

# SECTION V

## 6 REVIEWERS' GUIDE

Biodiversity inclusive assessments belong to a relatively new subject of concerns in EIA and have universally been found to be weak (Treweek *et al.*, 1993; Thomson *et al.*, 1997; Warnken & Buckley, 1998; Atkinson *et al.*, 2000; Byron *et al.*, 2000; Gray & Edward-Jones, 2003). The quality of EIAs is particularly weak both in terms of rigour, and coverage given to biodiversity issues in most South Asian countries.

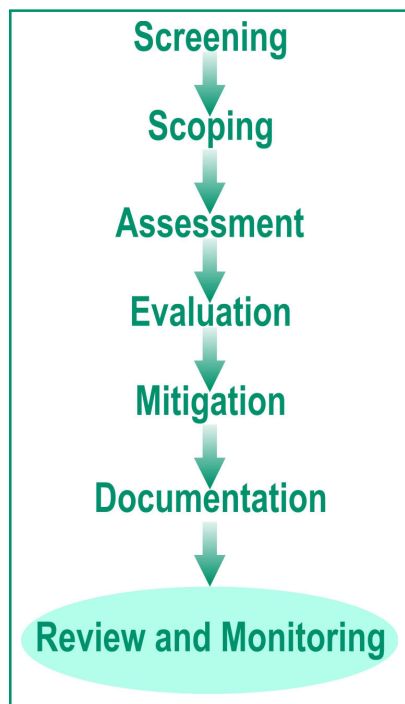
The more obvious reason of neglect of biodiversity in many EIA reports is the priority given to promoting development in key sectors to overcome poverty in South Asia and improve economic well being. Consequently, projects that are considered to be of national, political and strategic importance, often override consideration of potential negative impacts on biodiversity. Further, when locations of such priority project tend to overlap with ecologically important areas, biodiversity issues are consciously underplayed in EIA reports to prevent these issues become barriers to development.

Another ethical factor that invariably influences the quality of biodiversity related information in the EIA documents is the negotiation of costs between EIA consultants and the project proponent. Driven by the motive of making larger profits, some consultants tend to speed up EIA by avoiding field based studies targeted for generating biodiversity specific baselines and rely more on non specific secondary information. Attempts to speed up EIAs also lead to incompatibility of timelines with seasonality of the biodiversity surveys resulting in serious neglect of biodiversity issues.

The current experience of EIA reviews in South Asia identify concentration of assessments only around protected species and habitats, lack of formalized procedures for review, and capacity constraints as other significant factors contributing to the overall poor quality of EIA reports.

The purpose of review of the environmental impact statement is to ensure that the information for decision-makers is focused on the key issues, is scientifically accurate and technically defensible, and comprehensive to include biodiversity viewpoint based on relevant standards and policies where these exist, or based on good practice where official standards do not exist. Reviewers must have adequate skills and competence to review the quality of EIA reports for enforcing checks and balances before decisions are based on such reports.

This section of the document aims to provide generic guidance on mechanisms for harmonizing the process of EIA review in South Asia for better reflection of biodiversity issues in decision-making and to build capacity for improving professional standing of the reviewers for delivering review outputs more responsibly.



## 6.1 Review of EIA

The review of the quality of an EIA report is a formal step in the EIA process to ensure that the EIA is consistent with accepted standards of good practice for credible decision-making purposes.

### 6.1.1 Relevance of mainstreaming biodiversity in review process

While the early sections (I to III) of this guidance document reiterated the importance of biodiversity conservation and stressed upon the recognition of linkages between socio-economic development, environmental degradation and biodiversity, Section IV (Practitioners' guide) laid emphasis on the relevance of mainstreaming biodiversity in impact assessment and provided a step by step guidance on how to use EIA as a mainstreaming tool for biodiversity. It is ultimately the

effectiveness of a review process that can ensure the efficacy of recommended checks and balances. The outputs of a good review can determine if (i) biodiversity is sufficiently and appropriately integrated in environmental planning and implementation of effective mitigation and (ii) if the results of biodiversity assessment will be able to contribute to balanced decision-making. Case examples from the region (Box 60) demonstrate the reviews have helped in reviewing decisions, reconsideration of issues that were neglected earlier and in identification of the need for additional studies.

#### BOX 60 Role of EIA reviews in decision-making

In the Lionvert oil refinery and power generation project in Sri Lanka, the site selected was in the buffer zone of Muthurajawela marsh, which had been designated for recreational activities under the master plan passed by the cabinet. However the EIA consultant completely overlooked this key issue, resulting in two consecutive EIA reports being prepared for the same project to incorporate the assessment of impacts on marshland ecosystem (Kodituwakku, 2004).

Arun III Hydroelectric project was the biggest project proposed for meeting the domestic power needs of Nepal. It was due for implementation in 1994 with the World Bank as the major financing agency. The project, however, came under criticism by local and some western, NGOs and individuals as being risky, costly and liable to bring about severe environmental and social impacts. The environmental impact assessment (EIA) carried out for the project failed to provide systematic information on sustainability necessary for making decision on the project. Consequently the project was dropped on institutional, national, economic and financial (Chetry, 2002).

In 1988, as part of the feasibility study for the project, EIA of 4,800 m long four-lane Jamuna Multipurpose Bridge project was done by the Govt. of Bangladesh in collaboration with the World Bank and UNDP. The major issues identified were: land acquisition and involuntary resettlement; pollution of soil, surface water, ground water and air; impacts on natural vegetation, wildlife, fisheries and agriculture; and impact on navigation; socio-economic impacts. The EIA study suggested a number of mitigation measures formulated in 1994. The issue of resettlement though important was still not included under earlier studies and the additional studies. Finally, a Rehabilitation Action Plan (RAP) was formulated by a supplementary study under pressure from the funding agency (Ahammed & Harvey, 2004).

In India, invariably for all projects falling within ecologically sensitive area, stand alone and more focused biodiversity assessment are necessitated. These reports supplement the information in the initial EIA reports which are generally deficient in the treatment of biodiversity related information.

### 6.1.2 The review process

Most countries have legal frameworks for EIA and guidelines in place for conducting review and although there is some variance in review requirements and process in different countries in the region (Table 20), the key objective of the review in all the countries is essentially to ensure the following:

- i. Completeness and conformity with the ToR for the EIA.
- ii. Accuracy and veracity as defined by general acceptable scientific criteria (for example, quality assurance and quality control procedures for analysis of sampling data) and use of acceptable methods for the assessment of environmental impacts.
- iii. Clarity of description of environmental impacts, recommended mitigation measures, environmental monitoring plan and environmental management plan.

**Table 20** Existing institutional arrangement for review of project proposals in different countries

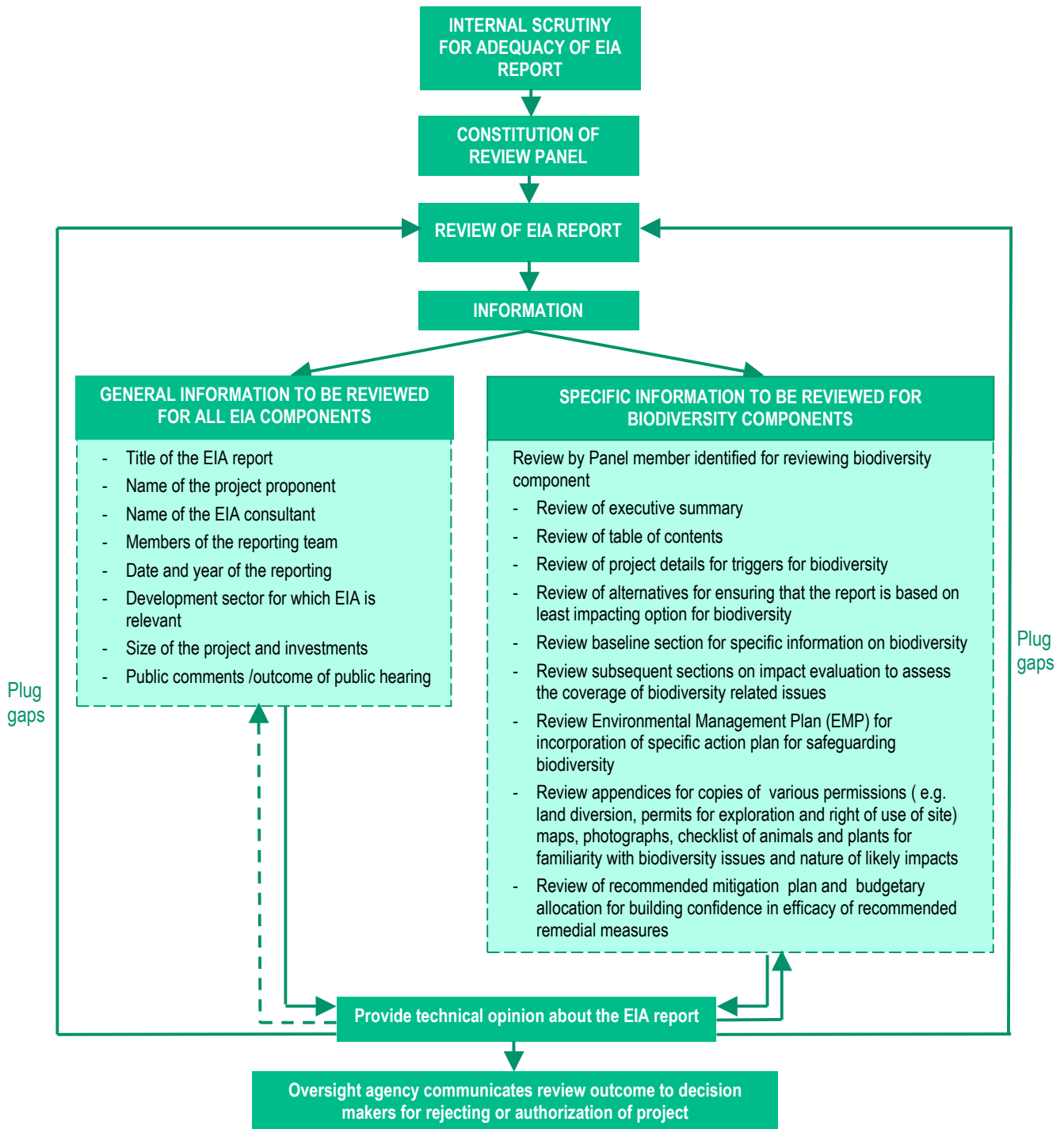
Country	Main oversight agency	Responsibility of preparing EIA	Review responsibility	Mandate and function of the EIA review panel	Review conditions	Responsibility of communicating review results
Bangladesh	Department of Environment	Project proponent	Technical committee constituted by Department of Environment, headed by Director (Technical) and comprising of Deputy Director (Enforcement), Deputy Director (Research), Joint Director (Biodiversity) and Project Coordinator	Preparation of guidelines for conducting EIA and post project monitoring plan. Conduct environmental screening for deciding the requirement of Initial Environmental Examination (IEE) or EIA. Review (IEE) and EIA reports for environmental clearance	The Director General has discretionary power to exempt proponent from obtaining location clearance.	Director General accords approval and issues directive to respective Divisional Office to issue environmental clearance certificate
India	Ministry of Environment and Forests, Govt. of India	Project proponent through engagement of consultants	Expert Appraisal Committee comprising of up to 15 expert members and headed by a chairperson For 'A' category projects the Expert Appraisal Committee is constituted by the Ministry of Environment and Forests, Govt. of India for different sectors.	Determine Terms of Reference for preparation of EIA reports Conduct inspection of sites where necessary Meet at least once in a month Make final decision of proposed project or activity	For category 'A' projects and B1 projects, the Appraisal Expert Committees prepare ToR for EIA within 60 days of the receipt of application and pre-feasibility report and make recommendations within 60 days of the receipt of EIA. For B2 projects, SEIAA conveys its decision to the applicant within 60 days of the receipt of the application.	Central government in the Ministry of Environment and Forests (for category 'A' projects) and State Environment Impact Assessment Authority (for Category 'B' projects) process the communication of review outcome

			For 'B' category projects, State (or Union territory) Environment Impact Assessment Authority (SEIAA) is constituted by central government in consultation with state level administrative authority.		Based on the review, decisions must be communicated to project proponent within 45 days after receiving the recommendations from the review panel	
Nepal	Ministry of Environment, Govt. of Nepal		EIA review and approval committee of the Ministry of Environment which is headed by the Chairman and has representatives from sectoral ministries	provide EIA clearance unconditionally disapprove EIA clearance, provide EIA clearance with condition, return the file with necessary instructions	Right to hearing to the proponent of the project before rejection of EIA clearance, Decision should be given in writing and backed by reasons in the case of rejection. A person involved in EIA study should not participate in the review.	
Pakistan	Pakistan Environmental Protection Agency and Provincial Environmental Protection Agency	Project proponent through consultants	EPA constitutes committee of experts from accredited institutions (Govt. and NGOs)	Advisory role	Conduct review of the IEE within 45 days and of the EIA within 90 days of issue of confirmation of completeness. The review panel may also solicit views of the sectoral Advisory Committee. Director-General may, constitute a committee to inspect the site of the project if necessary and submit its report on such matters as may be specified.	Director General, EPA communicates the result
Sri Lanka	Central Environment Authority, Coast Conservation Department, Northwest Province Environment Authority	Project proponent through consultant	Oversight Agency through Technical Evaluation Committees (TECs) which are project specific	Prima-facie adequacy checking by CEA. Provide independent review of the EIA report for the technical content	Meetings of TEC are convened as needed. Public consultation is a must and one month period is stipulated for inviting public comments	CEA

Source: Ahammed & Harvey (2004); GoP (2000); GoP (1997); MoE&F (2006); CEA (1995)

### 6.1.3 Good practice guidance for review of biodiversity inclusive EIAs

The basic framework (Figure 19) for the review procedures for promoting 'biodiversity driven' decision-making is adapted from the more generic framework (Lee & Colley, 1992; European Commission, 1994; VROM, 1994) developed for review of EIAs and incorporates specific process requirement and information needs based on the practical experience of EIA professionals from India and other countries in the region.



**Figure 19** Framework for review of EIA reports for integration of biodiversity issues in decision-making

### Guidance on developing review criteria for incorporating biodiversity issues

The guidance is provided here to enable reviewers assess the quality and completeness of the information provided in the EIA report in a quick and easy-to-understand manner. The review format presented in Table 21 is intended to guide the review process through the use of suggested mainstreaming criteria for biodiversity. These criteria are intended to help the reviewers in making a clear distinction between reviewing the quality and adequacy of an EIA report and determining the usefulness of the information in appraisal of the project proposal. The pre-decision review is thus aimed to assist both, practitioners in improving the quality of information and help decision makers note the gaps in the information that may affect reaching informed decisions.

The advantage of the review criteria presented in Table 21 is that it can help initiate the process of review even in absence of regulatory guidelines.

**Table 21** Review format for mainstreaming biodiversity issues in the review stage of EIA

Biodiversity issues	Review criteria	Quality of information			Adequacy of information		Usefulness of information		
		Good	Average	Poor	Adequate	Not adequate	High	Low	Nil
Coverage of biodiversity issues in introduction and project background	Recognition of biodiversity as a component of IEE/EIA Recognition of triggers for biodiversity change								
Scoping	Incorporation of biodiversity targets in ToR.								
Biodiversity as targets for assessments	Biodiversity components include habitats, species, communities								
Defining biodiversity values	Conservation priorities, protected status, protected area, protected species, unique ecosystems, specialized habitats, economic importance links with livelihoods								
Scale of biodiversity assessments	<b>Organization level</b> Gene, species, ecosystem <b>Ecosystem structure and function</b> Ecosystem process, good & services <b>Geographic scale</b> Site, landscape, region <b>Temporal</b> Immediate, short term, long term								

Assessment of impacts on biodiversity	<p>Description of methodologies</p> <p>Based on field surveys</p> <p>Use of ecological modeling, GIS Software, HSI models distribution maps</p>								
Biodiversity issues included in baseline information	<p>Single or multiples species</p> <p>Absence/presence/abundance of protected species</p> <p>Population dynamics and other habitat attributes (loss, modification, fragmentation)</p> <p>Movement, dispersal and extinction threats</p>								
Considerations for prediction of impacts on biodiversity	<p>Recognition of the drivers of change in biodiversity</p> <p>Cause effect relationship</p> <p>Relevance of variables</p> <p>Primary, secondary and tertiary impacts</p>								
Time consideration in biodiversity assessment	<p>Distinction in construction and operation phases</p> <p>Short term and long term impacts</p>								
Result of field work survey	<p>Species inventories, historical information of indicator species, resource inventory, resource dependency estimates</p> <p>Recognition of linkages with livelihoods</p>								
Presentation of information for evaluation of impact specifically on biodiversity	<p>Assessment of the confidence level in impact prediction</p> <p>Qualitative measures of impacts</p> <p>Quantitative measures of impacts</p> <p>Identification of significant impacts</p>								
Mitigation measures and efficacy	<p>Identification of specific measures for biodiversity (conservation plan, restoration plan) in EMP</p> <p>Consideration of mitigation hierarchy</p>								

	(avoidance, mitigation, compensation and enhancement) Financial allocation for biodiversity related action plan Allocation of responsibilities for mitigating impacts Whether a follow up monitoring programme included as a part of EMP							
<p><b>General remarks:</b></p> <p><b>Name of the reviewer:</b></p> <p><b>Professional background:</b></p>								

This guidance should not be seen as a mechanism to promote the use of rigid criteria and stifle the development of open, flexible, intuitive and more context relevant approaches for conducting review. The objective of providing such a guiding tool is not the replacement of the existing guidance for reviews that may exist at the country level but to encourage good practices generally. Not all of the criteria included in the recommended review format may have universal applicability in the South Asia region as the requirements under the regulatory EIA system governing the review process varies with countries. It may not be fair to impose the suggested format for review but it is recommended that reviewers use it to develop evaluation scales and scores to influence the decision to the extent possible. Box 61 provide helpful tips for initiating the review.

#### **BOX 61** Important note for reviewers

- ▶ Judge your competence for undertaking the review of the EIA report for which you have been assigned the responsibility of review.
- ▶ Review procedure and requirements established in the EIA legislation or guidelines before undertaking review.
- ▶ Familiarise yourself with review procedures and requirements for the project EIA to be reviewed.
- ▶ Read the report quickly from start to end page to review essential information such as the location and type of project, public concerns and Terms of Reference as this may help in ascertaining sensitivity of issues and the level of assessment required.
- ▶ Assess the rigour and time required for reviewing the EIA to ensure that the review work can be accomplished within the stipulated time for receiving review comments.
- ▶ Read the review criteria provided in Table 21.
- ▶ Find answers to specific criteria that are applicable as you review different sections of the report.
- ▶ Scale up the evaluation level depending upon the potential of the project to result in significant impacts.
- ▶ Scale down the evaluation level if the review requirements are not very stringent for a project category that have several potential benefits and where the review requirements are not specified under the regulatory guidelines.
- ▶ Use the assessment rating for each individual question within a particular review section in order to assess the review section as a whole.

### *Guidance on translating review outcome into appraisal results for decision-making*

When all sections of the report have been reviewed and evaluated, the reviewer should assign grades to the report as a whole. It is extremely important to make the final evaluation presented as a 'report card' for making recommendations for facilitating the decision-making.

A grading system in line with several grading systems that are already in place (Lee & Colley 1992; UNEP, 2002) has been recommended in Table 22 for evaluation of EIA reports for adequacy and completeness of information on biodiversity.

**Table 22** Evaluation of EIA reports

Quality grade	Quality remark	Explanatory note on quality grade/ remark
A	Excellent	The work has generally been well performed with no important omissions of biodiversity related issues.
B	good	Task performed satisfactorily and is complete with only minor omissions/ inadequacies.
C	Satisfactory	Task is satisfactory despite some omissions or inadequacies.
D	Weak	Indicates that parts are well attempted but, on the whole, are just unsatisfactory because of omissions or inadequacies.
E	Poor	Task is not satisfactory, revealing significant omissions or inadequacies.
F	No opinion	The work is insufficient to base judgment.

Where country procedures and guidelines exist for evaluation of EIA reports for biodiversity, these should be taken into consideration along with good practice principles and criteria described here.

This overall judgment should be supplemented with a brief note indicating specific instructions to the practitioner for providing supplementary or additional data/information, clarifications and explanation to inferences on significance of impacts as the case may be and with clear recommendation for decision makers to approve, reject or keep decision on hold until the gaps in information are plugged.

### *Identification of experts for review*

Experience from the region suggest that lack of sufficient expertise of the reviewers and incentives is the real cause of deficient reviews (Momtaz, 2002; Rajvanshi, 2005; Nadeem & Hameed, 2007).

The expertise required for EIA review is essentially the same as that required for preparing the EIA report. In some countries like India and Pakistan, processes are being initiated that will enable EIA experts to be accredited or registered as capable of carrying out a study or review. Where the accreditation system does not exist, the identification of experts is made based on a criteria reflecting potential reviewer's academic qualifications, professional background and competence, area of expertise, experience of conducting review of EIAs and number of EIAs reviewed. Some countries

follow a system of maintaining a roster of qualified experts who are invited to become member on review panels constituted by the relevant competent authority at the national or state level charged with the responsibility of conducting review.

Other possible solution to overcome the capacity constraints of reviewers is the enhancement of skills through well conceived capacity building initiatives. This should be the responsibility of the competent EIA agency. Until such time, till the capacities are appropriately build, use of review packages can be encouraged by developing these for specific sectors and for different countries. Such review packages are already in use in some more advanced countries and should lead to consistent and unbiased outputs that can withstand scrutiny and provide useful inputs for monitoring.

Developing a network of EIA professional in the region to serve as a regional resource pool for enhancing capacity, sharing knowledge and assisting with reviews would be another positive step. This should work well because countries in the region have comparable situations with respect to priorities for development and urgency of conserving the biodiversity wealth. Moreover, many of the linear projects (roads, and canals) have trans boundary context. The evaluation of EIA for such projects by reviewers from regional pool will lead to more credible decision-making.

Transparency of the review process is an ethical issue that must be promoted and respected. Yet, the countries in the region suffer from inherent problems of politization of decision and lack of trust in the EIA process as a result of which the review is never a transparent process. Although the experts contracted for the review of a particular report should be independent from those involved in preparing the EIA report or undertaking studies, this is not always the case when the organizations are involved. Some countries in the region are therefore debating if peer review process would help overcome some of the deliberate attempts of 'foul play' in the review and monitoring of EIAs or if more effective mechanism of review by public would be a better option.

## References

- Aboriginal Pipeline Group, Imperial Oil Resources Venture Limited, Conoco Phillips Canada (North) Limited, Shell Canada Limited, and Exxon Mobil Canada Properties. (2004). *Environmental Impact Statement for the Mackenzie Gas Project, Volume 1: Overview and Impact Assessment Summary*. At [www.mackenziegasproject.com/theProject/regulatoryProcess/applicationSubmission/Application scope/EIS.html](http://www.mackenziegasproject.com/theProject/regulatoryProcess/applicationSubmission/Application%20scope/EIS.html).
- ADB (1998). *Handbook on Resettlement: A Guide to Good Practice*. Asian Development Bank, ISBN: 971-561-152-4.
- ADB (2006). *Summary Environmental Impact Assessment Project Number: 36052*. Pakistan: North-West Frontier Province Road Development Sector and Sub regional Connectivity Project Peshawar–Torkham Subproject.
- Ahamed, R. & Harvey, N. (2004). Evaluation of environmental impact assessment procedures and practice in Bangladesh. *Impact Assessment and Project Appraisal*, **22**(1), pp. 63-78.
- Akiyama, S., Yonekura, K. & Ohba, H. (1998). New records and treatment of Nepalese flowering plants. *Newsletter of Himalayan Botany*, **23**, 18-25.
- Anon., (1999). *Biodiversity Action Plan of Pakistan*. Pakistan: Government of Pakistan.
- Anon., (2000) *Biodiversity Action Plan for Pakistan*. Government of Pakistan, Ministry of Environment, Local Government and Rural Development in collaboration with the World Wide Fund for Nature, Pakistan and IUCN-The World Conservation Union, Pakistan.
- Anon., (2002a). *Nepal Biodiversity Strategy*. Kathmandu, Nepal: Ministry of Forests and Soil Conservation, Singhadurbar.
- Anon., (2002b). *Business and Biodiversity: A Handbook for Corporate Action*. Earthwatch Europe, IUCN – The World Conservation Union and the World Business Council for Sustainable Development. ISBN 2-940240-28-0
- Anon., (2005). *Human Development Report 2005*. New York, USA: United Nations Development Programme (UNDP).
- Anon., (2006a). *Data Sources: CIA World Fact Book, and other Public Domain Resources*. At [www.cia.gov/cia/publications/factbook/geos/bg.html#Geo](http://www.cia.gov/cia/publications/factbook/geos/bg.html#Geo)
- Anon., (2006b). *Ministry of Forest and Soil Conservation, Government of Nepal*. At [www.biodiv-nepal.gov.np/nbub.html](http://www.biodiv-nepal.gov.np/nbub.html).

