



Technical report  
Improving preparedness of the region  
To assess and devise appropriate interventions  
To address challenges in 'adaptation to climate change'

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- Objectives and approach: a logical framework as part of a preparatory process
  - Deliberations and outcome of the scoping exercise
  - The way forward
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## Summary

SACEP attempts to fulfill its mandate of providing and enabling technical assistance at the regional level to address environmental challenges with a bearing on the developmental agenda of the countries in South Asia. SACEP recognizes the enormous significance of adaptation to climate change in this context. This is in response to a felt need to synergize expertise and efforts through mutually reinforcing interventions centered on a participatory process as articulated by its Governing Council. SACEP's collaboration with CEE-India signified such a synergy, aimed at a reality check of the needs and the development of a menu of responses.

The regional consultation on the 10<sup>th</sup> of January 2007 in Colombo in collaboration with CEE, India, consolidated the needs statement and a logical framework to guide sector-specific stocktaking and appropriate adaptation action. Sectoral specialists from India, Nepal, Pakistan, and Sri Lanka associated with action at the local, regional and global levels deliberated at the launch and contributed to the development of an integrated approach for way forward. Reality checks, capacity building, consolidating funding mechanisms, development of proposals to initiate and sustain support, intensive interactions with governments and other agencies are essential elements of such a process with results to be delivered in well-defined time frames.

Task forces have been initiated and the final framework of action, which lends itself to significant adaptation, will emerge soon after the deliberations at the SACEP Governing Council by end-January 2007. The process and the outcome of activities pertaining to the above are indicate

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## Objectives and approach: a logical framework as part of a preparatory process

The main objective of the joint initiative was to help all concerned stakeholders understand emerging trends in addressing challenges pertaining to adaptation to climate change adopting an integrated capacity building framework. The process of fulfilling this objective would obviously entail

- Comprehensive assessments of information and technical capacity needs of stakeholders,
- Providing guidance on adaptation opportunities and mechanisms including the process of up-scaling

- Enabling access to resources and
- Development of need-based augmentative interventions including design and implementation of policy and planning frameworks.

A concept note on the framework for capacity building to overcome challenges in adaptation was accordingly prepared (annexure - 1) to consolidate understanding of the various needs and opportunities. This was followed by an analysis of some of the most important prevailing initiatives in the region. This analysis provided the basis for developing a wide range of activities, which could be undertaken depending on their immediate relevance and ease of access (annexure-2). It was important to recognize that the mechanisms of funding vary significantly depending on the constraints which determine the quantum of funds available and the geographic domains over which the funds could be applicable. This constraint prompted the need for establishing partnerships with prevailing initiatives and opportunities for significantly up-scaling them wherever possible.

A detailed analysis of the various initiatives the world over, with a special emphasis on Asia was accordingly undertaken. Several initiatives were identified, and in this process a clear understanding of some of the challenges emerged (Annexure-3). The quality and spread of information on the physical, chemical and biological characteristics of relevance to assessments of vulnerability, capacities to monitor and report variations, development of tools and techniques to document, interpret and communicate to respective stakeholders, documentation of indigenous adaptations, integrated pilots to assess the relative importance of technical and technological interventions and demonstrating the feasibility of sustaining such interventions were some of the imperatives which appeared to be calling for urgent attention. The paper was presented to a wide range of stakeholders including focal points in governments responsible for initiating and sustaining adaptation activities, funding agencies, institutions engaged in capacity building of stakeholders, researchers and specialists who are involved in assessments and guiding action at the local, national, regional and global levels. These agencies and institutions were requested to represent themselves at a regional consultation in order to deliberate on the imperatives highlighted in the paper. This was also an essential element of the scoping exercise aimed at validating the understanding articulated in the concept note. More importantly the deliberations were expected to help consolidate the way forward for the SACEP-CEE initiative; in direct response to the mandate defined by the Governing Council as referred above.

### **Deliberations and outcome of the scoping exercise**

Experts in the field of climate change, representatives of governments and coordinators of community-based initiatives deliberated on the appropriateness of the framework for providing technical assistance on aspects of adaptation, in the region. A detailed presentation on the questions to be answered regarding the

- Thrust areas,
- Cross-cutting issues including financial mechanisms, compliance schedules, technical and technological capacity building, monitoring and reporting
- Tools and techniques for quantitative and qualitative assessments
- Interpretation of the appropriateness of interventions with respect to the developmental agenda of the country / region
- Frameworks to avoid duplication of efforts and
- Institutional mechanisms to initiate and sustain efforts at the local, national and regional levels, was made by the Director General of SACEP.

This presentation set the framework for the deliberations. Annexure - 4 presents the salient features of the presentation. Detailed responses by the experts and others indicated above

reinforced the technical aspects and the mechanism for providing technical assistance as elaborated in the concept note and the working paper. Annexure – 5 presents a copy of the presentations made by the invitees.

Some of the most important considerations which emerged through the deliberations are summarized in annexure – 6. These centered on the need to

1. Strengthen technical cooperation through intensive involvement of scientific and technical institutions in the region on
  - a. Assessment of perturbations,
  - b. Predictive analysis and integrated modeling including a clear understanding of the spread and depth of information on the variables
  - c. Prioritization of interventions considering the developmental imperatives duly integrated the precautionary approach
  - d. Capacity building of stakeholders to assess, monitor and report on the periodicity and intensity of perturbations, in order to consolidate empirical evidences
  - e. Documenting and strengthening indigenous options / adaptations
2. Establish pilots to demonstrate the feasibility of employing technically and economically viable tools and techniques for overcoming challenges at the local level
3. Up-scale appropriate interventions duly considering the limitations of scale and other system-specific characteristics and enable adaptation and not mere duplication of efforts.
4. Sensitize decision-makers and other advocacy groups to emerging trends in interpreting observed variations in order to improve their preparedness to suitably articulated developmental concerns and imperatives, relevant at different levels of decision-making.

Based on the above, it was quite evident that the SACEP-CEE initiative was timely and appropriate. In order to therefore sustain the momentum thus created, a roadmap on the way forward was also presented. The roadmap envisaged a preparatory phase for stock-taking and a delivery phase as a need-based response which may have to be freshly initiated in a few cases. It is however, important to establish systems by which such initiatives will be sustained over longer periods of time and hence the need for defining immediate, medium and long-term goals. Clearly defined guiding principles and a logical framework of action are essential elements of the proposed roadmap. The salient aspects of the roadmap are presented in annexure – 7. It will be obvious from the roadmap that the way forward will be characterized by an integration of the

- Needs relevant to the locally perceived constraints
- Prevailing initiatives thereby avoiding duplication of efforts, emphasizing an inclusive process and definitely not an exclusive mechanism.

### **The way forward**

The deliberations clearly served the purpose of the scoping exercise thereby fulfilling the objectives set forth by SACEP and CEE. The most important tasks to be fulfilled accordingly include the

- Development and implementation of a mechanism by which institutions and experts come together to assess prevailing facilities, needs and define options for systematic reality checks, capacity building, piloting and up-scaling.
  - This will involve the establishment of technical core groups led by experts in the respective fields. The workshop provided the best opportunity to initiate such a process. Experts present at the meeting were invited to provide the necessary leadership and impetus to the initiative. We are happy to report that the invitation was received very well.

- Establish a technically sound secretariat involving SACEP and CEE to function as a technical support facility and communicate with and between stakeholders, based on an initial institutional support mechanism through SACEP and other funding mechanisms.
- Jointly develop proposals and seek funding to initiate and sustain need-based ground-level interventions
- Document, disseminate and represent regional initiatives in national, regional and global deliberations.
  - An outline of the plan embodying the above stated will be presented at the Governing Council.

#### Annexure list:

1. Concept note on the framework for capacity building to overcome challenges in adaptation – draft
2. Outline of the action plan – draft
3. Working paper: Emerging trends in understanding and enabling adaptation to climate change.
4. Questions raised at the launch of the deliberations at the workshop
5. Presentations by experts (5.1 to 5.6)
6. Highlights of the imperatives and the roadmap stated at the workshop and the output statement.
7. Main text of the report

#### Acknowledgement

SACEP and CEE thank the SACEP Governing Council for endorsing the view that significant efforts focusing on adaptation to climate change have to be mobilized and handheld on a priority basis. The need for a systematic approach to define country-specific interventions was also appropriately highlighted, providing the basis for the present effort and the way forward. Our heartfelt thanks to Dr Jyoti Parikh, Prof. Munasinghe, Prof Sukumar, Prof Kodagama, Mr Sodhi, Ms Shireen, Mr Manandhar, Dr Anura and Mr Pracha for their presence and intensive involvement by deliberating on the framework and willingness to lend shoulders to the design and development of initiatives centered on the present effort. It was enlightening to understand the diversity of tasks, clarity of purpose, substantiated with scientific rigor, reflected in the deliberations enabled by the ones stated. Importantly, the framework of action was also vetted and found to be appropriate. Our thanks also to the Bangladesh Centre for Advanced Studies, the Ministry of Environment in Pakistan and the National Environment Commission, Bhutan, for the keen interest they have evinced in this process. CEE wishes to acknowledge the timely support based on which it was possible to establish links with SACEP and organize the regional consultation as part of the scoping study by the Swiss Agency for Development and Cooperation, India.

## Annexure I

### Concept note on Integrated Capacity Building For overcoming challenges in Adaptation to Climate Change integrating developmental imperatives

Submitted by CEE, India  
to  
South Asia Cooperative Environment Programme  
Sri Lanka  
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##### Abstract

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#### Abstract

The concept note is about improving preparedness of stakeholders to respond to the adaptation imperatives of climate change mitigation in South Asia. Improving preparedness here implies

1. Guiding adaptation through pilots and in the process generate empirical evidence about barriers
2. Providing appropriate information in a timely manner
3. Develop integrated approaches to overcome barriers through an analysis of the cross-cutting issues.

The note highlights the need for focusing on

1. Detailed analyses of national capacities particularly on cross-cutting issues relating to climate change mitigation per se, biodiversity conservation and land degradation
2. The links between adaptation needs and interventions to quantifiable climate change mitigation  
Needless to overemphasize, the sectors chosen for specific work will be directly relevant to the various countries and their developmental imperatives.

#### Guiding principles

1. The framework of action proposed in the concept note is based on
  - The felt need to improve capacities of all concerned stakeholders (decision makers associated with land use planning, including agriculture, forestry and related activities, financial institutions, implementing agencies) to
  - Understand opportunities for effectively using alternative approaches that are not emission – intensive and
  - Adapt suitably to overcome barriers and sustain interventions to reduce and eliminate vulnerability to climate change impacts.

2. In order to enable the development of need-based interventions pertaining to the aspects indicated above, it is important to
  - Carry out reality checks,
  - identify options and demonstrate ways and means of substitution leading to effective adaptation (and enable the development of protocols for quantification and abatement followed by capacity building).
3. This approach will very clearly document empirical evidences of barriers and opportunities to overcome them.
  - Inherent in the establishment of pilots, is the need to take into account all other existing interventions to avoid duplication of efforts.
4. The learnings generated out of the establishment of pilots will therefore have to be of significant value to financial institutions, technology transfer regimes and capacity building programmes to guide the development of hybrid interventions (command and control, market-based instruments and a suitable mix of these two) with implications in resource planning and consolidation of South-South cooperation mechanisms.

## Objective

Climate adaptation and sustainability goals have to be jointly promoted by suitably modifying policies to lessen pressures on resources, improve management of environmental risks, and enhance adaptive capacity. These call for an integrated assessment of extraction efficiencies and access to alternatives.

In this context it is important to recognize that several countries are in the process of carrying out their national capacity self assessments to respond to the imperatives of adaptation to climate change. It will therefore be very useful to focus on the crosscutting issues in particular to identify information needs, technology support and transition programmes and other decision support systems including the establishment of infrastructure for continuous monitoring of spatial and temporal variations in addition to emerging challenges.

We propose to fulfill this goal of

- identifying strategic actions to strengthen the planning process,
- help mainstream adaptation activities considering mitigation options by
  - increasing awareness on options and demonstrating the feasibility of some options in the region in addition to
  - capacity building for sustaining interventions.

It is therefore important to

- Highlight imperatives of
  - adaptation to manage agriculture and other sectors relevant to the countries as a priority issue in the region
  - development and establishment of decision-making framework to integrate adaptation to climate change in sustainable development planning through an
    - understanding of the links between livelihoods and climate, assessment of project's impact on community-level adaptive capacity and
    - implement adaptations to improve impacts on adaptive capacity.

- Recommend technical assistance and financial support mechanisms through demonstration/pilot projects and provide technical training opportunities.
- In this process it will be useful to integrate preventive frameworks for eliminating mal-adaptation interventions.
- It is equally important to understand the characteristics of vulnerability which may amplify damage.
  - For example an analysis of water resources impacts may consider
    - intense rainfall during short periods which tends to
      - result in little recharge of groundwater aquifers,
      - lower quality surface water,
      - flooding,
      - river pollution, and associated
      - social and economic losses
    - long, dry periods which
      - reduce water availability,
      - increase irrigation demands,
      - potential for saline intrusion,
      - soil degradation and
      - damage to public health due to proliferation of water related diseases.

The cross cutting issues include

- Functional responsibilities for related institutions for integrated decision making
- Link between technological interventions and institutional mechanisms for implementation
- Sharing knowledge
- Address overlaps and avoid duplication
- Inventorise vulnerabilities and trends
- Develop effective decision making capabilities in the region
- Develop approaches towards risk Communication-Resolution and Implementation
- Propose and help adopt approaches for mainstreaming adaptation interventions.
- Development of baseline information systems and protocols for quantification of limiting factors and adaptation needs. There are no significant initiatives at the local level and hence the need for developing demonstration projects.

### **Some imperatives and important thrust areas**

Signs of climate are becoming more prominent over 1 or 2 decades. If appropriate action is not taken now to design and implement long term adaptations based on anticipatory actions, it may be too late to avoid upheavals.

- The third assessment report of the UNEP/WMO Intergovernmental Panel on Climate Change (IPCC) mentions that the number of hungry and malnourished people in the world, are expected to increase by about 10% later in the 21st century if adaptation programme is not undertaken. Of special significance is the need to address agriculture which is particularly highly vulnerable to impacts of climate change in the South Asian region.
- **Crop production and aquaculture** would be threatened by
  - thermal and water stresses,
  - sea-level rise,
  - increased flooding, and
  - strong winds associated with intense tropical cyclones.



- Impacts of Acute water shortages will be aggravated due to thermal stress which is turn is expected to adversely affect productivity of important crops.
- **Land use planning** relating to limited availability of land is another critical issue.

Some of the adaptation measures envisaged to reduce the negative effects of climatic change may include

- changing the cropping calendar to take advantage of the wet period thereby avoiding extreme weather conditions duly integrating limitations of
  - affordability of adaptive measures,
  - access to technology, and biophysical
  - constraints such as land and water resources availability,
  - soil characteristics
  - genetic diversity and adaptability for crop breeding and
  - topography.
- Improved farming practices through
  - improved soil, crop and environmental quality
- Credible mitigation through carbon sequestration in
  - land use, land use change and
  - forestry including agroforestry or mangrove management thereby contributing partly offsetting costs of adaptation measures. Related benefits could include enhanced adaptive capacity through ameliorated micro climate including better water retention.

### **The Conceptual Framework of Mainstreaming adaptation to climate change (MACC) of GEF in the Caribbean region through support from Caribbean, French and Dutch Governments**

1. In national development planning and public and private investment decisions.
  - Work with such sectors as
    - Water resources and supply
    - Fisheries
    - Agriculture and forestry,
    - land use planning
    - coastal zone management
    - tourism
      - to incorporate
        - climate change impact and
        - risk assessment, disaster management in their ongoing programs and long-term planning.
2. Assist in Institutional and Technical Support mechanisms particularly in :
  - assessment of pilots for adaptation;
  - vulnerability assessments;
  - preparation of the National Communications regional agenda on adaptation
  - strengthening monitoring network
  - increased scope of measurements and data collection and modeling under climate change scenarios and
  - Disseminating mainstreaming activities.

## The way forward

We propose it will be useful to commence work in Sri Lanka, Bhutan, Nepal and Maldives.

- It is important to identify sector-specific stakeholders (say in areas of agriculture, land use planning and environment, waste treatment and disposal and financial institutions) as the first task.
- This activity is expected to be completed in a period of six months.
  - Detailed discussions on
    - the developmental imperatives
    - an assessment of their preparedness to understand options, opportunities to build capacities for assessing impacts and alternatives and
    - the development of action plan for improving their preparedness are the three elements of the reality checks which will help develop the roadmap for in conjunction with the existing national capacities.
  - These activities could be completed in a period of 9-12 months followed by a consolidation of the strengths weakness, opportunities and threats in the implementation of the roadmap.
  - It will be useful to commence on the other countries at the end of the preparatory phase of six months.

It will be useful to also target centres of higher learning in each of the countries with

- specialized information modules on integrated chemicals management and
- the interrelatedness of multilateral environmental agreements considering the fact that managers of the future emerge from these places.
  - It is essential to interact with the implementing agencies of the various Multilateral Environmental Agreements in the respective countries and present the proposed framework.
  - The objective is to show that the reality checks and the capacity building interventions proposed by us will only complement their own developmental initiatives by providing empirical evidences of the specific needs of the respective countries and the sectors.
  - Interventions of this nature are few and far between.
  - The State of Environment Report of the various countries of the region also highlights the imperatives stated and the present proposal is not only in conjunction with their developmental agenda but is aimed at lending much needed support to activities carried out by several bi-laterals and other agencies.

5. These preparatory activities are expected to be carried out over a six-month period. Continual documentation of experiences emerging from the pilots based on qualitative and quantitative analysis of improvement opportunities is expected to be carried out over the subsequent 9-12 months period and the final six months will be spent on disseminating the learnings to all relevant stakeholders.

### An outline of the action plan for

- understanding and
- implementing adaptation strategies

in South Asia by SACEP and CEE is presented on the basis of the framework embodied in the concept note of 19 January 2006.

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The justification for the action plan is presented by citing some examples of work in progress on adaptation strategies in countries of South Asia. For instance,

1. The UNEP/CICERO study highlighted the various opportunities and means of assessments on climate change impacts and adaptations in Pakistan.
2. Information on the status of high altitude ecological conditions has been presented in [www.wfpak.org](http://www.wfpak.org) in addition to the implications of risk assessments and control.
3. Some of the major issues in Bangladesh, Indonesia, Pakistan and Sri Lanka have also been stated as part of the output of a major Asia-Pacific seminar.
4. The IHDP, IGBP, WCRP initiative on System for Analysis Research and Training (START) also highlights some issues related to water resources, their vulnerability and coping mechanisms.
5. A detailed analysis of vulnerability to flood risks in Bangladesh, the status of the National Adaptation Programmes of Action and the output of deliberations on community level adaptation to climate change (organized by the Bangladesh Centre for Advanced Studies, IIED, the IUCN and others with the support of CIDA and DFID) provide the basis for understanding some of the opportunities in Bangladesh.
6. The Govt. of Maldives and the UNDP have initiated action on the National Adaptation Plan of Action for Climate Change with support from the Global Environmental Facility. Of special relevance are the impacts of sea-level rise. Assessment of technology needs and national capacities are integral to this intervention.
7. Nepal provides an opportunity to understand features unique to mountain systems as highlighted by a recent publication on climate vulnerability and adaptation. Some of the clear needs are information support to farmers and impacts, improving technical preparedness to disasters with special focus on primary health care and combating changes in profiles of glaciers vis-à-vis potential of floods. The CLACC initiative (Capacity strengthening in the least developed countries for adaptation to climate change) has highlighted some of these and other related issues.
8. Afghanistan provides yet another scenario where the need to enhance resilience appears to be quite obvious. Some country-study programmes were initiated by USAID and it is important to look at the imperatives stated therein.
9. Several initiatives in Sri Lanka and India are also in different stages of progress with respect to assessment of opportunities for adaptation.
10. Some important learnings from the above stated include:
  - The number of demonstration projects which provide empirical evidences of the appropriateness of correlates and interpretation of their inter-relationships are however few and far between.
  - The need for establishing such pilots to provide very clear policy guidance and hand-hold stakeholders is particularly obvious especially when we consider the urgent need to respond to such emerging regimes as; for instance, the resource allocation

framework of the GEF, the Community development Carbon Fund and the Special Climate Change Fund.

11. A well-guided response to these needs should therefore focus on
  - consolidation of efforts in each of these countries through sector-specific roundtables with a special emphasis on understanding cross-cutting issues
  - identify priority areas for establishing pilots
  - establish partnerships and develop proposals for actually implementing pilots supported by enabling access to appropriate funding mechanisms
  - Participate in the actual implementation, interpret observations and generate frameworks of analysis which could be disseminated for further capacity building of stakeholders.
  - Provide precise information on the diversity of options supported by a SWOT analysis.

## **Action plan**

### Step – I

Formalize partnership between SACEP and CEE for carrying out tasks to 'Enable and Strengthen Action on Adaptation Interventions with respect to impacts of climate change in South Asia'.

- This could be in the form of a MoU which can be developed immediately.

### Step –II

A joint proposal has to be developed and submitted to appropriate funding agencies including the GEF Secretariat, the Adaptation Fund and other sources. The objective is to derive funding to meet costs associated with the preparatory tasks and other enabling activities.

This proposal should therefore contain

- a copy of the MoU,
- a detailed statement of the needs of countries in the region with respect to consolidation of existing initiatives, assessment of opportunities for developing and strengthening appropriate interventions to suitably respond to the challenges of adaptation to climate change.
- This implies the need for placing the concept note and the present action plan in perspective.
  - This has to be accomplished within a period of 6-8 weeks.

### Step – III

Carry out an intensive desk-based research on major programmes and other initiatives by governments, research institutions, implementing and executing agencies on issues of adaptation in countries of South Asia.

- This task can be carried out by CEE over a period of two months along with step II to therefore help identify the most important contact points (operational and political focal points, technical experts and institutions and other contacts) apart from gaining insights on the diversity of initiatives, the concerns highlighted therein and the options available for
  - Strengthening work in progress
  - Re-defining analytical frameworks and identification of alternative options.
- An additional task will be to also establish contacts with the implementing and executing agencies and other resources.

- SACEP is in a sound position to establish contacts with the operational and political focal points on the way forward.

#### Step –IV

Based on the output of step-III it will be possible for CEE and SACEP to co-author working papers on the ground realities and justify a framework for further action as proposed in the following steps.

- Some of the most important areas which we expect to justify are the need to
  - Consolidate existing initiatives.
  - Help countries and their respective stakeholders
    - develop and implement frameworks of opportunity assessments and proposals for project-based interventions on adaptation.
    - link with appropriate sources of funding and expertise
  - Actually participate in the implementation of adaptation programmes
  - Generate and provide information on the viability of options and mid-stream corrections as required.
    - This task can be completed along with the desk-based work

#### Step-V

Invite the operational and political focal points and a group of relevant stakeholders for a regional roundtable to

- Vet the output of step-IV
- Prioritize interventions (for policy support/developing proposals/participating in implementation pertaining to capacity building or actually carrying out the project.)
- Propose partnerships for work in their respective countries
  - This roundtable has to be conducted over three days.

