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Flood Risk Mitigation and Management:

A TRAINING OF TRAINERS (TOT) MODULE

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Towards a disaster free India

NATIONAL INSTITUTE OF DISASTER MANAGEMENT
MINISTRY OF HOME AFFAIRS, GOVERNMENT OF INDIA

FLOOD RISK MITIGATION AND MANAGEMENT:

A TRAINING OF TRAINERS (TOT) MODULE

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FLOOD RISK MITIGATION AND MANAGEMENT

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Dr. SATENDRA, IFS
Executive Director

Foreword

A well-considered strategy and flexible mechanisms are necessary in order to make flood risk mitigation and management a reality. This calls for a concerted effort on the part of several sectors including national and state governments, activists, NGOs. A crucial component involves sensitizing civil servants on flood mitigation issues so that they bring to bear the appropriate perspective in planning, implementing and monitoring activities related to flood disaster management.

Section 42 Sub Section (9) (a) of the Disaster Management Act 2005 specifically ordains the NIDM to develop training modules. Accordingly, the present training module titled "Flood Risk Mitigation and Management" is developed. It is the first time that a module, which will be used in training courses on Flood Management all over India has been designed by National Institute of Disaster Management (NIDM). The module is the end result of several months of study, discussion, confabulation with many experts and feedback from participants of training programmes on flood.

The module was validated in the courses of training programmes and a pilot run was also conducted in the NIDM. The reading material, the select bibliography, glossary and the select web links on flood will enable facilitators to adequately equip themselves in conducting training courses more effectively.

A module of this nature, prepared for use all over the country, is bound to have certain shortcomings; we trust that users will communicate their views to us so that we can strive to make this module more effective.

(Satendra)

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MODULE AT A GLANCE.....

- **Name**: Training programme on Flood Risk Mitigation & Management
- **Developed by**: National Institute of Disaster Management (NIDM)
- **Technical Support**: Central Water Commission (CWC), New Delhi
- **Total number of modules**: 5
- **Target Group**: Senior & Middle level Officers from various sectors of Central and State Governments
- **Training programme on the basis of this Module requires:**
  - ✓ No. of Training Days: 5 working days
  - ✓ No. of Training Hours: 27-30 hours
  - ✓ No. of Trainers required: Two
  - ✓ No. of Resource Persons: Ten
  - ✓ Type of Training Hall: Movable tables and chairs
  - ✓ Sitting Arrangements: Row & Column type
  - ✓ All Training Materials: As mentioned
- No. of Total Pages: 103 excluding Annexures

Acknowledgements

This module is the outcome of a team work and support from many persons and agencies. We are thankful to the NDMA and DoPT, Government of India for entrusting us with this task and providing the overall guidance, motivating us and extending support in many ways. We are grateful to them for this.

We owe a special debt of gratitude to Dr. Satendra, IFS, Executive Director, NIDM and Shri P.G. Dhar Chakrabarti, IAS, former ED, NIDM not only for nominating me as the Anchor person, but also for the encouragement and support throughout the work. Dr.Santosh Kumar, Professor, Policy Planning and Cross Cutting Issues, NIDM, Dr. Chandan Ghosh, Professor & Head of GRM Division, Dr. Anandha Kumar, Associate Professor & Head of HYMET Division and the other members of the HYMET Division of NIDM, have brought their knowledge and the practical experience of conducting flood training programmes in the Institute. We have had several rounds of discussions before finalizing the module. An earlier draft of the module was validated in many off campus flood training programmes conducted by NIDM in collaboration at various ATIs during 2004-2011. Many experts made contributions in the design of module. We would like to thank all of them, particularly faculties of ATIs for their support and suggestions. We had also sent the content of this module to many experts of Central Water Commission, New Delhi for their comments. Prof. V.K. Sharma, Chairman, Policy & Planning and Environment, IIPA, New Delhi and Shri M.P. Singh, Director, CWC, New Delhi had discussed various issues related to flood risk management particularly preparedness aspects with me in detail and suggested some comments to improve the quality of the module, I am thankful to them. However, I take the responsibility for any inadequacy in the module.

At last but not the least, I thank to my colleagues and members of printing committee of NIDM for their time to time valuable discussion and suggestions.

Author

Dated: 11.06.2012

A.D. Kaushik

MODULE USER'S GUIDE

Who shall use the module?

This shall be used or guided by a person who has already undergone the training or involved in conducting training programmes. However, the module is self-explanatory and complete, so that a new person can also use it effectively. The under mentioned organizations/ people are the potential users of the module:

- Disaster Management Centres located in State Administrative Training Institutes (ATIs), State Institute of Rural Development (SIRDs) and other training institutes at regional and district levels in the above-mentioned departments
- People working in NGOs/CBOs and social organizations
- Volunteers in NCC, NYKS, NSS
- NDRF and first responders teams

HOW TO USE MODULE?

The design brief – an introductory chapter of this module will provide the users the objectives of the module, target group, basic structure and emphasis of the module, methodologies and other concerned informations to module.

The chapter on pre and post training assessments will guide on how to carry out evaluation assessment of the training programme with the sets of subject concerned questionnaires to be used and other necessary details by trainees.

The technical sessions of the training initiate from then onwards as per the contents of sub-modules i.e. learning units and would be done in an elaborate manner during each session with proper facilitating guidelines.

The session wise contents will be provided and the trainers can proceed day wise as per the suggested programme schedule given in Annexures.

Albeit, the sub-modules such as inauguration, valediction, recapitulization, feedback, etc. do not describe the total duration of a sub-module. It is reflected in the suggested programme schedule. The purpose of doing so is to provide little flexibility to the trainers to arrange or plan the sessions daily as per their convenience or institute's protocol.

Trainers Guide

The trainer or facilitator or the programme director may find the following tips useful for conducting the programme smoothly.

General

- During the inauguration session, the trainees should be asked to put their mobiles/cell phones in silent mode. In case of an urgent call, they should go out to receive the call and join back the session. They should also be asked to take prior permission with valid reasons, if they are to miss a session in between.
- All group activities (if possible & convenient) should be photographed and be shown after the training sessions are over every day.
- A group photograph should be taken on day 3 or 4, which is given to the trainees with the certificate on last day of the programme.
- Participants list with name, designation, address, contact numbers and e-mails should be circulated at least thrice during training before the final printout is brought out for circulating along with certificate and group photograph. One copy is to be circulated, so that all of them can make necessary corrections on that and give the same back to the trainer/ programme director/coordinator.
- All the training materials and equipments should be kept ready before the training.
- The trainees should be informed about the duration of lunch and tea/ coffee break and other group activities clearly every time. They should also be informed about the time when the next day's activity starts.
- The trainees should be informed to share their problems during the training and also on logistic issues so that every possible care should be taken to make their stay comfortable.
- During the programme, the duration of each session specified in various sub-modules may vary from the actual duration of the session, depending upon the number of trainees participating in the programme. As most of the sessions are very much process oriented and trainees centred, the duration would largely depend upon the size of group. So, the total training hours vary between 27-30 hours.
- The trainee shall not be given a certificate if he remains absent for more than one hour during training days. Exceptional cases may be considered favourably at the discretions of the programme director or coordinator.

Training specific

The programme has some common sessions everyday, which are not reflected in the programme matrix, but mentioned in programme schedule to avoid repetitions. The trainer should keep the following points in mind:

- The trainees shall be informed that the programme follows a strict time table and the minimum training hours would be seven hours per day for the entire duration. So they should book their return tickets accordingly.
- The training days (except first day) shall start with a recapitulation session which should be ideally of 15 minutes in the morning.
- Following the recapitulation, group presentation on the manual review, which should be of 10 minutes for each group (if the number of groups are two or three) needs to be done.
- Group composition shall change for every activity/ exercise through various methods. This would expedite the process of group support net work building process.
- Trainer's note will be there in every session, which will guide the trainer to proceed step by step.

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ABBREVIATIONS USED

ATI	Advanced Training Institute
BIS	Bureau of Indian Standard
CBDP	Community Based Disaster Preparedness
CBOs	Community Based Organizations
CD	Compact Disc
CD	Civil Defence
CRF	Calamity Relief Fund
CWC	Central Water Commission
DDMA	District Disaster Management Authority
DM	Disaster Management
DMP	Disaster Management Plan
DoPT	Department of Personnel & Training
DoT	Department of Telecommunications
DP	Disaster Preparedness
DSS	Decision Support System
ED	Executive Director
EOC	Emergency Operation Centre
ESFs	Emergency Support Functions
FF	Flood Forecasting
FM	Flood Management
GIS	Geographical Information System
GPS	Geographical Positioning System
HPC	High Powered Committee
ICS	Incident Command System
IDNDR	International Decade for Natural Disaster Reduction
IIPA	Indian Institute of Public Administration
IIRS	Indian Institute of Remote Sensing
IMD	India Meteorological Department
IRBM	Integrated River Basin Management
LCD	Liquid Crystal Display
mha	Million Hectares

MoES	Ministry of Earth Sciences
NCC	National Cadet Corps
NCCF	National Calamity Contingency Fund
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NFMI	National Flood Management Institute
NGOs	Non Governmental Organizations
NIDM	National Institute of Disaster Management
NRSA	National Remote Sensing Agency
NSS	National Service Scheme
NYKS	Nehru Yuva Kendra Sangathan
OHP	Over Head Projector
PHED	Public Health Engineering Department
PWD	Public Works Department
QPF	Quantitative Precipitation Forecasting
RBA	Rashtriya Barh Ayog
RBM	River Basin Management
RS	Remote Sensing
RWH	Rain Water Harvesting
SAR	Search and Rescue
SDMA	State Disaster Management Authority
SIRD	State Institute of Rural Development
SOPs	Standard Operating Procedures
ToT	Training of Trainers

TRAINING OF TRAINERS MODULE ON FLOOD RISK MITIGATION AND MANAGEMENT

Introduction

Disasters have been mankind's constant companion since time immemorial. Natural disasters continue to strike unabated and without notice. The previous decade, International Decade for Natural Disaster Reduction (1990-2000), was dedicated to promoting solutions to reduce risk from natural hazards. The decade, on the contrary, ended with more deaths from more disasters, involving greater economic losses and more human dislocation and suffering. It was then realized by the international community that the dedication of a decade to the core issue could not be expected to solve the repercussions of centuries of mismanagement and of passive fatalism before the vagaries of nature. Natural disaster is a high impact phenomenon, which has potential to wipe out years of development in a matter of few minutes or hours or over an extended period of time. Although disasters cannot be prevented fully, their impact can be reduced with better disaster management strategies aided by latest technological development.

Natural processes, such as cyclones, weather systems and snowmelt, can cause floods. Failure of levees and dams and inadequate drainage in urban areas can also result in flooding. Although loss of life to floods during the past half-century has declined, mostly because of improved warning systems, economic losses have continued to rise due to increased urbanization and development.

Target Group

The following are the target audience for the training programme:

Senior officers from District administration and from State government departments of Agriculture, Revenue, Irrigation, Health, PHED, PWD, Road & Highways, Food & Civil Supplies, Police, Environment & Forests, Animal Husbandry, Drinking Water Supply, Civil Defence, Municipal Corporations, Panchayati Raj and Rural Development, Officers of Central Government Agencies/ Ministries like IMD, CWC, DoT, Armed forces, NDRF, Railways, and NGOs & CBOs, etc.

Entry Behaviour

Target Level of trainees	:	Senior/Middle level Officers, trainers and field workers
Age	:	25-50 years
Years of Service	:	One to 25 years
Educational qualifications	:	Graduation as minimum
Disaster Experience	:	Substantial/Little/Nil
Flood Disaster Management Experience	:	Little/Nil
Medium of Instruction	:	English/Hindi

Aims

The training will primarily focus on enhancement of knowledge and skills of the participants to understand and respond to various issues in Flood Mitigation and Management. The programme aims to produce a corpus of trainers who can disseminate the knowledge and skills acquired on flood management amongst their colleagues and subordinates.

Learning Objectives

On the basis of the module at the end of the programme, the trainees would be able to:

- enable to understand and appreciate basic concepts of Natural Disaster Management.
- enhance understanding concerning the nature, extent of the threats and the value of counter measures to combat the adverse impact of floods.
- develop administrative capabilities to plan and implement disaster preparedness strategies.
- provide forum of interchange of ideas and views pertaining mitigation practices for flood disaster.
- provide the knowledge and skills for conducting training on the subject.

Methodology

The programme has five modules that impart the information and skills in flood problem analysis, understanding and appreciation of the various aspects of flood

disaster management and determination towards the measures to achieve the goal of flood risk reduction. The training methodology includes the following procedures:

- ✓ Lectures on Power Point/ Over Head Projector (OHP) etc. by Resource Persons.
- ✓ Group or Syndicate Exercises
- ✓ Interaction through panel discussion
- ✓ Needs assessment
- ✓ Role players
- ✓ Individual work and case studies
- ✓ Participatory learning/Experimental learning
- ✓ Field trips & Film shows
- ✓ Handouts i.e. Photostat copies of the presentations other published matter on flood disaster management.

Training Materials and Equipments Required

- ✓ Computer
- ✓ LCD Projector/ OHP
- ✓ Flip chart and its stand
- ✓ Speakers
- ✓ Mike
- ✓ Markers
- ✓ Chart sheets
- ✓ Folder and other training kit
- ✓ Photocopies/printouts of concerned resource materials, etc.

Teaching Aids

ToT Workbook: The workbook i.e.module will help the trainees to note down the highlights of each session in the page related to that session.

Handouts: The essential session related papers/articles of the presentations will be given to trainees during the programme for their use.

Exercises: Group exercises which are to be used by trainees during the training programme.

Case study: Small case studies to be given to the groups of trainees to carry out lesson learnt session as part of internalizing the basic skills of flood risk mitigation measures and management.

Compact Disc (CD): Resource materials such as power point presentations, reading materials and photographs, used in the training programme.

Reading materials: Trainees are to study or review the matter on flood disaster management during or after the training programme.

Contents

- Basic concepts of Disaster Management,
- Definitions, Hazard, Disaster, Risk, Vulnerability, etc.,
- Significance of Disaster Management,
- Disaster Management Cycle,
- Disasters & Development, Disaster Management System in India,
- Flood disaster management, Causes & Conditions, Characteristics, types & nature,
- Meteorological aspect,
- Flood situation in India, Global concerns, Flood risk assessment,etc.
- Mitigation measures (Structural and non-structural),
- Field visit to flood control measures,
- Institutionalization and Policy approach
- Preparedness Planning,
- Disaster Management Planning (DMPs, SOPs & ESFs,)
- Training & Capacity Building,
- Training Need Assessment
- Public education & awareness,
- Community Based Disaster Preparedness (CBDP),
- Role of NGOs and CBOs, Role of Media,
- GIS and RS application in settlement planning
- Emergency Response,
- Damage Assessment Techniques,

- Incident Command System,etc,
- Health Care, Management,
- Responding to the needs of Gender issue & vulnerable groups,
- New issues like impact of climate change,
- Lessons learnt based on case studies

Language of Instruction

The medium of instruction would be primarily English, but Hindi would be used as and whenever required.

Group Size

A total of 20-30 trainees can be trained at a time, however 20 is an ideal number. More than 30 trainees should not be allowed as most of the sessions are based on exercise and field visit. So, it will be difficult for the trainer to give individual attention to trainees during the programme.

Description of the Training Hall

As the training is group work and exercise, it is highly recommended that the training conference hall should have removable furniture for the sitting rearrangement in the hall.

Sitting Arrangements

The sitting arrangement of the trainees should be done in row & column or in two rows type with tables and chairs as per the design of training hall to adjust 20 to 25 trainees. At the time of group exercise, the four or five circles having five trainees in each group should be arranged in the hall on fourth day of the training.

Trainers/ Facilitators/ Resource Person Required

At least, a total of 12 trainers and resource persons may be required for the entire duration to conduct this module based training programme. It would be better if two trainers stay for the entire duration of the training. This will be helpful in building the course context and delivery of the module in a better way and will make the learning process continuous and consistent. The trainees can also refer/raise their doubts at any point of time during the training programme.

Expected Outcome

An in-depth knowledge about the flood disaster management and its skills shall build the capacity of trainees on different aspects of flood disaster management and the competencies to train persons at the State and District levels.