- Anon., (2006c). *UNESCO – MAB Number of Biosphere Reserves Directory*. At [www2.unesco.org/mab/br/brdir/directory/contact.asp?code=SRL](http://www2.unesco.org/mab/br/brdir/directory/contact.asp?code=SRL)
- Anon., (2006d). *CI Policy Paper - Mainstreaming Biodiversity Conservation into Oil and Gas Development*. Prepared for "Biodiversity Opportunities in Latin American and the Caribbean: The Role of the IDB". Conservation International Publication. At [www.celb.org/ImageCache/CELB/content/downloads/idb\\_5fpaper\\_5foilgasdevelopment\\_2epdf/v1/idb\\_5fpaper\\_5foilgasdevelopment.pdf](http://www.celb.org/ImageCache/CELB/content/downloads/idb_5fpaper_5foilgasdevelopment_2epdf/v1/idb_5fpaper_5foilgasdevelopment.pdf).
- Asian Development Bank (1994). *Asian Development Bank Environmental Impact Assessment Training Program*. Manila, Philippines: Office of the Environment, Asian Development Bank.
- Atkinson, S.F., Bhatia, S., Schoolmaster, F.S., & Waller, W.T. (2000). Treatment of biodiversity impacts in a sample of US environmental impact statements. *Impact Assessment and Project Appraisal*, **18**(4), 271-82.
- Aylward, B. (1991). *The Economic Value of Ecosystems: 3 - Biological Diversity*. London, Gatekeeper Series GK 91-03, London: Environmental Economics Centre.
- Aylward, B. (1999). *Direct Payments, Transfers and Markets for Environmental Services*. A Paper for FAO, pp. 31 + annexes.
- B.C. Gas Utility Ltd. (1998). *The Southern Crossing Pipeline Project, B.C. Gas Utility Ltd.: Application for a Project Approval Certificate*. At [www.eao.gov.bc.ca/epic/output/documents/p47/1036601869141\\_88b6a5bcf3034c6e9f288b69dad3d2da.pdf](http://www.eao.gov.bc.ca/epic/output/documents/p47/1036601869141_88b6a5bcf3034c6e9f288b69dad3d2da.pdf); accessed 6 October 2004.>
- Bagri, A. & Vorhies, F. (1997). *Biodiversity Impact Assessment*. Gland, Switzerland: IUCN.
- Bann, C., (1997). *An Economic Analysis of Alternative Mangrove Management Strategies in Koh Kong Province, Cambodia*. Research Report, EEPEA - Economy and Environment Programme for South East Asia, Ottawa: International Development Research Centre.
- Barbier, E.B. & Acreman M., et al. (1997). *Economic Valuation of Wetlands: A Guide for Policy Makers and Planners*. Gland: Ramsar Convention Bureau.
- Barbier, E.B. (1991). *The Economic Value of Tropical Ecosystems 2 - Tropical Forests*. London, Gatekeeper Series 91-01, London: Environmental Economics Centre.
- Bizer, J. R. (2000). *International Mechanisms for Avoiding, Mitigating and Compensating the Impacts of Large Dams on Aquatic and Related Ecosystems and Species*. Submission ENV249 to World Commission on Dams. New York: UNEP. At [www.dams.org/](http://www.dams.org/)
- Brown, G. & Henry, W. (1989). *The Economic Value of Elephants*. London: London Environmental Economics Centre (LEEC), pp. 89-12.

- Byron, H. (2000). *Biodiversity and Environmental Impact Assessment: A Good Practice Guide for Road Schemes*. The RSPB, WWF-UK, English Nature and Wildlife Trusts, Sandy.
- Byron, H.J., Treweek, J.R., Sheate, W.R. & Thompson, S. (2000). Road developments in the UK: An analysis of ecological assessment in environmental impact statements produced between 1993 and 1997. *Journal of Environmental Planning and Management* 2000, **43**(1), 71-97.
- Canada, National Energy Board (NEB) (1996). *Express Pipeline Project: Report of the Joint Review Panel*. Ottawa, ON: Queens Printer for Canada.
- Canada, National Energy Board (NEB) (1998). *Comprehensive Study Report: Alliance Pipeline Ltd. On Behalf of the Alliance Pipeline Limited Partnership, Alliance Pipeline Project*. Ottawa, ON: Queens Printer for Canada.
- Canada, National Energy Board (NEB). (2003). *Joint Panel Review: GSX Canada Pipeline Project*. Ottawa, ON: Queens Printer for Canada.
- Canter, L.W. (1996). *Environmental Impact Assessment. Second Edition*. New York, NY: McGraw Hill.
- Canter, L.W. & Canty, G.A. (1993). Impact significance determination - basic considerations and sequenced approach. *Environmental Impact Assessment Review* **13**, 275-297.
- Carson, R.T. & Mitchell, R.C. (1989). *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Washington, D.C.: Johns Hopkins University Press.
- CBD (1992). *Convention on Biological Diversity (CBD)*, United Nations Environment Programme, Publication No. Na. 92-7807.
- CBD (2001). *Workshop on Biological Diversity and Tourism held during 4 - 7 June 2001 - Item 3 of the provisional agenda*, Santo Domingo.
- CEA (1995a). *A Guide for Implementing the EA Process; A General Guide for Project Approving Agencies*. Colombo: Central Environmental Authority.
- CEA (1995b). *A Guide for Implementing the EA Process; A General Guide for Conducting Environmental Scoping*. Colombo: Central Environmental Authority.
- CEA (1997a). *Environmental Guidelines for Agricultural Sector Projects in Sri Lanka*. Colombo: Central Environmental Authority.
- CEA (1997b). *Environmental Guidelines for Road and Rail Development in Sri Lanka*. Colombo: Central Environmental Authority.

- CEA (1998). *Guidance for implementing the Environmental Impact Assessment (EIA) process*. Ministry of Forestry and Environment, Government of Sri Lanka, Third Edition.
- CELB (2007). *Initial Biodiversity Assessment and Planning (IBAP)*. Washington, DC: The Center for Environmental Leadership in Business (CELB). At [www.celb.org/xp/CELB/downloads/IBAP.pdf](http://www.celb.org/xp/CELB/downloads/IBAP.pdf).
- CEAA (1995). *Guidelines for Implementing the EIA Process*. Colombo: Central Environment Authority Publication.
- Cernea, M.M (1988). *Involuntary Resettlement in Development Projects: Policy Guidelines in World Bank – Financed Projects*. World Bank Technical Paper No. 80. Washington, DC: The World Bank.
- Chivian, E (ed.) (2002). *Biodiversity: Its Importance to Human Health*. Harvard: Centre for Health and the Global Environment Harvard Medical School.
- Chetry, L.K. (2002). EIA as applied in the case of the 402 MW Arun - III Hydroelectric project. In McCabe, M. & Sadler, B (eds.) *Studies of EIA Practice in Developing Countries*. Geneva, Switzerland: United Nations Environment Programme (UNEP).
- CNPPA (1995). *Economic Assessment of Protected Areas: Guidelines for their Assessment*. Gland, Switzerland: Commission on National Parks and Protected Areas, IUCN - The World Conservation Union.
- Cooney, R. & Dickson, B. (ed.) (2006). *Biodiversity and Precautionary Principle: Risk and Uncertainty in Conservation and Sustainable Use*. Earthscan Publication Ltd.
- Cuperus, R., Canters, K. J., Udo de Haes, H. A. & Friedman, D. S. (1999). Guidelines for ecological compensation associated with highways. *Biological Conservation*, **90**, 41-51.
- DEC, NSW (2006). *BioBanking: An Investigation of Market-based Instruments to Secure Long-term Biodiversity Objectives*. Background paper. Department of Environment and Conservation NSW. At [www.environment.nsw.gov.au/resources/biobankback0609.pdf](http://www.environment.nsw.gov.au/resources/biobankback0609.pdf).
- Dey, P.K. (2002). An integrated assessment model for cross-country pipelines. *Environmental Impact Assessment Review*, **22**, 703-721.
- DFID, EC, UNDP & World Bank (2002). *Linking Poverty Reduction and Environmental Management: Policy Challenges and Opportunities*. Washington: The World Bank.
- Dixon, J.A., Scura, L.F., Carpenter, R.A. & Sherman, P.B. (1994). *Economic Analysis of Environmental Impacts*. London: Earthscan Publications Ltd.

- Driver, J., Cowling, R.M. & Maze, K. (2003). *Planning for Living Landscapes: Perspectives and Lessons from South Africa*. Washington, DC: The Botanical Society of South Africa and the Center for Applied Biodiversity Science.
- Duncan, A., Baker, G.B. & Montgomery, N. (eds.) (1999). *The Action Plan for Australian Bats*. Canberra: Environment Australia.
- Earthwatch Institute (Europe), IUCN - The World Conservation Union, and World Business Council for Sustainable Development. (2002). *Business and Biodiversity: The Handbook for Corporate Action*. At [www.businessandbiodiversity.org/publications.html](http://www.businessandbiodiversity.org/publications.html).
- EBI (2003a). *Integrating Biodiversity Conservation into Oil and Gas Development*. Energy and Biodiversity Initiative (EBI) BP, Chevron Texaco, Conservation International, Fauna and Flora International, IUCN, The Nature Conservancy, Shell, Smithsonian Institution, Statoil. At [www.theebi.org/org/pdfs/sources.pdf](http://www.theebi.org/org/pdfs/sources.pdf).
- EBI (2003b). *Opportunities for benefiting biodiversity conservation BP*, Chevron Texaco, Conservation International, Fauna and Flora International, IUCN, The Nature Conservancy, Shell, Smithsonian Institution, Statoil.
- EBI (2004). *Integrating Biodiversity into Environmental Management Systems*. The Energy and Biodiversity Initiative. UK: Conservation International.
- Emerton, L. & Bos, E. (2004). *Value: Counting Ecosystems as Water Infrastructure*. Gland, Switzerland: IUCN.
- Emerton, L. & Kekylandala (2002). *Assessment of the Economic Value of Muthurajawela Wetland*, IUCN – The World Conservation Union, Sri Lanka Country Office and Regional Environmental Economics Programme Asia, Colombo.
- Emerton, L., Iyango, L., Luwum, P. & Malinga, A. (1999). *The Economic Value of Nakivubo Urban Wetland*. Nairobi, Uganda: IUCN – The World Conservation Union, Eastern Africa Regional Office.
- EnCana Ekwon Pipeline Inc. (2003). *Ekwon Pipeline: Application to the National Energy Board Volume 1 & 2*. At [www.neb-one.gc.ca/lleng/livelink.exe?func=ll&objId=273295&objAction=browse&sort=name](http://www.neb-one.gc.ca/lleng/livelink.exe?func=ll&objId=273295&objAction=browse&sort=name); accessed 24 August 2004.
- Environmental Protection Department, Government of Hongkong (1997). *Environmental Measures on Airport Core Projects, Case I, North Lantau Expressway Project*, Govt. of Hong Kong.
- EPA, Pakistan (1997). *Pakistan Environmental Protection Act*. Government of Pakistan, Ministry of Environment.

- EPA, Pakistan (2005). *National Environmental Policy*. Government of Pakistan, Ministry of Environment.
- EPC (1993). *Nepal Environmental Policy and Action Plan*. Kathmandu: Environment Protection Council.
- European Commission (1994). *Environmental Impact Assessment Review Checklist European Commission (DGXI)*, Brussels.
- FAO (1995). *State of the World's Forests*. Oxford, UK: Food and Agriculture Organization of the United Nations.
- Foothills Pipe Lines (South Yukon) Ltd. (1979). *Overview Summary of the Environmental Impact Statement for the Alaska Highway Gas Pipeline Project*. Whitehorse, YK: Foothills Pipe Lines (South Yukon) Ltd.
- GS&MB (2002). *Sri Lanka Minerals Yearbook: Dehiwala*. Sri Lanka: Geological Survey and Mines Bureau.
- Gibeau, M.L., Green, J., Herrero, S., Jorgenson, J., & Paquet, P.C. (1994). *Wildlife Corridors in the Bow River Valley, A report to the Wildlife Corridor Task Force*. Canmore, Alberta.
- GoB (1927). *The Forest Act*, Dhaka: Government of Bangladesh.
- GoB (1959). *The Private Forest Order*. Dhaka: Government of Bangladesh.
- GoB (1974). *The Bangladesh Wildlife (Preservation) (Amendment) Act*. Dhaka: Government of Bangladesh.
- GoB (1995) *Environmental Conservation Act (ECA)*, Government of Bangladesh, Dhaka.
- Gol (1972). *Wildlife (Protection) Act*. New Delhi: Ministry of Environment and Forests, Government of India.
- Gol (1985). *Research and Reference Division*. New Delhi: Ministry of Information and Broadcasting, Government of India.
- Gol (2002). *National Biodiversity Act*. New Delhi: Ministry of Environment and Forests, Government of India.
- GoN & UNEP (2006). *Millennium Development Goals Need Assessment for Nepal*. Nepal: National Planning Commission, Government of Nepal and United Nations Development Programme.
- GoP (1997). *Guidelines for the Preparation and Review of Environmental Reports*, Government of Pakistan. At [http://www.environment.gov.pk/eia\\_pdf/D\\_rev\\_enReprt.pdf](http://www.environment.gov.pk/eia_pdf/D_rev_enReprt.pdf)

- GoP (2000). *Pakistan Environmental Protection Agency (review of IEE and EIA) Regulations*. At [www.environment.gov.pk/act-rules/IEE-EIA-REG.pdf](http://www.environment.gov.pk/act-rules/IEE-EIA-REG.pdf)
- GoSL (1980). *National Environmental Act*. Colombo: Government of Sri Lanka.
- GoSL (1981). *Coast Conservation Act No. 57*. Government Publications Bureau. Colombo: Government of Sri Lanka.
- GoSL (1988). *Coast Conservation (Amendment) Act No. 64*. Government Publications Bureau. Colombo: Government of Sri Lanka.
- GoSL (1993a). *National Environmental (Procedure for Approval of Projects) Regulations No.1. The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary*. Colombo: Government of Sri Lanka.
- GoSL (1993b). *Orders made by the Minister of Environment under Section 23Y of the National Environmental Act No.47 1980; State Agencies as Project Approving Agencies*. Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary. Colombo: Government of Sri Lanka.
- Gray, I. & Edward-Jones, G. (2003). A review of environmental statements in the British forest sector. *Impact Assessment and Project Appraisal*, **21**, 303-312.
- Grimmet, R., Inskipp, C. & Inskipp, T. (2000). *Birds of Nepal*. New Delhi: Helm Field Guide, Prakash Books.
- Groombridge, B. (ed.) (1994). *IUCN Red List of Threatened Animals*. Gland, Switzerland and Cambridge, UK: IUCN.
- Groombridge, M. & Jenkins, M. (1994). *Biodiversity Data Sourcebook*, World Conservation Monitoring Centre. Cambridge, UK: World Conservation Press.
- Hagen, T. (1998). *Nepal - The Kingdom in the Himalaya (4<sup>th</sup> edn)*. Lalitpur, Nepal: Himal Books.
- Hagler-Bailly Canada (1998). *Measuring and Apportioning Rents from Hydro-electric Power Developments*. Washington, DC: World Bank, Industry and Energy Department.
- Hanowski, J.M., Niemi, G.J. & Blake, J.G. (1993). *Seasonal Abundance and Composition of Forest Bird Communities Adjacent to a Right-of-Way in Northern Forests USA*. Proceedings of the Fifth Symposium on Environmental Concerns in Rights-of-Way Management, Montreal, Quebec, Canada.
- Hara, H., Stearn, W.T., & Williams, L.H.J. (eds). (1978). *An Enumeration of the Flowering Plants of Nepal. British Museum of Natural History 1*, London.

- Hara, H., Chater, A.O. & Williams, L.H.J. (eds) (1982). An enumeration of the flowering plants of Nepal. *British Museum of Natural History*, **3**, London.
- Hennayake, S.K., Hewage, A., Wijeratne, M.S., Yasaratne, S.E. (eds.) (1997). *Environmental Impact Assessment: The Sri Lankan Experience*. Sri Lanka: Centre for Environmental Studies, University of Peradeniya.
- Hilden, M. (1995). *Evaluation of the Significance of Environmental Impacts*. EIA Process Strengthening Workshop, April 4-7, 1995, Canberra, Australia as part of International Study on the Effectiveness of Environmental Assessment sponsored by the International Association of Impact Assessment, the Canadian Environmental Assessment Agency, and Australian Environmental Protection Agency.
- IAIA (2005). *Biodiversity in Impact Assessment*. Special Publication Series No.3 July 2005. International Association of Impact Assessment (IAIA), Fargo, USA.
- ICMM (2005). *Good Practice Guidance for Mining and Biodiversity*. London, U.K.: International Council for Mining and Metals (ICMM).
- ICMM (2006). *Good Practice Guidance for Mining and Biodiversity*. London, UK: International Council on Mining and Metals (ICMM). At [www.icmm.com](http://www.icmm.com), [info@icmm.com](mailto:info@icmm.com).
- IFC (2004). *A Guide to Biodiversity for the Private Sector*. International Finance Corporation – World Bank Group. At [www.ifc.org/BiodiversityGuide](http://www.ifc.org/BiodiversityGuide)
- IPIECA (2000). *The Oil and Gas Industry: Operating in Sensitive Environments*. UK: International Petroleum Industry Environmental Conservation Association (IPIECA). At: [www.ipieca.org/downloads/biodiversity/SensitiveEnvironments\\_ENG.pdf](http://www.ipieca.org/downloads/biodiversity/SensitiveEnvironments_ENG.pdf).
- IPIECA (2004). *Series of Case Studies: The Oil and Gas Industry – Operating in Sensitive Environments: BP*. Dorset, Southern England, U.K.: International Petroleum Industry Environmental and Conservation Association (IPIECA). At [www.ipieca.org/publications/biodiversity.html](http://www.ipieca.org/publications/biodiversity.html).
- IUCN (1994). *Red List of Threatened Animals*. Gland, Switzerland and Cambridge, UK: IUCN.
- IUCN (2004). *Environment and biodiversity of Pakistan*. At [edu.iucnp.org/biopk.htm](http://edu.iucnp.org/biopk.htm)
- IUCN & ICMM (2004). *Integrating Mining and Biodiversity Conservation*. Case studies from around the world. Gland, Switzerland and Cambridge, UK: IUCN and ICMM.
- IUCN & WII (2006). *Capacity Building in Biodiversity and Impact Assessment (CBBIA) Project, International Association of Impact Assessment (IAIA)*.
- IUCN (2000). *International Union for Conservation of Nature*, Sri Lanka.

- IUCN (2005). *Capacity Building in Biodiversity and Impact Assessment*, Asia. Proceedings of the Inception Workshop held during December 23 – 24, 2005.
- IUCN (2006). *IUCN Red List of Threatened Species*. At [www.iucnredlist.org](http://www.iucnredlist.org)
- IUCN (2007). *Coastal Ecosystems News letter Issue #4*. Regional Information Hub on Coastal Ecosystems Management, IUCN - The World Conservation Union (IUCN) Asia.
- IUCN-Bangladesh (2000). *National Action Programme (NAP) for Combating Desertification in Bangladesh*. Department of Environment, Ministry of Environment and Forest, Government of the Peoples Republic of Bangladesh: IUCN and The World Conservation Union. At [www.sdnpsd.org/sdi/international\\_days/wed/2006/documents/NAP%20final%20draft.pdf](http://www.sdnpsd.org/sdi/international_days/wed/2006/documents/NAP%20final%20draft.pdf)
- Jhala, Y.V. & Rajvanshi, A. (2005). *Ecological Study of the Area under Consideration for Renewal of Mining Lease of M/s Narmada Cement Company Ltd., Jafarabad, District Amreli, Gujarat*. WII-EIA Technical Report 30. Dehradun: Wildlife Institute of India.
- Johnson, M.S. & Putwain, P.D. (1981). Restoration of native biotic communities on land disturbed by metalliferous mining. *Mining Environment*, **3**, 67–85.
- Karr, J.R. (1981). Assessment of biotic integrity using fish communities. *Fisheries* **66**: 21 - 27.
- Khadka, R., McEachern, J., Rautianen, O. & Shrestha, U.S. (1996). SEA of the Bara Forest Management Plan Nepal. In Therivel, R. & Partidario, M.R. (eds.) *The Practice of Strategic Environmental Assessment*. London: Earthscan.
- Khalil, S. (1990). Economic valuation of the mangrove ecosystem along the Karachi coastal areas. In Hecht, J. (ed.) *The Economic Value of the Environment: Cases from South Asia*. Washington, DC: IUCN – The World Conservation Union.
- Kodituwakku, D.C. (2004). The Environmental Impact Assessment Process in Sri Lanka. *SARID*, **1**(1).
- Kramer, R. (1996). *Slowing Tropical Forest Biodiversity Losses: Cost and Compensation Considerations*. At <http://economics.iucn.org>.
- Kuiper, G (1997). Compensation of environmental degradation by highways: a Dutch case study. *European Environment*, **7**, 118-125.
- Kumari, Kanta & Ken, King (1997). *Paradigm Cases to Illustrate The Application of The Incremental Cost Assessment to Biodiversity*. At [www.gefweb.org/Operational\\_Policies/Eligibility\\_Criteria/Incremental\\_Costs/paradigm.htm](http://www.gefweb.org/Operational_Policies/Eligibility_Criteria/Incremental_Costs/paradigm.htm).

- Land, D. & Lotz, M. (1996). *Wildlife Crossing Designs and use by Florida Panthers and other Panthers in South-West Florida*. Proceedings of the Florida Department of Transportation/Federal Highway Administration Transportation-related Wildlife Mortality Seminar. Orlando, Florida: U.S. Department of Transportation, pp.323-328.
- Lee, N. & Colley, R (1992). *Reviewing the Quality of Environmental Statements, Occasional Paper 24 (second edition)*. Manchester: Department of Planning and Landscape, University of Manchester.
- Lohani, B, Evans, J.W., Ludwig, H., Everitt, R.R., Carpenter, R.A., & Tu., S.L. (1997). *Environmental Impact Assessment for Developing Countries in Asia*. Volume 1 - Overview. 356 pp.
- Luneth, B. G. (1987). *Browse Production and Utilization on a Pipeline Right-of-Way*. Proceedings of the Fourth Symposium on Environmental Concerns in Rights-of-Way Management, Indianapolis, Ind.
- Mallon, D. (1991). *Biodiversity Guide to Pakistan*. Cambridge, UK: World Conservation Monitoring Centre.
- Margules, C & Usher, M.B. (1981). Criteria used in assessing wildlife conservation potential: A Review. *Biological Conservation*, **21**, 79-109.
- Maze, K. (2003). *AngloAmerican and the Bushmanland Conservation Initiative*. V<sup>th</sup> World Parks Congress, Workshop II.5, on Building Support from New Constituencies, Durban, South Africa, 11-13 September 2003. PDAC. At [www.pdac.ca/pdac/land-use/pa-manitoba.html](http://www.pdac.ca/pdac/land-use/pa-manitoba.html).
- McAney, K. (1999). *Mines as roosting sites for bats – their potential and protection*. Biology and Environment: Proceedings of the Royal Irish Academy, 99B, 63-65.
- McKinney, L.D. & Murphy, R. (1996). When biologists and engineers collide: habitat conservation planning in the middle of urbanized development. *Environmental Management*, **20**(6), 955-961.
- Millennium Ecosystem Assessment (2005). *Ecosystems and Human Well-being: Biodiversity Synthesis*. Washington, DC: World Resources Institute.
- Ministry of Petroleum, Govt. of India. (2002). *Basic Petroleum Statistics*. Ministry of Petroleum & Natural Gas.
- Miranda, M., Burris, P., Bingcang, F.J., Shearman, P., Briones, J., La Vina, A. & Menard, S. (2003). *Mining and Critical Ecosystems: Mapping the Risks*. Washington, DC: World Resources Institute.
- MoE&F (1970). *National Policy for Wildlife Conservation*. New Delhi: Ministry of Environment and Forests, Government of India.