#### Step –VI

1. Country-specific tasks can be undertaken based on the partnerships, (which will include a framework for meeting the costs of SACEP-CEE involvement with the support of the respective countries),
2. Step–V can also be used for announcing a series of interventions including detailed analysis of work in progress in the respective countries to help develop suitable planning and policy interventions. Activities relating to these detailed analysis and communicating on their output can happen as stand-alone exercises apart from the other partnership-based activities.

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Emerging Trends in Understanding and Enabling Adaptation  
To Climate Change

Working Paper

Prepared by

SACEP, Sri Lanka  
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Centre for Environment Education, India

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As part of a capacity building initiative on adaptation:  
Improving preparedness of decision-makers in South Asia  
To develop frameworks, initiate and sustain action

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Key words: Adaptation. South Asia. Capacity building. Projects. Preventive Environmental Management.

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## **Summary**

The need for building capacities of stakeholders to comprehend the concept of adaptation and develop appropriate strategies to reinforce preventive strategies has been clearly articulated even at the 12<sup>th</sup> Conference of Parties of the UNFCCC. This has also been reiterated by several countries in South Asia which have been gone through the NAPA and NATCOM processes. These countries are now preparing themselves to develop adaptation interventions integrating them with their developmental agenda. It is therefore essential to provide information on emerging trends in assessments and interpretation of sectoral adaptation opportunities and help optimize on financial and technical resources. The present effort accordingly captures some of such emerging trends and provides access to sources of authentic information in the form of a compendium of articles and documents of relevance. Information on some of the state-of-art tools and techniques used for assessments, frameworks of capacity building and case examples of adaptation measures are indicated. Importantly, learnings generated out of deliberations at the regional workshop will also be included. The approach of capacity building and the relevance of information provided will be (have been) justified and (have) created the milieu for sustaining interactions to progress beyond information support into the actual development and implementation of adaptation-based activities.

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## Section – 1: Concept of adaptation

### The regional capacity building initiative as a need-based response to improve preparedness to act

The present SACEP initiative is focused on improving preparedness of stakeholders to initiate and sustain adaptation-based activities in the region. This is in response to a felt need to complement such initiatives as the NAPA and the NATCOM which are in different stages of development. Deliberations at the 12<sup>th</sup> Conference of Parties reiterated the above-stated need considering the specific imperatives of effectively capturing financial mechanisms which are essential to provide impetus to well-guided assessments and help develop appropriate frameworks of action. One of the timelines refer to February 2007 by which time the rudiments for developing criteria to assess and prioritize sectors critical for sustainable development, ways and means of monetizing benefits and establish institutional mechanisms for quality assurance, management and implementation; monitoring and verification to sustain progress will be developed.

The need for capacity building of stakeholders to suitably respond to the opportunity cannot be overemphasized. This is particularly true when such parameters as the development of baseline for interpretation of impacts of interventions, fungibility, accountability, consistency and reporting are considered. More importantly, it is essential to understand the frameworks of analysis proposed for identifying project-based areas and quantifying impacts, based on which it may be necessary to create mechanisms of funding and technical support in addition to those covered by the Convention. This is especially to build on the inherent strengths and resources available within the respective countries and not wait to receive support through some of the well-known mechanisms. Central to the development of such frameworks is the need to understand the concept of adaptation thoroughly.

One of the most recent analyses of implications of adaptation by TERI India, calls for a more detailed examination of the process of adaptation notwithstanding initial efforts by several countries as indicated above. The paper stresses the need for

- A careful integration of adaptation strategies into a policy context on the basis of empirical evidences and perceptions documented through the direct involvement of stakeholders with a special emphasis on reduction of vulnerability.
- Response strategies to reduce vulnerability relating multiple stresses simultaneously, apart from understanding stress-specific and independent adaptation strategies.
- Relating mitigation and adaptation to develop a suitable mix of instruments through economically efficient systems to tackle impacts.

Yet another recent initiative of the START Regional Center (Lessons from the Final Report, Submitted to Assessments of Impacts and Adaptations to Climate Change (AIACC), Project No. AS 07 -Bangkok, 2006 “Vulnerability to Climate Change Related Water Resource Changes and Extreme Hydrological Events in Southeast Asia”) indicated that

- Policy makers still need
  - Explicit answers regarding climate change impacts, vulnerability and adaptation
  - Hand-holding through pilot implementation of projects that build resilience to climate impact with immediate as well as long-term benefit,
- While it is well known that climate change impacts bio-physical and socio-economic systems at the local level, it is essential to recognize the fact that adaptation measures may have equal relevance at the regional scale if the impact is felt across geographic boundaries of countries.
- This calls for collaboration to jointly look into the issues, establish and share a common understanding of the impact and adaptation at the regional scale.

This observation motivates the process of coming together at the regional level to answer such important questions as:

1. Do we have adequate information on
  - the various sources of perturbations
  - historical trends of impacts caused
  - apportionment with respect to the scale and intensity of perturbation including environmental fates of pollutants and means of abatement
  - technical preparedness of stakeholders to engage in preventive action and move towards adaptation?
2. What are the priority areas based on which proposals for projects can be developed in conjunction with the frameworks of the funding mechanisms available?
3. What are the various innovations if any, developed by people /systems in response to locally perceived issues?
4. Is it possible to build on such innovations to minimize dependence on support from outside?

Answers to these questions will complement the process of NATCOM and NAPA, in addition to creating linkages amongst stakeholders at the regional level. One of the effective starters in the process of coming together will be to orient oneself to some of the emerging trends in articulating opportunities in this context.

### The Compendium on Adaptation for Decision Makers and the Working Paper on Emerging trends

As part of the capacity building process, SACEP intends to present a 'Compendium on adaptation for decision-makers' to the participants at the workshop proposed for the 10<sup>th</sup> of January 2007 in Colombo. This compendium will help the participants gain access to significant information on aspects of funding, tools and techniques used for development of adaptation frameworks, project-based thrust areas with respect to the various sectors of development; supported by examples of interventions in various stages of evolution.

Since an electronic version of the compendium will be provided, it will be easy for the participants to link with the various sources of authentic information, thereby sustaining access. Importantly the plan of deliberations at the workshop will ensure sharing of insights on process of overcoming barriers in interpreting and initiating activities on adaptation.

The compendium will be complemented with the framework embodied in the present working paper on 'Emerging Trends in Understanding and Enabling Adaptation to Climate Change'. It is a working paper because the outcome of deliberations and learnings generated at the workshop will also be integrated with the contents of the draft of the paper. The final integrated version is therefore expected to help decision-makers in governments, financial institutions, bilateral and multilateral agencies understand opportunities for providing need-based support to stakeholders in order to effectively participate in assessments / reporting / initiating pilots / up-scaling activities on a location-specific basis.

The present draft is therefore a forerunner to the final working paper set to emerge on the basis of embodying inputs from the participants of the workshop and from other experts who may not be able to be present at the workshop. It accordingly commences with an overview of the concept of adaptation. This is followed by a highlight of the crosscutting nature of the adaptation framework including links with mitigation; its relevance to the development of

integrated policy and implementation programmes and the process of identifying adaptation needs.

Some important sector-specific adaptation opportunities, commonly used tools and techniques for initial assessments including the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations, the UNDP Adaptation Policy Framework (APE, Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC)) and the United Kingdom Climate Impacts Programme (UKCIP) Climate Adaptation: Risk, Uncertainty and Decision Making are indicated. Learnings from some initiatives in progress in different parts of the world, the process of capacity building and the present understanding of some funding mechanisms in the context of the frameworks for implementation are also presented.

The objective is to help readers gain an overview of the emerging trends and continue to access authentic information. Importantly an understanding of some of these aspects will help articulate perceptions with respect to the questions stated above; at the proposed workshop as a starting point for further deliberations. This will help initiate and sustain mutually reinforcing action at the level of the individual countries and at the regional level. Information presented herein is therefore meant to be only a pointer to some important sources. The present effort is therefore eclectic at best and is intended to initiate the process of deliberating on the process of capacity building through a participatory process.

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Adaptation refers to the ability of systems to manage or cope with changing climate. This calls for a combination of reactive and anticipatory measures of adaptation duly considering uncertainties in assessments and vulnerabilities at the national and regional levels. These can be initiated through market exchanges or through coordinated measures by government and other stakeholders.

Prevailing institutional processes, regulatory frameworks, property rights, access to resources and social conditions determine the mix of measures to be undertaken. Importantly adaptation is location and context –specific because of which there cannot be a single plan for adaptation. The plan could be based on learnings from past hazards.

In this process it is essential to recognize that

- Poverty tends to increase vulnerability, compounding issues due to lack access to water, poor diet, and health care etc.
- Additionally, precarious economic existence does not provide for insurance against external shocks.
- Adaptation to climate change is therefore a part of frameworks for improving livelihoods, market, and productivity variables and cannot be isolated from sustainable development objectives. Local capacity is critical to successful environmental adaptation. Adaptation has to be consistent with economic development, environmentally and socially sustainable over time, and equitable. Acting now and over the long-term can reduce costs and complement other goals.

Scientific and policy debates about adaptation center on:

- Extent and pace of change
- Cost and sustainability implications for natural and societal systems
- How much can be realistically done to off-set impacts?
- Opportunities and limits to adaptation. These are also based on the fact that
  - Adaptation is not an alternative to mitigation

- Often adaptation can be implemented through small changes to project design, strengthening existing regulatory and planning mechanisms  
<http://siteresources.worldbank.org/INTCC/214574-1110866984338/20480637/TenThingsKnowAdaptationNoble09152004.pdf>

From a development perspective, it is equally important to analyze

- How will climate change interact with other factors driving changes in population growth, social and economic vulnerability?
- Equity issues pertaining to development paradigms, constraints on future emissions and capacity to adapt to the effects of climate change.

A recent report of the Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC) initiative indicates the need to advance scientific understanding of climate change vulnerabilities and adaptation options in developing countries. The assessment

- Aims to fill gaps in the current understanding of vulnerability and opportunities for adaptation by funding, training, and mentoring developing country scientists to undertake multisector, multicountry research of priority to developing countries.
- Offers a toolkit for researchers, useful in the design of projects, gives information and links on climate models, agriculture models, water resources, ecosystems models.
- Project Code: AS12: Assessment of the Impacts of and Adaptations to Climate Change in the Plantation Sector, with Particular Reference to Coconut and Tea, in Sri Lanka has shown that
  - Coconut and tea are two economically important crops in Sri Lanka and other South and Southeast Asian countries
  - Extremely sensitive to drought conditions.
  - Any decline in their production due to anticipated climate change would affect a large number of people and national economies.
  - Crop-weather and integrated assessment models will be calibrated to local conditions and used to assess impacts on the production system, including economic factors, such as changes in labor force, markets and trade.
  - Using the scenarios and integrated assessment models, cost-effective adaptation strategies will be identified, evaluated, and communicated to planters.

The studies cited above indicate that an understanding Adaptation to Climate Change in Developing Countries centers on the fact that

- Poor are more dependent on climate-sensitive subsistence agriculture with limited financial, institutional and human capacity. Indirect climate change impacts such as water scarcity caused by less precipitation and reduced water availability will impact ability of people to grow food for their own consumption and to sell as a source of income.
- Vulnerability of communities, regions and countries to climate change is determined by a combination of their exposure to the impacts of climate change and by their *adaptive capacity*—their capacity to effectively prepare for and respond to changes such as those that will occur as a result of climate change.
- It is possible to promote poverty eradication in developing countries while reducing current or future greenhouse gas emissions by promoting ecosystem practices such as reforestation and grassland management; improve watershed function through reduced runoff and increased percolation and expanding the use of renewable energy sources.  
[http://www.iisd.org/climate/south/background\\_va.asp](http://www.iisd.org/climate/south/background_va.asp)

## **Classification of Adaptation**

Reactive (sometimes referred to as autonomous) adaptation is based on the concept of resilience. Proactive or anticipatory adaptation is related to the concept of adaptive reorganization. This implies altering relationships or creating newer links by which a system overcomes disturbance. This could also involve development of alternative economic, technological, and political institutions to avoid damages. In this context adaptability indicates the ability of a policy instrument to respond to unanticipated circumstances through formal and informal processes of monitoring, evaluation, learning and improvement. Robustness is the ability to be effective under a range of anticipated conditions, and deals primarily with achieving as thorough an understanding of the policy issues as possible and building in to the policy the ability to deal a wide range of anticipated conditions.

<http://idrinfo.idrc.ca/archive/corpdocs/121772/102963.pdf>

*Some significant work on adaptation includes:*

- National communications on emissions; vulnerability and adaptation
- Pilot Phase II adaptation studies (Caribbean, Bangladesh, Pacific);
- Development of the framework for National Action Plans for Adaptation (NAPA) etc

In spite of some of these preparatory exercises many of the developing countries (LDCs in particular) feel that the treatment of adaptation has been inadequate and needs to be addressed in much greater detail for better integration into processes of national planning for sustainable development. The purpose of this initiative is therefore, to advance the emerging concept of adaptive policies; contribute to building adaptive capacities and resilience of communities focusing on policymakers and implementing systems at the local, provincial and federal levels to design adaptive policies.

Several considerations explain the reluctance to address adaptation in a concerted manner. These include the fact that:

- Adaptation has been thought of as a long term strategy
- There is inadequate information on the costs and for determination of priorities.
- The GEF was initially established in response to a developing-country demand for international funding to meet the additional costs of global environmental protection. . A criterion for GEF funding has been the need to demonstrate global environmental benefits.
- Much development activity already takes present day climate, some probable variability and extremes into account. These however, do not readily distinguish adaptation measures from other preventive measures.

## **Section - 2 Project Areas**

### **What are adaptation needs?**

In developing countries, the capacity to adapt is reportedly much lower in most cases. This is apparently due to a relative lack of financial resources, lesser availability and access to technology, weaker scientific research and development capacity, less effective institutions, social and governmental organization, and less development of skilled human resources. It is therefore essential to define ways and means of improving the technical and financial capabilities in order to develop need-based and country-specific mechanisms of adaptation.

These circumstances raise some important questions about the use of adaptation as part of a more comprehensive and widely available portfolio of responses to climate change. These include

- Development of national policies or strategies for adaptation and capacity to implement..
- Distribution of costs and
- Merging adaptation with the portfolio of mitigation.
- It is however in their interests to be able to demonstrate that adaptation needs exist and can be assessed.
- It was agreed in Decision 11/CP.1 that adaptation would take place in developing countries in three sequential stages to deal with short, medium and long term strategies.

These are in response to an understanding of some of the priority areas for adaptation including land and water resources, food productivity, and disaster preparedness and planning, particularly for poorer countries. These imperatives emerge on an account of the fact that

- The resilience of most sectors in Asia to climate change is very poor.
- Expansion of irrigation will be difficult and costly in many countries.
- For many developing countries in Asia, climate change is only one of a host of problems to deal with, including nearer term needs such as hunger, water supply and pollution, and energy
- Resources available for adaptation to climate are limited.
- Early signs of climate change already are observed and may become more prominent over 1 or 2 decades.
- Adaptive capacities vary between countries, depending on social structure, culture, economic capacity, and level of environmental disruptions. Limiting factors include poor resource and infrastructure bases, poverty and disparities in income, weak institutions, and limited technology.

[http://pame.arctic-council.org/climate/ipcc\\_tar/wg2/pdf/wg2TARchap18.pdf](http://pame.arctic-council.org/climate/ipcc_tar/wg2/pdf/wg2TARchap18.pdf)

<http://www.pewclimate.org/docUploads/Adaptation.pdf>

#### *Identification and assessment of adaptation needs*

The imperatives of adaptation are obvious from IPCC's Third Assessment Report (TAR), which articulates the dimensions of future climate changes for Asia. The TAR shows that Southeast Asia will become warmer and wetter relative to current conditions, and that the changes will happen at a lower rate than in the rest of the world. This is also true of South Asia, on account of several geo-physical and developmental imperatives.

Some of the recent experiences of Maldives and Bhutan (refer notes) have demonstrated the rigor with which adaptation needs have been identified. The observations of the AIACC (2006) with respect to South East Asia also highlight the need for concerted efforts in understanding trans-boundary implications of adaptation and hence the need for a collective and a focused capacity building intervention. Several sector- specific considerations have been presented ( see notes) with respect to agriculture, bio-diversity conservation, management of land and forestry resources, water resources, protection of human – community health, mitigation and adaptation with respect to pollution impacts, coastal zone management etc. The OECD perspective in this regard has also been presented. .

The Pakistan Country Study concentrated on three sectors - water, agriculture and forests. The study used socio-economic scenarios of future growth and development and treated adaptation to climate change in the context of economic development. Pakistan, with hot and arid climate engages in year - round cropping. Water potential, water logging and salinity, and water use efficiency are the current as well as the future key issues. In this context, the adaptation strategy for the water sector may relate to conservation and efficient use of water in an informed manner.

In the case of Indonesia the government classifies its forests into four types including

- Protection forests intended to maintain watersheds;
- Sanctuary reserve and nature conservation areas;
- Conversion forests, which can be cleared for agriculture;
- Production forests, which can be exploited for timber.
- Deforestation is mainly due to increasing demand for land for cultivation; apart from transmigration and development of agro-industries which are the main causes of the rapid forest conversion.
- Forest fires cause significant social and environmental impacts and affect such sectors as health, livelihood, biodiversity, forestry and agriculture, tourism etc
- The links of fires with climate change and climate variability are likely to intensify further. Highlights of some U.S. projects and programs on adaptation to climate variability and potential climate change include:
  - Earth Observation Efforts: Observations on weather, climate, oceans, land, geology, natural resources, ecosystems, and natural and human-induced hazards are proposed.
  - Building Resilience through Development Assistance: A multi-year program to strengthen capabilities of host country institutions to assess relative vulnerabilities, evaluate and implement adaptation options for agriculture, water, and coastal zone management projects within USAID's development assistance portfolio.
  - Famine Early Warning System Network (FEWS NET): Produce high quality information for disaster and crisis prediction on food security.
  - Regional Climate Outlook Forums: Provide advance information about seasonal climate in several sub-regions including Asia.
  - RANET: Radio and Internet for the Communication of Hydro-Meteorological and Climate-Related Information for Development - which operates also in South and Southeast Asia, uses reserve capacity on the WorldSpace digital satellite system to transmit information to remote areas to assist in coping with hydro-meteorological hazards and environmental fluctuations.

<http://www.state.gov/documents/organization/39557.pdf>

<http://www.clacc.net/Documents/Napa/BhutanNAPA.pdf>

Attempts to measure the costs of adaptation to climate change are few and far between. In the impact and adaptation studies emphasis is on impacts and lists of possible adaptation options.<sup>25</sup> A compendium of decision tools to evaluate strategies for adaptation to climate change has been prepared for the Secretariat of the Framework Convention. Nine tools are described that are applicable to multiple sectors. These include benefit-cost analysis, risk analysis, expert judgment, and a range of screening techniques consisting of physical and economic models. Public (including government) action is critical to facilitate adaptation. Other significant sources of information on guidelines include the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations; the UNDP Adaptation Policy Framework (APE); Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC) and the United Kingdom Climate Impacts Programme (UKCIP) Climate adaptation: Risk, Uncertainty and Decision Making.

<http://unfccc.int/resource/docs/napa/ban01.pdf>

[www.ciem.cu/eventos/Internacionales/IPCC%202000/Paperx11\\_Ian.pdf](http://www.ciem.cu/eventos/Internacionales/IPCC%202000/Paperx11_Ian.pdf)

The IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations provide a seven step process, including the need to

- define the problem,
- select methods of assessment,
- test methods,
- select scenarios,
- assess biophysical and socioeconomic impacts,
- assess autonomous adjustments, and
- evaluate adaptation strategies. A range of methods could be used with respect to each of the steps depending on the location – specific needs duly integrating developmental agenda..

The Adaptation Policy Framework of the UNDP-GEF is as follows. The APF Guiding Vision which indicates the need to combine national policy-making with proactive “bottom-up” or “grass roots” actions The APF goals and objectives are to

- Protect and enhance human well-being in the face of climate variability and change
- Facilitate incorporation of adaptation into a country’s national development strategy by promoting sustainable policy processes and reducing climate vulnerability
- Provide technical guidance to national climate change teams to develop and assess climate change adaptation policies and measures

Some of the well known decision tools in this context include

- Benefit–cost analysis
- Cost-effectiveness analysis
- Multicriteria analysis (MCA)
- Adaptation decision matrix (ADM)
- Stakeholder networks and institutions
- Vulnerability indices
- Livelihood sensitivity exercise
- Multistakeholder processes
- Scoping and assessment of relevance to global sustainability scenarios

[www.unfccc.int/resource/docs/2004/sbsta/inf13.pdf](http://www.unfccc.int/resource/docs/2004/sbsta/inf13.pdf)

[http://unfccc.int/resource/cd\\_roms/nal/v\\_and\\_a/v\\_a\\_presentations/Overview\\_1\\_Formatted.ppt](http://unfccc.int/resource/cd_roms/nal/v_and_a/v_a_presentations/Overview_1_Formatted.ppt)

Some interesting lessons from the initiatives of the IIED on Setting the Agenda for Development Policy and Research on adaptation in this context are indicated in the following. The climate change programme at IIED has carried out regional workshops on adaptation to climate change and sustainable development for the most vulnerable countries in Africa and South Asia. The broad questions the workshop were

- What is the potential for adaptation to climate change?
- What research needs to be done to support such adaptation?
- What does this mean for development policy, both internationally and locally?

Specifically, the workshops focused on research and policy questions for development strategies:

- Who is currently vulnerable to climate change?
- How to enhance adaptive capacity, especially in developing countries and recognizing that communities have always adapted to decadal climatic variability?
- How to account for in-built resilience?



- How important is climate change compared to other manifestations of globalization, such as large scale demographic changes?

Ana Victoria Rojas Blanco (Comprehensive Environmental Projects: Linking Adaptation To Climate Change, Sustainable Land Use, Biodiversity Conservation And Water Management, 2004) argues that

- Article 4 of the UNFCCC treats the issue of vulnerability and adaptation to climatic changes in a certain framework while
- Article 10 of the UNCCD reflects on the need to develop strategies to prevent or minimize negative impacts of droughts.
- Article 14 of the CBD calls for the establishment of impact assessment and the minimization of adverse impacts with respect to biological diversity.

The author states that

- Small scale energy production systems, in this case micro hydro can effectively be linked up with adaptation strategies to future climatic variations.
- This is because communities are well aware of the importance of protecting and further expansion of catchment's areas, its vegetation, forest cover etc., is crucial for the sustainability of the electricity generating system
- Mitigation projects diminish the amount of GHG's in the atmosphere and consequently diminish the possibilities of suffering the impacts of climate change.
- They focus on reducing the root cause of climate change, they are also contributing to diminish the burden on adaptation activities in the future.

