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Regional Training Manual on Disaster Risk Reduction for **Coastal Zone Managers**

with financial and technical contributions from

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Acknowledgement

Regional Training Manual on 'Disaster Risk Reduction for Coastal Zone Managers' is developed by the Asian Disaster Preparedness Center (ADPC) with technical and financial support from United Nations Environment Program (UNEP), United Nations International Strategy for Disaster Reduction (UN/ISDR) and European Commission AIDCO Programme.

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The team expresses sincere gratitude to the individual and institutional reviewers for their input, which has informed this final version of the Manual. The reviewers include Mr. Anil Premaratne from Coast Conservation Department, Government of Sri Lanka, Dr. Shailaja Ravindranath and Dr. Shirji Kurup from CEE, India, Dr. Sudipyakto from University of Gaja Madah, Indonesia and the experts from the national review committee in each of the partner countries. The Manual also greatly benefited from the inputs and feedback received from the participants at the Regional Training Course organized by Mangroves for Future (MFF) in Semarang, Indonesia in October 2008 and the participants at the Learning Opportunity on Ecosystem Services, Disaster Risk Reduction and Coastal Community Resilience organized by UNEP, UN/ISDR and ADPC at the IUCN World Congress in Barcelona in October 2008.

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The team expresses sincere acknowledgement to the European Commission AIDCO Programme for the financial support in developing this important Regional Training Manual which is believed would be of great importance in building the capacity for reducing risk from natural hazards in coastal areas of Asia.

This Manual is developed by Loy Rego, Arghya Sinha Roy and Peter Roberts from ADPC. Support was provided by Mr. Lowil Fred Espada for design.

Introducing the Regional Training Manual on Disaster Risk Reduction for Coastal Zone Managers

Background

Asia is one of the region hardest hit by natural hazards and in which the vast populations settled in both urban and rural coastal areas are particularly vulnerable. Global climate change is expected to increase the frequency and intensity of climate related hazards (IPCC Fourth Assessment Report, 2007). Early warning systems and preparedness plans are necessary but are, in themselves, insufficient to reduce risk– additional measures must be taken to address underlying vulnerabilities. Healthy ecosystems play a vital role in this regard.

Coastal ecosystems and associated watersheds provide a wide range of services to coastal communities, including food provision, natural shoreline protection against storms and floods and flood regulation among others. These services are fundamental to building community resilience to coastal hazards, yet they are under threat from a variety of sources.

Thus protecting coastal ecosystems and reducing disaster risk in coastal communities requires the active participation of a broad cross section of stakeholders – the engagement of coastal zone managers and allied environmental professionals is essential for success.

The United Nations Environment Program (UNEP) through financial support from the United Nations International Strategy for Disaster Reduction (UNISDR) and European Commission AIDCO programme has undertaken to build disaster risk reduction (DRR) capacities of coastal zone managers. The project works with stakeholders at regional and national level (India, Indonesia Sri Lanka and Maldives) and links to the Mangrove for Future (MFF), a multi-agency, multi-country initiative which works for 'healthy, prosperous and secure future for all coastal populations in Indian Ocean countries, where ecosystems are conserved and managed sustainably'.

This manual has been prepared by the Asian Disaster Preparedness Center (ADPC) in partnership with UNEP and through close consultation with the national partners in the project countries and basing on the national training courses developed in the framework of the same project. This regional manual aims at building capacity of coastal zone managers to design and implement coastal development projects that enhance protection of lives and livelihoods while improving environmental quality and protecting ecosystem services.

Objectives of the Training Course

This Training Manual on 'Disaster Risk Reduction for Coastal Zone Managers' is for use in regional training course on DRR for Coastal Zone Managers, aimed at building the capacity of government officials, NGOs, academia and other entities responsible for developing and implementing coastal zone management (CZM) programs/projects by introducing the issues and opportunities for integrating DRR into CZM projects. The knowledge shared through this training will help the participants in developing projects and regulations on coastal areas that incorporate DRR concerns and measures – but will not turn coastal managers into DRR experts.

At the same time the course also aims at enhancing the awareness of DRR practitioners on the role healthy coastal ecosystems can play in disaster mitigation and prevention, emphasising the importance of adopting integrated coastal development planning (a combination of structural and non structural measures) for reducing risk,

At the end of the Training Course it is expected that the participants would be able to:

1. Identify risks from natural hazards which impact CZM projects and also improper coastal development processes which might lead to accumulation of risk in coastal areas;

2. Understand the conceptual framework of risk reduction;
3. Recognize various measures; structural and non structural, for risk reduction in coastal areas;
4. Apply the theory and use practical tools in integrating DRR in CZM plans and programmes; and
5. Develop a list of actions which they can undertake in their daily work programme in order to reduce the risk in coastal areas.

Content of the Regional Training Course

The course is structured in eight (8) modules. Hereunder is a brief description on each of the module.

Module 1: Introduction to the Course

The course would start with an introductory session, which would establish the importance of the course for the participants and the skills, technique and knowledge they would acquire at the end of the course. The rationale would be established through citing the impacts of natural hazards on coastal development projects as well as how improper planning and implementation of these projects could lead to increase in risk from natural hazards.

Module 2: Knowing the coast better with a DRR perspective

This module would explore the two sides namely importance of coastal development and the resources coastal ecosystem provides and at the same time the type of risk coastal areas face; risk arising from a combination of natural and human induced hazards and factors contributing to climate change (CC), clubbed with physical, social and economical vulnerabilities and limited capacity.

Module 3: Introducing DRR and its linkages with Climate Change Adaptation

This module would introduce the terminologies, concepts and framework for DRR by explaining the Hyogo Framework for Action (HFA) and its Five Priorities for Action. For each of the priorities, concepts would be explained through examples from coastal environment; systems, stakeholders and concerns. Linkages between Climate Change Adaptation (CCA) and DRR would be highlighted.

Module 4: Assessing the Coastal Risk from natural hazards

Undertaking risk assessment in itself is a complex exercise and needs to be carried out at various levels. This forms the first step if DRR needs to be integrated in coastal development programs and projects. While there are tools and techniques available, they need to be adapted in the context of coastal areas, data availability and capacity etc. Thus this Module would introduce the available tools for undertaking risk assessment and highlight the type of information required.

Module 5: Measures for DRR in Coastal area

This Module would introduce the various measures that could be adopted to reduce risk in coastal areas; structural man made, structural ecosystem based and non structural measures and how to link all these in an integrated manner.

Module 6: Understanding the ground realities: Field Exercise

This Module would give a flavour of the ground realities to the participants by undertaking a field visit to a coastal area affected by natural or human induced hazard, interaction with communities living in the area to understand their perception of risk and discussions with local agencies on existing systems and plans.

Module 7: Integrating DRR in CZM; from Policy to Action

Through examples and case studies, this Module would help identify entry points for integrating DRR in CZM policies, plans, programs and projects, thus aiming at influencing the way coastal development projects are planned, designed and implemented with a strong component on disaster resilient development.

Module 8: Taking it back home; where to start from

Through this Module, participants would be able to draw up a list of actions which should be undertaken in their respective organizations to make sure the initiatives they undertake in coastal areas are disaster resilient and do not add to the risk. Some of these actions the participants could directly initiate on their return, where as for some they could only advocate for and raise awareness among their peers.

Course Schedule

Day	Module/Session	Duration
Day 1	Module 1: Introduction to the Course	
	Session 1.1: Knowing the Participants	30 minutes
	Session 1.2: Expectation Setting	30 minutes
	Session 1.3: Why this course? Impact of disasters on coastal development	60 minutes
	Session 1.4: Looking at the skills and building on them	45 minutes
	Module 2: Knowing the coast better with a DRR perspective	
	Session 2.1: Importance of CZM (Optional)	45 minutes
	Session 2.2: Understanding coastal ecosystem services	60 minutes
	Session 2.3: Valuation for ecosystem services (Optional)	60 minutes
Day 2	Module 2: Continued	
	Session 2.4: Understanding the coastal hazards	45 minutes
	Session 2.5: Recognizing the coastal vulnerabilities	60 minutes
	Session 2.6: Introduction to coastal climate change	60 minutes
	Session 2.7: Knowing the coastal risk	45 minutes
	Session 2.8: Stakeholders involved in coastal development	60 minutes
	Guest Speaker/Documentary screening (Optional)	
	Module 3: Introducing DRR and its linkages to Climate Change Adaptation	
	Session 3.1: Understanding the Terminologies related to DRR	60 minutes
	Session 3.2: Framework for Disaster Risk Reduction	60 minutes
	Session 3.3: Linking DRR and CCA	60 minutes

Day	Module/Session	Duration
Day 3	Module 4: Assessing the Coastal Risk from Natural Hazards	
	Session 4.1: Undertaking Risk Assessments in Coastal Areas	60 minutes
	Session 4.2: Community based coastal risk assessment (Optional)	45 minutes
	Session 4.3: Risk Assessment- Hands on	180 minutes
	Session 4.4: Rapid Environmental Assessment in post disaster situation (Optional)	60 minutes

Day	Module/Session	Duration
Day 4	Module 5: Measures for DRR in coastal areas	
	Session 5.1: Structural measures- Man-made	60 minutes
	Session 5.2: Structural measures -Ecosystem based	75 minutes
	Session 5.3: Non structural measures	45 minutes
	Session 5.4: Integrated planning for coastal zone management with DRR considerations	60 minutes
	Guest Speaker/Documentary screening (Optional)	
Day 5 and 6	Module 6: Field Exercise	
	Session 6.1: Field Work on Risk Assessment (Optional)	2 days
Day 7	Module: 7: Integrating DRR in CZM; Linking Policy to Action	
	Session 7.1: Integrating DRR into National Coastal Zone Policy and Plans (Optional)	30 minutes
	Session 7.2: Integrating DRR into Coastal Development Programs and Projects	30 minutes
	Session 7.3: Integrating DRR into Community development projects in Coastal Areas (Optional)	30 minutes
	Session 7.4: Putting learning's from the field into programs	120 minutes
	Session 7.4: Integrating coastal ecosystem based measures in post disaster recovery (Optional)	45 minutes
	Module 8: Taking it back home; where to start from	
	Session 8.1: Defining next steps; formulating actions	120 minutes
	Session 8.2: Course Evaluation	60 minutes

Course Participants

The course is developed specifically for practitioners from the following agencies/ background:

- Government agencies at national and sub-national levels working in the field of CZM
- National research and technical institutes/universities involved in CZM
- NGOs/other agencies working in coastal areas on development projects
- Government agencies, national research & technical institutes, NGOs working in DRR

This course will be helpful for practitioners who are involved in:

- Developing and implementing CZM plans and projects
- Undertaking research in coastal areas, and the results of which influence coastal area development
- Implementing community development projects in coastal areas
- Implementing DRR activities in coastal areas

Proposed profile of trainers

It is proposed that the training be delivered by a range of trainers drawn from various partner agencies with respective expertise on DRR, ecosystem and environmental management and CZM and working closely with Governments at national and sub national levels in various countries in Asia. It is proposed to draw the pool of trainers with experience in delivering training along with involvement in programmes and projects on DRR and CZM.

Usage of this Training Manual

This manual is developed aimed at conducting training at a regional level on the 'Disaster Risk Reduction for Coastal Zone Managers'. It is intended to act primarily as a participant's handbook during the delivery of the training course, as a companion document to the power point presentations and compilation of reading material for each of the training session, both of which are provided in the accompanying CD.

In addition, though it also provides suggested approaches for delivery of each session under the course and thus covering some elements of a facilitator's guide, its objective is not to act as a manual for Training of Trainers.

It is believed that the participants attending the training course would find this manual handy in terms of getting introduced to key concepts for each of the session, reinforced with case studies from the region.

Apart from the Introduction, the Manual is structured into three (3) Sections:

- Section 1: Training Modules
- Section 2: Terminologies
- Section 3: References and Reading Materials

A brief description on each of the Section is provided below:

Section 1; Training Module: This section forms the main body of the manual. In this section, each of the session under the eight (8) training modules are detailed out in terms of Session Objectives, Key Terminologies, Key Concepts and References. The section on Key Concepts forms the base of the session and attempts to summarize the information which would be delivered by the trainer in the session. It is to be noted; the concepts are explained within the boundary of this training course and do not attempt to provide a comprehensive explanation on the said subject as a whole. In this context, it is to be emphasized that the content of the sessions are largely adopted from the National Training Courses being developed under this initiative in India, Indonesia and Sri Lanka and from existing literature and studies, and is aimed to be used for purely educational purposes.

In addition, wherever applicable Case Studies are provided to elaborate the key concepts which the session aims to convey to the participants. An attempt has been made to capture case studies from countries in the region for the sake of familiarity of the participants who are expected to be from the Asian region.

Statistics and information to substantiate the argument/message being conveyed through the session are presented (wherever applicable) under the heading of Quick Facts.

Session Delivery; as explained earlier, though the purpose of this manual is not to act as a facilitator's guide, it does provide possible approaches for delivering each of the session. The suggested approaches are primarily of two types; power point presentations and group exercise. The power point presentations for each of the session is not included in the printed version of the manual and provided in the accompanying CD. The suggested group exercises are provided under this section of the manual. However, it is to be noted that the approach provided in this manual for delivery of each session is a suggested approach and would need to be adapted by the session facilitator according to her/his need and the profile of the actual participants.

Both DRR and CZM being subjects encompassing a broad range of stakeholders and requiring a cross sectoral approach, it is highly recommended that wherever possible external resource persons should be invited from national stakeholders and partner agencies for delivering respective sessions. Considering the vast experiences of the external resources persons, it is believed their involvement in the training course would help in making the delivery richer and also in subsequent revisions of the course materials. In such cases where external resources persons would be engaged in delivering a particular session, the proposed content of this manual corresponding to the session should be provided to the external resource person as suggested content outline and the final content should be left to the resource person for detailing.

Section 2; Terminologies: Though each of the session described under Section 1 of this manual provides definitions of key terms which are being discussed in the particular session, this section would provide a detailed glossary of terms on the broader subject of DRR, CC and CZM.

Section 3; References and Reading Materials: Though the key concepts under each of the session (in Section 1) attempts to provide a brief summary on the content of the session, this Section attempts to provide a compilation of 3 to 5 documents relevant to the module which would provide the participant with a better understanding of the module. The documents compiled range from theory, research, case studies etc. In some cases they are relevant abstract from larger documents with the reference of the original document provided. The purpose of the compilation is purely educational. Due to large volume, the compilation is not provided in the printed version of this manual but included in the accompanying CD. However, the complete list of reading materials is provided in the printed version of the manual for easy reference.

Training Modules

Module 1
Introduction to the Course

Modular Learning Objectives

At the end of the Module the participants would be able to:

- Know each other and the resource persons better;
- List out their expectations from this training course;
- Understand the importance of this course and how it would help in their daily work area; and
- Discuss the skills required for developing and implementing disaster resilient CZM programs/projects

Sessions

This Module would consist of four (4) sessions as follows:

Session 1.1. Knowing the Participants
Session 1.2 Expectation Setting
Session 1.3 Why this course? Impact of disasters on coastal development
Session 1.4 Looking at the skills and building on them

Session_1.1 Knowing the Participants

Session Learning Objectives

At the end of the session the participants would be able to know each other better and the training resource team.

Session Duration

Exercise: 30 minutes
Total: 30 minutes

Session Delivery

This session would be delivered through an exercise involving each of the participants.

Materials Required: Paper, markers, masking tape
Instructions:

- Provide each participant with a piece of paper and a marker and ask them to write their names on the top and to finish the statement, "I am...," using six different endings.
- Ask the participants to attach their papers to their chests with masking tape and then walk around the room and read each other's statements.
- Suggest that people spend at least thirty seconds talking with one another.
- When the exercise has been completed, the "I am" sheets can be taped to the wall as a "Group Gallery". If you have photos of participants these can also be added.

Session_1.2 Expectation Setting

Session Learning Objectives

At the end of the session the participants would be able to list out their expectations from this training course

Session Duration

Exercise: 30 minutes
Total: 30 minutes

Session Delivery

This session would be delivered through an exercise involving each of the participants.