- MoE&F (1990) *National Policy and Macro level Action Strategy on Biodiversity*. New Delhi: Ministry of Environment and Forests, Government of India.
- MoE&F (1994). *The Environmental Impact Assessment Notification*. New Delhi: Ministry of Environment and Forests, Government of India.
- MoE&F (2002). *Wildlife Conservation Strategy*. New Delhi: Ministry of Environment and Forests, Government of India.
- MoE&F (2006a). *National Environment Policy*. New Delhi: Ministry of Environment and Forests, Government of India.
- MoE&F (2006b). *The Environmental Impact Assessment Notification (amended on 14<sup>th</sup> September 2006)*. New Delhi: Ministry of Environment and Forests, Government of India.
- Momtaz, S. (2002). Environmental assessment in Bangladesh: A critical review. *Environmental Impact Assessment Review*, **22**, 163–179.
- Munasinghe, M. (1994). 'Economic and policy issues in natural habitats and Protected Areas'. In Munasinghe, M. & McNeely, J. (eds.) *Protected Area Economics and Policy: Linking Conservation and Sustainable Development*. Washington, DC: The World Bank and IUCN — The World Conservation Union.
- Murthy, T.S.N. (1994). *Illustrated Encyclopedia of the Reptiles of India*. New Delhi: Vedams eBooks (P) Ltd.
- Nadeem, O. & Hameed, R. (2007). A critical review of the adequacy of EIA reports-evidence from Pakistan. *International Journal of Social Sciences*, **1**(1), 54-61.
- Narain, U. & Fisher, A. (1994). Modelling the value of biodiversity using a production function approach. In Perrings, C., Mäler, K-G., Folke, C., Jansson, B-O & Holling, C. (eds.) *Biodiversity Conservation: Policy Issues and Options*. Dordrecht: Kluwer Academic Publishers.
- Nishat, A., Huq, S.M. Enamul., Barua, S.P., Reza, A.H.M.A. & Khan, A.S.M. (2002). *Bio-ecological Zones of Bangladesh*. Dhaka: IUCN, Bangladesh Country office.
- Oxford, M (2001). *Developing Naturally*. A handbook for incorporating the natural environment into planning and development. Association of Local Government Ecologists.
- Pandey, D.N., Chaubey, A.C., Gupta, A.K. & Vardhan, H. (2005). Mine spoil restoration: A strategy combining rainwater harvesting and adaptation to random recurrence of droughts in Rajasthan. *Information Forestry Review*, **3**(7), 241-249. At [www.atypon-link.com/CFA/doi/abs/10.1505/ifer.2005.7.3.241](http://www.atypon-link.com/CFA/doi/abs/10.1505/ifer.2005.7.3.241) (last accessed on 25.01.2007)

- Pearce, D. (1992). *Economic Valuation and the Natural World*. London: Centre for Social and Economic Research on the Global Environment.
- Pearce, D. & Moran, D. (1994). *The Economic Value of Biodiversity*. London: Earthscan Publications Ltd.
- Perrow, M.R. & Davy, A.J. (2002). *Handbook of Ecological Restoration*. Cambridge: Cambridge University Press.
- Phillips, A. (ed.) (1998). *Economic Values of Protected Areas: Guidelines for Protected Area Managers*. Gland and Cambridge: IUCN - The World Conservation Union.
- Rahman, Syed Masiur (2005). *Prospect of Strategic Environmental Assessment (SEA) in Developing Nations*. At [www.eco-web.com/editorial/050303.html](http://www.eco-web.com/editorial/050303.html).
- Rajvanshi, A. (1999). Mitigation planning for biodiversity impacts of pipeline projects: Indian experience. In *Proceedings of the First South Asian Regional Environmental Assessment Conference*. Asia: IUCN, pp 79-96.
- Rajvanshi, A. (2002). Assessed impacts of the proposed Bodhghat Hydroelectric Project. In McCabe, Mary & Sadler, Barry (eds.) *Studies of EIA Practices in Developing Countries*. Geneva, Switzerland: United Nations Environment Programme, pp. 281-294.
- Rajvanshi, A. (2005). *Quality of biodiversity related information in EIA Reports for environmental decision-making: The Indian experience*. Presented at the Annual Meeting of the International Association of Impact Assessment (IAIA).
- Rajvanshi, A. (2006). Evaluation of irrigation tunnel project through Pench Tiger Reserve in India. In *Training material for pre meeting training course on Mainstreaming Biodiversity in EIA and SEA for Improved Environmental Decision-making*. IAIA - Capacity Building in Biodiversity and Impact Assessment (CBBIA) Project.
- Rajvanshi, A., Mathur, V.B., Teleki, G.C. & Mukherjee, S.K. (2001). *Roads, Sensitive Habitats and Wildlife: Environmental Guidelines for India and South Asia*. Wildlife Institute of India, Dehradun and Canadian Environmental Collaborative Ltd., Toronto.
- Ramsar Convention on Wetlands (1971). At [www.ramsar.org/](http://www.ramsar.org/).
- Ratcliffe, D.A. (ed.) (1977). *A Nature Conservation Review*. Cambridge, U.K.: Cambridge University Press.
- Rietbergen-McCracken, J. & Abaza, H. (2000). *Environmental Valuation: A Worldwide Compendium of Case Studies*. London: United Nations Environment Programme and Earthscan Publications Ltd.

- Rio Tinto (2004). *Sustaining a Natural Balance: A Practical Guide to Integrating Biodiversity into Rio Tinto's Operational Activities*. London: Rio Tinto.
- Roberts, T. J. (1991). *The Birds of Pakistan*. Vol. 1. UK: Oxford University Press.
- Rodgers, W.A., Panwar, H.S. & Mathur, V.B. (2000). *Wildlife Protected Area Network in India: A review*. Dehra Dun: Wildlife Institute of India.
- Rodriguez, A., Crema, G., & Delibes, M. (1996). "Use of non-wildlife passages across a high speed railway by terrestrial vertebrates". *The Journal of Applied Ecology*, **33**(6), 1527–1540.
- Rosenberg, D.K., Noon, B.R. & Meslow, E.C. (1997). Biological Corridors: Form, Function and Efficacy. *Bioscience*, **47**, 677-687.
- Ruediger, B. (1996). *The Relationship between Rare Carnivores and Highways*. Proceedings of the Florida Department of Transportation/ Federal Highway Administration Transportation-related wildlife mortality seminar. Orlando, Florida: U.S. Department of Transportation, pp. 24-38.
- Sadler, B. (1996). *Environmental Assessment in a Changing World Final Report of the International Study of the Effectiveness of Environmental Assessment*. Ottawa: Canadian Environmental Assessment Agency and International Association for Impact Assessment.
- Salmo Consulting Inc. (1999). *Maxhamish Project Application: Application for a Project Approval Certificate*. At [www.eao.gov.bc.ca/epic/output/documents/p65/1036777297007\\_07505034ba634131a16a95a13b071ccc.pdf](http://www.eao.gov.bc.ca/epic/output/documents/p65/1036777297007_07505034ba634131a16a95a13b071ccc.pdf).
- Saunders, D. A., Hobbs, R.J. & Margules, C.R. (1991) Biological consequences of ecosystem fragmentation: A review. *Conservation Biology*, **5**, 18-32.
- Scherr, S. (2003) *Millennium Project – Background Paper of the Task Force 2 on Hunger: Halving Global Hunger*. Commissioned by the UN Secretary General and supported by the UN Development Group.
- Sengupta, M. (1993). *Environmental Impacts of Mining: Monitoring, Restoration, and Control*. CRC Press. At <http://books.google.co.in/books?vid=ISBN0873714415&id=P20lkGOEkRwC&pg=PP1&lpg=PP1&ots=efnmGkGIM1&dq=restoration+of+mines&sig=eJdnNv5pMtrwNh66USI61MeGQ1A>.
- Shah, K. (1995). *Enumeration of the Amphibians and Reptiles of Nepal*. Biodiversity Profile Project Kathmandu, Publication No. 2. Nepal:, Department of National Parks and Wildlife Conservation, HMGN.
- Shammin, Md. R. (1999). A Case Study of Environmental Valuation of Dhaka Zoological Garden. In Hecht, J.E. (ed.) *The Economic Value of the Environment: Cases from South Asia*, IUCN – The World Conservation Union.

- Shell (2002). *Integrated Impact Assessment: Environmental Impact Assessment Module*, EP 95-0370.
- Shiva, V. & Jafri, A.H. (1998) *Stronger than Steel*. People's movement against globalization and the Gopalpur Steel Plant. New Delhi: Research Foundation for Science, Technology and Ecology.
- Shrestha, J. (2001). Taxonomic Revision of Fishes of Nepal. In Jha, P.K., Karmacharya, S.B., Baral, S.R. & Lacoul, P. (eds.) *Environment and Agriculture: At the Crossroad of the New Millennium*. Kathmandu, Nepal: Ecological Society (ECOS).
- Singh, R.K. & Chowdhury, S. (1999). Effect of mine discharge on the pattern of riverine habitat use of elephants *Elephas maximus* and other mammals in Singhbhum forests, Bihar, India. *Journal of Environmental Management* **57**, 177-192.
- Slootweg, R & Kolhoff, A. (2003). A generic approach to integrate biodiversity considerations in screening and scoping for EIA. *Environmental Impact Assessment Review* **23**: 657-681.
- Slootweg, R., Kolhoff, A., Verheem, R. & Hoft, R. (2006) *Biodiversity in EIA and SEA*. Background document to CBD decision VIII/28: Voluntary guidelines on biodiversity-inclusive impact assessment. The Netherlands: The Netherlands Commission for Environmental Assessment.
- Spurgeon, J.P.G. & Aylward, B. (1992). *The Economic Value of Ecosystems: 4 - Coral Reefs*. London, Gatekeeper Series No GK 92-03, London: London Environmental Economics Centre.
- Steinmetz, R., Chutipong, W., & Seuaturien, N. (2006). Collaborating to conserve large mammals in Southeast Asia. *Conservation Biology* **20**(5), 1391–1401.
- Suwal, R.N. & Verheugt, W.J.M. (1995). *Enumeration of the Mammals of Nepal*. Biodiversity Profile Project Publication No. 6. Kathmandu, Nepal: Department of National Parks and Wildlife Conservation, HMGN.
- Taggart, M. & McCracken, M.C. (2002). *Alaska Highway Pipeline Project and the Environment, Working Paper No. 7.2.8*. Informetrica Limited. At [www.emr.gov.yk.ca/Pipeline/AHP\\_Economic\\_Effects/Environmental\\_Linkages.pdf](http://www.emr.gov.yk.ca/Pipeline/AHP_Economic_Effects/Environmental_Linkages.pdf).
- ten Kate, K., Bishop, J., & Bayon, R. (2004). *Biodiversity offsets: Views, Experience, and the Business Case*. Gland, Switzerland and Cambridge, UK: IUCN and Insight Investment.
- TERI (2001). *Overview of Mining and Mineral Industry in India*. TERI Project Report No. 2001EE42. New Delhi: The Energy Research Institute.
- Thapa, V.K. (1995) *Enumeration of the Spiders of Nepal*. Kathmandu, Nepal: Biodiversity Profile Project Publication No. 5, Department of National Parks and Wildlife Conservation, HMGN.
- Thapa, V.K. (1997) *An Inventory of Nepal's Insects*. Kathmandu: IUCN-Nepal vol.1.

- Thompson, S., Treweek, J. & Thurling, D.J. (1997). The ecological component of environmental impact assessment: A critical review of British environment statements. *Journal of Environmental Assessment Policy and Management* **40**,157-171.
- Treweek, J. (1999) *Ecological Impact Assessment*. Oxford, UK: Blackwell Science.
- Treweek, Jo. (2001). *The Review of Experience and Methods of Integrating of Biodiversity in National EIA Process Supported by Biodiversity Planning Support Programme (BPSP)*. The United Nations Development Programme and the United Nations Environment Programme Publication.
- Treweek, J., Thompson, S., Veitch, N. & Japp, C. (1993). Ecological assessment of proposed road developments: a review of environmental statements. *Journal of Environmental Planning and Management*, **36**, 295-307.
- U.S. DOI (1972). *Final Environmental Impact Statement Proposed Trans-Alaska Pipeline, Volumes 1-6.*, U.S. Springfield, VA: Department of the Interior.
- UNEP (2001). *South Asia: State of the Environment 2001*. The United Nations Environment Programme.
- UNEP (2002). *Environmental Impact Assessment – Training Resource Manual*. The United Nations Environment Programme.
- UNEP (2004) *Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach*. The United Nations Environment Programme.
- UNESCO (2004). *World Heritage List, Paris, France: United Nations Educational, Scientific, and Cultural Organization*. At <http://whc.unesco.org/heritage.htm>.
- Vägverket (2002) *Miljökonsekvensbeskrivning inom vägsektorn, Del 2 Metodik*. Vägverket, Borlänge, Sweden: Vägverket Publikation 42.
- van Der Ploeg, S.W.F. & Vlijm, L. (1978). Ecological evaluation, nature conservation and land use planning with particular reference to methods used in the Netherlands. *Biological Conservation*, **14**, 197–221.
- van Bohemen, H.D. (2004). *Ecological Engineering and Civil Engineering Works; A Practical Set of Ecological Engineering Principles for Road Infrastructure and Coastal Management*. Delft, The Netherlands: Thesis.
- van der Zande, A.N., ter Kerus, W.J. & van der Weijden, W.J. (1980). The impact of roads on the densities of four species in an open field habitat – evidence of a long distance effect. *Biological Conservation*, **18**, 299 – 321.

- Van Wicklin III, W. A. (1999). Sharing project benefits for improving resettlers' livelihoods. In Cernea, M. (ed.) *The Economics of Involuntary Resettlement*. Washington, DC: World Bank, USA.
- Vasu, N.K. (2002). *Management plan of Kaziranga National Park for the period 2003-2004 to 2012-2013*. Forest Department, Govt. of Assam, India.
- Vorhies, F. (1999). *Financing Protected Areas*. IUCN Economics Unit. At <http://economics.iucn.org>.
- VROM (1994). *The Quality of Environmental Impact Statements*. EIA Series No. 47. The Hague: VROM.
- WA EPA (2004). *Environmental Offsets*. Preliminary position statement No. 9. Western Australia Environmental Protection Authority (WA, EPA).
- Warnken, J. & Buckley, R. (1998). Scientific quality of tourism environmental impact assessment. *The Journal of Applied Ecology*, **35**(1), 1-8.
- WCEL (2003). *Pump It Out: The Environmental Costs of BC's Upstream Oil and Gas Industry*. West Coast Environmental Law. At [www.wcel.org/wcelpub/2003/14028/pdf](http://www.wcel.org/wcelpub/2003/14028/pdf); accessed 14 October 2004.
- WII (1993). Environmental Impact Assessment of HBJ Gas Pipeline Upgradation Project on Wildlife and Wildlife Habitats. WII-EIA Technical Report 2. Dehradun, India: Wildlife Institute of India (WII).
- WII (1994a). Impact Assessment of Haldia - Barauni Pipeline Project on Wildlife Values. WII-EIA Technical Report 4. Dehradun, India: Wildlife Institute of India (WII).
- WII (1994b). Impact Assessment Studies of Narmada Sagar and Omkareshwar Projects on Flora and Fauna with Attendant Human Aspects. WII-EIA Technical Report 9. Dehradun: Wildlife Institute of India.
- WII (1998). *Ecological Assessment of the Proposed Mumbai - Pune Expressway*. WII - EIA Technical Report 22. Dehradun: Wildlife Institute of India (WII).
- WII (2005). *Ecological Study of the Area under Consideration for Renewal of Mining Lease of M/s Narmada Cement Company Ltd., Jafarabad, District Amreli, Gujarat*. WII-EIA Technical Report 30. Dehradun: Wildlife Institute of India.
- WII (2006a). *Impact Assessment of MMPL Ext. II (Manglya-Mathura-Pyala-Bijwasan) Pipeline on Wildlife Values*. WII-EIA Technical Report 31. Dehradun: Wildlife Institute of India.
- WII (2006b). *Determining the Offshore Distribution, Migration and Movement of Olive Ridley Sea Turtle (Lepidochelys olivacea) Along the East Coast of India*. Project proposal submitted by Wildlife Institute of India, Dehradun to Director General (Hydrocarbons), Govt. of India.

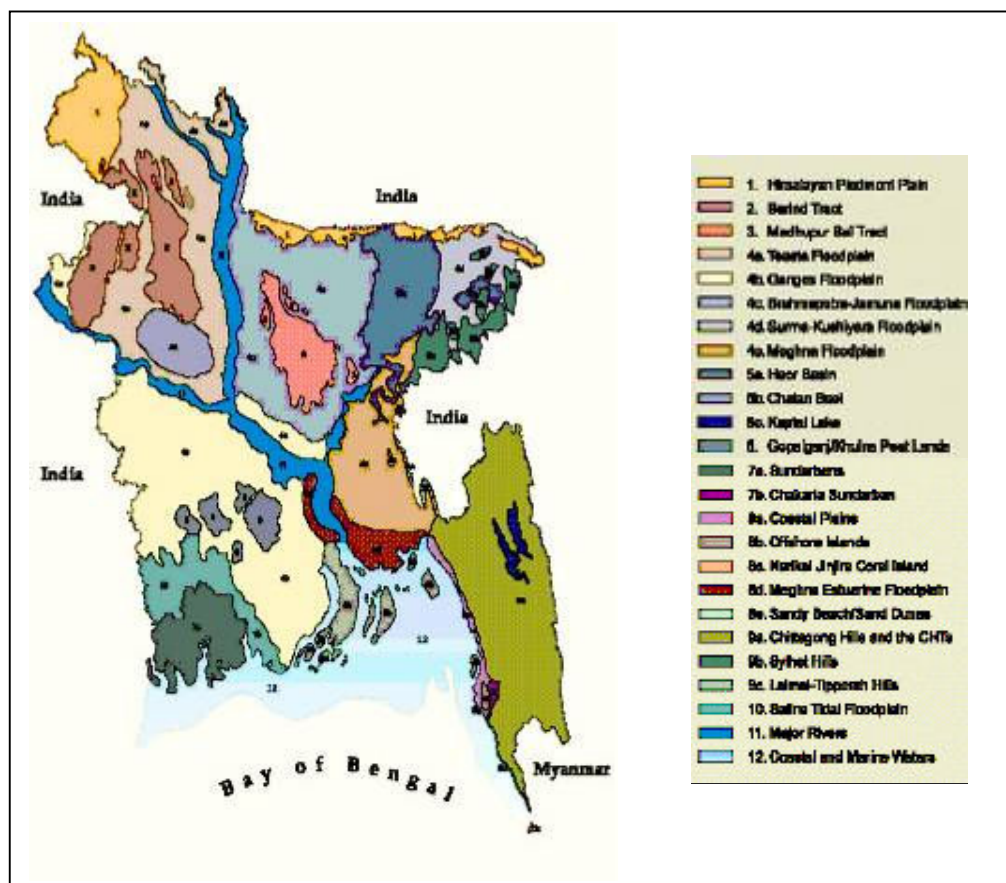
- Winpenny, J. T. (1991). *Values for the Environment: A Guide to Economic Appraisal*. London: HMSO Press.
- Withanage, H. (ed.) (2004). *Dream road: that destroys sustainable livelihood*. Nugegoda, Sri Lanka: Sri Lankan Working Group on Trade and IFIs.
- The World Bank (1988). *Involuntary Resettlement in Development Project: Policy Guidelines in the World Bank Financed Projects*. The International Bank for Reconstruction and Development/ The World Bank, 1919 H Street, N.W. Washington, DC.20433, USA
- The World Bank Group (2003). *Striking a Better Balance*. The World Bank Group and Extractive Industries. The Final Report of the Extractive Industries Review, Vol. I
- The World Bank (2004). *Monitoring and Evaluation: Some Tools, Methods & Approaches*. Washington DC: The World Bank.
- The World Bank (2006). *Pakistan Transport Sector*. At [www.worldbankgroup.org/](http://www.worldbankgroup.org/)
- WRI (2006). *EarthTrends Environmental Information*. World Resource Institute(WRI). At <http://earthtrends.wri.org/>
- WWF (2002). *To dig or not to dig?* Switzerland: WWF International.
- Yanes, M., Velaso, J. M. & Suarez, F. (1995). Permeability of roads and railways to vertebrates: The importance of culverts. *Biological Conservation*, **71**, 217-222.

## Appendix – IA

**Bangladesh: Overview of biodiversity status and threats**

Bangladesh, located between 20°34' to 26°38' north latitude and 88°01' to 92°42' east longitude is one of the youngest country in the region, born only in 1971. It has a border on the west, north, and east with India, on the South east with Myanmar and the Bay of Bengal is to the South. It has a coastline of 3306 km, covers an area of 147,570 km<sup>2</sup> and has a population of 150 million. Physiographically, the country can be divided into hills, uplifted land blocks, and the alluvial plains with very low mean elevation above sea level.

The natural ecosystems of the country range from sandy beaches to mangroves, flood plains, lowland forests, terraces and hills reaching far north into the east. The entire country is biogeographically a transition between the Indo-Gangetic plains and the eastern Himalayas and in turn part of the Indo-Chinese sub-region of the Oriental realm. Nishat *et al.* (2002) divided Bangladesh into 12 broad bio-ecological zones, shown in Figure I.

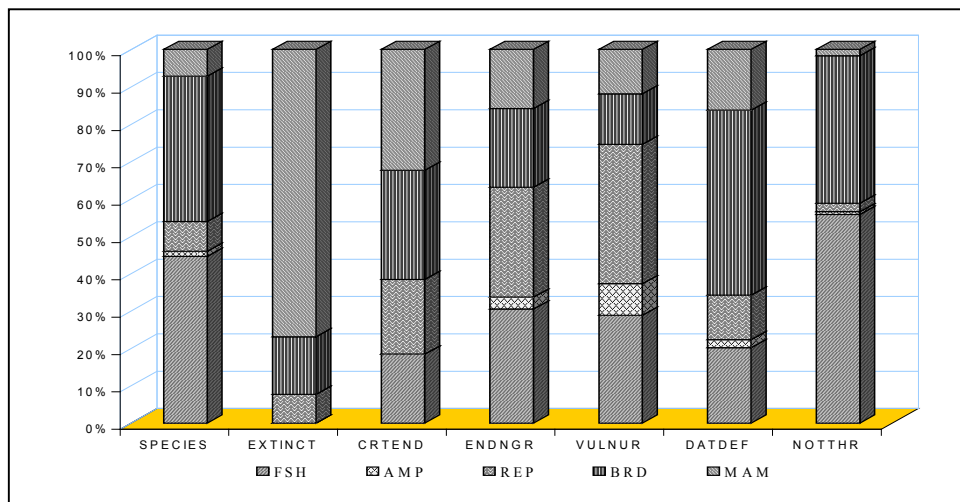


**Figure I** Bio-ecological zones of Bangladesh (Source: IUCN Bangladesh, 2000)

The ecosystems of Bangladesh can be placed under 4 broad types viz., coastal and marine ecosystem, inland freshwater ecosystem, terrestrial forest ecosystem and man-made ecosystem.

Among the terrestrial ecosystem, forests including officially classified and unclassified state lands, village forests and tea or rubber gardens that occupy about 2.56 million ha are environmentally and economically important natural resources. The Sundarbans, a World Heritage Site, is a globally recognized mangrove ecosystem.

The terrestrial and aquatic areas of the country together support a large number of diverse floral and faunal assemblages. Around 220 species of vertebrate animals including fish, amphibians, reptiles, birds and mammals have been listed in the Red Data Books of Bangladesh as they are faced with the threat of extinction. Though least known, the invertebrates form a major bulk of the faunal diversity, particularly aquatic invertebrates. The status of the various groups of vertebrates determined based on the numbers of threatened species and modified IUCN categories are shown in Figure II below.



**Figure II** Status of threatened species in Bangladesh  
(Source: IUCN Bangladesh, 2000)

Natural resources of Bangladesh include natural gas, arable land, and timber. The major economic sectors of the country include agriculture, manufacturing industries, and various services such as transport, trade, and housing. Bangladesh which has a comparatively low natural resource base has a high growth rate of population, with almost half of the population below fifteen years of age. Thus, for the survival of Bangladesh's dense population, it is essential to have environmental planning and management that conserves and sustains the ecosystems that support livelihoods.

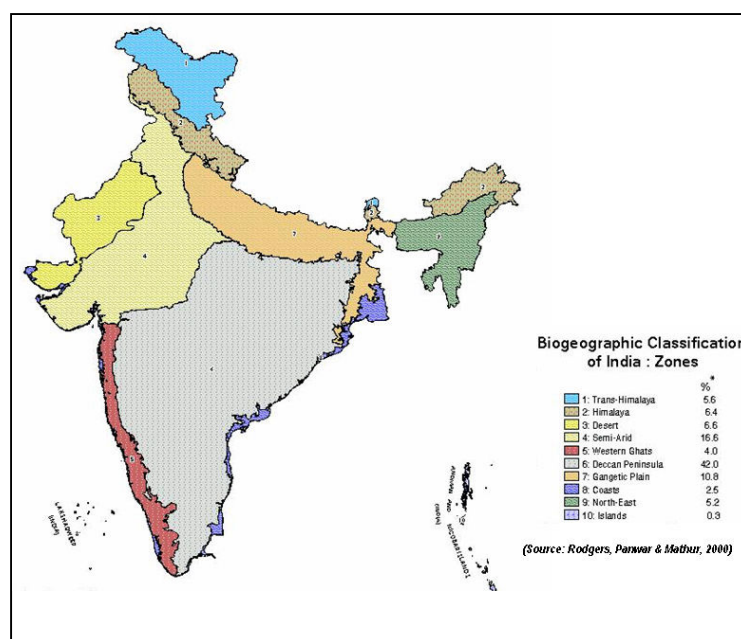
As an active delta of three of the world's major rivers, suitable conditions prevail for agricultural activities in Bangladesh, four-fifths of the population depends directly or indirectly upon agriculture. The agro-ecosystems are vital to human livelihoods and economy as they contribute 17% of the GDP.

The major causes of threats to biodiversity resources is the deforestation for industrialization, rapid urbanization and high population pressure on existing forest land, both for settlement and shifting cultivation. Other causes of biodiversity loss include water pollution (as a result of excessive use of commercial pesticides), encroachment, grazing, fire, uncontrolled and wasteful commercial logging, illegal felling, fuel wood collection, and official transfer of forestland to other sectors, i.e., for settlement, agriculture, industries and other competing uses such as horticulture. In Bangladesh, invasive floral and faunal species have been intentionally introduced for increasing productivity for commercial gains. Two controversial genera of flora introduced to the country are the *acacia* and *eucalyptus* spp, which exercise adverse effects on soil fertility, water table and humus dependent species and terrestrial wildlife. Bangladesh has high fish diversity due to its extensive wetlands, but indiscriminately introduced invasive species have spread rapidly during severe floods, posing a threat to the indigenous fauna. As a result, 54 indigenous fish species are now threatened with extinction in the country.