[http://www.bothends.org/service/Final\\_report\\_synergies.pdf](http://www.bothends.org/service/Final_report_synergies.pdf)

It is important to recognize that adaptation relates to health impacts wherein adaptation strategies include disease surveillance; better weather warning systems to reduce impacts by evacuating or preparing those at risk; improving vaccines and other disease-control measures; improving flood prevention and other strategies.

[http://www.tyndall.ac.uk/publications/tyn\\_symp/tss02.pdf](http://www.tyndall.ac.uk/publications/tyn_symp/tss02.pdf);

<http://arch.rivm.nl/env/int/ipcc/images/desch1.pdf>

A synthesis of research on adaptation options in Canadian agriculture identifies four main categories:

- technological developments,
- government programs and insurance,
- farm production practices, and
- farm financial management.

In addition to these 'direct adaptations', there are options, particularly information provision that may stimulate adaptation initiatives.

- Most adaptation options are modifications to on-going farm practices and public policy decision making processes with respect to a suite of changing climatic and there is an urgent need to understand the relationship between potential adaptation options and existing farm-level and government decision-making processes and risk management frameworks.
- It is essential to promote adaptive capacity through dissemination of information on climate change risks and vulnerabilities, and on the broad types of adaptations that stakeholders might consider.

- Low latitude countries are expected to have higher damages because they are already very hot and they have a greater economic dependence on climate - sensitive agriculture notwithstanding inadequate access to resources and technology for adaptation.
- Developing empirically-based estimates of the impact of climate change in low latitude regions is a critical issue for policymakers.
- Very little is known about how private entities (farmers, households, firms) in the low latitudes will adapt to climate change and therefore the larger question on how can poor farmers in low latitude countries change as climate changes over decades remains unanswered.
- Irrigation projects that bring water to new areas are examples of public adaptation.
- Governments can provide alternatives, such as crops, technologies, management, and other employment opportunities that are more suitable for a warmer climate.
- “Although the agricultural sector in a country may well survive warming, marginal regions could become infertile. Policymakers might want to develop strategies to help farmers caught in these precarious situations. For example, they might facilitate the development of alternative livelihoods, creating a more diversified rural economy that can better withstand climate change and weather shocks”.

With special reference to understanding climate susceptibility factors for another equally important sector viz, fisheries and address challenges it may be essential to focus on

- Effects of including projected changes in precipitation in vulnerability analyses - particularly for inland fisheries including those of storm and flood frequencies (based on historic observations), and sea level rise
- Use regional demographic data to refine some of the indices of sensitivity and adaptive capacity currently calculated at national level to assess sustainability implications.
- “Development and well-being trends are linked to vulnerability and exposure to climate change impacts can exacerbate vulnerability but the processes that link risk exposure to vulnerability are not well understood across scales”.
- Existing legal, institutional and technical frameworks are not strong enough to cope even with current climate variability and extreme weather events.

The four elements of domestic policy frameworks –

- legal,
- institutional,
- water management and
- information – therefore play very different roles in adaptation to climate change

“The analysis of the developing countries’ policy frameworks in the water sector and their abilities to facilitate adaptation revealed that adaptation to climate change in these countries should start with strengthening institutional, legal and technical capacities at all levels.

1. Review and update water legislation with a view to incorporate adaptation to climate change;
2. Where feasible, implement alternative systems of water abstraction permits;
3. Assess the adequacy of traditional institutions to streamline decision-making
4. Develop and improve water management strategies covering drought issues and flood plans; and examine linkages with agriculture, energy, environment, etc.

## Need for developing countries to prepare more detailed assessments of adaptation to climate change

Stage I was to support studies and planning, Stage II to support detailed planning and capacity building and Stage III to support actual adaptations. Most developing countries have already carried out the initial assessment (or Stage I) studies on adaptation (many of which are reported in their National Communications to the UNFCCC). A few Stage II studies (for example in the Caribbean, Pacific and Bangladesh) have also been initiated. However, there is a need for the developing countries to prepare more detailed assessments of adaptation to climate change including policies and ensuring their compatibility with action plans under other multilateral, environmental agreements (such as biodiversity and desertification) as well as with other national sustainable development plans or strategies (Huq, 2002).

The Climate Vulnerability Process and Points of Adaptation in Bangladesh was characterized by intensive interactions through organized groups, responding to beneficiaries' training needs on different adaptation measures, assessment of different service providers, development of training modules on adaptation measures and climate change issues, established demonstration farms and organized cross visits and individual follow-up.

Some of the principal adaptation strategies to increase income through alternative livelihoods included

- Duck Rearing
- Cage Aquaculture
- Prawn fish poly-culture
- Increase food through agriculture
- Floating Gardens.

Bangladesh's National Water Policy (NWP) and National Water Management Plan (NWMP) reportedly do not mention climate change explicitly, they however aid in adaptation to climate change through emphasis on:

- Developing early warning and flood-proofing systems
- Sustaining dry season flows and regulate monsoon flooding, synergistic with adaptation measures for water sector to help reduce salinity.

[http://www.acaweb.org/annual\\_mtg\\_papers/2006/0107\\_1430\\_1601.pdf](http://www.acaweb.org/annual_mtg_papers/2006/0107_1430_1601.pdf);

[http://www.iied.org/NR/agbioliv/gatekeepers/gk\\_abs/documents/GK118.pdf](http://www.iied.org/NR/agbioliv/gatekeepers/gk_abs/documents/GK118.pdf)

Some of the important project areas of direct relevance to South Asia are indicated in the following:

- [http://adaptation.nrcan.gc.ca/pdf/03069ca7e4344d2d8df9f82b7d8f8e7a\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/03069ca7e4344d2d8df9f82b7d8f8e7a_e.pdf)
- [http://adaptation.nrcan.gc.ca/pdf/96bffe74e8c3407cb55c3aadf6de940c\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/96bffe74e8c3407cb55c3aadf6de940c_e.pdf)
- [http://adaptation.nrcan.gc.ca/pdf/5a17e965fb5a4059850d0e433fa57e1c\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/5a17e965fb5a4059850d0e433fa57e1c_e.pdf)
- <http://www.cifor.cgiar.org/trofcca/ref/home/projects.htm>
- <http://www.choicesmagazine.org/2004-3/climate/2004-3-07.htm>
- [http://adaptation.nrcan.gc.ca/pdf/6a05b94c22c54edf918917d62131cb26\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/6a05b94c22c54edf918917d62131cb26_e.pdf)
- [http://adaptation.nrcan.gc.ca/pdf/15e9e593079d42c0bd9d8516aa1c7932\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/15e9e593079d42c0bd9d8516aa1c7932_e.pdf)
- <http://www.gefonline.org/ProjectDocs/NAPA>

Sector	Projects areas
Forestry	<ol style="list-style-type: none"> <li>1. Sequestration of carbon (forest growth)</li> <li>2. Climate-induced changes in natural disturbances (fire)</li> <li>3. Forest - based industries</li> <li>4. Conversion of forests into agricultural land</li> <li>5. Vulnerability assessment (changing growth rates, tree mortality, and seed production, insect outbreaks and diseases)</li> <li>6. Community based forest management</li> </ol>
Water resources	<ol style="list-style-type: none"> <li>1. Assessment of availability, distribution and vulnerability of water resources in diverse sectors</li> <li>2. Water Quality and quantity modeling</li> <li>3. Institutional Arrangements and Capacity development at the watershed scale</li> <li>4. Urban Drainage</li> </ol>
Agriculture	<ol style="list-style-type: none"> <li>1. Assessment of agricultural vulnerability and Capacity for Adaptation</li> <li>2. Integrating environmental change and rural community agendas</li> <li>3. Assessment of Forage and Livestock Production and vulnerability</li> <li>4. Bio - energy</li> </ol>
Coastal zone	<ol style="list-style-type: none"> <li>1. Sea Level Rise, Flooding; adaptation Needs of coastal Communities</li> <li>2. Risk of Erosion</li> </ol>
Fisheries	<ol style="list-style-type: none"> <li>1. River Water Temperature and Fish Growth</li> <li>2. Toxic Blooms</li> </ol>
Communities	<ol style="list-style-type: none"> <li>1. Health Risks</li> <li>2. Drainage Systems, urban and rural systems design</li> </ol>
Natural disasters and infrastructure	<ol style="list-style-type: none"> <li>1. River bank protection</li> <li>2. Re-location/ resettlement of affected towns</li> <li>3. Construction to withstand natural calamities</li> </ol> <p>Database on disaster-prone areas, early warning systems and hazard mapping</p>

### Section – 3 Adaptation Strategies, Tools & Techniques

#### Six framework elements for improving adaptation measures:

- Raise awareness of adaptation
  - Develop and share materials to increase understanding of adaptation.
  - Establish and maintain key partnerships to raise awareness of impacts and adaptation.
  - Develop key national messages and communication materials that incorporate these messages.
  - Develop and share outreach strategies and include information on impacts and adaptation in existing climate change outreach initiatives.
- Facilitate and strengthen capacity for coordinated action on adaptation
  - Develop and maintain capacity for coordinated action and sharing information
  - Promote collaboration on adaptation.
- Incorporate adaptation into policy and operations
  - Identify or develop procedures to review existing vulnerability to extreme weather events, and whether climate change would increase or decrease existing vulnerability.
  - Develop a compendium of approaches
- Promote and coordinate research on impacts and adaptation
- Support knowledge-sharing networks

- Provide methods and tools for adaptation planning with cost-benefit and effectiveness analyses, multi-criteria analyses, decision matrices, environmental assessments, risk management frameworks, models on hydrological, crop, or ecosystems; opinion-gathering techniques, data sets, and scenarios  
[http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6_e.pdf)

Some of the other elements which guided the development of National Adaptation Programmes included

- Land-water zoning for water management institutions.
  - Generate more information for Water Resources Planning
  - Formulate Land and Water Zonation for Climate Change Adaptation in Bangladesh
  - Improve drainage systems
  - Develop tools for Designing Structural Adaptation
- Outputs
  - Existing and possible future disease identification
  - Identification of remedial measures
  - Guidelines for adaptation of human health to the impact of climate change.
  - Improvement of human health treatment facilities.
  - Improved preparedness programme for sever communicable diseases Implementation
- Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry) vulnerable to climate change impacts and need to include such potential impacts in their sectoral design and investments.
- Enhancing resilience of urban infrastructure and industries to impacts of climate change including floods and cyclone
- Specification in National Building Code for building industry and infrastructure in potentially vulnerable areas and enhance resilience to climate change (including floods and cyclones) in urban and industrial sectors in the major cities
- Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change.
  - Hazard and vulnerability mapping
  - Climate change, variability and sea level rise scenarios
  - Risk identification
  - Asset risk assessment
  - Evaluation and prioritization of RMNH options complement implementation support tools (such as codes of practice and operational manuals) with such criteria as
    - Degree of vulnerability
    - Level of implementation with site-specificity
    - Cost Benefit
    - Urgency
    - Environmental impacts
    - Synergy with poverty reduction

Kiribati Adaptation Project and World Bank (2000)

Examples of possible impact indicators as part of Comprehensive Hazards and Risk Management: CHARM are stated in the following:

- National scale multi- sectoral
  - Trends in annual mortality due to disasters and population affected by disasters
  - Change in public expenditures dedicated to RMNH
  - Adoption of risk management criteria for approval of major investments
  - Change in country's vulnerability index
  - Infrastructure : Housing building codes; Climate-proof standards applied; % change in economic impact of floods or droughts
  - Agriculture: Change in yields, loss value, availability of food
  - Health: Change in epidemic potential of vector-borne diseases
  
- Technical support and training, particularly in the following areas
  - Guidelines and specifications for climate-proofing major investments
  - Establishment of early warning systems
  - Best-practice recommendations
  - Climate change and climate variability modeling
  - Hazard and vulnerability mapping
  - Regional monitoring (particularly for sea level rise and tsunamis)

<http://siteresources.worldbank.org/INTPACIFICISLANDS/Resources/Natural-Hazards-report.pdf>? The major thrust areas for identification by Maldives and Bhutan are also presented as part of the section on note below.

As indicated earlier developing countries have a far larger proportion of their economies in climate-sensitive agriculture. They also face more adverse impacts in this sector, severely constraining adaptive capacity.

- Flexible new developments in water institutions, include increasing use of markets and privatization, upgrade supply-side and demand-side measures and add flexibility to institutions to better cope with social and environmental changes.
- Weather services can provide information on changes in climate means and variability, while agriculture extension services can inform farmers about changes in crop varieties and practices that may be better suited to changing climate conditions.
- Avoidance of mal-adaptation is critical in situations where mis-management of natural resources is already causing harm to ecosystems.
- Innovations in transportation, agriculture, and information systems could enhance adaptive capacity.
- Agronomic strategies, such as switching crops and cultivars, planting earlier, and changing land-use allocations, may help adjust along with increasing water storage and improving water transfer regimes. The link between adaptive capacities and some of the empirical evidences cited below will be evident.

## Application of diverse methods and tools for vulnerability and adaptation assessment

Scenario-based assessment: coastal vulnerability modeling in the Philippines.

- As part of its first national communication, the Philippines followed a scenario-driven, global/expert approach to conduct a coastal resource vulnerability and adaptation assessment, following the IPCC method.
- Essential to this process was the acquisition of an inventory of baseline information that consisted of limited site surveys and interviews to note the type of coast (e.g. rocky, sandy), system responses (such as erosion, saltwater intrusion), coastal disaster history, vegetation and socio-economic information.
- Adaptation measures and strategies were identified based on vulnerability assessments and were developed through a review of existing policies within each sector.

Integrated impact assessment: Advanced Terrestrial Ecosystem Analysis and Modeling (ATEAM).

- This Europe-based project involved more than 50 scientists from 10 countries to assess vulnerability to global climate change. It covered agriculture, forestry, carbon storage, energy, water, biodiversity and mountains.
- An important part of ATEAM was the development of a framework that allowed for the integration of output from ecosystem and hydrological models with socio-economic data.
- Consultations with sectoral stakeholders complemented the study.
- The information on potential impacts and adaptive capacity was then combined in a series of vulnerability maps, which are to be published as a digital atlas.

Vulnerability-based assessment: Strategies for increasing human resilience and adaptive capacity in Sudan.

- This project is one of the 24 regional projects being undertaken within the programme Assessments of Impacts and Adaptations to Climate Change (AIACC).
- The assessment involved community-led development of “resilience indicators” relating to specific aspects of livelihoods that are important for coping with drought.
- The study shows that the sustainable livelihoods framework can be used as a tool for assessing and evaluating vulnerability and adaptation to climate change.

The following is a list of the most widely used RCMs:

- PRECIS (Providing Regional Climates for Impact Studies) is a regional climate modeling system that can be applied to any area of the globe to generate detailed climate change predictions; currently used in regional climate simulations in China, India and South Africa.
- HADRM3H is a regional model used in the United Kingdom and South Africa to examine local climate change scenarios for the future.
- Canadian Regional Climate Model (CRCM), is currently being used to conduct simulations in two regions of North America
- ALADIN, based on a numerical weather prediction model, is being used by the Regional Centre Limited Area Modeling in Central Europe (LACE).

## Capacity building for adaptation

The methods were originally developed for assessments of discrete climate impacts, not how to cope with future climate change at the local to regional level. Existing approaches for evaluating adaptation often are methods and models designed for specific sectors or complex integrated assessment models. Skills, time and resources may not be available to apply such techniques and they may not produce required outputs.

The need to place emphasis on strengthening capacity within developing countries to their agenda has been recognized. Capacity issues are embedded in political, cultural, and social dynamics of enormous complexity. For adaptation there is a need a) to strengthen scientific expertise and institutions capable of undertaking the relevant assessments and to promote linkages with this infrastructure with other parts of the public and private sectors; and b) to identify relevant tools and techniques to produce outputs for nationally determined priorities.

It will be obvious from the above that several of these assessments are predominantly in the initial stages of progress. This is the most appropriate to therefore clearly focused on capacity building initiatives which will not only enhance technical capability but will also help develop location specific tools and techniques.

The process of capacity building involving assessments of information needs and initiating pilots which can subsequently be upscale also entails significant expenditure. The most important in this context pertains to the development of proposals and tapping appropriate sources of funding to initiate and sustain such capacity building initiatives.

Some of the most interesting lessons from the implementation of the SGP, become relevant in this context.

1. The process of identifying technical barriers in transitioning to cleaner alternatives reveals the link between the specific information needs and system specific applications of interventions. This could also vary across different regions even within the same sector.
2. An up-scaling intervention does not merely mean an increase in the size of operations. This calls for a systematic medium to long term documentation of information on variables as part of comprehensive management information system. Qualitative and quantitative profile of information and the interpretation of such information depend on the developmental goals and economic constraints which determine the pace of transformation.

Considering those complexities state it is essential to create a framework of needs assessments with a special emphasis on the information and technical capacity building needs of the various stakeholders and implementation programs which delivers appropriate information on timely manner and builds technical capability is therefore needed to avoid duplication of efforts and deliver in response to the specific needs of the system.



## Section - 4 Financing mechanisms

A detailed understanding of the various funding mechanisms including the adaptation fund, the special climate change fund and others will be needed. The need to synergize developmental initiatives and locally available funding opportunities is also evident. The latest position regarding funding through the adaptation fund and other allocations are already presented (in quotes) as part of this section titled 'notes'.

With the Buenos Aires Conference (CoP4) also officially expanding the scope of the GEF, for example, to include adaptation, the Multilateral Development Banks (MDB) have seen technology transfer as part of their mission to encourage development. In particular, development banks have become aware of the role they can play in helping to mobilise private capital to help meet the needs of sustainable development and the environment, and of the potential to use financial innovation to encourage environmental projects and initiatives.

The most recent status on the GEF funding will be elaborated in this portion of the paper.

- The European Bank for Reconstruction and Development (EBRD), as the newest MDB, is the only one to have sustainable development incorporated in its charter. It is also much more active in working with the private sector than the other regional MDBs.
- Other MDBs, such as the regional development banks (ADB, IDB) play an important role in regional investment, and most have given some attention to issues of sustainable development, in varied ways.
- Various international agencies also harness considerable expenditure. Most notably, the UN Development Programme makes substantial grants in the area of institutional capacity-building. It has also directly supported the development of various financial mechanisms to encourage environmental technology transfer, such as supporting the feasibility work for an environmental venture capital fund.

## Notes

### Adaptation through Education & Training – Maldives

[http://www.ap-net.org/docs/15th\\_seminar/maldives\\_rws1\\_050913.pdf](http://www.ap-net.org/docs/15th_seminar/maldives_rws1_050913.pdf)

- Building Capacity to Adapt
  - Human resource development in coastal engineering
    - Appropriate coastal defense for the International Airport
    - Increasing the elevation of the airport
    - Developing an effective sea plane transportation network
  - Topographical data collection
  - Quantify the magnitude of erosion
  - Determine the importance of natural vs human induced erosion
  - Quantify changes in process mechanisms promoting erosion
  - To raise awareness of all stakeholders
  - Strengthen the oceanographic and meteorological data collection and management
  - Monitor and record the sea level and SST

- Some adaptation measures

#### Tourism Adaptation

- Proper insurance
- Reduce dependency on diving by presenting as a premium destination
- Reduce dependency on tourism through economy diversification

#### Water Resources Adaptation

- Increasing the rainwater storage capacity
- Allocation of ground water recharging basins in each island
- Treatment of ground and rainwater using solar technologies
- Use of cost effective desalination technologies
- Monitoring of precipitation

#### Human health

- Health statistics not very helpful
- Dengue fever epidemics on increase
- Malaria risk
- Physical injury due to extreme weather events
- Research oriented health statistics
- Better awareness among the health sector about climate related health problems.

#### Lessons from NAPA Bhutan

##### Human Health

- Increase number of/Protect existing water treatment plants to ensure safe drinking water
- Regular cleaning and vaccination campaigns at sites where mosquito vector is abundant
- Control of vector /water borne diseases
- Monitor air and drinking water quality
- Establishment of EMS

#### Water Resources & Renewable Energy

- Raise community awareness on sustainable use
- Improve land use planning in degraded water catchment areas to
- Promote forestation; improve watershed management
- Extend, improve and maintain water supply infrastructure
- Provide technological and financial support to harness hydropower potential
- Optimize design of installed capacity
- Assess GLOF threat in hydropower projects
- Conduct research for other renewable energy alternatives including solar power
- Improve efficiency in irrigation
- Indigenous methods for bringing about timely rain, adequate water for irrigation, ward off pests and diseases and usher good harvests)

## **Agriculture**

- Develop and introduce resistant crop and livestock varieties with greater adaptations to limited arable land, extreme temperature and rainfall events
- Promote agro-forestry or agro-silvo-pastoral systems to reduce soil erosion and run-off on steep slopes including terracing and contour bunding to mitigate heat stress and respiration problems
- Improve food security for marginal farmers
- Convert wetland to dryland reducing risks from prolonged rain and flood
- Create and build capacities for alternative off-farm livelihood opportunities for farmers affected by crop loss due to climate change effects
- Improve or upgrade storage facilities to store and have access to food grains as an insurance against crop loss or damage or bad yields

## **Forests and Biodiversity**

- Promote community-based forest management and forestation projects to conserve land, water resources and wood production in harmony with the natural environment

## **Natural Disaster and Infrastructure**

- Safeguard generation of hydropower with improved upstream watershed management in critical and high risk areas
- Install early warning systems; hazard mapping of key watershed areas, real time monitoring (unmanned) with automatic data transmission
- Artificial lowering of lake levels
- Restrict collection of sand and boulders and overgrazing
- Soil conservation techniques
- Re-location/ resettlement of affected towns
- Improve construction technology of building houses to withstand natural calamities
- Food security and emergency medicine to vulnerable communities
- Rainwater Harvesting to safeguard farmers from water shortages during dry periods and irregularities in the monsoon rainfall
- Promote Community based Forest Fire Management and Prevention

## **Delivering the UK Climate Change**

- Programme Locally - Leeds, 3 February 2005  
[http://www.defra.gov.uk/ENVIRONMENT/climatechange/uk/ukccp/review04/other\\_stake\\_holder.htm](http://www.defra.gov.uk/ENVIRONMENT/climatechange/uk/ukccp/review04/other_stake_holder.htm)  
[http://www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/2006/impacts\\_energy/ImpactsEnergy\\_FinalReport\\_V5.pdf](http://www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/2006/impacts_energy/ImpactsEnergy_FinalReport_V5.pdf)

## **Vulnerability of Indian Agriculture to Climate change and Globalization**

- The IISD, TERI, CICERO Oslo, Norway project "Vulnerability of Indian Agriculture to Climate Change and Globalization" used the "double exposure" method based on GIS to identify regions doubly vulnerable to change to create vulnerability profiles for India relating climate change and agricultural trade liberalization stresses vis-à-vis social and

economic implications of double exposure for inland and coastal agricultural areas at the district level. <http://www.iisd.org/climate/south/ccap.asp>

Some other important sources:

- <http://www.iisd.org/climate/south/>
- A Scoping Study on the Effects of Climate Change on the UK Energy Industry [http://www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/2006/impacts\\_energy/ImpactsEnergy\\_Theme2\\_3\\_V2\\_15.pdf](http://www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/2006/impacts_energy/ImpactsEnergy_Theme2_3_V2_15.pdf)

### **UNDP's Programmes**

- As a pilot, the project, funded by a GEF grant, is collaborating with eight countries—Costa Rica, Cuba, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama—on strategies for protecting human health, water resources, and agricultural lands. Building on earlier assessments conducted in connection with the UN Framework Convention on Climate Change, this pilot programme focuses on the links between biophysical impacts and prevailing socio-economic conditions which contribute to vulnerability, such as high population densities in coastal areas and informal settlements in flood-prone zones. These are in addition to the SGP of the UNDP – GEF dominant in several countries of the region. <http://www.energyandenvironment.undp.org/indexAction.cfm?module=Library&action=GetFile&DocumentAttachmentID=1019>

**TERI** reviews the link between adaptation, vulnerability and sustainable development and refers to the IPCC context, the African perspective, the GEF Adaptation Policy Framework and the urgent need to facilitate mainstreaming.