Materials required: Coloured card papers, Tapes, Board
Instructions:

- Provide each participant with 3 pieces of coloured card paper and request to write their expectation from the Training Course.
- Give around 10 minutes to the participants to write the expectations, after which each participant is requested to read out the expectations which are to be grouped by the facilitator under specific categories such as 'To learn tools and techniques', 'Approaches', 'Learn from examples' etc.
- After all the expectations are grouped, it is the task of the facilitator to summarise the expectations.
- The idea is to keep the expectation put up in a board on one side of the room and to revisit them during the last day of the course in order to understand how much of it has been met by the course.

Session_1.3 Why this course? Impacts of disasters on coastal development

Session Learning Objectives

At the end of the session the participants would be able to understand the importance of this course and how it would help in their daily work area

Session Duration

Power point Presentation: 45 minutes
Discussion: 15 minutes
Total: 60 minutes

Key Concepts

This session would cover the following key concepts:

1. More than half of the world's population lives within 100 km of the shore-line – a figure which could rise to three quarters by the year 2020.
2. In addition, in island and archipelagic nations, national economies and people's livelihoods are inextricably linked with the coasts and the seas. In these countries, the vast living and non-living resources available in the coastal seas provide the primary resources necessary for industrial development within the coastal lowlands.
3. Coastal areas also provide a variety of services, as a result of the processes that occur in the various coastal systems. Examples include shoreline protection, the maintenance of marine biodiversity and water quality, as well as opportunities for transportation, recreation and tourism.
4. Coastal areas are also the preferred sites for urbanization with population density in urbanized coastal cities being among the highest in the world.
5. Coasts are major social and economic development zones that contribute significantly to national economies. In fact, a large part of the gross domestic product (GDP) of the coastal nations is derived from coastal and maritime industries. In some coastal nations, coastal and marine environments contribute an estimated 20 to 60 percent of the GDP.

6. However, the coastal areas are frequently impacted by natural hazards such as cyclones, floods, storm surges and tsunamis. For example the coastal plains of the Philippines, Vietnam and Japan face tropical cyclone every year. Similarly, during La Nina episodes, the frequency and fury of typhoons are heightened, accompanied by devastating floods. The Orissa Super Cyclone in India, 1999, Indian Ocean Tsunami of 2004, Cyclone Sidr in Bangladesh, 2007 and the Cyclone Nargis in Myanmar, 2008; highlights the impacts on coastal development and its effect on lives, livelihoods and the coastal ecosystem.
7. The 2004 Indian Ocean tsunami specifically highlights the impact of coastal hazards on social and economic development of the countries. Apart from the horrific number of lives lost in the countries such as India, Indonesia, Maldives, Sri Lanka and Thailand, the tsunami significantly affected the economy of the countries and especially the ones dependant on coast intense livelihoods namely fisheries and tourism. In, fact in areas such as Banda Aceh, the Indian Ocean tsunami is estimated to have increased the proportion of people living below the poverty line from 30 per cent to 50 per cent.
8. Vietnam with its 3200km of coastline now ranks in the top 5 for countries that will be hardest hit by climate change. It is estimated that a five meter increase in sea level would flood 16 per cent of Vietnam and threaten 35 per cent of its population.
9. The natural hazards in the coastal areas can be divided into discrete coastal events and those due to continuing changes over the long period. Table 1.3.1 shows the classification of natural coastal hazards:

Table 1.3.1

Discrete coastal events	Continuing changes over the long-term
Severe waves	Relative sea-level change
Storm surges	Coastal erosion
Tsunamis	Saline intrusion
Coastal earthquakes	

(Source: Arthurton, 1998)

10. Along with natural hazards, at times improper development poses threat to coastal area and lead to creation of risk. For example flooding in Mekong Delta is often caused by reduced drainage due to expansion of agricultural activities into wetland areas that previously served an important drainage function.
11. The above scenarios have two fold implications. Firstly, the hazards itself has impacts on the programs/projects which coastal zone managers work on and hence slows down development. On the other hand, when development activities themselves increase the chance of disasters in the area, they create severe risk to the population for whom the development was actually intended., Thus risk reduction should be factored in all CZM programs/projects, so that they are less impacted by disasters and also not contribute to any kind of growing risk.

References for Key Concepts

- Paragraph 1 to 5 and 9; Thia-Eng Chua; The Dynamics of Integrated Coastal Management
- Paragraph 6; Reducing the risk of disasters-helping to achieve sustainable poverty reduction in a vulnerable world: A policy paper; DFID, 2006
- Paragraph 8; The World Bank
- Paragraph 10; Tools for Mainstreaming Disaster Risk Reduction, Guidance Notes for Development Organisations, ProVention Consortium, 2007

Case Study

The 2004 Tsunami

The significant damage statistics of the Indian Ocean Tsunami include the following:

Water and Soil Contamination: Water supplies from ground water, boreholes and aquifers were either infiltrated by seawater and (or) by sewage because of damage to sanitation facilities. In Sri Lanka, all the 62,000 freshwater wells are now contaminated with salt and bacteria. In Aceh, 28,000 ha of coastal irrigation have been affected. Somalia's groundwater is infiltrated by hazardous waste which seeped from damaged coastal dump sites. Up to 90 percent of toilets in the Maldives were lost.

Soil Fertility has also been affected, with reports of rice crops yellowing in the western islands of Indonesia within three weeks of the disaster. In Victoria, the Seychelles, the soils now have a salt content which is double the amount that plants on the islands can tolerate. In Thailand, 20,000 ha were inundated by seawater, damaging 1,500 ha of agricultural land.

Huge amounts of waste. Solid debris, rubble and hazardous waste remain a major concern. Banda Aceh has to dispose of 7 to 10 million cubic meters of wastes. In the Phi Phi Islands, Thailand, only about 13,000 tonnes have so far been collected from estimated total debris of 35,000 tonnes.

Somalia, which allowed the dumping of nuclear and other hazardous waste for as little as USD 2.50 per ton, must now grapple with health consequences of disturbed wastes. Coastal communities in North Hobyo and Warsheik, south of Benadir will have to bear this additional grave concern.

Impacts on livelihoods. Tourism and fisheries were particularly badly affected. In Thailand, 315 hotels and 234 restaurants were totally or partially destroyed. In the Maldives, 87 resorts reported losses of over USD 100 million. Sri Lanka's fishing community's sustained damage to 29,700 fishing boats along with gear and nest. In the Maldives, apart from damaged fishing boats, 374 fish processors lost equipment while two fishery institutions suffered damage.

(Source; UNEP, 2005)

The Orissa ordeal / Orissa saga

The 1999 super cyclone also known as cyclone 05 B / Paradeep cyclone, hit the Orissa coast at 250 km /hour. The cyclone triggered torrential rain over southeast India, causing record breaking flooding in the low-lying areas. The storm surge of about 26 feet (8 meters) struck the coast of Orissa traveling up to 20 km inland. 17,110 km_ of crops were destroyed, and an additional 90 million trees were either uprooted or destroyed. Around 275,000 homes were damaged, leaving 1.67 million people homeless. Another 19.5 million people were affected by the super cyclone to some degree. Over 10,000 people died. The fatality of domestic animals was around 2.5 million. With this around 5 million farmers lost their livelihood. The estimated damage across fourteen affected districts in India was 20,000 crores of Indian National Rupees. It affected places like Bhubaneswar and Nayagarh, which were never traditionally cyclone-prone.

Orissa sorrow seems to be endless. While the 2001 drought parched fields in coastal districts, the unprecedented floods in 2001 submerged 25 of the State's 30 districts. Many of these areas had never witnessed floods before. Orissa has experienced around 952 small and big cyclones and 451 tornadoes between 1891 and 1970. From 1901 to 1981 there were 380 cyclones, of which 272 resulted from depressions in the Bay of Bengal. Twenty-nine of these cyclones were devastating.

(Source: National Training Course on DRR for Coastal Zone Managers, CEE, India, 2009)

Session Delivery

Power point Presentation (provided in the attached CD)

Discussions: Participants would be requested to share experiences of hazards affecting the coastal area they come from. The discussion would highlight the importance of considering hazards with frequent likely return period and the ones which is bringing about continuous change over the long-term. Following questions could be posed to facilitate the discussion:

- What kind of hazards does the coast you come from face?
- Are these hazards frequent?
- What is the greatest impact of these hazards?
- Are there factors due to which the impacts of these hazards are increased?
- Are their measures being taken to reduce these impacts?
- Can the work in which you are involved, help reduce some of the risk from these hazards?

Session_1.4 Looking at the skills and building upon

Session Learning Objectives

At the end of the session the participants would be able to discuss the tasks undertaken by a coastal zone manager for developing and implementing CZM projects and have a better understanding of the knowledge and skills they would acquire at the end of this course which would help in integrating DRR in their task list

Session Duration

Group Exercise: 25 minutes
Presentation by groups: 20 minutes
Total: 45 minutes

Session Delivery

Group Exercise: Materials required: Paper, markers
Instructions:

- Divide the participants into three groups
- Give each group a specific topics for example
  - Development of Coastal Area Plan in a cyclone prone coast
  - Building a sea wall along the coast with no back waters
  - Planting casuarinas on sand dunes along the coast
- Request the participants to list out 2 key tasks for the topic
- Against each task, identify the knowledge required and skills needed
- Identify the gaps in terms of knowledge and skills and discuss the additional knowledge and skill they expect to gain at the end of this course which would help in fulfilling the gaps
- Provide the groups with the template as shown in Table 1.4.1 below.

Table 1.4.1

Key Task	Knowledge required	Skills Needed	Existing Gaps	Recommendations

Module 2
Knowing the coast better with a DRR perspective

Modular Learning Objectives:

At the end of the Module the participants would be able to:

- Recognize the importance of coastal area and its management in the context of overall development of the geographical area (country/province/cities);
- Appreciate the importance of services the coastal ecosystem provides with special focus to reduce risk and recognize the need of economic valuation of coastal ecosystem services;
- Discuss the different types of coastal hazards; natural and human induced and the types of vulnerabilities specific to coastal areas and recognize the factors that create risk from natural hazards in coastal areas;
- Discuss the causes and impacts of climate change especially in the context of coastal area and as factor contributing to coastal risk; and
- Discuss the various stakeholders involved in a typical CZM program/project and the role each of them play/could play in reducing or creating risk

This Module would consist of eight (8) sessions as follows:
Session 2.1: Importance of CZM (Optional)
Session 2.2: Understanding coastal ecosystem services
Session 2.3: Valuation for ecosystem services (Optional)
Session 2.4: Understanding the coastal hazards
Session 2.5: Recognizing the coastal Vulnerabilities
Session 2.6: Introduction to coastal Climate Change
Session 2.7: Knowing the coastal Risk
Session 2.8: Stakeholders involved in coastal development

Guest Speaker/Documentary screening (Optional)

Session_2.1 Importance of Coastal Zone Management

Session learning Objectives

At the end of the session the participants would be able to:

- Understand what is meant by coastal zone and basic concepts on Coastal Zone Management. This basic understanding would help in subsequent sessions.
- Recognise the importance of coastal zone for the overall development of an area.

Session Duration

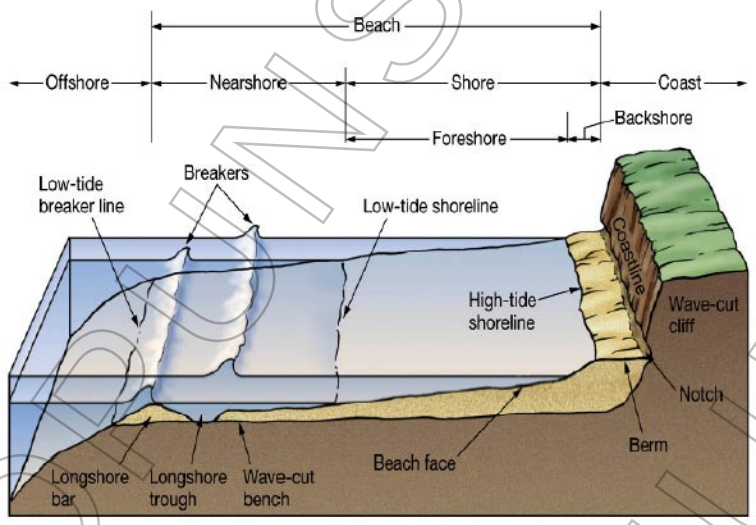
Power point Presentation: 30 minutes
Discussion: 15 minutes
Total: 45 minutes

Key Terminologies

- Coastal zone refers to the transitional region between the land and the ocean. The transitional refers to the two main environments, terrestrial and marine, and their main influences to coastal zone. In the coastal zone, the terrestrial environment influences the marine environment and vice versa.(Source: B. Carter, Coastal environments: an introduction to the physical, ecological, and cultural systems of coastlines, 1988)

Coastal zone covers coast, beach or shore and near shore zone. Figure 2.1.1 defines the various physical characteristics of the area. The seaward area beyond the coastal area is known as the offshore, where the oceanic influence is predominant. The area beyond the backshore in the landward direction is known as the coast. The coastal region extends inland in several ways including tidal mark, tidal influence, salinity mark and seaward extent of the permanent vegetation. The characteristics of this region are marked by the direct physical influence (tidal, salinity, coastal flooding) of coastal waters, the inland boundary of a local unit of Government, or all lands, the use of which may have a direct and significant impact on coastal waters.

Figure 2.1.1

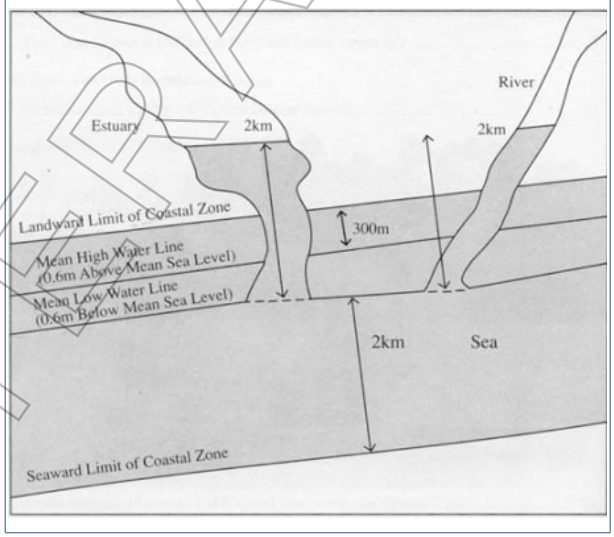


(Source: Millersville University of Pennsylvania, Lecture handout on "The Coastal Ocean", Course ESCI 104, vol. 2006, (2006))

To explain the definition, an example of coastal zone jurisdiction of Sri Lanka is provided below in figure 2.1.2.

- Integrated Coastal Management (ICM) is a natural resources and environmental management framework which employs an integrative, holistic approach and an interactive planning process in addressing the complex management issues in the coastal areas. (Source: Thia-Eng Chua; The Dynamics of Integrated Coastal Management)

Figure 2.1.2



(Source, National Training Course on DRR for Coastal Zone Management, Coast Conservation Department, Sri Lanka, 2009)

Key Concepts

This session would cover the following concepts:

1. Different countries have different definitions for coastal zone. For example in Bangladesh three main criteria are used to delineate coastal zones; tidal in fluctuations, salinity and cyclone and storm surge risk. Using these criteria, the coastal zone of Bangladesh consists of the Exclusive

Economic Zone and 19 districts. Out of these, 12 districts demonstrate all three of the criteria and are defined as Exposed Coast. The remaining seven districts, where one or two of the criteria are observed, are defined as Interior Coast. (Source: Integrated Coastal Zone Management Plan, Government of Bangladesh).

On the other hand as explained earlier; in Sri Lanka the term "coastal area" is defined as the 2 km wide band of ocean and an adjoining strip of land extending 300 m inland. (Source; Coast Conservation Act, Government of Sri Lanka).

