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Curriculum Development
on
**Climate Change Adaptation and Mitigation,
Climate-resilient Ecosystem Conservation and
Co-management for Natural Resource Management (NRM)**

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USAID's Climate-Resilient Ecosystems and Livelihoods (CREL) Project



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Environment**



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Executive Summary

Climate change and its concurrent effects are significantly influencing our ecosystem, economy and environment. Biodiversity and community both are under severe threat due to the multi-faceted impacts of climate change. In the backdrop of accelerated climate vulnerabilities, adaptation, mitigation and resilience issues are getting amid importance in sustaining conservation and development efforts. Community adaptation to the changing climate scenario is now at the centre stage of all legal and policy interventions adopted globally, regionally and nationally. Collaborative efforts in natural resource management (NRM) are also drawing frequent attention of the policy makers, practitioners and the development partners to ensure sustainable management of our scarce natural resources. Under this backdrop, the issues of climate change particularly adaptation, mitigation and resilience issues have gained momentum. To increase the adaptive capacity of the community with a view to addressing the diverse impacts of climate change, there felt a need for developing an integrated and up-to-date curriculum meeting the need of the time at tertiary level intuitions addressing broader context of environment and NRM issues. Under this backdrop an initiative was taken to develop five curriculums on related aspects of climate change and NRM. Efforts are being made to accommodate relevant suggestions and comments given by the academia, researcher, field practitioner and project partners on the draft curriculums with a view to developing a comprehensive curriculum for the tertiary academic, research and training institution . Based on the extensive and rigorous consultation with the stakeholders during and after the process have resulted in the formulation of an updated curriculum. The revised curriculum is then again shared with eighteen departments of seven universities including both public and private universities with a view to receiving concrete comments on the developed curriculum. Finalization of the curriculum has been made keeping in mind the academic requirement as well as further modification will be done when necessary in order to satisfy cliental needs. This exertion is believed to contribute and share knowledge, information and future directions in the fields related to climate change issues and co-management to facilitate teaching, learning and research process.

Background

Biodiversity conservation, community livelihood and issues of sustainable development are the principal considerations of policy makers, practitioners, community as well as the development partners. Development worldwide creates opportunity for human beings while also poses threat to our biodiversity and ecosystem. The human induced factors of climate change are intervening the natural factors and are increasing at an alarming rate. The probable effects of global climate change and its possible impacts on ecology, economy and society are mainly due to human activities such as unregulated extraction of biological resources, forest destruction and forest extraction, forest land conversion. These activities are speeding up the process of greenhouse gas emission and consequently towards climate change. The potential impacts of climate change particularly to resource user groups are complex. Natural resource sector particularly forestry and fisheries all are under considerable stress affecting the life and living of resource dependent communities. In this backdrop, active engagement of local community in the resource governance mechanisms is believed to be the improved and well accepted strategy in creating a synergy between conservation and development. The paradigm shift in resource governance from traditional top-down approaches to community based approaches are now increasingly being practiced in forestry and fishery sector with broader goals of addressing climate change issues and its various drivers that are directly or indirectly affecting livelihood and their natural resources .

The government of Bangladesh in cooperation with the various stakeholders and development partners is gradually adopting collaborative approaches namely co-management in governing natural resource management (NRM) particularly in forestry and fishery sector. Local resource dependent communities are now increasingly being involved in the planning, implementation and decision-making processes of their respective natural resources.

In materializing maximum benefits through NRM governance, the concepts and practices of co-management approaches and climate change (CC) issues viz. adaptation, mitigation and resilience demands extra attention. How these concepts are reflected in the curriculum of NRM disciplines claim strong impetus to integrate them in the syllabuses of the respective departments and or institutions.

USAID's Climate Resilient Ecosystem and Livelihood (CREL) project contributes to building and institutionalizing technical capacity of the academic, research and training institutions to deal the broader context of climate change and related issues. The project also aimed at better promoting the concepts and practices of co-management and climate change related issues of NRM in their regular curriculum to facilitate the exchange of views and experiences and to

stipulate a better and effective curriculum. Climate change worldwide is posing significant challenges to NRM governance and subsequently major natural resources like forestry, fishery and agriculture are at potential risk and threat due to carbon accumulation and greenhouse gas emission. The present study aims at addressing the growing concerns of the policy makers, researchers, academia by developing a compatible curricula that will better address the concepts and attributes of climate change particularly adaptation, mitigation and resilience with particular reference to NRM.