- Sensitivity to the issue of adaptation has grown particularly after the TAR (Third Assessment Report). Adaptation has now emerged as an urgent policy priority, prompting action both within and outside the climate change negotiations.
- Some of the important tools and methods for integration of adaptation into policy processes involve:
  - Identification of current risks and coping strategies
  - Estimates of risks and impacts to review policies, programmes and projects to assess contributions to adaptive capacity and whether modifications are needed
  - Identification and implementation of reform measures
  - Monitor and evaluate based on
    - Benefit Cost Analyses
    - Social Account Matrices
    - General Equilibrium Models
    - Risk Assessment and Risk Management
    - Sustainable Livelihoods Approach, and
    - Participatory Vulnerability Assessment

TERI's paper also presents examples of

- Mozambique integrating Adaptation to Climate Risks into the Action Plan for Poverty Reduction. The impact of natural disasters is recognized in the country's Action Plan for the Reduction of Absolute Poverty.
- Vietnam: Mangrove Planting 12000 hectares of mangrove trees to break the 1.5 metre eaves typically associated with tropical typhoons. This has created livelihood opportunities for several families involved in the replanting and protection effort

## Some other sectoral references

### Agriculture

Smit and Skinner 2002 state that agriculture is highly vulnerable to the impacts of climate change. Adaptation measures can significantly reduce vulnerability and are in conjunction with the different farm types and locations. Technological developments could pertain to development of new crop varieties with increased tolerance to temperature and moisture variations. Early warning systems on weather changes supported by appropriate irrigation patterns; crop substitution; changing land topography to reduce moisture deficiency; related livestock management are additional measures. Farm financial management includes improved crop insurance, investment in crop shares and futures.  
[http://www.c-ciarn.uoguelph.ca/documents/Smit\\_and\\_Skinner\\_2002.pdf](http://www.c-ciarn.uoguelph.ca/documents/Smit_and_Skinner_2002.pdf)

### Biodiversity

The WWF, English Nature, RSPB and IUCN report clearly state that the emission reductions agreed to so far “are too modest” to have to be of any consequence for mitigation of impacts. The challenge in Nature Conservation is about dealing with specific projected impact alongwith the management of uncertainties and certainties. It is equally important to understand rigid physiological responses to climatic variabilities and develop suitable landscape and seascape management strategies.  
<http://www.iucn.org/themes/climate/docs/climateandnature.pdf>

The WMO, UNEP-IPCC Technical paper 5 on Climate change and biodiversity indicates that the current rate of biodiversity loss is greater than the natural background rate of extinction. Climatic changes have affected timing of reproduction of plants and animals, distribution patterns, frequency of pest attacks and migration patterns. Habitat loss and fragmentation enhance disruption. There is an urgent need to develop comprehensive assessment methodologies, criteria and indicators of changes in the occurrence, distribution and stabilization characteristics of population. Measurement of net primary productivity, net ecosystem productivity and net biome productivity provides useful indicators of performance status of system. These variations have an equally important impact on populations depending on the forest resources directly. Potential impacts of afforestation and management of grazing land, links with energy sources and other natural resources management constrains have also be considered. Some of the adaptation options include development of networks of reserves, minimizing habitat fragmentation, captive breeding and trans-locations and appropriate management of bio-resources with respect of pests, predators and vectors integrated land and water management strategies are also critical.

### Coastal zones

Some of the adaptation options for management of coastlines include construction of hard structures, elevating buildings on piles, introducing flood or salt tolerance crops and watershed resources plans.  
[http://www.grida.no/climate/ipcc\\_tar/wg2/300.htm](http://www.grida.no/climate/ipcc_tar/wg2/300.htm)

Allison et al 2005 indicate that vulnerability is a function of exposure, sensitivity and adaptive capacity this includes the capacity to modify exposures, absorb and recover from stresses as part of the adaptation process. Precipitation and evapo-transpiration patterns affect hydrology of water bodies, river flows, floods and consequently their impacts on fish reproduction and populations.  
<http://www.dfid.gov.uk/pubs/files/summary-climatechangefisheries.pdf>

Mal-adaptations have to be guarded against in order to avoid disruption of ecosystems services. This includes the loss of mangroves to fish farming (NSE newsletter 2005)

### Energy

The national communications support program of UNDP GEF has developed the adaptation policy framework based on assessments of human health, water resources and agricultural land management issues.

Emission scenarios could relate to different socio economic characteristics. (IPCC)

The Climate Change Knowledge Network (CCKN) argues for decentralized renewable energy systems as a means of building adaptive capacity; further linking with the clean development mechanisms. Examples of the use wind power, dependence on forest resources and use of bio energy have been discussed.

<http://www.cckn.net/dre.asp>

The OECD experience in six countries including Bangladesh linking adaptation and other developmental activities related to including assessments of vulnerabilities, analysis of national plans, and development of assistance measures.

<http://www.oecd.org/dataoecd/46/15/37671630.pdf>

### **Forestry**

The Tropical Forests and Climate Change Adaptation (Trop FCCA) program is aimed at identifying regional developmental issues and appropriate policy oriented measures to address them. The first report of the initiative highlights the fact that the forest has a sustainable source of bio-energy is under increasing stress; water resources in catchment areas under forest covers are susceptible to variation experienced by the cover. This is related to variability in rainfall across space and time. The most important negative factor affecting forest system is land cover change. Forest fires also are a major cause of loss and degradation of forest resources.

[http://www.cifor.cgiar.org/trofcca/attachment/FlyerTroFCCA\\_E.PDF](http://www.cifor.cgiar.org/trofcca/attachment/FlyerTroFCCA_E.PDF)

[http://www.cifor.cgiar.org/trofcca/attachment/first\\_annual\\_report.pdf](http://www.cifor.cgiar.org/trofcca/attachment/first_annual_report.pdf)

Ravindranath et al indicate that there are long gestational period in the development and implementation of adaptation strategies for the forestry sector.

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### **Water**

Existing infrastructure in several countries is not adequate to overcome problems related to droughts or floods. Some of the well-known management policies include pricing, metering, infrastructure improvement and replenishment of water. Water pollution adds significantly to the diversity and intensity of issues. Water rights including abstraction rights are contentious.

<http://www.oecd.org/dataoecd/46/15/37671630.pdf>

Agrawala et al (OECD 2003)

Retreat and melting of glaciers increase the size and volume of Nepal lakes because of which they are more prone to lake outburst flooding. Potential intensification of monsoons further increases these impacts. The most important impacts will therefore be on Nepal's water resources.

<http://www.oecd.org/dataoecd/6/51/19742202.pdf>

### **Glaciers**

Some of the important geo hazards for Bhutan include rock falls, land slides and flash floods. Hazard zonation concept as part of a larger plan is in use.

<http://www.unitar.org/ccp/bhutan/06-%20BhutanGlacialhazards-GIS%20demo.pdf>

The project Community Adaptation and Vulnerability in the Arctic Region (CAVIAR) can provide useful lessons for understanding adaptation options in very cold conditions.

<http://www.cicero.uio.no/workshops/acia-workshop-2006/Hovelsrud.pdf>

### **Guidelines**

Adger et al review the process of interpreting adaptation opportunities with respect to several changes in climate. The uncertainties peculiar to each of the system have been discussed.

[http://www.poptel.org.uk/iied/ddd/docs/climate/adapt\\_to\\_cc.pdf](http://www.poptel.org.uk/iied/ddd/docs/climate/adapt_to_cc.pdf)

Bouwer and Aerts discuss climate-proofing and eight different means of financing adaptation. The three stages of planning adaptation activities and the implications of various funding and the financial mechanisms have been discussed.

[www.blackwell-synergy.com/doi/pdf/10.1111/j.1467-9523.2006.00306.x](http://www.blackwell-synergy.com/doi/pdf/10.1111/j.1467-9523.2006.00306.x)

The Climate Change Adaptation Framework prepared by the Intergovernmental Climate Change Impacts and Adaptation Working Group 2005 discusses six elements of developing an adaptation strategy.

[http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6_e.pdf)

## **Funding**

The May 2006 report of the GEF Council describes the status of climate change funds. The report also discusses the special climate change fund, the adaptation fund and its governance. The list of projects as part of the GEF SCCF pipeline, water, human health, glaciers, resilience - related projects of the UNDP and climate proofing are discussed.

[http://www.gefweb.org/Documents/Council\\_Documents/GEF\\_C28/documents/C.28.4.Rev.1Climate\\_Change.pdf](http://www.gefweb.org/Documents/Council_Documents/GEF_C28/documents/C.28.4.Rev.1Climate_Change.pdf)

## **ADAPTATION FUND**

The Adaptation Fund was established to finance concrete adaptation projects and programmes in developing countries that are Parties to the Kyoto Protocol. The Fund is to be financed with a share of proceeds from clean development mechanism (CDM) project activities and receive funds from other sources. (The share of proceeds amounts to 2% of certified emission reductions (CERs) issued for a CDM project activity.)

Decision 28/CMP.1 Initial guidance to an entity entrusted with the operation of the financial mechanism of the Convention, for the operation of the Adaptation Fund

- Recognizing that low-lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change
  - Recognizing the need to operationalize the Adaptation Fund as soon as possible,
1. Decides that the Adaptation Fund established under decision 10/CP.7 shall finance concrete adaptation projects and programmes in developing country Parties that are Parties to the Kyoto Protocol, as well as activities identified in decision 5/CP.7, paragraph 8;
  2. Decides that the Adaptation Fund shall function under the guidance of, and be accountable to, the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol;
  3. Decides that the operation of the Adaptation Fund shall be guided by the following:
    - (a) A country-driven approach
    - (b) Sound financial management and transparency
    - (c) Separation from other funding sources
    - (d) A learning-by-doing approach;

## **Adaptation Fund 2006**

*Decides* that the Adaptation Fund shall be guided by the following principles:

- A share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation;

- Funding for eligible Parties will be available for national, regional and community level activities for concrete adaptation projects and programmes
- Projects should be country driven and should clearly be based on needs, views and priorities of eligible Parties, taking into account national sustainable development and poverty reduction strategies, national communications and national adaptation programmes and other relevant instruments.

### **Funding opportunities**

Proposals on sources of funding for the Adaptation Fund:

- ✓ Main source of funding for the Adaptation Fund is the share of proceeds from CDM project activities
- ✓ Countries have to therefore consider alternative and innovative sources of funding, including:
  - ✓ Contributions from the private sector at national and local levels,
  - ✓ Existing development assistance,
  - ✓ Other bilateral and multilateral sources.
- ✓ A time frame should be set to implement and prepare the readiness of the developing countries for achievements of the fund, i.e. three years before 2012 including
  - ✓ Options on what is understood by concrete adaptation projects and programmes:
    - ✓ Concrete projects = stage III activities
    - ✓ Concrete projects = stage II and III activities
- ✓ Establish a % of the fund to go for technical assistance (15%) and use most of the funds for “actions in the field”
- ✓ Complement the existing assessment, planning, and capacity-building activities,
- ✓ Proposals should be on how to operationalize the country based approach:
- ✓ Focus on sectors identified as being particularly vulnerable as stated in NAPAs, national communications, national sustainable development strategies
- ✓ Identify thematic priority areas that have links with development goals
- ✓ Give priority to sectors that are of critical importance to
  - ✓ human survival, and economic sustainability
  - ✓ addressing specific problems, local capacity-building,
  - ✓ technology transfer and the promotion of indigenous technological applications
- ✓ Examine complementarities with other funding activities (to funding priorities and allocations for adaptation activities under the SCCF and the LDCF)

### **The GEF SCCF Pipeline**

List of projects

1. Ecuador: Adaptation to Climate Change through Effective Water Governance  
GEF/SCCF contribution: \$3.350m; co-financing: \$6m Total project cost: \$9.350m
2. Global: Piloting Climate Change Adaptation to Protect Human Health  
GEF/SCCF contribution: \$6.5m; Co-financing: \$18m; Total project cost: \$24.5m
3. Regional: Design and Implementation of Pilot Climate Change Adaptation Measures In the Andean Region  
GEF/SCCF contribution: \$7.29m; Co-financing: \$20.1m; Total project cost: \$27.4m
4. India: Climate-resilience Development and Adaptation  
SCCF/GEF: \$4m; co-financing \$16m; Total costs \$20m
5. Regional: Pacific Islands Adaptation to Climate Change Project (PACC)  
SCCF/GEF: \$11.250m; co-financing \$70.8m; Total costs \$82m



6. Tanzania: Mainstreaming Climate Change in Integrated Water Resources Management in Pangani River Basin  
SCCF/GEF: \$1m; co-financing \$1.57m; Total costs \$2.57m

7. MSPs at PDFA stage: Adaptation to Climate Change in the Tourism sector in Fiji Islands and the Maldives; adaptation and health in the Solomon Islands

Source :

[http://www.gefweb.org/Documents/Council\\_Documents/GEF\\_C28/documents/C.28.4.Rev.1ClimateChange.pdf](http://www.gefweb.org/Documents/Council_Documents/GEF_C28/documents/C.28.4.Rev.1ClimateChange.pdf)

**The Climate Change Impacts and Adaptation Program of the Govt. of Canada** is aimed at reducing Canada's vulnerability to climate change. This program also supports the C-CIARN. More than 150 projects have been carried out so far to examine the impact.

[http://adaptation.nrcan.gc.ca/pdf/6a05b94c22c54edf918917d62131cb26\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/6a05b94c22c54edf918917d62131cb26_e.pdf)

Some information sources include:

- The Science and Development Network - [www.scidev.net/dossiers/index.cfm?](http://www.scidev.net/dossiers/index.cfm?)
- The UNFCCC website <http://unfccc.int>
- [www.uea.ac.uk/dev/climate](http://www.uea.ac.uk/dev/climate)
- [www.ids.ac.uk/ClimateChange](http://www.ids.ac.uk/ClimateChange)
- The OECD Development and Climate Change Project is described at [www.oecd.org/document/](http://www.oecd.org/document/)
- [www.ipcc.ch/](http://www.ipcc.ch/)
- Small Island Developing States Network website [www.sidsnet.org/1f.html](http://www.sidsnet.org/1f.html)
- South Pacific Regional Environment Programme [www.sprep.org/ws/climate/index.asp](http://www.sprep.org/ws/climate/index.asp)
- [www.ciesin.columbia.edu/TG/AG/AG-home.html](http://www.ciesin.columbia.edu/TG/AG/AG-home.html) \
- <http://www.aiaccproject.org>

<b>Adaptations Options in Agriculture to Climate Change and Variability</b>				
<b>Adaptation option:</b>	<b>Purpose</b>	<b>Necessary supporting policies</b>	<b>Other prerequisites</b>	<b>Limitations</b>
<b>Short term</b>				
<b>Crop insurance</b>				
Private public programs  Formal/informal schemes	Enabling improved risk coverage	Improving access  Risk management through risk reduction and risk sharing  Improving supervisory capacity  Revising pricing incentives  Improving affordability/availability of coverage for catastrophes	Synergies between govt. and private sector in bearing risks Minimizing information asymmetries  Establishing enforcement mechanisms  Introducing measures for the correct estimation of premiums  Innovative schemes should be pursued (e.g. tradable financial assets; catastrophic bonds; weather markets)	Risk averse communities/insufficient collateral  High opportunity costs of public funds  High monitoring costs (institutional limitations)  Adverse selection/moral hazard  Need to establish well functioning producer organizations
<b>Portfolio (Crop/Livestock) Diversification</b>  Replacement of plant types, cultivars, hybrids and animal breeds with new	Risk-spreading/promoting farm-level risk management  Increasing	Availability of extension Services  Financial support/	Tenure reform to ensure property rights are established	Traditions, lack of awareness, and other limitations (high opportunity costs) may dampen willingness to diversify

<p>varieties</p> <p>Alternative production techniques (adjustment of capital and labor inputs)</p> <p>Multi-cropping</p> <p>Mixed farming systems of crops and livestock</p>	<p>productivity</p> <p>Defending against disease, pest</p>	<p>alternatives should be provided by private and public sector</p> <p>Enable mobility of activities</p> <p>Remove subsidies on certain crops/livestock production not conducive to changed climatic and resource conditions</p>	<p>Land-use regulations need to be reviewed to enable diversification</p> <p>Education/training/extension services need to be provided</p>	<p>Over-dependence on government support mechanisms needs to be Reduced</p> <p>Need alternatives that maintain quantity and income from production</p>
<p><b>Adjusting Timing of Farm Operations</b></p> <p>Adjusting cropping Sequence</p> <p>Adjusting timing of irrigation</p>	<p>Reducing risks of crop damage/ maximizing output in light of new condition</p>	<p>Extension services/training is necessary</p> <p>Pricing policies have to be reviewed</p>	<p>Mechanisms for the dissemination of agronomic and climate information</p> <p>Institutional support must be strengthened</p>	<p>Investment in collection of climate data and disseminating information required</p> <p>Limitations of existing infrastructure</p>
<p><b>Changing Cropping Intensity</b></p> <p>Adjusting fertilizer and other inputs</p> <p>Changing land use Practices</p> <p>Changing location of crop/livestock production</p>	<p>Improving moisture and nutrient retention</p> <p>Reducing soil erosion</p> <p>Adjusting to changing length of growing season</p>	<p>Extension services must be improved</p> <p>Pricing policy adjustments for incentives to making adjustments</p>	<p>Location-specific solutions should be sought</p>	<p>Availability of cultivable land;</p> <p>availability of alternative lands</p> <p>Socioeconomic (financial)</p> <p>Conflicts with other farm operations at other times of the year</p>

<p>Rotating or shifting production between crops and livestock</p> <p>Abandonment of land</p> <p>Changing the timing of activities (of sowing, planting, spraying and harvesting)</p> <p>Changing the timing of irrigation</p>	<p>Increasing plant protection</p>			<p>Traditions, lack of awareness, and other limitations (high opportunity costs) may dampen willingness to diversify</p> <p>Concerns regarding maintaining similar production level</p>
<p><b>Livestock Management</b></p> <p>Change in biological diversity, species</p> <p>Altering the breeding management program (i.e., changing composition, or species distribution)</p> <p>Change in grazing management (timing, duration, and location)</p> <p>Changing the location of watering points</p>	<p>Spreading risks; increasing productivity</p> <p>Adjusting to new climate conditions</p>	<p>Provision of extension services</p>	<p>Promoting investment in livestock management</p> <p>Institutional support</p>	<p>Traditions, lack of awareness and other limitations (high opportunity costs) may dampen willingness to diversify</p>

<p>Changes in rangeland management practices</p> <p>Modifying operation production strategies Changing market Strategies</p> <p>Implementing feed conservation techniques/ varying supplemental feeding</p>				
<p><b>Changes in Tillage Practices (Conservation Tillage)</b></p> <p>Land contouring and Terracing</p> <p>Maintaining crop residues</p> <p>Fallow and tillage Practices</p> <p>Planting of hedges</p> <p>Alternative drainage methods</p> <p>Construction of</p>	<p>Conserving soil moisture and organic carbon contents and increased soil erosion maintain soil fertility and prevent erosion (nutrient management)</p> <p>Maintaining soil quality/provide protection against wind erosion</p> <p>Increasing production per unit of evapotranspiration</p> <p>Reducing water runoff/ improving water uptake</p> <p>Recharging water supply</p>	<p>Extension services need to support activities</p> <p>Pricing incentives to promote conservation</p>	<p>Investment</p> <p>Land tenure reform</p> <p>Indigenous knowledge</p>	

diversions and reservoirs and water storage  Reducing water use inland preparation	Reducing runoff and erosion  Nutrient restocking  Conserving water			
<b>Temporary Migration</b>	Risk diversification strategy to withstand climate shocks and seasonal effects	Employment training/opportunities	Institutional support	Availability of employment opportunities in urban areas; growth elsewhere in economy Skills and earnings potential High population density in cities
<b>Short-Term Forecasts</b>	Improve preparation for medium-term climatic impacts	Institutional support for collection and dissemination, information dissemination	Infrastructure for monitoring	Financial resources constraints
<b>Food Reserves and Storage</b>	Temporary relief		Delivery mechanisms	Expensive/complacency
<b>Changing Crop Mix</b> Adopting new crops  Planting in different part of farm  Converting land use	Spreading risk of damage  Move away from unstable cash crop systems	Revising pricing; food importation policy  Tenure; extension; pricing incentives  Improving access and affordability  Need viable alternatives (incomes)	Promoting investment Institutional support to administer  Agricultural marketing policies  Review of agricultural credit schemes	Institutional failures  Acceptance of change gradual  Economic failures (maintaining incomes)  Knowledge

<b>Irrigation</b>	Increase productivity; withstand rainwater shortages	Investment by public and private sectors	Clear water management policy	Institutional support and enforcement mechanisms
<b>Modernization of Farm Operations</b>  Research and development (biological and mechanical options)  Adoption of technology (e.g., use of sprinklers)	Increase productivity Withstanding climate effects	Promoting the adoption of technological innovations	Establishment of intellectual property rights  Role of private multinationals	Conflicts between national/private objectives Maintaining similar production Levels  Subsidization programs may create perverse incentives
<b>Permanent Migration</b>	Diversify income earning opportunities To overcome long lasting climate impacts	Education and training for alternative opportunities  Retraining	Institutional support (property rights)	Impacts on resource base  Land pressure
<b>Defining Landuse and Tenure Rights</b>	Incentives to make necessary investments in agricultural land to withstand climatic impacts	Legal reform and enforcement		
<b>Efficient Water Use</b> Improving water Distribution  Promoting irrigation	Water conservation  Avoid salinization; increase in moisture	Pricing reforms for water Clearly defined property rights  Develop open markets	Sustainable water projects  Diffusion of technological advances in water management	Cost Competing demands  Financial crises  Low-cost recovery of the