In Indonesia, the coastal zone is defined as transition zone between land based and marine ecosystem which is affected by change from land and sea (Source; Law number 27 Year 2007 of Republic of Indonesia)

2. Being the transitional region between the land and the ocean, the coastal zone is a unique system because it is subjected to dynamic influences from land and ocean ecosystems. Each ecosystem has its specific characteristic and the interaction between these remains ever changing with natural fluctuation in the biological, chemical and geological attributes. The complex and dynamic character of the coastal zone has the physical action on the area, as well as the interaction of three bio-ecological systems: land and sea, sea and air, and sea and sediments. Table 2.1.1 below shows the importance of coastal areas in Indonesia.
3. The uniqueness makes the coastal zone one of most productive ecosystems which abounds with natural resources, and is often considered highly scenic. The coastal zone has several valuable and important resources both in economic and biological terms, such as coral reefs, mangroves, and sea-grass beds. These resources provide numerous functions and services to support a variety of livelihoods and provide the backbone to many local economies. For example; "in Sri Lanka the Coastal Zone covers approximately 24% of the land area with 32% of the population residing in it. It includes 65% of the urbanized land area with the principal road and rail transport infrastructure, commercial ports, fishery harbours and anchorages. 65% of the industrial output, 80% of tourism related infrastructure and 80% of fish production comes from the coastal zone". (Source, National Training Course on DRR for Coastal Zone Management, Coast Conservation Department, Sri Lanka, 2009)
4. Coastal zones have been used for different purposes including tourism, fisheries, transportation, mining, and communication. Table 2.1.2 shows the statistics of India's coastal fishing community, emphasizing the importance of coastal livelihoods.

Table 2.1.1: Facts on Indonesian Coastal Area

Parameter	Unit of measurement	Notes
Total number of island	17,508	5 major island: Sumatra, Java, Sulawesi, Borneo, and New Guinea; 30 groups of smaller island (Indonesian Naval Hydro-Oceanographic)
Coastline length (baseline)	80.791 km	The actual length of the Indonesian coastline may be about 204.000 km (Astuti et.al, 1994)
Total land area	1.926.337 km2	24.4% of total area under Indonesian jurisdiction
Area of archipelagic (inner) seas	2.820.000 km2	35.7% of total area under Indonesian jurisdiction
Area of territorial (12 nm zone) sea	420.000 km2	5.3% of total area under Indonesian jurisdiction
Continental shelf area	1.500.000 km2	19% of total area under Indonesian jurisdiction
Area of EEZ (Exclusive Economic Zone)	2.730.000 km2	34.6% of total area under Indonesian jurisdiction
Total area of national jurisdiction	7.892.350 km2	81% of total area under Indonesian jurisdiction (Indonesian Naval Hydro-Oceanographic)

(Source; Tomascik, Mah, Nontji and Moosa, 1997; http://www.asianinfo.org/asianinfo/indonesia/pro-geography.htm)

5. The multiple functions and services supported by the coastal zone have lead to highly intensive exploration and exploitation. These multiple uses, combined with rapid economic and industrial growth in recent decades, have attracted an increasing percentage of the population to live in coastal areas. For example statistics show that coastal systems are experiencing growing population and exploitation pressures; nearly 40 per cent of the world population lives in this thin fringe of land (Source; Population, Consumption and the Environment, www.pcebase.org). In Indonesia, 60 million people or 30 per cent of the total population lives in the coastal areas. This increased population has led to significant impacts on the coastal zone.

Table 2.1.2

Coastline	8118 km
Coastal States	09
Coastal Districts	65 (Source: 2001 census)
Area of coastal districts	379,610 km2
Number of marine fishing villages	3638
Density population in coastal districts	455 (Source: 2001 census)
Coastal population	10 million > 200 million (within 50 km of the coastline)
Marine fisherman population	3 million
Marine fishermen household	0.5 million
Marine fish production	2.66 million tons (50 percent traditional/near shore waters)
Number of active fishermen	1.03 million
Average number of seagoing fishermen per village	262
Average number of fishermen per village	825
Fish landing centres	2251

(Source; National Training Course on DRR for Coastal Zone Managers; CEE, India, 2009)

6. Because of the topography the coastal areas are also frequented by natural hazards and the impact of which is only increased with the growing over exploitation of the coastal resources.

7. Equally of importance is wide range of stakeholders which includes the communities living on the coast, population whose livelihood is dependent on the coast, the managers responsible for managing the coast, the policy makers, natural and social scientist etc. For example Table 2.1.3 shows the range of government agencies involved in managing resources in coast of India. The interaction between the various stakeholders is complex and often not limited to administrative boundaries of coastal zone. For example in most coastal areas of Indonesia, there has been a lack of integration and regulation of the diverse activities which take place in the coastal zone. This has resulted in resource-use conflicts, severe resource overexploitation, widespread environmental degradation, and social hardship. (Source; Tomas Tamascik, 1997)

Table 2.1.3

Other Department/ Agency	Responsibility
Ministry of Agriculture	Fisheries Management, Aquaculture
Ministry of Commerce	Marine Products, Special Economic Zones
Ministry of Tourism	Tourism Development
Ministry of Urban Development	Town and Country Planning
Ministry of Home	Disaster Management
Ministry of Defence	Oil Pollution, Poaching etc.
Ministry of Surface Transport	Ports and Harbours
Ministry of Industries	Coastal Industries
Ministry of Mines	Coastal and offshore mining
Ministry of Petroleum and Natural Gas	Exploration of Oil and Natural Gas

(Source: National Training Course on DRR for Coastal Zone Managers; CEE, India, 2009)

8. Since the coastal resources provide numerous services their management should ensure sustainable environmental, social and economical needs, and should be an integrated approach. The coastal zone will remain productive only if there is a holistic and comprehensive approach such as the Integrated Coastal Management (ICM). This approach provides a conceptual framework for ecologically sustainable use of coastal resources, thus meeting the overall objective of ICM which is to provide for the best long-term and sustained use of coastal natural resources and for perpetual maintenance of the most beneficial natural environment. ICM also incorporates modern principles of planning and resource management, intensive information bases and interdisciplinary processes toward an effective general framework for dealing with conflicts arising from interactions of the various uses of coastal areas.
9. Thus effective CZM requires a close coordination and working between various stakeholders involving the government line agencies, research institutes, NGOs and the communities.

References for Key Concepts

- Paragraph 2,3 and 8; Making decentralised coastal zone management work for the South east Asia region: comparative perspectives, Siry, 2006-2007

Quick Facts

Importance of coastal zones to humans

- Coastal areas comprise 20% of the Earth's surface yet contain over 50 percent of the entire human population. By the year 2025, coastal populations are expected to account for 75% of the total world population.
- More than 70% of the world's megacities (greater than 8 million inhabitants) are located in coastal areas.
- Average human population density in coastal areas is about 80 persons /km2.

(Source: Ocean Info Pack, World Ocean Network)

In spite of its importance

- 1/3 of coastal regions run a high risk of degradation, especially from infrastructure development and pollution. In 4/7 of coastal regions, the degradation is increasing.
- Asia is the second most threatened regions with 69 percent of their coastal ecosystems at risk.
- In Southeast Asia, more than 80 % of the most species-rich coral reefs of the world are threatened by coastal development and fishing pressures, and over half are at high risk.
- In Southeast Asia, 20 to 60 % of sea-grass beds have been lost.

(Source: Ocean Info Pack, World Ocean Network)

Session Delivery

Power point Presentation (provided in the attached CD)

Discussions:

Participants would be requested to share details of the coast they come from/work in. The discussion could focus on the following:

- What is the definition of the coast in the area they come from?
- Is there any specific topographic feature in the area?
- What are the economic activities in the area?

Session_2.2 Understanding coastal ecosystem services

Session learning Objectives

At the end of the session the participants would be able to appreciate the importance of services the coastal ecosystem provides and understand how these services especially provides a protective role.

Session Duration

Presentation: 40 minutes
Discussion: 20 minutes
Total: 60 minutes

Key Terminologoes

- Ecosystems: Dynamic complexes of plant, animal, and microorganism communities and the non-living environment, interacting as functional units. (Source; Millennium Ecosystem Assessment, 2003)
- Ecosystem services: The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth. The concept 'ecosystem goods and services' is synonymous with ecosystem services. (Source; Marine and coastal ecosystems and human well-being, A synthesis report based on findings of Millennium Ecosystem Assessment, UNEP)
- Ecosystem Approach: A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use. An ecosystem approach is based on the application of appropriate scientific methods focused on levels of biological organization, which encompass the essential structure, processes, functions, and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems. (Source; Marine and coastal ecosystems and human well-being, A synthesis report based on findings of Millennium Ecosystem Assessment, UNEP)

Key Concepts

This session would cover the following concepts:

1 The Millennium Ecosystem Assessment classifies the services that ecosystems can provide into four broad categories: provisioning services, regulating services, cultural services, and supporting services (Figure 2.2.1). This typology separates services along functional lines. These categories illustrate the diverse ways in which ecosystems contribute to human welfare.

Figure 2.2.1

Source: Millennium Ecosystem Assessment, 2003.

2. Figure 2.2.2 shows the main ecosystem types recognized by the Millennium Ecosystem Assessment and the principal services that each provides. The services provided by the Coastal ecosystem are highlighted in Blue and Red and it emphasizes the fact that one of the important regulatory role the coastal ecosystem plays is reduction of natural hazard.

Figure 2.2.2

	Ecosystem								
Ecosystem service	*Cultivated*	*Dryland*	*Forest*	*Urban*	*Inland water*	*Coastal*	*Marine*	*Polar*	*Mountain*
Freshwater			•		•	•		•	•
Food	•	•	•	•	•	•	•	•	•
Timber, fuel, and fiber	•		•			•			
Novel products	•	•	•		•		•		
Biodiversity regulation	•	•	•	•	•	•	•	•	•
Nutrient cycling	•	•	•		•	•	•		
Air quality and climate	•	•	•	•	•	•	•	•	•
Human health		•	•	•	•	•			
Detoxification		•	•	•	•	•	•		
Natural hazard regulation			•		•	•			•
Cultural and amenity	•	•	•	•	•	•	•	•	•

Source: Millennium Ecosystem Assessment

3. Figure 2.2.3 shows the habitat wise services provided by coastal and marine ecosystem where 'X' indicates the habitat provides a significant amount of the service.

Figure 2.2.3

ECOSYSTEM SERVICES	Coastal									Marine		
	Estuaries and marshes	Mangroves	Lagoon and salt ponds	Intertidal	Kelp	Rock and shell reefs	Sea grass	Coral reefs	Inner shelf	Outer shelves edges slopes	Seamounts & mid-ocean ridges	Deep sea and central gyres
Biodiversity	X	X	X	X	X	X	X	X	X	X	X	X
Provisioning services												
Food	X	X	X	X	X	X	X	X		X	X	X
Fibre, timber, fuel	X	X	X						X	X		X
Medicines, other resources	X	X	X		X			X	X			
Regulating services												
Biological regulation	X	X	X	X		X		X				
Freshwater storage and retention	X		X									
Hydrological balance	X		X									
Atmospheric and climate regulation	X	X	X	X		X	X	X	X	X		X
Human disease control	X	X	X	X		X	X	X				
Waste processing	X	X	X				X	X				
Flood/storm protection	X	X	X	X	X	X	X	X				
Erosion control	X	X	X				X	X				
Cultural services												
Cultural and amenity	X	X	X	X	X	X	X	X	X			
Recreational	X	X	X	X	X			X				
Aesthetics	X		X	X				X				
Education and research	X	X	X	X	X	X	X	X	X	X	X	X
Supporting services												
Biochemical	X	X			X			X				
Nutrient cycling and fertility	X	X	X	X	X	X		X	X	X	X	X

(Source; Millennium Ecosystem Assessment)

4. So too figure 2.2.4 below showing the ecosystem services provided by the Mangroves and Coral Reefs highlights the regulatory role it provides against natural hazards and protecting the coastal area.

5. However, because these ecosystem services are provided free of charge, as a gift of nature, their importance is often overlooked. Table 2.2.1 shows some of the threats being faced by the coastal ecosystem in India.

Figure 2.2.4

Ecosystem services	Coral reefs	Mangroves
REGULATING	Protection of beaches and coastlines from storm surges and waves Reduction of beach erosion Formation of beaches and islands	Protection of beaches and coastlines from storm surges, waves and floods Reduction of beach and soil erosion Stabilization of land by trapping sediments Water quality maintenance Climate regulation
PROVISIONING	Subsistence and commercial fisheries Fish and invertebrates for the ornamental aquarium trade Pharmaceutical products Building materials Jewellery and other decoration	Subsistence and commercial fisheries Aquaculture Honey Fuelwood Building materials Traditional medicines
CULTURAL	Tourism and recreation Spiritual and aesthetic appreciation	Tourism and recreation Spiritual – sacred sites
SUPPORTING	Cycling of nutrients Nursery habitats	Cycling of nutrients Nursery habitats

(Source: IUCN)

Table 2.2.1

Coastal Ecosystem	Threats
Mangroves	• Convert mangrove areas into agricultural areas • Cutting of mangroves for fuel wood • Overdose of chemical fertilizers and pesticides detrimental to the mangrove • Seawalls, bunds and other coastal structures often restrict tidal flow, resulting in the killing of mangroves
Coral Reefs	• Destruction due to chemical pollution, mechanical damage, nutrient loading or sediment loading • Pesticides, fertilizers reaching coral reefs from agricultural runoff areas, Destructive fishing practices • Heavy metals from industrial sources, petroleum hydrocarbons. etc chemically damage the corals • Mining and trawl fishing
Sea grass Beds	• Eutrophication, siltation, trawling, coastal engineering constructions and removal for commercial purposes are the major threats for sea grass beds.
Sea Weeds	• Over exploitation for commercial purpose, • Pollution of coastal waters, • Sedimentation
Turtle Nesting Grounds	• Beach erosion, habitat degradation, poaching
Beaches	• Habitat conversion because of Industrial and human settlements, sand mining • Activities which accelerate the erosion processes like clogging of river flow, construction on shoreline • Poorly designed coastal engineering works (that alter long shore currents or wave forces and lead to undesirable erosion and deposition patterns) • Coastal dredging/mining projects
Sand Dunes	• Sand mining, • Leveling for construction of beach resorts • Road, rail and other infrastructure development included unplanned tourism facilities
Rocky Cliffs	• Degradation of the rock cliffs because of mining for the extraction of valuable minerals, e.g. chromium from serpentine, or as a road stone as with granite and basalt, limestone for cement factories
Rocky Foreshores	• Unplanned tourism structures, • Pollution, • Mining of rocks for construction purposes
Estuaries	• Reclamation, • Pollution from urban and industrial waste disposal, • Reduction in fresh water discharge due to dams, • Prevention of fresh water flow, • Dredging for water-ways

Rocky Foreshores	• Unplanned tourism structures, • Pollution, • Mining of rocks for construction purposes
Estuaries	• Reclamation, • Pollution from urban and industrial waste disposal, • Reduction in fresh water discharge due to dams, • Prevention of fresh water flow, • Dredging for water-ways
Lagoons	• Reclamation, • Pollution from urban and industrial waste disposal, • Reduction in fresh water discharge due to dams, • Prevention of fresh water flow, • Dredging for water-ways • Constructions like dike, artificial bars, jetties affect the structure of lagoons
Mudflats	• Reclamation, • Urban and industrial waste disposal, • Waste disposal/effluent discharge
Deltaic Areas	• Reclamation, • Flooding
Tidal Inlets	• Dredging for maintaining the channel increases turbidity, • Channel stabilization disrupts the natural flow of sediment
Barrier Islands	• Sand mining, • Pollution from tourism activities • Erosion
Salt-marshes	• Reclamation, • Cutting and removal of marsh vegetation for agriculture and construction of embankments

(Source: National Training Course on DRR for Coastal Zone Managers, CEE, India, 2009)

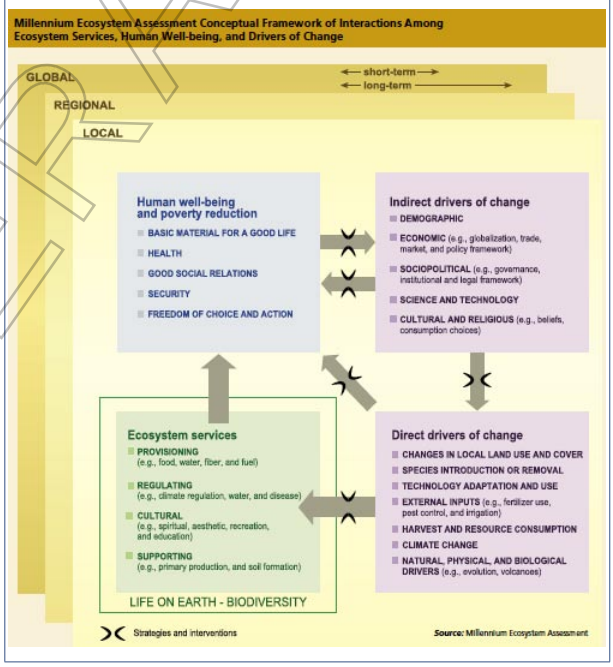
6. Hence, we need to consider protection of these services by adopting a broader approach that recognizes that people in their daily lives depend on a range of services that ecosystems provide. These services are fundamental to attaining development goals as explained in figure 2.2.5.