## Appendix – IB

## India: Overview of biodiversity status and threats

India is the seventh largest country in the world and Asia's second largest nation with an area of 3,287,263 km<sup>2</sup>. The Indian mainland stretches from 8°4' to 37°6' N latitude and from 68°7' to 97°25' E longitude. It has a land frontier of some 15,200 km and a coastline of 7,516 km (Gol, 1985) and is a home to over 1 billion people, representing 16% of the world's population. Physically, the massive country is divided into four relatively well defined regions - the Himalayan mountains, the Gangetic river plains, the Southern (Deccan) plateau, and the islands of Lakshadweep, Andaman and Nicobar. Biogeographically, the country is divided into ten zones (Figure III).



**Figure III** Biogeographic zones of India

India possesses a distinct identity, not only because of its geographic, historic and cultural attributes but also because of the great diversity of its natural forests, grasslands, deserts, wetlands and marine ecosystems that provide a gamut of diverse habitats for sustaining a sizeable percentage of the world's faunal and floral wealth. India has 47,000 species of flowering and non flowering plants representing about 12% of the recorded world's flora. Its fauna is represented by 422 species of mammals, 5749 species of fishes and 521 species of reptiles which accounts for nearly 10% each of the world's mammalian, insect and fish species, and over 8% of reptiles ([www.wii.gov.in](http://www.wii.gov.in)). Its avian diversity represented by 1228 species doubles that of Europe. India has many endemic plant and vertebrate species. Among plants, species endemism is estimated at 33% with c. 140 endemic genera. Areas rich in endemism are north-east India, the Western Ghats and the north-western and eastern Himalayas. A small pocket of local endemism also occurs in the Eastern Ghats. Only 44 species of Indian mammal have a range that is confined entirely within Indian territorial limits. In contrast,

endemism in the Indian reptilian and amphibian fauna is high. There are around 187 endemic reptiles, and 110 endemic amphibian species. India contains 172 species of animal considered globally threatened by IUCN, or 2.9% of the world's total number of threatened species (Groombridge, 1994).

The main natural resources of India are iron, bauxite, copper and limestone reserves, natural gas, petroleum, arable land and hydro power. India is one of the ten most industrialized nations and is among the ten fastest growing economies in the world. The share of the Industrial sector to GDP is about 30 percent while agricultural sector contributes about 27.6%.

India's globally and nationally important biodiversity is threatened by several factors. The steady growth of human as well as livestock population and current phase of economic and trade liberalization are exerting heavy pressure on limited land resources. The number of urban agglomerations/cities with populations of over one billion has increased from 5 in 1951 to 9 in 1971 and 23 in 1991 (UNEP, 2001). This rapid increase in urban population and country's need for civic infrastructure and industrial expansion has resulted in unplanned urban development that has led to habitat fragmentation, conversion, and associated loss of many biodiversity resources. Some of the root causes of declining biodiversity are poverty and lack of sustainable alternative livelihoods for resource dependent communities; lack of integration of biodiversity and livelihood considerations into development planning in around biodiversity rich areas and lack of financial and social incentives to local communities from conservation efforts and related funding. The greatest challenges for biodiversity conservation are perhaps posed by large scale mining operations in integrated forest landscapes and impoundments of biodiversity rich tracts of natural ecosystems for hydroelectric projects. The environmental problems are linked to the pollution of air and water from increased industrial activities, intensive farming, and the overuse of fertilizers and other chemicals in agricultural production.

Degradation of ecosystem from combined impacts of different census already mentioned is a major threat both to biodiversity and livelihoods (loss of productivity of NWFP, forage, farms and livestock). Industrial projects including hydro-electric-irrigation, mining infrastructure does not compensate the loss of 'commons' (forests, pastures, rivers etc.) diverted by them. Consequently, the overuse of residual commons further compounds the process of degrading the ecological services.

## Appendix – IC

**Nepal: Overview of biodiversity status and threats**

The Kingdom of Nepal, situated between India and China, on the southern slopes of the central Himalayas is located between latitudes 26° 22' and 30° 27' N and longitudes 80° 40' and 88° 12' E. The country occupies a total area of 147,181 km<sup>2</sup> and has a population of 26.1 million. The average population density is 157.73/km<sup>2</sup>, with the highest density (330.78/km<sup>2</sup>) in the *terai*, medium density in the hills (167.44/km<sup>2</sup>) and lowest in the mountains (32.62/km<sup>2</sup>).

Nepal comprises only 0.09% of land area on a global scale, but it possesses a disproportionately rich diversity of flora and fauna at genetic, species and ecosystem levels. Its biodiversity is greatly influenced by its unique geographic position and altitudinal, climatic and ecological variations that range from monsoon tropical, temperate, alpine to arctic ecosystems. Because of its location in the transitional zone between the eastern and western Himalayas, it falls within two biogeographical realms – the Palaearctic and the Indo-Malayan biogeographical regions and the major floristic provinces of Asia (the Sino-Japanese, Indian, western and central Asiatic, Southeast Asiatic, and African Indian desert) creating a unique and rich terrestrial biodiversity. According to Hagen (1998), Nepal has seven physiographic divisions from south to north: Terai, Siwalik Hills Zone, Mahabharat Lekh, Midlands, Himalaya, Inner Himalaya, and Tibetan Marginal Mountains.

The angiosperm flora of Nepal comprising of 5,856 species belonging to 203 families (Hara *et al.*, 1978 & 1982; Akiyama *et al.*, 1998) is impressively high on a global scale considering the area of the country. A comprehensive account of Nepal's fauna has been produced. Suwal & Verheugt (1995) listed a total of 181 mammalian species belonging to 12 orders and 39 families. Grimmet *et al.*, (2000) reported 852 species belonging to 18 orders; Shrestha (2001) listed 185 species of fishes and Shah (1995) reported 143 species of amphibians and reptiles. Thapa (1995, 1997) reported 144 species of spiders and 5,052 species of insects of which 1,131 were discovered for the first time and described from Nepalese specimens. Altogether, 342 plant species and 160 animal species have been reported as being endemic to Nepal. Of the mammalian species listed from Nepal, 27 mammal species are listed as threatened by IUCN. Additionally, 22 bird species, nine reptile species (one endangered, two vulnerable, one rare, four indeterminate and one insufficiently known), and two insect species are listed under IUCN's Red List (1995).

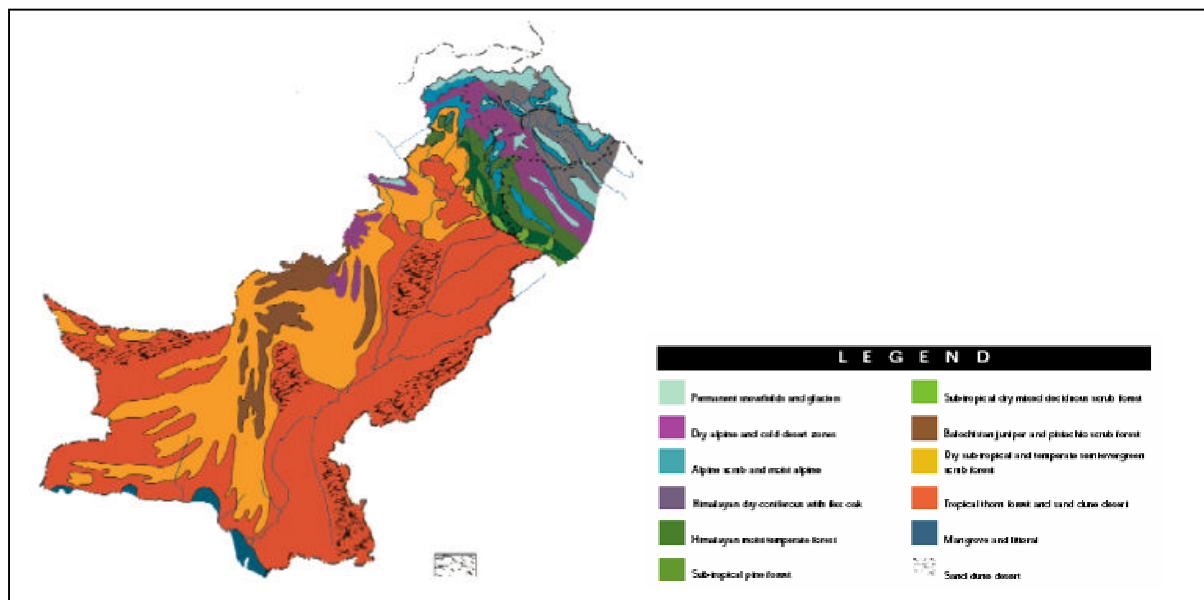
In terms of natural resources of Nepal, forests make up the second largest resource base after water. The hydroelectric potential of the country is estimated to be about 45,000 MW. The forested area represents 29% of the country's total land area. The economy in terms of foreign exchange to subsistence is heavily reliant on agriculture, forestry and fishing.

Poverty, ecological fragility, and instability of high mountain environments, deforestation, poor management of natural resources, and inappropriate farming practices are the primary threats to mountain biodiversity of Nepal. The cumulative impacts of these threats result in accelerated soil

erosion, catchment's degradation, and loss of biodiversity. Diversity in forests is also under increasing pressure from growing human population; unsustainable harvesting of fuel wood, timber, leaf litter, medicinal plants and other forest products, the impacts of excessive grazing by large numbers of livestock, and the construction of roads, dams and settlements, etc. One of the greatest threats faced by Himalayan flora and fauna is over-exploitation and poaching for trade of specific plants and animal parts that fetch high commercial values in local and international markets. Of the many species threatened with extinction, three wildlife species (Himalayan black bear (*Selenarctos thibetanus*), brown bear (*Ursus arctos*) and the Himalayan musk deer (*Moschus chrysogster*) are poached for their organs that fetch enormous amounts of money through illegal international trade. The increasing pressures of tourism have induced greater demands of natural resources and introduced several alien species.

## Pakistan: Overview of biodiversity status and threats

Pakistan covers a land area of 88.2 million ha and has a coastline of about 1,046 km with 22,820 km<sup>2</sup> of territorial waters and an Exclusive Economic Zone of about 196,600 km<sup>2</sup> in the Arabian Sea (Anon., 1999). It lies between 23°35' to 37°05' north latitude and 60°50' to 77°50' east longitude touching the Hindukush Mountains in the north and extending from the Pamirs to the Arabian Sea. With its dramatic geological history, broad latitudinal spread and immense altitudinal range, Pakistan spans a remarkable number of the world's ecological regions. These range from the coastal mangrove forests of the Arabian sea to the spectacular mountain tops where the western Himalaya, Hindukush and Karakoram ranges meet. The region's topography (Figure IV) is constantly changing, as frequent earthquakes help the mountains grow at the remarkable rate of 7 mm (1/4 inch) a year.



**Figure IV** Vegetative zones of Pakistan (Source: Roberts, 1991)

The country's flora and fauna are composed of a blend of Palaearctic and Indo-Malayan elements, with some groups also containing forms from the Ethiopian region. About 5,700 species of flowering plants, 174 mammals, 668 species of birds, 177 species of reptiles and 198 freshwater fish species including both native and introduced species have been reported (Anon., 1999). Due to man-made borders and the country not being an isolated entity in bio-geographic terms, the rates of endemism are low (about 7% for flowering plants and reptiles, and 3% for mammals). On the other hand, the proportion of 'restricted range' species is much higher and for many of them, Pakistan contains the bulk of the global population (IUCN, 2004).

The natural resources of the country include land, extensive natural gas reserves, limited petroleum, low grade coal, iron ore, copper, salt and limestone.

A number of serious environmental problems are inherent in the country, which are of great ecological concern for a sustainable economic future. These include – poverty; urban migration and the growing population; shortage of potable water; agricultural runoff and pesticide misuse; pollution of fresh water and marine systems; water logging and salinity; deforestation and soil erosion and desertification. The biggest threat to biodiversity is the progressive loss, fragmentation and degradation of natural habitats leading to the disappearance of countless species from forested area, rangelands and freshwater and marine ecosystems. Based on various reports (e.g. Mallon, 1991) and the opinions of recognized authorities (T.J. Roberts, *pers. comm.*, R. Rafiq, *pers. comm.*), at least 10 ecosystems of particular value for their species richness and/or unique communities of flora and fauna are threatened with habitat loss and degradation. Trees are indiscriminately cut to provide for the ever-increasing demand for timber. The rapidly increasing domestic livestock population is also taking its toll on the genetic diversity of country's rangelands and forests. This loss has been more rapid in the past few decades. Among the other factors of biodiversity decline, is the increase in the number of trawlers and the international demand for shrimp that has resulted in shrimp fishing beyond sustainable yield and have threatened the existence of many species of marine turtles caught in the trawlers.

## Appendix – IE

**Sri Lanka: Overview of biodiversity status and threats**

Sri Lanka, an island in the Indian Ocean is located to the south of the Indian subcontinent. It lies between 5°55' and 9°55' north of the equator and between the eastern longitudes 79°42' and 81° 52'. Being an island country, Sri Lanka is endowed with a coastline of 1585 km and has a land area of 6.5 million ha. Land is the most vital and heavily threatened natural feature. The country's total population is around 19 million and a population density of 280 persons per km<sup>2</sup>.

Sri Lanka has rich ecosystem diversity for its small size. Its natural ecosystems include (i) the marine and maritime or coastal ecosystems influenced by the sea, (ii) the natural forest ecosystems, (iii) the natural grassland ecosystems and (iv) the inland wetland ecosystems. Of the 83 wetland sites in Sri Lanka, 41 are included in the Asian Directory of Wetland Sites (UNEP, 2001).

Among the Asian countries, Sri Lanka has the highest biodiversity per unit area of land in terms of flowering plants and all vertebrate groups, excepting birds. The vegetation of Sri Lanka supports over 3,350 species of flowering plants and 314 species of ferns and fern allies. There is also considerable invertebrate faunal diversity. The vertebrate fauna include 51 species of teleost fishes, 39 species of amphibians, over 125 species of reptilia, over 390 species of birds, 96 species of mammals including 38 species of marine mammals. Approximately 28.3% or 927 of the flowering plant species are endemic to Sri Lanka. Among the different vertebrate groups, the highest proportion of endemic species is recorded among the amphibians (65%), reptiles (52%), and freshwater fishes (41%). Among the invertebrate groups, the highest proportion of endemics is recorded among the freshwater crabs -100% and land mollusks -76% (UNEP (2001).

Until the 1960s, the Sri Lankan economy depended heavily on the export oriented plantation of crops of tea, rubber and coconut. But the adoption of open economic policies in late 1970s and the trade liberalization programme stated in the late 80s, lead the country more towards industrialization. By 1998, the services sector contributed 53% to the GDP, while agriculture, forestry and fisheries sector provided 21% (The South Asia Environment and Natural Resource Centre (UNEP, 2001).

The trends of biodiversity losses are significant. Over 284 flowering plants and 90 fern species are identified as globally threatened species. Among the animals, over 55% of the endemic species in the each of vertebrate groups, and over 50-100% of species in the invertebrate groups are under threat. Most of the ecosystems and habitats are under threats due to pressures arising from the increasing demand for land for urban expansion, agriculture, large-scale development projects and expansion of tea plantations. The dense forest cover in Sri Lanka decreased by 20%, during the period 1956 to 1992. The rate of deforestation from 1960 to 1990 has been estimated at 42,000 ha per year. Removal of timber and other forest products have affected biodiversity both at species and genetic levels. Slash and burn cultivation and forest fires have affected specially the biodiversity in the dry zone. Mining in natural ecosystem in the wet and intermediate zones especially for precious stones, result in the

complete removal of the natural vegetation. Over 200-300 marine fish species and invertebrate are exported for the aquarium. Over exploitation is inevitable and affects the diversity of these reefs. At present, around 20 floral and 10 faunal invasive species have been introduced in various ecosystems. Over visitation to wild life and natural reserves, in vulnerable areas of Sri Lanka have significant impacts on ecosystem in terms of changes in community composition and dynamics. Water and soil pollution due to agrochemicals and industrial wastes and sediment loads and increase in temperature of seawater due to global warming are the factors that threaten the coral reefs in Sri Lanka. About 80% of the industries are concentrated in the districts of Colombo and Gampaha. Some of these industries such as textile dyeing, bleaching, food processing, leather tanning, metal finishing, agro and mineral products are highly polluting and pollute inland water. Marine turtles are still exploited, and turtle egg poaching, slaughtering of turtles for their flesh or carapace and turtle hatcheries that operate illegally, are common occurrences along the coastline.

## Appendix – II

### Biodiversity conservation: An overview of country specific legislations

#### *Bangladesh*

The Forest Act, (GoB, 1927), The Private Forest Order (GoB, 1959), and The Bangladesh Wildlife (Preservation) (Amendment) Act (GoB, 1974) are the key legislations in place for conservation of forests and wildlife in Bangladesh. In 1992, the Government of Bangladesh announced 'The National Environmental Policy of 1992' for ecological protection from natural disaster, sustainable use of natural resources and other related programs. Bangladesh has prepared National Conservation Strategy (NCS) and the National Environment Management Action Plan (NEMAP) for 1995 to 2005 under assistance from UNDP. Both NCS and NEMAP contain national strategy and national program for conservation of sites important from biodiversity consideration.

Bangladesh has signed, ratified, accepted and acceded to CITES, World Heritage Convention, Ramsar Convention, Convention on Biodiversity, Climate Change Convention and Convention to Combat Desertification. Bangladesh has also initiated the preparation of Biodiversity Strategies and Action Plan (BSAP) for conservation of biodiversity in Bangladesh under the sponsorship of the GEF.

#### *India*

The adoption of a National Policy for Wildlife Conservation (MoE&F, 1970) and the enactment of the Wildlife (Protection) Act (GoI, 1972) subsequently amended in 1993 and 2002 led to a significant growth in the protected areas network, from 5 national parks to 96 and 452 wildlife sanctuaries to 504 today respectively.

The enactment of Forest (Conservation) Act, 1980 (amended in 1988) helped in regulating the diversion of forests for non forest purpose and afforded legal protection to biodiversity within forested habitats of the country.

The recently enacted National Biodiversity Act (GoI, 2002), provides for conservation of biological diversity, sustainable use of its components and equitable sharing of the benefits arising out of the use of biological resources.

Among the key policy guidance, Wildlife Conservation Strategy (MoE&F, 2002) and National Environment Policy (MoE&F, 2006a) are notable and aim to provide mutually reinforcing strategies for conservation and development.

India is also a party and signatory to most of the multilateral agreements relevant for biodiversity conservation. These include Ramsar Convention (1971), CITES (1973), Vienna Convention (1969), Montreal Protocol (1987), CBD (1992), Convention on Climate Change (1992), World Heritage Convention (1972), Basel Convention (1989) and Bonn Convention (1983).

## Nepal

The importance of conserving wild species of fauna and flora was first recognized by His Majesty's Government of Nepal (HMGN) in Nepal's first Five-Year Development Plan (1956-1961). The enactment of the NPWC Act in 1973 provided a regulatory mechanism for the conservation of natural areas and wildlife. It prohibited destruction, exploitation and removal of fauna or flora, and any kind of damage to habitat. The Act was subsequently amended four times, in 1974, 1982, 1989 and 1994, for the protection of endangered species of wildlife and their habitats, and management of different categories of protected areas (national park, strict nature reserve, wildlife reserve, hunting reserve, conservation area and buffer zone), and for the regulation of consumptive and non-consumptive uses of biodiversity so that the welfare of the people is sustained.

In order to fulfill its international obligations towards the conservation of genetic diversity, Nepal has become a party to several international agreements and conventions that include International Union for the Protection of New Varieties of Plants (1961), CITES, (1973), Convention on Biological Diversity (1992), Ramsar Convention (1971), International Technical Conference on Plant Genetic Resources: Global Action Plan on Plant Genetic Resources, Leipzig, (1996) and World Trade Organization (WTO) under the General Agreement on Tariffs and Trade (GATT), 1994. To honour obligations under the Convention on Biological Diversity, the two important policy documents – the National Conservation Strategy (HMGN/IUCN 1988) and the Nepal Environmental Policy and Action Plan (EPC, 1993) have been published by HMGN under support from Global Environment Facility and UNDP. These policy documents have highlighted the necessity of establishing appropriate policies, regulations, and management approaches to ensure sustainable extraction of medicinal plants.

## Pakistan

The legislative framework for the conservation of wildlife consists of the various provincial acts and ordinances. The first legislation targeting environmental conservation as a whole was the Pakistan Environmental Protection Ordinance of 1983. This has very recently been replaced by the Pakistan Environmental Protection Act (GoP, 1997). These laws provide for the establishment of provincial wildlife management boards with responsibility for the formulation of policy and the supervision of activities related to the conservation and management of wildlife.

The Government of Pakistan has recognized the importance of preparation of the National Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. To meet the planning requirements of the Convention on Biodiversity, the Biodiversity Action Plan has already been prepared for Pakistan in 2000 under an agreement between the Government of Pakistan and the World Bank's Global Environment Facility. Pakistan is a party to two other international conventions dealing with species: the Bonn (1987) and CITES (1973), Pakistan is also a party to two area-based treaties: the Ramsar Convention (1971), and the Convention Concerning the Protection of the World Cultural and Natural Heritage signed at UNESCO, Paris in

1972. In addition to these treaties, Pakistan is a party to the United Nations Convention on the Law of the Sea (1982).

### *Sri Lanka*

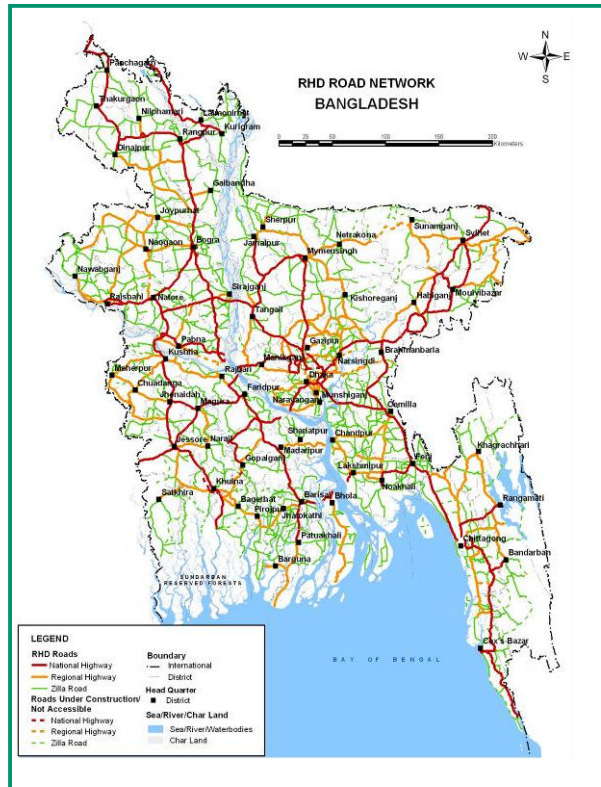
Major legislative enactments on the biological resources of Sri Lanka are the National Environmental Act (NEA) (GoSL, 1980), Forest Ordinance (1845), The Flora and Fauna Protection Ordinance (1937), National Heritage Wilderness Areas Act (1988), Botanic Gardens Ordinance (1928), Fisheries and Aquatic Resources Act (1996), the Plant Protection Ordinance (1999), and the Customs Ordinance (1969). The concept of environmental protection is enshrined in the country's constitution. A National Environmental Action Programme (NEAP) was prepared by the Ministry of Environment and Parliamentary Affairs and is the first comprehensive document regarding environmental planning in the country. The National Environmental Steering Committee and NGO's were involved in the formulation of the NEAP.

The preparation of the Biodiversity Action Plan was undertaken in response to Article 6 of the Convention (CITES). While consolidating the ongoing efforts of conservation and sustainable use of biological diversity, the Biodiversity Action Plan aimed at establishing a policy and programme regime, to bring national action to various aspects of the subject, including capacity-building and bio-safety measures, in line with the articles of the Convention. A National Conservation Strategy (NCS) for the country has been prepared by a special task force. The NCS identifies constraints to conservation and lay out a plan of action to remove them. It also provides guidelines for the implementation and monitoring of the Action Plan. The NCS includes directions for the establishment of a comprehensive system of protected areas and in the forestry sector, for the identification of forests for protection by the state.

## Developments in road sector: An overview by country

### Bangladesh

The Government of Bangladesh has accorded high priority to the building up of necessary surface transport system, particularly a suitable road transport network. The total length of paved road network in Bangladesh has increased rapidly in recent years. The paved road network has increased from 600 km in 1947, to about 300,000 km at present. Of this 21,571 km of national, regional and district roads are managed by the Roads and Highways Department. The other roads including about 250,000 km of rural roads and 29,000 km of urban roads are managed by City Corporation and local government institutions. Cumulative ADB lending to Bangladesh, for transport and communication as of 31 December 2004 was 1,687.0. The investments on road projects in Bangladesh are being met both from government funds (128.7 Million US Dollar) and the Asian Development Bank loan (320.4 million US Dollar).