Objectives of the study

- To review the existing curricula of selected universities, training and research institutions in regards to Climate Change (adaptation, mitigation and resilience) and Co-management
- Motivating the relevant body to update existing curricula of the institutions for incorporating the salient aspects of climate change adaptation, mitigation and climate resilient NRM and co-management in their respective curriculum.
- and To contribute to raising awareness and perception among the new generation and future leaders regarding climate change and its impact on ecosystem and livelihood.

Project Approaches

The process of curriculum development was initiated by USAID's CREL project and has engaged a large number of academic, research and training institutions. Participants (both institutions and individuals) were selected based on their role in imparting education, conducting research and training on broader aspects of environment, climate change and NRM. Flexibility, adaptable in nature, up to date contents and eminence are the key strengths of the designed curriculum.

Key Recommendations

The project was designed to develop the curriculums based on the outcome, recommendations and real time experiences of the participants who are actively engaged in teaching, training and research related to NRM and climate change aspects. Three inception workshops were organized (See appendix-1 for the complete list of participating institutions) to get feedback on the existing status of the syllabus and the future requirements to improve the content of the syllabus based on the SWOT analysis. Besides, training modules and curriculum of the relevant courses of various national and international academic institutions were also analyzed while developing the curriculum. While conducting the workshops many issues were raised those deemed important for designing and developing a comprehensive curriculum with a view to serving broader goals and objectives of the academics, researchers, and practitioners. Based on the feedback and suggestions, a draft version of the curriculum was developed which was then further validate through arranging several sharing workshop by meeting respective departments of both public

and private universities (See appendix-2 for the list of institutions with whom the draft curriculum was shared before finalizing) . Based on the comprehensive consultation process several issues have been raised those deemed pertinent for the development and execution of the curriculum as per need. In this context, some of the issues also need to be addressed by the policy and decision makers, donors and development partners while rendering support and cooperation. The salient recommendations are as follows:

- Climate change (CC) adaptation, mitigation and resilience issues are poorly represented in the existing curricula of the academic, training and research institutions. A significant number of participants demanded adequate supporting measures to integrate the issues in their existing syllabus.
- CC issues must address community based adaptation, mitigation and resilience as major thrust of curricula development since significant changes will take place at community level.
- Local level experiences and best practices must be revealed and generated through study and research in the proposed curricula.
- Joint research programme needs be promoted to exchange views, ideas and field experiences in relation to climate change and co-management of natural resources.
- Many participating institutions and organization requested of arranging training to orient young faculties on various attributes of CC and co-management.
- Teaching materials on CC issues is strikingly limited as noticed by the academics, trainers and practitioners thus unanimously urged for resource support to be provided by CREL and other development partners.
- Introducing, implementing and practicing CC related topics in tertiary education level might require certain level of laboratory facility, field visit and empirical research programme. Participants' have requested CREL to take these requisitions into consideration in their future planning to bring desired success.
- Number of faculty, trainers and researchers available in NRM and environment related field particularly on the broader aspect of CC is strikingly limited thus needs investment to enhance quality and quantity of the manpower.
- Curricula should be need based, flexible and up to date in order to adopt any required changes when necessary.
- Market demand should also be considered while developing and updating curricula related to CC and co-management aspects focusing NRM.
- Each individual institution has got its own legal system to design, integrate and update contents of the respective syllabus thus need motivation and time.

■ Many changes and additions have been suggested by the participants in order to enhance the acceptability and credibility of the curriculums to be considered for possible inclusion in their respective syllabus.

The participating institutions highlighted their current status of the syllabus and the extent of representation of the themes related to climate change and co-management. The participants urged that, for climate change adaptation and mitigation, resilience is the last best option. Since this is a practical action that can endure sustainable development process in the long run. They recommended for more practical researches engaging teacher and students to find better option in tackling climate change issues and in this regard a comprehensive curriculum needs be available. The adequate physical and material support in this regard reckoned vital since almost all participants requested for cooperation in this regard.