<b>Efficiency</b> Changing crop and irrigation schedules Water recycling and the conjunctive use of groundwater Rehabilitation and modernization	<b>Retention</b> Water storage and flood control	Strengthening farm level managerial capacity	Institutional reforms	investment in the water system Political economy issues
<i><b>Both short and long term</b></i>				
<b>Investment Promotion</b>	Overcome financial limitations to adapt	Property rights; designing innovating financial tools Injection of initial capital		Social constraints against capital accumulation Reluctance of agricultural traders to offer inputs on credit
<b>Develop Market Efficiency</b>				
Pricing reform Develop open markets Reform of agricultural markets	Promote more efficient use of resources	Remove barriers Property rights; pricing policy Adjustment of agriculture input subsidies that constrain adaptation Land use regulations	Institutional support The establishment of regional consultation centers Impart knowledge on adaptation alternatives Legislative reform	Poor transport infrastructure
<b>Adoption of Technological and</b>	Increasing agricultural yields	Pricing incentives/ tax reform	Community management and cooperation programs	Natural constraints- if land is



<p><b>Other Adaptation Measures</b></p>	<p>Reducing average fixed costs Reducing variable costs</p>	<p>Extension services for training Finance schemes</p>		<p>Available</p> <p>Socioeconomic capacity to adapt Complete removal of government support</p> <p>Lower producer prices</p> <p>Lower world food prices</p> <p>Attitudes towards risk</p> <p>Level of uncertainty of the Future</p> <p>Availability of funds for investment Access to assets, capital, and Credit</p> <p>High tariffs in export markets</p>
<p><b>Promoting Trade</b></p>	<p>Promoting economic growth</p> <p>Strengthening long-term food supply and production<sup>1/</sup></p> <p>Limitations Reducing risks of food shortages</p>	<p>Pricing and exchange rate reform and stabilization</p> <p>Adjustment of agricultural subsidies and tariffs</p>	<p>Social policy</p>	<p>Subsidies in developed markets</p>

<b>Developing Extension Services</b>	<p>Improve agricultural Productivity</p> <p>Improve awareness and knowledge of measures</p>	<p>Role of private, nongovernmental And cooperative agencies</p> <p>Ensuring sufficient agents per farmer/region</p>	<p>Ensure agents are productive through adequate incentives</p> <p>Limit/remove management failures</p> <p>Public organization, resources, and institutional support</p> <p>Utilize indigenous knowledge</p>	
<b>Improving Forecasting Mechanisms</b>	<p>Assist planning</p> <p>Strengthen ability of to cope</p>	<p>Extension</p> <p>Institutional support (e.g. establishment of farmer cooperatives to spread knowledge)</p>	<p>Information needs to be distributed across all sectors</p> <p>Horizontal and vertical exchanges of information</p> <p>Ensure information is in a usable form</p>	<p>Financial</p> <p>Conflicts with traditional practices/ social conventions</p> <p>Skepticism</p>
<b>Institutional Strengthening and Decision-making Structures</b>	<p>To support long term planning</p> <p>Reduce vulnerability</p> <p>Provide information on the changing socioeconomic structure, demographics, technology, and public preferences</p> <p>Improving organization</p>	<p>Reform existing institutions that support agricultural sector</p> <p>Pricing incentives; improving regulations and technology standards</p> <p>Legal infrastructure (reform) for stimulating domestic and international Investment</p> <p>Changes in international and</p>	<p>Participation of key stakeholders</p> <p>Requires integrated management practices; need to fit specific institutional settings</p> <p>Comprehensive multisectoral management plans</p> <p>Resilience; flexibility; public education program</p>	<p>Planning agencies formed by administrative resolution as opposed to being mandatory</p>

	capacity, responsibility and operational effectiveness	domestic competition Social policies Upgrading of current physical planning laws and regulations	Remove bureaucratic inefficiencies Equally well functioning institutions in other sectors Improve coordination between central and local government	
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[http://www.gefweb.org/projects/Focal\\_Areas/climate/documents/GEFs Work on Global Climate Change.pdf](http://www.gefweb.org/projects/Focal_Areas/climate/documents/GEFs_Work_on_Global_Climate_Change.pdf)

M. S. Swaminathan Research Foundation - Project on Vulnerability & Adaptation to Climate Change

[CURRENT SCIENCE, VOL. 88, NO. 8, 25 APRIL 2005](#)

OPPORTUNITIES FOR CLIMATE CHANGE MITIGATION PROJECTS IN INDIA

[http://ciionline.org/services/78/Images/hbook\\_2.pdf](http://ciionline.org/services/78/Images/hbook_2.pdf)

Summary of submissions on the Adaptation Fund Workshop on the Adaptation Fund Edmonton May 3-5, 2006

[unfccc.int/.../financial\\_mechanism/adaptation\\_fund/application/vnd.ms-powerpoint/options.ppt](http://unfccc.int/.../financial_mechanism/adaptation_fund/application/vnd.ms-powerpoint/options.ppt)

Capacity Building for Adaptation to Climate Change (CACC) Project

Implemented by the Canadian Centre for International Studies and Cooperation & Funded by CIDA through the Canada Climate Change Development Fund

<http://www.bcas.net/CCAdaptation/Documentation/Phan.pdf>

Synthesis and Assessment Product 4.4 Preliminary Review of Adaptation Options for Climate

Sensitive Ecosystems and Resources

[http://www.climatescience.gov/workshop2005/posters/P-DS1.8\\_Julius.pdf](http://www.climatescience.gov/workshop2005/posters/P-DS1.8_Julius.pdf)

GEF Resource Allocation Framework: Indicative Resource Allocations for GEF-4, for the

Biodiversity and Climate Change Focal Areas

[http://www.gefweb.org/Documents/RAF\\_Public\\_Disclosure\\_Document\\_15Sep2006.pdf](http://www.gefweb.org/Documents/RAF_Public_Disclosure_Document_15Sep2006.pdf)

Research Projects/Climate change and Southern Africa

[http://www.cru.uea.ac.uk/~mikeh/research/cc\\_safr.htm](http://www.cru.uea.ac.uk/~mikeh/research/cc_safr.htm)

Adaptation to Climate Change to Enhance Food and Environmental Security: Sri Lanka

[www.waterandclimate.org/dialogue/Adapt/documents/Adapt%20Walawe%20100203.pdf](http://www.waterandclimate.org/dialogue/Adapt/documents/Adapt%20Walawe%20100203.pdf)

UNDP's Experience with GEF Adaptation-related projects

<http://www.iges.or.jp/en/news/cop11/adap/UNDP.pdf>

A Presentation by UNEP At the UNFCCC Workshop on the Adaptation Fund

[http://unfccc.int/files/cooperation\\_and\\_support/financial\\_mechanism/adaptation\\_fund/application/vnd.ms-powerpoint/unep\\_adaptation\\_fund\\_pres.ppt](http://unfccc.int/files/cooperation_and_support/financial_mechanism/adaptation_fund/application/vnd.ms-powerpoint/unep_adaptation_fund_pres.ppt)

U.S.-Sponsored Climate Change Adaptation Activities – Enhancing Resilience

<http://www.state.gov/documents/organization/39557.pdf>

Global Climate Change: Policies & Programs

[http://www.usaid.gov/our\\_work/environment/climate/policies\\_prog/index.html](http://www.usaid.gov/our_work/environment/climate/policies_prog/index.html)

Adapting to Climate Variability and Change

[http://www.usaid.gov/our\\_work/environment/climate/policies\\_prog/vulnerability\\_overview.html](http://www.usaid.gov/our_work/environment/climate/policies_prog/vulnerability_overview.html)

Growing imports of oil causing greater pollution and increasing emissions of greenhouse gases

[http://www.gefweb.org/Outreach/outreach-Publications/Project\\_factsheet/SriLanka-ener-2-cc-wb-eng-ld.pdf](http://www.gefweb.org/Outreach/outreach-Publications/Project_factsheet/SriLanka-ener-2-cc-wb-eng-ld.pdf)

Adaptation to climate change in the developing world

[http://www.poptel.org.uk/ued/\\*\\*\\*\\*docs/climate/adapt\\_to\\_cc.pdf](http://www.poptel.org.uk/ued/****docs/climate/adapt_to_cc.pdf)

Bridging Adaptation Research and Policy: Issues and Challenges

<http://www.iges.or.jp/en/news/cop11/adap/munasinghe.pdf>

Report on the Asia and the Pacific regional workshop on Article 6 of the Convention

<http://unfccc.int/resource/docs/2005/sbi/eng/21.pdf>

Climate Change & the Financial Sector: An Agenda for Action

<http://www.pewclimate.org/docUploads/Allianz%20%2D%2D%20WWF%20Climate%20Agenda%20for%20Financial%20Sector%20%2D%2D%202005%2Epdf>

Financing climate change adaptation

[www.blackwell-synergy.com/doi/pdf/10.1111/j.1467-9523.2006.00306.x](http://www.blackwell-synergy.com/doi/pdf/10.1111/j.1467-9523.2006.00306.x)

Climate Change: Impacts, Adaptation & Vulnerability (Reference: IPCC Third Assessment

Report)

[http://www.natcomindia.org/presentations/cc\\_impacts.pdf](http://www.natcomindia.org/presentations/cc_impacts.pdf)

Climate change and India: Emissions, mitigation, impacts and adaptation

CURRENT SCIENCE, VOL. 90, NO. 3, 10 FEBRUARY 2006

Climate change Impacts and Adaptation Programme

[adaptation.nrcan.gc.ca](http://adaptation.nrcan.gc.ca)

Greenhouse gas emissions from India: A perspective

CURRENT SCIENCE, VOL. 90, NO. 3, 10 FEBRUARY 2006

GHG Inventory Information

<http://www.natcomindia.org/pdfs/chapter2.pdf>

Final Report Recommendations on New Emission Scenarios, Prepared by the IPCC Task Group on New Emission Scenarios (TGNES) March 28, 2006

<http://www.ipcc.ch/meet/tgnew28032006.pdf>

State Responsibility for Global Climate Change: The Case of the Maldives

<http://fletcher.tufts.edu/research/2005/Davis.pdf>

Meeting the Climate Challenge Recommendations of the International Climate Change Taskforce January 2005

<http://www.americanprogress.org/kf/climatechallenge.pdf>

Formulation of the Bangladesh Program of Action for Adaptation to Climate Change (NAPA) Inception Workshop 1 October 2004

[http://www.sdnbd.org/sdi/issues/climate\\_change/napa/workshop/NAPA%20incertion%20Presentation.pdf](http://www.sdnbd.org/sdi/issues/climate_change/napa/workshop/NAPA%20incertion%20Presentation.pdf)

Formulation of the MALDIVES National Adaptation Programmes of Action for Adapting to Climate Change - Ahmed Jameel

<http://www.unitar.org/ccp/bhutan/05-%20Maldives%20NAPA.pdf>

National Climate Change Adaptation Framework

[http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6\\_e.pdf](http://adaptation.nrcan.gc.ca/pdf/e84cc04097004024847deda0f9cb72c6_e.pdf)

Climate Change: A Challenge to India's Economy

[www.cseindia.org](http://www.cseindia.org)

Climate Proofing: A Risk-based Approach to Adaptation

<http://www.adb.org/Documents/Reports/Climate-Proofing/main-report.asp#contents>

Climate Change 2001: synthesis report

<http://www.ipcc.ch/pub/un/syrenq/spm.pdf>

Sustainable Development, Energy & the Environment: UNDP's Climate Change Initiatives

<http://www.energyandenvironment.undp.org/undp/indexAction.cfm?module=Library&action=GetFile&DocumentAttachmentID=1019>

Vulnerability Assessment & Adaptation due to Climate Change

[http://www.natcomindia.org/presentations/vulnerability\\_assess.pdf](http://www.natcomindia.org/presentations/vulnerability_assess.pdf)

## Framework of deliberations at the workshop

Prof. Mohan Munasinghe, Prof. Sarath Kotagama, Prof Jyoti Parikh, Dr Sukumar, representatives of the Small grants Programme of the UNDP and colleagues from the Ministries of Environment in Nepal, Sri Lanka, initiatives in Pakistan ...

Welcome to the workshop on Adaptation Opportunities and the Way Forward, a regional consultation. We appreciate your efforts to travel large distances after re-scheduling your activities. Thanks indeed for accepting our invitation. Your interest reflects the importance of the present initiative. I am aware of your contributions to the growing body of knowledge and hand-holding initiatives in the field of climate change mitigation and adaptation. Your inputs will be valuable to consolidate and strengthen the way forward to address challenges in adaptation at the regional level in South Asia in particular.

I have wanted to organize this workshop on climate change adaptation for quite some time. This interest is in response to a felt need perceived by SACEP and articulated so in its Governing Council meetings recently. The felt need is particularly because of the growing recognition of the links between preventive measures and augmentation to increase resilience of systems; especially when susceptibility appears to be increasing along with the randomness and intensity of perturbations.

This also leads us to the next aspect of the relatively lesser importance given to adaptation efforts vis-à-vis mitigation; thus calling for concerted efforts to focus on adaptation opportunities. Is it because of the relatively more complex nature of adaptation frameworks involving several cross-cutting themes impinging on developmental imperatives or the lack of precise quantification tools and techniques unlike targeted mitigation goals and approaches. I invite you to deliberate on these aspects.

I wish to highlight the fact that the Governing Council of SACEP has mandated work on adaptation through this scoping initiative. We need to provide the Council with a clear understanding of the regional consensus on prioritizing adaptation – related thrust areas and hence set the agenda in conjunction with the developmental and environmental protection imperatives at the local, regional and global levels. The questions we wish to therefore find answers for are

1. What are the principal adaptation-related issues in the region? We may draw upon the recent experiences of countries derived through the NATCOM and the NAPA processes.
2. Do you think it will be useful for SACEP and CEE to initiate intensive assessments through reality checks on
  - a. Adequacy of information on eco-system health vis-à-vis susceptibility to perturbations
  - b. Existing institutional and technical strengths to assess and guide implementation of solutions within location-specific frameworks
  - c. Indigenous solutions which need to be significantly up-scaled and in this process avoid duplication of efforts. You may agree that the scope for technical and technological cooperation at the regional level is quite

- significant in this context. This could signify a true South – South cooperation model of enabling adaptation – focused development.
- d. Is it possible to also establish a few pilots which demonstrate the feasibility of evolving appropriate systems integrating institutional, technical, technological, regulatory and fiscal adaptations in addition to up-scaling a few as mentioned above?

I am raising these questions to draw your attention to the framework of discussions for the day so that a roadmap for our work may be charted. I invite you all to provide leadership in this joint initiative which we have had the privilege of kick-starting. I am sure you have the necessary insights to provide clear answers to the questions I have raised for your consideration.

We all have followed the recent discussions on adaptation within the UNFCCC system. Some of the salient features include the following.

1. Adaptation Fund: At the 12<sup>th</sup> UNFCCC COP in Nairobi, discussions on the adaptation fund were on several guiding principle including administration, access, full cost funding, accountability to the COP; project cycles, competency, quality assurance, monitoring etc. Thanks to the UNDP GEF SGP office for indicating the following through the SGP in India that

- There are two important processes as part of the UNFCCC.
- LDCs are preparing their NAPAS (under the LDCF Fund) and it would make a lot of sense if the implementation of NAPA outcomes recognize the contribution of all stakeholders in implementing adaptation measures including local communities.
- The other process is the role of the special climate change Fund (SCCF). Like NAPA outcomes, it is important to recognize the role of all stakeholders including local communities in the implementation of interventions related to this fund.
- Unless that recognition is included in the country adaptation documents that are used to make funding decisions, there will be no possibility of accessing resources (both financial and otherwise) for the participation of all stakeholders.
- For the Small Grants programme, inclusion of communities in the implementation of both LDCF and SCCF adaptation outcomes is essential.
- Importantly the LDCF operational guidelines and the SCCF paper from GEF have made recognition for involvement of local communities in specific paragraphs.
- One consequence of involvement of all stakeholders is the need for methods and strategies for assessing the adaptive capacity and the achievement of impacts of all adaptation interventions. The background paper prepared by CEE & SACEP has mentioned several methods used in assessing the pre-intervention aspects.
- What is lacking today is a set of tools for assessing impacts during and after the interventions have been made. This is another area of interest to SGP, specifically for community-based adaptation (CBA) activities.

I am glad that our thinking is inline with the UNDP- GEF and reflects the questions raised earlier by me. I am sure Prof Parikh, Prof Munasinghe, Prof Sukumar to name a few, will be able to help design and evaluate appropriate tools which may be used by relevant stakeholders in this process.

I am also aware of the significant community – based interventions enabled by the SGP in particular. Is it possible for the SGP to help define some unaddressed challenges in the community interface including opportunities for capacity building, piloting and up-scaling some initiatives? Please help us develop proposals for some medium and large scale projects which can be logical extensions of the small grants initiatives and in this process involve the significant expertise brought by such experts as the ones assembled here.

I have recently been told about the Framework Programme 7 of the European Union as another significant funding opportunity. Is it possible for us to jointly apply for such a funding based on the partnership we hope to establish between SACEP, you all and CEE in addition to linking with others in the European Union as required by the FP7? Please contemplate in these and orient your inputs to these suggestions because we need to respond in another 4 – 6 weeks time to capture the FP 7 opportunity. SACEP and CEE are planning to wish re-visit you after the Governing Council deliberations this month to seek your guidance and involvement based on mutually acceptable terms to fulfill the regional agenda of improving preparedness to adapt.

2. The LDC negotiating group in the UNFCCC deliberations is very active. Bangladesh is the current chair. There is also a LDC Expert Group of which Maldives and Bhutan are members. Four countries in South Asia are preparing their National Adaptation Programme of Action and are accessing funds from the LDC Fund administered by GEF;
3. Most countries are preparing their Second Greenhouse Gas Inventory. Baseline surveys have already been completed by countries;
4. Community based adaptation activities to link climate change into sustainable development. The Small Grants Programme of the GEF is already focused on adaptation and communities.
5. We would like to look at priority programme areas namely, training, awareness raising, technology transfer, infrastructure development, exchange of information and scenario building, establishment of a clearing house mechanism and a knowledge management center, guidelines, baseline studies, pilot studies and Data and Information Management, as appropriate. These are few issues
6. I would like to highlight and suggest that the forum highlights specifics that could be addressed by the Secretariat under a 2 to 3 year programme once it is endorsed by the Governing Council.

I once again welcome Prof. Munasinghe who is one of the lead authorities on the subject, his inputs here will set the stage for the deliberations appropriately. Prof. Kotagama with all his experience on bio-diversity and his research considerations related



to Climate Change; Prof. Jyoti Parikh's contributions to the field of developmental economics and the IPCC Mr. Prabhjot Sodhi and Ms. Shireen with significant experiences from the region with implementing projects through UNDP SGP support; Prof. Sukumar coming as he does from one of the foremost schools of ecological research, contributing to the body of knowledge through the IPCC will undoubtedly add to the value of the deliberations.

It is unfortunate that colleagues from BCAS, ICIMOD and SDPI could not join for different reasons. However we will communicate with them regarding the outcome of this meeting and seek their views on the issues.

Thank you for being with us now and I hope that the discussions will yield a concrete suggestion to the Ministerial meeting at the end of this month.

**Annexure – V**

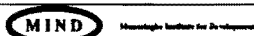
**Presentations at the Workshop**

## Adaptation to CC and Sustainable Development - Formulating and Implementing Practical Policies and Projects

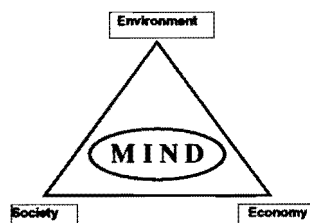
**Mohan Munasinghe**

Vice-Chair, Intergovernmental Panel on Climate Change (IPCC), Geneva  
Chairman, Munasinghe Institute for Development (MIND), Colombo  
Education Advisor to the Govt. of Sri Lanka, Colombo  
Visiting Professor, United Nations University, Tokyo

South Asia Regional Consultation on Adaptation to Climate Change organised by SACEP  
Colombo, 10 January 2007



## An Introduction

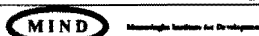


**Munasinghe Institute for Development**

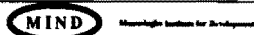
"making development more sustainable - MDMS"

10/1 De Fonseka Place, Colombo 5, Sri Lanka  
Phone: +9411-255-1208; Fax: +9411-255-1608

E-mail: <MIND@mindlanka.org> ; Web: <www.mindlanka.org>

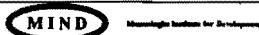


MIND was established in the new millennium as a private, non-profit organization, to play a key role in nurturing communities of stakeholders and scholars to address major issues of **Sustainable Development (SD)** worldwide. MIND aims to explore viable means of achieving this goal in Sri Lanka and elsewhere without compromising social, economic, and environmental integrity.



## MIND PROGRAMMES

- **Awards**  
Research fellowships, Scholarships, MIND Sustainable Support Service (MS3), Book donations
- **Research & Training**  
Training workshops/expert meetings  
Applied research studies and evaluations  
UN "Centre of Excellence" for Asia in the Climate Change Capacity Development (C3D) network of the United Nations Institute for Training and Research (UNITAR).



## Climate Change Capacity Development (C3D)

Assistance to developing countries to build capacity for better understanding, analysing and negotiating climate change issues

### Partners

ENDA, Dakar, Senegal – Vulnerability & Adaptation Module  
ERC, Cape Town, South Africa – Mitigation Module  
MIND, Colombo, Sri Lanka – Climate Change & Sustainable Development Module  
UNITAR, Geneva, Switzerland – Coordination & Management

### Ongoing Activities

- Training programme development (tools and methods like AIM)
- Development/implementation of "Training of Trainers programme" by regional centres



## C3D Activities in Asia – led by MIND

### Phase 1: 2004-2006

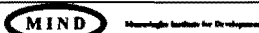
Training Workshops (Sri Lanka, India, China, etc.) on CC & SD  
Training Documents (books, manuals, CDs, etc.)

Participation at international conferences (COP, IPCC, etc.)

### Phase 2: 2007-2009

Expanded activities planned, including:

- training workshops throughout the region,
- practical case studies integrating adaptation and mitigation into national SD strategy
- closer collaboration in regional capacity building efforts, with: UN system, bilateral donors, multilateral banks, etc.

