, Aswagandha, Brahmi, us

ND : Nursery Development, FC : Field Cultivation, EC: Encourages Cultivation (including contract cultivation)

6.1.3: Ayurveda in the age of WTO-biodiversity conservation –A case study

The town of Kottakal stands today as the symbol of the Arya Vaidya Shala's achievements in healthcare and social work. Ayurveda institutions are changing with the times. While attempting to keep alive the brand loyalty for its products and services amongst its traditional clients, these institutions are constantly endeavoring to expand their consumer base by setting up state-of-the-art factory complexes, advanced centres of learning and well-equipped nursing homes. The liberalised global trade order exemplified by the World Trade Organisation agreement is of great purport to these time-tested institutions.

The WTO TRIPS affords a window of opportunity to these enterprises. For instance, the geographic appellation of the term Kottakal provides a unique opportunity to protect the Arya Vaidya Shala's ayurvedic medicines under India's Geographic Indication of Goods (Registration and Protection) Act, 1999.

In recent times, the Arya Vaidya Shala has also entered into a MoU with the CSIR for developing modern standards for its products and processes. The MoU with CSIR would conceivably strengthen IPR protection for the Vaidya Shala's new products and enhance the market share for ayurvedic medicines in the global market place.

In WTO parlance, these measures would be described as market-access facilitation. However, success of this market-access strategy will depend on the ability of the Arya Vaidya Shala to sustain its time-tested quest for improving the quality of raw drugs and medicinal plants through enforcement of strict quality standards and rigorous supply-chain management systems. Paradoxically, despite the promise heralded by the WTO, ayurvedic centres appear to be hamstrung. Their unique strength of supply-chain management systems appears to be weakening in the wake of India's new forests and biodiversity regulations.

While it is true that the herbal gardens of the ayurvedic pharmacies have contributed to their raw material supply base, it remains a fact that this cannot substitute the rich reservoirs of the medicinal plant wealth in the forest areas. Medicinal plants in the wild state are relied upon for two reasons: (1) the quality of medicinal plant parts (such as roots of Sida rhombifolia) picked up from the wild is superior in comparison to those "cultivated" off-site, and (2) the prospects of ex-situ cultivation of medicinal plants by large manufacturers of ayurvedic medicines is limited in land-scarce Kerala.

Under Clause 7 of India's draft National Biodiversity Legislation (currently before the Parliamentary Standing Committee on Science and Technology), a body corporate, association or organisation registered in India needs to give prior intimation to the State (Government's) Biodiversity Board before obtaining any biological resources for commercial utilisation or bio-survey or bio-utilisation.

The legislation exempts "vaids" and "hakims" from this requirement. Policy-makers and local communities who have all along felt the adverse effects of erosion of genetic and biological materials (including medicinal plants and herbs) on account of unscrupulous traders and other middlemen have rightful reasons to advocate this restriction. Ayurvedic institutions, on their part, find this clause to be problematic, as it would disrupt the smooth flow of quality medicinal plants from forests. This, in turn, could severely hamper their ambition of enhancing their presence in the global medicine markets. Further, those ayurvedic institutions, which are trusts, cannot be equated with non-public limited companies. They are swadeshi in spirit with strong traditions of charity work. They have sustained the traditions of ISM. In addition, these institutions source a large proportion of their raw materials from Girijan Cooperative Societies and SC/ST federations which are entities set up by state governments to pool non-timber forest produce collected by tribals and other weaker sectors.

Given the government of India's positive approach to international promotion of ayurvedic medicines, it is essential that the core strengths of ayurvedic institutions in relation to supply-chain management are further enhanced. For this to be achieved, there ought to be facilitating changes in the proposed National Biodiversity Legislation.

The Biodiversity Legislation should distinguish traditional from non-traditional bio-utilisation systems and categorise ISMs as traditional bio-utilisation systems. Lastly, the

Biodiversity Legislation should distinguish different intermediaries and collectors of medicinal plants from forests.

Sale of medicinal plants by Girijan cooperatives and related federations should not be equated with sales of these raw materials effected by private traders and middlemen. Accordingly, the "prior intimation" provision of Clause 7 of the proposed Biodiversity Act should not apply to the former. It should be even considered whether cooperatives and federations of the state government, which pool non-timber forest produce from tribals, should ever be subjected to the requirement of producing legally-procured certificates, prior to transacting raw materials relevant to ISM enterprises.
(Damodaran, 2001)

6.2: Stake holder Analysis (*with main inputs from Sigh and Hegde,2001)

6.2.1: Participatory Approach

The total economic values of forest and natural areas arise from demands placed on their services by different stakeholders. One can discern at least three ***broad categories of stakeholders*** for bio-diversity services as, the local, the 'national' and the 'global'. A forest area, if left undisturbed, undergoes a successful process of ecological succession to attain a state of climax beyond which evolution ceases. This climax stage could represent a high degree of species, genetic and habitat diversity, or a high quality bio-diversity service. The problem is that not all the three stakeholders mentioned above, may have the same degree of interest in a forest ecosystem attaining its optimum bio-diversity potential, as illustrated below:

I. A local community, which derives its NTFP's from a forest area could profit from its undisturbed and high bio-diversity state. However, their over-extractive consumptive use of staple food items and energy biomass etc., may not have any bearing on the bio-diversity potential.
II. A 'regional' or a 'national' community, which may have a stake in the watershed functions of a forest area may not per se be interested in optimising the consumptive use values of local communities. Indeed, the regional and national communities could be prioritising development projects such as irrigation and hydel reservoirs (e.g., Sardar Sarovar Project).
III. The global community comprising of pharmaceutical and agro-biotech companies and green philanthropic associations may have a stake in bio-diversity services for their own sake. They may have scant regard for consumptive use values of the locals or watershed functions entailed by the regional and national. Indeed, they would prefer to eliminate these use value and non-use value functions, in case these

values are seen to interrupt the ecological succession towards the climax state.

In other words, stakeholder interests can conflict when it comes to bio-diversity services. Different stakeholders have different requirements of bio-diversity services. Generally, each stakeholder desires to maximise her/his requirements even if it is at the cost of the requirements of other stakeholders. It is this factor, which makes stakeholder management of bio-diversity services extremely complex.

6.2.2: What is stakeholder analysis?

Stakeholder Analysis (SA) is an approach and procedure for gaining an understanding of a process or project mainly from the point of view of key stakeholders, an assessment of their interests, and the ways in which these interests conflict and affect the process and vice-versa. SA can help in the design and monitoring of biodiversity conservation projects in several ways:

I. Elicit the interests of stakeholders in relation to the problems that the process is seeking to address (at the identification stage) or the purpose of it (once it is started).
II. Identify conflicts of interests between stakeholders, which will influence assessment of project riskiness before committing funds (for proposed project activities).
III. Help to identify relations between stakeholders, and enable 'coalitions' of process ownership, sponsorship, and co-operation.
IV. To better address the distributional and social impacts of policies and projects.
V. Help to assess the appropriate type of participation by different stakeholders, at successive stages of the process cycle.

Although stakeholder approach is applied to a wide variety of areas in the development sector, there are several distinctive characteristics of natural resource management that make SA particularly relevant to the analysis. It can serve as a means of complementing and strengthening the policy and project assessment procedures, especially in dealing with stakeholder interests, where the conventional methods such as cost-benefit analysis are deficient.

6.2.2.1: When is SA required?

Consideration of the interests of different stakeholders would be useful in almost all policy making and project design contexts. Following are the key conditions where SA is likely to be particularly crucial (Grumble and Chan, 1995).

Box 6.1: Where and when SA's are Relevant

When and where	Comments and explanations
In the presence of Externalities	SA would be applicable where the externalities exist. In a way they internalise them.
When the property rights are not clear	SA is more applicable to situations where resources (e.g. forests) are managed as common property rather than are privately owned; more particularly where traditional institutions regulating communal use and management are breaking down; and, where resources are officially owned by the state but function in practices as de facto open access resources.
Different levels of stakeholders with distinct interests and agenda.	They include broadly, **three levels of stakeholders: local, regional or national and global**. In such contexts, not only the interests in natural resources but also the cognitive frameworks (knowledge base, decision making criteria, etc.) and economic circumstances will vary considerably between stakeholders.
Trade-offs to be made at the policy level over the use and management of resources	In a situation where national policy objectives encourage conservation, but local people are primarily interested in consumption or alternative uses, SA would be convenient.
In all such situations with different institutional arrangements, and at different levels of planning (national, regional, local and project), SA is directly relevant in the management of biodiversity conservation.	