7. The Millennium Ecosystem Assessment provides a framework (Figure 2.2.6) which can be used by decision makers as diverse as mayors, national economists, natural resource managers, and conservation planners to explore the links between ecosystems and development, gaining a better

Figure 2.2.5

(Source: Ecosystem services: A guide for decision makers; World Resource Institute)

Figure 2.2.6



(Source: Ecosystem services: A guide for decision makers; World Resource Institute)

understanding of how development goals both affect and depend on ecosystem services.

8. Thus one important task would be to identify these drivers of change which has impact on the coastal ecosystem services. Table 2.2.2 shows the services the coastal ecosystem provides and the drivers of change which includes among others climate change, destruction of mangroves, coral reefs etc.

Table 2.2.2

Ecosystem	Ecosystem services	Drivers of ecosystem change
Coastal	Tourism, recreation, cultural value, fisheries (commercial and subsistence), aquaculture, transportation, nutrient cycling, storm/flood protection, climate regulation, disease regulation, waste processing, erosion control, hydropower, freshwater storage	Nutrient runoff and deposition creating dead zones, industrial and urban pollution, dredging of waterways, sediment transport from rivers, climate change, invasive species, conversion of estuaries and wetlands, destruction of estuarine fish nurseries, destruction of mangroves and coral reefs, overexploitation of fisheries, mangroves (for fuel wood), sand for construction, seaweed for consumption

(Source: Ecosystem services: A guide for decision makers; World Resource Institute)

References for Key Concepts

- Paragraph 1, 2 and 6; Millennium Ecosystem Assessment, 2003.

Session Delivery

Power point Presentation (provided in the attached CD)

Discussions

Participants would be requested to share information on the following:

- List 5 different kind of services provided by the ecosystem in your area?
- Under which functional category these services fall?
- Are any of these services changing over years? If yes, what are the factors that are contributing to this change?

Session_2.3 Valuation for ecosystem services

Session learning Objectives

At the end of the session the participants would be able to appreciate the need of economic valuation of coastal ecosystem services especially from a point of view of regulatory services it provides in reducing risk from natural hazards. The session would introduce common tools for carrying out economic valuation and identify the challenges in carrying out economic valuation. The session will also help in the identification of relevant organizations with capacity on valuation of ecosystem services.

Session Duration

Presentation: 30 minutes
Guest Speaker: 30 minutes
Total: 60 minutes

Key Terminologies

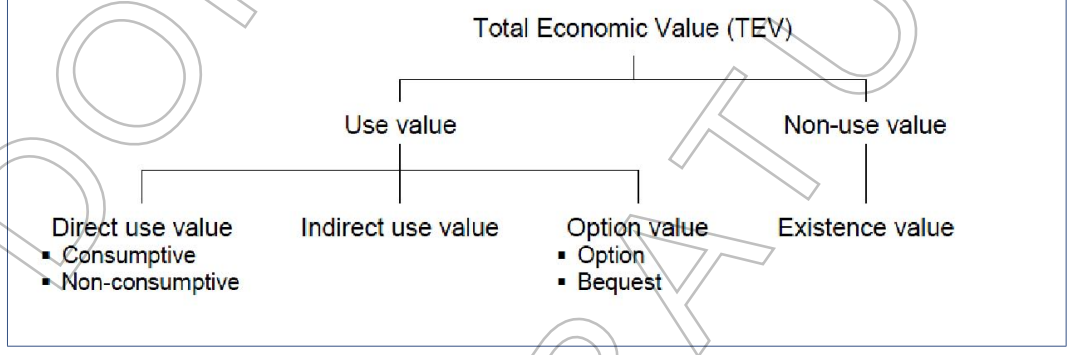
- Economic valuation offers a way to compare the diverse benefits and costs associated with ecosystems, by attempting to measure them and expressing them in a common denominator typically a monetary unit. (Source: World Bank – 2006)

Key Concepts

This session would cover the following concepts:

1. The previous session highlighted the importance of various services coastal ecosystem provides and hence the need to protect them. However, protection through various management processes requires certain amount of resources. Hence it is essential to understand 'How much value' the ecosystem provides and 'to whom', in order to take the appropriate decision on conserving it.
2. Economic valuation offers a way to compare the diverse benefits and costs associated with ecosystems, by attempting to measure them and expressing them in a common denominator— typically a monetary unit.
3. Many methods for measuring the utilitarian values of ecosystem services are found in the resource and environmental economics literature. Some are broadly applicable, some are applicable to specific issues, and some are tailored to particular data sources. A common feature of all methods of economic valuation of ecosystem services is that they are founded in the theoretical axioms and principles of welfare economics. Most valuation methods measure the demand for a good or service in monetary terms, that is, consumers' willingness to pay (WTP) for a particular benefit, or their willingness to accept (WTA) compensation for its loss. (Source; Hanneman, 1991; Shogren and Hayes, 1997)
4. One of the common frameworks for undertaking economic valuation is the Total Economic Value (TEV) framework. Figure 2.3.1 below shows a graphical representation of the framework.

Figure 2.3.1



5. Economic valuation should be used to examine four distinct aspects of the value of ecosystems:
   - Determining the value of the total flow of benefits from ecosystems
   - Determining the net benefits of interventions that alter ecosystem conditions
   - Examining how the costs and benefits of ecosystems are distributed
   - Identifying potential financing sources for conservation
6. These four approaches (Figure 2.3.2) are closely linked and build on each other. They represent four different ways to look at similar data regarding the value of an ecosystem: its total value or contribution to society, the change in this value if a conservation action is undertaken, how this change affects different stakeholders—that is, who are the beneficiaries and who are the losers and how beneficiaries could be made to pay for the services they receive to ensure that the ecosystem is conserved and its services are sustained.

Figure 2.3.2

Approaches to valuation

Approach	*Why do we do it?*	*How do we do it?*
Determining the total value of the current flow of benefits from an ecosystem	To understand the contribution that ecosystems make to society	Identify all mutually-compatible services provided; measure the quantity of each service provided; multiply by the value of each service
Determining the net benefits of an intervention that alters ecosystem conditions	To assess whether the intervention is economically worthwhile	Measure how the quantity of each service would *change* as a result of the intervention, as compared to their quantity without the intervention; multiply by the marginal value of each service
Examining how the costs and benefits of an ecosystem (or an intervention) are distributed	To identify winners and losers, for equity and practical reasons	Identify relevant stakeholder groups; determine which specific services they use and the value of those services to that group (or changes in values resulting from an intervention)
Identifying potential financing sources for conservation	To help make conservation financially sustainable	Identify groups that receive large benefit flows, from which funds could be extracted using various mechanisms

(Source: How much is an ecosystem worth? - Assessing the economic value of conservation - The World Bank, IUCN - The World Conservation Union)

7. A major limitation of economic valuation is that the resulting estimates are often highly subjective, being sensitive to both the methods selected and assumptions used. The selected ecosystem services to be valued, coupled with assumptions on period of valuation (number of years) and discount rate (reflecting how we value the future), will have profound effects on the estimates produced. Some techniques focus on narrow, marketable goods and services, which can be more accurately estimated, but omit important non-market and non-use values. In addition, inaccuracies exist because of incomplete understanding of complex ecosystem processes and inherent biological uncertainties (for example, how much wetland is required to provide sufficient flood regulation or water filtration for a population).

Figure 2.3.3

Decision	Goal	Example winners	Ecosystem services decreased	Example losers
Increasing one service at the expense of other services				
Draining wetlands for farming	Increase crops, livestock	Farmers, consumers	Natural hazard regulation, water filtration and treatment	Local communities including farmers and some downstream users of freshwater
Increasing fertilizer application	Increase crops	Farmers, consumers	Fisheries, tourism (as a result of dead zones created by excessive nutrients)	Fisheries industry, coastal communities, tourism operators
Converting forest to agriculture	Increase timber (temporarily), crops, livestock, and biofuels	Logging companies, farmers, consumers	Climate and water regulation, erosion control, timber, cultural services	Local communities, global community (from climate change), local cultures
Converting ecosystems and their services into built assets				
Coastal development	Increase capital assets, create jobs	Local economy, government, developers	Natural hazard regulation, fisheries (as a result of removal of mangrove forests or wetlands)	Coastal communities, fisheries industry (local and foreign), increased risks to coastal businesses
Residential development replacing forests, agriculture or wetlands	Increase capital assets, create jobs	Local economy, government, developers, home buyers	Ecosystem services associated with removed ecosystems	Local communities, original property owners and downstream communities
Competition among different users for limited services				
Increased production of biofuel	Reduce dependency on foreign energy	Energy consumers, farmers, government	Use of crops for biofuels instead of food	Consumers (rising food prices), livestock industry
Increased water use in upstream communities	Develop upstream areas	Upstream communities, industries	Water downstream	Downstream communities, industries

(Source: Ecosystem services: A guide for decision makers, World Resource Institute)

8. When identifying risks and opportunities, it can be helpful to think of ecosystem service changes in terms of trade-offs. Trade-offs arises from management choices or actions that intentionally or otherwise alter the quantity or quality of an ecosystem service in order to achieve a goal. Assessing trade-offs involves identifying the different groups that will win and lose in the short term as well as the long term as a result of changes to ecosystem services. Trade-offs can involve economic losses, or losses to the health and well-being of certain populations (Figure 2.3.3).

References for Key Concepts

- Paragraph 2, 3, 5 and 6; How much is an ecosystem worth? - Assessing the economic value of conservation - The World Bank, IUCN
- Paragraph 7 and 8; Ecosystem services: A guide for decision makers; World Research Institute, 2008

Quick Facts

- The total potential sustainable annual economic net benefits per km of healthy coral reef in Southeast Asia is estimated to range from $23,100 to $270,000 arising from fisheries, shoreline protection, tourism, recreation, and aesthetic value. (Source: Burke, Selig and Spalding, 2002)
- Sri Lanka; A 2005 Total Economic Value (TEV) assessment of the Rekawa mangrove lagoon ecosystem, Sri Lanka, found that it was $1,088/ha/year, or $217,600 per year, based on 200-ha of mangrove. Forestry net benefits accounted for $4,800 per year, lagoon fishery $53,600 per year, coastal fishery $98,600 per year, erosion control and buffer against damage from storms $60,000 per year, and existence, bequest and option values to local communities $520 per year. (Source: Gunawardena and Rowan, 2005)
- Indonesia; Potential sustainable economic net benefits per year from coral reefs in Indonesia from fisheries, shoreline protection, tourism, and aesthetic value have been estimated at $1.6 billion per year. (Source: Burke, Selig and Spalding, 2002)

Case Study

The value of mangrove forests as fish nurseries in Thailand

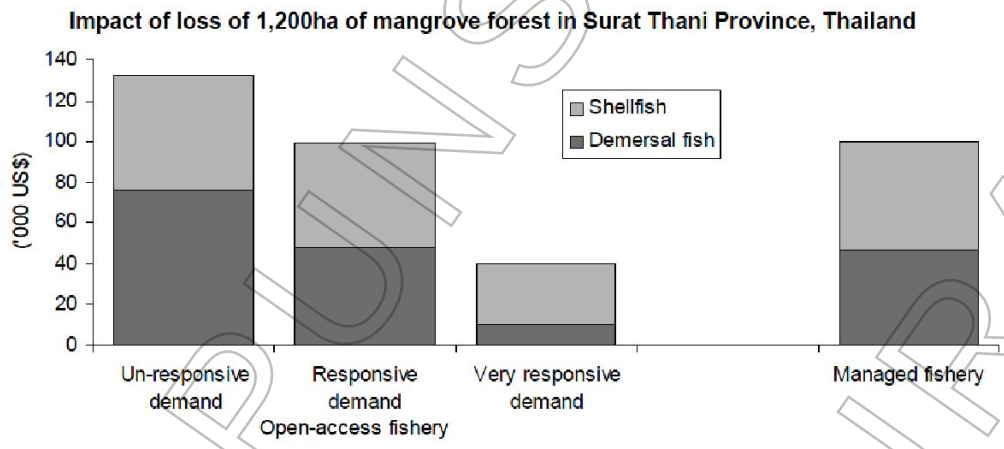
Mangrove forests can provide a number of services. These often include direct uses such as production of fuel wood and other goods, and recreation. Their most valuable services, however, are often their indirect benefits such as storm protection and their role as breeding grounds and fisheries for fish.

A large number of studies have explored the mangrove-fishery linkage. These studies generally use the production function approach: they assess the role that mangroves play as an 'input' into the production' of fish. This type of analysis requires two major elements. The first is an understanding of the role that mangrove forests play in the life cycle of relevant fish species. This might be arrived at either through an understanding of the biological processes at work, or by statistical analysis of the relationship between fish populations and mangrove forest condition (allowing for other factors that also contribute). The second element needed is an understanding of the markets for the products—in this case the fish. The value of mangrove forests is imputed based on how changes in their condition change the value generated in the market for the fish (holding other things constant). When there are multiple species of fish dependent on a given area of mangrove forest, and either the biology or the markets for each species are different, these analyses would have to be conducted separately for each species.

Figure 2.3.4 below shows the estimated consequences of loss of mangrove forest in Surat Thani Province, on the Gulf of Thailand. This region lost half its mangrove forest area in the period

1975- 1993, primarily to expansion of shrimp cultivation. As can be seen, the estimated losses resulting from a loss of 1,200ha of mangrove forest (the approximate annual rate of loss in the early 1990s) depends on both the species concerned and the characteristics of the market. If the fisheries are assumed to be managed, the loss of 1,200ha of mangrove forest would cause losses of about US$100,000. If the fisheries are assumed to be open access, the losses depend on how consumers respond to price changes: losses are highest when consumers are unresponsive (about US$40,000), and lower when consumers are very responsive (about US$132,000). Note that without knowing the benefits of the land uses which replace the lost mangrove forests, we cannot conclude anything about whether society is better or worse off as a result of this deforestation.

Figure 2.3.4



(Source: How much is an ecosystem worth? - Assessing the economic value of conservation - The World Bank, IUCN - The World Conservation Union)

Session Delivery

Power point Presentation (provided in the attached CD)

Guest Speaker

Since Valuation of ecosystem services is a new concept and not much have taken place in the region on this particular subject, it would be extremely beneficial to invite an expert from this area who could enlighten the participants with examples of valuation undertaken in the Asian region and highlight the typical challenges encountered in the process.

Session_2.4 Understanding the coastal hazards

Session learning Objectives

At the end of the session the participants would be able to discuss the nature and behaviour of different types of coastal hazards (natural and human induced) and understand the relationship between frequency and impact of hazards.

Session Duration

Presentation: 30 minutes
Exercise: 15 minutes
Total: 45 minutes

Key Terminologies

- Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

  Comment: The hazards of concern to disaster risk reduction as stated in footnote 3 of the Hyogo Framework are "... hazards of natural origin and related environmental and technological hazards and risks." Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological, and technological sources, sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis.

Hazards can be classified as following:

- Biological Hazard: Process or phenomenon of organic origin or conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

  Comment: Examples of biological hazards include outbreaks of epidemic diseases, plant or animal contagion, insect or other animal plagues and infestations.
- Geological Hazard: Geological process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

  Comment: Geological hazards include internal earth processes, such as earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses, and debris or mud flows. Hydro-meteorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize; although they are triggered by undersea earthquakes and other geological events, they are essentially an oceanic process that is manifested as a coastal water-related hazard.
- Hydro-meteorological Hazard: Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

  Comment: Hydro-meteorological hazards include tropical cyclones (also known as typhoons and hurricanes), thunderstorms, hailstorms, tornados, blizzards, heavy snowfall, avalanches, coastal storm surges, floods including flash floods, drought, heat waves and cold spells. Hydro-meteorological conditions also can be a factor in other hazards such as landslides, wild land fires, locust plagues, epidemics, and in the transport and dispersal of toxic substances and volcanic eruption material
- Socio-natural Hazard: The phenomenon of increased occurrence of certain geophysical and hydro-meteorological hazard events, such as landslides, flooding, land subsidence and drought, that arise from the interaction of natural hazards with overexploited or degraded land and environmental resources.