Conclusion

The developed curriculums are expecting to instigate the fervor of the institutions in integrating courses on climate change and co-management in tertiary education, research and training system. In addition to that, creation of a professional platform involving teachers, researchers and trainers working in the field of CC and NRM related disciplines is another advantage of the project. The networking and sharing platform of the academics, researchers and practitioners and their coordinated efforts is believed to ensure proper reflection of climate change issues and co-management in NRM for sustainable conservation and development through community engagement.

Curriculums on Climate Change, Co-management and NRM

Course Curriculum-1: Principles and Practices of Co-management for NRM

Total Credit- 3

1. Concepts of Natural Resource and its Management

- A. Definition and features of natural resources
- B. Broad classification of natural resources
- C. Principles of natural resource management (NRM)
- D. Natural resource base of Bangladesh – a brief description
- E. Forest and wetlands as major components of natural resources

2. Community Participation for Sustainable NRM

- A. Basic concepts of community and community participation
- B. Importance and forms of community participation in NRM
- C. Concepts and principles of sustainable development (SD)
- D. International legal and policy frameworks of community participation for SD

3. Governance of natural resources

- A. Concepts of governance and NRM governance
- B. Principles of good governance
- C. Salient feature of environmental governance
- D. Global trends in natural resource governance
- E. Community participation in NRM governance

4. CBNRM and Co-management – Tools for Natural Resource Governance

- A. Basic concepts and features of participatory NRM approaches
- B. Strength and weakness of participatory NRM approaches
- C. Pluralism in environmental governance-the co-management approach

- D. Concepts and salient features of Co-management
- E. Rationale for introducing co-management in NRM
- E. International legal and policy frameworks of co-management
- 5. Ecotourism, Carbon Trading, Education and Research Potentials of Co-management
 - A. Ecotourism and the role of local community
 - B. Community based carbon trading mechanism- CDM, REDD+
 - C. Community based education and research potentials in NRM sites
- 6. Co-management practices in Bangladesh- background and lesson learned
 - A. History of co-management in Bangladesh
 - B. Co-management in the forestry sector of Bangladesh- history and lessons learned
 - C. Co-management in the fishery sector of Bangladesh- history and lessons learned
 - D. Co-management in the wetlands of Bangladesh- history and lessons learned
 - E. ECAs of Bangladesh- status and implication to biodiversity and livelihood
 - F. Future development strategies for co-management

Suggested Readings

- A. Z. M. Manzoor Rashid and Niaz Ahmed Khan, 2014. Role of Co-management organizations in protected area governance: some observations from the Chunati Wildlife Sanctuary **In** M.S.H. Chowdhury (ed) Forest conservation in protected areas of Bangladesh, World Forest Series No 20: 181-200. Springer International Publishing Switzerland, ISBN 978-3-319-08146-5.
- A. Z. M. Manzoor Rashid, Donna Craig, Michael I Jeffery and Niaz Ahmed Khan, 2013. Forest protected area governance in Bangladesh: A focus on the legal and policy framework, *Chinese Journal of Population, Resources and Environment*, Vol. 11(4): 345-351.
- A. Z. M. Manzoor Rashid, Donna Craig, Sharif Ahmed Mukul and Niaz Ahmed Khan, 2013. A journey towards shared governance: status and prospects of collaborative management in the protected areas of Bangladesh, *Journal of Forestry Research*, Vol. 24(3): 599-605.