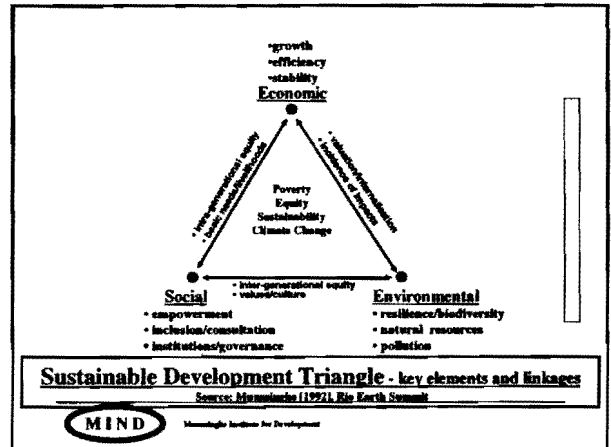
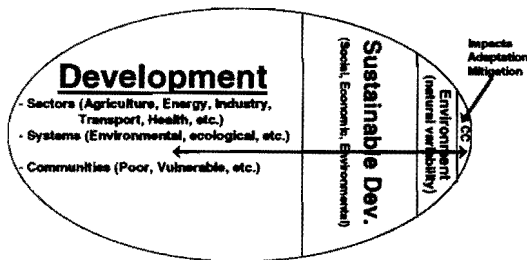


# Understanding and Analyzing Links Between Climate Change and Sustainable Development

## Sustainomics Framework Core concepts and elements

1. Making development more sustainable (MDMS)
2. Sustainable development triangle
3. Transcending boundaries
4. Full cycle application of integrative tools – from data gathering to practical policy implementation

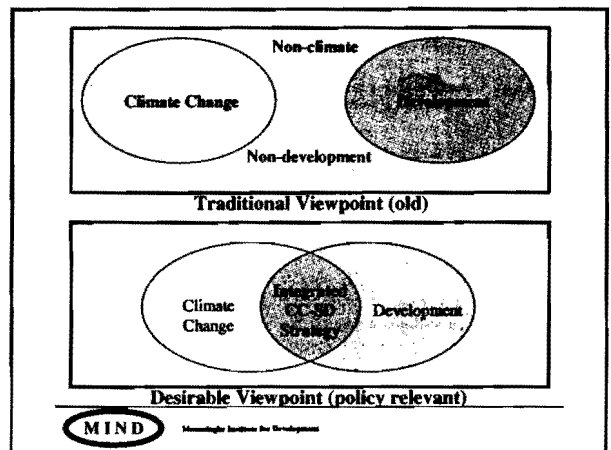
### Making development more sustainable (MDMS) Climate change policies must be integrated into national sustainable development strategy, to get attention from decision makers

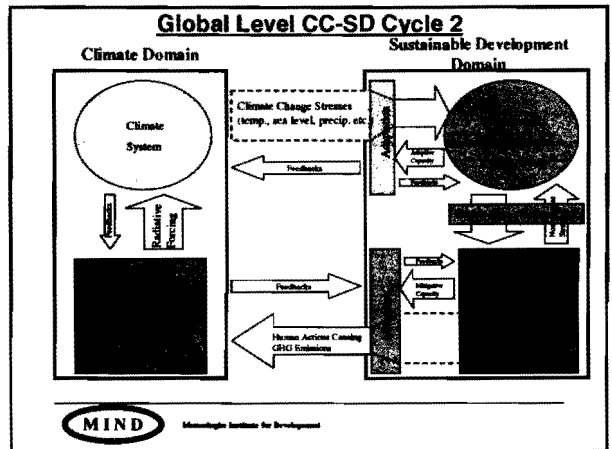
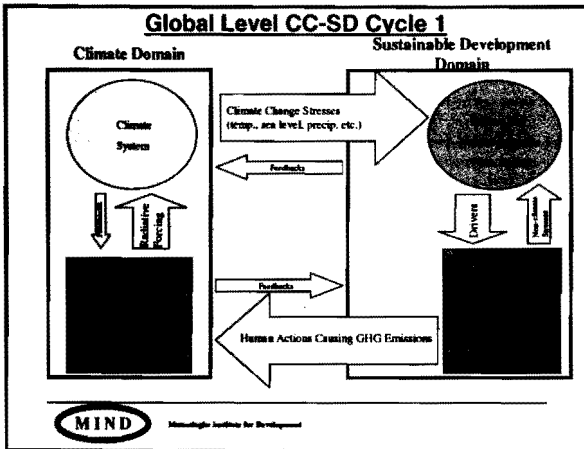


### Transcending Boundaries to link CC and SD

- Disciplinary
- Space
- Time
- Stakeholder
- Operational

Using the Action Impact Matrix (AIM)





## Brief Introduction to the Application of Action Impact Matrix (AIM) Approach to SD-CC Links (Vulnerability and Adaptation) in Sri Lanka

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### Action Impact Matrix (AIM) Methodology

The AIM methodology may be used to better understand interactions among three key elements, at the country-specific level:

- (a) national development policies and goals;
- (b) key SD issues and indicators; and
- (c) climate change adaptation (and mitigation).

First, the two-way linkages between elements (a) and (b) are explored, in the context of natural climate variability. Then, we impose the additional impacts of element (c) on the interactions between elements (a) and (b). The AIM approach analyses key economic-environmental-social interactions to identify potential barriers to making development more sustainable (MDMS) - including climate change. It also helps to determine the priority macro policies and strategies in economic, environmental and social spheres, that facilitate implementation of climate change adaptation and mitigation to overcome the effects of climate change. Thus, the AIM helps to integrate CC within SD. It has been used since the early 1990s to link macroeconomic policies and environment.

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### AIM Process

The AIM methodology relies on a fully participative stakeholder exercise to generate the AIM itself. Up to 50 experts are drawn from government, academia, civil society and the private sector, who represent various disciplines and sectors relevant to both sustainable development and climate change. In the initial exercise, they usually interact intensively over a period of about two days, to build a preliminary AIM. This participative process is as important as the product (i.e., the AIM), since important synergies and cooperative team-building activities emerge. The collaboration helps participants to better understand opposing viewpoints, resolves conflicts, and ultimately facilitates implementation of agreed policy remedies. On subsequent occasions, the updating or fine-tuning of the initial AIM can be done within a few hours by the same group, since they are already conversant with the methodology.

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### AIM Principles

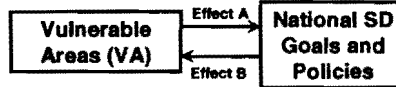
The AIM methodology is based on the sustainomics framework [1], which draws on the following principles:

1. MDMS approach – sustainable development is defined as a process (rather than an end point), while the step-by-step approach of “making development more sustainable” (MDMS) becomes the prime objective.
2. Sustainable development triangle - SD is viewed through three main domains or perspectives: social, economic and environmental.
3. Trans-boundary approach – analysis transcends conventional boundaries imposed by discipline, space, time, stakeholder viewpoints, and operability.
4. Full cycle application of integrative tools – Action Impact Matrix (AIM) is the key link from initial data gathering to practical policy application and feedback.

[1] Proposed at 1992 Rio Earth Summit - see Munasinghe (1992) and Munasinghe (2002).

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## Action Impact Matrix (AIM) for Analyzing SD-CC Adaptation Links: 1

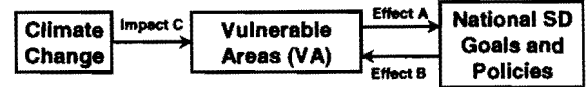


**Step 1: DEV-AIM = Effect B**  
(Development Effects on VA)

**Step 1: VED-AIM = Effect A**  
(VA Effects on Development)

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## Action Impact Matrix (AIM) for Analyzing SD-CC Adaptation Links: 2



**Step 2: DEV-AIM = Effect B + Impact C**  
(Development Effects on VA)

**Step 2: VED-AIM = Effect A + Impact C**  
(VA Effects on Development)

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### Building the AIM – Step 1: Identify Rows and Columns

**Row Headings:** key national macro-economic goals and policies.

**Column Headings:** key areas of vulnerable areas (VA), and associated economic, environmental and social indicators.

		Vulnerable Areas (VA)			
		Economic		Environmental	Social
		(1) Agricultural output	(2) Industrial Activity	(3) Water Resources	(4) Health
<b>Dev. Goals/Policies</b>					
(A)	Growth				
(B)	Poverty alleviation				
(C)	Food Security				
(D)	Employment				

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### Building the AIM – Steps 2&3: Natural Var. & CC

Determine VA status due to natural variability and climate change, respectively.

		Vulnerable Areas (VA)			
		Economic		Environ.	Social
		(1) Agricultural output	(2) Indust. Activity	(3) Water Resources	(4) Health
+ means beneficial - means adverse					
3 = HIGH 2 = MODERATE 1 = LOW					
<b>Dev. Goals/Policies</b>					
(A)	Growth				
(B)	Poverty alleviation				
(C)	Food Security				
(D)	Employment				

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### Detailed description of impacts of climate change on agriculture

#### Background

Global warming will lead to temperature increases and alterations in the hydrological cycle through increases in surface temperature and rates of evaporation, and in some regions, increases in precipitation. Changes in the total amount of precipitation and its frequency and intensity directly affect the magnitude and timing of run-off and the intensity of floods and droughts. Such changes will have significant impacts on agriculture.

#### Rainfall

Dharmasena (2004), Bandara and Wickramagamage (2004)

#### Temperature

Zubair et al. (2004), Bandara & Wickramagamage, 2004.

#### Asian Brown Cloud (ABC)

Swain and Herath (2004), Herath et al. (2004), Pethirana and Herath (2004)

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### Building the AIM – Step 4: Filling VED Matrix Cells

Determine VA impacts on development goals and policies.

		Key Vulnerability, Impacts and Adaptation (VA)			
		Economic		Environ.	Social
		(1) Agricultural output	(2) Indust. Activity	(3) Water Resources	(4) Health
+ = beneficial - = adverse					
3 = HIGH 2 = MODERATE 1 = LOW					
<b>Development Goals/Policies</b>					
(A)	Growth	[-1] Less agricult. income			
(B)	Poverty alleviation	-2			
(C)	Food Security	-2			
(D)	Employment	-1			

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**Detailed description of effects of agriculture on growth [net -1]**

**(+1) Gains:** Higher rainfall in the dry zone and higher temperatures in the highlands will increase production of rice and highland crops. Although climate changes may have some detrimental impacts on agricultural production, the increase in atmospheric CO2 concentrations could be beneficial. Plants grow as a result of photosynthesis - the mechanism whereby the plant converts carbon dioxide from the atmosphere into food. With higher levels of carbon dioxide stimulating the rate of photosynthesis, the growth rate and productivity of plants could be expected to increase.

**(-2) Risks:** CC leads to variations in spatial and seasonal distribution of rainfall. Higher intensity of rainfall during short spans of time leads to runoff. Long periods of drought will affect production. ABC reduces both inter-monsoonal rainfall and solar radiation, each of which will reduce crop yields. CC impacts complicates the ABC effect, making management of Yala and Maha seasonal cropping more difficult, and leading to lower production and growth.



**Adaptation Effects on Development (VED-AIM) in Sri Lanka - CC Impacts and Effects of VA on Development Goals/Policies**

Key Vulnerabilities, Impacts and Adaptation (VIA)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Agri. Output	Hydro Power	Deforestation	Mitig. (trees & forest)	Wetlands & coastal energy storage	Water resources	Power system resilience	Human health	Infrastructure	Industrial & Tourism
(24)	Stable (Dist. Variability)	-1	0	-2	-1	-1	-2	-1	0	2

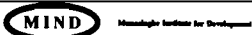
Dev. Goals/Policies (+CC Impacts)

(A)	Growth	-1	-1	-1	-1	-1			-1	-1	-1
(B)	Poverty alleviation		0	-1	-1	-1				-1	-1
(C)	Food Security		0	-1	-1	-1		-1	-1	0	0
(D)	Employment	-1	0	-1	0	-1		-1	-1	-1	-1
(E)	Trade & Globalisation		-1	0	0	0	-1	-1	0	0	-1
(F)	Budget Deficit Reduction	-1	-1	0	0	0	0	0	0	0	-1
(G)	Privatisation	0	1	1	0	0	1	0	0	-1	-1



**VED-AIM Example: Priorities for Policy Analysis**

The -3 value in cell C6: Water Resources → Food Security suggests an area for further detailed research and modeling. For example, a specific model may be used to study the effects of climate change induced rainfall variations (as well as temperature rise and possible carbon fertilisation) on the most important types of crops (for a study using Ricardian agricultural modelling, see Seo, Mendelsohn and Munasinghe, 2005). Specific policy options could be simulated - e.g., measures to protect against floods and droughts, more efficient use of water in agriculture, use of drought resistant crops, etc.



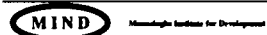
**Summary of Four AIMs used in SD-CC Analysis**

VED = Vulnerable Areas Effects on Development

DEV = Development Effects on Vulnerable Areas

MED = Mitigation Effects on Development

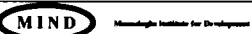
DEM = Development Effects on Mitigation



**Analyzing Macro- and Micro- Linkages**

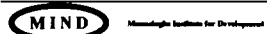
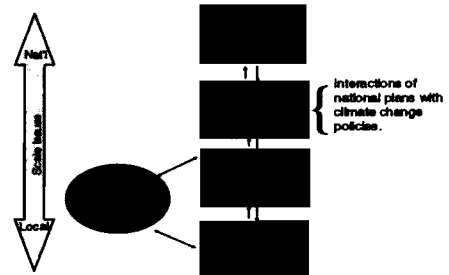
Examples:

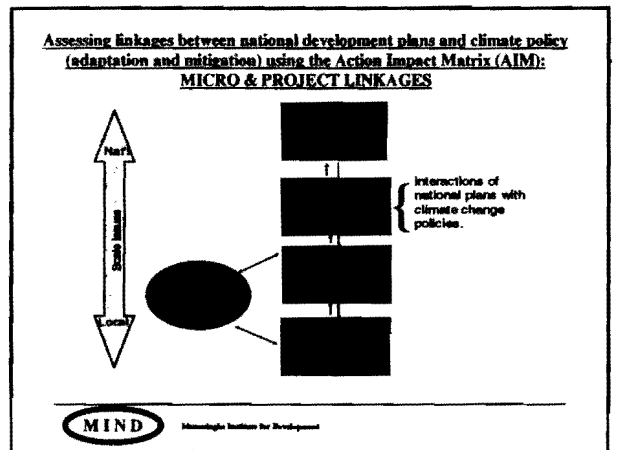
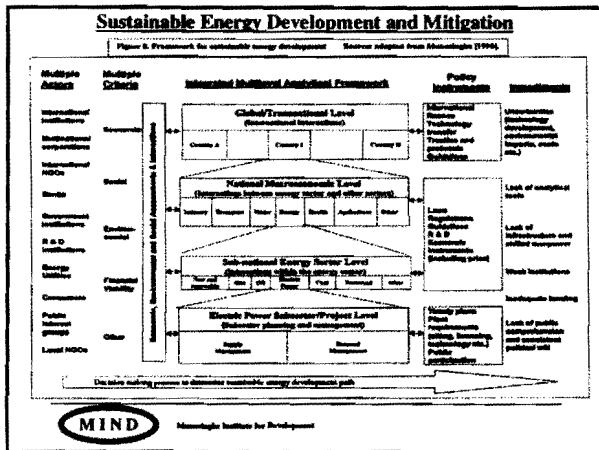
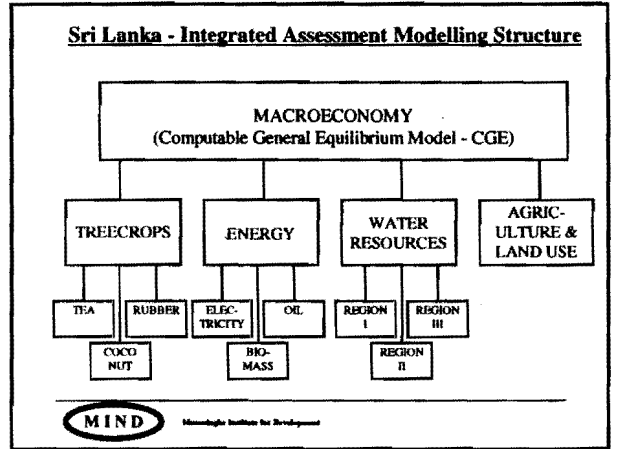
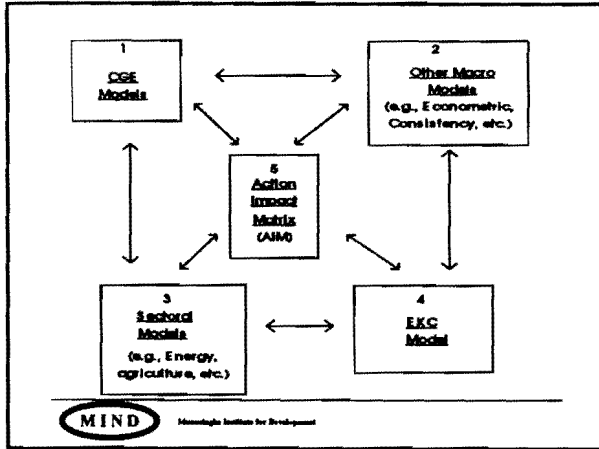
1. CC-Macroeconomic analysis
2. Adaptation assessment



**Assessing linkages between national development plans and climate policy (adaptation and mitigation) using the Action Impact Matrix (AIM):**

**MACRO LINKAGES**





**Example 1: Sectoral Level**

**Analysing Climate Change Impacts on Agriculture in Sri Lanka Using a Ricardian Model**

Source: Munasinghe and Perera(2006)

**MIND** Managaha Institute for Development

**Sri Lanka - National level impact on Agriculture Revenue in 2050**  
(AIF1 scenario based projection)

Crop	Temperature Effect	Rainfall Effect	Temp. Plus Rainfall Effect
Paddy	-3.5%	-7.8%	-11.4%
Plantation Crops	+1.5%	+2.0%	+3.5%

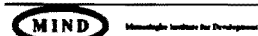
**MIND** Managaha Institute for Development



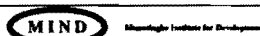
### Impact on Sri Lanka national economy in 2050\*

Crop	Change of Total GDP in 2050 (%)	Change Agriculture GDP in 2050 (%)
Paddy	-0.36	-2.46
Plantation Crops	+0.10	+0.70
Paddy + Plantation Crops	-0.26	- 1.76

\*Note: Assuming the same economic structure in 2050

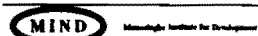


### Sri Lanka Impacts: HAD3 and CSIRO models



### Change in net agriculture income: Results of various Ricardian models

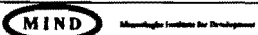
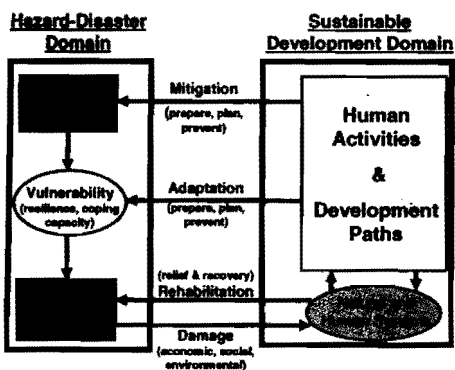
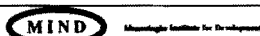
Country	Temperature rise (°C) plus 7% rainfall increase	Change in net income (percent)	Source
Sri Lanka	2.0	-27	Basic model - Analysis 1 (this paper)
Sri Lanka	3.5	-46	Basic model - Analysis 1 (this paper)
United States	2.0	-3 to +3	Mendelsohn, Nonheam, and Shaw (1994)
India	2.0	-3 to -6	Sanghi, Mendelsohn, and Dinar (1998)
India	3.5	-3 to -8	Sanghi, Mendelsohn, and Dinar (1998)
India	2.0	-7 to -9	Kumar and Parikh (1998a)
India	3.5	-20 to -26	Kumar and Parikh (1998a)
Brazil	2.0	-5 to -11	Sanghi (1998)
Brazil	3.5	-7 to -14	Sanghi (1998)



### Example 2: Extreme Events

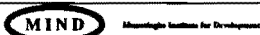
### Impacts of 2004 Asian Tsunami on Sustainable Development

Source: MIND (2006)



### SD Indicators of Tsunami Impacts

	Environmental		
	Coral Reef	Mangroves	Land (salinity)
Sri Lanka	Low	Med	High
Indonesia	Low	Low	High
Thailand	Low	Med	High
India	Low	Low	High
Maldives	Low	Med	High



## Climate Change Adaptation and Sustainable Development Links in South Asia

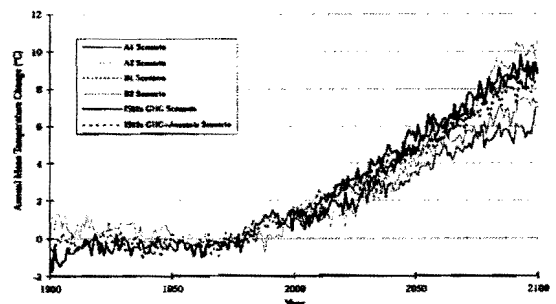
### Vulnerable characteristics of South Asia

- High population density
- Inadequate health provision & low quality of public services
- Relatively low economic growth
- Low incomes
- High dependence on water resources for fisheries, agriculture, forestry, livestock production and industrial activity

### Major Risks

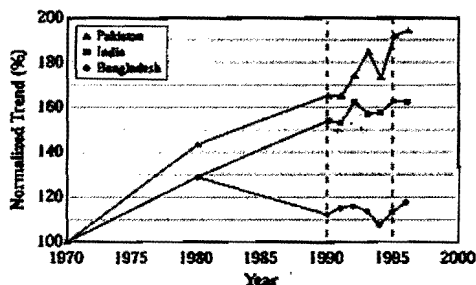
- Inundation of large deltas and low lying areas due to sea level rise
- Increased precipitation, particularly in summer monsoon, could increase flood prone areas
- Drier conditions in arid and semi arid areas could lead to more severe droughts
- Freshwater availability highly vulnerable
- Tropical cyclones more intense
- Crop production and aquaculture threatened by thermal and water stresses, sea level rise, increased flooding, strong winds.
- Warmer and wetter conditions increase the risk of heat related and infectious diseases
- Increased threats to biodiversity from land use/cover change and population pressure.

### Future trends in area-averaged annual mean temperature increase over land regions of Asia



### Normalized trends in grain production in Bangladesh, India, and Pakistan since 1970

(CIA, 1998).



### Potential land loss and population exposed in Asian countries with sea-level rise and no adaptation (Expected sea level rise about 0.5m by 2100)

	SLR (cm)	Potential Land Loss		Population Exposed	
		(Km <sup>2</sup> )	(%)	(Mn)	(%)
Bangladesh	45	15668	10.9	5.5	5.0
India	100	5763	0.4	7.1	0.8
Indonesia	60	34000	1.9	2.0	1.1
Malaysia	100	7000	2.1	>0.05	>0.3
Pakistan	20	1700	0.2	n.a	n.a

Source: IPCC 2001

## General Strategies for Adaptation

**Macro** – build social capital and reduce vulnerability to CC

- Sustainable and equitable development will increase income levels, education, skills, improve food distribution, disaster preparedness, health care systems

**Micro** – modify management of sectors sensitive to CC

- develop/modify institutions to promote CC adaptation  
- modify climate sensitive infrastructure to incorporate risks of CC

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## Some Sector-Wide Adaptation Options (1)

### • Agriculture

- Adjust cropping calendar & crop rotation;
- Develop & promote high yielding varieties and sustainable technological applications

### • Water Resources

- Develop flood and drought control management
- Reduce future development on flood plains
- Use appropriate measures for protection against soil erosion;
- Conserve ground water supply

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## Some Sector-Wide Adaptation Options (2)

### • Ecosystems and Biodiversity

- Assess risks to endemic species and ecosystems.
- Introduce integrated ecosystem planning and management.
- Reduce habitat fragmentation; promote development of migration corridors and buffer zones.
- Encourage mixed-use strategies.
- Prevent deforestation and conserve natural habitats in climatic transition zones inhabited by genetic biodiversity of potential for ecosystem restoration.