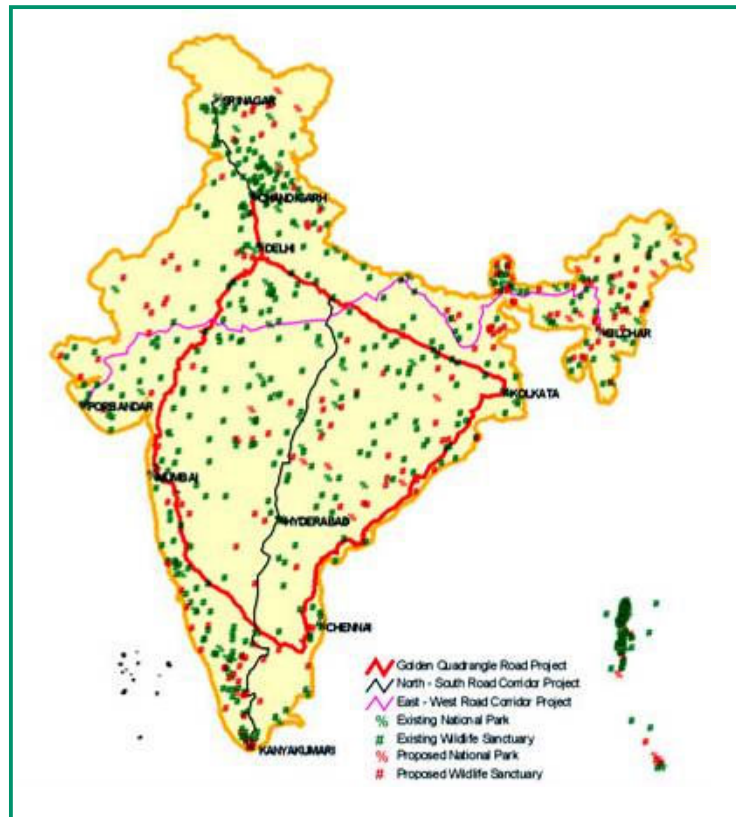


**Figure V** Road network of Bangladesh (Source: Roads and Highways Department, Bangladesh)

### India

India's transport system is one of the largest in the world. It serves a land area of 3.3 million square kilometers (km<sup>2</sup>) and consists mainly of roads, railways, and air services. Road transport with the total estimated road length of about 3.4 million km, is now the dominant mode. India's road network mainly consists of three categories of roads: national highways (about 60,000 km) that provide high-density links between states; state highways (about 600,000 km) for linking national highways with district headquarters, important towns, and minor ports and major district roads; and rural roads (about 2.7 million km) mainly consisting of linking rural communities with the highway network. Improving the road transport network has been recognized as an important factor in promoting economic development, social integration and poverty alleviation in India. The Government of India has targeted to achieve balanced development of the total road network, which includes adding capacity by widening roadways, improving riding quality, strengthening road safety measures, and improving connectivity among rural communities. These objectives are being achieved through two elaborate and ambitious

road building programmes- (i) The National Highway Development project which envisages construction of 6,000 km golden quadrilateral linking Delhi, Mumbai, Chennai, and Kolkata and (ii) the 7,300 km north–south, east–west corridors from Kashmir to Kanyakumari and Silchar to Porbandar. This project requires US Dollar 11 billion. Financing for this project is being met from earmarked excise duty (cess) on petrol and diesel, multilateral funding, budgetary allocations, and market borrowing. The Prime Minister's Rural Roads Program - Pradhan Mantri Gram Sadak Yojana (PMGSY) is under progress to address the problem of lack of rural road connectivity. PMGSY has identified more than 170,000 unconnected habitations requiring new road connectivity. The revised target to achieve connectivity to all habitations with a population of 1,000 (500 in the case of hilly or tribal areas) or more by the year 2010 would require US Dollar 30 billion. About 40 % of this requirement is being funded from the cess on high-speed diesel oil and about 7% from the committed assistance from ADB and the World Bank. Funding sources for the balance of 53% have not yet been identified.



**Figure VI** Road network of India between major metropolitan towns (Source: GIS center, WII)

## Nepal

Nepal is a landlocked country with China to the north and India to the south. Because of its mainly mountainous terrain and difficult weather conditions, roads and aviation are the major modes of transportation in the country. Nepal's total road network and density is the lowest in the region. The current road network extends to 37,000 km including 7535 km of highway and 20,000 km of rural road network. Of the rural roads, only 30 percent of the rural population has access to all-weather roads. More than 60 percent of the network is concentrated in the lowland (Terai) areas of the country. The poor condition of the road network has been recognized as a major barrier in the delivery of social services in the remote hill and mountainous districts and in improving the country's economic development. Therefore, improving and modernizing means of transportation and increasing communication networks to integrate rural area has been realized as a target under the Nepal

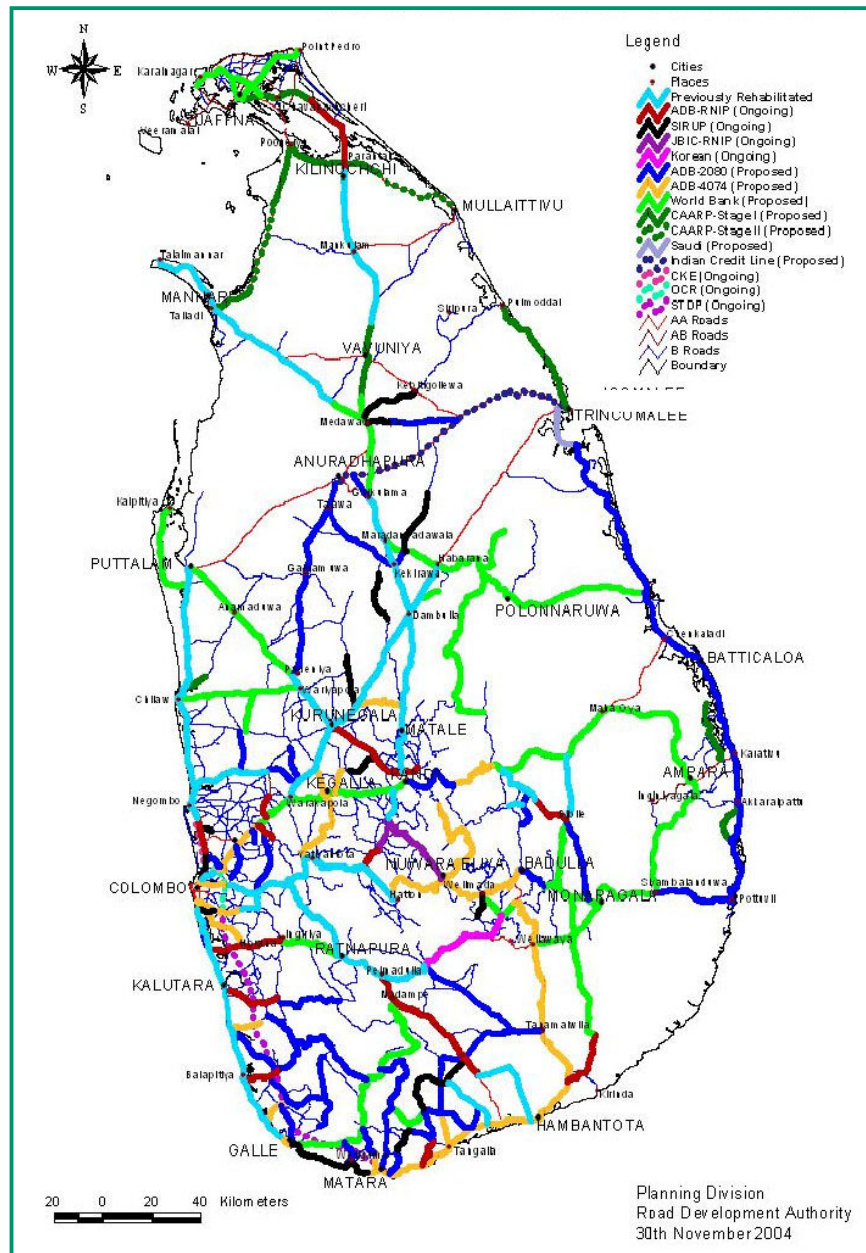


transport system. Roads are increasingly being viewed as a 'service' and a 'business' and major investments are being made in improving the network and rehabilitation of existing highways.

**Sri Lanka**

Sri Lanka has an extensive road network dating back to pre-independence times. The systematic construction of roads in Sri Lanka started in 1821 when the British built a road from Colombo to Kandy. The present total road network of approximately 100,000 km including 11,658 km of national highways, 15,000 km of provincial roads, and other rural roads is vital for the movement of people and goods and play an important role in integrating the country, facilitating economic growth, and ultimately reducing poverty. While the road density in Sri Lanka is higher than that of many developing countries, their capacities have not expanded in line with the growth of the vehicle population, which currently stands at around 2.4 million and carry over 70% of the traffic in Sri Lanka. The liberalization of the economy in 1978 caused a rapid increase in the demand for road transport. The rapid transfer of 98% of freight transport from rail to road over the past 50 years has also resulted in an additional demand for road transport. In spite of the substantial increase in traffic demand, there has been very little investment for construction of new highways or for widening and improving existing trunk. The Government of Sri Lanka recognized an urgent need to invest in the

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**Figure IX National highway development programme of Sri Lanka – 2004 onwards** (Source: Planning Division, Road Development Authority, 2004)

improvement of its transport infrastructure. Several new highway and expressway projects are now underway with new traffic management system. The Government budget allocation for road sector developments has rapidly increased from SL.Rs.9.65 million (US Dollar 88,654.11) in 2003 to SL. Rs. 37.29 million (US Dollar 342,581.53) in 2005. Major projects in the pipeline under government aid include rehabilitation of the cluster of 20 road projects, Outer Circular Highway and Colombo – Kandy Alternate Highway. In addition, the Asian Development Bank and Japan Bank for International Corporation (JBIC) have funded rehabilitation of several sections of roads (totaling 348 km in length) and 47 bridges under its Road Network Improvement Project (RNIP). Other projects involving the rehabilitation and reconstruction of bridges and roads are being funded by Japanese International Corporation Agency (JICA), Kuwaiti Fund for Arab Economic Development.

## Appendix – IV

**Developments in mining sector: An overview by country*****India***

The history of mineral development is as old as the civilization in India and the mineral production dates back to the ancient times as the mining activities can be traced to as far back as 6,000 years or so. The country has a well-developed mining sector, which has vast geological potential with over 20,000 known mineral deposits. India produces as many as 84 minerals comprising 4 fuel, 11 metallic, 49 non-metallic industrial and 20 minor minerals. Their aggregate production in 1999- 2000 was about 550 million tonnes, contributed by over 3,100 mines (reporting mines) producing coal, lignite, limestone, iron ore, bauxite, copper, lead, zinc etc. The mining leases numbering 9,244 are spread over 21 States on about 13,000 mineral deposits occupying about 0.7 million hectares which is 0.21% of the total land mass of the country (TERI, 2001). The aggregate value of the mineral production in 1999-2000 was more than Rs. 450 billion (approximately US \$10 billion).

The distribution of the value of mineral production shows that fuel minerals account for about 82% (of which solid fuels 44% and liquid /gaseous fuels is 38%), metallic minerals about 8%, non-metallic minerals 4% and the balance 6% is contributed by minor minerals. The National Mineral Policy (1993) opened the gates of Indian mineral industry to domestic and foreign investment, much of which was earlier reserved for the public sector. It aims to boost the country's exploration and mining efforts and render the mineral industry more competitive. In October 1996, the Ministry of Steel and Mines, Government of India, issued guidelines for grant of large areas for aerial prospecting under the provisions of the amended MM(R&D) Act (1995).

***Pakistan***

Pakistan has a favorable geological environment with a large number of mineral deposits including metallic, non-metallic, precious and semi-precious stones. Currently, Pakistan produces about 58 minerals. Mining all over the country is conducted on a small scale. During the last few decades its contribution to GNP has been about 0.5%. The future of mining in Pakistan is bright. Mega projects like Thar Coal, Duddar Lead-Zinc, and Copper-Gold are in the process of development.

***Sri Lanka***

Sri Lanka has reasonable endowments of mineral resources in relation to its size. The major mineral commodities are kaolin, ball clay, feldspar, vein quartz, silica sand, calcite, dolomite, mica, graphite, ilmanite, rutile, zircon, rock phosphate, seashells, inland coral, salt, gypsum and gems. Gems have been the most economically valuable resource accounting for more than 90% of all mineral exports from the country (GS&MB, 2002). Over 2200 metal quarries are in operation. Apart from the major minerals, mining of construction materials (limestone, dimension stone & aggregate) constitute a significant portion of mining. Despite the relatively high economic and social benefits, gem mining which is a wide spread activity has caused significant environment damages.

## Developments in oil and gas sector: An overview by country

### **Bangladesh**

Bangladesh has relatively low levels of domestic oil reserves (28 million barrels) and consumption (91,000 bbl/day) as estimated in 2005 (Oil and Gas Journal, <http://www.ogj.com/>) that makes it a net oil importer. To date, oil exploration has been rather unsuccessful in Bangladesh. Exploration and production activities are primarily carried out by the Bangladesh Petroleum Exploration and Production Company (BAPEX), a subsidiary of the state-owned Bangladesh Oil, Gas & Mineral Corporation (Petrobangla). However, the country has also initiated several Production Sharing Contracts (PSCs) with foreign oil companies and has employed tax incentives to attract foreign company involvement. In 1993, after the formation of a new National Energy policy, the government of Bangladesh divided its territory and offshore sites into 23 blocks and opened them to foreign bidding for oil and gas exploration.

While estimates of the country's reserves vary, natural gas is Bangladesh's only significant source of commercial energy. The government of Bangladesh estimates that natural gas accounts for 80 percent of the country's commercial energy consumption. Natural gas reserve estimates vary widely for Bangladesh. Bangladesh's Ministry of Finance estimated 28.4 trillion cubic feet (tcf) of total gas reserves in 2004 of which 20.5 tcf is recoverable. Oil & Gas Journal (OGJ, <http://www.ogj.com/>) reported that Bangladesh had 5 tcf of proven natural gas reserves as in January 2006. In mid 2004, Petrobangla put net proven reserves at 15.3 tcf.

### **India**

India has become the fifth largest consumer of oil in the world in 2006. The combination of rising oil consumption and fairly stable production levels leaves India increasingly dependent on imports to meet consumption needs. According to Oil and Gas Journal (OGJ, <http://www.ogj.com/>) India has 5 – 6 billion barrels of proven oil reserves in 2007, the second largest amount in Asia – Pacific region. Much of India's crude oil reserves are located off the western coast (Mumbai High) and the north east of the country. Substantial undeveloped reserves are located in the offshore Bay of Bengal and in Rajasthan state. To help meet growing oil demand, India has promoted various exploration and projects over last several years. ONGC is the dominant player in India's upstream sector, accounting for nearly three – fourth of the country's oil output during 2006.

Similarly, India has 38 trillion cubic feet (tcf) of proven gas reserves as in January 2007. The bulk of natural gas production comes from western offshore regions, specially the Mumbai Complex. The onshore fields in Assam, Andhra Pradesh and Gujarat states are also major producers of natural gas. Despite that there have been several large gas finds in India over last five years, natural gas consumption (1089 billion cubic feet ) is outstripping the new supply leading to newer developments in

this sector to maximize recovery. India's natural gas import is likely to increase in coming years. This would lead to the consideration of number of LNG import terminals and pipeline projects.

### ***Pakistan***

Pakistan has not experienced many new oil fields as a result of which the majority of produced oil comes from fields located in Southern Indian Basin. Additional producing fields are located in middle and upper Indus basins. The combination of rising oil consumption (approximately 350,000 bbl/day) and flat production (around 60,000 bbl/day) in Pakistan has led to oil imports from Middle East exporters with Saudi Arabia as the lead importer. As Pakistan's net oil imports are projected to rise, there is all possibility of the increase in refining capacity in five of its existing refineries and proposals of setting up of new refineries. In June 2006, already Kuwait agreed to fund a US\$ 1.2 billion oil refinery to be located in Port Qasim, Karachi.

Pakistan had 28 tcf) of proven natural gas reserves in 2006. The bulk of these reserves are located in the southern half of Pakistan. Pakistan's largest natural gas production occurs at the Sui field, which is located in the Southern Indus Basin. Pakistan Petroleum Limited (PPL) operates Sui field, with production averaging 655 mmcf/d. In the past few years, the country discovered seven new natural gas fields. The Pakistani Government expects the development of these new fields to add an additional 1 bcf/d to Pakistan's natural gas production. Pakistan's Government is also working on plans to build a pipeline that spans from Iran's massive natural gas reserves to Indian markets across Pakistani territory.

## Environmental legislations: An overview by country

### 1. Bangladesh

The Government of Bangladesh enacted the Environmental Conservation Act (GoB, 1995) with a view to providing a legal framework for conservation and improvement of environmental quality and regulation of environmental pollution. To address these needs, the Environment Conservation Rules (1997) were subsequently promulgated and EIA became a mandatory requirement for authorization of projects in Bangladesh under these rules.

In Bangladesh, the EIA procedure adopts a tiered system to determine the level of details necessary to appraise a project from the environmental angle before significant efforts and funds are committed for implementation of the project. The three tiers are (i) screening (ii) Initial Environmental Examination (IEE) and (iii) detailed Environmental Impact Assessment (EIA) Screening decides whether the EIA process should be applied to a development project, and if it is required, the type of study (IEE or EIA) required. The primary responsibility for conducting EIA study for any project rests with the project proponent who may get the study done through the in-house expertise or an independent environmental consulting agency having requisite qualification to perform the task. The responsibility for carrying out review of the EIA report before awarding clearance rests with the Department of Environment (DoE) which is the focal organization and regulatory body for EIA approval, at the Government level. The process for EIA in Bangladesh is summarized in Figure X.

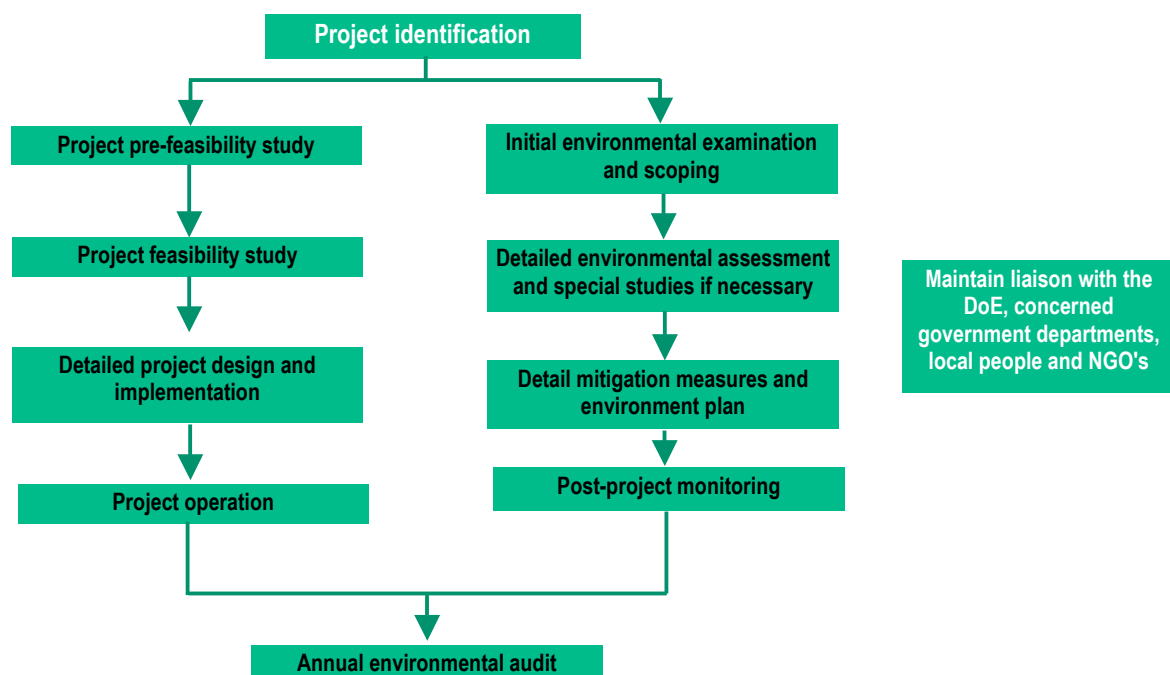


Figure X EIA process in Bangladesh

## 2. India

The Environmental (Protection) Act, 1986 is the umbrella legislation for the protection of environment in the country. The EIA Notification issued on 4th May 1994 (MoE&F, 1994) and subsequently amended on September 14, 2006 (MoE&F, 2006b) under the rules of the above Act lays down the regulatory process for EIA in India. The EIA Notification stipulates that prior environmental clearance from regulatory authority is mandatory for construction of new projects or activities or the expansion or modernization of existing projects or activities listed in its schedule to be taken in any part of the country. All projects are broadly classified into Category 'A' and 'B' projects based on the spatial extent of potential impacts on human health and natural and man made resources. All projects included in Category 'A' require environmental clearance from the Ministry of Environment and Forests, Government of India on the recommendation of the Expert Appraisal Committee and for all Category 'B' projects, environmental clearance is required from the State Environmental Impact Assessment Authority (SEIAA) duly constituted by the Central Government. As per the provisions of the EIA Notification as amended on 14th September 2006, the environmental clearance process comprise of four stages-screening, scoping, public consultation and appraisal based on final EIA report.

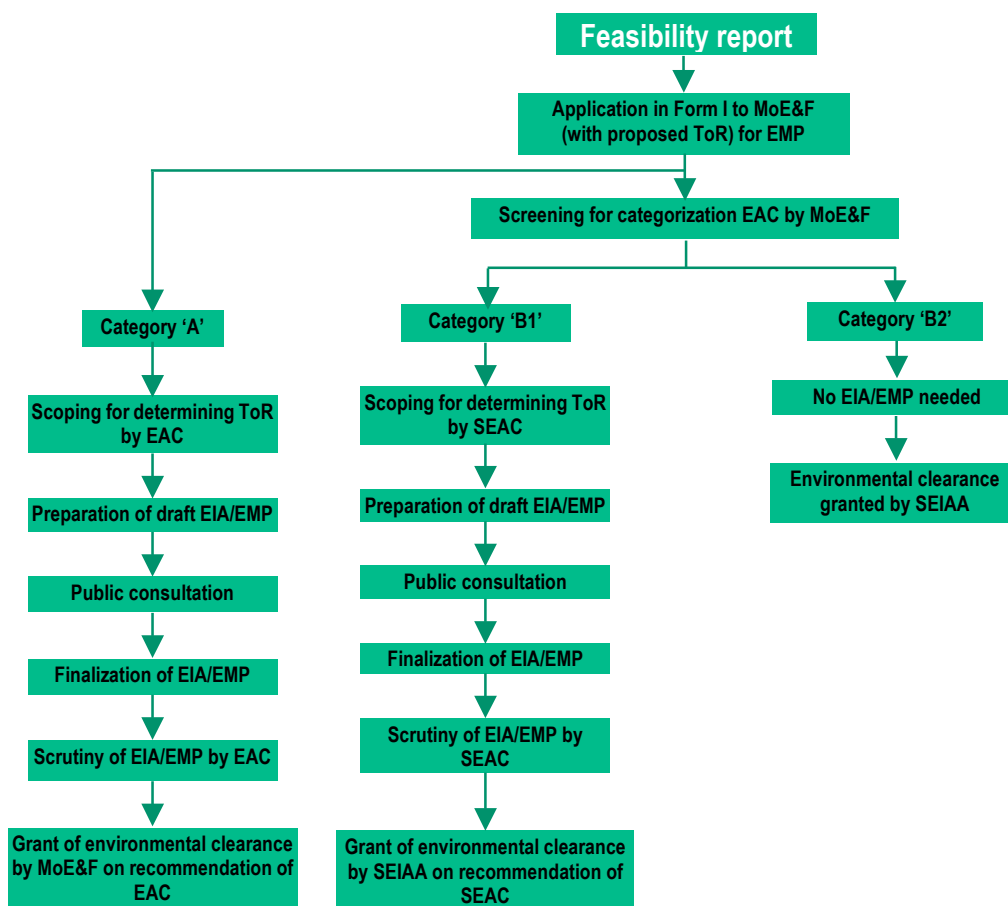
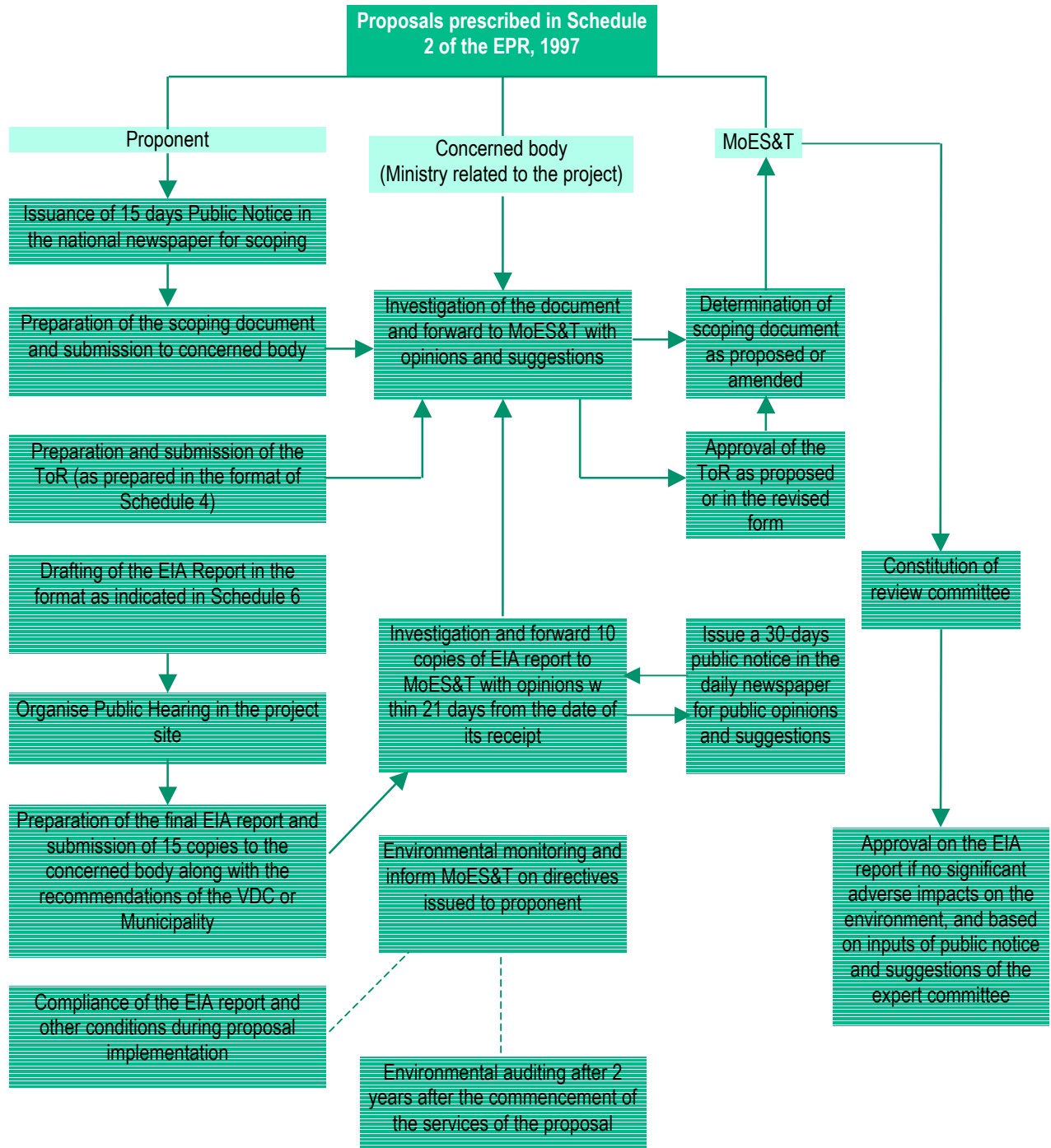


Figure XI EIA process in India

### 3. Nepal

The Environment Protection Act is an 'umbrella' law for providing a legal basis for the EIA system in Nepal. This newly adopted environmental protection law, together with the Environment Protection Rules makes the integration of IEE and EIA legally binding for the 'prescribed' projects. Proposals requiring IEE and EIA study have been included in Schedules 1 and 2 of the EPR, 1997 (amended in 1999). Ministry of Population and Environment (MoP&E) published an additional notice in the Nepal Gazette, on 23 August 1999, stating that the proposals which are not listed in Schedules 1 but the have investment worth ranging between Rs. 10 million (US Dollar 141843.97) to 100 million (US Dollar 1418439.71) may require IEE study, and those which are not listed in Schedule 2 but have investment worth over Rs. 100 million (US Dollar 1418439.71) should undergo an EIA process.