- Anderson, Krister, 2008. Understanding Decentralized Forest Governance-An Application of the Institutional Analysis and Development Framework **In** Debashree Mukherjee (ed), *Environmental Governance: Concepts, Relevance and Lessons*. The Icfai University Press.
- Arnold, J E M, 1999. Managing Forest as Common Property. FAO Forestry Paper No.136.
- Balloffet, Nicole M and Angela Sue Marin, 2007. Governance Trends in Protected Areas- Experiences from the Parks in Peril Program in Latin America and the Caribbean, The Nature Conservancy, USAID.
- Bauman, Toni and Dermot Smyth, 2007. Indigenous Partnership in Protected Area Management in Australia: Three Case Studies. The Australian Institute of Aboriginal and Torres Strait Islander Studies.
- Berkes, Fikret, 2003. Rethinking Community-Based Conservation, *Conservation Biology*, Vol. 18(3)
- Berkes, Fikret, 2010. Devolution of Environment and Resources Governance: Trends and Future, *Environmental Conservation* Vol. 37(4).
- Berkes, Fikret, Peter George and Richard J Preston, 1991. Co-Management-The Evolution in Theory and Practice of the Joint Administration of Living Resources, *Alternatives* Vol. 18(2).
- Biermann, Frank, et al, 2007. Multi-Stakeholder Partnership for Sustainable Development: Does the Promise Hold?, **In** Pieter Glasbergen, Frank Biermann and Arthur P J Mol (eds), *Partnership, Governance and Sustainable Development—Reflections on Theory and Practice*. Edward Elgar Publishing.
- Borrini-Feyerabend, Grazia et al (eds), 1998. Indigenous and Local Communities and Protected Areas: Towards Equity and Enhanced Conservation, Best Practice Protected Area Guideline Series No.11, IUCN.
- Borrini-Feyerabend, Grazia, Ashish Kothari and Gonzalo Oviedo, 2004. Indigenous and Local Communities and Protected Areas-Towards Equity and Enhanced Conservation, Best Practice Protected Area Guideline Series No. 11, Cardiff University and IUCN, WCP.
- Borrini-Feyerabend, Grazia, et al, 2000. *Co-Management of Natural Resources- Organising, Negotiating and Learning-by-Doing*, GTZ-IUCN.
- Borrini-Feyerabend, Grazia, et al, 2007. *Sharing Power- A Global Guide to Collaborative Management of Natural Resources*, Earthscan Publishing.
- Brockington, Dan, Rosaleen Duffy and Jim Igoe, 2008. *Nature Unbound-Conservation, Capitalism and the Future of Protected Areas*, Earthscan Publishing.

Brosius, J Peter, Anna Lowenhaupt Tsing and Charles Zerner (eds), 2005. *Communities and Conservation-Histories and Politics of Community-based Natural Resource Management*, Altamira Press.

Carley, Michael and Ian Christie, 1992. *Managing Sustainable Development*, Earthscan Publication.

Donna Craig and M Jeffery, 2010. Non-Lawyers and Legal Regimes: Public Participation for Ecologically Sustainable Development, **In** David Leary and Balakrishna Pisupati (eds), *The Future of International Environmental Law*. United Nations University Press.

Donna Craig and Michael I Jeffery, 2008. Global Environmental Governance and the United Nations in the 21st Century **In** Debashree Mukherjee (ed), *Environmental Governance: Concepts, Relevance and Lessons*. Icfai University Press.

Ghee, L. Teck and Mark, J. Valencia (eds). 1990. Conflict over natural resources in South-East Asia and the Pacific, United Nations University Press, 268 pp.

Komiyama, H.; Kazuhiko, T.; Hideaki, S. and Takashi, M. 2011. Sustainability science: a multidisciplinary approach, United Nations University Press, 375 pp.

Niaz Ahmed Khan et al, 2008. An exploratory study on performance and capacity of Nishorgo Support Project (NSP) co-management committees, Bangladesh Forest Department, USAID and IRG, Dhaka, Bangladesh.

Niaz Ahmed Khan, 1998. Land Tenurial Dynamics and Participatory Forestry Management in Bangladesh, *Public Administration and Development* 18:335-347.

Sharif Ahmed Mukul, A. Z. M. Manzoor Rashid, Shimona A Quazi, M Belal Uddin and Jefferson Fox, 2012. Local peoples' responses to co-management regime in protected areas: A case study from Satchari National Park, Bangladesh, *Forest Tress and Livelihood*, Vol. 21(1):16-29.

Sharif Ahmed Mukul, M. Belal Uddin, A. Z. M. Manzoor Rashid and Jefferson Fox, 2010. Integrating livelihoods and conservation in protected areas: understanding the role and stakeholder views on prospects for non-timber forest products, a Bangladesh case study. *International Journal of Sustainable Development and World Ecology*, Vol.17(2):180-188.

Sumi, A.; Nobuo, M. and Toshihiko, M. Climate change and global sustainability: a holistic approach, United Nations University Press, 325 pp.