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## Some Sector-Wide Adaptation Options (3)

### • Coastal Resources

- Protect wetlands and allow for migration;
- prepare contingency plans for migration in response to sea-level rise;
- improve emergency preparedness for weather extremes (e.g., cyclones and storm surges);
- evaluate coastal subsidence rates in sensitive coastal regions.
- Implement coastal zone management; protect marine resources.

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## Some Sector-Wide Adaptation Options (4)

### • Human Health

- Build heat-resistant urban infrastructures and take additional measures to reduce air and water pollution.
- Adapt technological/engineering solutions to prevent vector-borne diseases/epidemics.
- Improve health care system, including surveillance, monitoring, and information dissemination.
- Improve public education and literacy rate in various communities.
- Increase infrastructure for waste disposal.
- Improve sanitation facilities in developing countries.

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## Some Sector-Wide Adaptation Options (5)

### • Cross Cutting Issues

- Continue monitoring and analysis of variability and trends in key climatic elements.
- Improve weather forecasting systems in the region.
- Improve and implement reforms on land-use planning.
- Apply new techniques for confident projection of regional climate change and its variability, including extreme events.
- Improve coordination of climate change adaptation activities among countries in the region.
- Keep the public aware of developments on risks of climate change and involve them in planning, adaptation, and mitigation strategies.
- Use traditional knowledge in planning for the future.

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### **Suggestions for Further Information**

1. Munasinghe, M. (2007) *Sustainable Development Primer: Sustainomics and Its Applications*, Edward Elgar Publ., UK.
2. Munasinghe, M., and Swart, R. (2005) *Primer on Climate Change and Sustainable Development*, Cambridge University Press, UK.
3. Munasinghe, M. (2002) 'The sustainomics trans-disciplinary meta-framework for making development more sustainable: applications to energy issues', *International Journal of Sustainable Development*, Vol. 4, No.2, pp.6-54.
4. MIND (2005) *Action Impact Matrix (AIM) Application to Climate Change: Adaptation & Mitigation - Users Guide*, Munasinghe Institute for Development (MIND), Colombo.
5. Website URL: <[www.mindlanka.org](http://www.mindlanka.org)>



Munasinghe Institute for Development

**Thank You  
Very Much**

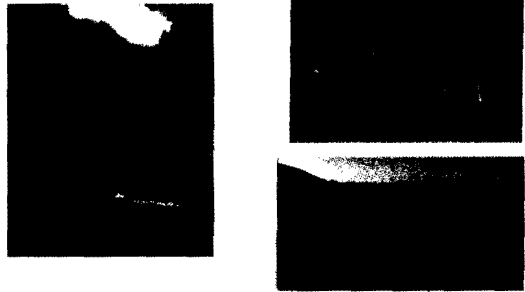


Munasinghe Institute for Development

## Climate Change and Forests in India: Adaptation in the Forest Sector

R. Sukumar & N.H. Ravindranath  
Centre for Ecological Sciences  
Indian Institute of Science  
Bangalore

India has 16 major forest types, varying from the alpine pastures in the Himalayas to temperate, sub-tropical and tropical forests, and mangroves

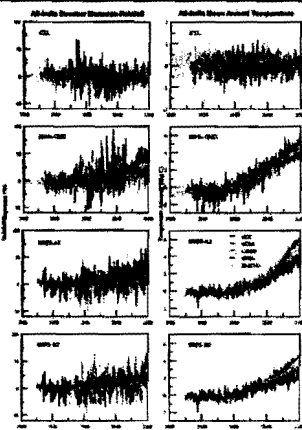
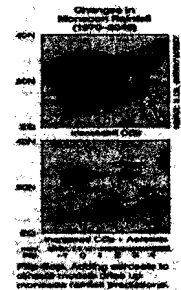


### Importance of forests to the country

- The State of the Forest Report, 2001, records the forest cover in India as 67 Mha, constituting 20.5% of the geographical area
- Dominant forest types are the tropical dry deciduous (38%) and tropical moist deciduous (32%) forests, while other important forest types are tropical evergreen, tropical dry thorn, sub-tropical pine and alpine forests.
- Approximate extent of forests on functional basis is: Protection Forests - 10 Mha; Production Forests - 15 Mha; Social Forests - 25 Mha and Protected Area Network - 14.8 Mha.
- Forests meet nearly 40% of the country's energy needs and 30% of the fodder needs. It is estimated that approximately 270 Mt of fuelwood, 280 Mt of fodder and over 12 million m<sup>3</sup> of timber and several NTFPs are removed from forests annually.
- The value of goods and services provided by the forest sector is estimated to be nearly Rs. 26000 crores (US\$ 5.8 billion).

### Climate change projections for India:

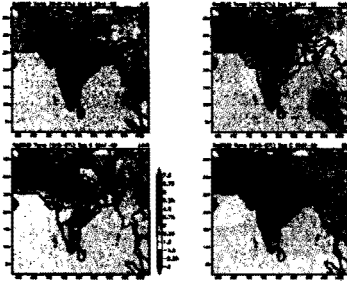
- The Indian Monsoon is one of the most difficult climate systems to model
- The CO<sub>2</sub>-only model for the Indian sub-continent predicts an increase in the precipitation over the sub-continent.
- The CO<sub>2</sub>+aerosol model for the Indian sub-continent predicted a significant drop in monsoon rainfall over northern India as a consequence of the cooling effect of the aerosol.
- However, more recent models are significant improvements over earlier attempts



Source:  
IITM Pune  
Natcom

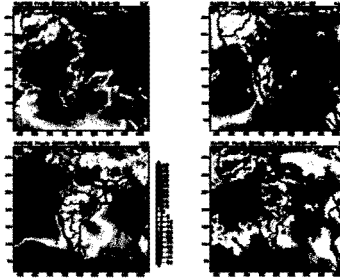
# UNCERTAINTY!

Projections of seasonal surface air temperature for the period 2041-60, based on the regional climate model HadRM2.



Source:  
IITM Pune  
Natcom

Projections of seasonal precipitation for the period 2041-60, based on the regional climate model HadRM2.

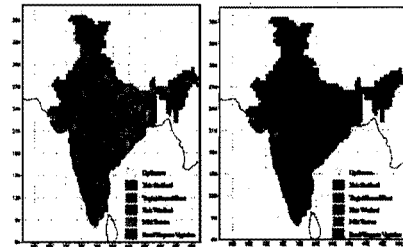


Source:  
IITM Pune  
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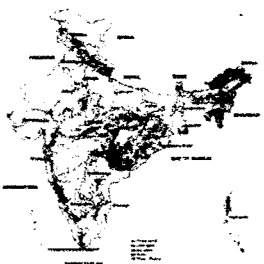
### SELECTION OF VEGETATION MODEL

- Equilibrium models: BIOME 3
- Dynamic model: HYBRID 4.2
- BIOME3 selected due to input data limitations for Dynamic Model

Vegetation map for year 2050, GHG run of HadRM2 considering all grids of India and potential vegetation



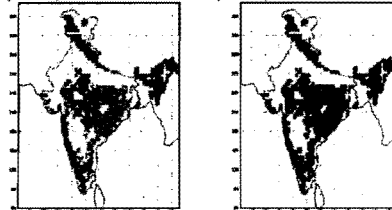
### Forest cover of India



Source:  
Forest Survey  
Of India

Vegetation map of India for 2050, including only grids that have forests

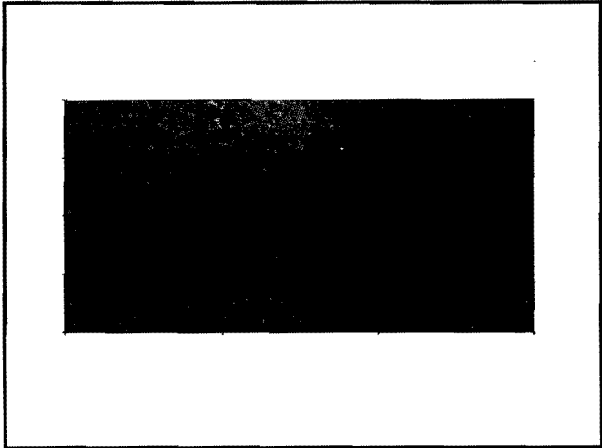
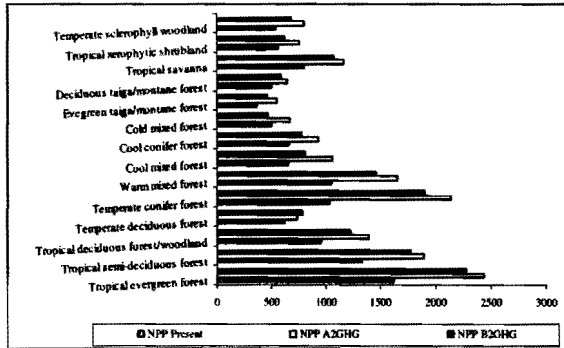
Vegetation map for the central run of HadRM2 Vegetation map for Year 2050, GHG run of HadRM2



Red Xeric shrubland; Purple Xeric woodland  
Yellow Dry savanna; Orange Moist savanna  
Green Seasonal tropical



Climate impacts on NPP: % Forest biome-RCM grids subjected to change in NPP under GHG scenario over the current scenario under B2 Scenario



### SUMMARY OF IMPACTS

Had RM3 Model outputs using SRES: A2 and B2 scenarios & BIOME3 show;

1. Over 85% of forest grids will undergo changes in forest type (similar trend using Had RM2)
2. Regional assessment shows;
  - Higher impact on Savanna biomes, Teak and Sal forests of central and east, temperate biomes of Himalayas
  - Lower impact on Western ghats and North-east; Evergreen biomes
3. Large increase in Net primary productivity
  - 70% (B2) to 100% (A2)

### IMPACTS ON BIODIVERSITY

- IPCC-TAR concluded; species composition and dominance could be altered due to climate change
- Shift in forest type (% of grids)
  - B2-Scenario = 85%; A2-Scenario = 90%
  - During the transient phase large-scale forest die-back likely
- Large-scale impact or loss of biodiversity likely

### POLICY IMPLICATION OF CLIMATE IMPACTS ON FORESTS

Why and need for adaptation

- Climate change could cause irreversible damage to unique forest ecosystems and biodiversity
- Inertia in climate and ecological systems
- Long gestation period in developing and implementing adaptation strategies

THUS NEED TO DEVELOP AND IMPLEMENT ADAPTATION STRATEGIES

Need for identifying forest management practices and forest policies which;

- enhance vulnerability of forest ecosystems
- reduce vulnerability of forest ecosystems

### STRATEGIES FOR FUTURE

CURRENT STATUS

- Large uncertainty in climate and vegetation response models;
- Inadequate or lack of data for the models
- Adaptation not incorporated in impact models



## What is Adaptation?

- *Adaptation* is adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.
- This term refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate.
- It involves adjustments to reduce the vulnerability of communities, regions, or activities to climatic change and variability.

## Types of Adaptation

- *Reactive and Anticipatory adaptation:*
  - Reactive adaptation refers to responses that institutions, individuals, plants and animal communities are likely to make after the impacts of climate change have been observed.
  - Anticipatory adaptation, unlike reactive responses, refers to the deliberate decisions made, based on foresight and planning, to prepare for the potential effects of climate change.
- *Autonomous adaptation;* is defined as “natural or spontaneous adjustments in the face of changing climate.” Planned adaptation, on the other hand, requires conscious intervention.

## Types of Adaptation

		Anticipatory	Reactive
Human Systems	Private	<ul style="list-style-type: none"> <li>• Purchase of insurance</li> <li>• Construction of house on stilts</li> <li>• Redesign of oil-rigs</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in farm practices</li> <li>• Changes in insurance premiums</li> <li>• Purchase of air-conditioning</li> </ul>
	Public	<ul style="list-style-type: none"> <li>• Early-warning systems</li> <li>• New building codes, design standards</li> <li>• Incentives for relocation</li> </ul>	<ul style="list-style-type: none"> <li>• Compensatory payments, subsidies</li> <li>• Enforcement of building codes</li> <li>• Beach nourishment</li> </ul>
Natural Systems		X	

## Why is Adaptation Necessary?

- Threat to unique ecosystems and biodiversity
- Aggregate impact on GDP or economy
- Distributional impact: Developing countries are more vulnerable to climate change than the industrialized countries
- Adaptation capacity is varied
- Extreme weather events: An increase in the frequency and intensity of extreme events would adversely affect all sectors and regions
- Long gestation periods for developing and implementing adaptation strategies
- Lack of awareness among different stakeholders
- Inertia in climate and ecological system
- Inertia in socio-economic systems

## Adaptation Options for Forestry Sector

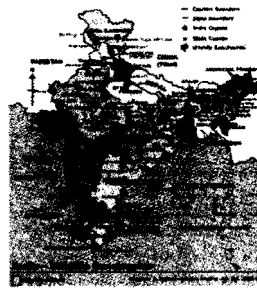
- Conserve forests by halting deforestation, leading to biodiversity conservation
- Expand Protected Areas
- Reduce and avoid forest fragmentation
- Promote mixed species forestry
- Undertake anticipatory planting
- Assist natural migration of wildlife between protected areas by linking them with corridors
- Assist natural migration through transplanting plant species
- Gene pool conservation through *in situ* and *ex situ* conservation.
- Silvicultural practices; sanitation harvest, shortening rotations and increased thinning.

## Forestry Sector Adaptation Strategies

- Characterized by long gestation periods
- Require long-term planning and implementation
- Adaptation to loss of some ecosystem services may be possible, especially in managed ecosystems.
  - Commercial forestry is adaptable, reflecting long-term management decisions under uncertainty
  - Adaptation is also possible in land use management (species selection, silvicultural practices) and product management (processing, marketing etc.).
- However, adaptation to losses in natural ecosystems and biodiversity may be difficult or impossible.

- Adaptation can significantly reduce adverse impacts of climate change.
- Adaptation is an important part of societal response to global climate change
- Planned, anticipatory adaptation has the potential to reduce vulnerability and realize opportunities associated with climate change effects and hazards.
- In the absence of planned adaptation, communities will adapt autonomously to changing climatic conditions, but not without costs and residual damages.

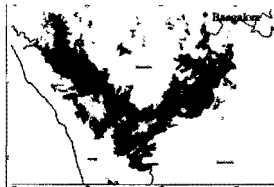
## Protected Area Network



- India has nearly 600 Protected Areas (National Parks/Sanctuaries)
- These perhaps offer the best insurance for adaptation to CC because diverse forests/ecosystems are more likely to have species that have climate tolerance
- Need to redesign Protected Areas taking into consideration possible changes in ecosystem structure and function as a result of future climate change

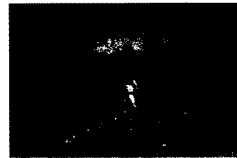
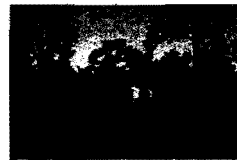
## Linking Protected Areas through Corridors

- Both plant and animal species need to adapt through migration along latitudinal and altitudinal gradients
- Habitat fragmentation would be a constraint to migration, especially in species with limited dispersal abilities
- "Corridors" across large landscapes are needed for effective dispersal and establishment of species



Corridors across the Nilgiri Elephant Landscape in S. India

## Plantations as win-win solution



- Anticipatory planting along latitudinal and altitudinal gradient using genetic stock from lower latitudes and elevation
- Promote mixed species forestry under afforestation programmes – at least some of these species are likely to survive climate change

## Forest Management measures

- Fire protection and management to cope with potentially higher fire incidence due to CC (warming and drought)
- Thinning and sanitation harvest in plantations to minimize the risk of pest and disease attack



## Priorities & Modalities for Climate Change Adaptation

Dr. Jyoti Parikh



Integrated Research and Action for Development,  
New Delhi  
10 January 2007  
Colombo, Srilanka

## Responding by Adaptation and Mitigation

- ✓ Adaptation can significantly reduce vulnerability to climate variability and change
- ✓ Adaptation to Climate Change is already taking place
- ✓ Adaptation measures can be no-regrets but may also entail significant costs.
- ✓ Capacity to adapt varies across regions, societies and gender and income groups.

## Adaptation at various levels

- ✓ Capacity building for global negotiations
- ✓ National preparation
- ✓ Local implementation

## Adaptation for Global Negotiations

- ✓ National level policy makers, experts
- ✓ Risk sharing
- ✓ CDM type mechanisms
- ✓ Sharing of knowledge
- ✓ Availability of funds

## National Preparations

- ✓ Identification of various ministries
- ✓ Merging with development priorities
- ✓ Co-ordination with existing policies, programs & projects

## Agriculture and Climate Change

### Indian Agriculture

- ◇ GDP from agriculture: 34% , 1994
- ◇ 42% , 1980
- ◇ Area under agriculture: 50% , 760 mha
- ◇ Dependent population: 70%
- ◇ Average farm size: 1 to 5 ha
- ◇ Landless dependent on others

Crop	Area & Irrg., mha	Prod., mt	Rs.	% of Agri. GDP
RICE	42, 20	73	365	22 %
WHEAT	24, 21	57	208	12.6 %

### **Indian Agriculture contd.**

- ♦ Pests and diseases always predominant
  - favourable weather in tropics
  - multiple cropping
  - availability of alternative hosts
  - low , but indiscriminate, usage of pesticides
- ♦ Disturbance days due to extreme events
  - 17 to 27 ; 10 days increase
- ♦ Rise in sea level can
  - inundate 1700 km<sup>2</sup> agricultural land
  - necessitate 4000 km of dykes and sea walls
  - submerge 576 km<sup>2</sup> total land & 4200 km of roads

### **Adaptation and Damages Vulnerability to**

- ♦ Pests and diseases always predominant
  - favourable weather in tropics
  - multiple cropping
  - availability of alternative hosts
  - low , but indiscriminate, usage of pesticides
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  - submerge 576 km<sup>2</sup> total land & 4200 km of roads

### **Local Level Implementation**

- ✓ Integrate climate concerns in overall development objectives of the community and also their agricultural practices, such that climate components will be built into already existing programs.
- ✓ Introduce concepts in the context of climate change and its implications on matters that are of direct concern to the stakeholders. Emphasis on issues prioritized by women, endorsing a gender sensitive approach.
- ✓ Identify and promote relevant traditional adaptation practices.

### **Local Level Implementation Contd..**

- ✓ Establish a continued partnership between the farming community the Regional Research Station and local governments at village, block and district level, for continued cooperation.
- ✓ Monitoring and evaluation to identify factors that impede effective adaptation and design assessment activities that would generate new knowledge to overcome the same.

### **Local Level Implementation Contd..**

- ✓ Disseminate project recommendations on possibilities to integrate adaptation practices and technologies in existing development policies through workshop/seminars.
- ✓ Project experiences to be used to develop useful materials such as policy briefs.

### **Main activities at community level**

- ✓ Assess the perceptions and available knowledge on climate change and its implications on agriculture and other allied agricultural activities.
- ✓ Identify and rank biophysical, social and technical problems faced by the community and rank the same in terms of its severity, as perceived by the community.

## Main activities at community level

Contd..

- ✓ Risk communication materials on climate change and vulnerability such as brochures and other printed and audio visual material to be developed after consultations with partners. Awareness and the need to adapt will be disseminated
- Risk communication material discussed presented by experts through community forums (meetings).
- Audio-visual presentations, television shows, films and so on on the need for risk adaptation.

## Farm level best Practices

- ✓ Select best practices with the help of the collaborating partners. The same shall be introduced through community meetings. Suggestions and proposals resulting from the discussions will be incorporated.
- Introduction of short duration drought tolerant varieties for major cereal crops.
- Soil water conservation and optimum utilisation through using efficient agro techniques. Such as soil mulching and deep ploughing before onset of rainy season for soil and water conservation.

## Farm level best Practices contd..

- Suitable agronomic practices for improving and stabilizing yields of different cropping crops, ie the use of vermicompost, optimum spacing, adjustment in sowing ad so on..
- Introduction of mixed cropping such as intercropping of pearl millet (major summer crop) with leguminous crops and practise of agri-horticulture system with local hardy fruit trees like Ber(*Ziziphus mauritiana*), Amla (*Emblica officinalis*).

## Follow up activities

- ✓ Capacity building programs for demonstrating the various techniques for climate change adaptation.
- Audio-visual presentations
- On field training and demonstration of suitable techniques by experts. Participatory research trials, field demonstrations and farmers meetings etc.

## Follow up activities contd..

- ✓ Organize focus groups to assess and identify limitations, if any, in implementing the selected adaptation strategies and identify ways to overcome the same.
- ✓ Impact assessment studies to understand project implications.
- ✓ Disseminate project recommendations on possibilities to integrate adaptation practices in current development policies and other useful material through workshop/seminars.

## Follow up activities contd..

- ✓ Disseminate successful practices to neighbouring villages through community meetings and experience sharing by the community members of the targeted region.

***THANK YOU!***



***BACK***

## Emerging Trends in Understanding and Enabling Adaptation to Climate change

10 January 2007

Prabhjot Sodhi, NC  
UNDP GEF Small Grants Program (SGP)  
INDIA, CEE Delhi

## SGP Project Experiences Focus

- SGP does address the direct CC mitigation strategies, involving communities
- Removing the cultural, institutional, technical and economic barriers to energy conservation and energy efficiency and
- Promote the adoption of renewable energy by optimizing implementation costs.
- Promoting sustainable transport systems.

## CC adaptation projects

- Based on scientific assessments to cover risks and direction
- Many Climate changes and issues are effecting
  - increase in frequency of rainfalls in some ares and decline in other
  - average temperature changes, increase in CO2 concentrations
  - India is among the 27 vulnerable countries in terms of coastal impacts

## Contd..

- Variety of physical systems are sensitive to climate change including water resources; agriculture ( especially food security) and forestry; coastal zones and marine systems; human settlements; energy and industry and human health..
- Currently majority of disasters are CC related and the studies show that this is on the increase both the intensity and frequency of extreme climate events will be more..

## Contd..

- We need to see and have the overall guiding framework which enables the integration of adaptation related activities in a more synchronized manner
- We need to see and document the adaptation related measures adopted and how are they being effective in which sectors, areas and how they are addressing vulnerabilities and livelihoods of communities

## Included in the country adaptation documents

- Framework strategy at the government levels on the CC adaptation
- We need to be strategic and with a long term focus in reducing risks
- Develop and identify the appropriate baselines
- Identify which ministries and areas of focus.. & Geographic.. Areas..
- Recognize the contribution of all stakeholders in implementing adaptation measures including local communities
- COP discussions on the implementation of the Special Climate Change Fund (SCCF) decisions

## Contd..

- The LDCF operational guidelines and the SCCF paper from GEF have made recognition for involvement of local communities in specific paragraphs. Thus again it is important that the role of communities is defined..
- Tools for assessing impacts on Adaptation during and after the interventions have been made. This is another area of interest to SGP, specifically for community-based adaptation (CBA) activities.