  Comment: This term is used for the circumstances where human activity is increasing the occurrence of certain hazards beyond their natural probabilities. Evidence points to a growing disaster burden from such hazards. Socio-natural hazards can be reduced and avoided through wise management of land and environmental resources.
- Technological Hazard: A hazard originating from technological or industrial conditions, including accidents, dangerous procedures, infrastructure failures or specific human activities, that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Comment: Examples of technological hazards include industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires, and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event
(Source; UN/ISDR, 2009)

Key Concepts

This session would cover the following concepts:

1. Below is a brief description of typical hazards in coastal areas:

Tsunamis: A tsunami is a series of ocean waves typically generated by an underwater earthquake. Landslides, volcanic activity, and meteor strikes may also generate a tsunami. A tsunami wave may be very small in the deep ocean, but as it approaches land can increase to more than 10 meters in height and reach shore as a fast-moving wall of turbulent water. Tsunamis can inundate low-lying coastal areas with multiple waves that can penetrate and cause destruction far inland. There are two types of tsunamis: distant and local. A distant tsunami travels long distances from the event that triggers it to impact the coast hours later. A local tsunami can impact the coast within minutes after the triggering event, allowing little to no time for warning and evacuation. The frequency of damaging tsunamis throughout the Indian Ocean region has been low compared with other natural hazards such as tropical cyclones, earthquakes, and floods.

Storms: Numerous meteorological events can impact the coast, including, very commonly, storms. Various types of storms impact coastal communities, such as severe thunderstorms, tropical cyclones, and extra tropical cyclones.

Storm Surge: Storm surge is simply water that is pushed toward the shore by the force of the winds swirling around a storm. This advancing surge combines with the normal tides to create the storm tide. Tropical cyclone-induced storm tides can increase the mean water level 5 meters or more. In addition, wind waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm surge coincides with the normal high tides. The greatest potential for loss of life related to a tropical cyclone is from the storm surge, which historically has claimed nine out of ten victims of these events.

Flooding: Flooding is a localized hazard that is generally the result of excessive precipitation. The primary types of flooding are riverine flooding, coastal flooding, and urban flooding. Floods can be generally classified as flash floods—the product of heavy localized precipitation in a short time period over a given location— or general floods, caused by precipitation over a longer time period and over a given river basin. Historically, flooding is the most common environmental hazard, due to the widespread geographical distribution of river valleys and coastal areas and the attraction of human settlements to these areas. The severity of a flooding event is determined by a number of local factors, including river basin physiography, precipitation patterns, and recent soil moisture conditions and vegetative state. While flash floods occur within hours of a rain event, general flooding is a longer-term event, and may last for several days.

Spills and Chronic Pollution: There are various ways in which pollution can impact coastal areas. Spills can be in the form of oil spills from ships, toxic materials released from storage tanks, petroleum releases from severed pipelines, etc. These events can have devastating effects on coastal environments. In some cases these episodic pollution events are caused by other coastal hazards such as tsunamis, tropical cyclones, and storm surge. Chronic pollution can be caused by numerous sources. Improper disposal of garbage in coastal communities can be a cause of pollution. Improper treatment of human waste prior to discharge in rivers and coastal waters can also be a cause of pollution. Polluted surface water runoff from land-based sources can be a significant source of pollution to coastal areas. Regardless of the source of pollution, the impacts

on coastal resources can be devastating. Many coastal communities rely on coastal resources for their survival.

Shoreline Erosion: Shoreline erosion is the wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes. Wind, waves, and long shore currents are the driving forces behind coastal erosion. This removal and deposition of sand permanently changes beach shape and structure. Additional factors involved in coastal erosion include human activity, sea-level rise, seasonal fluctuations, and climate change. Shoreline erosion is typically a chronic hazard, but severe shoreline erosion may be induced by a single storm event.

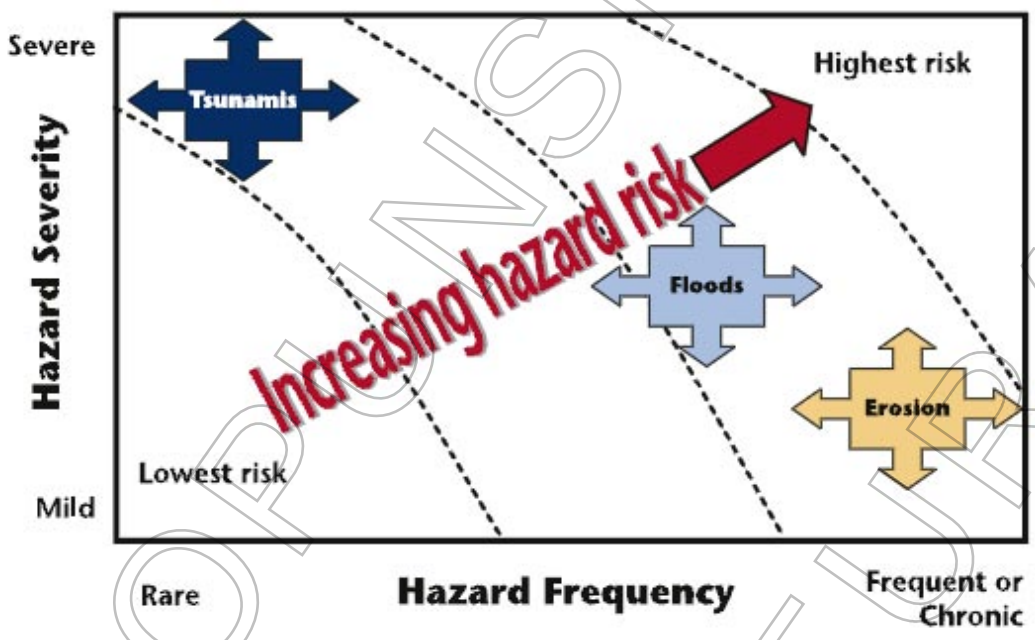
Sea Level Rise: Sea level rise can be defined as an increase in the mean sea level. Throughout history, the earth has gone through periods of sea level rise and decline, which are directly tied to climate change and global warming and cooling trends over geologic and recent time. Sea level fluctuations are a part of the natural processes on earth that are determined by many factors, but largely are influenced by climate and global warming. In comparison to other disasters that affect the coastal zone, such as tropical cyclones, tsunamis, floods, and earthquakes, sea level rise is on a much more gradual time scale. The impacts of a tsunami can be seen immediately, whereas the effects of sea level rise take a longer period of time to realize. A major potential impact of sea level rise on the natural environment in the coastal zone is that of habitat loss due to wetland inundation, coastal erosion, salt water intrusion, or shift in climate limits on vegetation.

Coastal Resource Degradation: Many of the earth's most complex, diverse and productive ecological systems are located in coastal zones. Coastal resources are very productive in both a biological and economic sense. Reefs, mangroves, wetlands, and tidelands provide nursery and feeding areas for many marine species. In addition, these coastal resources also provide important buffer areas for storm protection and to control erosion. Frequently, human activities within coastal areas can contribute to the degradation of these crucial resources.

2. Lightning: It is the discharge of electricity from a thunder cloud, technically named 'Cumulonimbus'. It is generated mostly in Cumulonimbus clouds. A well developed cumulonimbus cloud is electrically charged and the electro-static charges are distributed in the cloud so that the negative charges are concentrated in the lower part of the cloud and positive charges in the upper part. Under the influence of a charged cloud, the earth surface below the cloud is positively charged by induction. Under the favourable conditions, electrical discharges occur from a charge centre in a cloud either to the induced charge on the earth, or to charge centres of another cloud or to a charge centre of the same cloud. Accordingly, lightning may be categorized mainly into two types namely Ground Flash – Discharge between a cloud and the earth and Cloud Flash– Discharge within a cloud or between clouds.
3. Harmful algal blooms (HAB): Eutrophication of waters caused by excessive nutrients, especially nitrogen, leads to potentially harmful algal blooms (HAB). They result in rapid growth of an algal species that may contain toxins causing negative impacts on coastal resources and /or human beings. HABs can occur naturally due to the reasons like sea surface temperature rise or due to human activities like excessive use of phosphorus and nitrogen fertilizers in agriculture. They get into the sea through river systems causing eutrophication.
4. Hazards can be single, sequential or combined in their origin and effects. For instance, it could be a cyclone followed by floods. Sometimes natural hazards may get augmented by human activities. For instance, natural coastal erosion by wave action may increase due to cutting down of mangroves.
5. The risk from coastal hazards is characterized by the frequency of occurrence and severity of the hazard (Figure 2.4.1). For example tsunamis are typically infrequent

events with moderate to severe consequences. Mild flooding may occur frequently, while severe flooding may be an infrequent event. Coastal erosion may be a chronic event with mild consequences or, coupled with other hazards, may result in severe impacts on the shoreline. Infrequent events with limited predictability pose the greatest risk of disaster and the longest time needed for disaster recovery. Frequent or ongoing hazards such as resource or environmental degradation processes can be monitored to reduce risk.

Figure 2.4.1



((Source; How Resilient is your Coastal Community? A guide for evaluating coastal community resilience to tsunamis and other hazards, U.S IOTWS)

6. Hazards on its' own need not be dangerous. However, when clubbed with vulnerable factors can turn into disasters. The following session would help identify some of these vulnerable factors.

References for Key Concepts

- Paragraph1, 5 How Resilient is your Coastal Community? A guide for evaluating coastal community resilience to tsunamis and other hazards, U.S IOTWS
- Paragraph 2 National Training Course for DRR for Coastal Zone Managers, Coast Conservation Department, Sri Lanka, 2009
- Paragraph 3, National Training Course on DRR for Coastal Zone Managers, CEE, India, 2009

Quick Facts

Table 2.4.1 shows the typical coastal hazards in India.

Case Study

The devastating algal bloom in India – Warming effect?

The rich biodiversity of gulf of Mannar region, which is declared as marine biosphere reserve in the south of Tamil Nadu region is in danger. Reason, the harmful algal bloom (HAB). Sudden and rapid multiplication of huge number of Dinoflaggelate Noctiluck (an algal species)

had rapidly depleted oxygen levels in the sea water killing tens of hundreds of fish along the coast and attacking the coral reefs as well. According to Dr. G. Gopakumar, Principal Scientist-in-charge at the Mandapam Regional Centre of the Central Marine Fisheries Research Institute (CMFRI) "Corals got bleached due to lack of oxygen while many fishes and sea animals also died. This type of mass mortality of bio-diversity has taken place for the first time in the Gulf of Mannar. The HAB phenomenon has been reported from other parts of the world, but the "intensity here has been severe."

Table 2.4.1

Hazard	*Region most affected*	*Frequency of occurrence*	*Magnitude of impact*	*Remarks*
Storm surges	Bay of Bengal.	Above table	Biggest killer in this part of the world.	Impact event by event is not easily available, but it should be possible to assemble for the last century at least based on instrumental records.
Tsunami	Needs further study.	Sporadic, not known	Highly damaging.	Need to document occurrence in the past and evaluate the impact
Coastal pollution	All major coastal industrial areas, ports, major cities and towns on the coastline.	Persistent, but sporadic bursts of heavy pollution may occur.	Affects biodiversity & tourism industry, and human health through the marine food chain.	Impact needs to be monitored on continuous basis. Need to generate data base of the major pollution constituents and their effects on ecology. Not well documented or quantified in spite of several EIA studies.
Coastal erosion	Not fully known.	Persistent hazard, but exacerbated by other hazards like cyclones and storms, floods, tsunami, and by anthropogenic activity.	Variable, but can be disruptive.	As with pollution, there is a need to integrate the results of several small-scale, disparate studies.
Oil spills	Usually along shipping routes and around harbours, but, in the event of an accident, almost anywhere.	Variable.	Harmful effect on the coastal or marine ecosystem.	Need to understand how a potential spill will spread, and need methods to reduce effect of harmful toxins.
Harmful algal blooms (HABs)	Mostly off the southwest coast of India, but also occur at other places.	Annual event (may be more), but of short duration.	Variable; affects sea-food chain, tourism; human health hazard.	Need to understand causative effects and spatio-temporal spread;
Submarine mudslides	Not predictable as this depends on soil/sediment structure & texture.	Not known.	Can have serious impact on offshore structures, and result in huge loss for the oil sector.	Need for a detailed study of past events using paleontological methods, and sediment stratification classification.
Impact of global climate change	Global, but projections suggest an increase in the already high frequency of storms in the Bay of Bengal.	Projected increase in the frequency of storms in the Bay of Bengal	Not known, subject to uncertainty inherent in global climate models.	Needs to be taken seriously because an already stressed and fragile coastal zone may be subject to more intense and frequent hazards.

(Source: National Training Course on DRR for Coastal Zone Managers, CEE, India, 2009)

Stretching off the coast from Mandapam on the mainland up to Tuticorin, the marine park has suffered the algal bloom in a 30 km stretch from near Pamban to Keezhakarai. Nearly 13.9 tons of commercially important species are killed. During the bloom phase, the coastal water turned dark green. The phosphate and ammonia levels were found very high. At several landing stations very low oxygen levels were recorded due to the bloom - below 1 milliliter (ml) per litre of water against the norm of 5 ml per litre. In the reefs around the algal bloom it is said that no fish was observed because sea grass and seaweed had also been wiped out. Alerted by local fishermen scientist found that the algal bloom was fortunately not toxic and was seen just before the northeast monsoon and in unusually high temperatures. With the onset of monsoon, temperatures dropped and the bloom disappeared by October 15, leaving pale white damaged coral reefs mainly in Vaazhai and Mulli Islands. Are the fingers (reason for this alga bloom) pointing towards sea surface warming along with pollution?

(Source: National Training Course on DRR for Coastal Zone Managers, CEE, India, 2009, Dangerous algal bloom on TN coast; MR Venkatesh Hindustan times- Nov 11, 2008)

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise: Materials required: Computer, Projector, Screen
Instructions:

- Show a name of a hazard on the screen and request the participants to match the hazards under following categories;
- Geological,
- Hydro-meteorological,
- Biological and
- Technological hazards.

Session_2.5 Recognizing the Coastal Vulnerabilities

Session learning Objectives

At the end of the session the participants would be able to discuss the different types of vulnerabilities in coastal areas; social, physical and economical and identify the factors which contribute to vulnerabilities in coastal areas

Session Duration

Presentation: 30 minutes
Group Exercise: 30 minutes
Total: 60 minutes

Key Terminologies

- Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

  Comment: There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its

exposure. However, in common use the word is often used more broadly to include the element's exposure. (Source: UN/ISDR, 2009)

- Capacity: The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.

  Comment: Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacity also may be described as capability. Capacity assessment is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action. (Source: UN/ISDR, 2009)

Key Concepts

This session would cover the following concepts:

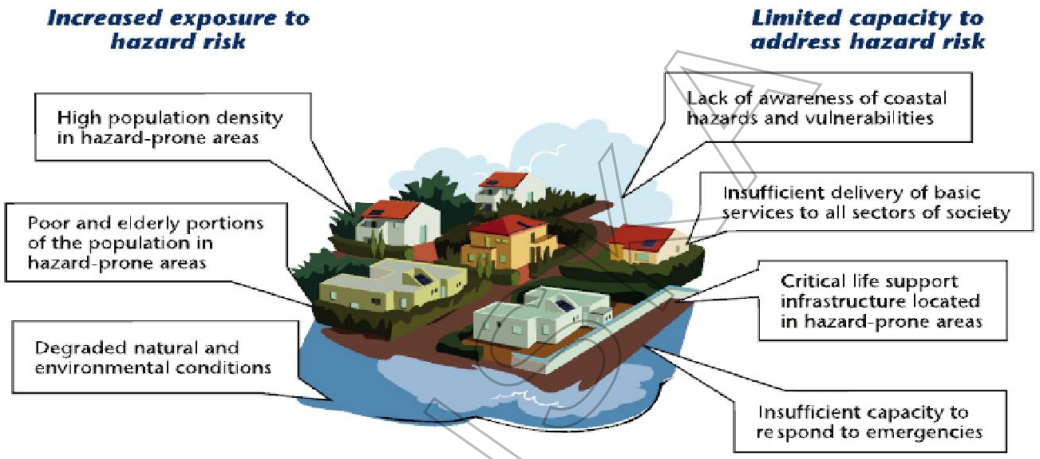
1. Various factors contributing to vulnerability are given in the table 2.5.1. These factors have been grouped under broad categories for better understanding.