6.2.2.2: How is SA conducted?

The following major steps are involved in any Stakeholder Analysis.

Step 1: Identifying Key Stakeholders and their Interests.

The thumb rule is to relate each stakeholder with either the problems that the biodiversity conservation project is trying to address or the its stated objectives. This is achieved by preparing a table of stakeholders with their level of functioning (such as primary and secondary) to answer the following questions: (1) Who are the potential beneficiaries; (2) Who might be adversely impacted; (3)Who are the vulnerable groups; (4) Who would be the supporters and opponents; (5) What are the relationships among the stakeholders; (6) What are the stakeholders' expectations of the project; (7) What benefits are likely to accrue; (8) What stakeholder interests conflict with project goals; and (9) What resources would the stakeholders be able to and willing to provide.

Step 2: Determining Stakeholder influence and importance

The influence and importance that a stakeholder can have on the project is reflected in terms of the over-all effect they can have on the project, such as in deciding what decisions are to be made or in facilitating or hindering its implementation. ‘Influence’ refers to how powerful a stakeholder is. ‘Importance’ refers to those stakeholders whose problems, needs, and interests are the priority of the project. If these "important" people are excluded, and are not assisted, then the project cannot be deemed a "success".

The questions that are relevant here are: (1) What are the relationships between various stakeholders; (2) Who has power over whom; (3) How are stakeholders organised, and how can that organisation be influenced or built upon; (4) Who controls the resources; and (5) Who has control over information.

Step 3: Drawing out assumptions and risks affecting project design and participation

Based on the interests and expectations of stakeholders along with the influence and power they can wield on the system, one needs to anticipate their responses before hand in order to construct the framework for the project. This can be achieved by making certain assumptions about the behaviour of stakeholders.

Step 4: Formulating a stakeholder participation strategy

It is important to define who should participate and in what ways, and which stage of the project depending upon the interests, influence and importance of stakeholders.

6.2.3: Recent developments on stakeholder approach at the policy levels

In India, bio-diversity services are offered both by forest and non-forest areas including agricultural ecosystems. However, the basic focus of bio-diversity services in India has traditionally been on the protected forest areas of the country. The legal foundation for the protected forest areas has been provided by the Wildlife (Protection) Act 1972. However, with India signing the Convention on Biological Diversity in 1992 and with the initiation of the National Bio-diversity Action Plan by the Government of India in 1998 and now with the introduction of Biodiversity Conservation Bill of 2000 in the Parliament, the focus is steadily shifting towards bio-diversity services in non-forest ecosystems as well. Equally noticeable is the shifting trend since 1992 towards multi-diversity services involving national, local and global stakeholders, which is aided by the provisions of the Bio-diversity Convention. The Convention highlights three aspects viz, (a) that State have sovereign rights over biological resources, (b) that traditional dependence of local communities of biological resources are to be recognised and respected, and finally, (c) that bio-diversity is a common concern of humankind. These trends of multi-stakeholdership of biodiversity services in turn have had major police implications on stakeholder management for bio-diversity services in recent times.

6.2.4: Experience with the Strategy of Singular Stakeholder Management in Protected Areas during 1972 to 1992

Something should be said about the conflict that arose in the stakeholder situation resulting from the enactment of the Wildlife (Protection) Act, 1972. No doubt that the process of formation of Protected Forest Areas in the form of National Parks and Sanctuaries, has received a major fillip in India. By 1996, India had a network of 80 National Parks and 441 Wildlife Sanctuaries, which is one of the largest networks of protected areas in the world (Neena Singh, 1996). The Wildlife Act prohibits destruction, exploitation or removal of wildlife or habitat within National Park and Sanctuaries except when permitted by the Chief Wildlife Warden. This provisions of the Act thus emphasises the principle of singularity of stakeholdership and Government control seeks to bring all bio-diversity services into an *exogenic* management of the protected areas by eliminating the stakeholder rights of the local communities inhabiting the forests declared as protected area. The implicit assumption of the Wildlife (Protection) Act 1972 is that 'State takeover' of a biologically well endowed area is a pre-requisite for 'protecting, propagating or developing wildlife in the protected area' or in other words, for conserving the bio-diversity of the area. In other words, the philosophy of the Wildlife (Protection) Act 1972 is that the value of bio-diversity services of a National Park or Sanctuary is inversely related to its stakeholder base.

The Wildlife (Protection) Act 1972 has not met with unqualified success in sustainably offering its bio-diversity services. The local communities of National Parks and Sanctuaries whose rights have been taken away under the provisions of Act have rebelled against the National Park and Sanctuary authorities in many parts of India. For instance the tribals of Nagarahole have been fighting against the Nagarahole National Park authorities for restoration of their rights for collection of minor forest produce such as honey and gooseberry from the Park (Seidensticker et al., 1999). The nomadic Gujjars have resisted attempts to relocate them from the Rajaji National Park of Uttar Pradesh and demanded their rights to stay inside the forest areas. In some cases such as that of Buxa Tiger Reserve in West Bengal protests by local communities have been on the non-unsuitability of alternative livelihood systems proffered by the Forest Department such as smokeless chullahs etc. All these protests either reflect opposition to the principle of singularity of stakeholdership or convey the fact of inadequacy

of compensation offered for settled rights (Anon, 1999). In other words, the state of exogenic management of bio-diversity services has not been successful in the Protected Area of India.

6.2.5: Experience with the Eco-development Strategy of 1990s

In the 1990s, particularly after the Convention on Biological Diversity, the concept of 'eco-development' was floated by the Government of India and incorporated in the World Bank initiated India-Eco-development project, which is being implemented in 7 National Parks in India. The World Bank project describes eco-development as a strategy, which aims to conserve bio-diversity by addressing "both the impact of local people on the protected areas and the impact of protected area on the local people". According to the World Bank (1996), eco-development has two main thrusts: 'improvement of PA management and involvement of local people'.

A careful reading and analysis of the World Bank definition of eco-development indicates that 'eco-development' is a two edged strategic weapon of stakeholder management in Protected Forest Areas. At the government level, eco-development has the potential of improving the compensation principle implicit in the Wildlife (Protection) Act 1972. The impact of local people on protected area normally arises from their appropriation of consumptive use value goods from these areas. Similarly, the (reverse) impact of protected areas on local communities could take the form of damages caused by wildlife on agricultural land and crops of local communities staying within or in the fringes of these areas. Eco-development programmes, which seek to provide alternative biomass and livelihood means has the potential of compensating the local communities for the loss of rights over Protected Areas adequately and thereby minimising the local community impacts on Protected Areas. This is something that the Wildlife (Protection) Act had failed to do in the past. If the scope of eco-development is restricted to the 'compensation' aspect, the programme could paradoxically strengthen the singular stakeholder principle being enforced through the Wildlife (Protection) Act. Involvement of the local people under 'eco-development' could be interpreted to mean the role of local communities in the design of eco-development programmes aiming at upholding the compensation/principle.

However, 'eco-development' has a progressive face as well. The 'co-option' aspect of

eco-development goes beyond the compensation principle for it requires participation of the local communities in the management of the national park of Sanctuary. In other words, the co-option aspect of eco-development represents a higher level of providing bio-diversity services as it leads to multi-stakeholdership or 'plurality of stakeholders which forms the basic spirit of the Convention on Bio-diversity and the National Bio-diversity Action Plan. This may require amendments to Wildlife (Protection) Act 1972, and particularly those provisions of the Acts, which seek to stop local community activities from collecting Non-timber and other forest Produce (Ashish Kothari, 1996). Non-realisation of the co-option aspect of eco-development could therefore be viewed as a major policy for India in the field of bio-diversity services.

For sustainable bio-diversity services, multi-stakeholdership or plurality of stakeholdership is desirable and inevitable. But the policy makers in India are armed with the strengths provided by the convention on Biological Diversity 1992 and the National Biodiversity Action Plan 1998 to pursue a management strategy leaving out the stake holders particularly from Protected Forest Areas. The proposed National Legislation on Bio-diversity, to be adopted by the Indian Parliament needs to further enshrine the principle of multi-stakeholderhip and endogenising the stakeholders in the management of bio-diversity services in the interests of its sustainability. In practical terms this would mean involvement of local communities even in the undisturbed core zones of a National Park. Under the circumstances of such a management system the bureaucracy of National Parks or Sanctuaries will not be mere executors of a centrally designed and formulated operational plans as at present. Rather they will operate as a catalyst of multi-stakeholdership principles and institutions designed to provide sustainable bio-diversity services.