Course curriculum-2: Climate Change - Policy, Adaptation and Mitigation Strategies for NRM

Total Credit: 3

1. Introduction to Climate Change

- A. Definitions, concepts and basic features of Climate Change (CC)
- B. Causal factors of CC
- C. Current Context of CC – The global scenario
- D. Impact of CC on natural resources and livelihood
- E. International legal and policy frameworks on CC –
IPCC, UNFCCC, UNCCD, CBD, CDM, AFOLU, Kyoto Protocol, COP)

2. CC scenario in Bangladesh

- A. Nature and extent of CC in Bangladesh
- B. Impacts of CC on livelihood, ecosystem and economy- some case studies
- C. Policy implications for CC adaptation and mitigation

3. Climate Change Adaptation

- A. Definitions and basic concepts of adaptation
- B. Relationship of adaptation and development
- C. Vulnerabilities in CC
- D. Vulnerability in community development through CC
- E. Types, principles and importance of adaptation
- F. Gender sensitive adaptation strategy

4. Community and Ecosystem Based CC Adaptations
 - A. Concepts and principles
 - B. Characteristics of community-based adaptation strategy
 - C. Legal and policy frameworks for community-based adaptation strategies
 - D. Strength and weaknesses of community-based CC adaptations
 - E. Importance of CC adaptations mechanisms in NRM
 - F. Role of forest in CC Adaptation
5. Mitigation of Climate Change
 - A. Definitions and basic concepts of mitigation
 - B. Importance and options of mitigation
 - C. Community based CC Mitigation- Global and Bangladesh context
 - D. Indigenous knowledge and practices for CC mitigation
6. Climate Financing
 - A. Concepts of green economy
 - B. Ecosystem services valuation
 - C. Global and national frameworks for CC funding
7. Environmental Diplomacy
 - A. Basic concepts and procedures of climate and environmental diplomacy
 - B. Environmental financing for negotiation
8. Climate Migration- Resettlement and Rehabilitation perspective
 - A. Concepts and theories of migration
 - B. Rationale and factors of climate migration
 - C. Extent and nature of the problem
 - D. Climate migrants in Bangladesh
9. Social, Political and Institutional Attributes of CC Mitigation

- A. Stakeholder participation
 - B. Gender sensitive CC mitigation efforts
 - C. FPIC (Free and prior informed consent) and its importance
 - D. Legal, policy and institutional frameworks for CC mitigation in NRM- Global
Regional and Bangladesh perspective
10. Environmental Governance and its Role in CC Mitigation
11. Ecosystem Based Disaster Risk Reductions (DRR) and adaptation (EbA)
- A. Valuation of ecosystem services-concepts and principles
 - B. Principles and challenges of Eco-DRR and EbA
 - C. Putting Eco DRR into practices
 - D. Ecosystem based tools for DRR
 - E. Economic valuation and policy measures
12. Best Practices and Lessons Learned in CC Adaptation and Mitigation – Some cases studies of Bangladesh
- A. Examples from forestry
 - B. Examples from fishery
 - C. Examples from other natural resources

Suggested Readings

A. Atiq Rahman et al., 2007. Risk, vulnerability and adaptation in Bangladesh **In** Human Development Report 2007/2008, UNDP.

Bonan, B. Gordon, 2008. Ecological climatology: concepts and applications, Cambridge University Press, 568 pp.

Burroughs, W. James. 2007. Climate change- a multidisciplinary approach, 2nd ed, Cambridge University Press, 390 pp.

Dalia Shabib and Susmita Khan, 2014. Gender-sensitive adaptation policy-making in Bangladesh: status and ways forward for improved mainstreaming, *Climate and Development* Vol 6(4):329-335.

Dessler, A. 2011. Introduction to climate change, Cambridge University Press.

Fabrice G Renaud, K Sudmeier-Rieux and M Estrella, 2013. The role of ecosystem in disaster risk reduction, UNU Press, Tokyo, Japan.

Farmer, G Thomas and John Cook, 2003. Climate change science: a modern synthesis, Vol. 1, Springer Publications Ltd.

Jessica Ayers et al., 2014. Mainstreaming climate change adaptation into development in Bangladesh, *Climate and Development* Vol. 6(4):293-305.

Holder, J. 2007. Environmental protection, law and policy, 2nd ed, Cambridge University Press, 818 pp.

Houghton, J. 2009. Global warming: the complete briefing, 4th ed, Cambridge University Press, 456 pp.

Komiyama, H.; Kazuhiko, T. ; Hideaki, S. and Takashi, M. 2011. Sustainability science: a multidisciplinary approach, United Nations University Press, 375 pp.