The establishment of the Ministry of Population and Environment (MoP&E) was announced on September 22, 1995. This Ministry was subsequently dissolved in March 2005 and its Environment Division was transferred to the Ministry of Science and Technology renamed as the Ministry of Environment, Science and Technology (MoES&T). The MoES&T as the lead agency for environment has the responsibility of promoting the EIA process by helping the sectoral ministries (nine in number). On receipt of EIA report from the project proponent, the concerned ministry makes observations and then submits the scoping, ToR and EIA reports of the projects to MoES&T for final approval. The MoES&T constitutes a review committee with the representation from concerned ministries, project proponent and EIA expert and has the ultimate responsibility of communicating the decision based on the EIA report after public notice period is over. The process for EIA in Nepal is summarized in Figure XII.

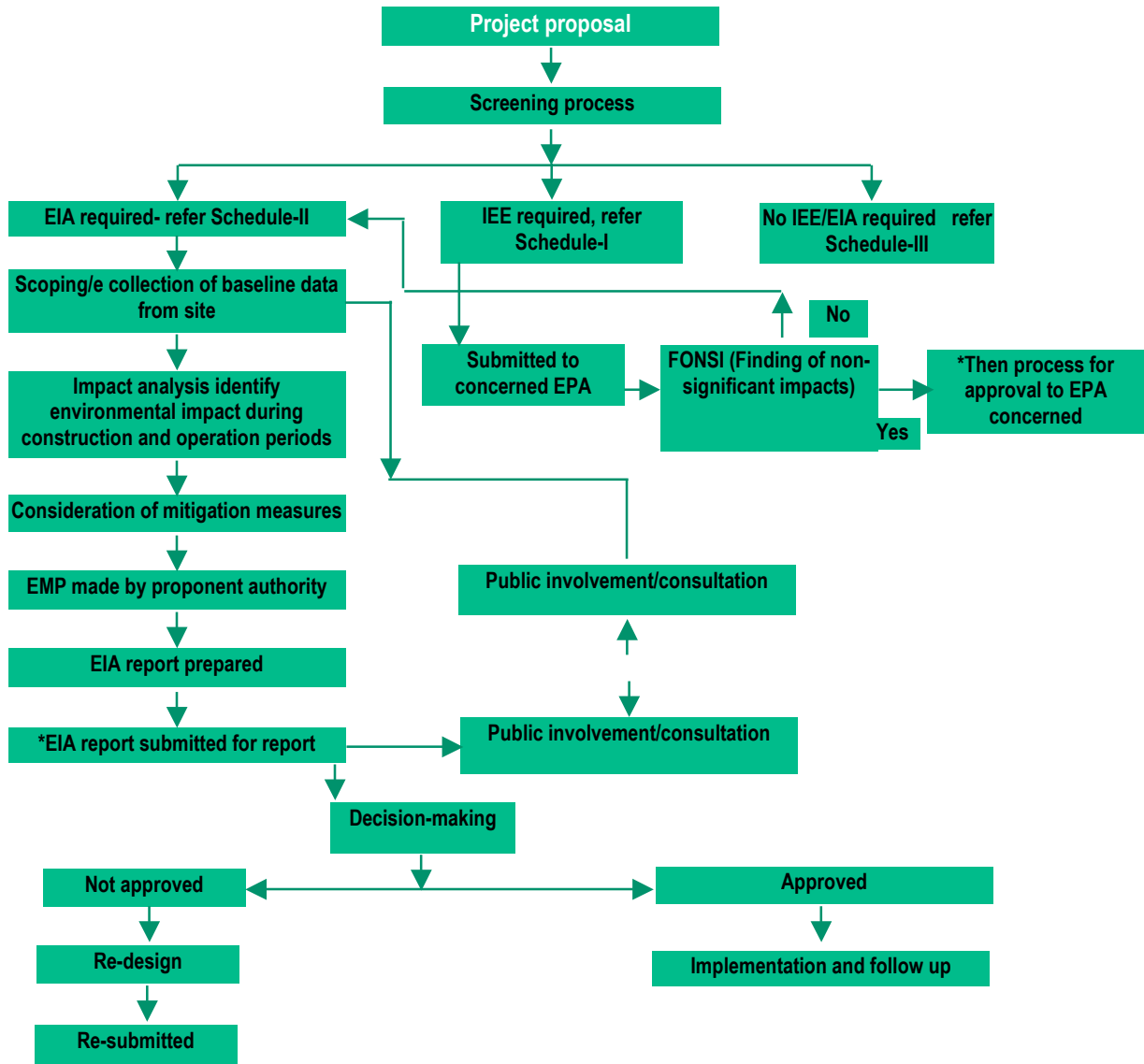


**Figure XII** EIA process in Nepal

#### 4. Pakistan

The formalized arrangements for implementation of EIA system in Pakistan evolved over a period of fifteen years. It started with the promulgation of Pakistan Environmental Protection Ordinance (PEPO) of 1983 (repealed in 1997). Environmental impact assessment of all development projects whether public or private is a legal requirement under section 12 of Pakistan Environmental Protection Act of (1997), which became operational in year 2000. Requirements regarding the content, style and details of the EA are stated in the Pakistan Environmental Assessment Procedures, 1997 (PEAP). PEAP (1997) also provides the specific guidelines for the preparation of the EA reports. Subsequent Initial Environmental Examination (IEE) and EIA Review Regulations (2001) provide the list of projects categorized in Schedule I and II to make clear distinctions between projects which require IEE (preliminary environmental review) and the projects which require EIA (a detailed environmental study). This categorization is based on the nature and magnitude of projects and the anticipated level of impacts arising from them. In addition, the Federal Environmental Protection Agency (EPA) may also direct the proponent of any project, irrespective of its listing or non listing in the two schedules, to submit an IEE or an EIA if the project is likely to have major impact or is located within environmentally sensitive area. For the preparation of the EIA, it is the responsibility of the proponent to reach out to all stakeholders: communities, NGO's, regulators, and concerned government departments. After submission of the report, the responsibility of reviewing the document for technical soundness and accuracy of content lies entirely with the concerned EPA.

After EPA accepts the EIA, a date for a Public Hearing of the EIA is fixed, and announced in a national newspaper. Based on the EPA's review of the report, an environmental approval is granted in the form of an NOC. The process for EIA in Pakistan is summarized in Figure III.



**Figure XIII** Current EIA/IEE process in Pakistan (Source: EPA, Pakistan, 2005)

## 5. Sri Lanka

Although several laws exist in Sri Lanka to protect the different aspects of the natural environment such as wildlife, forests, and water bodies, specific legislation taking into account the integrity and quality of the environment in its broadest sense came into being only with the enactment of the National Environmental Act No. 47 of 1980 (Government of Sri Lanka (GoSL, 1980)). This act established the main institution, the Central Environmental Authority (CEA) as the lead government agency for environmental protection in Sri Lanka.

The need for the Environmental Assessment (EA) was first introduced in coastal areas by the Coast Conservation Act No. 57 (GoSL, 1981). EA was introduced as a legal requirement throughout the country by the enactment of an amendment to the National Environmental (amendment) Act No. 56 (GoSL, 1988). This act stipulates that approval of major development projects, whether public or private in origin, requires the preparation of one of the two types of reports an Initial Environmental Examination (IEE) and/or an Environmental Impact Assessment (EA). However, mandatory EAs were only made effective after regulations and orders required to implement the EA process were introduced in June 1993 (GoSL 1993a & 1993b). Other actions of GoSL arising from the 1988 amendments that strengthened the legal framework for environmental management were: the issuance of regulations published in the Gazette no. 772/72, 1993c, which designated specific types of projects as 'prescribed activities' requiring detailed EAs for approval from responsible ministry and agency. The CEA has published general EA guidelines (CEA, 1995a & 1995b) and sectoral guidelines for the agricultural (CEA, 1997a), transport (CEA, 1997b), tourism, irrigation and energy (Hennayake *et al.*, 1997) sectors. Once an EIA report is submitted, as per the provisions of NEA (1998), it is placed for a public inspection and comment during the stipulated period of 30 days. According to the Gazette Extra Ordinary No. 1159/22 dated 22<sup>nd</sup> November 2000, public commenting period for IEE is not mandatory. A public hearing may be held to provide an opportunity to any member of the public (who has submitted his comments) to be heard if the PAA considers it to be in the public interest to do so. The EIA process is implemented through designated Project Approving Agencies (PAAs) specified under Section 23 Y of the NEA (1998). At present, 17 state agencies have been specified in Gazette Extra Ordinary No. 859/14 dated 23<sup>rd</sup> February 1995 as PAAs. When the PAA is also the project proponent, the CEA is required to designate an appropriate PAA. In cases where more than one PAA is involved, the CEA must determine the appropriate PAA. In the event of doubt or difficulty in identifying the appropriate PAA, it has been a practice for the CEA to take over the role of PAA. The process for EIA in Sri Lanka is summarized in Figure XIV.

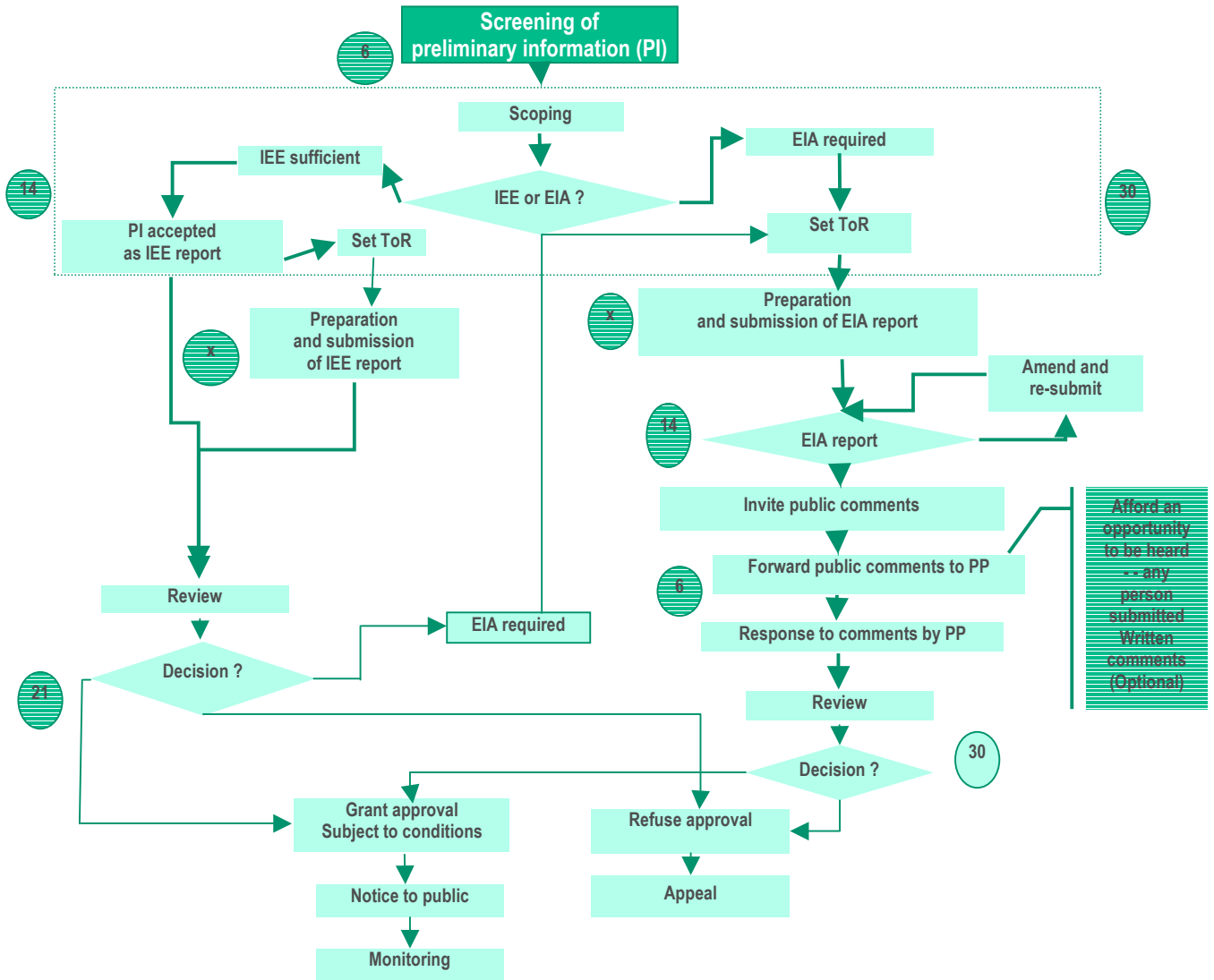


Figure indicated No of

**Figure XIV** EIA process in accordance with the National Environmental Act (1988) Govt. of Sri Lanka (Source: CLA, 1998)

## Appendix – VII

## Legal and policy framework for biodiversity conservation and EIA in different countries in South Asia

Country	Legislations related to environment & biodiversity conservation and EIA	Vision/policy document	Policy institution/ executing agency	Apex national council
<b>Bangladesh</b>	<ul style="list-style-type: none"> <li>• The Forest Act, 1927(as amended up to 2000)</li> <li>• Bangladesh Wild Life (Preservation) (Amendment) Act, 1974</li> <li>• Water Pollution Control (amendment) Act, 1974</li> <li>• Environment Pollution Control Ordinance, 1977</li> <li>• Forest (Amendment) Ordinance, 1989</li> <li>• Water Resource Planning Act, 1992Environmental Preservation Act, 1997</li> <li>• The Environmental Conservation Rules (ECR), 1997</li> <li>• National Water Policy, 1999</li> <li>• Environmental Conservation Act (ECA) 1995, 2002</li> <li>• Bangladesh Environment Protection Act, 2003</li> </ul>	<ul style="list-style-type: none"> <li>• National Conservation Strategy (NCS)</li> <li>• The National Environment Policy (NEP), 1992.</li> <li>• National Forest Policy, 1994</li> <li>• The National Water Policy, 1999National Land Use Policy, 2001</li> <li>• Coastal Zone Policy, 2005</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment &amp; Forests</li> <li>• Department of Environment, Govt. of Bangladesh</li> </ul>	<ul style="list-style-type: none"> <li>• National Environment Committee</li> </ul>
<b>India</b>	<ul style="list-style-type: none"> <li>• Indian Forest Act, 1927</li> <li>• Wildlife Protection Act, 1972 (amended 2002)</li> <li>• The Water (Prevention and Control of Pollution) Act, 1977 (amended 1992)</li> <li>• Forest (Conservation) Act, 1980</li> <li>• The Air (Prevention and Control of Pollution) Act, 1981 (amended 1987)</li> <li>• Environment Protection Act, 1986 (amended 1991)</li> <li>• Coastal Zone Regulation Act, 1991 (amended 2001)</li> <li>• EIA Notification, 1994 (amended 1997, 2006)</li> <li>• Biological Diversity Act, 2002</li> </ul>	<ul style="list-style-type: none"> <li>• National Policy on Pollution Abatement, 1992</li> <li>• National Conservation Strategy and Policy Statement on Environment and Development, 1992</li> <li>• National Biodiversity Strategy and Action Plan (NBSAP), 2002</li> <li>• National Environment Policy, 2006</li> <li>• Wildlife Action Plan, 2002</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment &amp; Forests, Govt. of India</li> <li>• State/UT level regulatory agencies</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment &amp; Forests, Govt. of India</li> </ul>
<b>Nepal</b>	<ul style="list-style-type: none"> <li>• Aquatic Animals Protection Act, 1960</li> <li>• Plant Protection Act, 1964</li> </ul>	<ul style="list-style-type: none"> <li>• National Environment Policy &amp; Action Plan, 1993</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Population &amp; Environment, Govt. of Nepal</li> </ul>	<ul style="list-style-type: none"> <li>• Environment Protection Council</li> </ul>

Framework Country	Legislations related to environment & biodiversity conservation and EIA	Vision/policy document	Policy institution/ executing agency	Apex national council
	<ul style="list-style-type: none"> <li>• National Parks and Wildlife Conservation Act, 1973</li> <li>• Wildlife Sanctuary Rules, 1977</li> <li>• Soil &amp; Watershed Conservation Act, 1982</li> <li>• King Mahendra Nature Conservation Trust Act, 1982</li> <li>• Nepal Petroleum Act, 1983</li> <li>• Nepal Electricity Authority Act, 1984</li> <li>• Mines &amp; Mineral Act, 1985</li> <li>• National Parks &amp; Wild Life Conservation Act, 1987</li> <li>• Electricity Act, 1992</li> <li>• The Forest Act, 1992</li> <li>• Water Resources Act, 1992</li> <li>• Industrial Enterprises Act, 1992</li> <li>• Management Act, 1992</li> <li>• Environment Protection Preservation Act, 1993</li> <li>• Environment Protection Act, 1996</li> <li>• Environment Protection Regulations, 1997</li> </ul>		of Pakistan	
<b>Pakistan</b>	<ul style="list-style-type: none"> <li>• The Forests Act, 1972</li> <li>• The Provincial Wildlife (Protection, Preservation, Conservation and Management) Acts, Ordinances and Rules (Sindh 1972, Punjab 1974, and NWFP 1975)</li> <li>• Pakistan Environment Protection Ordinance, 1983</li> <li>• Environmental Protection Act 1997</li> <li>• Pakistan Environmental Protection Act, 1997</li> <li>• Government of Punjab, Forestry, Wildlife, Fisheries and Tourism Department (Notification No. FOFT (EXT) VIII. 17/96, 1998</li> <li>• Environmental Tribunal rules, 1999</li> <li>• Pakistan Environmental Protection Agency (review of IEE/EIA) Regulations, 2000</li> <li>• Project Implementation and Resettlement of Affected Persons Ordinance, 2001</li> <li>• Pakistan Biosafety Rules, 2005</li> <li>• National Drinking Water Policy, 2005</li> </ul>	<ul style="list-style-type: none"> <li>• National Conservation Strategy, 1992</li> <li>• Forest Sector Master Plan, 1992</li> <li>• Biodiversity Action Plan, 2000</li> <li>• National Resettlement Policy March, 2002</li> <li>• National Environment Policy, 2005</li> <li>• Clean Development Mechanism (CDM), National Operational Strategy, 2006</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment, local and rural development</li> <li>• Environmental Protection Council together with Federal/ Provincial Environmental Protection Agencies</li> </ul>	<ul style="list-style-type: none"> <li>• Environment Protection Council</li> </ul>

Country	Legislations related to environment & biodiversity conservation and EIA	Vision/policy document	Policy institution/ executing agency	Apex national council
<b>Sri Lanka</b>	<ul style="list-style-type: none"> <li>• Fauna and Flora Protection Ordinance No.2, 1937 (amendment Acts No. 44, 1964)</li> <li>• Forest Ordinance, 1945 (amended in 1966 and 1988)</li> <li>• Soil Conservation Act, 1951 (amended in 1953, 1981 and 1996) Felling of Tres (Control) Act No 9, 1951</li> <li>• National Water Supply and Drainage board act No 2, 1974</li> <li>• Maritime Zone Law, 1976</li> <li>• Marine Pollution Prevention Act No 39, 1981</li> <li>• National Resources, Energy and Science Authority Act No 78, 1981</li> <li>• National Aquatic Resources Research and Development Agency Act No. 54, 1981 (amendment Act No.32, 1996)</li> <li>• National Environment Act, No. 47 1980 (amended in 1988 and 2000)</li> <li>• Coast Conservation Act, 1981 (amended in 1988 and 1997)</li> <li>• National Heritage and Wilderness Areas Act No. 3, 1988</li> <li>• Mines and Minerals act No 33, 1992</li> <li>• Fauna and Flora Act No. 49, 1993</li> <li>• Fisheries and Aquatic Resources Act, 1996</li> <li>• Plant Protection Act, 1999</li> <li>• Forest Ordinance (Cap 453)</li> <li>• Land settlement Ordinance (Cap 463)</li> </ul>	<ul style="list-style-type: none"> <li>• National Forest Policy, 1996</li> <li>• National Environment Action Plan, 1998-2001</li> <li>• Biodiversity Action Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Ministry of Environment and Natural Resources</li> <li>• Central Environment Authority</li> </ul>	

**Source:****Bangladesh**

Ministry of Environment and Forests, Government of Bangladesh, <http://www.moef.gov.bd/html/laws/laws.html>  
Sustainable Development Networking Programme (SDNP), (2006). At [www.sdnbd.org/sdi/international\\_days/wed/2006/wed2006/index.htm](http://www.sdnbd.org/sdi/international_days/wed/2006/wed2006/index.htm)

**India**

Wildlife Institute of India (2006). <http://www.wii.gov.in/envis/sdnp/policy.htm>  
Ministry of Environment & Forests, Government of India, At [envfor.nic.in/legis/legis.html](http://envfor.nic.in/legis/legis.html)

**Nepal**

Ministry of Environment Science and Technology. At [www.most.gov.np/en/environment/actlist.php](http://www.most.gov.np/en/environment/actlist.php)

**Pakistan**

Pakistan Environmental Protection Agency (2006). At [www.environment.gov.pk/info.htm](http://www.environment.gov.pk/info.htm)

**Sri Lanka**

Ministry of Environment, Government of Sri Lanka. At [www.menr.lk/legislation.htm](http://www.menr.lk/legislation.htm)