6.2.6: Stakeholders in Joint Forest Management: Some Lessons

In a typical JFM programme a variety of stakeholders are involved at different levels of functioning. At the conceptual level they can be grouped as:

(1) Resource user groups; (2) Women and JFM; (3) de facto users under open access regime; (4) User industries; (5) Forest Department and JFM; (6) Panchayats; (7) NGOs; (8) Donor agencies; and (9) Various Departments in State and Central Governments. These are

summarily illustrated in Table 6.2.

Table 6.2: Stakeholders in a typical JFM programme

Level of stake	Stakeholders	Interests (in the order of priority)	Impact of interests on forest resources
Primary (local on-site)	Specific resource users	Availability of specific products Sustainability of such products	- or no impacts +
	Women	Fuelwood, fodder, water availability Sustainability	- or no impacts +
	Headloaders and wood smugglers	Fuelwood and fodder Wood products	- -
	Neighbouring communities	Forest products	-
	User industries	Availability of forest product	?
	JFM committee	Forest protection	+/-
Primary (local off site)	FD	Forest protection and augmentation	+
Secondary (local off-site)	Panchayat	Local resource management Control over funds Over-all economic development	+/-
Local/ regional	NGOs	Development of the weaker sections Natural resource conservation Institutional learning	+/- +/-
Local / regional	Political parties	Community organisation	+/-
State / National level	Governments	Economic development Legal control on resources Natural resource conservation	+/- +
National / International	Donor agencies	Resource conservation and economic development (regional/ global level)	+

Note: Positive and negative impacts are designated by + and - signs respectively.
The stakeholders in JFM are now illustrated with a case study.

6.2.6.1: The case of JFM in Shivalik Hills, Haryana

The seriousness of the problem of land degradation in lower Shivalik hills of Haryana state came into sharp focus in mid-70s when deforestation in the catchments of Sukhna lake reaching alarming levels, causing serious problems of soil erosion and siltation (Chopra et al. 1990). A participatory watershed programme was initiated in 1979 in selected villages. Since the area is very extensively studied and documented, the details of the watershed programme, local initiatives, progress, management strategies etc., are not presented here. Rather the specific aspects of stakeholder analysis are addressed here.

The watershed strategy adopted in the region were: (1) Construction of water-harvesting structures to provide irrigation water to rainfed agriculture; (2) Distribution of water equally among all the households irrespective of land-ownership, through Water Users' Association (WUA); and (3) Treatment of and protection of the catchment by constructing silt detention structures and plantation of trees and grasses.

In a way, it is important to note that some of these villages such as Sukhomajri, Jattanmajri, Dhamala and Nada had adopted the JFM methodology much before the concept was even coined in the Ministry of Environment and Forests. Now, after the adoption of JFM officially, about 80 villages have come under JFM in this region.

The Stakeholder analysis of the HRMS experience is demonstrated briefly in tabular forms (for details, see TP Singh and Ravi Hegde, 2001).

Step 1: The stakeholders are identified along with their interest summarily shown in Table 6.3.

Step 2: Identification of the relative power, influence and importance of the stakeholders are summarised in Table 6.4.

Step 3: Several assumptions regarding the roles and responses of the stakeholders are made. Following from the assumptions, Table 6.5 captures the likely project impacts and the consequent responses of the stakeholders. The striking features are that (a) an apparent match

of interest of most of the stakeholders (shown in Table 6.3), and (b) the likely impacts of the projects, consistent with their interests and expectations (shown in Table 6.4).

Step 4: The final stage in SA is to formulate a participation strategy for stakeholders as presented in Table 6.6. The present state of participation and the strategy suggested differ as far as the link between the HRMS and BPL is concerned. Keeping profitability and sustainability into consideration, the modifications for the success of JFM are summarily shown in Table 6.7

It can be seen that at the identification stage, the FD should take the initiative and consult interest groups and the NGO, and forge a partnership with them and the donor agency. The FD, NGO and the community institution (e.g., HRMS) should begin the project formulation in consultation with interest groups, Panchayat, BPM (wherever bhabbar is the major produce, else it is the network of traders) and the donor agency. The over-all responsibility should be jointly held by the FD and HRMS, and to be assisted by an NGO. At the implementation stage, the NGO needs to assist the FD and HRMS in implementation, which would be in partnership with interest groups, donor agency and BPM. The responsibility of monitoring and internal evaluation would be that of the NGO in partnership with FD and HRMS, which would consult interest groups, BPM and donor agency.

The above findings could be used either to provide an understanding of the entire intervention in an ex ante appraisal, or used as basic frame-work for monitoring and evaluation, and more improved form of JFM. The same approach can be used to other areas where JFM is still emerging.

6.2.7: What are the likely conflicts in JFM?

There are several conflicts arising in JFM in Shivaliks at various levels; within and between villages, and within and between societies. The causes of conflicts range from resource demarcation, benefit sharing, fund-utilisation, financial transparency and so on. Some of them are major while some minor, but a large number of them have been resolved amicably.

How do the conflicts arise? As the JFM institution matures and becomes more widespread, the degrees of conflicts are likely to increase. As and when more lucrative range of NTFPs mature, and the sharing of timber harvests becomes regularised, questions of equity and distribution of benefits is likely to create new management challenges and conflict resolution skills (Saxena, et al. 1997; Singh and Varalakshmi, 1998; TERI, 1999). Therefore, conflicts are liable to increase over resource use between adjoining villages, the landless, non-forest fringe villages migratory herders, etc. The typical conflict mechanisms in a JFM programme are depicted in Table 6.8.

There could be largely four general categories of conflicts based on the actors involved and the relative power they wield: micro-micro, micro-macro, macro-micro or macro-macro (Conroy et al, 1998 as cited in TERI, 1999). Micro-micro conflicts occur between subgroups of one protection committee (multiple hamlets, villages, power-groups with in a village, etc.) or with other communities, but they are more or less on an equal footing. Macro-micro conflicts arise between stakeholders on an equal footing such as when government agencies like the FD take decisions that adversely impact micro-level stakeholders such as FPCs. Micro-macro conflicts arise when the micro-level stakeholders take decisions that go against agreements worked out with higher level stakeholders (say FD). The failure to ensure protection of a forest by the participating community would lead to such conflicts. Macro-macro conflicts represent a difference in objectives between departments, programmes, etc. of the government. For example, the transfer of ownership rights of NTFPs in scheduled areas to Panchayats might lead to conflicts between the JFM Programme and Panchayat Raj programme of the government.

Broadly, there can be two types of approaches that can be applied to stakeholder interests, conflicts and their resolution.

Box 6.3: Conflict Resolution Mechanisms

Round table negotiations	Top-down analysis
Conflict resolution reached through initiative of primary stakeholders, where outsider play a marginal and supportive role	Participation of primary-local stakeholders is minimal.

Table 6.3: Stakeholders in Shivalik JFM

Level of stake	Stakeholders	Interests (in the order of priority)
Primary (local on-site)	Farming groups (Gujjars and Jats)	Availability of water Fodder and fuelwood
	Forest dependants (Rope-maker and basket weavers)	Availability of specific forest products Sustainability Fuelwood Fodder Water
	Wage-earners (Non-farming groups working for wages in villages and towns)	Fuelwood Fodder Water
	Women (mainly at home)	Fuelwood, fodder, water availability, Sustainability
	HRMS (association of user groups)	Forest protection Water-management and distribution
	Wood Smugglers	Wood products
	Neighbouring communities	Forest products
Primary (local off site)	HFD represented by Beat Guard / Forester / Range Officer/ DFO	Forest protection and augmentation
	Ballarpur Industries (BPM)	Availability of bubbar grass at cheap prices
Secondary (local off-site)	Panchayat	Local resource management Control over funds Over-all economic development
Local/ regional	NGOs (TERI, etc.)	Natural resource conservation Institutional learning Over all development
Local / regional	Political parties	Community organisation
State / National level	Governments	Economic development Natural resource conservation
National / International	Donor agencies (Ford Foundation)	Resource conservation and economic development (regional/ global level)

Table 6.4: Stakeholder influence and importance

Level of stake	**Stakeholders**	**Degree of influence**	**Variables affecting the relative power and influence**	**Degree of importance**
Primary (local on-site)	Farming groups	High	Socio-economic and political status Control over resources	High
	Forest dependants	Low	Skills	High
	Non-farming groups	Low	-	High
	Women	Low	-	High
	Wood Smugglers	??	??	Low
	Neighbouring communities	Low	??	Low
	BPM	High	Control over market	High
	HRMS	High	Organisation and leadership (PR Mishra) Control over strategic resources	High
Primary (local off site)	FD represented by Beat Guard / Forester / Range Officer/ DFO	High	Authority of leadership Control over strategic resources	High
Secondary (local off-site)	Panchayat	??	Control over resources Legal backing	Medium
Local/ regional	NGO	High	Key knowledge Negotiating position Political	High (initially)
Local / regional	Political parties	??	Political power	Low
State / National level	Governments	High	Authority Legal power Control over budget	Low
International	Donor agencies	High	Monetary Political	High