Table 2.5.1

Categories	Vulnerability factors
Geographical	Physiographic characteristics of coasts like slope, elevation, shoreline features
Climatic	Temperature increase
Social	Demographic features (population, gender, age, density), literacy and education, insurance, health
Economic	Livelihood and other economic indicators like property, vehicles, communication systems
Physical	Houses, road bridges, cyclone shelters, transport and communication systems, and other infrastructure
Environmental	Access to and availability and quality of natural resources, quality of ecosystem services
Development related	Type of developmental activity, location, process followed

2. The increased vulnerability of coastal communities to potential hazards is partly due to the constantly increasing coastal population. Human activities are degrading the quality of the coastal environment and integrity of coastal ecosystems on a daily basis, making coastal populations more vulnerable. Coastal habitats such as reefs, mangroves, wetlands, and tidelands provide nursery and feeding areas for many marine species and serve as buffer areas for storm protection and to control erosion. These coastal habitats are being destroyed by a wide range of human uses, including shoreline development, land reclamation, mining, and aquaculture. Runoff, wastewater discharges, and oil spills pollute coastal waters and endanger marine life. Overfishing and the use of destructive fishing practices are causing the decline of fishery resources and changes in marine ecosystem structure and function. The degradation of the coastal environment from chronic human-induced actions threatens food security, livelihoods, and the overall economic development and well being of coastal communities.
3. Most of the coastal population lives in relatively densely populated rural areas and small to medium cities, rather than in large cities. In these relatively rural communities, basic services and disaster warning and response mechanisms are limited (Figure 2.5.1). Limited capacity of a community to plan for and respond to coastal hazards makes coastal populations increasingly vulnerable and increases disaster risk."
4. Following are some of the suggested Indicators for coastal vulnerability
   - Persons/square km (population density) captures threats from coastal development, sewage, land cover clearance, ground water depletion, and overexploitation of resources.

Figure 2.5.1 Factors that contribute to vulnerability in coastal populations



(Source; How Resilient is your Coastal Community? A guide for evaluating coastal community resilience to tsunamis and other hazards, U.S IOTWS)

- Density of tourist rooms (tourist infrastructure) captures the threat to land use and land cover, ground water depletion, water and beach pollution from recreational activities
- Area under intensive aquaculture captures threats to mangrove clearance, land use change (e.g., agriculture), saline intrusion into coastal aquifers, eutrophication, threats to wild stock
- Fertilizer use/ha, cultivated area, irrigated area captures potential threats of eutrophication, groundwater depletion, soil degradation, and land cover change.
- Number of potentially polluting industrial units located captures threats from industrial pollution, land cover change, and ground water depletion
- Total cargo handled at ports measures potential threats from oil spills and impacts on marine life; from species introduction through release of ballast water and need for port extension and consequent impact on marine life.

(Source: adopted from A framework of indicators potential coastal vulnerability to development, TERI)

References for Key Concepts

- Paragraph 2 and 3; How resilient is your coastal community: A guide for evaluating coastal community resilience to tsunamis and other hazards, U.S. IOTWS, 2007
- Paragraph 4; A framework of indicators potential coastal vulnerability to development, TERI

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise: Materials required: Computer, Projector, Screen
Instructions:

- Divide the participants into 3 Groups
- Request each group to fill in the table below by providing an example against each of the criteria contributing to vulnerability in coastal areas. An example of vulnerability due to criteria related to physical aspects is provided in Table 2.5.2 below for better understanding.

Table 2.5.2	
Category	
Example	
Physical	The non-engineered houses built along the coast do not have permanent roofs
Economic	
Social	
Environmental	
Climatic	

Session_2.6 Introduction to Coastal Climate Change

Session learning Objectives

At the end of the session the participants would be able to recognise the impacts of climate change and the related increasing vulnerability of the coastal area.

Session Duration

Presentation: 40 minutes
Group Exercise: 20 minutes
Total: 60 minutes

Key Terminologies

- Climate change: means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (Source; UNFCCC). The UN Framework Convention on Climate Change (UNFCCC) uses the term "climate change" for human-caused change and "climate variability" for other changes.
- Climate change adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. (Source; UNFCCC)
- Mitigation: In the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere. (Source; UNFCCC)
- Climate change impacts: The effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts: Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation. Residual impacts: the impacts of climate change that would occur after adaptation. See also aggregate impacts, market impacts, and non-market impacts. (Source: IPCC 4th Assessment Report, Working Group 2)

Key Concepts

This session would cover the following concepts:

1. Main characteristics of climate change include: Increase in average global temperature (global warming); change in cloud cover and precipitation; melting of ice caps and glaciers and reduced snow cover and increase in ocean temperatures and ocean acidification.

2. Many of these impacts associated with climate change exacerbate or alter existing hydro-meteorological hazards, such as droughts, floods, storms and heat waves. Climate change is caused by the anthropogenic emission of greenhouse gases and leads to alterations in global climate patterns with shifts in local precipitation, temperature and weather patterns. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will stress critical ecosystems and lead to water and food shortages this century.

Figure 2.6.1 Socio economic impact on coast

	More frequent floods	Erosion of coast	Inundation by sea water	Rise in water table	Intrusion of salt water	Changes in biological processes
Water resources			✓	✓	✓	✓
Agriculture	✓		✓	✓	✓	
Human health	✓		✓			✓
Fisheries	✓	✓	✓		✓	✓
Tourism	✓	✓	✓			✓
Human settlements	✓	✓	✓	✓		

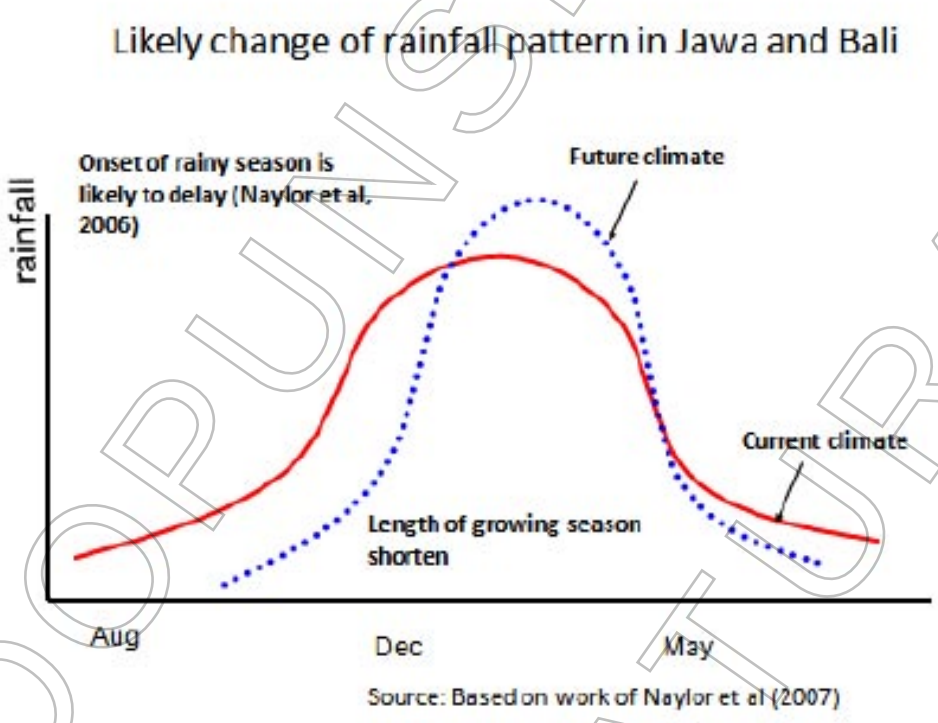
(Source; UNFCCC, 2006)

3. Sea level rise, coastal erosion, ocean acidification, increased cyclones, floods, storm surges height, saltwater intrusion; loss of land & resources and changes in marine species composition/distribution are some of the impacts of climate change in coastal area as illustrated in the figure 2.6.1. This will threaten the vital coastal ecosystems including settlements and services that support livelihood of coastal communities. For example in Indonesia sea level rise in particular has severe impacts on the coastline. Currently, around 42 million people in Indonesia live in areas less than 10 meters above the average sea level. It has already undermined livelihoods in many islands in Maluku in Indonesia, where fishermen say they can no longer predict the right times or places to catch fish because of the different climate patterns. Rising sea levels could also inundate many of the shrimp and fish ponds in Java, Aceh and Sulawesi. The increase in sea temperature has also caused serious problems for the coral ecosystems and coral bleaching is observed in many places such as in the eastern part of Sumatra, Java, Bali, and Lombok. In 'thousands islands' (north of the Jakarta coast), about 90 to 95 percent of the corals located 25 metres below sea surface have been bleached. (Source; Ministry of Environment, Government of Indonesia)
4. Typically water resources, agriculture, fisheries, tourism, human settlement are some of the sectors affected by climate change in the coastal areas. Similarly, coastal cities

which are typically the hot spots of the country's economic activities are facing the danger of submergence. For example; around 7 million people are projected to be displaced due to submergence of parts of Mumbai and Chennai city in India, due to increase of global temperature of 20 degree centigrade. (Source; National Training Course on DRR for Coastal Zone Managers; CEE, India, 2009)

5. The impact of climate change is also very local specific. Figure 2.6.2 shows the likely change in rainfall pattern in Jawa and Bali in Indonesia.

Figure 2.6.2 Likely change of rainfall pattern in Jawa and Bali



(Source; Presentation made by Ministry of Environment, Government of Indonesia at National Review Workshop on development of National Training Course on DRR for Coastal Zone Managers, Jakarta, May, 2009)

References for Key Concepts

- Paragraph 2; Environment and Disaster Risk, Emerging Perspectives, UNEP, 2007

Quick Facts

Projected impacts of Climate Change in India

- By 2100 temperature rise likely to be over 4o C.(Source; Indo British study, December 2005)
- Projected sea level rise of 1 mm/year is expected.
- Precipitation may rise by 11%
- Climate-related factors could cause India's GDP to decline by up to 9% washing away all the developmental gains
- More than 35% of the population who are living on less than 50 Indian Rupees per day are at high risk
- Intensity and frequency of natural disasters will increase (storm surges, cyclones, flood & drought)
- Water related stress (recession of glaciers, changes in rainfall pattern, sea level rise) are critical concerns
- Climate change is likely to affect agriculture, water resources, critical river basins and ecosystems, natural resources causing 15 to 30% decline in productivity.

- Shifting of growing seasons of major crops like rice may reduce the production by 40%.
- Submergence risk is high in the coastal zone due to sea level rise and floods
- Coasts may suffer due to salination of ground water.
- Disappearance of biodiversity hot spots such as Sunderbans is likely
- Vector related disease incidences may increase
- Ecosystem services will be impacted adversely increasing the risks due to disasters
- Ecological disasters like incidences of coral bleaching, disappearance of wetlands, reduction in mangrove extent, species extinction may become more common

(Source; National Training Course on DRR for Coastal Zone Managers; CEE, India, 2009)

Projected impacts of climate change in Indonesia

- In Indonesia, 42 million people live in areas less than 10m above sea level
- Indonesia has installed a number of instruments to monitor sea level. The existing Indonesia Sea Level Monitoring Network consists of 65 operational stations. Increasing trends in MSL has been observed in a number of stations.
- A rise of about 1 metre could inundate around 405,000 hectares of coastal land, causing the disappearance of many low-lying islands along with coral reefs, mangrove ecosystems and wetlands.
- Industry in coastal areas will also be impacted: oil and gas exploration, transportations, fisheries, settlements, agriculture and tourisms
- A sea level rise of 8-30cm would have serious impacts on coastal cities such as Jakarta and Surabaya because the ground level has also been falling due to building construction and ground water extraction
- Within the period of 2003-2005 alone, there were about 1,429 disaster incidences in Indonesia. About 53.3 percent were hydro-meteorological disasters. Of this figure, floods occur most often (34%), followed by landslides at 16%. Notable examples include: Jakarta, 2007: 422,300 displaced / US$695m in damage, Sinjai, 2007: 200,000 displaced and Aceh, 2006: 110,000 displaced
- A 0.5m sea level rise and continuing subsidence could lead to the permanent inundation of three locations in Jakarta (Kosambi, Penjaringan and Cilincing) and three in Bekasi (Muaragembong, Babelan and Tarumajaya) with a total population of approximately 270,000 people

(Source; Presentation made by UNEP/UNDP at MFF Regional Training on 'Applying Project Cycle Tools to Support Integrated Coastal Zone Management', Semarang, Indonesia, October, 2008)

Case Study

The sinking Sunderbans

Lohachara and Suparibhanga, islands in the Sunderbans have gone under waters - in to the history- before any one even knew of these islands. These are the first inhabited islands to sink into the swelling seas, say reports. So remote are these places that their disappearance was noticed only from the satellite pictures. The islands form part of the UN world heritage site of the mangrove forests, famous for the Bengal tiger, the endangered big cat species. Ganges and the Brahmaputra rivers emptied their waters here into the Bay of Bengal.

The Government of West Bengal, India says that the islands were eroded by ocean currents which is a natural phenomenon and hence cannot be linked with rising sea levels caused by Climate Change. According to scientists global warming induced climate change raised sea levels and made the islands uninhabitable. Washing of these islands off the face of the earth over the three decades only shows that the prediction of climate scientists is coming true.

A six-year study of Calcutta's Jadavpur University also show that two-thirds of nearby populated island Ghoramara has been inundated and will suffer the same fate as Lohachara. Over 10,000 people are homeless over the last decade from these islands. These inhabitants from the vanished Lohachara and the vanishing Ghoramara islands are likely to join the first wave of environment refugees. They have fled to Sagar; one of the largest islands, which itself has already lost 7,500 acres of land to the sea and facing the high risk of sinking. This influx is putting pressure on the island's fragile resources and the original inhabitants as well.

According to Sugata Hazra from the School of Oceanographic Studies at Jadavpur University, the sea levels could rise up to 3.5 mm a year in the next few decades washing away 15 per cent of the islands (a dozen islands) and displacing 70,000 people and putting 400 Bengal tigers and other distinct flora and fauna in danger. Carteret Islands off Papua New Guinea were predicted to be the first inhabited ones to sink in about eight years' of time, but Lohachara has beaten this prediction.

As the seas continue to swell, they will gulp the island nations, from Maldives to Marshall Islands, inundate vast areas of countries from Bangladesh to Egypt, and submerge huge parts of coastal cities.

According to Asian Development Bank, if sea level increases by 1 meter, 7.1 million people may get displaced,5,76,400 ha of land will turn into waste land in India. Economic activities of major coastal cities such as Bombay may experience the loss up to 2, 28, 700 million Indian Rupees.

(Source: Islands sinking in Sunderbans; Subhra Priyadarshini ; The Telegraph ; Calcutta, India - Monday, October 30, 2006 Disappearing world: Global warming claims tropical island; Geoffrey Lean; The Independent ; Sunday, December 24, 2006)

Lombok, Indonesia

In Lombok Island in Indonesia the main economic activity is located in the coastal area and includes agriculture, fisheries and tourism. The population growth in the Lombok Island between 1994 and 1998 has been an average 1.99 % per year. Climate hazard potency based on temperature change has affected the main economic activities. Air temperature in 1948 reached 26.5 – 27 degree Centigrade while in 2007 increased until 28 – 28.5 degree Centigrade. Effect of this change is decrease in quantity and quality of spring source from year to year, flood and landslide, change in rainy season, sea level rise which can trigger beach abrasion, increase of thunderstorm and sea wave inundation. Impact is seen in the beach abrasion in Penghulu Agung Gatep, Ampenan, Lombok which occurred in March 2007. (Source: Ari Muhammad, www.lead.or.id). Sea level rise and extreme events are predicted in Lombok, Nusa Tenggara Barat, Indonesia. These events will likely affect coastal area inhabitant as shown in Table 2.6.1 below:

Table 2.6.1 Sea Level Rise Scenario in Lombok

	Year 2030	Year 2080	Year 2100
Level of Risk	Area (Ha)		
Low Risk	1215,86	1590,56	1750,56
Moderate Risk	701,9	744,37	1026,31
High Risk	5258,73	5609,18	5635
Extreme Risk	7768,67	7934,11	8039,14

(Source; Presentation made by Ministry of Environment, Government of Indonesia at National Review Workshop on development of National Training Course on DRR for Coastal Zone Managers, Jakarta, May, 2009)

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise: Materials required: Computer, Projector, Screen
Instructions:

- Divide the participants into 3 Groups
- Request each group to fill in the table below (Table 2.6.2) by providing an example of possible impact on the sector due to climate change in coastal area.