Evaluation and Validation

There will be two types of formal evaluations carried out during the five day training programme. The trainer is expected to evaluate day-wise individual sessions based on the feedback received during the recapitulation session. A formal evaluation of the programme will be done after the programme. The evaluation of skill transfer would be done during various sessions where group exercise is to be carried out.

DAY ONE

FLOOD DISASTER MANAGEMENT SYSTEM IN INDIA

This module consists of the following four learning units:

Learning Unit 1.1.1: Pre and Post Training Assessment
Learning Unit 1.1.2: Disaster Management – An overview
Learning Unit 1.1.3: Flood Disaster Management
Learning Unit 1.1.4: Flood disaster experience sharing

Objectives

The key objectives of the module are to:

1. carry out a pre training assessment to know the entry level behaviour/ awareness of the trainees
2. enable the participants to understand and appreciate basic concepts of natural disasters and disaster management system of India
3. enhance understanding concerning the nature, extent of the threats and the value of counter measures to combat the adverse impact of floods.
4. develop ideas on integration of flood disaster preparedness & mitigation measures with developmental programmes in terms of a safe national development through the concerned case studies.
5. collect and record disaster experiences of the trainees
6. To provide forum for exchange of ideas and views pertaining to flood mitigation, response and recovery.

Duration

Maximum five day and 6 hours per day including inauguration session.

Methodology

The programme has five modules that impart the information and skills in flood problem analysis, understanding and appreciation of the various aspects to flood disaster management and determination towards the measures to achieve the goal of flood risk reduction. The training methodology includes the following procedures:

- Lectures on Power Points/ Over Head Projector (OHP), etc. by Resource Persons.
- Group or Syndicate Exercises
- Interaction through panel discussion

- Individual work and case studies
- Experience sharing
- Field trips & Film shows
- The Handouts i.e. Photostat copies of the presentations & other published matter on flood risk mitigation and management.

Trainer's Guidelines

Following are the instructions to trainers / resource persons for handling the sessions effectively:

- The course director of this training programme should adequately equip himself/herself by reading the relevant literature on the subject and preferably by attending flood training programmes.
- Though it may be necessary to bring in out side experts as guest faculty, it is essential that one faculty from the NIDM functions as the Course Director providing continuity to the training and to support and facilitate the learning process.
- The reading material is provided by the Course Director or Coordinator/ resource person to trainees. The resource persons should read them before starting the programme so that trainee gains a thorough knowledge in the subject area. The trainees may be given separate set of reading material in the form of brief articles on each topic covered in the module. It is desirable that this is supplied to them well on first day of the course.
- The select bibliography is meant for the Course Directors or Coordinators and resource persons handling sessions. They may equip themselves by reading the books, articles etc. referred to. Besides, they may refer to other materials they come across since the bibliography given is only a select one.
- A glossary of terms relating to flood is also given in the module. We suggest that the course directors and resource persons go through it. Copies of this may also be supplied to the participants along with the reading material or as hand out.
- A select list of web links on flood is provided and the course directors/ resource persons are advised to update their knowledge on recent developments in the field by using the same.
- The suggested timings of the programme are from 9.30 am to 5.30 pm with 90 minutes for each session. This is required for adequate coverage of all sessions in a day. It is better to make the programme a residential one. This will enable the participants to spend the evening hours in studying cases, go through the reading material, exchange their views and so on.
- Each session has to be participatory and experiential. The participants may be encouraged to ask questions, seek clarifications, share their personal experience and express their views freely and frankly.
- The reading material provides national level data on demographic and other aspects relating to flood. However, the resource persons should

present district and state level data relating to the respective state on various topics and discuss the same. This way the participants will gain more insight into the issues closer to home.

- Group exercise based on case studies depicting the local situation may be prepared in advance for use in the sessions.
- Films are very powerful in making the participants analyse and critique the issues covered in the module. A select list of such films is given in the module. Other video- films, if available, can also be used. We recommend that the participants be shown such films in the evenings, besides those indicated in the module as part of sessions.
- Though the module was validated and a pilot run was conducted, it may be necessary to make some changes suitable to the local context. Feedback from participants is very important and useful for making the necessary modifications. This may be done as part of the evaluation session on the last day.
- The course has to be sufficiently flexible, in terms of time allotted to each session and content, to accommodate the requirements of the participants.
- Since the module attempts to cover a wide canvass, there is no separate time slot for participants to use the library in NIDM. However the library facilities, including borrowing of books, should be provided to them after training sessions.

Material : Brochure & Programme Schedule

Learning Unit 1.1.1: Pre and Post Training Assessment

Context and description of the session

The session consists of some written exercises to determine the knowledge level of the trainees before actual training starts. This will be repeated in the last session of the programme during valediction and a comparison be made between entry and exit behaviour of the trainees, to know if the training made a difference.

Learning Objectives

- To compare the entry and exit behaviour of the trainees
- To evaluate the knowledge and skills gained from the training
- To assess perceived competency of trainees on flood disaster management
- To carry out a formal internal evaluation

Methodology

- Questionnaires
- Experience sharing

Duration

01 hour

Tool Description

1. **Trainers's expectations from the ToT programme:** This is an open ended questionnaire with five questions. This exercise can also be done by circulating small coloured cards/papers and on which trainees may be asked to write down their expectations and later on the facilitator or trainer or course coordinator could display all cards on the training board or on the flip chart as required.
2. **Flood Risk Mitigation & Management opinion questionnaire:** This is a true/false type of questionnaire with 15 questions covering statements on trainee's 'basic ideas about flood disaster, impact & management. Statements 2, 4, 6, 8, 10, 12, 14 are true statements while the rest of the statements are false. Each right answer is scored as one point, thus 15 is the highest score, which means the trainee has the highest level of understanding of the concerned course.
3. **Ten point rating scale on trainee's perceived competency on flood risk mitigation & management:** This scale indicates the perceived competency on ability, knowledge and skills to provide flood risk mitigation & management aspects. The trainees should be instructed to encircle or tick the options available on both the sides. A higher number on the rating scale means higher perceived competency.
4. **Trainee's knowledge on flood risk mitigation and management:** This is a sentence completion test which having 15 multiple choice questions on different aspects of flood risk mitigation & management. Each statement has 4 or 5 alternative answers.

Exercise (Handout) 1.1.1 (A)

Expectations from the Course

Name:…….. **Date:**……

Instructions: Please express your true feelings related to the following queries. Fill and return it to the trainer/ facilitator.

What do you hope to learn during these 5 days? :

_____
_____
_____
_____

The trainer's roles during these days is/ are to:

_____
_____
_____
_____

Your role as a trainee during the course is/ are to:

_____
_____
_____
_____

From the course overview the course seems to be:

_____
_____
_____
_____

I would/ would not love to be associated with flood preparedness activities in the pre and post disaster scenario, because:

_____
_____
_____
_____

Exercise (Handout) 1.1.1 (B)

Flood Disaster Management opinion queries

Name:..... **Date:**..... **Assessment: Pre/Post**

Instructions: Please state whether the following statements are True or False. Write F, if the statement is FALSE and T if the statement is TRUE in case of disasters:

S.No.	Statement	T	F
1.	The Indian subcontinent is not highly vulnerable to floods		
2.	Floods are high stream flows, which overlap natural or artificial banks of a river or a stream		
3.	In India, each State and Union Territory are susceptible to floods.		
4.	In India, 25 States and one Union Territory (Andaman & Nicobar) are susceptible to floods.		
5.	The flood mitigation measures can not be classified into structural and non-structural measures		
6.	Non-structural measures strive to keep people away from flood waters		
7.	The average area affected by floods annually in India is about 80 million hectares		
8.	The structural measures are physical in nature and aim to prevent flood waters from reaching potential damage areas, whereas non-structural measures strive to keep the people away from flood waters		
9.	CWC has not undertaken various modernization schemes of Early warning of floods to cover more areas in India		
10.	In India, Central Water Commission (CWC) is presently issuing flood forecasts for 175 stations of which 147 stations are for river stage forecast and 28 for inflow forecast		
11.	Epidemiological data on the health effects of floods indicate that most immediate flood deaths are not due to drowning and acute trauma		
12.	Most of all, Rain Water Harvesting is environmentally sound as it assists in recharging ground water, enhances wetlands, assists forest conservation, encourages ecological farming, and slows down construction of new dams for water supply thus helping the ecological flow		
13.	Remote Sensing, GIS and GPS technologies have no special advantage in terms of generating state-of-the art informatics - capturing the variability, vulnerability and dynamism of flood plain like agricultural system		
14.	River Basin Management includes all aspects of Hydrology, Ecology, Environmental Management, Wetlands and Flood Plains		
15.	The influence of anthropogenic climate change on the nature of floods is not an issue of societal concern		

Exercise (Handout) 1.1.1 (C)

Perceived Competency on Flood Disaster Management Knowledge & Skills

Name:..... **Date:**..... **Assessment: Pre/Post**

Instructions: Read the following sentences as given in different boxes and find out one most your appropriate sentence. Then encircle the number corresponding to that box following the arrow mark linked that box with the number given in the middle column..

I do not know anything about flood risk mitigation & management	1	
	2	Providing basic ideas of flood risk mitigation & management to the people is important than flood management
I know that flood risk mitigation & management is not important for in helping people deal with floods	3	
	4	Flood risk mitigation & management practice is required only for such people who may utilize in their area
I know the need of flood risk mitigation & management practices but know very little about its implementation	5	
	6	I know how to provide flood risk mitigation measures like early warning to general community
I know about flood risk mitigation & management and know how to provide the same to vulnerable groups	7	
	8	I know about the basic skills and methods for providing flood risk mitigation & management and know how to help community in field
I understand the importance of holistic approach and will be able to provide the same to more vulnerable groups	9	
	10	I definitely understand the basic concepts of flood risk mitigation & management and will be able to train others on the same

Exercise (Handout) 1.1.1 (D)

Trainee's Knowledge on Flood Disaster Management

Name:..... **Date:**..... **Assessment: Pre/Post**

Instructions: Read the following incomplete sentences written in bold. Each of these sentences has 4 alternative choices. Put a tick mark or encircle the most appropriate alternative choice that completes the sentence.

1. **Floods may be defined as-**
   (a) Floods are any high stream flows which overlap natural or artificial banks of a river or a stream
   (b) Floods are any low stream flows which overlap natural or artificial banks of a river or a stream
   (c) Both of the above
   (d) None of the above

2. **Forecasting on floods is done by-**
   (a) IMD
   (b) CWC
   (c) IMD & CWC both
   (d) None of the above

3. **The recurrence of floods in Bihar every year is due to-**
   (a) Its intensity; unpredictability; Unseasonality -in its timing; spatial coverage; successive bouts;
   (b) Its non-intensity; unpredictability; seasonality; non-spatial coverage; successive bouts;
   (c) Both of the above
   (d) None of the above

4. **How many people lost their lives during Bihar floods 2007?**
   (a) 510
   (b) 650
   (c) 1010
   (d) 705

5. **The total damages accounted during Bihar floods 2007 was around-**
   (a) Rs. 10 billions.
   (b) Rs. 12 billions.
   (c) Rs. 2 billions.
   (d) None of the above

6. **During and after flood disaster, affected people function with -**
   (a) full efficiency and capacities
   (b) maximum efficiency and capacities
   (c) less efficiency and capacities
   (d) no efficiency and capacities

7. **Impact of flood disaster is -**
   (a) Same for every person
   (b) Different for men and women
   (c) Women are more vulnerable than men
   (d) All of the above are not correct

8. **During floods, more vulnerable group consists of -**
   (a) Aged people
   (b) Children & Women
   (c) People with disability
   (d) All of the above

9. **The impact of flood disaster depends upon -**
   (a) Severity of exposure to the floods
   (b) The type of damage experienced
   (c) Age and sex of the survivors
   (d) Efficiency and effectiveness of governance and administration
   (e) All of the above

10. **Which one of the following statement is correct? -**
    (a) Flood disaster does not affect everyone
    (b) Flood disaster affects people who are less capable
    (c) Flood disaster is an individual specific event
    (d) No one who experiences or witnesses a flood disaster is untouched by it
    (e) All of the above

11. **Health problems are occurred only during floods in -**
    (a) Rescue phase
    (b) Relief phase
    (c) Rehabilitation phase
    (d) Reconstruction phase
    (e) In all of the above phases

12. **Flood mitigation measures are**
    (a) Structural flood control measures
    (b) Non-structural flood control measures
    (c) Both (a) & (b)
    (d) None of the above

13. **What do you mean by RWH?**
    (a) Rain Ware Housing
    (b) Rivolutionery Work House
    (c) Rain Water Harvesting
    (d) None of the above

14. **What is IRBM?**
    (a) Integrated River Basin Management
    (b) Integrated Rainwater Basin Management
    (c) All of the above
    (d) None of the above

15. **May climate change induce flood hazard across India and rest of the world?**
    (a) Yes, Climate change may induce the frequency of flood hazard across India and rest of the world in future
    (b) No, Climate change may not induce the frequency of flood hazard across India and rest of the world in future
    (c) Both (a) & (b) are correct
    (d) Can not say

Trainer's note and session plan

The list of pre and post training materials with description is mentioned and hard copy of each hand out would be provided to the trainees. All the filled in copies should be collected from the trainees after the session and repeat the process again during post-training assessment. Put the expectation handout on the wall/notice board in the training room with the help of adhesive tape or paste or thumb pins. At the end of the training these should be verified one by one to check if their expectations are fulfilled.

Session Plan

Training activities	Time
Expectation from the programme Handout	5 minutes
Flood Disaster Management opinion queries Handout	15-20 minutes
Perceived Competency on Flood Disaster Management Knowledge & Skills Handout	5 minutes
Trainee's Knowledge on Flood Disaster Management Handout	25-30 minutes

Methodology

The participants may be asked to spend 15 minutes to discuss and write down on flip charts their expectations from the course. The facilitator should explain how these are covered in the programme or the reason for not meeting them. For example, some participants may demand inclusion of a separate session on flood early warning system in India, which obviously is the part of the module. The facilitator may also note down the expectations of participants at individual level on flip chart.

Learning Unit 1.1.2: Disaster Management: An overview

Introduction and Description of the session

Natural and Man-made disasters in India are increasing at an alarming rate claiming a large number of human lives and damaging valuable properties. Every year 6% of the country's population is affected by disasters. In absolute numbers, this is just second to China. The Indian subcontinent is highly vulnerable to floods, droughts, cyclones and earthquakes, landslides, avalanches and forest fires. Out of the 35 States/ Union Territories in the country, 25 are disaster prone. Natural disasters uproot people, trigger migration, cause physical disability, increase mortality, create orphans, influence fertility, and change marriage patterns. They also impact sex composition and age structure by inducing sex and age selective deaths, besides reshaping density and settlement patterns, shifting rural population to urban areas and forcing occupational changes. Such demographic consequences are shaped by the extent of human habitation, ecological buffers, incidence poverty, state of governance, rescue and rehabilitation programme, coping strategies. These disasters tend to hit marginalized and economically disadvantaged groups in South Asia especially hard for a variety of reasons: often they live in particularly vulnerable areas and dwellings.

Disasters have been increasing in frequency, intensity and impact all over the world at a huge economic cost. In the decade between 1990-2000, the United Nations International Decade for Natural Disaster Reduction (IDNDR) was observed globally, during which the need for a holistic approach to disaster management focusing on preparedness and mitigation was advocated through the Yokohama Strategy. India took a number of initiatives during the decade that were in line with the Yokohama Strategy, and aimed at better preparedness and mitigation measures against the impacts of disasters.

This session will introduce the broad concepts of disaster management to the trainees. This consists definitions of various terminologies used locally and globally, types of disasters, DM Act 2005, DM approach and mechanisms in India, and case studies of few major disasters in the past. This session particularly attempts to orient them to the training slowly with the help of a film and power point presentation.

Learning Objectives

The trainees will be able to:

- explain the phenomena, causes and consequences of natural disasters.
- provide an overview on the impact of various disasters based on case studies in the country
- explain the terms and concepts of Disaster Management and importance of DM Act 2005
- discuss existing legal and institutional framework for Disaster Management
- list out initiatives undertaken for management of disasters at Central Government level.