Table 6.5: Stakeholder responses and roles				
Level of stake	**Stakeholders**	**Impact of project**	**Likely response towards project**	**Resources which would be mobilised by the stakeholders**
Primary (local on-site)	Farming groups	Water Fodder and fuelwood	+	Time and effort (individual)
	Forest dependants	Bamboo/ Bhabbar Water Fodder and Fuelwood	+	Time and effort (individual)
	Wage earners	Water for sale Fodder and Fuelwood Increased wage (indirectly)	+	Time and effort (individual)
	Women	Water Fodder and Fuelwood	+	Time and effort (individual)
	Wood Smugglers	Non-availability	-	Nil
	Neighbouring communities	Non-availability	-	Nil
	BPM	Increased bhabbar availability Higher prices for bhabbar	+ / -	Uncertain
	HRMS	Say in resource management Village development Institutional learning	+	Time and effort at the community level Monetary (at a later stage)
Primary (local off site)	FD	Effective forest conservation and development Job made simple	+	Legal backing Monetary
Secondary (local off-site)	Panchayat	Natural resource conservation Village development Dilution of power and responsibilities	+ + -	Institutional Monetary Uncertain
Local/ regional	NGOs	Natural resource conservation Village development	+	Technical Legal
Local / regional	Political parties	Community organization	+ / -	Uncertain
State / National level	Governments	Natural resource conservation Village development	+	Legal Monetary

Internatio nal	Donor agencies	Natural resource conservation Village development	+	Monetary Institutional

Note: Positive and negative responses are designated by + and - signs respectively.

Table 6.6: Existing participation matrix

Type of participation	Who	Consult whom	Partnership with	Control and Responsibility
Identification	FD	Interest groups NGO	Interest groups NGO	FD and HRMS assisted by NGO
Formulation	FD and HRMS Assisted by NGO	Interest groups Panchayat	Interest groups Donor agency	FD and HRMS assisted by NGO
Implementation	FD and HRMS facilitated by NGO	NGO Donor agency	Interest groups Donor agency	FD and HRMS Facilitated by NGO
Monitoring and evaluation	NGO	Interest groups HRMS Donor agency	FD and HRMS	NGO assisted by FD and HRMS

Table 6.7: Recommended participation matrix

Type of participation	Who	Consult whom	Partnership with	Control and Responsibility
Identification	FD	Interest groups NGO	Interest groups: NGO Donor agency	FD and HRMS assisted by NGO
Formulation	FD and HRMS Assisted by NGO	Interest groups Panchayat	Interest groups Donor agency BPM	FD and HRMS assisted by NGO
Implementation	FD and HRMS facilitated by NGO	NGO Donor agency	Interest groups Donor agency BPM	FD and HRMS Facilitated by NGO
Monitoring and evaluation	NGO	Interest groups HRMS BPM* Donor agency*	FD and HRMS	NGO assisted by FD and HRMS

*: These are added to make participation more functional.

Table 6.8: Conflict matrix

	Directly related to protection	**Indirect effect on protection**
Conflicts within protection community	One sub-group refuses to abide by protection and harvesting rules	Conflicts between two subgroups who refuse to co-operate any longer in various issues leading to violation of protection
Between protection communities and other stakeholders	Other interested parties (other villagers, timber merchants, etc.) do not recognise the community's protection rules	Conflicts not relating to issues other than protection (such as personal disputes, party-politics, etc.) indirectly affecting forest protection

(Adopted from: TERI, 1999)

6.3: **Restructuring Joint forest management** (* with major inputs from Sehgal)

6.3.1:From Social Forestry to JFM

India is one of the pioneering countries in the world where forest management regimes stressing on partnerships between the state departments and the local communities, generically known as Joint Forest Management (JFM) have been introduced. The driving force behind these innovative changes is the new forest policy of 1988, which stressed on management of forests for conservation and meeting local communities needs and made commercial exploitation and revenue generation secondary objectives.

The involvement of local communities in the management of state forest lands was facilitated by the issuance of specific guidelines by the Central Government on 1st June, 1990. In the following years, several state governments adopted this concept and issued state specific orders/ resolutions for its implementation. As on date 23 states in the country have passed enabling orders/resolutions and bout 10.24 million hectares forest area is under JFM. It is

expected that this figure will continue to rise in the coming years.

The state-wise progress of the JFM programme in different states as on 30th September 2000 is given in Table 6.9:

Table 6.9: Status of JFM in the country

S.No.	State	Area under JFM (ha.)	Number of FPCs
1	Andhra Pradesh	1632190.00	6575
2	Arunachal Pradesh	5285.00	10
3	Assam	3060.00	101
4	Bihar	935065.00	1675
5	Gujarat	91071.28	706
6	Himachal Pradesh	62000.00	203
7	Haryana	60733.56	350
8	Jammu and Kashmir	79273.00	1599
9	Karnataka	12800.00	1212
10	Kerala	4000.00	21
11	Madhya Pradesh	5800000.00	12038
12	Maharashtra	94727.99	502
13	Manipur	1400.00	35
14	Mizoram	5870.00	103
15	Nagaland	627.00	55
16	Orissa	419306.00	3704
17	Punjab	38991.42	89
18	Rajasthan	235634.00	2705
19	Sikkim	2191.00	98
20	Tamil Nadu	224382.00	599
21	Tripura	16227.30	157
22	Uttara Pradesh	34569.36	197
23	West Bengal	490582.00	3431
	Total	**10249986.41**	**36165**

Note: As on 30-09-2000
Source: Bahuguna, V.K. 2000. Joint Forest Management Cell. *Van Sahyog – JFM Network Newsletter.* Vol. 2, Aug.-Oct.

6.3.2: Some new direction needed: Prospects for eco-tourism

The feasibility of sustaining JFM programme through biodiversity conservation linked benefits (as against fellings) in different parts of the country needs to be explored (e.g., Eco-

tourism initiative in a few FPCs in South-West Bengal – see box below). Emerging opportunities such as carbon sequestration/trading need to be seriously explored as a way of sustaining the interest of the community in forest regeneration and protection.

BOX 6.4: Eco-tourism under JFM: Case study

Eco-tourism : A new Initiative in South-West Bengal

Eco-tourism has been started as a support activity in two FPCs in Bankura (South) Forest Division – Chenchuriya and Sutan. One of these, Sutan, was visited for a day by the ETS team, the findings of which are briefly summarised.

I. Sutan FPC is located about 60 kms. Away from Bankura town on the Jhilimili road. It comes under the Ranibandh Range of Bankura (South) Forest Division. The FPC has 55 members. The *sal* forest under the FPC is lush and located on low hills and valleys surrounding the village. The entire forest of the village has now reportedly been put under the Conservation Circle and hence no final felling will be carried out.

II. In order to help people earn some income from the forests, FD has promoted Sutan as an eco-tourism destination. Trekkers' lodges have been built near the village and an earthen dam built earlier by the FD has been developed for boating and the FD has provided two boats. The FD has also provided some other items such as furniture, utensils and crockery. In all, FD has spent about Rs. 2,50,000 on the development of infrastructure for ecotourism in the village. It has earlier spent about Rs. 40,000 on the construction of the earthen dam.

III. These facilities were opened for public in January 1999. The FD has fixed rent for the Trekkers' lodge and people can make booking either from the Divisional or the Circle office of the FD. The FD retains the proceeds from the rent. The FPC's income sources include :

    A. Catering;
    B. Boating;
    C. Watch and ward services; and
    D. Local Guidance

I. The FD has fixed the rates for items such as tea, breakfast and main meals. The FPC members supply these items to the tourists at approved rates and make some profit. However, the FPC retains all the income from boating, watch and ward services and local guidance. FPC members are thinking of further enhancing their income by charging parking fee from picnickers and levying entry charge for climbing the Watch Tower that has been constructed by the FD to get a good view of the forest.

II. The FD has introduced the concept of revolving fund and 10 percent of the income eco-tourism is to be kept aside by the FPC into a revolving fund for maintenance of facilities created in the village.