## Information sources for conducting ecological assessments

Topics	Key references
Vegetation ecology	<p>Mueller-Dombois, D. and H. Ellenberg (1974). <i>Aims and methods of vegetation ecology</i>. John Wiley, Chichester.</p> <p>Anon., (2000). <i>Riverine chars in Bangladesh : Environmental dynamics and management. Environment and GIS Support Project for Water Sector Planning</i>. University Press, Dhaka. ISBN: 9840515802</p> <p>Puri, Gopal Singh (1960). <i>Indian forest ecology; a comprehensive survey of vegetation and its environment in the Indian subcontinent</i>. Oxford Book and Stationery Co., New Delhi.</p> <p>Negi, Sharad Singh (1989). <i>Forest types of India, Nepal, and Bhutan</i>. Periodical Expert Book Agency, Delhi India.</p> <p>Sen, David N. (1990). <i>Ecology and vegetation of Indian desert</i>. Agro Botanical Publishers (India), Bikaner. ISBN: 8185031290</p> <p>Shrestha, T. B. (1982). <i>Ecology and vegetation of north-west Nepal (Karnali Region)</i>. Royal Nepal Academy, Kathmandu, Nepal.</p> <p>Numata, Makoto (1983). <i>Structure and dynamics of vegetation in eastern Nepal</i>. Laboratory of Ecology, Faculty of Science, Chiba University, Japan.</p> <p>Shrestha, Keshab (1995). <i>Biodiversity assessment of forest ecosystems of the central mid-hills of Nepal. Biodiversity Profiles Project (Nepal)</i>. Euroconsult, Arnhem. ISBN: 907328709X</p> <p>Snead, R. E. and Mohammad Tasnif (1966). <i>Vegetation types in the Las Bela region of west Pakistan</i>. Coastal Studies Institute, Louisiana State University, Baton Rouge.</p> <p>Akbar, Khalid Farooq (2000). <i>Urban corridors : The ecology of roadside vegetation in Sahiwal city</i>. LEAD, Islamabad, Pakistan. ISBN: 9698529039</p> <p>Fernando, S. N. U. (1968). <i>The natural vegetation of Ceylon: The forests, the grasslands, and the soils of Ceylon</i>. Lake House Bookshop, Colombo.</p>
Vegetation classification	<p>Champion, H. G. and S. K. Seth (1968). <i>A revised survey of the forest types of India</i>. Government of India, New Delhi.</p> <p>Gandhi Tara (1989). <i>Rajasthan vegetation index. Society for Promotion of Wastelands Development</i>, New Delhi.</p> <p>Vana Vibhaga (2002). <i>Forest and vegetation types of Nepal. by Natural Resource Management Sector Assistance Programme (Nepal)</i>. Nepal Vana Vibhaga. Tree Improvement and Silviculture Component, Kathmandu, Nepal. ISBN: 9993370223</p> <p>Lilles, Jens-Peter Barnekow (2005). <i>The map of potential vegetation of Nepal : A forestry/agro-ecological/biodiversity classification system</i>. Forest &amp; Landscape Denmark. ISBN: 8779032109</p> <p>Dickoré, W. B. and Marcus Nusser (2000). <i>Flora of Nanga Parbat (NW Himalaya, Pakistan): An annotated inventory of vascular plants with remarks on vegetation dynamics</i>. Botanic Garden and Botanical Museum Berlin- Dahlem, Berlin, Germany. ISBN: 3921800439.</p>
Ecological surveys	<p>Weinstein Jay Allan (1976). <i>The Ecological structure of Madras</i>. University Microfilm, Ann Arbor, Mich.</p> <p>Misra, R. (1993). <i>Ecology Workbook</i>. Oxford and IBH Publication, New Delhi.</p>
Wildlife surveys methods	<p>Gile. Robert H. (1972). <i>Wildlife manaagement techniques</i>. The Wildlife Societv. Washington.</p>

	D.C. Sale, J. B. and K. Berkuller (1988). <i>Manual of wildlife techniques for India</i> . FAO, United Nations' India Establishment of the Wildlife Institute of India, Dehradun.
<b>Identification guides</b>	
Mammals	<p>Khan, M. A. R. (1985). <i>Mammals of Bangladesh: A Field Guide</i>. Nazma Reza, Dhaka, Bangladesh. Pp. 92.</p> <p>Khan, M. M. H., Ahmed, R., Joarder, N. B., Islam, Md. A., Ameen, M., Akonda, A. W. and Ainun Nishat (2000). <i>Red book of threatened mammals of Bangladesh</i>. IUCN Bangladesh, Dhaka. ISBN: 9847460043.</p> <p>Barad, M. and M. Panchal (undated). <i>Mammals of India</i>. Centre for Environment Education, Ahmedabad.</p> <p>Prater, S. H. (1980). <i>The book of Indian animals</i>. Bombay Natural History Society. Oxford University Press, Oxford, U.K.</p> <p>Gurung, K. K. and Raj Singh (1996). <i>Field guide to the mammals of the Indian subcontinent: where to watch mammals in India, Nepal, Bhutan, Bangladesh, Sri Lanka, and Pakistan</i>. Academic Press, San Diego. ISBN: 0123093503.</p> <p>Alfred, J. R. B. (2002). <i>Checklist of mammals of India</i>. Zoological Survey of India, Kolkata. ISBN: 8185874794.</p> <p>Alfred, J. R. B., Ramakrishna and M. S. Pradhan (2006). <i>Validation of threatened mammals of India</i>. Zoological Survey of India, Kolkata. ISBN: 8181710851.</p> <p>Fleming, Robert L. (1973). <i>Mammals of Nepal</i>. His Majesty's Government, Ministry of Industry &amp; Commerce, Dept. of Tourism, Kathmandu, Nepal.</p> <p>Shrestha, T. K. (1997). <i>Mammals of Nepal : with reference to those of India, Bangladesh, Bhutan, and Pakistan</i>. Bimala Shrestha, Kathmandu.</p> <p>Şiddiqi, Md. S. U. (1969). <i>Fauna of Pakistan</i>. Agricultural Research Council, Govt. of Pakistan, Karachi.</p> <p>Phillips, W. W. A. (1980). <i>Manual of the mammals of Sri Lanka</i>. Wildlife and Nature Protection Society of Sri Lanka, 1980.</p> <p>Arudpragasam, K. D. (1982). <i>A check list of the mammals of Sri Lanka</i>. National Science Council of Sri Lanka, Colombo.</p>
Birds	<p>Harvey, W.G. (1990). <i>Birds in Bangladesh</i>. University Press Limited. Dhaka, Bangladesh. Pp. 188.</p> <p>Ali, S. and Ripley, S.D. (1978). <i>Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka</i>. Oxford University Press, Delhi, India. Vol 1-10.</p> <p>Ali, S. (1980). <i>Handbook of the birds of India and Pakistan</i>. Oxford University Press. Oxford, U.K.</p> <p>Ali, S. and Ripley, S.D. 1987. <i>A pictorial guide to the birds of the India sub-continent</i>. Bombay Natural History Society and Oxford University Press, Bombay, India. p. 165.</p> <p>Ali, S. (1996). <i>The book of Indian birds</i>. Bombay Natural History Society and Oxford University Press, Bombay, India. Pp. 354.</p> <p>Buceros (1998). <i>Vernacular names of the birds of the Indian sub-continent</i>. Bombay Natural History Society, Bombay, India. Vol. 3, No. 1, Pp. 53.</p> <p>Inskipp, C. and Tim Inskipp (1991). <i>A guide to the birds of Nepal</i>. Smithsonian Institution Press, Washington, D.C. ISBN: 1560980974.</p> <p>Grimmett, R., Inskipp, C. and Tim Inskipp (2000). <i>Birds of Nepal</i>. Princeton University Press, Princeton, N.J. ISBN: 0691070482</p>

	<p>Kotagama, S. and Prithiviraj Fernando (1994). <i>A field guide to the birds of Sri Lanka</i>. Wildlife [sic] Heritage Trust of Sri Lanka, Colombo, Sri Lanka. ISBN: 9559114077.</p> <p>Wijeyeratne, Gehan de Silva and Richard Thomas (1997). <i>A birdwatcher's guide to Sri Lanka</i>. Oriental Bird Club. Rubythroat, Basingstoke, Hampshire.</p> <p>Henry, G. M. (1998). <i>A guide to the birds of Sri Lanka</i>. Oxford University Press, Delhi. ISBN: 0195638131</p> <p>Harrison, John and Tim Worfolk (1999). <i>A field guide to the birds of Sri Lanka</i>. Oxford University Press, Oxford ; New York. ISBN: 019854961X 0198549601</p>
Reptiles	<p>Haque, M. N., Khan, M. M. H., Ahmed, R., Joarder, N. B., Islam, Md. A., Ameen, Mahmud-ul and Ainun Nishat (2000). <i>Red book of threatened amphibians and reptiles of Bangladesh</i>. IUCN Bangladesh, Dhaka. ISBN: 9847460043.</p> <p>Danial, J.C. (1983). <i>The book of Indian reptiles</i>. Bombay Natural History Society and Oxford University Press, Bombay, India.</p> <p>Murthy, T. S. N. (1990). <i>A field book of the lizards of India</i>. Zoological Survey of India, Calcutta.</p> <p>Sharma, R. C. and B. K. Tikader (1992). <i>Indian lizards</i>. Zoological Society of India, Calcutta.</p> <p>Daniel, J. C. (2002). <i>The book of Indian reptiles and amphibians</i>. Bombay Natural History Society. Oxford University Press, Mumbai. ISBN: 0195660994</p> <p>Schleich, Hans-Hermann and Werner Kastle (2002). <i>Amphibians and reptiles of Nepal: Biology, systematics, field guide</i>. Ruggell, Liechtenstein: A.R.G. Gantner; Koenigstein, Germany. ISBN: 3904144790.</p> <p>Auffenberg, W. and Hafeezur Rehman (1991). <i>Studies on Pakistan reptiles</i>. University of Florida, Gainesville.</p> <p>Khan, Md. S. (2006). <i>Amphibians and reptiles of Pakistan</i>. Krieger Pub. Co., Malabar, Fla. ISBN: 0894649523</p> <p>Ferguson, W. (2001). <i>Reptile fauna of Ceylon</i>. Society for the Study of Amphibians and Reptiles. Salt Lake City, Utah.</p>
Amphibian	<p>Haque, M. N., Khan, M. M. H., Ahmed, R., Joarder, N. B., Islam, Md. A., Ameen, Mahmud-ul and Ainun Nishat (2000). <i>Red book of threatened amphibians and reptiles of Bangladesh</i>. IUCN Bangladesh, Dhaka. ISBN: 9847460043.</p> <p>Dass, Inderneil (1985). <i>Indian Turtles: A field guide</i>. World Wide Fund for Nature (WWF) Publication.</p> <p>Dutta, S.K., (1997). <i>Amphibians of India and Sri Lanka</i>. Odyssey Publishing House, Bhubneshwar.</p> <p>Swan, L. W., Leviton, A. E. and C. Kurt Lamber (1962). <i>The herpetology of Nepal; A history, check list and zoogeographical analysis of the herpetofauna</i>. The Academy, San Francisco.</p> <p>Shah, K. (1995). <i>Enumeration of the amphibians and reptiles of Nepal</i>. Euroconsult, Arnhem. ISBN: 9073287030.</p> <p>Schleich, Hans-Hermann and Werner Kästle (1998). <i>Contributions to the herpetology of South Asia (Nepal, India)</i>. Fuhlrott-Museum, Wuppertal. ISBN; 3874294048.</p> <p>Shrestha, T. K. (2001). <i>Herpetology of Nepal: A study of amphibians and reptiles of trans-Himalayan region of Nepal, India, Pakistan and Bhutan</i>. B. Shrestha, Kathmandu, Nepal. ISBN; 9993351938 .</p> <p>Schleich, Hans-Hermann and Werner Kastle (2002). <i>Amphibians and reptiles of Nepal: Biology, systematics, field guide</i>. Ruggell, Liechtenstein: A.R.G. Gantner; Koenigstein, Germany. ISBN: 3904144790.</p>

	<p>Shah, K. B. and Sagendra Tiwari (2004). <i>Herpetofauna of Nepal: A conservation companion</i>. IUCN, Nepal, Kathmandu. ISBN: 9993386030.</p> <p>Minton, Sherman A. (1966). <i>A contribution to the herpetology of west Pakistan</i>. New York, 1966.</p> <p>Dutta, S.K., and Morrison-Scott, T.C.S. (1996). <i>The Amphibian fauna of Sri Lanka</i>. Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka. Pp. 230.</p> <p>De Silva, Anslem (2001). <i>The amphibia of Sri Lanka: Recent research</i>. Research Organization of Sri Lanka, Gampola.</p>
Carnivores	<p>Kanchanasakha, B., Simcharoen, S., and Than, U.T. (1998). <i>Carnivores of mainland South-east Asia</i>. WWF-Thailand Project Office, Bangkok, Thailand. Pp. 32-37.</p>
Fishes	<p>Aguero, M. (1989). <i>Inland fisheries management in Bangladesh</i>. Bangladesh Dept. of Fisheries, Dhaka, Bangladesh. ISBN: 971102263X.</p> <p>Quddus, M. M. A. And Shafi, M. (1995). "<i>Bangopasagarer Matsya Sampad</i>" (<i>The Fisheries Resources of Bay of Bengal</i>). Bangla Academy, Dhaka, <b>Bangladesh</b>. P. 426.</p> <p>Rahman, E.A. (1996). <i>Freshwater fishes of Bangladesh</i>. The Zoological Society Of Bangladesh, Dhaka, Bangladesh. Pp. 324.</p> <p>Khan, S. M. M. H., Khan M. M. H., Ameen, Mahmud-ul, Islam, Md A. and Ainun Nishat (2000). <i>Red book of threatened fishes of Bangladesh</i>. IUCN Bangladesh, Dhaka. ISBN: 9847460043.</p> <p>Jayaram, K. C. (1981). <i>The freshwater fishes of India, Pakistan, Bangladesh, Burma, and Sri Lanka: Handbook</i>. The Survey, Calcutta.</p> <p>Jhingran, V. G. (1975). <i>Fish and fisheries of India</i>. Hindustan Pub. Corp. (India), Delhi.</p> <p>Day, F. (1981). <i>The fishes of India</i>. Today And Tomorrow's Book Agency, New Delhi, India. P. 778.</p> <p>Talwar, P. K. and Jhingran, A. G. (1991). <i>Inland fisheries of India and adjacent countries</i>. Oxford and IBH Publishing Co. Pvt. Ltd.; New Delhi, Bombay, Calcutta; India. Vol. 1, p. 541-1158.</p> <p>Ellerman, J.R. And Morrison-Scott, T.C.S. (1996). <i>Checklist of Palearctic and Indian mammals</i>. Trustees of The British Museum (Natural History), London, U.K. P. 810.</p> <p>Kapoor, D., Dayal, R. and A. G. Ponniah (2002). <i>Fish biodiversity of India</i>. National Bureau of Fish Genetic Resources, Lucknow, India. ISBN: 819010148X.</p> <p>Sandhu, G. S. (2005). <i>A textbook of fish and fisheries</i>. Dominant, New Delhi, <b>India</b>. ISBN: 8178882744.</p> <p>Shrestha, J. (1981). <i>Fishes of Nepal</i>. Curriculum Development Centre, Tribhuvan University, Kathmandu.</p> <p>Shrestha, J. (1995). <i>Enumeration of the fishes of Nepal</i>. Euroconsult, Arnhem. ISBN: 9073287111</p> <p>Qureshi, M. Rahimullah (1961). <i>Pakistan's fisheries</i>. Central Fisheries Dept. Pakistan. Government of Pakistan Press, Karachi.</p> <p>Mirza, Md. R. and Md. Nazeer Phatti (1993). <i>Fishes of Pakistan and fish culture</i>. Ferozsons Pvt. Ltd., Lahore, Pakistan. ISBN: 9690012002</p> <p>Mirza, M. Ramzan (2003). <i>Checklist of freshwater fishes of Pakistan</i>. Zoological Society of Pakistan, Lahore.</p> <p>Evans, Diana (1981). <i>Threatened freshwater fish of Sri Lanka</i>. IUCN Conservation Monitoring Centre, Cambridge.</p> <p>Pethiyagoda, Rohan (1991). <i>Freshwater fishes of Sri Lanka</i>. Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka. ISBN: 955911400X .</p>

	Anon (1996). <i>Ornamental fishes of Sri Lanka: Towards better management</i> . Bay of Bengal Programme, Chennai, India.
Insects	<p>Mani, M. S. and V. K. Gupta (1985). <i>Oriental Insects: Association for the study of oriental insects</i>. Composite Book Publication.</p> <p>Baksha, M. W. (1990). <i>Some major forest insect pests of Bangladesh and their control</i>. Govt. of the People's Republic of Bangladesh, Bangladesh Forest Research Institute, Chittagong.</p> <p>Kalyanam, N. P. (1967). <i>Common insects of India</i>. Bombay, New York, Asia Pub. House.</p> <p>Mani, M. S. (1989). <i>Indian insects</i>. Satish Books, Agra, India.</p> <p>Sengupta, T. (2005). <i>Insects of India</i>. Tapan Sengupta, Kolkata. ISBN: 8187337206</p> <p>Thapa, V. K. (1997). <i>An inventory of Nepal's insects</i>. IUCN-The world conservation union, Kathmandu, Nepal. ISBN: 929144023X 9291440264.</p> <p>Chaudhry, Ghulam-Ullah, Chaudhry, M. Ismail and Sadiq M Khan (1966-70). <i>Survey of insect fauna of forests of Pakistan – Final technical report</i>. Forest Entomology Branch, Pakistan Forest Institute, Peshawar.</p> <p>Krombein, Karl V. (1982). <i>Biosystematics studies of Ceylonese wasps</i>. Smithsonian Institution Press, Washington, D.C.</p>
Butterflies	<p>Larsen, T. B. (2004). <i>Butterflies of Bangladesh: An annotated checklist</i>. IUCN, the World Conservation Union, Bangladesh Country Office, Dhaka. ISBN: 9848574042.</p> <p>Blyth, Wynter (1982). <i>Butterflies of the Indian region</i>. New Delhi.</p> <p>Evans, Brigadeir W.H. (1985). <i>The Identification of Indian butterflies</i>. Bombay Natural History Society Publication.</p> <p>Haribal, Meena (1992). <i>The butterflies of Sikkim Himalayas and their natural history</i>. Sikkim Nature Conservation Foundation (SNCF), Gangtok, Sikkim, India.</p> <p>Gay, T., Kehimkar, I. D. and Jagdish Chandra Punetha (1992). <i>Common butterflies of India</i>. Published for World Wide Fund for Nature—India. Oxford University Press. ISBN: 0195631641</p> <p>Smith, C. (1975). <i>Commoner butterflies of Nepal</i>. Tribhuvan University, Institute of Science, Natural History Museum, Kathmandu, Nepal.</p> <p>Smith, C. (1981). <i>Fieldguide to Nepal's butterflies</i>. Natural History Museum, Kathmandu.</p> <p>Smith, C. (1990). <i>Beautiful butterflies: A colourful introduction to Nepal's most beautiful insects</i>. Tecpress Service, Bangkok.</p> <p>Smith, C. (1993). <i>Illustrated checklist of Nepal's butterflies</i>. Published by Rohit Kumar, Gwalior, India. ISBN: 9748881075.</p> <p>Smith, C. and T. C. Majupuria (1994). <i>Butterflies of Nepal</i>. Tecpress Service L.P., Bangkok, Thailand. ISBN: 9748684938.</p> <p>Hasan, S. A. (1994). <i>Butterflies of Islamabad and the Murree hills</i>. Asian Study Group, Islamabad.</p> <p>Roberts, T. J. (2001). <i>The butterflies of Pakistan</i>. Oxford University Press, Karachi. ISBN: 0195779959.</p> <p>Banks, J. and Judy Banks (1985). <i>A selection of the butterflies of Sri Lanka</i>. Lake House Investments, Colombo.</p> <p>Ormiston, W. (2003). <i>The butterflies of Ceylon</i>. Asian Educational Services, New Delhi. ISBN: 8120618408.</p>
Plants	

Vascular plants	<p>Khan, M. S., Rahman, M. M. and M A. Ali (2001). <i>Red data book of vascular plants of Bangladesh</i>. Bangladesh National Herbarium, Dhaka. ISBN: 9843201280.</p> <p>Hooker, J. D. (1872-1897). <i>The flora of British India</i>. Vols. I-VII. L. Reeve, London.</p> <p>Rao, C K., Geetha, B. L. and Geetha Suresh (2003). <i>Red list of threatened vascular plant species in India: compiled from the 1997 IUCN red list of threatened plants</i>. ENVIS, Botanical Survey of India, Ministry of Environment &amp; Forests, Howrah. ISBN: 818177003X 9788181770035.</p> <p>S B Malla (1976). <i>Catalogue of Nepalese vascular plants</i>. His Majesty's Government, Ministry of Forests, Dept. of Medicinal Plants, Kathmandu, <b>Nepal</b>.</p> <p>Rajbhandary, T. K., Bista, M. S. and Vidya Laxmi Gurung (1994). <i>Enumeration of the vascular plants of west Nepal</i>. His Majesty's Govt. of Nepal, Ministry of Forests and Soil Conservation, Dept. of Plant Resource, Kathmandu.</p> <p>Nasir, E., Ali, S. I. and R. R. Stewart (1972). <i>Flora of west Pakistan: An annotated catalogue of the vascular plants of west Pakistan and Kashmir</i>. Fakhri, Karachi.</p> <p>Ali, S. I. and Joseph H. Kirkbride (1988). <i>Vascular plants of Pakistan</i>. Dept. of Botany-Taxonomy, University of Karachi, Karachi, Pakistan.</p> <p>Kubitzki, K., Kramer, K.U., Green, P.S., Rohwer, J. G., Bittrich, V., Huber, H. AND J. W. Kadereit (undated). <i>The families and genera of vascular plants</i>. Wildlife Heritage Trust of Sri Lanka. Lakhanpal, RN. Birbal Sahni Inst. p. 197, <b>Colombo</b>.</p>
Pteridophytes	<p>Beddome, R. H. (1864). <i>The Ferns of Southern India and Ceylon</i>. Today and Tomorrow, New Delhi.</p> <p>Surange, K. R. (1966). <i>Indian fossil pteridophytes</i>. Council of Scientific &amp; Industrial Research, New Delhi.</p> <p>Dixit, R. D. (1984). <i>A census of the Indian pteridophytes</i>. Botanical Survey of India, Dept. of Environment, Howrah.</p> <p>Dixit, R. D. and J. N. Vohra (1984). <i>A dictionary of the pteridophytes of India</i>. Botanical Survey of India, Botanical Survey of India, Dept. of Environment, Howrah.</p> <p>Khullar, S. P. (1994). <i>An Illustrated fern flora of western Himalaya</i>. International Book Distributors, Dehradun, <b>India</b>.</p> <p>Vanaspati Vibhaga (1981). <i>Keys to the pteridophytes, gymnosperms &amp; monocotyledonous genera of Nepal</i>. Ministry of Forests, Dept. of Medicinal Plants, Thapathali, Kathmandu, Nepal.</p> <p>Bista, M. S., Adhikari, M. K., and K. R. Rajbhandari (2002). <i>Pteridophytes of Nepal</i>. Ministry of Forests &amp; Soil Conservation, Dept. of Plant Resources: National Herbarium &amp; Plant Laboratories, Lalitpur, Nepal.</p> <p>Abeywickrama, B. A. (1978). <i>A check list of pteridophytes of Sri Lanka</i>. National Science Council of Sri Lanka, Colombo.</p>
Gymnosperms	<p>Sitholey, R V (1963). <i>Gymnosperms of India: Fossil forms</i>. National Botanic Gardens, Lucknow, India.</p> <p>Sahni, K. C. (1990). <i>Gymnosperms of India and adjacent countries</i>. Shiva Offset Press, Dehradun.</p> <p>Shrestha, T. B. (1974). <i>Gymnosperms of Nepal</i>. Cahiers Nepalais Documents; 3. Centre National de la Recherche Scientifique, Paris. Pp 23. ISBN: 2222016517.</p> <p>Koba, H. ; Akiyama, S. Endo, Y. and H. Ohba (1994). <i>Name list of the flowering plants and gymnosperms of Nepal</i>. University Museum, University of Tokyo, Tokyo.</p> <p>Nasir, E., Siddiqi, M. A. and Zaffar Ali (1968). <i>Gymnosperms of west Pakistan</i>. Ferozsons, Rawalpindi.</p>

Bryophytes	<p>Srivastava, K. P. (1964). <i>Bryophytes of India - I Ricciaceae</i>. National Botanic Gardens, Lucknow, India.</p> <p>Singh, V. B. (1966). <i>Bryophytes of India</i>. National Botanical Gardens, Lucknow.</p> <p>Bruhl, P. A. (1931 and reproduced in 1982). <i>A census of Indian mosses</i>. Rec. Bot. Surv. India XIII (1&amp;2)</p> <p>Tiwari S. D. and G. B. Pant (1994). <i>Bryophytes of Kumaun Himalaya</i>. Bishen Singh Mahendra Pal Singh, Dehradun, <b>India</b>.</p> <p>Pradhan, N. (2000). <i>Materials for a checklist of bryophytes of Nepal: A catalogue of bryophyte specimens collected from Nepal</i>. Natural History Museum, London.</p>
Algae	<p>Islam, A. K. M. N. (1976). <i>Contribution to the study of the marine algae of Bangladesh</i>. J. Cramer, Vaduz.</p> <p>Carter, N. (1926). <i>Fresh water algae from India</i>. Rec. Bot. Surv. <b>India</b>. 9, 263-302.</p> <p>Kargupta, A. N. and E. N. Siddiqui (1995). <i>Algal ecology: An overview</i>. International Book Distributors, Dehra Dun, <b>India</b>. ISBN: 8170892066.</p> <p>Krishnamurthy, V. (2000). <i>Algae of India and neighbouring countries</i>. Science Publishers, Enfield, N.H. ISBN: 1578080525.</p> <p>Baral, S. R. (1995). <i>Enumeration of the algae of Nepal</i>. Euroconsult, Arnhem. ISBN: 907328712X.</p> <p>Anand, P. L. (1981). <i>Marine algae from Karachi</i>. Sushma Publications : sole distributor, Bishen Singh Mahendra Pal Singh, Dehra Dun.</p> <p>Abeywickrama, B. A. (1979-1986). <i>The genera of the freshwater algae of Sri Lanka</i>. National Science Council of Sri Lanka, Colombo.</p>
Fungi	<p>Butler, E. J., Bisby, G. R. and R. S. Vasudeva (1960). <i>The fungi of India</i>. Indian Council of Agricultural Research. Delhi.</p> <p>Bilgrammi, K. S., S. Jamakuddin and M. A. Rizvi (1991). <i>Fungi of India</i>. Today and Tomorrow, New Delhi.</p> <p>Jamaluddin, Goswami, M. G., Ojha, B. M. and K. S. Bilgrami (2004). <i>Fungi of India, 1989-2001</i>. Scientific Publishers (India), Jodhpur. ISBN: 8172333544.</p> <p>Balfour-Browne, F. L. (1968). <i>Fungi of recent Nepal expeditions</i>. British Museum (Natural History) London.</p> <p>Bista, M. S., Bhattarai, S. and M. K. Adhikari (1996). <i>Fungi of Nepal</i>. Ministry of Forest &amp; Soil Conservation. Department of Plant Resources, Godawary, Lalitpur. 69 p. Bulletin of the Department of Plant Resources, 13.</p> <p>Ahmad, Sultan (1956). <i>Fungi of west Pakistan</i>. The Biological Society of Pakistan at the Biological Laboratories, Govt. College, Lahore, Pakistan.</p> <p>Coomaraswamy, U. And R. N. de Fonseca (1981). <i>A hand book to the soil fungi of Sri Lanka</i>. National Science Council of Sri Lanka, Colombo, Sri Lanka.</p> <p>Petch, T. and G. R. Bisby (undated). <i>The fungi of Ceylon</i>. Government Pub. Bureau, Colombo.</p>
<b>Conservation status</b>	
Animals	IUCN (1996). <i>IUCN Red List of threatened animals</i> . The IUCN Species Survival Commission, IUCN, Gland.
Plants	Nayar, M. P. and A. R. K. Sastry (1987). <i>Red Data Book for Indian Plants</i> , Vol. I, II, & III. Botanical Survey of India, Calcutta.
<b>Wildlife census techniques</b>	Rodaers. W. A. (1991). <i>Techniques for wildlife census in India. A field manual</i> . Technical