Methodology

- Power Point Presentation
- Film on disaster

Duration

90 minutes

Teaching/ Performance aids

- Reading material on basic concepts of disaster management including DM Act 2005
- Hard copy of presentation if possible

Trainer's note and Session plan

The trainer will make a power point presentation on the basis of the literature available in the concerned area. A copy of presentation and some reading materials on this topic are attached herewith in the Annexure for the trainer's Handout.

Contents	Methodology	Teaching aids
Definitions, Hazard, Disaster, Risk, Vulnerability, etc., Disaster Management Cycle, Impacts of Disasters, Disasters and Development, Significance of Disaster Management, DM Act 2005, Disaster Management System in India Film on disaster occurred in India	Lecture cum discussion through power point presentation	Flip chart/ Sketch board Handout 1.1.2.1

Session plan

Training activities	Time
Introduce the basic concepts and types of disasters. Make the presentation very interactive. Highlight the main differences between disasters caused by natural and manmade disasters. Discuss the vulnerability map of India and let the trainees study it for their own State's vulnerability profile.	30 minutes
Focus on past major disasters of India & the impacts. Increasing frequency of disasters and their aggravating factors, DM cycle. India's approach towards DM.	20 minutes
DM Act 2005 and DM system of India	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	15 minutes
Open house for question and answer	10 minutes

After the interactive presentation, the film on a disaster would be shown to the trainees. Instructions may be given to the trainees to observe the film attentively and note down what they feel important to remember so that it would be easier for them to do the next session. Handouts are attached in the annexure.

Learning Unit 1.1.3: Flood Disaster Management

Introduction

Floods are high stream flows, which overlap natural or artificial banks of a river or a stream and are markedly higher than the usual as well as inundation of low land. Sometimes copious monsoon rains combine with massive flows from the rivers, then the floods indeed become calamitous. Through geophysical studies, it has been found that more than one and half billion people on the earth planet reside on riverside or coastal flood plains where they produce 1/3 of world's food production. At least- some fraction of these plains go under flood water one or the other day, hence causing widespread losses to human lives, devastated homes and heads of cattle dead, destroy agricultural crops and disrupt the communication links such as railways, roads as well health hazards (i.e. spread of diseases such as cholera or Gastrointestinal symptoms, etc.). Even after the receding of floods, it takes several months or even years for the community to come to the pre-flood status.

The vulnerability of states or Union Territories of India due to floods was not observed seriously in the past due to low developmental activities and less population pressure. However, in the present time, unabated population and high rate of developmental activities have forced the people to occupy the flood plains and making the society highly vulnerable for flood losses. Other factors like lack of adequate sites for rescue operations above flood levels, accessed routes for reaching these sites, lack of public information system for escape routes and other appropriate response activities may be rendered to make communities more sensitive. The protected area (32 mha) sometimes becomes more vulnerable to floods as the flood control measures mainly the embankments may breach during a severe flood and the protected area may be inundated.

In India, 25 states and one Union Territory (Andaman & Nicobar) are susceptible to floods. However, the most vulnerable states in India are Uttar Pradesh, Bihar, Assam, West Bengal, Gujarat, Orissa, Andhra Pradesh, Madhya Pradesh, Maharashtra, Punjab and Jammu & Kashmir. District wise, there are 137 districts vulnerable to floods (Fig. 1).

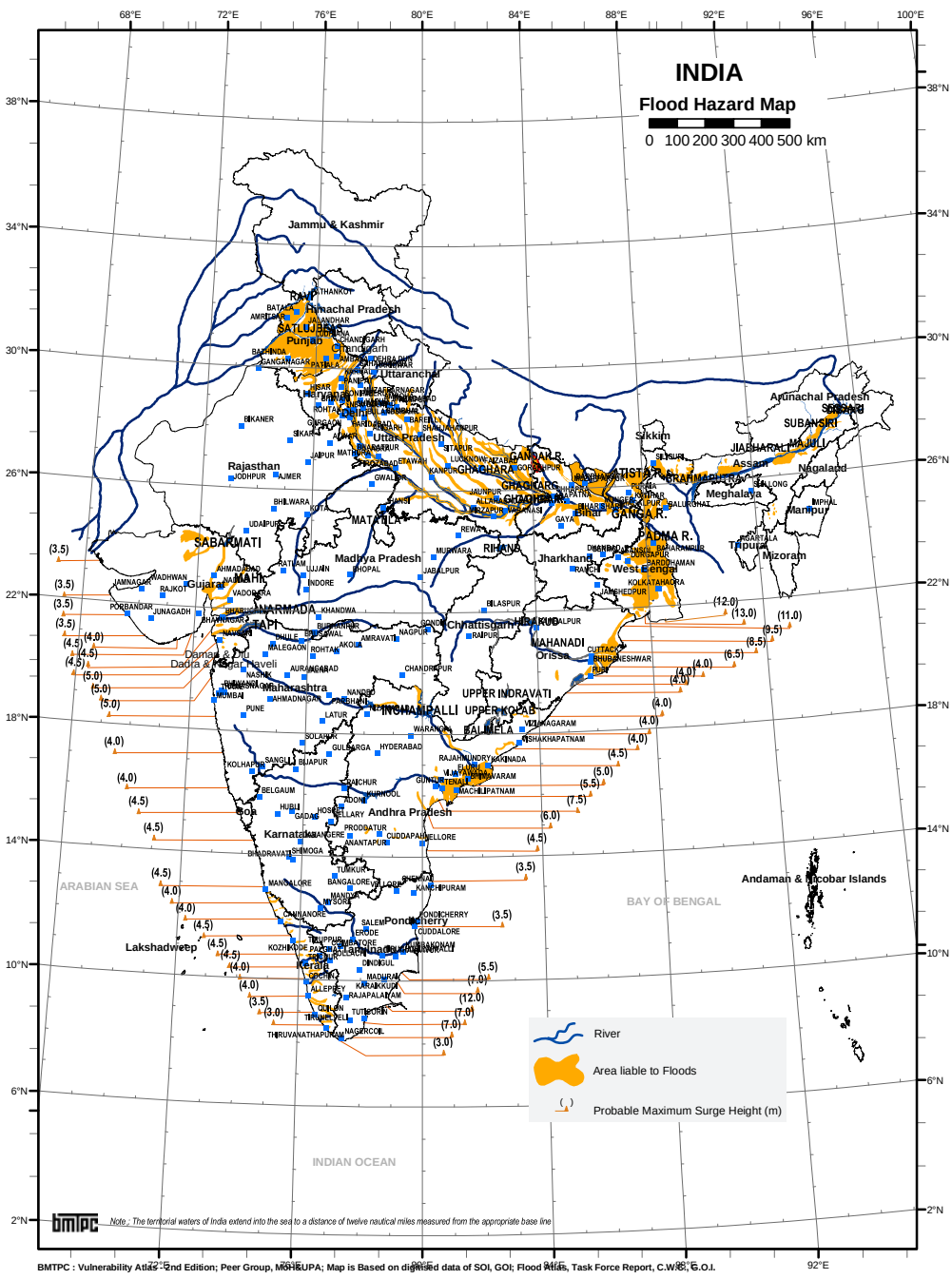


Fig. 1: India Flood Prone Areas

CAUSES: The primary causes for Floods are-

1) Excessive rainfall in river catchments or concentration of runoff from the tributaries and river carrying flows in excess of their capacities.

2) Backing water in tributaries at their confluence with the main river.
3) Synchronization of flood peaks in the main rivers or their tributaries.
4) Intense rainfall when river is flowing full.
5) Poor natural drainage system.
6) Landslides leading to obstruction of flow and change in the river course.
7) Cyclone and very intense rainfall when the EL Nino effect is on a decline.

AREA PRONE TO FLOODS

Generally, the floods are caused due to the concentrated spells of heavy rains in the upper reaches of river during the monsoon months (June- September). The South- west monsoon accounts for 75% to 90% annual rainfall of the country. Thus, the irregular and erratic distributions of rains in different parts of the country during monsoon are the reasons for loss of lives, property and agricultural crops in the wake of floods.

Brahmaputra and the Gangetic Basins are the most flood prone areas. The other flood prone areas are the northwest region of west flowing rivers such as the Narmada and Tapti, Central India and the Deccan region with major east flowing rivers like Mahanadi, Krishna and Cavery. The area liable to floods is 40 million hectares (98.8 million acres) as assessed by Rashtriya Barh Ayog (RBA) in 1980; the average area affected by floods annually is about 8 million hectares covering Uttar Pradesh with 21.9%, Bihar (12.71%), Assam (9.4%), West Bengal

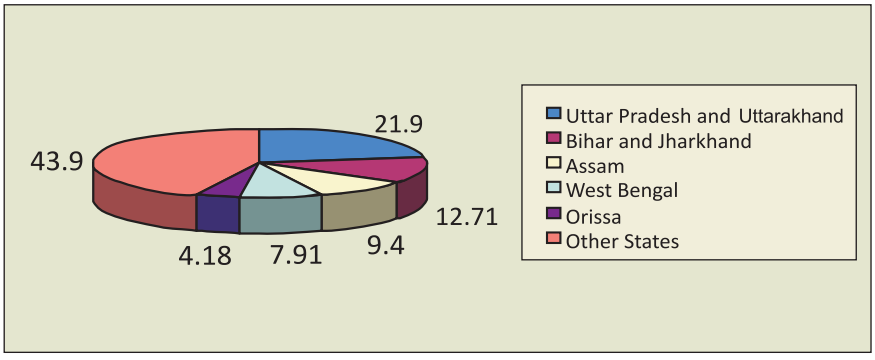


Fig.2 - Flood Prone areas in different states

(7.91%), Orissa (4.18%) and other states have 43.9% flood prone areas (Fig.2).

The heavy rain in the Himalayas at the peak of the South- West Monsoon causes severe floods in the rivers of **Uttar Pradesh, Bihar, West Bengal, and Assam,** while Central & Southern Rivers get flooded on account of heavy rain produced by depressions in Bay of Bengal during Southwest monsoon season. In most

flood prone states, land depression and well marked low pressure/ low-pressure areas are the two most important synoptic systems responsible for devastating floods. In case of **Bihar,** 62% cases of the flood occurred due to well-marked low pressure/low pressure area, while the remaining 38% cases, flood occurred due to Land depression. In **West-Bengal,** the most favorable significant situation for occurrence of flood is either low-pressure area or the cyclonic circulation. Similar is the case for **Punjab, Gujarat, Rajasthan and Jammu & Kashmir** where devastating flood occurred mostly due to Low-pressure area. The monsoon depression plays an important role in occurrence of the flood in the states like **Orissa and Andhra Pradesh.** During the period of 1980-99, 53 cases of floods are identified, out of which:

25 cases (47%) – due to either low pressure or well-marked Low-pressure area
18 cases (34%) - due to either depression over land area
7 cases (13%) – due to cyclonic circulation, and
3 cases (1%) - due to cyclonic storm

TYPES OF FLOODS

Flash floods – Such floods that occur within **Six hours** during heavy rainfall and are usually associated with towering cumulus clouds, severe thunderstorms, and tropical cyclones or during the passage of cold weather fronts. This type of flood requires rapid localized warning system and immediate response in favour of affected communities. Other causes of flash floods include dam failure or other river obstructions.

River floods - Such floods are caused by precipitation over large catchment's areas or by melting of snow or sometimes both. They take place in river systems with tributaries that may cover or drain large geographical area and encompass many independent river basins. These floods are normally built up slowly or on seasonl basis and may continue **for days or weeks** as compared to flash floods. Factors such as ground conditions like moisture, vegetation cover, depth of snow, etc. and size of the catchments govern the amount of flood covering the main rivers of India like Ganga, Brahmaputra and Yamuna, etc.

Coastal Floods – Some floods are associated with the cyclonic activities like Hurricanes, Tropical cyclones, etc. generating catastrophic flood from rainwater which often aggravate wind-induced storm and water surges along the coast. As in river floods, intense rain falling over a large geographic area produces extreme flood situation in coastal river basins.

FLOOD DAMAGE

An analysis of data of different states for the period of 1953-2010 reveals that average annual damage to crops, houses and public utilities in the country was around Rs. 1804.419 crore and maximum reported 8864.54 crore was in the year of 2000. On an average, an area of about 7.208 million hectares (17.50 mha maximum in 1978) was flooded, of which, on average crop area affected was of the order of 3.679 million hectares (15.180 mha in 2005). The floods claimed on an average 1612 human life and 89345 heads of cattle dead every year, Table-1.

Table -1: Flood Damage (India) 1953 -2010

Item	Average	Maximum (Year)
Area Affected (Million Hectare)	7.208	17.50(1978)
Crop Area Affected (Million Hectare)	3.679	15.180(2005)
Population Affected (crore)	3.9	7.045(1978)
Human Lives Lost (Nos.)	1612	11,316(1977)
Cattle Lost (Nos.)	89345	6,18,248(1979)
Houses Damaged (Nos.)	1194637	35,07,542(1978)
Value of damage to crops (crore)	693.866	4246.62(2000)
Value of damage to house (crore)	275.481	1307.89(1995)
Value of damage to public utilities (crore)	814.596	5604.46(2001)
Value of damage to crops, houses & public utilities (crore)	1804.419	8864.54(2000)

Source: Central Water Commission, Ministry of Water Resources, Government of India

Institutional Framework

As per the constitutional provisions, Flood Management (FM) is a state subject and as such the primary responsibility for FM is of State Governments. The Central Government (National Disaster Management Division of Ministry of Home Affairs, Govt. of India) has taken various initiatives and set up a number of organizations dealing with the floods. In this direction, the most notable one is the enactment of the National Disaster Management Act 2005 and setting up of National Disaster Management Authority (NDMA) to deal with all types of disasters.. The State Governments have set up State Disaster management Authorities (SDMAs) to perform similar functions at the State level. It is also proposed to set up a National Flood Management

Institute (NFMI) in one of the flood prone States to impart training to engineers, administrators, police departments, NGOs and Community Based organizations (CBOs) etc.

Learning Objectives

The trainees will be able to:

- explain the phenomena, causes and consequences of floods.
- provide an overview on the impact of floods in the country
- explain the terms and concepts of Flood Disaster Management
- discuss existing legal and institutional framework for Flood Disaster Management
- list out initiatives undertaken for flood risk management at District, State and Central Government levels.

Methodology

- Power point presentation
- Question-answer
- Film on flood disaster

Duration

75 minutes

Teaching/ Performance aids

Handout-Hard copy of the presentation and reading material

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Introduce the basic concept of Flood & its management in India, Vulnerability, Causes, Areas prone to floods, Types of floods (Flash flood, River flood, Coastal flood), Flood Damage, Flood Response	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.1.3.1

Session plan

Training activities	Time
Introduce the basic concepts of flood management, causes and types of flood disaster, Flood prone areas of India, Flood damage and Flood response, etc. Make the presentation very interactive. Highlight the main differences between natural and manmade factoral causes of floods. Discuss the flood vulnerability maps of different States of India and let the trainees study it for their own State's vulnerability profile.	25 minutes
Focus on past major floods of India & the impacts as case studies. Increasing frequency of floods and their aggravating factors like climate change, India's approach towards Flood Disaster Management.	20 minutes
DM Act 2005 and DM system of India in reference to Flood Preparedness and Flood Response, Institutional Frame work of Flood Management	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

After the interactive presentation, a film on a flood disaster may be shown to trainees to observe the different activities of flood disaster management carried out at pre, during and post floods by Distrct, State and Central levels to reduce the flood impact and damage. Handouts are attached in the annexure.

Learning Unit 1.1.4: Flood disaster experience sharing

Introduction

High Powered Committee (HPC) identified about 33 different types of natural and manmade disasters occurred time to time in various parts of the country and every individual has some kind of disaster experience or the other that happened to him or humankind at personal, official and community level. This type of situation indicates some important characters and problems which the person gets to share with others. S/he needs to describe how s/he coped with the situation and people helped him to overcome the problem and gained it as a disaster experience. The trainee has to focus more on the views experienced during this disaster such as floods.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of the flood disaster survivor's experience.