III. The FPC members were in the lodge on a rotational basis as there is not enough work for everyone to be involved. This year ten families have been given the responsibility and next year another ten will take their place. After deducting the 10 percent amount for the revolving fund, the balance is shared between the families working in the lodge and the FPC in the ratio of 80:20.

The Lesson from West Bengal experiment

There are very few studies available on the above topics and much of the JFM debate on these issues is based on anecdotal evidence. The funding for these studies may be obtained from donor agencies interested in the community forestry issues such as the Ford Foundation, DFID, SIDA, etc.). It may be possible to get some funding support from the MoEF and the Planning Commission.

6.3.3: The Lessons from JFM till now

I. There are a large number of studies on the performance of JFMs all over the country. Findings from these studies should be widely publicised. The biodiversity issues and concerns need to be introduced and discussed in JFM related forums such as the National JFM Network and regional networks.

II. The JFM Cell within the MoEF should issue guidelines mentioning biodiversity conservation as one of the explicit objective of JFM.

III. The economic benefits (and costs) of biodiversity conservation should be discussed with the community at the time of micro-plan preparation and biodiversity conservation strategy should also be included in the micro-plan. Instead of using the standard Cost-Benefit Analysis, Stakeholder and Multi-criterion Analysis are to be introduced in the NBSAP process.

IV. Training programmes on alternative economic valuation methods should be organised for the officials of the Forest Department as well as NGOs active in the field of JFM.

V. An attempt should be made to get the biodiversity concerns included in the large forestry projects that focus on JFM, especially at the time of their formulation. Periodic meetings should be organised with the main donor agencies supporting JFM.

6.3.4: JFM Guidelines and Amendments

After almost 10 years of experimenting with JFM in different states, on 21st February 2000, the Government of India circulated a net set of guidelines for various JFM activities, in response to many issues confronting the FPCs, NGOs and the Forest Departments. The major features of the guidelines along with suggested amendments are given in Box 6.5:

Box 6.5: New Guidelines and Suggestions to Amend

Feature as in the new guidelines	Suggested amendments

Providing legal status to JFM committees: The guidelines stress the necessity for the state governments to register the Village Forest Committees (VFC) under the Societies Registration Act, 1960, to provide legal back up.	VFC's can also be registered under any local act or rules, but no restriction that they need a clearance from the Conservator of Forests. Instead a MoU should be signed between the forest department and the JFM Committee, clearly empowering the VFC.
Increased participation of women in the programme: Recognising the need to involve all sections of the community, particularly women, it is suggested that the general body should consist of 50% women members, and	All the VFC members should be given Identity Cards, to book the offenders. They should be involved in processing of NTFP products and marketing.
the Executive Committee, at least 33%.	
Extension of JFM to less degraded areas: Identifying the need to involve people even in less degraded areas, the guidelines suggest that forest areas with >40% crown density could also be brought under JFM. In these areas, the major emphasis will be given to NTFP management and harvesting of timber will be based on the forest working plans. The share of profit from sale proceeds of timber in such forests depends on the involvement of people in forest protection and regeneration.	Some capacity building among the VFC's is required in understanding the so called Working Plan, life styles and livelihood basics, control of grazing, NTFP management, use of indigeneous knowledge, training in fire prevention, NTFP processing, storage and marketing, even some exposure to GIS based information will be relevant. A seed money on these activities be transferred to the VFC's.
Micro-plan for JFM areas : Local people, along with forest officials, should prepare the micro-plan in consultation with all the user groups in the village. Adequate importance should be given to each user group, promotion of marketing links and the local industries, based on the production potential of the land and environmental and biodiversity functions.	Training on this must be made compulsory. This be done jointly with the Panchayats, so that the conflicts between them are minimized.
Recognising the self-initiated forest protection groups : The feature gives legitimacy to and recognises the efforts of local self-help groups, which had come into being voluntarily, without any official assistance.	Such members should be given a Green Card of recognizing their role.

Contribution for regeneration of resources : From the profit accrued to the FPC, it was decided that 25% of the share of the village community be kept aside to meet conservation and development needs of the forest. A matching grant was to be provided by the Forest Department from its share. Further, it suggested that a transparent mechanism be developed to compute the income and benefit sharing between different stakeholders.	As is being done in several villages under *Chakriya Vikas Pranali* in Palamau district of Jharkhand, a bank account be opened exclusively to deposit the Village Development Fund.

6.4: Strategy / Action Points for NBSAP

6.4.1: On modifying JFM Regulations

Considering that JFM already covers over 13 percent of the recorded forest area of the country and the area is likely to increase even more in the future, attempt should be made to include biodiversity conservation as one of the explicit objectives of the JFM programme.

There is also the need to explore the link between biodiversity conservation and long term sustainability of JFM. An attempt should be made to quantify the biodiversity linked benefits to the communities participating in JFM and these should be compared to the benefits from timber which are often considered as the main benefit to the community from the JFM programme.

In addition, the Amended Guidelines suggested in Section 6.3.4 may also be considered by NBSAP.

6.4.2: Strategy / Action Plan on Indigenous Medicinal System

Under the NBSAP process, several newer directions of actions and strategies are required now. Some of the major ones are listed here.

I. There is an urgent need to estimate the overall impact of the ayurvedic and cosmetic industry on the country's biodiversity. The rates of extraction of herbal and medicinal plants and wild animals from herbal gardens, forest and glacier areas be linked to domestic ayurvedic and cosmetic industries' requirements and for exporting. The growth of domestic demand pattern also be assessed. There is also a need to involve the industry along with Forest Department, NGOs, communities and others in ensuring this process of NBSAP.

II. A comprehensive study needs to be undertaken on the economic impact of *ayurvedic* industry on biodiversity conservation (using green accounting principles).

III. A forum to bring together industry, Forest Department, NGOs and others needs to be established. They should deliberate upon the matters such as rates of extraction, federating on processing standards and management, pricing system etc.

IV. Ways of encouraging sustainable management, harvest and utilisation of *ayurvedic* herbs need to be explored e.g. application of market-based instruments (MBIs) or Criteria and Indicator (C&I) process for sustainable forest management. At present, the industry is depending mainly on herbal gardens owned by ayurvedic forms for their supply of raw materials. But it remains a fact they can not substitute the rich reservoir of medicinal plants in the forest area. This is because of richness of the forest wild plants and due to scarcity of land for garden based herbal plantations.

V. The proposed National Biodiversity Legislation should distinguish between 'corporates', 'associates' and the 'trusts' in the matter of access to biological resources. Secondly, it should distinguish traditional from non-traditional bio-utilisation systems. Finally, the legislation should distinguish different intermediaries and collectors of medicinal plants from forests. Sale of such products by cooperatives such as Girijan Co-operatives and other federations should not be equated with private contractors and middlemen of drug companies. Accordingly, 'prior intimation' provision of clause 7 of the proposed Biodiversity Legislation Bill should not apply to the former. Furthermore, the question of them being subjected to producing 'legally procured certificates' prior to transacting the raw materials to the Ayurvedic industry directly be examined again.

C H A P T E R - S E V E N

GAPS IN ECONOMIC APPROACH TO BIODIVERSITY CONSERVATION

7.1: Preamble

The purpose of this chapter is essentially to draw the major limitations in the present day levels of understandings and applications from economic thinking and approaches. The gaps are grouped as (i) essentially internal to economic models (such as consistency) and approaches, (ii) gaps in the levels of understanding about economics among the various stake

holders, and (iii) boundaries of economic approaches requiring multi-disciplinary approaches.

7.2: Missing the stake holders in a market approach

As was discussed in detail in chapter six, the stakeholders in biodiversity conservation are coming from heterogeneous groups of people and animals. The stakeholders can be broadly distinguished as *beneficiaries* and *enablers or benevolent citizens*. Even among the beneficiaries the perceptions and stakes are different. The local, regional, national and global perceptions differ significantly (see chapter six, section 6.2). The enablers' motivations and interests are never clearly understood by the beneficiaries and vice-versa (see chapter three, section 3.6). Hence it is a kind of game that goes on between them (apart from the kinds of game that goes on between beneficiaries themselves).

At all stages of handling of biodiversity resources, be it at local collections, at the processing stages in enterprises, or at the export levels, the 'market' does not distinguish between the stakeholders backed up by different perceptions. With pure profit motivation the exploitation of the locals, traditional breeders, and indigeneous people is obvious. Therefore, economic models based on 'market' approaches are not the best for managing biodiversity resources. Therefore, at the levels of WTO, national policy making level (say at MoEF level) and at the corporate sectoral levels some re-thinking has to go on to bridge the gaps in understanding between the stakeholders.