M Al-Amin, 2013. Vulnerability and Adaptation to Climate Change- From theories to applications, Institute of Forestry & Environmental Sciences, University of Chittagong.

Metz, B. 2009. Controlling climate change, Cambridge University Press, 352 pp.

Ministry of Environment and Forests, Government of Bangladesh (MOEF). Bangladesh Climate Change Strategy and Action Plan, 2009.

Sumi, A., Fukushi, K. and Hiramatsu, Ai (eds), 2010. Adaptation and Mitigation Strategies for Climate Change, 356 p.

Course Curriculum-3: Climate Resilient Ecosystem Conservation

Total Credit- 2

1. Climate Change and Ecosystem Conservation
 - A. Concepts, definitions and salient features of CC
 - B. Importance of conservation
 - C. Threats and challenges of conservation
2. Ecosystem Conservation for Sustainable Development (SD)
 - A. Concepts and attributes of sustainable development
 - B. Basic principles of sustainable development
 - C. Ecosystem conservation and SD- the connectivity
 - D. International legal and policy frameworks for conservation and SD
3. Conceptual Understanding of Resilience Theory
 - A. Resilience theory in ecological systems
 - B. Resilience theory in social systems
 - C. Community resilience to natural calamities
 - D. Community resilience and NRM
6. Integration of Resilience Concepts as Social-Ecological Systems
7. Stakeholder Participation and Social Benefits of Conservation
 - A. Factors affecting stakeholder participation
 - B. Good governance and its role in SD
 - C. Gender equity and women empowerment
 - D. Indigenous people, knowledge and their empowerment
 - E. Importance of social co-benefits in NRM

8. Lessons Learned on Ecosystem Resilience – Global and Bangladesh context

A. Case studies on forestry

B. Case studies on wetlands and fishery

Suggested Readings

A. Atiq Rahman et al., 2007. Risk, vulnerability and adaptation in Bangladesh In Human Development Report 2007/2008, UNDP.

Bonan, B. Gordon, 2008. Ecological climatology: concepts and applications, Cambridge University Press, 568 pp.

Burroughs, W. James. 2007. Climate change- a multidisciplinary approach, 2nd ed, Cambridge University Press, 390 pp.

Dessler, A. 2011. Introduction to climate change, Cambridge University Press.

Fabrice G. Renaud, K. Sudmeier-Rieux and M. Estrella, 2013. The role of ecosystem in disaster risk reduction, UNU Press, Tokyo, Japan.

Farmer, G Thomas and John Cook, 2003. Climate change science: a modern synthesis, Vol. 1, Springer Publications Ltd.

Fran H. Normis et al, 2008. Community resilience as a metaphor, theory, set of capacities and strategy for disaster readiness, *Am J Community Psychol* 41:127-150.

Jessica Ayers et al., 2014. Mainstreaming climate change adaptation into development in Bangladesh, *Climate and Development* Vol. 6(4):293-305.

Holder, J. 2007. Environmental protection, law and policy, 2nd ed, Cambridge University Press, 818 pp.

Houghton, J. 2009. Global warming: the complete briefing, 4th ed, Cambridge University Press, 456 Pp.

Lorrae van Kerkhoff , 2013. Knowledge governance for sustainable development. *Challenges in Sustainability*, Vol. 1(2): 82-93.

Metz, B. 2009. Controlling climate change, Cambridge University Press, 352 pp.

Moberg and Hauge (eds), What is Resilience? An introduction to socio-ecological research. Stockholm Resilience Centre.

R. Price-Robertson and K. Knight, 2012. Natural disasters and community resilience- A framework for support, CFCA Report No 3, Australia.

S. B. Manyena, 2006. The concept of resilience revisited, *Disasters* 30(4):433-450.

UNEP, 2004. Understanding environment, conflict and cooperation. Woodrow Wilson Center for Scholars, UNEP.

UNEP, 2013. Greening Universities Toolkit: Transforming Universities into Green and Sustainable Campuses.