Learning Objectives

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

- deliberate their personal experiences of any types of flood disaster through which the importance of sharing and how it helps in an individual capacity would be clear
- analyse their experiences, thoughts and feelings related to the sufferings of the flood victims and generalize them among all the trainees
- assist in understanding their own situation and their coping styles
- find out solution for a particular issue related to floods damage

Methodology

- Sharing and interaction of experiences among the trainees
- Recording the experiences

Duration

60 minutes

Trainers Note and Session plan

The trainees will be asked to deliberate their experiences on different events of floods happened at personal level or otherwise. They would also be requested to be brief and specific on the concerned events so that all trainees will get a chance to express their thoughts. After it, the first person who raised hand is requested to share his/ her experiences related to floods while others would listen carefully so that analysis at the session's end would become rich. The important experiences of all persons will be recorded by the trainer or facilitator during this session.

DAY TWO

Module 1.2: Flood Mitigation

This module consists of the following learning units:

Learning Unit 1.2.1**:** Structural measures for flood mitigation

Learning Unit 1.2.2: Non-structural measures for flood mitigation

Learning Unit 1**.**2.3: Rain Water Harvesting for flood mitigation

Learning Unit 1.2.4: River basin management for flood mitigation

Learning Unit 1.2.5: Resilient structures for flood mitigation

Objectives

The key objectives of the module are to:

- describe the nature and type of flood mitigation measures being taken up in different parts of the country
- differentiate between structural and non-structural measures in reference to flood risk mitigation and management
- discuss the Significance of Rain Water Harvesting and River Basin management in flood prone areas
- explain the importance Flood Resilient Structures for flood prone areas

Duration

420 minutes/ 7 hours

Methodology

- Power point presentation
- Question/ answer

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Learning Unit 1.2.1: Structural measures for flood mitigation

Introduction

The flood mitigation measures may be classified into structural and non-structural measures. The structural measures are physical in nature and aim to prevent flood waters from reaching potential damage areas, whereas non-structural measures strive to keep the people away from flood waters. The trainees have to focus more on the main thrust of the flood protection programme undertaken so far has been on structural measures in India.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of structural mitigation measures for flood management.

Learning Objectives:

- To highlight the difference between Structural & Non Structural mitigation measures
- To explain the importance of Dams, Reservoirs, embankments, flood/ sea walls, channel improvement, drainage improvement, desilting of rivers and flood levees in flood protection in India
- To discuss the watershed management measures in conjunction with structural measures such as check dams, detention basins, etc.
- To discuss the anti-erosion works taken up for protection of suburban areas
- To prepare an action plan for structural flood risk mitigation measures

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of structural mitigation measures of floods in India, importance of Dams, Reservoirs, embankments, flood/.sea walls, channel improvement, drainage improvement, desilting of rivers and flood levees, watershed management measures, anti-erosion works and action plan for structural flood risk mitigation measures	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.2.1.1

Session plan

Training activities	Time
Introduce the basic concept structural mitigation measures of floods in India, Construction and design of Dams, Reservoirs, embankments, flood/.sea walls, channel improvement, drainage improvement, desilting of rivers and flood levees. Watershed management measures in conjunction with structural measures such as check dams, detention basins, etc.	30 minutes
Focus on past & present anti-erosion works taken up for protection of suburban areas in India, Diversion of flood water, Coastal protection works. Vents, Culverts, Bridges and causeways in National & State Highways	25 minutes
Preparation of the Action Plan for structural measures of floods	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

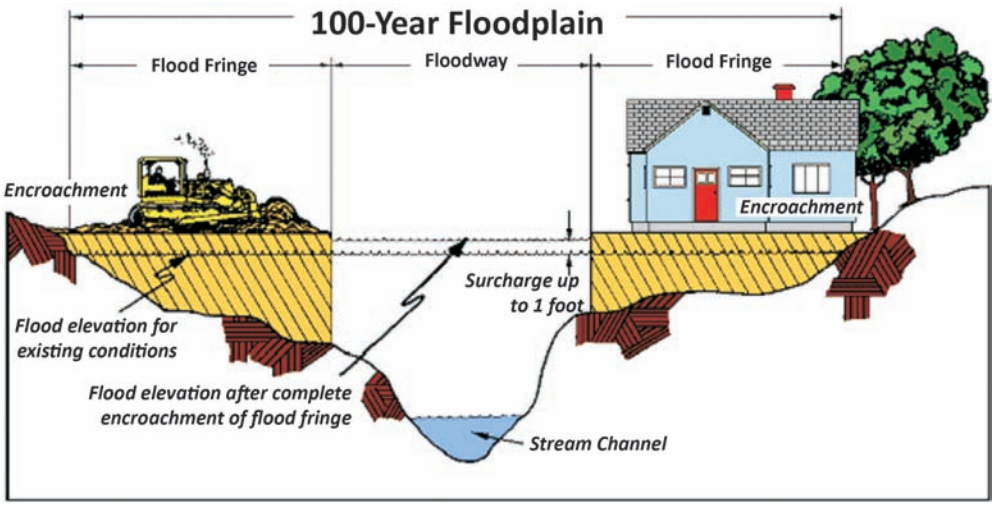
During the interactive presentation the models on the flood protection work may be shown to trainees to know the different types of control measures carried out at pre, during and post floods by District, State and Central levels to reduce the flood impact and damage. Handout is attached in the annexure as 1.2.1.1.

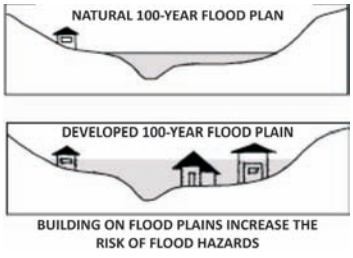
Learning Unit 1.2.2: Non-structural measures for flood mitigation

Introduction

Non-structural measures strive to keep people away from flood waters. These measures allow the use of flood plains judiciously by reducing the disaster dimension, while retaining its beneficial effects. The trainees have to focus more on the main thrust of the flood protection programme undertaken so far has been on non-structural measures in India.

Increased encroachment of flood plains has been responsible for ever-growing damage over the years. The basic concept of flood plain management is to regulate the land use in flood plains in order to restrict the damage due to floods, while deriving maximum benefit from them. This is done by determining the location and extent of the areas likely to be affected by floods of different magnitudes/frequencies and to develop those areas in such a fashion that the resulting damage is minimal.





Flood-plain zoning, therefore, aims at disseminating information with the association of people, civil servants and NGOs on a wider basis so as to regulate indiscriminate and unplanned development in flood plains, both for unprotected and protected areas. Flood-plain zoning recognizes the basic fact that flood plains are essentially ruled by the whims of river flows, and as such all developmental activities in flood plains must be compatible with the flood risk involved.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of non-structural mitigation measures for flood management.

Learning Objectives:

- To discuss the different non-structural mitigation measures and their significance
- To explain the judicious use of flood plain zoning to regulate land use in the flood plains in order to restrict the flood damage
- To discuss the different techniques adopted for flood proofing by the State Governments for the people of flood prone areas
- To discuss the legal framework for buildings in flood prone areas
- To enable the trainees with the modernization of flood forecasting services and warning system in India
- To prepare an action plan for non-structural flood risk mitigation measures

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of non-structural mitigation measures of floods in India, use of flood plain zoning, flood proofing and its techniques, Bye-laws for Buildings of flood prone areas, Modern forecasting services and warning system of India and action plan for non-structural flood risk mitigation measures	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.2.1.1

Session plan

Training activities	Time
Introduce the basic concept non-structural mitigation measures of floods in India, Use of flood zoning in flood plains, Flood proofing and its adopted techniques.	30 minutes
Focus on Legal framework for buildings of flood prone areas, Modernization of forecasting services and warning system in India. Role of CWC & IMD in flood management at State and National levels. Govt. policy on Early warning system	25 minutes
Preparation of the Action Plan for non-structural measures of flood management	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the models on the flood mitigation work may be shown to trainees to know the different types of non-structural measures taken up at pre, during and post floods by the State Governments to reduce the flood impact on the people's life and their properties. Handout is attached in the annexure as 1.2.1.1.

Learning Unit 1.2.3: Rain Water Harvesting for flood mitigation

Introduction

Rain Water Harvesting (RWH) is a popular term used for a tradition of collecting rainwater, improved by modern concepts and technologies, a result of more than two decades of research work around the globe. Today, RWH is used in wet and dry countries, in poor and modern situations, for water supply and for sanitation in homes. It is utilized in addressing agricultural productivity and food security for poverty alleviation, even in places with 200 mm of rain. Rainwater Harvesting is employed in flood mitigation in rain-drenched countries, and in solving infiltration problems of sealed surfaces in urban areas and industrial complexes, or in avoiding polluted water and toxic ground water. Mostly, RWH is environmentally sound as it assists in recharging ground water, enhances wetlands, forest conservation, encourages ecological farming, and slows down construction of new dams for water supply thus helping the ecological flow.

Source: A water harvesting manual for urban areas

Rainwater harvesting can be adopted in cities to supplement the city's other water supplies, to increase soil moisture levels for urban greenery, to raise the water table through artificial recharge, to mitigate urban flooding and to improve the quality of groundwater. In urban areas of the developed world, at a household level, non-potable uses of harvested rainwater include bathroom (i.e. shower/bath/basin), flushing toilets and washing laundry. Indeed in hard water areas it is superior to municipal water for laundry because of its compatibility with detergents and soaps. In Rajasthan, India rainwater harvesting has traditionally been practiced by the people of the Thar Desert where flood is not the problem. It has made itself relevant in other aspects of living, foo d and water security, environmental rehabilitation and now, in coping with climate change. As ancient wisdom meets science, Rainwater Harvesting is born.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of non-structural mitigation measures i.e. harvesting technique to save the rain and flooded water particularly in flood prone urban cities.

Learning Objectives:

- To discuss the various non-structural mitigation measures including RWH and their significance
- To explain the judicious use of rain water harvesting system to regulate land use in the flood plains in order to restrict the flood damage
- To discuss the different techniques adopted for RWH by the State Governments for the people of flood prone areas
- To discuss the legal framework of RWH for buildings in flood prone areas
- To enable the trainees with the modern techniques of RWH system adopted in India
- To prepare an action plan for use of RWH for flood prone urban cities

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of Rain Water Harvesting (RWH) in India, use of RWH in flood mitigation and its techniques, Bye-laws of RWH for Buildings of flood prone areas, Modern technique cum services and utility in India and action plan for RWH for flood risk urban areas/cities	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.2.3.1

Session plan

Training activities	Time
Introduce the basic concept RWH in India, Use of RWH in flood prone urban areas/ cities, Watershed management measures in conjunction with structural measures.	30 minutes
Focus on Legal framework of RWH for buildings of flood prone areas, Modern services and utility in India. Role of RWH in ground water recharging, ecological flow and flood management at State and National levels. Govt. policy on RWH system	25 minutes
Preparation of the Action Plan for RWH for flood ed urban cities	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the models on the RWH system may be shown to trainees to know the uses of RWH in flood mitigation adopted by various State Governments to reduce the flood impact on the people's life and their properties particularly in flood affected areas. Handout is attached in the annexure as 1.2.3.1.

Learning Unit 1.2.4: River basin management for flood mitigation

Introduction

River Basin Management (RBM) is one of the biggest challenges of the 21st century. The current term Integrated River Basin Management (IRBM) refers to various aspects essential to achieve a sustainable development of river basins, and includes water demand and supply, trans-boundary aspects, upstream-downstream linkages, water and environment, development (including poverty alleviation) and environment, as well as organisational and institutional aspects at different scales.

River Basin Management includes all aspects of Hydrology, Ecology, Environmental Management, Wetlands and Flood Plains. River Basin Management deals with technical, as well as socio-economic and ecological aspects and calls for an integrated approach. Scientists developed such an approach during the preparation of the Netherlands' national water master plans. This approach consists of a comprehensive set of analysis steps, supported by mathematical tools for the analysis of natural resource systems in a socio-economic context. Using this approach scientists support water, river and floodplain managers' world-wide in structuring complex decision-making processes and provide technical know-how for effective evaluation of planning alternatives applicable in flood mitigation measures.

Learning Objectives:

- To explain interaction between development, water and environment at the river basin scale;
- To discuss the importance of holistic approaches in river basin research and management for flood mitigation;
- To give an overview of the latest concepts, international trends and practices of Integrated River Basin Planning and Management of flooded areas;
- To follow a step-wise flood mitigation approach in applying Integrated River Basin Planning and Management in a river basin

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
The river system and human interferences, RBM aspects, IRBM concepts and Issues, International trends & practices, Planning for sustainable river basin development, Operational management of river basins, Analytical support for IRBM, Organisational, institutional framework and Action plan of IRBM for flood plain	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
The river system and human interferences, RBM aspects & IRBM concepts and Issues, International trends and practices for flood mitigation measures	30 minutes
Planning for sustainable river basin development, Operational management of river basins, Analytical support for IRBM,	25 minutes
Organisational, institutional framework & Action plan of IRBM for flood plain	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the models on the flood protection work may be shown to trainees to know the different types of non-structural measures based on IRBM taken up by the State Governments to achieve the sustainable development of river basins.

Learning Unit 1.2.5: Resilient structures for flood mitigation

Introduction

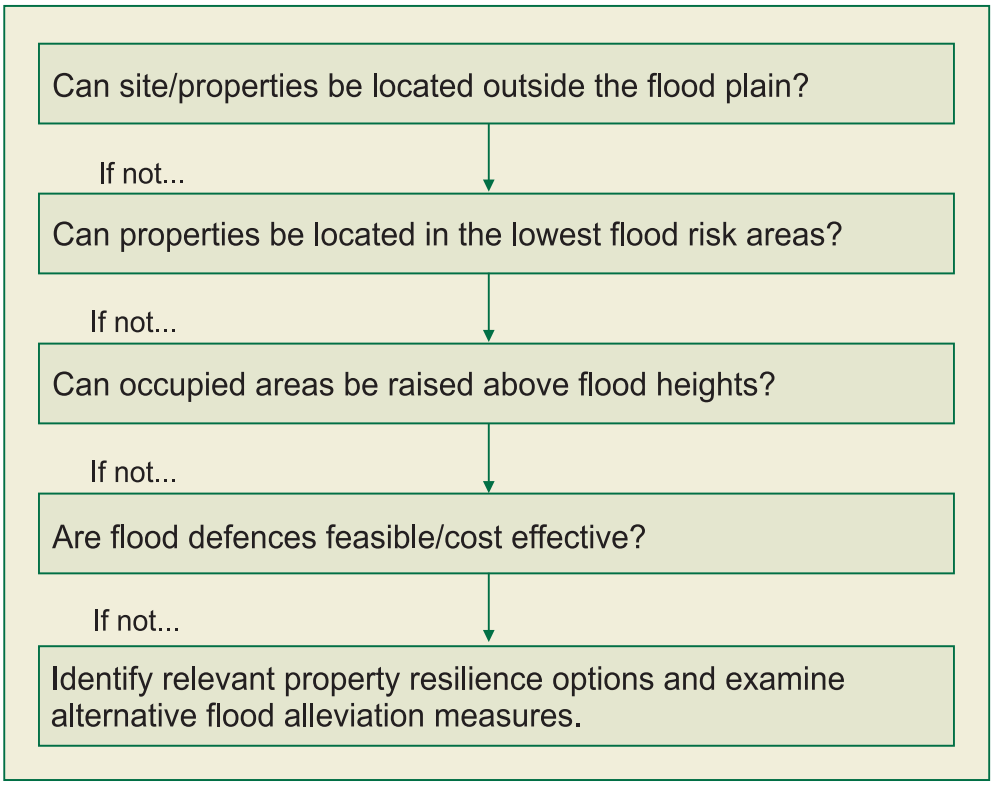
Flood resilient construction' recognises that while planning policy aims to direct inappropriate development away from flood risk areas, some building will be necessary to maintain existing services and communities. Therefore, structures should be designed and constructed to keep people safe, reduce financial losses and speed up disaster recovery. Many experts predict that climate change could mean an increase in the prevalence of flooding as we experience milder, wetter winters and hotter drier summers. It is therefore important to construct new buildings in flood risk areas in a way that minimises flood damage and resilience measures have a role to play in ensuring the safety and robustness of necessary development.

Flood resilient structures are such structures that can recover from a flood in less time with reduced damage to the property. This does not prevent the flood from entering a building but controls the possible damage that can result from flooding.