Take the case of budgetary allocation for biodiversity conservation. This is treated purely as a state subject, which is conceptually wrong. Corporate sectors can also take part on this, as much as bilateral donors and multi-national companies under Activities Implemented Jointly (AIJ) and Clean Development Methods (CDMs). Even the local communities should be made responsible to own the responsibilities in implementing the budgetary allocations.

Take another example of price formulations and sharing the benefits. This is an important exercise to be carried out between all the stakeholders, be they the local collectors or users, regional traders, multinationals and exporters. The government has also to play its positive role in price negotiations, in setting up of floor prices, in setting up of cooperatives and training institutions regarding processing and pricing.

One also comes across considerable amount of mis-trust between different stakeholders: between NGOs and corporate sector; between policy makers and implementers; between the local and government departments and so on. There is a need to bridge this gap through joint training camps for all such concerned people.

7.3: Missing perfect methods of ecological valuation

The importance of ecological values has already been stressed in chapter four. To the extent, the 'market' is used as an institution to generate the signals about values, there are some limitations in valuation of ecological resources. As argued earlier in chapters three and four, value and price can be two different things. The policy maker is perhaps looking for price and not value. The people and ecologists in generally are looking for value. Secondly, even if an enlightened policy maker is interested in values, there are problems of integrating such values with other economic prices. Some of these problems are highlighted here.

7.3.1: The Institutional Mechanism

One of the greatest problems in valuation of biological resources has been the availability of data in a format that can be used for analysis and later for the valuation. In fact most of the problems have arisen because of non-availability of data with economist, which authenticated and vetted by the ecologists. In this connection what also needs to be mentioned is the time period required to collect and collate the data on biological systems. However, in view of the methodology, it is suggested that a number of data types can be made available in a year's time frame for a region, which will provide a first rate picture of the status of the biological resources. There are limitations in this process, but at least one can have a reasonably good idea about ecosystem and its health. Remote sensing data on forests coupled with sampled ground truthing and Geographic Information System can provide much needed data on forest types, forest cover, density classes at much faster rates. By using conventional experimental data and equations productivity data also can be had for the purpose.

It is proposed that such data can be collected at each district or state headquarter through a properly trained statistical officer, who in turn would supply all the data on land use

and all the above parameters. These Statistical Officers need to undergo training and capacity building in these areas, which should not be difficult because expertise in generation of data is available with various institutions in this country.

7.3.2: The Rider

It needs to be mentioned that biodiversity valuation is not even in its infancy and there are pitfalls and resistance, as always are, in a new subject. Some important points that need to be borne in mind before the valuation of biological resources is oversimplified. But, it surely needs to be simplified.

I. There are no uniform processes across board in ecology/biology that can be fitted into a single equation.
II. Irregularity and specificity of processes and patterns is an integral part of living world;
III. Biodiversity is not a renewable commodity, as very often referred to in literature, as water is. The death of an individual causes a loss that cannot be renewed by planting another tree/plant of same type or species;
IV. We must emphasise on the in situ functional aspects of biological diversity as against the harvested values followed in economics;
V. There is a need to value interactive processes of ecosystems as against individual contributions, like timber or medicinal plants, etc.;
VI. It must be borne in mind that biological world operates at space time scales varying between a millionth second to million of years, therefore, species-population extinctions is not a minor event;

VII.

VIII.

IX.

X. In ecological economics b
iodiversity should be treated as (revenue) productivity instead of conservational liability and a source of expenditure.

7.4: Gap between research and practice

Economic theory and models are much well developed to deal with a variety of socio-economic problems. But generally the problems faced are at the stage of their applications. Take an example of applying Pigovian tax principles for pollution abatement. Given the data gaps, imperfect information and market situations, extra-market issues such as location, infancy and nationalism etc., it is some times difficult to apply the optimum tax-subsidy principles. Then, there are alternative tax-standard approaches or community managed treatment plants (CETPs) etc. To that extent, other than 'polluter pay' principle, 'polluter participation' principle may be practical.

Another issue here is about the gap between research and training. Not all the developments in the economic spheres are translated in to practice. An example can be that of cost benefit analysis. Quite often it is mis-understood than understood about the applicability of this techniques. If applied with all the imputations of social costs and benefits, with shadow prices etc., it is still a useful tool in decision-making. Most often, only the tangible benefits and costs are valued, leaving a host of others for guessing. Such a partial analysis of cost-benefit can be misleading. But proper training for the practitioners of such tools as well as the affected people will be useful.

One can give many more examples. Take the valuation techniques. Quite often, in the eager of applying the techniques, one may end up with the problem of double counting (referred in chapter four). The use of these valuation techniques, avoiding the double counting, and also working with non-monetised values along with monetised values requires lots of training of the concerned evaluators.

7.5: Crossing the boundaries:

One major gap in the economic approach is the missing inter-disciplinary approach. The chapters five and six clearly underline the need for such a collective approach rather than,

any unilaterally taken economic approach. The major reasons for an integrated approach are:

I. It allows for greater scope for appreciating originality in the questions asked and methodologies to be used, and to allow a more unified research methodology;
II. The accuracy and applicability of such an approach is higher;
III. The assumptions made under economic models can be crossed checked;
IV. The approach is more appealing to policy makers.

But such an inter-disciplinary approach to manage biodiversity is not easy to come by. The university education system (acting as barriers), the system of journal reporting (restricting too much to disciplines rather than inter-disciplines), the shyness and hesitations on the part of scientists and social scientists, all have to change.

CHAPTER EIGHT

ACTION PLAN AND STRATEGIES FOR NBSAP

8.1: Actions towards bridging the gaps and setting the NBSAP process going

This chapter is developed with the intention of high lighting the major steps involved in the NBSAP process towards the issues raised in this report on Economics and Valuation of Biodiversity. On the basis of the available methods and tools of environmental economics (dealt in chapters three and four) and also taking the stock of experience in implementing the biodiversity conservation and prioritization programme in the country and elsewhere (dealt in chapters five and six), the action plans developed here are basically addressed to the economic and social science approaches only. Broadly speaking they can be grouped as:

I. Macro-economic, international, inter-governmental Actions,
II. Sector specific Actions, and
III. Social Actions and Programmes

As far as the gaps mentioned in chapter seven are concerned, they also require specific action plans and programmes. The specific Actions required in bridging the gaps are:

A. **Developing data system** to bring the ecological and economic approaches of valuation together. This has been dealt extensively in Chapter four, section 4.3. Use of the GIS, and satellite information systems together with greater transparency in the existing ground level data from the official machineries (e.g., Forest departments, Soil conservation departments, Revenue departments) can make it possible. Central Statistical Organisation apart, other agencies outside of the government should be made responsible to develop such data banks and disseminate regularly.

B. When it comes to biodiversity resources, **use of appropriate valuation technique** is most important. For this, the users of the biodiversity resources and the promoters should come together and develop the techniques and parameters of valuation (e.g., land productivity, values of soil conservation, watershed development or wetland development etc.,). This requires a national scheme of research, training, and re-training for ecologists, social scientists, donor agencies, and policy makers. This

Working Group strongly recommends establishing one such system in any well established national and regional level institutions.

C. Equally important is to make the whole approach **multi-disciplinary, and multiple agency oriented**, bringing all the stakeholders together. This is where, the government, corporate sector, donor agencies, scientists and social scientists have to work with the local communities.

With this briefly mentioned broad approaches, the details are mentioned in the following sections.

8.2: On the external front: WTO, IPRs and TRIPs

As one reads between the lines of the WTO resolutions, there is not much to fear about any adverse effects of the regulations on Indian Biodiversity conservation. But several inconsistencies in its implementation need to be looked in to by the NBSAP process.

1. As per the Agreement on Agriculture in WTO, and with the passing of Plant Variety Protection and Farmers' Rights Bill in Indian Parliament, a share of profits made from the new variety goes, on behalf of the communities, into a National Gene Fund. But it is very much poorly and incompletely written (Section 46 (2) d). The Gene Fund should be the recipient of all revenues payable to the farming communities under various heads. The use of the money should not be restricted to conservation or for maintaining ex situ collections. That would mean that the revenue generated from the use of farmer varieties would partly be used to maintain the National Gene Bank.