Course Curricula-4: **REDD+ -A Strategic Tool for Forest and Biodiversity Conservation**

Total Credit- 3

1. Introduction to Climate change

- A. Scientific background
- B. Concepts, definitions and basic features of CC
- C. Forms and extent of CC
- D. Climate Change- Global and Bangladesh Perspectives

2. Forest and Biodiversity Conservation- The interconnectivity with CC

- A. Definitions, concepts and basic features
- B. Importance of conserving forest and biodiversity
- C. Various approaches to conservation
- D. Legal and policy frameworks dealing forest and biodiversity conservation
- E. Sink and sources of carbon- special discussion on forests

3. Basics Concepts of Forest Inventory

- A. Deforestation and degradation of forest
- B. Monitoring of the degradation process

4. Various Mitigation Strategies of Climate Change

- A. The CDM mechanism
- B. A/R
- C. REDD+
- D. Verified Carbon Standard for AFOLU

6. Introduction to REDD+

- A. Definitions, concept and background
- B. Scopes and scale of REDD+
- C. Various stages of REDD+
- D. Global initiative for REDD+- salient features of UN-REDD Programme
- E. Governance and social issues in REDD+
- F. Challenges in implementing REDD+ program

7. Stakeholder Involvement in REDD Mechanism

8. Environmental and Social Benefits of REDD Programme

9. Carbon Stock Measurement for REDD+ Program

10. Key Issues to National Forest Monitoring and the REDD+

11. Developing a Monitoring, Reporting and Verification System for REDD+

12. The REDD+ Scenario in Bangladesh

- A. Current status of REDD+ in Bangladesh – MRV, RPP
- B. Institutional framework of REDD+ in Bangladesh
- C. Challenges in implementing REDD+ in Bangladesh

Suggested Readings

Bangladesh REDD+ MRV Action Plan, 2012. MoEF, FAO and UN REDD Programme.

Brice Mora et al. (eds), 2012. Capacity development in national forest monitoring: Experiences and progress for REDD+. CIFOR and GOF-C-GOLD, Indonesia.

Louis V. Verchot and Elena Petk, 2009. The state of REDD negotiations: Consensus points, options for moving forward and research needs to support the process. CIFOR and UN REDD Programme.

Parker, C., Mitchell, A., Trivedi, M., Mardas, N., Sosis, K. , 2009. The Little REDD+ Book. Global Canopy Foundation.

Course Curricula-5: Carbon Measurement and Ecosystem Monitoring

Total Credit: 2

1. Introduction to Climate Change
 - A. Definitions, concepts and basic features of CC
 - B. Carbon as an agent of CC
 - C. The relationship between CC and carbon
 - D. Various forms of CC
2. Terrestrial Carbon
 - A. Basic concepts and attributes of carbon
 - B. Global carbon cycle
 - C. Land use change and carbon accumulation
 - D. Role of terrestrial carbon and forests in mitigating CC
3. Legal, Policy and Institutional Frameworks Related to CC and Carbon Monitoring
 - A. Offsetting carbon
 - B. Institutional mechanism-UNEP, GEF
 - C. Framework approaches- UNFCCC, Kyoto Protocol, IPCC, CDM
 - D. Verified carbon standard (VCS) and AFOLU
 - E. Overview of REDD+
4. Land Use, Land Use change and Forestry
 - A. Concepts and nature of land use change
 - B. Impact of land use changes on forest and environment
 - C. GHG emissions and terrestrial carbon stocks
 - D. Drivers of land use change and the carbon pool

- E. Biomass estimation- methods and principles
- 5. IPCC Approach- reference level, setting baseline
 - A. Emission data- changes in carbon stocks
 - B. Activity data- changes in area by category
- 6. Role of Carbon Stock Measurement in Activity Data and Emission Factors
 - A. Generation of land use maps
 - B. Generation of carbon density
- 7. Carbon Stock Measurement Methods
 - A. Carbon monitoring methods
 - B. Designing sampling framework for field study and its importance
 - C. Application of statistics
 - D. Terrestrial carbon measurement method
- 8. Community Involvement in Carbon Measurement
 - A. Importance of community engagement
 - B. Approaches to engage community- case studies

Suggested Readings

Bliss, J. et al, 2010. Community based ecosystem monitoring, *Journal of Sustainable Forestry*, Vol. 12(3-4):143-167.

Callicot, J. Baird and Karen, M. 1997. Ecological sustainability as a conservation concept, *Conservation Biology*, Vol. 11(1):32-40.