A resilient approach may be dedicated to accommodating floods, with concurrent impact minimisation and rapid recovery. As part of this approach, the form of buildings, their occupation and use of materials will need to consider the range of flood conditions to which they may be exposed. The area as a whole is more resilient if land uses that are flood-compatible (e.g. informal open spaces and floating spaces), are planned in the highest risk areas. If essential infrastructure, vulnerable uses and increased housing densities are directed towards areas of low (residual) risk then these are being safeguarded longest. This implies diversifying measures and defence levels for different land uses according to their vulnerability, based on the costs and benefits of different solutions.

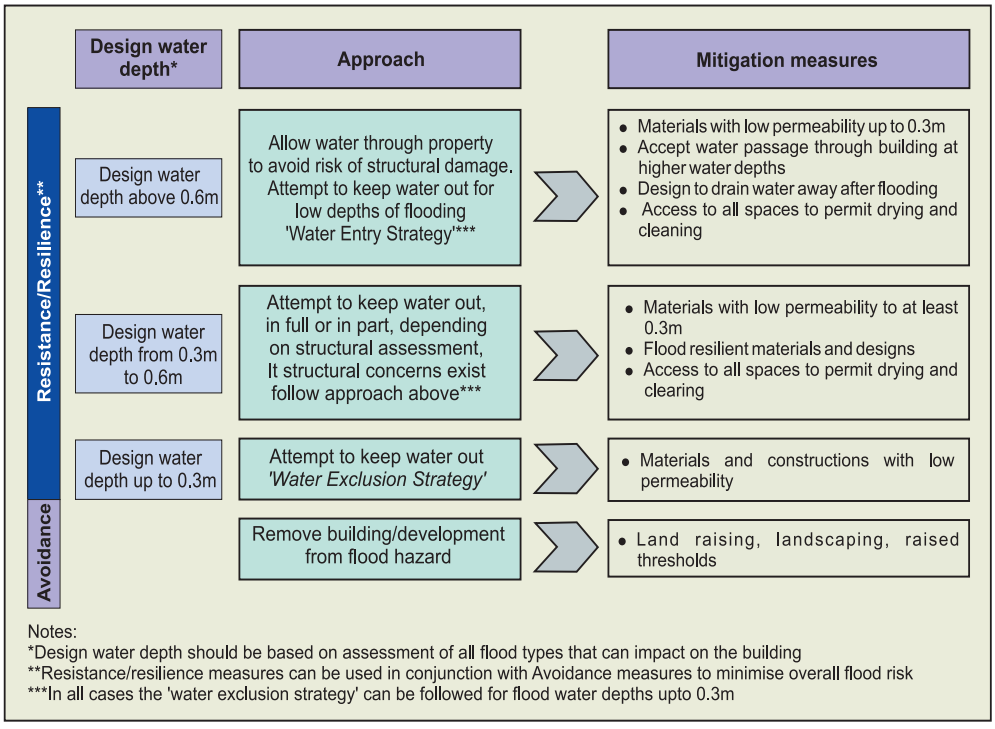
Constructing a building in such a way that although floodwater may enter, its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated). (North American term: 'wet-proofing'). This term is also used in a more general sense, e.g. in the title of the Communities and Local Government (CLG) document, to collectively describe all forms of design for mitigating the effect of flooding.

This differs somewhat from the hierarchy of preference provided by the ABI, on page 14 of their report Summer Floods 2007: Learning the Lessons, which is reproduced over. Understandably the ABI hierarchy is driven by the goal of minimising flood damage insurance payouts.



Flood Hierarchy of choices for adaptation
Source: Summer floods 2007: Learning the lessons, ABI 2007.

An 'approach matrix' which is reproduced below, whilst some forms of construction (e.g. engineered brick wall) can prevent water ingress for a period of time (i.e. a water exclusion strategy), they cannot provide structural stability over a certain height of water (approximately 600mm) due to excessive hydrostatic pressure. Therefore at higher design water depths it becomes necessary to accept that the water needs to enter the building (i.e. a water entry strategy), which in turn means that the ground floor needs to be designed for easy draining, cleaning and drying. It should be remembered that, in all cases, safe access is needed to evacuate in the event of an emergency. Houses raised on stilts, for example, will need raised roadways or some other safe means of escape.



Source: Design approach matrix taken from page 9 of Improving the flood performance of new buildings: Flood resilient design, CLG, May 2007.

Currently a number of aspects of an integrated approach to urban flood management are relatively new to (local) decision-makers, (urban planning) professionals and socio-economic sectors. One of the main issues that need in-depth attention is to decide at the extent to which measures will be provided. Research will also need to provide sound information to inform the choice between reducing the probability of floods by reinforcing protection works versus the reduction of potential impact of floods by adapting the built environment (or a combination of both measures). Current knowledge and data are insufficient to reliably quantify the effectiveness and efficiency of adaptation strategies. Moreover, scientific knowledge is often fragmented and not readily accessible to stakeholders. This makes it difficult to establish a long-term management strategy.

Learning Objectives:

- To discuss the importance of flood resilient structures for flood prone areas
- To explain the role of resilient structures in ensuring the safety and robustness of necessary development

- To imply the diversifying measures and defence levels for different land uses based on vulnerability and the costs and benefits of different solutions
- To establish a long-term management strategy for protection of suburban areas
- To prepare an action plan of flood resilient structures for flood prone areas

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of resilient structures for flood prone areas in India, importance & design of flood resilient structures for flood risk mitigation and an action plan of resilient structures for flood prone areas	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.2.5.1

Session plan

Training activities	Time
Introduce the basic concept of flood resilient structures applicable in India, Construction and design of resilient structures such as buildings, houses, embankments and flood/.sea walls in lieu of flood risk mitigation for flood prone areas. Role of resilient structures in ensuring the safety and robustness of necessary development for flood affected areas	30 minutes

Training activities	Time
Focus on past & present diversifying measures and defence levels of resilient structures for different land uses based on flood vulnerability and the costs and benefits of different solutions and establish a long-term management strategy for protection of suburban areas	25 minutes
Preparation of the Action Plan of flood resilient structures for flood prone areas	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various types of models of the flood resilient structures may be shown to trainees to know the different types of mitigation or preventive measures carried out by District, State and Central levels to reduce the flood impact. Handout is attached in the annexure as 1.2.5.1.

Module 1.3: Flood Preparedness

This module consists of the following learning units

- **Learning Unit 1.3.1:** Flood preparedness strategies, Flood preparedness planning, Components of flood preparedness plan and action plan for flood preparedness
- **Learning Unit 1.3.2:** Flood forecasting and warning network in India
- **Learning Unit 1.3.3:** Space technology for flood risk management
- **Learning Unit 1.3.4:** Medical preparedness
- **Learning Unit 1.3.5:** Community Preparedness and Adaptation of "Living with Floods"

Learning Objectives

The key objectives of the module are to:

- describe the nature and type of flood preparedness measures being used in different parts of the country
- discuss the flood preparedness planning and its components in reference to flood risk mitigation and management
- explain the significance of flood forecasting and warning network of the country
- develop administrative capabilities to plan and implement flood preparedness strategies.

Duration

450 minutes/ 7.30 hours

Methodology

- Power point presentation
- Question/ answer
- Interaction and experience sharing

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Learning Unit 1.3.1: Flood preparedness strategies, Flood preparedness planning, Components of flood preparedness plan and action plan for flood preparedness

Introduction

Floods, which are a natural hazard, need not become a disaster, if we are prepared and are aware of how to deal with them. This would reduce the losses of life and minimize human suffering. Flood preparedness planning is about putting in place a set of appropriate arrangements in advance for an effective response to floods. The key to flood preparedness planning is to have a clarity and agreement on the roles and responsibilities of relevant stakeholders such as the government agencies, disaster management organizations, Red Cross, voluntary groups as well as community members. Such an arrangement is possible by forming disaster management committee and teams at various levels to agree on set of Standard Operating Procedures (SOPs) defining what actions to be taken before, during and after floods. The benefits of the flood preparedness are systematic arrangement and deployment of resources to reduce the impact of flood disaster; Vulnerable communities get access to crucial information, such as timely flood forecasts and warnings; The provision of basic needs, such as shelter and medical care, clean water, sanitation and food during floods; Continued access to livelihoods, in order to minimize disruption of economic activities; Effective coordination among disaster management agencies to ensure efficient emergency response during floods; Urgent restoration of critical infrastructure and measures to be taken to bring normalcy immediately after the floods. The trainees have to focus more on the main thrust of the paradigm shift of relief measures to preparedness measures under flood protection programme in India.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of flood preparedness and on its various components undertaken for flood management.

LEARNING OBJECTIVES

- To enable the trainees to understand and appreciate basic components of flood preparedness.
- To discuss the paradigm shift of relief to preparedness in flood management
- To deliberate the roles and responsibilities of various stakeholders in flood preparedness
- To develop administrative capabilities to plan and implement flood preparedness strategies.

- To provide forum of interchange of ideas and views pertaining preparedness planning for an effective response to floods.
- To provide the knowledge and skills on the coordination among the Central Water Commission, India meteorological Department and the States

Methodology

- Power Point Presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of paradigm shift of relief to preparedness, Flood preparedness measures, Preparedness components, Flood preparedness planning and its benefits, Roles and responsibilities of stakeholders, Flood forecasting and warning network in India, Quantitative Precipitation Forecasting (QPF), GIS and RS application, Coordination and cooperation at national & international levels	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
Introduce the basic concept of paradigm shift of relief to preparedness and mitigation of disasters, Flood preparedness measures, Flood preparedness planning its components in flood risk reduction, Flood preparedness activities as Pre, During and Post floods, Health preparedness	35 minutes

Training activities	Time
Focus on flood forecasting network and warning system in India. Modernization of flood forecasting services, Roles and responsibilities of CWC & IMD in flood management at State and National levels. Govt. policy on Early warning system, International Cooperation on flood forecasting and management	20 minutes
GIS and RS application in settlement planning, Preparation of the Action Plan for flood forecasting and warning	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to flood preparedness and planning may be discussed with trainees to know the different components of flood preparedness measures taken up at pre, during and post floods by the stakeholders to reduce the flood impact on the people's life and their properties. Handouts are attached in the annexure.

Learning Unit 1.3.2: Flood forecasting and warning network in India

Introduction

The Flood Forecasting (FF) network covers most of the flood prone river basins of the country. The services of FF enable us to be forewarned as when the river is flowing over the flood plain, to what extent and for how long. The forecast of a flood may be for the water level i.e. stage forecast, discharge (flow forecast) and area likely to be submerged (inundation forecast) at various stations at a specific time. In India, Central Water Commission (CWC) is presently issuing flood forecasts for 175 stations of which 147 stations are for river stage forecast and 28 for inflow forecast. To make forecasting work more efficient and reliable, the CWC has undertaken various modernization schemes to cover more areas. India Meteorological Department (IMD) and the Ministry of Earth Sciences (MoES) are also using modern techniques in the area of rainfall forecasting and warning in India. The trainees have to focus more on the main thrust of the flood forecasting network, modern schemes of forecasting and warning adopted by CWC, IMD and MoES for reducing the impact of floods through cooperation at state, national, regional and international levels.

This session is aimed to reinforce trainee's experiences and to focus on a generalized picture of flood forecasting & warning and action plan for forecasting and warning undertaken for flood management.

Learning Objectives

- To enable the trainees to understand and appreciate basics of flood forecasting and warning system and its significance in India.
- To discuss the efficiency of modern schemes of flood forecasting services and its network in India
- To deliberate the roles and responsibilities of various stakeholders in flood forecasts and warnings for administrators and public to minimize loss of lives and property caused by floods
- To provide forum of interchange of ideas and views pertaining to international cooperation on FF and warning system
- To provide the knowledge and skills on the coordination among the Central Water Commission, India meteorological Department and the States

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic Flood forecasting & warning, moderanisation of forecasting services, methodology Roles and responsibilities of stakeholders, Flood forecasting network and warning system & QPF in India, Coordination and cooperation at national & international levels, Action Plan for flood forecasting and warning	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.3.2.1

Session plan

Training activities	Time
Introduce the basic Flood forecasting & warning, moderanisation of forecasting services, methodology of forecasting & warning, Forecasting network and warning system in India. Schemes of flood forecasting services by CWC, IMD & MoES etc.	35 minutes
Focus on, Roles and responsibilities of CWC & IMD in flood forecasting & warning at State & regional levels, Govt. policy on Early warning system, International Cooperation on flood forecasting and warning	20 minutes
Preparation of the Action Plan for flood forecasting and warning	20 minutes

Training activities	Time
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to flood forecasting network, modernization of forecasting and warning of the country and at global level may be discussed with trainees to know the significance of modern technology of flood forecasting & warning taken up at pre, during and post floods by the stakeholders to reduce the flood impact on the people's life and their properties. Handout is attached in the annexure as 1.3.2.1.

Learning Unit 1.3.3: Space technology for flood risk management

Introduction

Shrinking natural resource base (per capita availability of land and water devoted to agriculture), declining quality of resources and environmental degradation issues will imply increasing threat to our ability to meet the basic needs of the growing population of the region unless we shift our effort to potential regions like flood plains of the country for improving productivity.

The flood plain riverine lands of India covering approximately 42 mha though most endowed with natural resources and has all the potential of becoming rich, is still economically backward. The reason behind this paradox of extent of poverty in the midst of richness of resources is that the natural resources of the region are not being productively harnessed into the process of the economic development and thus are not delivering their potential and commensurate benefits to the people. The Green Revolution technologies evolved during 1960's and 70's had little or no impact in this region of the country. Undesirable spatio-temporal distribution of flood in these areas keeps agricultural areas under uncertainty and risks. These are also the areas where the poorest are concentrated and agriculture largely continues to be more of subsistence. The nature of agricultural problems are highly variable due to great diversity in the production system as also in the socio-economic conditions of the communities requiring location specific approaches to address the problems and enhance the productivity.

Recent development in geoinformatics particularly in the field of Satellite Remote Sensing, GIS and GPS technologies have special advantage in terms of generating state-of-the art informatics - capturing the variability, vulnerability and dynamism of flood plain like agricultural system. This information would enable us to provide valuable scientific insights into the factors contributing to the low productivity which in turn would form the essential ingredients to evolve the effective strategies to enhance it.

This session is aimed to reinforce trainee's experiences and to focus on the role of remote sensing and Geographical Information System (GIS) in flood risk management and an action plan for reducing the impact of floods undertaken for flood plain management.

Learning Objectives

- To enable the trainees to understand and appreciate basics of space technology i.e. Remote Sensing & GIS and its network in India.
- To discuss the efficient role of RS and GIS in flood risk management in India
- To deliberate the significance of RS & GIS in flood preparedness for administrators and public to minimize loss of lives and property caused by floods
- To provide forum of exchange of ideas and views pertaining to international cooperation on RS & GIS in flood plain management
- To provide the knowledge and skills on the coordination among the IIRS, NRSA, Central Water Commission, India meteorological Department and the States

Methodology

- Power point presentation
- Question/ answer

Duration

90 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of Space technology, Remote Sensing and GISmethodology, Roles and responsibilities of stakeholders in space technology in flood risk management in India, Coordination and cooperation at national & international levels, Action Plan for RS & GIS in flood risk mitigation	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.3.3.1

Session plan

Training activities	Time
Introduce the basics of space technology such as Remote Sensing & Geo Informatics System, Position & function of satellite, methodology of RS & GIS in flood zone mapping in India. Roles of IIRS & NRSA in flood forecasting services,etc.	35 minutes
Focus on roles and responsibilities of IIRS & NRSA in flood preparedness and mitigation at State & regional levels, Govt. policy on space technology, International Cooperation on RS & GIS for flood risk management	20 minutes
Preparation of the Action Plan for using of RS & GIS in flood plain management	20 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to RS & GIS, modernization of space technology of the country and at global level may be discussed with trainees to know the significance of modern technology of RS & GIS taken up at pre, during and post floods by the stakeholders to reduce the flood impact on the people's life and their properties. Handout is attached in the annexure as 1.3.3.1.

Learning Unit 1.3.4: Medical preparedness

Introduction

Floods are the most common natural disaster in both developed and developing countries, and they are occasionally of devastating impact, as the floods in China in 1959 and Bangladesh in 1974 , the tsunami in Southeast Asia in December 2004 and Koshi floods 2008 in India show. Their impacts on health vary between populations for reasons relating to population vulnerability and type of flood event. Under future climate change, altered patterns of precipitation and sea level rise are expected to increase the frequency and intensity of floods in many regions of the world.