## Background

- Substantial iron ore deposit found in the belt of Keonjhar, Mayurbhanj, Sundargarh & Jajpur districts of Orissa
- There are 28 **Sponge Iron Units** in Orissa (at the starting of this project in 2002-2003) & now there are 64 operational unit in Orissa
- 300 Sponge Iron Units are there in India in the states of Jharkhand, Chhatisgarh, Andhra Pradesh, Maharashtra & Goa apart from Orissa.

## How project affects environment and society.

- It pollutes the atmosphere with high SPM (Solid Particulate matter) gaseous emission.
- Discharges solid waste like iron dust, coal dust and char in atmosphere.
- Affects near to the units agricultural land.
- Placidity of the rural environment is disturbed.
- Dumping of char on road side, mobility of heavy vehicles affect road conditions.
- Provokes the sentiment of the poor rural mass, creates ill-health.

*To address issues RAC under took a project with support of UNDP GEF*

## Project Objectives

- Create sensitivity for environmental protection and benefits.
- Enlighten rural mass for self protection against pollution and optimum utility of local resources for better livelihood.
- Bridge gaps between industry and community for harmonious inter-relationship.
- Establish a unit for producing smokeless briquettes, a fuel source, which utilizes char

## Rapport, trust building with Community

- Community orientation and motivational campaign
- Village school programme to encourage the children and motivate the parents



- \* Organize village health camps



## Building community confidence and trust in all social classes :

Orientating local farming community on seasonal land use pattern through agro based trainings and in-puts.



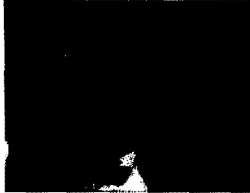
Facilitating water development Prog. for irrigation support.



- ❖ Establishing nursery for nurturing saplings for plantation (block Plantation in waste land & strip-plantation)

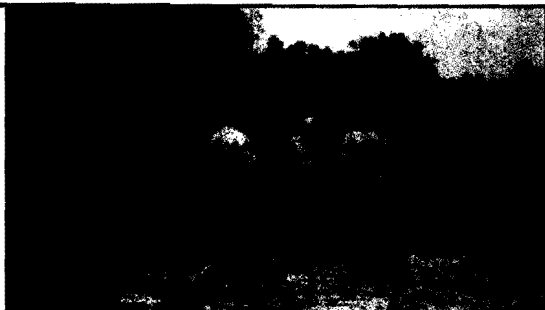


### Formation of women SHGs livelihoods



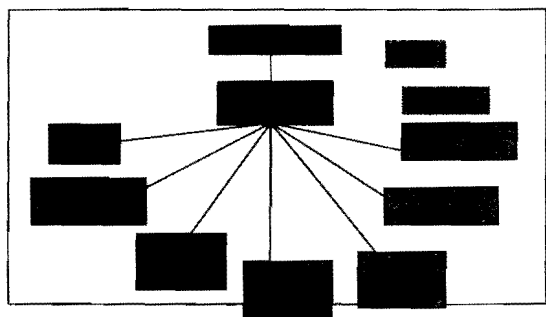
Tailoring, toy making, rural crafts – center for rural women.

### Ingredients for the Briquette production.

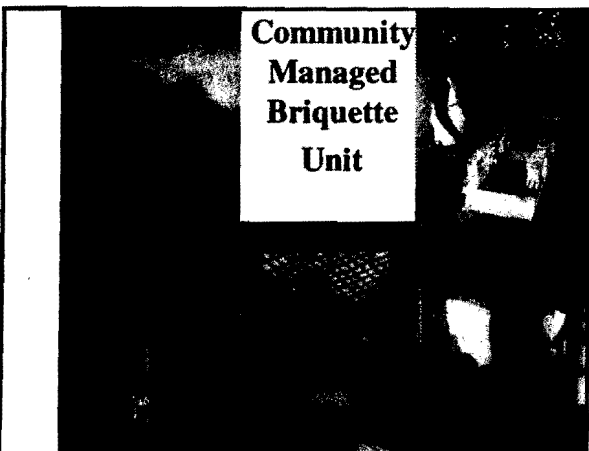


Agreement with the Sponge Iron Plant for the supply of Char (Industrial waste) Free of cost regularly, although in the costing of the product done and cost 75 paise per kg and sale at Rs 100 Paise and 150 paise per kg.

### Model of the Institutional process for the Management of the unit



### Community Managed Briquette Unit



### RESULTS from project...

- One women SHG developed; regular Savings, minutes of meetings recorded and nearly USD 330 savings. Linked to bank and a loan of USD 700 arranged
- Women SHG members were provided trainings in doll making; tailoring and around 20 women were trained. Also sale for more than 550 USD done by women in last 2 years.
- Two nos. of water pumps provided and installed. With 20 persons days as people's participation and cost sharing of Rs. USD 245
- One Youth Groups created and they planed to start poultry & diary through linkages with bank for 300 USD
- Institutional enterprise formed to manage the Briquette manufacturing unit

### RESULTS Contd...

- One nursery prepared with fruit bearing trees & trees for fodder & fuel wood. More than 5000 trees of 7 different species planted. Strip plantations of 2 kms
- The community planted 1500 trees in a block with co-financing arranged 300 USD
- Production of enhanced agriculture on 11 hectares wasteland. Double cropping as well as vegetable cultivation were introduced. Nearly annual benefit of 2500 USD shared between 85 HHs in 3 villages

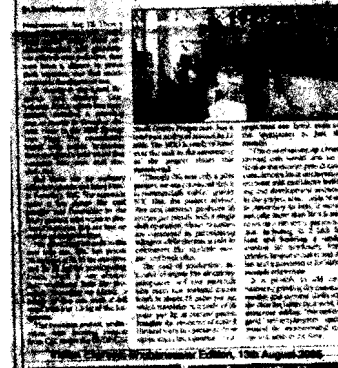
### RESULTS Contd...

- Total profit of nearly 6000 USD in one year to the enterprise working and meeting its costs.
- Alternate fuel wood of 2-3 kgs per day for more than 90 HHs for 330 cooking days saved.
- Nearly 9,000 kgs of carbon emissions checked as alternate fuel sources in one year.
- The unit is now coming to break even. This will be analyzed in the final evaluation.
- More than 35% of the households in three project villages are using this briquettes and around 50% of production of briquette are sold to outsiders.

### RESULTS Contd...

- The unit established with co financing of 2500 USD from industry; labor communities labour USD 400 . Land local co financing by community USD 3000.
- The unit produces 50 tons briquette per month. The rate for villagers is ½ USD for 20 kgs and outsiders is 2/3 USD for 20 kgs.
- 1.5 to 2 kg of briquettes cooks for a family of four persons a day.

### 'Fuelling' sponge iron waste, the RAC way



### IMPACTS..

- Locals capacities created to manage potential for income generation for livelihoods.
- Minimizing the environmental pollution.
- Alternate fuel reducing drudgery on women, saving time from fuel wood collection, better health through less of emissions in house holds
- Local Sponge Iron (SI) unit having better productivity in the plant and harmonious relations with the communities
- Local govts and other 20 SI Units keen to replicate the program into other areas and Local govts and SI units ready to share more than 60% costs in the scaling up

### The production of briquette (monthwise) depicted in Diagram

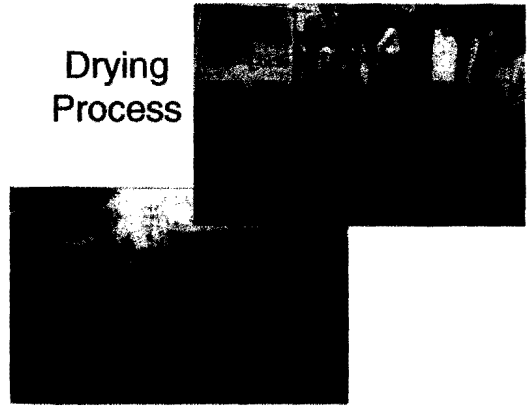


**COMPARATIVE ANALYSIS OF FUEL WOOD  
VIS-A- VIS BRIQUETTE**

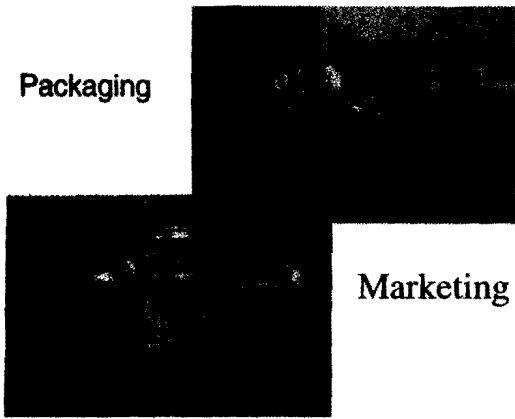
<b>Fuel wood Consumption</b>	(10kg/HH) (Rs. 18.66)	300kg/HH (Rs. 500)	3600kg/HH (Rs. 6000)
<b>Briquette consumption</b>	4 Kg/HH (Rs. 5)	120 Kg/HH (Rs. 150)	1440 kg/HH (Rs. 1800)

**Briquette consumption protects the biodiversity.** The consumption of fuel wood is 6 trees/year per HH. So for the project area of 306 HH the tree preservation ratio is  $306 \times 6 = 1836$  trees.

Drying  
Process



Packaging



Marketing

Cheers !!! We will get it..

> Thank You.....for the  
learning opportunity

## Nepal & Adaptation to CC

**B. R. Manandhar**  
Environmental Engineer

Ministry of Environment, Science and Technology  
Government of Nepal

## UNFCCC

- Adoption of the Convention: 9 May 1992
- Nepal's Signature: 12 June 1992
- Nepal's Ratification: 2 May 1994
- Entry into force: 21 March 1994 (global level)
- Entered into force in Nepal: 31 July 1994
- First Initial National Communication (INC) Report prepared with GEF/UNEP assistance: July 2004

## Kyoto Protocol

- Entry into force (global): 16 February 2005
- Deposition of instrument of Accession: 16 September 2005
- Entry into force in Nepal: 14 December 2005

## Clean Development Mechanism

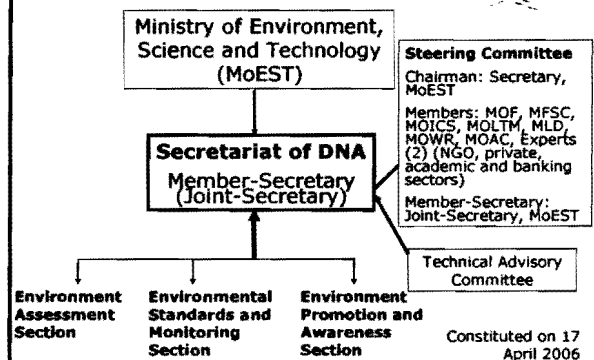
- Ministry of Environment, Science and Technology (MoEST) designated as DNA: 22 December 2005
- 11 Member Steering Committee - 17 April 2006 for DNA activities
- MoEST-WB joint organization of a seminar on Capacity Building Needs for CDM: 1 August '06

## Policy Focus

### Tenth Plan (2002-'07)

- Carbon trade for resource management and for poverty reduction
- Promotion of the use of environment-friendly technologies, cleaner production, energy efficiency, clean energy, and alternative energy
- Implementation of multilateral environmental agreements (MEA's) including UNFCCC

## Structure of DNA



### Nepal's Perspective of Needs for Adaptation to CC Impacts

- The global impacts of CC are real and now even more evident on many fronts of our lives
- Nepal and other south Asian nations are more at the receiving end of the CC impacts

### Nepal's Perspective of Needs for Adaptation to CC Impacts

- Need for our efforts towards adaptation to the CC impacts is more urgent and important to us
- Need for exploring possibilities of co-operation among SA nations to create synergy from individual adaptation efforts

### Nepal's Perspective of Needs for Adaptation to CC Impacts

- Current provisions for funds/mechanisms for adaptation to be made more effective and secured for LDC's like Nepal
- Need to pay serious attention to the ecological fragility and vulnerability of mountainous nations like Nepal

### Potential CC Impacts

- Shrinking of glaciers in last two decades
  - Major river systems are of glacial origin
  - GLOF with frequent floods downstream
  - GLOF catastrophic to human lives and valuable infrastructures

### Potential CC Impacts

- Deficient rain/quicker return of extreme climatic events
  - Monsoon driven agro-based economy
  - Major challenge to livelihood of people
- Pest and disease outbreaks in the *terai* region
  - Changing niches and up-migration of disease vectors: new challenges for public health
- Loss of bio-diversity

### Prospective Actions of Adaptation

To be planned and designed to effectively/efficiently deal with the potential impacts

*Thank You!!*

## THE URGENT NEED TO SUPPORT ADAPTATION

Prof. Sarath Wimalabandara Kotagama

## Adaptation...

The ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to **take advantage of opportunities**, or to cope with consequences.

IPCC 2001

## The “conventional” view of adaptation

- Adaptation to CC is an additional cost to developing countries and thus should be funded by those responsible
- There is a high degree of uncertainty in climate projections
- Form collaborative links with international organisations
- Improve our projections of climate change
- Identify hot spots
- Understand traditional coping strategies
- Build capacity in all sectors
- Mainstream adaptation into the development process

## Current Adaptation Projects Usual Outcome

- **Assess literature**
- **Assess current and future vulnerability**
- **Increase local forecasting capacity (downscaling)**
- **Assess institutional structures**
- Develop adaptation options
  - Costing and prioritizing
  - Implement priorities
  - Monitor and assess outcomes
  - Compare lessons learnt

## A restated message

Based on these major points

- Urgency - climate change is occurring now
- Climate variability and change is currently a threat to development.
- Start by dealing with capacity to cope with current climate variability
- We know enough about the nature of climate change to take sensible decisions about adaptation now
- Can we assess (do we need to) the costs of adaptation?

## We can act now

- o We will never be able to predict climate with the precision that we would like
- o But, we already know enough about the core climate trends to make sensible decisions about adaptive measures
- o Most actions have to start with current coping (in)capacities with current climate variability

## Impacts in Asia...

## Agriculture and Food security

Food insecurity to be the primary concern for Asia.

- Crop production and aquaculture would be threatened by thermal and water stresses,
- Sea level rise
- Increased flooding, and
- Strong winds associated with intense tropical cyclones

## Agriculture and Food security....

- Asia dominates world aquaculture, producing 80% of all farmed fish, shrimp and shellfish.
- Many wild stocks are under stress as a result of overexploitation, trawling on sea-bottom habitats, coastal development, and pollution from land-based activities.

## Ecosystems and Biodiversity

- Climate change would exacerbate current threats to biodiversity resulting from land-use/cover changes and population pressure.
- Permafrost degradation resulting from global warming would increase the vulnerability of many climate-dependent sectors affecting the economy in boreal Asia.
- Frequency of forest fires is expected to increase in boreal Asia.

## Water Resources

- Freshwater availability is expected to be highly vulnerable to anticipated climate change.

## Extreme weather events

- Tropical Asia is already quite vulnerable to extreme climate events such as typhoons/cyclones, droughts, and floods. Climate change and variability would exacerbate these vulnerabilities.
- Increase flood prone areas
- Potential for drier conditions in arid and semi-arid Asia during summer.



## Deltas and Coastal Zones

- The large deltas and low-lying coastal areas of Asia would be inundated by sea-level rise

## Human Health

- Warmer and wetter conditions would increase the potential for higher incidence of heat-related and infectious diseases

## Adaptive capacity..

Depends very much on the affordability of adaptive measures, access to technology, and biophysical constraints such as land and water resource availability, soil characteristics, genetic diversity for crop breeding and topography.

## Our problem however is...

- Increasing population, spread of urbanization, lack of adequate water resources, and environmental pollution, which hinder socio-economic activities.

## What are the options....

**RAPID DEVELOPMENT** – a macro strategy to increase income levels, education, and technical skills etc...

**MODIFYING THE MANGEMENT OF SECTORS THAT ARE MOST SENSITIVE TO CC.**

## Pressing priorities for research to ensure poor communities are able to adapt to climate change

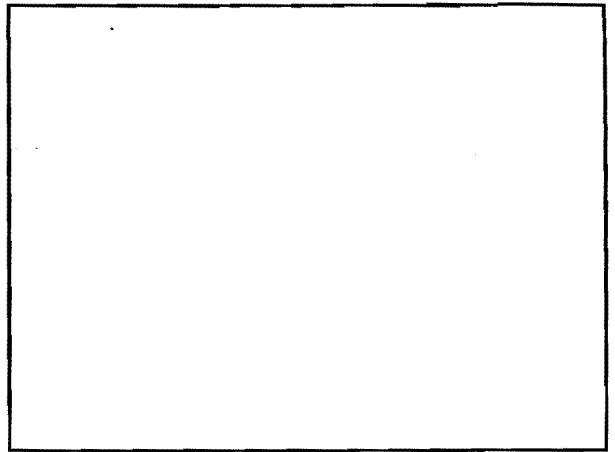
- Traditional/indigenous knowledge –communities' skills in production and ways of identifying or assessing an impending disaster/risk & how they dealt with such problems (ref. flooding, pro-longed drought, famine etc.);
- Desk research on existing best case scenarios where climate change adaptation and disaster risk management have been successfully linked to ensure sustainable poverty reduction;

## Pressing priorities for research to ensure poor communities ....(2)

- Research into alternative livelihoods for the RURAL communities;
- Research into technologies that are gender friendly taking into account women's priorities and constraints;
- GMOs & potential contribution to climate change;
- Ways of improving accuracy of data and information derived from the Meteorological Depts and utilization of the same;

What researchers must do to ensure communities are involved in, and benefit from research on adaptation!

- Action research through use of participatory tools such as:
  - Participatory Vulnerability Assessment (PVAs),
  - PRA & RMA tools (non-exhaustive)
- Embrace a bottom-up approach and work with the existing grass-root structures (depending on the nature of the problem);
- involve and empower particularly the weakest & most vulnerable members of the community (e.g. women) to participate;
- Come up with resolutions that promote use and application of locally available resources



Draft

Road map –  
 Improving preparedness of the region  
 To assess and devise appropriate interventions  
 To address challenges in “adaptation to climate change”

- Guiding principles
  - Logical framework of action
    - Based on salient highlights which emerged through deliberations today on issues and opportunities relating to
      - science,
      - management including institutional mechanisms, regulatory frameworks, fiscal opportunities and
      - implementation of interventions
- 

## Guiding principles

- The action plan should be based on the highlights relating to the above stated
  - Suggest
    1. Preparatory – phase
    2. Delivery – phase activities
      - Avoid duplication of efforts
      - Involve locally relevant and established systems of expertise / facilities / practices to strengthen local – relevance and acceptance to ensure that it is an inclusive process and not exclusive.
- 

## Logical framework of action

- Goals, approaches, tools and techniques could be system – specific
- Indicators need to be agreed upon with respect to each of the interventions to help assessments and devise mid – course corrections / augmentation as needed.
  - Typology of interventions, therefore includes
    - Assessments of
      - information needs of all concerned stake holders
      - gaps in existing body of information
      - infrastructure for collection, expertise for interpretation
      - appropriateness of interventions
    - Technical capacity building of stakeholders
    - Generating and sustaining funding
    - Establishment of pilots
    - Up-scaling and location – specific adaptation

Some salient highlights through today's deliberations with respect to the typology

1. Tools and techniques for assessments, interpreting and developing interventions are not adequate
2. Infrastructure needs and practices could vary across regions even within a country
3. Has the role of communities been recognized and integrated in models of management?
4. Significant gaps between what scientists think and the way policy makers function. Need to bridge this gap.
5. Bring adaptation to center stage ( Dr Boaz)
6. Highlight climate politics
7. Data is imperfect
8. Generate and strengthen capacities to cope
9. Use the AIM
10. Involve private sector and government in deliberations
11. Focus on agriculture, water resources, community health
12. Important vulnerability characteristics / quantification is critical
13. Tap leap – frog opportunities
14. Take people's perceptions and knowledge on board
15. Strengthen community roles
16. Share knowledge and information across the region on assessments (Dr Munasinghe)
17. Need four task force on
  - a. land management,
  - b. agriculture
  - c. glacier – melting
  - d. disaster mitigation
    - i. help develop clearly defined and well- guided projects
    - ii. build capacities for global negotiations, assessing national priorities and community action
18. Risk sharing between perpetrators of challenges and suffering sectors is essential
19. Establish a 'funding mechanism" similar to CDM (/ MLF etc)
20. Involve multiple – ministries
21. Pest / diseases dynamics
22. Promote relevant traditional practices
23. Macro – integration of information needed to assess adaptation needs in agriculture
24. Do we know enough to re-define physical boundaries and hence ecological characteristics
25. Can CDM encourage emission – reduction based adaptation measures?
26. What are the other opportunities to twin mitigation and adaptation?
27. Superimpose policy and institutional imperatives on the AIM.
28. Develop policy briefs
  - a. Assess existing systems
  - b. Identify and rank problems
  - c. EIA integration is essential(Dr Jyoti Parikh)
29. Nepal Government is playing an interesting role integrating these concerns
30. Are uncertainties related to baselines or models which depend on them?
31. Focus on fragile and vulnerable systems
32. Early stages of NAPA and need more strengthening

33. The GLOF and terai-climate variations are critical issues. (Mr.Manadhar)
34. Adaptation is important due to the close and real – life link with sustenance of communities vi-a-vis forest systems
35. Uncertainties are large in diversity and scale with respect to the quality and quantity of information available for assessments and guiding adaptation
36. Prevent habitat fragmentation
37. Focus on tackling fire – related disasters in forests
38. Strengthen south- south cooperation (Dr Sukumar)
39. How to integrate climate change concerns with community preparedness in management of forest resources? (SDPI)
40. Sri Lanka is integrating the business opportunities of mitigation in all developmental planning ( Dr Anura)
41. Chemical ecological bases of species interactions are critical to guide (Gopi)
42. Community participation is critical for success; several lessons learnt from the UNDP – GEF SGP experience will be useful pointers for developing an integrated approach. The SGP can also become a lever in initiating and sustaining local interventions (Sodhi & Shireen)

- Preparatory phase

- Form task forces in areas stated
  - Involve in short term, medium term and long term activities
    - Policy briefs
    - Guide development of framework of action on assessments, preventive action, adaptation interventions etc
    - Join hands in developing proposals on
      - Reality checks
      - Capacity building
      - Establish pilots
      - Upscale some
  - Start immediate action by coming together, coordination

- Delivery phase

- Develop proposals and
- Engage in parallel capacity building
- Establish pilots
- Upscale
  - Focusing on
    - Funding options
    - Agriculture
    - Pest dynamics
    - Water
    - Forestry
    - Bio – diversity conservation
    - Community role
    - Land resources
    - Disaster mitigation

Stock taking to guiding action

Climate Change

Climate Change

Climate Change

Climate Change

Climate Change

Climate Change

Climate Change

Climate Change

Climate Change