	<p>Manual: TM 2. Wildlife Institute of India, Dehradun.</p> <p>Jennifer Rietbergen-McCracken and Hussein Abaza (2000). <i>Environmental valuation: A worldwide compendium of case studies</i>. Earthscan, London. ISBN: 1853836958</p> <p>Saxena, K. K. (2005). <i>Recent advances in environmental analysis</i>. University Book House, Jaipur.</p>
<b>Air, water and land pollution</b>	Economopolous, Alexander P. (1993). <i>Assessment of sources of air, water and land pollution Part I (of two): Rapid inventory techniques in environmental pollution</i> . No. WHO/PEP/89. WHO, Geneva.
<b>General EA guide for Asia</b>	<p>Lohani, B. N. et al. (1997). <i>Environment impact assessment for developing countries in Asia: Overview (Volume I)</i>. Asian Development Bank, Manila.</p> <p>Lohani, B. N. et al. (1997). <i>Environment impact assessment for developing countries in Asia: Case studies (Volume II)</i>. Asian Development Bank, Manila.</p>
<b>Overview of EIA methods</b>	<p>World Bank (1997). <i>Roads and the environment: A handbook</i>. World Bank Technical Paper No. 376. World Bank, Washington, D.C.</p> <p>IAIA website. <a href="http://www.iaia.org">www.iaia.org</a></p>
<b>Population status and viability analysis</b>	
Minimum viable populations	<p>Gilpin, M. E., and M. E. Soulé (1986). <i>Minimum viable populations: processes of species extinction</i>. In: Soulé ME (ed). <i>Conservation biology: The science of scarcity and diversity</i>. Sunderland MA: Sinauer. Pp 19-34.</p> <p>Goodman, D. (1987). <i>The demography of chance extinction</i>. In: Soulé ME (ed). <i>Viable populations for conservation</i>. New York NY: Cambridge University Press. Pp 11-34.</p> <p>Soulé, M. E. (ed). (1987). <i>Viable populations for conservation</i>. New York NY: Cambridge University Press.</p>
Plants	Schemske, D.W., Husband, B. C., Ruckelshaus, M. H., Goodwillie, C., Parker, I. M. and J.G. Bishop (1994). <i>Evaluating approaches to the conservation of rare and endangered plants</i> . <i>Ecology</i> 75:584-606.
Animals	Reed, J. M., Doerr, P. D. and J. R. Walters (1988). <i>Minimum viable population size of the red-cockaded woodpecker</i> . <i>Journal of Wildlife Management</i> 52:385-91.
<b>Landscape design issues</b>	
Metapopulations	<p>Gilpin M. and I. Hanski (eds). (1991). <i>Metapopulation dynamics: Empirical and theoretical investigations</i>. New York NY: Academic Pr. Pp. 336.</p> <p>Hastings A, Harrison S. (1994). <i>Metapopulation dynamics and genetics</i>. <i>Annual Review of Ecology Systematic</i> 25:167-88.</p>
Ecosystem fragmentation	<p>Harris, L. D. (1984). <i>The fragmented forest: island biogeography theory and the preservation of biotic diversity</i>. Chicago IL: Univ Chicago Pr. 211 p.</p> <p>Wilcox, B.A. and D. D. Murphy (1985). <i>Conservation strategy: The effects of fragmentation on extinction</i>. <i>Amer Nat</i> 125:879-87.</p> <p>Saunders, D. A., Hobbs, R. J. and C. R. Margules (1991). <i>Biological consequences of ecosystem fragmentation: A review</i>. <i>Conservation Biology</i> 5:18-32.</p> <p>Turner, M. G. and R. H. Gardner (eds). (1991). <i>Quantitative methods in landscape ecology</i>. New York NY: Springer-Verlag.</p> <p>Forman, R. T. T. (1995). <i>Land mosaics: The ecology of landscapes and regions</i>. New York NY: Cambridge Univ Pr.</p>
Habitat corridors (connectivity)	Forman, R. T. T. and M. Godron (1986). <i>Landscape ecology</i> . New York NY: J Wiley.

	<p>Forman, R. T. T. (1995). <i>Land mosaics: The ecology of landscapes and regions</i>. New York NY: Cambridge University.</p> <p>Beier, P. and R. F. Noss (1998). <i>Do habitat corridors provide connectivity?</i> Conservation biology 12: 1241-52.</p>
Population sources and sinks	<p>Howe, R. W. and G. J. Davis (1991). <i>The demographic significance of "sink" populations</i>. Biological Conservation 57: 39-255.</p>
Nonindigenous species	<p>Mooney, H. A. and J. A. Drake (eds). (1986). <i>Ecology of biological invasions of North America and Hawaii</i>. New York NY: Springer-Verlag.</p> <p>Parker, I. M. and S. H. Reichard (1998). <i>Critical issues in invasion biology for conservation science</i>. In: Fiedler P.L., Kareiva P.M. (eds). Conservation biology, 2nd ed. New York NY: Chapman &amp; Hall. p. 283-305.</p>

## Appendix – IX

## Valuation methods at a glance

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
<b>Market price</b>	High	High	<p>There are three main steps involved in collecting and analysing the data required to use market price techniques to value ecosystem services:</p> <ol style="list-style-type: none"> <li>(i). Find out the quantity of the product used, produced or exchanged;</li> <li>(ii). Collect data on its market price;</li> <li>(iii). Multiply price by quantity to determine its value.</li> </ol>	<p>The greatest advantage of this technique is that it is relatively easy to use, as it relies on observing actual market behaviour. Few assumptions, little detailed modelling, and only simple statistical analysis are required to apply it.</p> <p>Data is generally easy to collect and analyse. Market information, including historical trends, can usually be obtained from a wide variety of sources such as government statistics, income and expenditure surveys, or market research studies. In most cases it will be necessary to supplement these secondary sources with original data, for example through performing market checks or conducting some form of socio-economic survey</p> <p>A major disadvantage is the fact that many ecosystem products and services do not have markets or are subject to markets, which are highly distorted or irregular – the market fails. In such cases, it is inappropriate to use market price techniques:</p> <ul style="list-style-type: none"> <li>• Ecosystem services such as catchment protection or nutrient retention are rarely available for purchase or sale. Because they have many of the characteristics of public goods<sup>6</sup>, it is in fact questionable whether the market can ever accurately allocate or price them.</li> <li>• Many ecosystem products are utilized at the subsistence level. They are not</li> </ul>

<sup>6</sup> A public good is characterised by the non-excludability of its benefits – each unit can be consumed by everyone, and does not reduce the amount left for others. Many ecosystem services are pure or partial public goods – for example scenic beauty (a pure public good), or water quality (which has many of the characteristics of a public good). In contrast a private good is one from which others can be excluded, where each unit is consumed by only one individual. Most natural products are private goods.

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
				<p>traded in formal markets, and are consumed only within the household.</p> <ul style="list-style-type: none"> <li>• There exist a wide variety of subsidies and market interventions which distort the price of ecosystem products. Examples include subsidies to water and electricity, centrally-set royalties and fees for products such as timber and state controlled prices for basic food and consumer items.</li> <li>• Because markets for most ecosystem products and services are not well-developed, they tend not to be competitive, and prices are a poor indicator of true social and economic values. This may be the case where there is an additional social or environmental premium attached to products and services, where there are only a small number of buyers and sellers, or where there is imperfect market information.</li> <li>• In many cases, even where an ecosystem product has a market and a price, it is impossible to measure the quantities produced or consumed. Especially at the subsistence level, ecosystem product consumption and sale is often highly seasonal or irregular. For example, particular products are only available at particular times of the year, are used under special conditions, or are collected and used on an opportunistic basis. Ecosystem products are also often collected and consumed as part of a bundle of items or have high levels of substitution<sup>7</sup> or complementarity<sup>8</sup> with other goods. For example, they are used only when other products are unavailable or unaffordable, or they form occasional inputs into the production of other goods.</li> <li>• Even where an ecosystem good or service has a market, and quantities bought or</li> </ul>

<sup>7</sup> A substitute good or service is one which is used in place of another – for example kerosene instead of firewood, or bottled water instead of tap water.

<sup>8</sup> A complementary good is one which is used in conjunction with another – for example between other products and fishing activities such as the collection of reeds for fishing baskets or firewood for fish smoking.

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
				<p>sold can be measured, prices do not tell us how important this product or service is to society, nor how much some buyers would actually be willing to pay.</p>
<b>Effect on production techniques</b>	High	High	<p>There are three main steps to collect and analyse the data required for using effect on production techniques to value ecosystem goods and services:</p> <ul style="list-style-type: none"> <li>• Determine the contribution of ecosystem goods and services to the related source of production, and specify the relationship between changes in the quality or quantity of a particular ecosystem good or service and output;</li> <li>• Relate a specified change in the provision of the ecosystem good or service to a physical change in the output or availability of the related product;</li> <li>• Estimate the market value of the change in production.</li> </ul>	<p>Effect on production techniques are commonly used, and have applicability to a wide range of ecosystem goods and services. Their weakness relates to the difficulties that are often involved in collecting sufficient data to be able to accurately predict the biophysical or dose-response relationships upon which the technique is based. Such relationships are often unclear, unproven or hard to demonstrate in quantifiable terms. Simplifying assumptions is often needed to apply the production function approach.</p> <p>An additional concern is the large number of possible influences on product markets and prices. Some of these should be excluded when using effect on production techniques. In some cases, changes in the provision of an ecosystem good or service may lead not just to a change in related production, but also to a change in the price of its outputs. In some cases, product may become scarcer or more costly to produce. In other cases, consumers and producers may switch to other products or technologies in response to ecosystem change or to a scarcity of ecosystem goods and services. Furthermore, general trends and exogenous factors unrelated to ecosystem goods and services may influence the market price of related production and consumption items. They must be isolated and eliminated from analysis.</p>
<b>Replacement cost techniques</b>	High	High	<p>There are three main steps involved in collecting and analysing the data required to use replacement cost techniques to value ecosystem goods and services:</p>	<p>Replacement cost techniques are particularly useful for valuing ecosystem services, and have the great advantage that they are simple to apply and analyse. They are particularly useful where only limited time or financial resources are available for a valuation study, or where it is not possible to carry out detailed surveys and fieldwork.</p>

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
			<ul style="list-style-type: none"> <li>Ascertain the benefits that are associated with a given ecosystem good or service, how it is used and by whom, and the magnitude and extent of these benefits;</li> <li>Identify the most likely alternative source of product, infrastructure or technology that would provide an equivalent level of benefits to an equivalent population;</li> <li>Calculate the costs of introducing and distributing, or installing and running, the replacement to the ecosystem good or service.</li> </ul>	<p>The main weakness of this technique is that it is often difficult to find perfect replacements or substitutes for ecosystem goods and services that would provide an equivalent level of benefits to the same population. In some cases this results in ecosystem under-valuation, as artificial alternatives generate a lower quantity or quality of goods and services. Yet this technique may also lead to the over-valuation of ecosystem benefits, as in some instances the replacement product, infrastructure or technology may be associated with secondary benefits or additional positive impacts. The reality of the replacement cost technique is also sometimes questionable: we may question whether, in the absence of a well-functioning ecosystem, such expenditures would actually be made or considered worthwhile.</p>
<b><i>Mitigative or avertive expenditure techniques</i></b>	High	High	<p>There are four main steps involved in collecting and analysing the data required to use mitigative or avertive expenditure techniques to value ecosystem goods and services:</p> <ul style="list-style-type: none"> <li>Identify the negative effects or hazards that would arise from the loss of a particular ecosystem good or service;</li> <li>Locate the area and population who would be affected by the loss of the ecosystem good and service, and determine a cut-off point beyond which the effect will not be analysed;</li> <li>Obtain information on people's responses, and</li> </ul>	<p>Mitigative or avertive expenditure techniques are particularly useful for valuing ecosystem services. In common with other cost-based valuation methods, a major strength is their ease of implementation and analysis, and their relatively small data requirements.</p> <p>As is the case with the replacement cost technique, the mitigative or avertive measures that are employed in response to the loss of ecosystem goods and services do not always provide an equivalent level of benefits. In some cases it is also questionable whether in fact such expenditures would be made or would be seen as being worth making. An additional important factor to bear in mind when applying this technique is that people's perceptions of what would be the effects of ecosystem loss, and what would be required to mitigate or avert these effects, may not always match those of "expert" opinion.</p>

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
			<p>measures taken to mitigate or avert the negative effects of the loss of the ecosystem good or service;</p> <ul style="list-style-type: none"> <li>• Cost the mitigative or avertive expenditures.</li> </ul>	
<b>Damage cost avoided techniques</b>	High	High	<p>There are four main steps involved in collecting and analysing the data required to use damage cost avoided techniques to value ecosystem goods and services:</p> <ul style="list-style-type: none"> <li>• Identify the protective services of the ecosystem, in terms of the degree of protection afforded and the on and off-site damages that would occur as a result of loss of this protection;</li> <li>• For the specific change in ecosystem service provision that is being considered, locate the infrastructure, output or human population that would be affected by this damage, and determine a cut-off point beyond which effects will not be analysed;</li> <li>• Obtain information on the likelihood and frequency of damaging events occurring under different scenarios of ecosystem loss, the spread of their impacts and the magnitude of damage caused;</li> </ul>	<p>Damage cost avoided techniques are particularly useful for valuing ecosystem services. There is often confusion between the application of damage costs avoided and production function approaches to valuation. Here it is important to underline that whereas this technique deals with damage avoided such as from pollution and natural hazards (which are typically external effects), change in production techniques usually relate to changes in some input such as water (typically internalised).</p> <p>A potential weakness is that in most cases estimates of damages avoided remain hypothetical. They are based on predicting what might occur under a situation where ecosystem services decline or are lost. Even when valuation is based on real data from situations where such events and damages have occurred, it is often difficult to relate these damages to changes in ecosystem status, or to be sure that identical impacts would occur if particular ecosystem services declined.</p>

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
			<ul style="list-style-type: none"> <li>Cost these damages, and ascribe the contribution of the ecosystem service towards minimising or avoiding them.</li> </ul>	
<b>Travel cost</b>	Medium	Medium	<p>There are six main steps involved in collecting and analysing the data required to use travel cost techniques to value ecosystem goods and services:</p> <ul style="list-style-type: none"> <li>Ascertain the total area from which recreational visitors come to visit an ecosystem, and dividing this into zones within which travel costs are approximately equal;</li> <li>Within each zone, sample visitors to collect information about the costs incurred in visiting the ecosystem, motives for the trip, frequency of visits, site attributes and socio-economic variables such as the visitor's place of origin, income, age, education and so on;</li> <li>Obtain the visitation rates for each zone, and use this information to estimate the total number of visitor days per head of the local population;</li> <li>Estimate travel costs, including both direct expenses (such as fuel and fares, food, equipment, accommodation) and time spent on the trip;</li> </ul>	<p>The travel cost method is mainly limited to calculating recreational values, although it has in some cases been applied to the consumptive use of ecosystem goods.</p> <p>Its main weakness is its dependence on large and detailed data sets, and relatively complex analytical techniques. Travel cost surveys are typically expensive and time consuming to carry out. An additional source of complication is that several factors make it difficult to isolate the value of a particular ecosystem in relation to travel costs, and these must be taken into account in order to avoid over-estimating ecosystem values. Visitors frequently have several motives or destinations on a single trip, some of which are unrelated to the ecosystem being studied. They also usually enjoy multiple aspects and attributes of a single ecosystem. In some cases travel, not the destination <i>per se</i>, may be an end in itself.</p>

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
			<ul style="list-style-type: none"> <li>Carry out a statistical regression to test the relationship between visitation rates and other explanatory factors such as travel cost and socio-economic variables;</li> <li>Construct a demand curve relating number of visits to travel cost, model visitation rates at different prices, and calculate visitor consumer surplus.</li> </ul>	
<b>Contingent valuation</b>	High	Low	<p>There are five main steps involved in collecting and analysing the data required to use contingent valuation techniques to value ecosystem goods and services:</p> <ul style="list-style-type: none"> <li>Ask respondents their WTP or WTA for a particular ecosystem good or service;</li> <li>Draw up a frequency distribution relating the size of different WTP/WTA statements to the number of people making them;</li> <li>Cross-tabulate WTP/WTA responses with respondents' socio-economic characteristics and other relevant factors;</li> <li>Use multivariate statistical techniques to correlate responses with respondent's socio-economic attributes;</li> <li>Gross up sample results to obtain the value</li> </ul>	<p>A major strength of contingent valuation techniques is that, because they do not rely on actual markets or observed behaviour, they can in theory be applied to any situation, good or service. They remain one of the only methods that can be applied to option and existence values, and are widely used to determine the value of ecosystem services. Contingent valuation techniques are often used in combination with other valuation methods, in order to supplement or cross-check their results.</p> <p>One of the biggest disadvantages of contingent valuation is the large and costly surveys, complex data sets, and sophisticated analysis techniques that it requires. Another constraint arises from the fact that they rely on a hypothetical scenario which may not reflect reality or be convincing to respondents.</p> <p>Contingent valuation techniques require people to state their preferences for ecosystem goods and services. They are therefore susceptible to various sources of bias, which may influence their results. The most common forms of bias are strategic, design, instrument and starting point bias. Strategic bias occurs when respondents believe that they can influence a real course of events by how they answer WTP/WTA questions. Respondents may for instance think that a survey's</p>

Valuation Method	Reliability of Results	Ease of Application	Data Collection and Analysis	Applicability, strengths and weaknesses
			<p>likely to be placed on the ecosystem good or service by the whole population, or the entire group of users.</p>	<p>hypothetical scenario of the imposition of a water charge or ecosystem fee is actually in preparation. Design bias relates to the way in which information is put across in the survey instrument. For example, a survey may provide inadequate information about the hypothetical scenario, or respondents are misled by its description. Instrument bias arises when respondents react strongly against the proposed payment methods. Respondents may for instance resent new taxes or increased bills. Starting point bias occurs when the starting point for eliciting bids skews the possible range of answers, because it is too high, too low, or varies significantly from respondents' WTP/WTA. With careful survey design, most of these sources of bias can however be reduced or eliminated.</p>

## Appendix – X

## Environmental legislations applicable to different sectors in different countries

Country	Legislations
<b>Bangladesh</b>	<ul style="list-style-type: none"> <li>• The Highways Act, 1925 (Bengal Act III of 1925)</li> <li>• Bangladesh Wildlife Preservation Act, 1973 (amended 1974)</li> <li>• The Motor Vehicles Ordinance, 1983</li> <li>• Gas Safety Rules, 1991</li> <li>• Environment Policy, 1992</li> <li>• Environmental Conservation Act of (ECA), 1995</li> <li>• Bangladesh Environmental Conservation Act, 1995 (amendment 2000, 2002)</li> <li>• Environmental Conservation Rules, 1997</li> <li>• Environment Court Act, 2000</li> <li>• National Conservation Strategy of (NCS), 1992</li> <li>• National Environmental Policy, 1992</li> <li>• National Industrial Policy, 1992</li> <li>• National Forest Policy, 1994</li> <li>• National Energy Policy, 1995</li> <li>• National Environment Management Action Plan of (NEMAP), 1995</li> <li>• National Water Policy, 1999</li> <li>• National Land Transport Policy, 2002</li> </ul>
<b>India</b>	<ul style="list-style-type: none"> <li>• Land Acquisition (Mines) Act, 1885</li> <li>• The Petroleum Act, 1934 (Act No. 30 of 1934)</li> <li>• The Oilfields (Regulation and Development) Act, 1948 (53 of 1948)</li> <li>• Coal Mines Provident Fund and Miscellaneous Provisions Act, 1948</li> <li>• National Highways Act, 1956</li> <li>• Mines and Minerals (Development and Regulation) Act, 1957</li> <li>• The Petroleum and Natural Gas Rules, 1959</li> <li>• Petroleum and Minerals Pipelines (Acquisition of Right of User in Land) Act, 1962</li> <li>• The Wildlife (Protection) Act 1972</li> <li>• Coal Mines (Nationalisation) Act, 1973</li> <li>• Coal Mines (Taking Over of Management) Act, 1973</li> <li>• Coal Mines (Conservation and Development) Act, 1974</li> <li>• Oil Industry (Development) Act, 1974</li> <li>• Forest (Conservation ) Act and Rules, 1980</li> <li>• Environmental Protection Act, 1986</li> <li>• Coal Mines Labour Welfare Fund (Repeal) Act, 1986</li> <li>• Goa, Daman and Diu Mining Concessions Act, 1987</li> <li>• Air Pollution (Prevention) Act, 1981, amended 1987</li> <li>• Water Pollution (Prevention) Act, 1974, amended 1988</li> <li>• National Highways Authority of India Act, 1988</li> </ul>

Country	Legislations
	<ul style="list-style-type: none"> <li>• CESS and other Taxes on Minerals(validation) Act, 1992</li> <li>• Oil and Natural Gas Commission (Transfer of Undertaking and Repeal) Act, 1993</li> <li>• Mines Act, 1995</li> <li>• Coal India (Regulation of Transfers and Validation) Act, 2000</li> <li>• Control of National Highways (Land and Traffic) Act, 2002</li> <li>• Offshore Areas Mineral (Development and Regulation) Act, 2002</li> <li>• Petroleum and Natural Gas Regulatory Board, Act, 2006</li> <li>• The National Mineral Policy (1993)</li> <li>• Guidelines for laying petroleum product pipelines, Ministry of Petroleum and Natural Gas Notification, 2002</li> <li>• EIA Notification, 1994 (amended in 2006)</li> </ul>
<b>Nepal</b>	<ul style="list-style-type: none"> <li>• Aquatic Animals Protection Act (AAPA), 1961</li> <li>• National Parks and Wildlife Conservation Act (NPWCA), 1973</li> <li>• Public Road Act, 1974</li> <li>• Soil and Watershed Conservation Act (SWCA), 1982</li> <li>• Nepal Petroleum Act, 2040 (1983)</li> <li>• Mines &amp; Mineral Act, 1985</li> <li>• Petroleum Regulation, 2041 (1985) (amended in 2046 (1989) and in 2051 (1994))</li> <li>• Petroleum Industry (Income Tax) Regulation, 2041 (1985) (issued under the Income Tax Act, 2031 (1974))</li> <li>• Water Resources Act (WRA), 1992</li> <li>• Forest Act, 1993</li> <li>• Environment Protection Act (EPA), 1996</li> </ul>
<b>Pakistan</b>	<ul style="list-style-type: none"> <li>• Explosives Act, 1884.</li> <li>• Regulation of Mines and Oil Fields and Mineral development Act, 1948</li> <li>• Motor Vehicle Ordinance, 1965 and Rules, 1969</li> <li>• Pakistan Environmental Protection Act, 1997</li> <li>• Highways Safety Ordinance, 2000</li> <li>• Pakistan Petroleum (Exploration &amp; Production) Rules, 2001.</li> <li>• Pakistan Petroleum Rules for offshore, 2003</li> <li>• National Mineral Policy, 1995</li> <li>• Petroleum Exploration and Production Policy, 2001</li> </ul>
<b>Sri Lanka</b>	<ul style="list-style-type: none"> <li>• The Timber Act, 1822</li> <li>• Forest Act, 1885</li> <li>• The Fauna and Flora Protection Act No.2, 1937</li> <li>• The Crown Lands Ordinance, 1947</li> <li>• Motor Traffic Act, 1951</li> <li>• Soil Conservation Act, 1951 (amended in 1953, 1981 and 1996)</li> <li>• The Flood Protection Ordinance,</li> <li>• The National Heritage Wilderness Act No. 4, 1988</li> <li>• Mines and Mineral Act, 1992</li> <li>• National Policy on Wildlife Conservation, 1990</li> </ul>