Epidemiological data on the health effects of floods indicate that most immediate flood deaths are due to drowning and acute trauma. The number of deaths is related to the characteristics of the flood. Limited data indicate that most injuries are mild and occur during self-rescue attempts or while attempting to rescue families and possessions.

However, during the first year after a flood, the mortality rate of the flooded population still may continue to increase up to 50%. In low-income countries, a significant increase of deaths due to diarrhea occurs. Fecal and oral diseases are an important issue in low-income populations with limited access to water and sanitation. Collections of stagnant water can increase the risk for developing malaria. During the post-flood period, anxiety, depression, and increased physical symptoms are found, more common in women. Among children, behavioral changes and increased bedwetting is noted.

Exposures to projected climate changes are likely to affect the health status of millions of people, particularly those with low adaptive capacities. In Europe, inland flash floods and coastal floods from storms and high waters will occur more frequently. Increased morbidity and mortality is expected. This will result in a considerably higher burden on health services.

Adequate new policies on how to deal with the health aspects of floods should be based on lessons learned in the past. These policies must lead to an effective answer to questions such as: Which measures can be taken to mitigate the expected health problems? The complexity and scale of the problems requires a joint process. During this process, searches for new systems of checks and balances between the public domain and the private domains are needed. Scientists should participate in heterogeneous networks to allow the inclusion of scientific data into a more extended process of knowledge production that is

required to solve the issues. Research gaps that must be filled include further modeling of relationships between health and floods.

Learning Objectives

1. To enable the trainees to understand the structural and infrastructural health problems occurred in pre, during and after large-scale floods
2. To discuss the preventive measures taken to mitigate the health problems
3. To integrate these preventive measures into decision-making
4. To elaborate the responsibilities of the government and the individual citizen towards health preparedness measures
5. To Stimulate cooperation between governmental organizations, non-governmental organizations, and public organizations such as lifesavers and health professionals

Methodology

- Power point presentation
- Question/ answer

Duration

70 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of Hygiene of Health in India, Health problems occurred in pre, during and post floods on flood victims, Preventive measures against various types of diseases particularly water borne diseases. Coordination and cooperation at national & international levels, Action Plan for health preparedness & mitigation aspects in flood risk management	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.3.4.1

Session plan

Training activities	Time
Introduce the basics of medical aid and health preparedness aspects adopted in India in pre, during and post impacts of floods by medical experts to prevent the epidemic diseases among vulnerable groups of a society	25 minutes
Focus on roles and responsibilities of Government and individual in health preparedness and mitigation at State & regional levels, Govt. policy on medical relief and role of various National & International Organizations like World Health Organization on health preparedness	15 minutes
Preparation of the Action Plan for health preparedness & mitigation aspects in flood risk management	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to health aspects, preventive measures to check the epidemic diseases in the country and at global level may be discussed with trainees to tell the significance of health preparedness and mitigation measures taken up at pre, during and post floods by the stakeholders to reduce the flood impact on the hygiene of people's health. Handout is attached in the annexure as 1.3.4.1.

Learning Unit 1.3.5: Community Preparedness and Adaptation of "Living with Floods"

Introduction

Most efforts designed to reduce the effects of floods have focused on structural measures such as construction of dams or embankments (polders, levees, etc). Many development experts question whether large-scale flood control projects are economically suitable for the least-developed countries, since they increase the country's debt significantly for little economic return. Interest has recently increased in alternative strategies for protecting the flood plains especially in rural areas. These strategies can often be adopted or modified into a national 'living with floods' strategy to encourage people to adapt to floods and to capture their benefits for economic development. This strategy has been cost-effective, easy to implement and compatible with the environment. More important, it can be incorporated into long-term development programmes.

Creating functional groups, developing organisational capacities and enabling them to link with the national disaster management mechanisms are effective ways of strengthening preparedness at the community level. Small-scale mitigation, teaching life saving skills, contingency planning and even upgrading service provision are some key measures undertaken by non-governmental organizations (NGOs) and governments in Asia. In many cases such good work by agencies on an ad-hoc basis is found to be unsustainable and not often scaled up. Longer-term success requires strong engagement with the community. For many smaller NGOs, continuity of funding support is a critical limiting factor in maintaining their disaster preparedness (DP) work. Globally, some funding is available for disaster reduction, but little is left to support concrete action, beyond training and planning. The best way is therefore to enable the communities to organise themselves and link them with the national disaster response mechanisms.

Learning Objectives

1. To enable the trainees to understand the preparedness planning by the community designed for pre, during and post floods
2. To highlight the role of community in flood risk management
3. To elaborate the responsibilities of the community and the individual citizen towards flood vulnerability in changing climate
4. To generate awareness among the community to tackle the floods
5. To prepare the community for adaptation of "Living with floods'

Methodology

- Power point presentation
- Question/ answer

Duration

70 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of community and its role in preparedness planning for pre, during and post impact of floods. Community awareness to tackle the floods and prepare the community for adaptation of Living with floods in changing climate. Action Plan for community preparedness & its palnning in flood risk management	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.3.5.1

Session plan

Training activities	Time
Introduce the basics of preparedness aspects adopted in India in pre, during and post impacts of floods by communities to tackle the problem of floods occurred annually in the country	25 minutes
Focus on roles and responsibilities of community and individuals in flood preparedness at State & regional levels in present scenario of changing climate, Community awareness generation for flood preparedness and Adaptation of "Living with floods"	15 minutes
Preparation of the Action Plan for community preparedness aspects in flood risk management	15 minutes

Training activities	Time
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to community preparedness aspects, awareness generation to check the impact of floods and to prepare the community for adaptation of "Living with floods" in the country and at global level may be discussed with trainees to tell the significance of preparedness planning at pre, during and post floods by the stakeholders to reduce the flood impact on the urban & rural society of the country. Handout is attached in the annexure as 1.3.5.1.

Module 1.4: Flood Response

This module consists of the following learning units:

- **Learning Unit 1.4.1:** Field visit to flood control measures at Barrage
- **Learning Unit 1.4.2:** Government Response and Damage Assessment
- **Learning Unit 1.4.3:** Community Response Approach
- **Learning Unit 1.4.4:** Incident Command System in flood management
- **Learning Unit 1.4.5:** Search And Rescue (SAR) operation in flood management

Learning Objectives

The key objectives of the module are to:

- describe the nature and type of flood response being used in different parts of the country
- discuss the flood response strategies and its components in reference to Incident Command System
- explain the significance of Search & Rescue (SAR) of flood in India
- develop administrative capabilities to plan and implement flood response strategies.

Duration

330 minutes/ 5.30 hours excluding lunch and tea

Methodology

- Power point presentation
- Question/ answer
- Interaction and experience sharing

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Learning Unit 1.4.1: Field visit to flood control measures at Barrage

Introduction

The coordinator/ facilitator will brief the trainees about the significance of field visit of a barrage to see the structural and non-structural measures of flood management on site that how do control measures manage flood disaster . The coordinator/facilitator will also provide opportunity to trainees for sharing their practical experiences with officials working in the areas of flood control and they may get an opportunity to apply their learnings of the classroom in the field.

Learning objectives:

- To study & understand the control measures for managing flood disaster
- To share the practical experience with officers working in the areas of flood control
- To apply the learnings of the classroom in the field.

Methodology

On site Interaction and discussion of participants with the officials of Flood control cell of Irrigation Department

Duration

180 minutes

Teaching/ Performance aids

- Maps of the field visit
- Models of study site
- Transport facility

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Flood mitigation measures (Structural and Non-structural) like Dam, embankments, flood walls, channels & Drainage system, flood levees, flood plain zoning, flood proofing and its techniques, Modern flood forecasting methods and warning system and action plan for flood risk mitigation measures of concerned Irrigation Department	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
Familiarization of trainees classroom knowledge of the flood management by sharing with the practical experiences of officials working in the areas of flood control measures along with the use of flood zoning in flood plains, flood proofing and its adopted techniques. Watershed management measures in conjunction with structural measures such as check dams, detention basins, etc.	60 minutes
Interaction on the modernization of forecasting methods and warning system. Role of CWC & IMD in flood management at State and National levels. Govt. policy on Early warning system	35 minutes
Discussion on Action Plan of flood mitigation measures adopted by the flood control cell of concerned Irrigation Department	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarise whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	5 minutes
Open house for question and answer	5 minutes
Journey duration of the field site	60 minutes

During the field visit, the flood protection works carried out by the flood control cell of concerned Irrigation Department may be shown to trainees to tell the different types of structural and non-structural measures practically taken up at pre, during and post floods by the State Governments to reduce the flood impact on the people's life and their properties.

Learning Unit 1.4.2: Government Response and Damage Assessment

Introduction

During flood emergencies, assessment of the extent of flooding, flood losses and resultant needs of the affected communities is essential for flood relief coordination. Depending on the severity of the flood and the level of preparedness in the affected area, this has to be done under extraordinary circumstances, involving varying degrees of chaotic conditions, contingencies and time pressures. Usually the immediate estimates are drawn arbitrarily due to the chaotic circumstances and mounting public pressure. These flood loss assessments later provide the basis for reconstruction planning and for decisions on flood management policy reform. Nevertheless, certain basic principles can be observed to avoid too unrealistic estimates and resulting repercussions.

For the Government, evacuation of flood affected communities is one of the most difficult response measures, especially, when it invloves large population. Evacuation is carried out as a precautionary measure based on warnings issued in order to protect flood threatened people from the full impacts of flood disaster. For carrying out successful evacuation, the threat perception from the Government i.e. Disaster Management officials is essential to maintain dialogue with some crucial sectors such as CWC, IMD, transportation, medical, food suppliers, Civil socities, NGOs and communities including Decision Support System (DSS) and Geographical Information System (GIS).

The importance of assessing the potential losses of the flood becomes evident when policy makers and planners try to strike an optimal balance between the development needs of a particular area and the levels of flood risk society is ready to accept. In this context, the flood losses become a vital element in assessing the net-benefits of a society and this can derive from using the areas of flood plains, i.e. the overall benefits like relatively easily exploitable land for economic activity of various sectors, space for settlement, fertile alluvial soils for agriculture, readily available navigation links, etc., minus the expected flood losses, both assessed for the same timeframe. The assessment cum estimation of severity of flood can not be done immediately after its occurrence as the local communication infrastructure often fails. So the preliminary assessment of damage caused by a flood should be based on water level and the estimate of the area flooded as assessed from satellite imageries. Field observation data are to be used to modify this damage assessment once available.

Learning Objectives

1. To enable the trainees to introduce with the response system of flood
2. To highlight the relief measures taken by a Government during & post flood
3. To elaborate the responsibilities and coordination among various stakeholders in flood response
4. To discuss the Government's evacuation plan & its constraints
5. To discuss the significance of Damage Assessment in floods

Methodology

- Power point presentation
- Question/ answer

Duration

75 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of Response system in flood management, Government's Response Plan and response coordination among various stakeholders based on new concept of DM during and post impact of floods. Emergency Evacuation Plan, Relief measures and Estimation/Assessment of damage caused by a flood Action Plan for Government response plan & damage assessment in flood risk management	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.4.2.1

Session plan

Training activities	Time
Introduce the basics of response system of India during and post impacts of floods by Government to tackle the problem of floods occurred annually in the country, Response and new paradigm scenario in DM	25 minutes
Focus on coordination and responsibilities of various stakeholders for effective post-flood response at State & district levels, Emergency Evacuation Plan and significance of Estimation cum Assessment of flood damage	20 minutes
Preparation of the sector wise Action Plan specific for saving lives during emergency as per local scale flood risk profile of the area	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize the contents of the session that has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the various issues related to Government response and Damage Assessment and emergency evacuation plan with the response coordination among various stakeholders to reduce the impact of floods and significance of damage assessment caused by a flood may be discussed with trainees to know the significance of flood response plan during and post floods by the Governments & stakeholders to reduce the flood impact on the urban & rural society of the country. Handout is attached in the annexure as 1.4.2.1.

Learning Unit 1.4.3: Community Response Approach

Introduction

Community response approach in flood risk management has been felt for some time. This is in conformity with the current trend of participative approaches to socio-economic development and welfare activities. Community participation is a process where the concerned communities function and contribute as a cohesive group to perform a predetermined activity. The basic premise behind this approach is that the involvement of the people in flood management is expected to be more effective and useful. Such an approach also provides an opportunity to the community to meet its obligations towards its members. Community involvement would, of course, be more effective if people are fully conscious, empowered and trained. Community participation would be forthcoming if community can expect to derive visible benefits from it. People, therefore, should be provided an opportunity to play a more active role and the official machinery provides facilitating and catalytic support only. It may be noted that this task has now become easier in India since community based organizations elected by the people known as Panchayats have become functional at village, block and district levels as a part of the Indian Constitution (73rd Amendment, 1992). Community participation can only mitigate the hardships and losses caused by floods. It has little effect on controlling or moderating floods. It assumes that floods would continue to come and that people have to live with them. Therefore, the community response approach is to combat floods and to reduce the consequent losses.

In present context, the State governments particularly State Disaster Management Authority (SDMAs) and District Disaster Management Authority (DDMAs) are performing various response activities in coordination with the civil societies to understand and plan their roles in the framing of Standard Operating Procedures (SOPs) and incorporate them in the flood Disaster Management plan of a region.

Learning Objectives

1. To enable the trainees to introduce with the community response approach in flood
2. To highlight the role of community in relief works taken by a Government during & post flood
3. To discuss the nature of coordination of civil societies with State government in flood mitigation efforts

4. To discuss the significance of Standard Operating Procedures in disaster response

Methodology

- Power point presentation
- Question/ answer

Duration

75 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of community response in flood management, Role of community in relief works of Government during & post floods, Coordination of civil societies with State Governments in flood mitigation efforts, Framing and incorporation of Standard Operating Procedures into disaster management plan of flood of a region, Action Plan for community response approach in flood risk management	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
Introduce the basic theme of community response approach in flood management in India during and post impacts of floods, Role of community in relief works of Government during & post floods and coordination of civil societies with State Governments in flood mitigation efforts,	30 minutes
Focus on Framing and incorporation of Standard Operating Procedures into flood disaster management plan of a region	15 minutes

Training activities	Time
Preparation of the Action Plan for community response approach in flood risk management	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the current trend of community approach towards response mechanism of a Government in flood risk management, coordination of civil societies with the State disaster management bodies like SDMAs & DDMAs as well as active Panchayats in flood mitigation efforts may be discussed with trainees to know the significance of community response approach during and post floods to reduce the flood impact on the urban & rural society of the country in changing scenario of climate in India.

Learning Unit 1.4.4: Incident Command System in flood management

Introduction

The Incident Command System (ICS) consists of personnel, policies, procedures, facilities, and equipment that work together in an organized structure designed to greatly improve emergency response effectiveness, response time, and efficiency for all disasters, no matter how big or complex. The ICS is based on a common command structure that allows all officials in organizations, no matter private or public, in any jurisdiction to effectively communicate with each other in emergency situations. The goal of ICS is designed to reduce any problems with communication and emergency techniques in such incidents in which quick response and proper operations are critical.

The ICS focuses on a system of management and procedures on a temporary basis for an incident of any size or severity. The ICS has a general emphasis on preparedness, with all aspects of its operations practiced and personnel trained well before an incident occurs. When an incident does occur, the ICS formulates a management hierarchy that is used to control funds, employees, facilities, equipment, resources, and communications. The Incident Command System is designed to not only be structural guidelines, but also to be flexible enough to adapt to unexpected circumstances. For example, in an emergency situation that would cover many jurisdictions, the ICS system is designed to meet the needs of each one of those jurisdictions and to establish firm communication with all of them. In the event of an incident, the ICS system will allow for many different agencies and organizations to quickly formulate a management structure, using common terminology for easy communication vital in a time of crisis. In addition, the ICS provides logistical support to an operational staff, is designed to be cost effective by avoiding doubled work, and delivers a unified system of organization.

During a flood, all response activities are taken up at the local level through a suitably devised ICS coordinated by the local administration through the Emergency Operation Centres (EOCs). State governments maintain EOCs at appropriate levels for the coordination of human resources, relief supplies and equipment. State governments have developed Standard Operating Procedures (SOPs) for the EOCs, which are integrated within the framework of the ICS for taking advantage of modern technologies and tools such as GIS maps, scenarios and simulation models for effectively responding to floods and other disasters.