2. The attempt at global standardisation and uniformity by way of TRIPs agreement is in conflict with the main thrust of the Rio Earth Summit of 1992 that set out the conditions for sustainable development. These two reveal two contrasting types of international approaches and norms. While the 1992 Earth Summit and the 1993 convention on bio-diversity (CBD) focused on 'diversity' as being fundamental to sustain life and development, TRIPs and WTO are pushing for 'conformity' to international standardised norms on patents, services, labour, investment and what not, irrespective of their history, ecology, level of economic development, etc (WCED, 1990). The areas of intellectual property that the TRIPS agreement covers are: copy right and related rights; trademarks including service marks; geographical

indications including appellations of origin; industrial designs; patents including the protection of new varieties of plants; the layout-designs of integrated circuits and undisclosed knowledge including trade secrets and test data. There is the need for perfect transparency in the patent and TRIP regulations down to the farmer levels.

8.3: Actions On Government Budget Allocation:

Government Budget allocation for the Ministry of Environment and Forests is at present a mixed bag. It is at present driven by anthropogenic activities and not by biodiversity resources, relevant areas and activities. For this purpose, the biodiversity related areas as shown in Chapter three (Box 3.1) can be used. In order to work out the specific rates of resource allocation for various components, an Expert Group may have to go in to these. The degree of criticality of these areas, the livelihood dependency on them, the long term sustainability of those resources etc., will have to be used as the relevant criteria. Budget allocation can be based on (i) research and development, (ii) for protection and conservation, (iii) for promotion and awareness, (iv) for short term and long term planning etc.

Apart from these criteria of biodiversity areas, the number of species of different animal and plant life can also be considered in making the allocation of resources. After all, under the plans, resource allocations are normally done on the basis of population. Then why not also on the basis of biodiversity? In Chapter three (Box 3.2) a broad categorization of such numbers are shown. These need to be looked in to by an Expert Group to work out the requisite resource allocations.

Till such time such a formula is worked out, the present Thematic Working Group recommends maintaining a 3% share of total revenue expenditure and another 3% share in capital expenditure exclusively for natural resource development in the states. At the MoEF level, at least 6% of GDP be allocated for all activities including biodiversity, and 3% exclusively fro forestry and wildlife preservation.

8.4: Sharing the Responsibility on Resource Allocation:

The responsibility of resource mobilization is not only with the government but also lies with the corporate sector, external donor sector and public at large. This sharing mechanism also needs to be fully understood and worked out at least once in five years. The same Expert Group mentioned above also can look in this aspect to. Finally, there is the question of introducing proper market based instruments to regulate the use of biodiversity related resources. Specifically in the area of water resource management, use of forest resources, and marine resources, the types of market-based instruments would differ. Separate studies are required to be carried out on this issue of appropriate instruments, to look in to who gains and who loses from such market based instruments.

8.5: Action Oriented Role for the Corporate sector

It is vital that the corporate sector should actively participate in biodiversity conservation initiatives by accepting responsible roles in implementing and managing various conservation and sustainable use programmes. A key entry point for corporate sector is through the country's national biodiversity planning process where its knowledge and expertise can be utilized effectively. It would also help corporate sector as its legitimate interests would be represented in the development of government polices and programs, guidelines and other management tools. Conservation of biodiversity should be at the heart of the company's management strategy. This means, it should help to try to retain natural areas wherever possible, to restore degraded areas and to harvest resources sustainably. It should also respect and support the livelihoods and rights of communities dependent on biodiversity, and promote cultural diversity and values relevant to biodiversity. In fact, the companies may develop a formal biodiversity policy or incorporate biodiversity into its existing environmental policies. A stress on labour-intensive methods would be one step in this. Biodiversity strategy and policies of individual companies should reflect or recognize the national biodiversity strategy, and should adhere strictly to existing and proposed laws on wildlife and biodiversity. They should keep abreast of the discussions and developments relating to national guidelines for incentive measures, biosafety, equitable benefit-sharing, intellectual property rights, monitoring of biodiversity indicators and other related topics.

In light of the above, it is proposed that corporate sector may be involved in a two-way process in the NBSAP: to provide inputs into the process, and to learn from it to imbibe and integrate biodiversity concerns into corporate attitudes, programmes and policies. This can be attained in one or the other ways listed below:

I. As part of the action plan, the corporate sector will have to act together with the farmers on at least two counts. First, they will have to get to the business of investing on 'seed development and supply of infrastructure'; second, they should enter in to a clearly defined ' buy back system, ensuring the right price.
II. They should interact closely with the state and central governments to pickup the threads hand in hand to promote biodiversity conservation. Financial resource pooling is one such approach. This is a matter of sharing responsibility in financing biodiversity conservation between the corporate sector state and central government, a process initiated by CII already.
III. Corporate sector can develop in-house biodiversity policies and strategies to manage the biological resources and also respect the concerns of local communities and other stakeholders. Methods for education and training to instill a biodiversity conscious culture within company management should be explored. An example is that of TVS Suzuki cited in Chapter three.
IV. They can share information, knowledge and practices with the local communities (lessons from examples such as the benefit-sharing arrangement between the Kani tribe, the Tropical Botanic Garden Research Institute, and the Arya Vaidya Pharmacy Ltd, to develop a herbal drug based on adivasi knowledge, can be learnt from).
V. They should adopt measures, which ensure sustainable use of biological resources. The measures may be explored for the moral responsibility of corporate sector going beyond monetary and material consideration such as respecting the sanctity of critical natural habitats and threatened species.
VI. They should create awareness regarding the need for appropriate intellectual rights regimes, respecting the knowledge, innovations and practices of indigenous and local communities and ensuring that collection and use of biological and genetic resources is done within a framework/guidelines of such respect.
VII. Engage in active partnership amongst corporate sector, research institutions and

biodiversity conservation organizations as well as with the general public and with local communities for the management of important species and ecosystems. In this, the corporate sector needs to accept the guidance of biodiversity specialists and local communities. The research collaborations should be encouraged to have appropriate financial agreements, training of/by scientists, and transfer of appropriate technologies.

VIII. Instituting incentives and awards for members of the corporate sector who adhere to a definition of "progressive" in terms of being biodiversity-friendly and respectful of local community livelihood rights.

8.6: Action at the Fiscal and monetary Policy levels: On Market based instruments

In practice, neither the economic instruments alone nor the command and control measures alone feasible in abating environmental degradation. A hybrid approach is feasible. Fixation of pollution standards (MINAS) apriori by Pollution Control Boards and using either pollution tax or marketable permits instrument to induce the polluter industry to meet those standards is a hybrid method using regulatory and economic instruments.

A community based method is yet another alternative. Under this approach, producers can pool their pollution loads and share to establish a combined effluent treatment plant and manage the pollution complying with the regulations at a minimum cost. This type of CETP has been established by now in the textile, leather sectors in certain states in India (e.g., in Tirpur for textiles, in several places in Tamil Nadu for tanneries).

In India at present, no major innovations on the market based or the hybrid approach are implemented. The community approach however has been introduced on an experimental basis in sectors such as textile, chemicals, and leather manufacturing. It is time that a separate Expert Group is established to go into the feasibilities of the various market based approaches, sector by sector, and come up with recommendations on their introductions and action plans.

8.7: Action on pricing policies

One can cite hundreds of case studies to elaborate the point that the pricing system for most of the biodiversity products does not function well (including the cereal crops and some non-cereal crops whose prices are regulated by the Commission on Agricultural Costs and Prices of the Ministry of Agriculture). Under the NBSAP process it is intended to reduce such gaps and margins between the collectors' price and the market price. One can give four reasons for this:

I. First, for the collectors and local communities it should be an empowerment and income avenue,
II. Second, even the local communities should realize its true worth or value,
III. Third, the gains from the natural resource extraction and use should by and large be based on in-situ distributional benefits,
IV. Fourth, it should be corrective for sustainable rates extractions (based on the concept of carrying capacity), proper use of land and water resources and ecological conservation.

8.8: Strategy and Action Plan on Valuation

The following can be some of the major recommendations for the NBSAP process based on the methodology of Valuation and the experience widely presented in Chapters four and five).

Studies on economic valuation of various ecological functions of biodiversity should be encouraged. The comparison of values estimated from various sites/areas has to be done with caution. The gap as in this connection is mentioned in Chapter seven.

There should be more research on methodologies for estimating non-use values in India.

The MoEF should initiate to bring out a publication on rapid and cost effective valuation methodologies for valuing biodiversity.

The economic benefits of biodiversity enjoyed by the private sector companies including MNCs require special attention and there should be some mechanism to capture a portion of these benefits for investing biodiversity conservation programmes.

A Social Science based research institution be identified by MoEF, which can undertake studies on valuation on a continual basis, almost on the lines of EIA for project clearance. The institution can also conduct regular training programmes on this and also act as a platform for scientists and social scientists come together regularly to discuss the methodological improvements.