Codi , M. Hoover (ed), 2010. Field measurements for forest carbon monitoring: A landscape-scale approach, Springer Publication.

Coppin, P et al, 2004. Digital change detection methods in ecosystem monitoring: a review, *International Journal of Remote Sensing*, Vol. 25(9):1565-1596.

Franchetti, M. John and Defne, A., 2012. Carbon footprint analysis: concepts, methods, implementation and case studies, CRC Press, 270 pp.

Kimble, J. M. ; Ronald, F. Follett and Bobby A. Stewart, 2000. Assessment methods for soil carbon, CRC Press, 696 pp.

Rapport, D. J.; Gaudet, C. L. and Calow, P. (eds), 1995. Evaluating and monitoring the health of large scale ecosystem.

Appendix-1

List of institutions participated in the workshops

Sl No.	Name of the Institutions/ Departments
1.	Institute of Marine Science and Fisheries, University of Chittagong.
2.	Institute of Forestry and Environmental Science, University of Chittagong.
3.	Department of Zoology, University of Chittagong.
4.	Department of Marine Science and Fisheries, Noakhali Science and Technology University, Noakhali.
5.	Department of Environmental Science and Hazard Studies, Noakhali Science and Technology University, Noakhali.
6.	Bangladesh Forest Research Institute, Chittagong.
7.	Forestry Science and Technology Institute, Chittagong.
8.	Bangladesh Forest Academy, Chittagong.
9.	Fisheries Diploma Institute, Chandpur.
10.	Department of Development Studies, University of Dhaka.
11.	Institute of Environmental Science, University of Rajshahi.
12.	Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet.
13.	Faculty of Fisheries, Hajee Danesh Science & Technology University, Dinajpur.
14.	School of Environmental Management, Independent University, Dhaka.
15.	Bangladesh Centre for Advanced Studies (BCAS).
16.	Department of zoology, University of Dhaka.
17.	Department of Zoology, Jahangirnagar University, Savar, Dhaka.
18.	Department of Zoology, University of Rajshahi, Rajshahi.
19.	Bangladesh Public Administration Training Centre (BPATC), Savar, Dhaka.
20.	Faculty of Fisheries, Sylhet Agriculture University, Sylhet.
21.	Forestry and Wood Technology Discipline, Khulna University, Khulna.
22.	Fisheries Training Academy, Department of Fisheries, Matshya Bhaban, Dhaka.
23.	Department of Fisheries, University of Dhaka.
24.	Faculty of Fisheries, Bangladesh Agricultural University, Mymensing.
25.	Department of Agroforestry Patuakhali Science & Technology University, Patuakhali.
26.	Department of Agroforestry & Environment Hajee Mohammad Danesh Science & Technology University, Dinajpur.
27.	Department of Agroforestry & Environmental Science Sylhet Agricultural University, Sylhet.
28.	Department of Agroforestry and Environment Science Sher-e-Bangla Agricultural University, Dhaka-
29.	Bangladesh Forest Department, Agargaon, Dhaka.
30.	USAID CREL Project, Gulshan, Dhaka.

Appendix-2

List of Universities and Departments participated in sharing meeting

Name of University	Date of Visit	Name of Department / Institute
Rajshahi University (Contacted 3 Departments)	10 Dec 2014	Dept. of Zoology
	10 Dec 2014	Dept. of Botany
	9 Dec 2014	Institute of Environmental Studies
Chittagong University (Contacted 3 Departments))	15 Jan 2015	Dept. of Zoology
		Inst. of Marin Fisheries
		Inst. of Forestry and Environment Science
Khulna University (Contacted 2 Departments)	25 Feb 2015	Dept. of Forestry and Wood technology
		Dept. of Environmental Science
Dhaka University (Contacted 5 Departments)	11 Feb 2015	Dept. Of Development studies
		Dept. of Anthropology
	21 Apl 2015	Dept. of Fisheries
		Dept. of Zoology
Independent University Bangladesh (IUB (Contacted 2 Departments)	24 Mar 2015	Dept. of Environmental Management
	25 Mar 2015	Dept. of Environmental Science
University Liberal Arts Bangladesh (ULAB) (Contacted 2 Departments)	13 April 2015	Center for Sustainable Development and
		Department General Education
North-South University (NSU) (Contacted 1 Departments)	15 April 2015	Dept. Environmental Science and Management