The state governments/SDMAs undertake the training of personnel involved in the ICS.

Learning Objectives

1. To discuss the structure and functions of ICS
2. To understand the significance of ICS in flood preparedness & mitigation
3. To formulate the ICS management hierarchy to control funds, employees, facilities, equipment, resources, and communications
4. To coordinate a suitable devised ICS by local administration through the EOCs during a flood
5. To explain the advantage of SOPs within the framework of ICS based on GIS maps and simulation models for an effective response to floods

Methodology

- Power point presentation
- Question/ answer

Duration

75 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic concept of ICS, structure and function of ICS during a flood, Role of ICS in flood risk management, Formulation of ICS management hierarchy during a flood, SOPs, EOCs in ICS at local administration, Significance of ICS in framing of SOPs based on GIS maps & simulation models etc.	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board Handout 1.4.4.1

Session plan

Training activities	Time
Meaning of ICS in a flood situation, Structure and functions of ICS in flood management, ICS components, ICS management and system, Significance of ICS in flood risk mitigation	30 minutes
Formulation of ICS management hierarchy during a flood, SOPs, EOCs in ICS at local administration, Importance of SOPs in EOCs at local administration of a State	15 minutes
Development of Action Plan in framing of ICS oriented SOPs based on GIS maps & simulation models etc.	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation the current status of Structure and functions of ICS in flood management, ICS components, ICS management and system, Significance of ICS in flood risk mitigation, ICS management hierarchy during a flood, SOPs, EOCs in ICS at local administration may be discussed with trainees to know the advantage of SOPs within the framework of ICS based on GIS maps and simulation models for an effective response to floods to reduce the flood impact on the Indian economy in changing scenario of climate induced disasters in India. Handout is attached in the annexure as 1.4.4.1.

Learning Unit 1.4.5: Search And Rescue (SAR) operation in flood management

Introduction

In India, the state governments particularly SDMAs are developing procedures for formally recognizing and certifying trained search and rescue team members through the ATIs. These trained persons are also providing suitable indemnity to community level team members for their actions in the course of emergency response during a flood. NDRF battalions are assisting the state governments and district authorities in training communities, which being further assisted by the ATIs, CD, Home Guards and NGOs. In addition to it, the youth organizations such as the NCC, NSS and NYKS are providing support services to the response teams at the local level under the overall guidance and supervision of the local administration.

Learning Objectives

1. To discuss the structure and functions of SAR operation
2. To understand the significance of SAR operation in flood preparedness & mitigation
3. To explain the various tools and the linkages of SAR with other relief and response operations.
4. To highlight the coordination of State government/ district authorities with NDRF in training of SAR operation in India
5. To explain the role of youth organizations in SAR operation

Methodology

- Power point presentation
- Question/ answer

Duration

75 minutes

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Basic idea of SAR operation during a flood, Significance cum objectives of SAR operation in flood risk management, Various tools and linkages of SAR in flood relief & response, Role of NDRF and youth organization in SAR operation	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
An overview of SAR operation of a flooded area, Objectives of SAR operation in flood preparedness and mitigation, Tools and Linkages of SAR in relief and response of a flood,	30 minutes
NDRF and its assisting role in training of SAR operation to communities under supervision of local administration, Role of youth organization such as NCC, NSS and NYKS in SAR operation	15 minutes
Preparation of an Action Plan of SAR operation through ATIs for local communities for their actions during emergency response of a flood	15 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the session, the basic idea of SAR operation during a flood, SAR operation in flood preparedness, in emergency relief and response, role of youth organizations and NDRF in the operation of SAR during a flood as well as activity of local trained community during emergency response of a flood may be discussed with trainees to know the significance of SAR operation during floods to reduce the its impact on the urban & rural society of the country.

DAY FIVE

Module 1.5: Cross cutting Issues & lessons learnt

- **Learning Unit 1.5.1:** Role of Civil Society in flood risk management
- **Learning Unit 1.5.2:** Responding to Gender concerns & needs of vulnerable groups,
- **Learning Unit 1.5.3:** Impact of climate change, lessons learnt based on case studies of floods
- **Learning Unit 1.5.4:** Financial arrangement & flood insurance for flood risk management
- **Learning Unit 1.5.5**: Group Exercise – Presentation & Discussion

Learning Objectives

The key objectives of the module are to:

- describe the nature and role of civil societies in flood risk management
- discuss the response of gender concerns & needs of vulnerable groups,
- highlight the impact of climate change, lessons learnt based on case studies of major Indian floods
- develop administrative capabilities to plan the financial arrangement for flood risk management

Duration

165 minutes/ 2.45 hours

Methodology

- Power point presentation
- Question/ answer
- Interaction and experience sharing

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Learning Unit 1.5.1: Role of Civil Society in flood risk management

Introduction

Civil society refers to the arena of uncoerced collective action around shared interests, purposes and values. In theory, its institutional forms are distinct from those of the state, family and market, though in practice, the boundaries between state, civil society, family and market are often complex, blurred and negotiated. Civil society commonly embraces a diversity of spaces, actors and institutional forms, varying in their degree of formality, autonomy and power. Civil societies are often populated by organisations such as registered charities, development non-governmental organisations, community groups, women's organisations, faith-based organisations, professional associations, trade unions, self-help groups, social movements, business associations, coalitions and advocacy group.

It has now been revealed that the civil society as an institution in itself is emerging as an effective player in the entire mechanism of disaster administration. In the event of actual disasters, the civil society, if well aware of the preventive actions it is required to take, can substantially reduce the damage caused by the floods or any disaster. Awareness and training of the civil society is particularly useful in areas that are prone to frequent disasters. While the civil society as an effective institution is yet to take shape in the country, considerable efforts are being made to form and strengthen community based organizations at grassroots levels.

Learning Objectives

The key objectives of the module are to:

- describe the nature and structure of civil society in flood risk management
- discuss useful role of civil society in awareness and training for flood prone areas
- highlight the significance of civil society as an effective institution in flood mitigation
- discuss the considerable efforts of civil society made to form and strengthen community based organizations at grassroots levels in flood management

Duration

60 minutes

Methodology

- Power point presentation
- Question/ answer
- Interaction and experience sharing

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Nature and structure of a civil society, Role of civil society in training and awareness activities for flood risk mitigation, civil society as an effective institution in flood preparedness and efforts of civil society to strengthen the various community organizations in flood management	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
An overview of nature and structure of a civil society and its role in training and awareness activities for flood risk mitigation	20 minutes
Civil society as an effective institution in flood preparedness and its efforts in strengthening the various community organizations in flood management	15 minutes
Preparation of an Action Plan on training and awareness activities of a civil society in flood risk management	10 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	10 minutes
Open house for question and answer	5 minutes

During the interactive presentation an overview of nature and structure of a civil society and and its role in training and awareness activities for flood risk mitigation civil society as an effective institution in flood preparedness and its efforts in strengthening the various community organizations in flood management may be discussed with trainees to know the significance of civil society in reducing the flood impact on the economy and vulnerable groups of the society of the country.

Learning Unit 1.5.2: Responding to Gender concerns & needs of vulnerable groups in flood risk mitigation

Introduction

Human beings have been at the mercy of natural disasters since the beginning of time. Floods, fires, earthquakes and tremors, mudslides, volcanic eruptions, hurricanes, tornadoes, tsunami, tropical storms, ice storms, landslides, droughts and famine consistently remind us of how vulnerable we are.

The recent increase in attention to the effects of natural disasters particularly in case of floods has resulted in a plethora of different perspectives on the issue. In particular, several authors have brought a gender focus to the analysis of flood risk mitigation and management, The image of the suffering woman and child during a flood is a popular one in the media. Women are disproportionately affected by natural disasters, usually as a result of their gendered status in society. What the media does not show, however is that women are a vital part of disaster mitigation and response efforts, whether acting within their traditional gender roles, or transcending them. Women are made more vulnerable to disasters through their socially constructed roles.

An effective development process must include both the needs and the potential contributions of women as well as men. A community-based disaster preparedness and response plan that takes women's physical, psychological, social and economic vulnerabilities into account will help to reduce women's vulnerability to disaster overall. A plan that goes even further to recognize women's abilities and include them in disaster relief efforts will help to change gendered beliefs about women. A gender-based approach to the study and analysis of natural disasters e.g. floods is essential in accomplishing this goal.

Learning Objectives

The key objectives of the module are to:

- describe the Gender and its responding concerns in flood risk management
- discuss the needs of vulnerable groups of flood prone areas
- highlight the role of gender in flood mitigation

Duration

30 minutes

Methodology

- Power point presentation
- Question/ answer
- Interaction and experience sharing

Teaching/ Performance aids

- Reading material
- Hard copy of the presentations
- Flip chart
- White board with markers

Trainer's Note and Session plan

Contents	Methodology	Teaching aids
Status of responding gender concerns and its role in flood risk mitigation, Needs of vulnerable groups of a flood prone area and gender response during & post floods, Preparedness aspects of gender in flood management in India	Lecture cum discussion through power point presentation followed by Question-answer	Flip chart/ Sketch board

Session plan

Training activities	Time
Definition of gender and its status in flood disaster management, Nature and role of gender in mitigation of flood impact on the needs of vulnerable groups of the flood prone areas,	10 minutes
Preparedness aspects of gender in flood management in India	5 minutes
Preparation of an Action Plan on training and awareness activities of a responding gender concerns in flood risk management	5 minutes
Summary & evaluation of the learning in this session. Trainer may ask one of the trainees to summarize whatever the contents of the session has been covered and how they plan to use this knowledge. Invite other trainee to supplement whatever their colleague has discussed. The trainer may check out that the learning objectives of the session have been achieved.	5 minutes
Open house for question and answer	5 minutes

During the interactive presentation an overview of nature and status of a gender and its role in flood risk mitigation, Gender as an effective institution in flood preparedness and its efforts in strengthening the various community organizations in flood management may be discussed with trainees to know the significance of gender in reducing the flood impact on the economy and vulnerable groups of the society of the country.

Learning Unit 1.5.3: Impact of changing climate and lessons learnt based on case studies of floods

Introduction

Global warming is projected to intensify the hydrological cycle and increase the magnitude and frequency of intense precipitation events in most parts of the world. Within this activity we assess how future climate developments may impact flood hazard across India and Europe.

It has been traditionally assumed that the annual maximum flood process at a location is independent and identically distributed. While nonstationarities in the flood process due to land use changes have long been recognized, it is only recently becoming clear that structured interannual, interdecadal, and longer time variations in planetary climate impart the temporal structure to the flood frequency process at flood control system design and operation timescales. The influence of anthropogenic climate change on the nature of floods is also an issue of societal concern. A diagnosis of variations in the frequency of floods is synchronous with low-frequency climate state and an exploration of limiting flood probability distributions as implied by a long simulation of a model of the El Niño/Southern Oscillation.

Global warming is projected to intensify the hydrological cycle and increase the magnitude and frequency of intense precipitation events in most parts of world. Within this activity we assess how future climate developments may impact flood hazard across India and rest of the world (Handout 1.5.3.1).

Case study I: Urban Flooding: Mumbai flood 2005 in Maharashtra

Description: Flooding is not a new phenomenon. The recent experience has however, shown that sudden, incessant rains are the major factor behind deluges. Well one cannot control the rains, but it is possible to tame and utilize the flood waters in urban areas.

The reasons which led to massive flooding in Mumbai (2005) include, antiquated drainage system. The 20th century drainage network of Mumbai is capable of carrying only 25 millimeter of rainwater per hour. With drains clogged at several places it proved inadequate for the 944mm rain which lashed Mumbai in one day alone. It seems that only three drains which drain into the sea have gates whereas, other 102 outlets have no such gates. Problem with coastal areas is lack of adequate gradient for water to flow into the sea. During high tides, the sea water incursion takes place through these drains. Drains without gates

become vulnerable points and a salt water deluge engulfs upcountry. It goes without saying that the drainage system needs a thorough overhaul with gates to man the backflow of the sea water.

Floods in the rivers are dependent on topography, drainage, rainfall and the ground geology. For example, if the drainage is poor as in Mumbai even less rainfall will cause floods. If the channel of the river is made of clay at a particular site excess water will rather spill over as it will not be able to go down to the depths. All these criteria have to be considered before planning development of a particular area. Unfortunately it is not so, and as a consequence most of the cities are flood prone.

It is observed that the mechanism of urban flooding is complex and site specific. Heavy rains, river overflowing the banks, sudden release of water from dams due to natural or anthropogenic reasons, coastal hurricanes and tsunamis and a combination of any of the above can create havoc in the urban areas. If we revert back to Mumbai we realize the gentle slope of the ground is towards the sea. Water flows down the slope. During rains if the path of water is obstructed by buildings and the drains have no capacity, the outcome is what the people of Mumbai experienced in 2005.

Objectives:

- To overview of the Mumbai floods 2005
- To provide an overview of response mechanism during the flood
- To illustrate the gaps during the flood
- To illustrate the best practices as well as the lessons learnt
- To discuss the future measures and Plans to handle such situations

Content

- An overview of Mumbai flood 2005 as a case study
- Response mechanism and gaps during Mumbai flood 2005
- Best practices and lessons learnt for future planning to handle such situations

Methodology

- Lecture cum discussion on Mumbai Floods 2005 as case study

Case study II: Barmer Floods 2006 in Rajasthan

Description: The heavy downpours — about 723 mm in just seven days — that caused a major flood across Barmer district in Rajasthan, especially the northern and western regions, has triggered off discussions about how the

water can be used. Many experts are saying that it is possible to go beyond the immediate ravages to look at positive aspects.

It was noted that even after the rain stopped, the water did not drain out, because of an impermeable layer of sub-surface gypsum. On the one hand, this raises the spectre of new problems related to health and environment. Already, more than 45 people have died of malaria and more than 5,000 have contracted the disease.

Though large parts of Rajasthan are drought-prone, flash floods are not uncommon in the state. A small part of the floodwater recharges aquifers, but most of it drains into the sea. "Flash floods, like the present one, can bring as much as 22.6-54.8 billion cubic metres of additional water in a year,' says Pratap Narain, Director, Central Arid Zone Research Institute, Jodhpur. For the future, the government should focus on this possibility, he adds. According to the Central Groundwater Authority, groundwater in Barmer is overexploited.

The recent flood in Barmer (2006) indicates a solution to a potential crisis through groundwater recharge, especially since heavy rainfall once in four to five years is a common phenomenon in many areas. According to some estimates, Rajasthan has about 50 million hectares of rocky terrain with a high run-off potential. If suitable rainwater harvesting structures are developed, it could harvest and conserve 90-145 million cubic metres of runoff a year in addition to recharging aquifers.

Objectives:

- To provide an overview of the flood situation in Rajasthan
- Genesis of floods in Barmer
- To provide an overview of the response and relief measures taken during the flood
- To discuss and assess the gaps
- To illustrate some good practices and lessons learnt
- To discuss future measures of preparedness and mitigation

Methodology

- Lecture cum discussion on Barmer flood 2006 as a case study

Content

- An overview of Barmer flood 2006 as a case study
- Response mechanism and gaps during Barmer flood 2006

- Similarities & dissimilarities in the nature between Mumbai flood 2005 and Barmer flood 2006
- Best practices and lessons learnt for future planning to handle such situations

Guidelines to Facilitator

- The facilitator will help the participants in discussion over similarities and dissimilarities of the case studies of Mumbai flood 2005 and Barmer flood 2006 with the resource persons in view of new emerging issues like climate change and other impacts of weather events (El-Nino and La-Nino, etc.).
- The facilitator will also provide opportunity to participants to discuss the preparedness strategies in detail to reduce the impact of climate change and other weather events with resource persons.
- The facilitator will arrange the copies of case study to distribute to all the trainees.

Learning Unit 1.5.4: Financial arrangement for flood risk management

Introduction

The two main financial arrangements open to meet the expenditures for compensating disaster victims for their losses are the Calamity Relief Fund (CRF) and National Calamity Contingency Fund (NCCF). The Calamity Relief Fund is used for meeting the expenditure for providing immediate relief to the victims of various natural disasters. Expenditure on restoration of damaged capital works should ordinarily be met from the normal budgetary heads, except when it is to be incurred as part of providing immediate relief, such as restoration of drinking water sources or provision of shelters etc., or restoration of communication links for facilitating relief operations.