Some of the specific actions required in valuation are:

I. For assessing ecological losses, the structure of the forest ecosystem is to be estimated by three main ecological attributes viz. Importance value Index (IVI), population dynamics and species diversity where as the functioning of the ecosystem is to be ascertained with the help of bio mass studies, litter fall and transfer of mineral within the various biotic and abiotic compartments of the ecosystem.

II. All the forest types, as classified by Champion and Seth (1968) be identified. The major ecological function(s) that a particular forest type is performing at the particular site be identified. Having identified the major ecological function(s) the appropriate methodology of valuation be identified and demonstrated.

III. Specific attempts be made to bridge the data gaps (referred in Chapter seven).

IV. Precisely developed model studies of ecological valuation be developed (to explain the problems of double counting, problems of benefit transfer methods, contingent valuation method, cost benefit analysis etc.).

8.9: Action/Strategies on Natural Resource Accounting.

As presented in Chapter four and five, the progress on this at the national scale is very much limited. Only for some selected regions (e.g., Yamuna basin) or states (e.g., Goa) attempts are made in this direction. The implementation of an NRA at the national and state levels is the responsibility of respective Statistical organisation and Directorates of Economics and Statistics. Some of the lessons fro the on-going exercises are listed here for further actions.

I. First, the data base requirements for Natural Resource Accounting are quite high. Central Statistical Organisation should have a separate wing to collect the necessary data exclusively for natural resource accountings.
II. Second, more and more studies on valuation be built-in the NBSAP process to address to aspects such as depletion, degradation, preservation, inter-generational values, dose-responses etc.
III. Third, the National Sample Survey, having engaged in a survey of environmental status (e.g., common property resources in NSS 50th Round) of the economy, together with demographic and health status data from various other sources can be used to develop some of the parameters for NRA.
IV. Fourth, environmental economists and statisticians should continue to demonstrate the possibilities to adjust the domestic products for all the natural resource related issues, some of which may not directly appear in the traditional income accountings (e.g., biodiversity). Certainly, a long way to go further before a complete SEEA is available for policy planning for India.

8.10: Strategy/ Actions on Indian medicinal systems

********NEW*******

Under the NBSAP process of policy formulation, several newer directions of actions and strategies are required now. Some of the major ones are listed here.

I. There is an urgent need to estimate the overall impact of the ayurvedic and cosmetic industry on the country's biodiversity. The rates of extraction of herbal and medicinal

plants and wild animals from herbal gardens, wetlands, grasslands, forest and glacier areas be linked to domestic ayurvedic and cosmetic industries' requirements and for exporting. The growth of domestic demand pattern also be assessed. There is a need for mandatory disclosure of sources, quantity, methods of extraction of medicinal plants by each company, as also the terms under which the local people are employed for the extraction. Also to involve the industry along with Forest Department, NGOs, communities and others in ensuring this process of NBSAP policy formulation.

II. A comprehensive study needs to be undertaken on the economic impact of *ayurvedic* industry on biodiversity conservation (using green accounting principles).

III. A forum to bring together industry, Forest Department, NGOs and others needs to be established. They should deliberate upon the matters such as rates of extraction, federating on processing standards and management, pricing system etc. The National Medicinal Plants Board or National Bio-resources Board can act as such a forum. The latter can regulate export of medicinal palnts and products.

IV. Ways of encouraging sustainable management, harvest and utilisation of *ayurvedic* herbs need to be explored e.g. application of market-based instruments (MBIs) or Criteria and Indicator (C&I) process for sustainable forest management. At present, the industry is depending mainly on herbal gardens owned by *aurvedic* forms for their supply of raw materials. But it remains a fact they can not substitute the rich reservoir of medicinal plants in the forest area. This is because of richness of the forest wild plants and due to scarcity of land for garden based herbal plantations.

V. The proposed National Biodiversity Legislation should distinguish between 'corporates', 'associates' and the 'trusts' in the matter of access to biological resources. Secondly, it should distinguish traditional from non-traditional bio-utilisation systems. Finally, the legislation should distinguish different intermediaries and collectors of medicinal plants from forests. Sale of such products by cooperatives such as Girijan Co-operatives and other federations should not be equated with private contractors and middlemen of drug companies. Accordingly, 'prior intimation' provision of clause 7 of the proposed Biodiversity Legislation Bill should not apply to the former. Furthermore, the question of them being subjected to producing 'legally procured certificates' prior to transacting the raw materials to the Ayurvedic industry directly be examined again.

8.11: Strategy/Action regarding Joint Forest management

Considering that JFM already covers over 13 percent of the recorded forest area of the country and the area is likely to increase even more in the future, attempt should be made to include biodiversity conservation as one of the explicit objectives of the JFM programme. Some of the major actions needed are:

I. There is also the need to explore the link between biodiversity conservation and long term sustainability of JFM. An attempt should be made to quantify the biodiversity linked benefits to the communities participating in JFM and these should be compared to the benefits from timber which are often considered as the main benefit to the community from the JFM programme.

II. There are a large number of studies on the performance of JFMs all over the country. Findings from these studies should be widely publicised. The biodiversity issues and concerns need to be introduced and discussed in JFM related forums such as the National JFM Network and regional networks.

III. The JFM Cell within the MoEF should issue guidelines mentioning biodiversity conservation as one of the explicit objective of JFM.

IV. The economic benefits (and costs) of biodiversity conservation should be discussed with the community at the time of micro-plan preparation and biodiversity conservation strategy should also be included in the micro-plan. Instead of using the standard Cost-Benefit Analysis, Stakeholder and Multi-criterion Analysis are to be introduced in the NBSAP process.

V. Training programmes on alternative economic valuation methods should be organised for the officials of the Forest Department as well as NGOs active in the field of JFM.

VI. An attempt should be made to get the biodiversity concerns included in the large forestry projects that focus on JFM, especially at the time of their formulation. Periodic meetings should be organised with the main donor agencies supporting JFM.

Since a new guideline for JFM is under preparation, possible modifications on the existing ones are listed.

New Guidelines and Suggestions to Amend

Feature as in the new guidelines	Suggested amendments
Providing legal status to JFM committees: The guidelines stress the necessity for the state governments to register the Village Forest Committees (VFC) under the Societies Registration Act, 1960, to provide legal back up.	VFC's can also be registered under any local act or rules, but no restriction that they need a clearance from the Conservator of Forests. Instead a MoU should be signed between the forest department and the JFM Committee, clearly empowering the VFC.
Increased participation of women in the programme : Recognising the need to involve all sections of the community, particularly women, it is suggested that the general body should consist of 50% women members, and the Executive Committee, at least 33%.	All the VFC members should be given Identity Cards, to book the offenders. They should be involved in processing of NTFP products and marketing.
Extension of JFM to less degraded areas: Identifying the need to involve people even in less degraded areas, the guidelines suggest that forest areas with >40% crown density could also be brought under JFM. In these areas, the major emphasis will be given to NTFP management and harvesting of timber will be based on the forest working plans. The share of profit from sale proceeds of timber in such forests depends on the involvement of people in forest protection and regeneration.	Some capacity building among the VFC's is required in understanding the so called Working Plan, life styles and livelihood basics, control of grazing, NTFP management, use of indigeneous knowledge, training in fire prevention, NTFP processing, storage and marketing, even some exposure to GIS based information will be relevant. A seed money on these activities be transferred to the VFC's.
Micro-plan for JFM areas : Local people, along with forest officials, should prepare the micro-plan in consultation with all the user groups in the village. Adequate importance should be given to each user group, promotion of marketing links and the local industries, based on the production potential of the land and environmental and biodiversity functions.	Training on this must be made compulsory. This be done jointly with the Panchayats, so that the conflicts between them are minimized.

Recognising the self-initiated forest protection groups : The feature gives legitimacy to and recognises the efforts of local self-help groups, which had come into being voluntarily, without any official assistance.	Such members should be given a Green Card of recognizing their role.
Contribution for regeneration of resources : From the profit accrued to the FPC, it was decided that 25% of the share of the village community be kept aside to meet conservation and development needs of the forest. A matching grant was to be provided by the Forest Department from its share. Further, it suggested that a transparent mechanism be developed to compute the income and benefit sharing between different stakeholders.	As is being done in several villages under *Chakriya Vikas Pranali* in Palamau district of Jharkhand, a bank account be opened exclusively to deposit the Village Development Fund.

Follow up and Conclusions

Yet to write**********

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