Table 2.6.2

Sector	Example
Agriculture	
Fisheries	
Tourism	
Housing	

Session_2. Knowing the coastal risk

Session learning Objectives

At the end of the session the participants would be able to connect the concepts earlier discussed in the module and recognise how their interaction leads to creation of risk.

Session Duration

Presentation: 30 minutes
Exercise: 15 minutes
Total: 45 minutes

Key Terminologies

- Risk: The combination of the probability of an event and its negative consequences.
  Comment: This definition closely follows the definition of the ISO/IEC Guide 73. The word "risk" has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in "the risk of an accident"; whereas in technical settings the emphasis is usually placed on the consequences, in terms of "potential losses" for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.
  (Source; UN/ISDR, 2009)
- Coping Capacity: The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
  Comment: The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during crises or adverse conditions. Coping capacities contribute to the reduction of disaster risks.
- Exposure: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
  Comment: Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

Key Concepts

This session would cover the following concepts:

1. Vulnerability and Hazards are not dangerous taken separately. But if they come together, they become a risk. Figure 2.7.1 shows the locations and populations in the yellow region are characterised by certain types of vulnerability, those in red and orange are threatened by natural hazards. However, risk only arises in the orange area, where hazard and vulnerability coexist.

Figure 2.7.1

(Source; Guidelines Risk Analysis – a Basis for Disaster Risk Management, GTZ, 2004)

2. Hazard and vulnerability must be simultaneously present at the same location to give rise to risk, which then becomes a disaster if the event actually occurs. A society may be vulnerable to floods, but not to earthquakes (and vice versa). Vulnerability can only be identified and studied with reference to a concrete hazard. Vulnerability to a specific type of hazard varies, depending on the sector and context: for example, in housing, vulnerability arises out of the poor quality of buildings and basic infrastructure, in health it arises out of a lack of reserves of medication and first aid equipment, in economic activities such as agriculture it arises out of a shortage of stockpiles, etc. However, it is important to remember that a large part of the vulnerability can be reduced through human capability for self-protection (''coping strategies'').
3. Thus risk can be expressed as the product of the hazard, vulnerability and exposure or in other words Risk = Hazard x Exposure x Vulnerability
4. Different people perceive risk differently. Perception of risk is the subjectivity that people make about their characteristics and severity of a risk and explains why people make different estimates of the danger and decisions to avoid it. For example, communities may regard real every day concerns or problems such as livelihoods, health, and family as more immediate threats than the infrequent natural hazards. Local authorities may be more concerned with street fighting and solid waste management problems than disaster risk. However, factor such as environmental degradation contributes to vulnerability and increases the risk. Similarly, climate change increases hazards and contributes to vulnerability too. Some of the factors which account for varying perceptions of risks are as follows:
   - Socio-economic characteristics- age, gender, ethnicity, income, education, employment, health
   - People's knowledge about of their environment resulting in adopting local coping strategies
   - Lack of knowledge (and experience) about the hazards or threats
   - Ability to cope with hazards and risks through technology, financial attributes education, political power and having a voice.
   - Ability to access help from outside.

References for Key Concepts

- Guidelines Risk Analysis – a Basis for Disaster Risk Management, GTZ, 2004

Session Delivery

Power point Presentation (provided in the attached CD)

Exercise: Materials required: LCD Projector, Flip Chart
Instruction:

1. A set of statements would be screened on the computer
2. Each statement relates to one basic concepts taught in this module
3. On the flip chart, the key terms would be written. Each of the key term refers to one or more of the statements being screened on the computer
4. Each of the statement would be read out by the facilitator and the participants requested to provide the answer

Table 2.7.1 provides an example of the proposed exercise which could be adapted as per the need of the training:

Table 2.7.1

Match the following	
Statements	**Concept**
"As a result of the migration from rural to urban, the young generations do not have strong links with their traditional village communities and thus the safety nets which have been developed by Pacific Island societies over hundreds of years are weakening"	• Hazards • Vulnerability • Risk • Capacity • Exposure
"Since 1950, natural disaster have directly affected more than 3.4 million people in Pacific Island Countries and the trend is increasing"	
"A common practice among road designers is to make the road higher than the expected design flood level, thereby ensuring uninterrupted access while floods are in full flush. Sometimes this creates a dilemma because the road embankment itself creates higher flood levels on the uphill side of the road and which can exacerbate flooding of homes and other property."	

Session_2.8 Stakeholders involved in coastal development

Session learning Objectives

At the end of the session the participants would be able to list out the various stakeholders involved in the coastal area and map their role in reducing or creating risk from natural hazards.

Session Duration
Presentation: 15 minutes
Group Exercise: 45 minutes
Total: 60 minutes

Key Concepts

This session would cover the following concepts:

1. Stakeholders or in this case; coastal zone managers would include all actors and groups who affect or have influence on, and/or are affected (positively or negatively) by, the policies, decisions and developmental actions on the coast.
2. In this case, stakeholder analysis would include the process to identify and understand the key people/groups that have a stake or interest in managing the coastal area.
3. Though the primary objective is to understand the range of active stakeholders (those who affect or determine a decision, action or outcome) involved, it is equally important to understand the passive stakeholders; one affected by the decision or action; because they are the ones at the heart of interest and should benefit from the interventions in coastal areas.

4. Since the aim of this course is to make sure the management activities in the coastal areas should be disaster resilient, while carrying out the stakeholder analysis following steps should be followed:

Identifying key stakeholders

- Who are potential beneficiaries of the proposed action related to development in the coastal area?
- Who might be adversely impacted from the proposed action?
- Have vulnerable groups been identified?
- Have supporters and opponents been identified?
- What are the relationships among the stakeholders?

Determining stakeholder interest

- What are the stakeholder's expectation of the policy, project and intervention (i.e. proposed action)?
- What benefits are there likely to be for stakeholders?
- Would the action have any negative impact on the stakeholders? If Yes, what kind of negative impact?
- What stakeholder interests conflict with the objectives of the policy, project and intervention?
- What resources might the stakeholder be able and willing to mobilize for the implementation of the proposed action?

Determining stakeholder power and influence

- What are the relationships between the various stakeholders?
- Who has power over whom? Who is dependent on whom?
- Which stakeholders are organized? How can that organization be influenced or how can the proposed action built upon the skills/values of the stakeholders?
- Who has control over resources? Who has control of information?

Session Delivery

Group Exercise; Mapping the Stakeholders
Materials required: Flip Charts, Markers
Instruction:

1. Divide the participants into 3 groups
2. Provide each group with a theme for example;
    - Coastline inhabited by a cluster of fishing village
    - Coastal forest of 5 km stretch under the Forest Department
    - Coastal town famous for tourism
3. Each group would be required to fill in Table 2.8.1 and discuss the following in respect to their theme:
4. A discussion would be facilitated around the findings of each of the group, highlighting the stakeholders involved and the gaps in the system.

Table 2.8.1			
	Coastline inhabited by a cluster of fishing village	Coastal forest of 5 km stretch under the Forest Department	Coastal town famous for tourism
Description of the coast			
Primary services provided by the coast			
Primary stakeholders involved in managing these services			
Hazards faced by the area			
Stakeholders involved in dealing with natural hazards in the area			
Existing Vulnerability in the area			
Physical			
Social			
Economical			
Agencies to be involved in dealing with the existing vulnerability			
Any major impact of climate change in the area			
Existing capacity which could reduce the risk from natural hazard			

Module 3
Introduction to DRR and linkages with Climate Change Adaptation

Modular Learning Objectives:

At the end of the Module the participants would be able to:

- Understand the terminologies related to Disaster Risk Reduction (DRR) and distinguish them from terminologies used in climate change
  - Understand the importance and framework of DRR
  - Discuss various measures and approaches for DRR (Policies, Plans, Programs)
  - Identify some responses and options for climate change adaptation and its linkages with DRR

This Module would consist of three (3) sessions as follows:

Session 3.1: Understanding the Terminologies
Session 3.2: Framework for Disaster Risk Reduction
Session 3.3: Linking Disaster Risk Reduction and Climate Change Adaptation

Session_3.1 Understanding the terminologies

Session learning Objectives

At the end of the session the participants would be able to understand the key terminologies related to Disaster Risk Reduction (DRR)

Session Duration

Power point Presentation: 30 minutes
Group Discussion: 30 minutes
Total: 60 minutes

Key Terminologies

Only the key terms related to DRR are explained below. The complete list of terminology is provided in Section 2 of this Manual.

- Prevention: The outright avoidance of adverse impacts of hazards and related disasters.

  Comment: Prevention (i.e. disaster prevention) expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance. Examples include dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high risk zones, and seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake. Very often the complete avoidance of losses is not feasible and the task transforms to that of mitigation. Partly for this reason, the terms prevention and mitigation are sometimes used interchangeably in casual use

- Mitigation: The lessening or limitation of the adverse impacts of hazards and related disasters.

  Comment: The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness. It should be noted that in climate change policy, "mitigation" is defined differently, being the term used for the reduction of greenhouse gas emissions that are the source of climate change.

- Preparedness: The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

  Comment: Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response through to sustained recovery. Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and includes such activities as contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities. The related term "readiness" describes the ability to quickly and appropriately respond when required.
- Adaptation: The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

  Comment: This definition addresses the concerns of climate change and is sourced from the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The broader concept of adaptation also applies to non-climatic factors such as soil erosion or surface subsidence. Adaptation can occur in autonomous fashion, for example through market changes, or as a result of intentional adaptation policies and plans. Many disaster risk reduction measures can directly contribute to better adaptation.
- Response: The provision of emergency services and public assistance during or immediately after a disaster in order to save lives reduces health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

  Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called "disaster relief". The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.
- Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

  Comment: The recovery task of rehabilitation and reconstruction begins soon after the emergency phase has ended, and should be based on pre-existing strategies and policies that facilitate clear institutional responsibilities for recovery action and enable public participation. Recovery programmes, coupled with the heightened public awareness and engagement after a disaster, afford a valuable opportunity to develop and implement disaster risk reduction measures and to apply the "build back better" principle.

(Source; UNISDR, 2009)

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise: Materials Required: Flip Chart, Markers
Instructions:

1. Divide the participants in 3 groups and provide each group with the following scenario. The facilitator could choose any one from the three given scenarios or create a new scenario
   - Scenario 1: Coastal community recently affected by a tsunami
   - Scenario 2: Village in a delta region which is hit by floods every year

- Scenario 3: Village along a hazard prone coast which has just received an early warning of a super cyclone approaching in the next 48 hours

2. Request each of the groups to discuss an example of the following taking in consideration the given scenario
   - Group 1: Recovery, Response
   - Group 2: Prevention, Preparedness
   - Group 3: Preparedness, Mitigation
3. Each group is requested to present the examples and a discussion would be facilitated to discuss and clarify the level of understanding among the participants on the terminologies related to DRR

Session_3.2 Framework for Disaster Risk Reduction

Session learning Objectives

At the end of the session the participants would be able to understand the importance of DRR, get introduced to the framework for DRR; discuss various measures and approaches for DRR particularly in relation to coastal zone management.

Session Duration

Power point Presentation: 30 minutes
Group Exercise: 30 minutes
Total: 60 minutes

Key Terminologies

- Disaster Risk Reduction: The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

  Comment: A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action, adopted in 2005, whose expected outcome is "The substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries." The International Strategy for Disaster Reduction (ISDR) system provides a vehicle for cooperation among Governments, organisations and civil society actors to assist in the implementation of the Framework. Note that while the term "disaster reduction" is sometimes used, the term "disaster risk reduction" provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks. (Source; UNISDR, 2009)

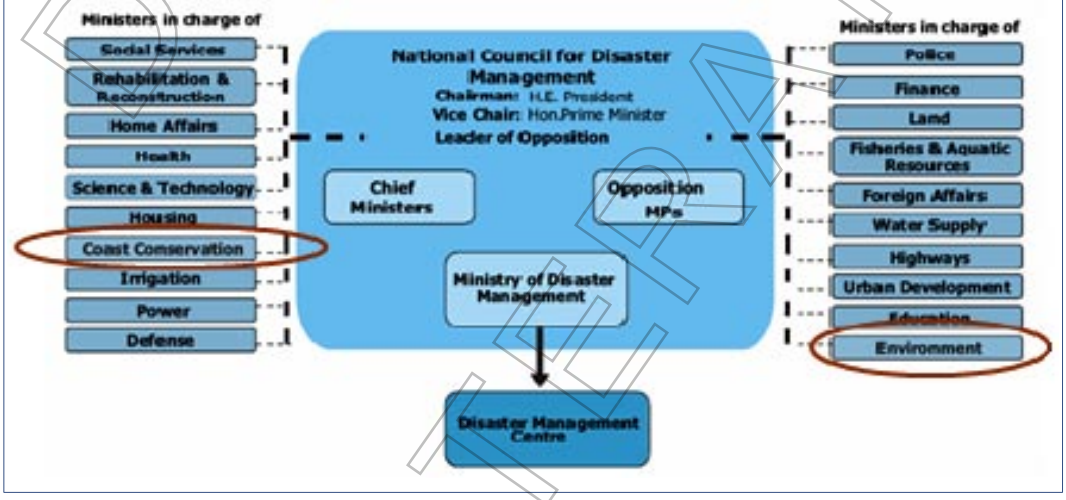
Key Concepts

This session would cover the following concepts:

1. Disasters have an enormous impact on development. With every disaster, there is a significant impact on various sectors of development such as agriculture, housing, health, infrastructure etc. This results in a serious social and economic setback to the development and particularly the poverty reduction priorities of the developing countries, and poses a threat for achieving the Millennium Development Goals (MDGs). To meet with this crisis, the scare resources that are programmed for development are often diverted for relief and rehabilitation efforts. For e.g. in Vietnam it is estimated that a further 4-5 per cent of the population could be pushed into poverty in the event of a disaster. (Source; Asian Development Bank)

2. On the other hand, the process of development, and the kind of development choices made in many countries, sometimes creates disaster risks. For e.g. flooding in Mekong Delta, is often caused by reduced drainage due to expansion of agricultural activities into wetland areas that previously served an important drainage function. (Source; ProVention Consortium, 2006)
3. Thus disasters are unresolved problem of development and there is a need to make sure that every development which takes place needs to reduce future risk of disasters and at same time should be resilient enough to withstand the impact of a natural hazard. This includes all development in the coastal zone and thus all six aspects of development processes namely policy, strategy, programming, project management, external relations and institutional capacity, should integrate DRR.
4. The Hyogo Framework for Action (HFA) has been adopted by the countries around the world as a framework for DRR. HFA offers five areas of priorities for action, guiding principles and practical means for achieving disaster resilience for vulnerable communities in the context of sustainable development. The below is a brief description of the priorities for action, specifically highlighting on possible linkages with coastal zone management.
5. HFA Priority for Action 1: Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation
   - **Legislations related to DRR**
     This provides a formal basis for counter-disaster action in the countries and allocates major responsibilities in legal form. DRR legislations should be comprehensive and adopt a multi–hazard holistic approach involving multiple levels of the government and wider stakeholders. It is to be noted that legislation that is relevant to DRR, should also be part of laws governing development, environmental management, social welfare etc. This emphasizes the necessity for legislations related to CZM to integrate DRR.

Figure 3.2.1



(Source; Ministry of Disaster Management and Human Rights, Sri Lanka)

   - **Institutional arrangements for DRR**
     Typically national institutions responsible for DRR are multi-layered with inter ministerial and inter departmental arrangements and its effectiveness often depends on the composition, devolution of responsibility at the sub-national level and its level of engagement with multi-stakeholder. For example the figure 3.2.1 below on national DRR arrangements in Sri Lanka shows the membership of the Coast Conservation Department.

6. HFA Priority for Action 2: Identify, assess and monitor disaster risk and enhance early warning
   - Risk assessment:
     Comprehensive risk assessments need to be carried out, in appropriate scale with a multi-hazard approach. There are two kind of challenges which remains in this aspect; the results of the assessments not reaching the policy makers or being used in development planning on a nationwide scale and secondly the unavailability of data on hazards and factors contributing to socio economic conditions. This requires coordination and information sharing between the various agencies (which are often respective sectoral agencies) that collect the information, carries out the assessments, and uses the results of these assessments in planning and making policies. A recent example of carrying out a comprehensive nationwide risk assessment is in the Maldives. It has developed the disaster risk profile for the entire country taking into consideration exposures of physical, environmental and social aspects. The scale of the assessment is appropriate to guide national policy and planning and the results of the assessments are being used by the Government agencies in planning and designing the safe islands.
7. HFA Priority for Action 3: Use knowledge, innovation and education to build a culture of safety and resilience of all levels
   - Need for information on disasters is required to be available and accessible at all levels, to all stakeholders (through networks, development of information sharing systems etc). In the context of coast, this emphasizes the need for stronger partnership between the national DRR agencies and the national agency responsible for coastal management, so that the information on natural coastal hazards is exchanged effectively with the managers working in the coastal areas at the sub national level.
8. HFA Priority for Action 4: Reduce the underlying risk factors
   - DRR, Environment and Natural Resource Management
     Natural resource exploitation, urban development and environment degradation all directly affect risk. Changes in weather intensities, circulation, hydrology, and sea level brought about by climate change have increased risk. The loss of ecosystems services that regulate floods and fires increases the vulnerability of vast populations in densely populated coastal areas and flood plain.

     Addressing the factors that create adverse environmental conditions requires strengthened governance systems, improved education, awareness and capacity building systems and appropriate technologies based on both scientific advances and traditional knowledge. Environmental management supports risk reduction through protecting and enhancing the ecological conditions that promote resilience and adaptation to a changing climate. (Source: Environment and Disaster Risk, Emerging Perspectives, UNEP, 2007)

     Thus this priority emphasizes on adopting measures for reducing risk in coastal areas among others. These measures could be structural (man-made or ecosystem based) and non-structural. The Module 5 of this course discusses in details various measures for reducing risk in coastal areas. Furthermore the Module 7 of the course discusses various approaches for integrating DRR in coastal zone management initiatives. These approaches range from policies, plans to programs.
9. FA Priority for Action 5: Strengthen disaster preparedness for effective response at all levels
   - Preparedness and Emergency Response
     This priority highlights among other the need to periodically update emergency response plans to address changes in physical, social, environmental and climate conditions. With the growing vulnerability to climate change, this is of particular importance especially in the coastal areas.

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise:

Objective: Brainstorm the range of activities and stakeholders involvement in a development project in a coastal area which could reduce risk.

Materials Required: Flip Chart, Markers

Instructions:

1. Divide the participants in 5 groups and provide each group with a scenario based on the five priorities of the HFA. The scenarios could be as follows; If your agency is implementing a development project in a coastal area which would indirectly reduce risk from natural hazards;
   Group 1: Define the project and discuss which stakeholders would you work closely with at the local level to incorporate DRR in your project
   Group 2: Define the project and discuss how would you make sure the activities you are planning under your project would be safe from impacts of natural hazards;
   Group 3: Define the project and discuss how can you raise awareness among the communities on the benefits of the project;
   Group 4: Define the project and discuss which development agency you would be working closely with and what inputs would you require from them in order to reduce risk
   Group 5: Define the project and discuss in what sort of activities can you involve the local volunteer organization in the project to ensure sustainability of the project
2. Each group would be requested to present the findings of the discussions and discussions would be facilitated to clarify the concepts and connect the links between the five groups.

Session_3.3 Linking DRR and Climate Change Adaptation

Session learning Objectives

At the end of the session the participants would be able to identify some responses and options for Climate Change Adaptation and its linkages with DRR

Session Duration

Presentation: 40 minutes
Discussion: 20 minutes
Total: 60 minutes

Key Terminologies

- Adaptation Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploit beneficial opportunities. (Source: Extracted from GLOSSARY, IPCC 4th Assessment Report, Working Group 2)
- Adaptive capacity (in relation to climate change impacts) 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 the consequences. The whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures. (Source IPCC 4th Assessment Report, Working Group 3, Glossary)

Key Concepts

This session would cover the following concept:

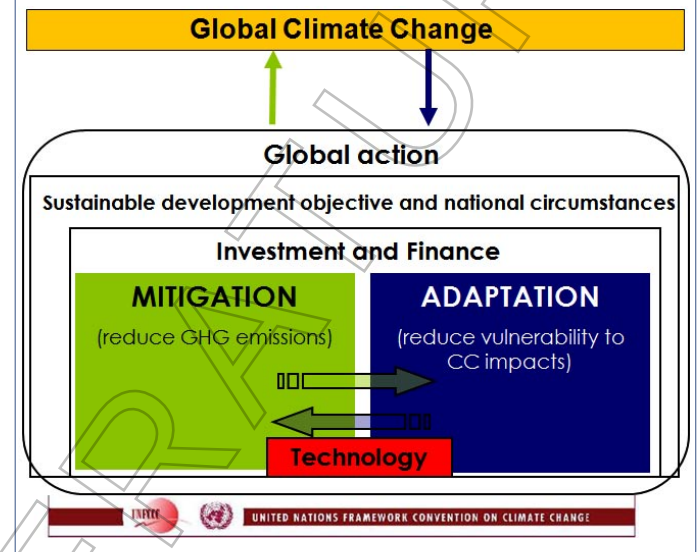
1. In Session 2.6 the impact of climate change on coast is discussed. Table 3.3.1 shows the considerations on coastal ecosystem and Climate Change.

Table 3.3.1	
Coastal Ecosystem	**Considerations**
Beach and Rocky shore	• Migrating in-land as widespread phenomenon • Local response depends on total sediment budget • Tendency for embayment infilling major changes in shoreline geography
Deltas	• Often heavily populated • Land subsidence accentuates impact of SLR • Simplification of delta structure, e.g. for transportation, greatly increases sensitivity
Estuaries and Lagoons	• Increased salinity • Potential decreased water residence time (if increased freshwater run-off) • Increased water temperature • Increased impact of storms
Coral Reefs	• Overall coral health is key • Bleaching, storm damage can negatively affect vertical accumulation rate • High CO2 rates and more acidic water slows growth
Mangroves and Sea Grasses	• Highly sensitive to impacts of CC - all models anticipate significant losses • Local hydrological conditions and sediment budget determine fate • Landward progression observed, but may be blocked by natural or human barriers

(Source; Presentation made by UNEP at MFF Regional Training on 'Applying Project Cycle Tools to Support Integrated Coastal Zone Management', Semarang, Indonesia, October, 2008)

2. Though healthy ecosystem are often the victims but they can also play an important role in reducing risk from natural hazards as well as climate change mitigation. For example; mangroves can act as green belt to reduce the impact of hazards on the coast as well as they serve as carbon sink.

Figure 3.3.1



3. Globally the efforts taken up for reducing the impacts of Climate Change is through Mitigation and Adaptation (Figure 3.3.1). In simple words Mitigation looks at the efforts to decrease the amounts of greenhouses gases released to the atmosphere, and Adaptation considers taking the right measure to reduce the negative impacts of Climate Change and is a process through which societies are better able to cope. The discussion in session would concentrate on Climate Change Adaptation.
4. In order to explain further let us look at what Climate Change Adaptation means to the Agriculture sector. Because of the impact of Climate Change and change in precipitation pattern, some of the typical impacts on the Agriculture sector are decrease in crop yields, reduction in soil fertility, shifts and changes in lengths of growing seasons and ultimately leading to food insecurity. Furthermore, the figure 3.3.2 shows the projected percentage change in agriculture productivity in 2080 and which clearly highlights that though for some countries (countries shown in light green to dark blue in the map) agriculture productivity from climate change would increase, the overall impact would be negative (countries shown in yellow to dark red in the map). This highlights the need

Figure 3.3.2

Potential Impact on Agriculture — Projected Percentage Change in Agricultural Productivity in 2080

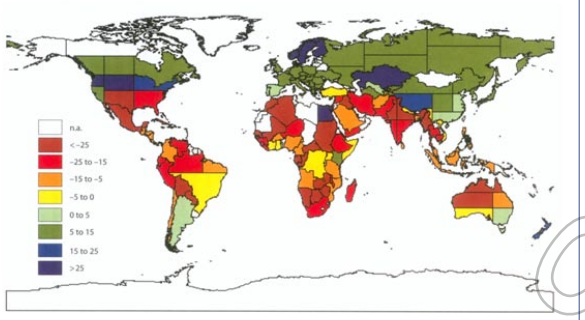
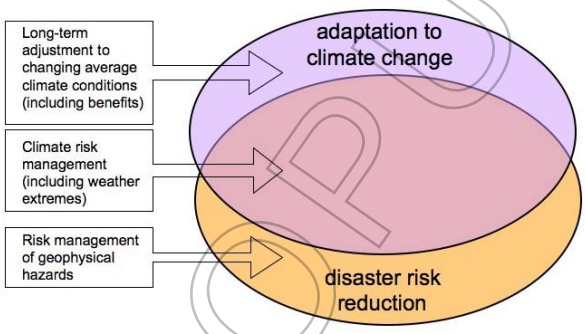


Figure 33.3



(Source; Presentation made by GFDRR, World Bank at ASEAN DRM Training Course, Yangon, July 2009)

Table 3.3.2

Anticipatory	Reactive
Natural systems	
• Increased ecosystem management • Biodiversity conservation • Protection and conservation of coral reefs, mangroves, sea grass and littoral vegetation • Development of legislation for coastal protection • Research and monitoring of coast and coastal ecosystems	• Longer or shorter growing season • Migration of wetlands • Changes in ecosystems • Protection and conservation of coral reefs, mangroves, sea grass and littoral vegetation
Human systems	
• Establishing new building codes (flood-proof houses on stilts) • Buying hazard insurance • Installing early warning systems • Improved risk management/ coastal zone planning • Enhanced water management • Improving coastal defenses through reforestation/ afforestation (greenbelts), hard structures (if needed) • Integrated CZM • Set-back areas	• Moving home • Changing occupation • Changing insurance premium • Buying air conditioning systems • Offering compensation or subsidies • Enforcing building codes • Beach nourishment • Protection of economic infrastructure • Public awareness to enhance protection of coastal and marine ecosystems • Building sea walls

(Source; Presentation made by UNEP at MFF Regional Training on 'Applying Project Cycle Tools to Support Integrated Coastal Zone Management', Semarang, Indonesia, October, 2008)

to undertake adaptation strategies such as crop diversification, improved irrigation and fertilizer, mixed farming systems (crops, livestock and trees), dams for water storage, water harvesting, and storage, reduction of run-off and drainage systems.

5. Adaptation is classified as Anticipatory and Reactive. While Anticipatory would include responses aimed at reducing exposure to future risk posed by climate change, Reactive includes actions implemented as a response to an already observed climate impact. Table 3.3.2 shows types of adaptation in the context of coastal ecosystem:
6. Most impacts of climate change, especially in the short to medium term, will materialize through variability and extremes. Hence reducing disaster risk is thus a no-regrets Climate Change Adaptation strategy. Climate Change Adaptation and DRR have similar aims and mutual benefits. They are two complementary approaches for sustainable development with areas of overlap offering opportunities for synergies (Figure 3.3.3). They are both closely linked to the poverty alleviation agenda and economic growth and are means to achieve the MDGs and sustainable development. Thus DRR and climate change adaptation should largely be managed as one integrated agenda.
7. The technology for adaptation in coastal zone is of three types namely; Protect, Retreat and Accommodate. Table 3.3.3 provides examples of adaptation in the coastal area and shows its close linkage with DRR.

Table 3.3.3

Protect	Retreat	Accommodate
Protect existing assets and livelihood from Sea Level Rise Seek to exclude the hazard	Avoiding SLR in order to eliminate a direct impact Seek to remove human activities from hazardous zone	Accommodate SLR, reducing the overall severity of damages Allows human activities and hazard to co-exist
• Hard structures – dykes, sea-walls, tidal barriers, detached breakwaters • Soft structures – dune or wetland restoration or creation, beach nourishment, greenbelts, biodiversity conservation • Indigenous options walls of wood, stone or coconut leaf, afforestation	• Establishing set-back zones • Re-locating threatened buildings • Phasing out development in exposed areas • Creating upland buffers • Rolling easements	• Early warning and evacuation systems/ increased awareness • Hazard insurance • New agricultural practices, such as using salt-resistant crops • New building codes • Desalination systems

(Source; Presentation made by UNEP at MFF Regional Training on 'Applying Project Cycle Tools to Support Integrated Coastal Zone Management', Semarang, Indonesia, October, 2008)

8. In summary, the need for adaptation is inevitable and we need to take action immediately. Especially for developing countries, climate change is today's crisis, not tomorrow's risk: adaptation matters for development and has to start now. Table 3.3.4 summarizes some of the key needs and actions.

Table 3.3.4

What is Climate Change Adaptation?	Reduce negative impacts. Need better analyses at national-local level.
Why is it necessary	Adaptation is necessary for development. Climate risks undermine growth and hurt the poor.
When do we start it?	Need to start now to adapt to current climate variability in a cost effective way and prepare for the future.
The good news	In a very real sense development is the best adaptation: strong institutions, education, health, infrastructure, and a diversified economy strengthen resilience.
Understand risk and priorities	Develop hazard and risk analysis, use improved climate data, climate risk analysis, adaptation needs assessments.
Stakeholders	Involve key stakeholders with regular meetings, comprehensive, Processes led by researchers that focus on technical modeling will reduce stakeholder engagement.
Plans	Identify and appraise options, develop plans.
Don't rework government objectives	Mainstreaming in existing strategies ensures that objectives are met, use sectoral strategies to reach local governments and communities, build on existing platforms
Design policies	Encourage a shift towards climate-resilient growth across all sectors of the economy.
Line Ministries	Provide budget allocation for: • Climate resistant public infrastructure (e.g., roads, dams) • Preparedness and emergency response to extreme events • Information to help citizens in their everyday decisions (e.g., early warning systems, seasonal forecasts) • R&D and extension services in agriculture • Preparedness of the health sector for new diseases
Plan ahead with contingency plans	Provision for unforeseen events; create contingency funds, sign contingent loans, and/or buy insurance for emergency responses to climatic disasters.

(Source; Presentation made by GFDRR, World Bank at ASEAN DRM Training Course, Yangon, July 2009)

References for Key Concepts

- Paragraph 1,2, 3, 5 and 7; Presentation made by UNEP at MFF Regional Training on 'Applying Project Cycle Tools to Support Integrated Coastal Zone Management', Semarang, Indonesia, October, 2008

- Paragraph 4, 6 and 8; Presentation made by GFDRR, World Bank at ASEAN DRM Training Course, Yangon, July 2009

Session Delivery

Power point Presentation (provided in the attached CD)

Group Exercise:
Objective:
Materials Required: Flip Chart, Markers
Instructions:

1. Divide the participants in 4 groups
2. Each group is requested to fill up table 3.3.5 which would recommend possible anticipatory adaptation measures for the four sectors mentioned and highlight wherever these recommendations are linked to DRR;

Table 3.3.5

Sector	Adaptation Measures	Link to DRR
Agriculture		
Fisheries		
Tourism		
Housing		

3. Each group would be requested to present the findings of the discussions. It is to be noted that the same sectors were provided in the group exercise under Session 2.6 which enabled the participants to understand the possible impacts of Climate Change on the sectors. Now with this exercise they would be able to identify possible recommendations for adaptation for the same sectors and explore wherever these recommendations are linked to DRR.