Of the total contribution, the Government of India contributes 75 per cent of the total yearly allocation in the form of a non-plan grant, and the balance amount is contributed by the State Government concerned. NCCF is intended to cover natural calamities which are considered to be of severe nature requiring expenditure by the State Government in excess of the balances available in its own Calamity Relief Fund. The assistance from NCCF is available only for immediate relief and rehabilitation. Any reconstruction of assets or restorations of damaged capital is to be financed through re-allocation of Plan funds. Apart from this various NGOs and external agencies also come forward voluntarily to contribute for relief, medical help and rehabilitation of the victims. Human Rights Commission also tries to check that the genuine victims get all the possible help from Centre/ state to cover up their losses.

Objectives:

1. To explain the significance of Calamity Relief Fund and National Calamity Contingency Fund in terms of flood losses
2. To discuss the role & contribution of Central and State Governments in CRF & NCCF in restoration of damaged capital works
3. To highlight the NCCF assistance availability for immediate relief and rehabilitation of a flooded area

Methodology

- Lecture cum discussion on financial arrangements (CRF & NCCF) in restoration of damaged capital works.

Content

- A brief description on CRF and NCCF in terms of flood losses
- Role & contribution of Central and State Governments in CRF & NCCF in restoration of damaged capital works
- Availability of NCCF assistance for immediate relief and rehabilitation of a flooded area
- Role of NGOs and Voluntary organizations in financial contribution for relief and recovery

Guidelines to Facilitator

- The facilitator will help the participants in discussion over CRF and NCCF in restoration of flood affected areas by the learnings from case studies of floods with the resource persons in view of financial contributions made by Central and State Governments in 75:25 i.e. 3:1 ratio based on the severity of a flood occurred in flood prone areas and affecting the life and property.
- The facilitator will also provide opportunity to participants to discuss the significance of CRF and NCCF assistance for immediate relief and rehabilitation of a flooded area with resource persons.
- The facilitator will provide a discussion forum for participants to interact on various issues related to CRF & NCCF and roles of Government agencies and NGOs to each other and with resource person
- The facilitator will arrange the copies of case study to distribute to all the participants

Learning Unit 1.5.5: Group Exercise – Presentation & Discussion

Introduction

Group exercise is a very effective method of training. It serves more than one purpose. It reinforces what has already been taught through lectures. It helps assess if the trainees assimilated the concepts explained or the knowledge imparted. It breaks the monotony of classroom lectures. It helps participants apply the knowledge gained during the interaction of the training to near practical situations. Infact, the ultimate test of effectiveness of any training endeavour is its practical utility to the participants.

Group exercises have been used with great success in the training programmes organised by the facilitator or course coordinator or trainer of a training institute. Such group exercises have been highly welcomed by the participants. These exercises have very often sprung up novel ideas on different topics related to flood risk mitigation and management set by the facilitator or course coordinator or trainer of a training programme. These are used in various training courses conducted in the training institutions at National level followed by State, Regional and District levels. Training institutions also develop other similar exercises and use them in the concerned training course.

Group Exercise Presentation by participants

Facilitator or course coordinator or trainer will provide the topics related to various aspects of flood disaster management to the groups of participants who would be equally divided into a number of groups based on their profile and experience on first or second day of the course by the facilitator. Participants of the concerned groups will choose their group leaders to make the presentations on allotted topics on the last day of the course. Before presentations, the groups will prepare their power point presentations after making own study learned during lectures and consulting the literature in the library and reading material. On last day the group leaders will make presentations followed by discussion among the participants and with the experts or facilitators of the course.

Objectives:

- To exchange the practical experiences with other groups on structural and nonstructural measures of flood risk mitigation and management
- To illustrate the best practices as well as the lessons learnt
- Future measures and Plans to handle such situations of floods

Methodology

Group presentation followed by discussion

Guidelines to Facilitator

- Ask one representative (Group leader) from each group to make a presentation of the group's answers to the questions raised.
- Discuss these in the open house.
- Focus on how flood mitigation and preparedness measures are often ignored in the formulation and implementation of development projects resulting in adversely affecting the lives of people
- Explain the concepts of flood mitigation and management and its policies

Module 1.6

Module 1.6: Programme Evaluation & Valediction

The programme evaluation and official valediction session could take place after oath taking as per the protocol of the concerned institute or organization with an aim to take note of the trainee's feed back including suggestions to make the next course programme more assertive.

Evaluation

In the last but not the least, the participants will be asked to give their feed back in terms of the academic and other aspects of the programme. This may be done through an evaluation form as well as seeking their oral feedback (**Annexure- 1.6.1**)

Valediction

In the last, the certificates along with the list of participants and a CD of the concerned programme are to be given to the participants on successfully completion of their training programme by Course Coordinator/ Director of the programme.

(Duration: 30 minutes)

GLOSSARY

A list of terms, considered important for organizational and procedural purposes in flood disaster-related activities:

Alert – advisory that hazard is approaching but is less imminent than implied by warning message.

Annual flood – highest peak discharge in a year.

Assessment – survey of a real or potential disaster to estimate the actual or expected damages and to make recommendations for prevention, preparedness and response.

Climate - a description of the long-term pattern of weather in a particular area.

Disaster – a serious disruption of the functioning of a society, causing widespread human, material, or environmental losses, which exceed the ability of affected society to cope using only its own resources. Disasters are often classified according to their speed of onset (sudden or slow), or according to their causes (natural or man-made).

Discharge (syn flux: rate of flow) – volume of water flowing through a river (or channel) cross-section in unit time.

Disaster insurance – government sponsored or private insurance policies for protection against economic losses resulting from disaster.

Disaster legislation – the body of laws and regulations that govern and designate responsibility for disaster management concerning the various phases of disaster.

Disaster management – the body of policy and administrative decisions and operational activities, which pertain to the various stages of a disaster at all levels.

Disaster mitigation – measures taken in advance of a disaster aimed at decreasing or eliminating its impact on society and on environment.

Disaster response – a sum of decisions and actions taken during and after disaster, including immediate relief, rehabilitation, and reconstruction.

Ecology – The scientific study of relationships between organisms and their environment. It is concerned with the structure and function of natural systems at the level of populations, communities, and ecosystems.

Elements at risk – the population, buildings and civil engineering works, economic activities, public services, utilities and infrastructure, etc., at risk in a given area.

Emergency – a sudden and usually unforeseen event that calls for immediate measures to minimize its adverse consequences.

Environment – The circumstances or conditions that surround an organism or group of organisms as well as the complex of social or cultural conditions that affect an individual or community.

Flash flood – a dangerous and sudden flood (extreme volume of water) that flows rapidly and causes inundation. It threatens lives and property and usually occurs after heavy rain. May also occur after an ice jam breaks up or after a dam breaks. Due to its nature it is difficult to forecast.

Flood forecasting – procedure for estimation of stage, its discharge value, time of occurrence, and duration of a flood, especially of its peak discharge.

Flood alarm level – water level that is considered to be dangerous and at which warnings should be commenced.

Flood – a significant rise of water level in a stream, lake, reservoir or a coastal region.

Flood control – the management of water resources through construction of dams, reservoirs, embankments, etc. to avoid floods.

Flood plains – low lands along riverbanks, lakes, and coastal lines subjected to periodic inundation by the repeated overflow of the natural channel bed.

Flood plain zoning – a plan that defines the main zones of a potential flood area, usually accompanied by housing restrictions or other recommendations to prevent flood damages.

Flood proofing – techniques for preventing flood damage to the structure and contents of buildings in a flood-hazard area.

Forecast – statement or statistical estimate of the occurrence of a future event. This term is used in different meanings in different disciplines, as well as "prediction".

Ground water level – the level at which soil and porous rock begins to be saturated with water.

Ham radio – the international amateur radio network, frequently a valuable contribution by the community to disaster response.

Hazard – a rare or extreme natural or human made event that threatens to adversely affect human life, property or activity to the extent of causing disaster.

Hazard Assessment – the process of estimating for defined areas, the probabilities of the occurrence of potentially-damaging phenomenon of given of given magnitudes within a specified period of time.

Hazard Mapping – the process of establishing geographically where and to what extent particular phenomenon are likely to pose a threat to people, property, infrastructure, and economic activities.

Human-made Disaster – disaster or emergency situation of which the principal, direct causes are identifiable human actions, deliberate or otherwise.

Mitigation – repairing or rehabilitating a damaged ecosystem or corresponding for damage by providing a substitute or replacement area.

Maximum probable flood – the greatest flood that may be expected, taking into account all pertinent factors of location, meteorology, hydrology and terrain.

Natural hazard – the probability of occurrence within a specific period of time in a given area of a potentially damaging natural phenomenon.

Non-Governmental Organisation (NGO) – the non-profit making organization operating at the local, national, or international levels and distinct from

a governmental organization, having no statutory ties with a national government.

Non-structural flood mitigation – the system for reduction of the effects of floods using non-structural measures, e.g. Land-use planning (flood plain zoning), advance warning systems, flood insurance.

Populations at risk – a well-defined population whose lives, property, and livelihoods are threatened by given hazards. Used as a denominator.

Post Disaster Assessment – also called **damage and needs assessment,** it is the process of determining the impact of a disaster or events on a society, the needs for immediate, emergency measures to save and sustain the lives of survivors, and the possibilities for expediting recovery and development.

Precipitation intensity (rainfall intensity) – amount of precipitation collected in unit time interval.

Precipitation gauge; precipitation gage – general term for any device that measures the amount of precipitation; principally a rain gauge or snow gauge.

Preparedness – activities designed to minimize loss of life and damage to organize the temporary removal of people and property from a threatened location and facilitate timely and effective rescue, relief and rehabilitation.

Prevention – encompasses activities designed to provide permanent protection from disasters. It includes engineering and other physical protective measures, and also legislative measures controlling land use and urban planning.

Probable Maximum Precipitation (PMP) syn. extreme rainfall – an amount of precipitation that is the upper limit for a given duration over a particular basin.

Public awareness – the process of informing the community as to the nature of the hazard and actions needed to save lives and property prior to and in the event of disaster.

Reconstruction – actions taken to reestablish a community after a period for rehabilitation subsequent to a disaster. Actions would include construction of permanent housing, full restoration of all services, and complete resumption of the pre-disaster state.

Rehabilitation – the operations and decisions taken after a disaster with a

view to restoring a stricken community to its former living conditions, whilst encouraging and facilitating the necessary adjustments to the changes caused by the disaster.

Relief – assistance during or after disaster to meeting the life preservation and basic subsistence needs. It can be of emergency or protracted duration.

Remote sensing – the study of an area, object or phenomenon from an aerial desistance, frequently using data collected by satellite.

Resettlement – actions necessary for the permanent settlement of persons dislocated or otherwise affected by a disaster to an area different from their last place of habitation.

Risk – the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk.

Risk Assessment – also called as **Risk Analysis or Evaluation**, it is a process of determining the nature and scale of losses and damage due to disaster, which can be anticipated in particular areas during a specified period of time.

Risk Mapping – the presentation of the results of risk assessment on a map, showing the levels of expected losses, which can be anticipated in specific areas, during a particular time period, as a result of particular disaster hazards and vulnerabilities.

Satellite applications – the use of satellite technology for the purpose of communications or data transmission for monitoring, warning and dissemination of information pertinent to emergency response and/ or disaster management.

Search and rescue – the process of locating and recovering disaster victims and the application of first aid and basic medical assistance as may be required.

Shelter (temporary housing) – physical protection requirements of disaster victims who no longer have access to normal habitation facilities. Immediate post-disaster needs are met by the use of tents. Alternatives may include polypropylene houses, plastic sheeting, geodesic domes, and other similar types of temporary housing.

Slow-onset Disasters – also called **Creeping Disasters or Slow-onset Emergencies,** these are situations in which the ability of people to sustain their livelihood slowly declined to a point where survival is ultimately jeopardized.

Structural flood mitigation – structural system for reduction of the effects of floods using physical solutions, including reservoirs, levees, dredging, diversions, and flood proofing (raising villages).

Subsidence – collapse of a considerable area of land surface, due to the removal of liquid or solid underlying or removal of soluble material by means of water.

Sudden-onset Disasters – sudden calamities caused by natural phenomena such as earthquakes, floods, cyclones and volcanic eruptions.

Trauma – injury of any nature.

Vulnerability – the degree of loss to a given element at risk or set of such elements resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale 0 (no damage) to 1 (total loss).

Warning – dissemination of message signaling imminent hazard, which may include advise on protective measures.

Water logging – water saturation of soil that fills all air spaces and causes plant roots to die from lack of oxygen; a result of over irrigation.

Zonation – the division of an area, country, or region into zones according to its disaster incidence rate or intensity.

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The three States of **Bihar**, Assam and Uttar Pradesh are worst **...** 1 min 12 sec www.metacafe.com/watch/753122/india_monsoon_**flooding**/ *South Asia **flood** death toll rising - CNN.com*

The **flood** water was receding in eastern **Bihar** state where nearly 10 million people have been effected in 19 of the state's 36 districts, **...** edition.cnn.com/**2007**/WORLD/asiapcf/08/04/asia.**floods**.ap/index.html - 59k -

SELECT WEBLINKS ON FLOOD

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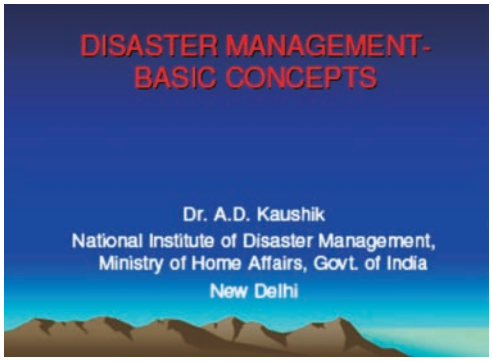
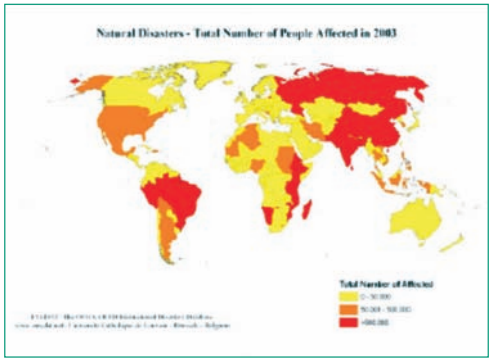
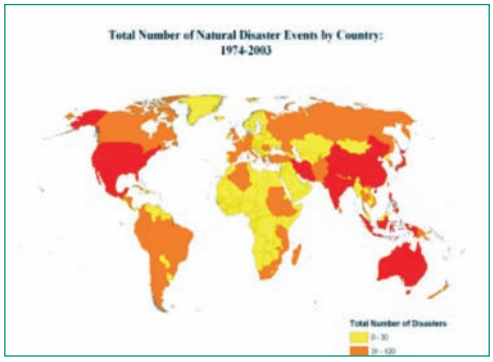
ANNEXURE

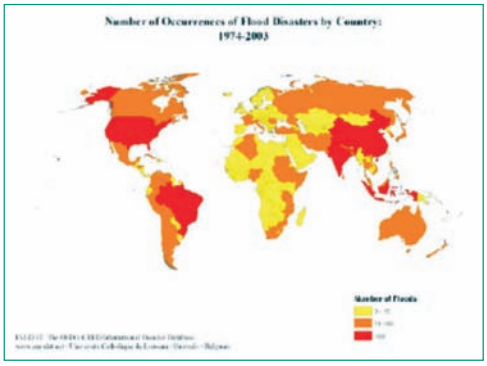
Annexure:

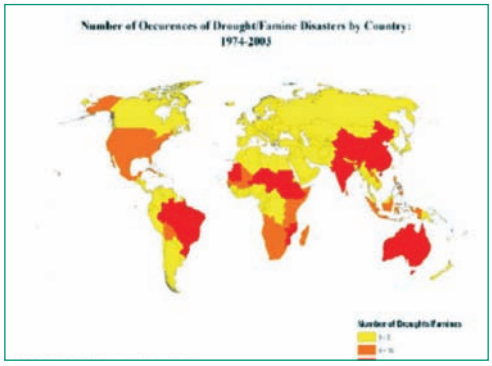
Handout 1.1.2.1

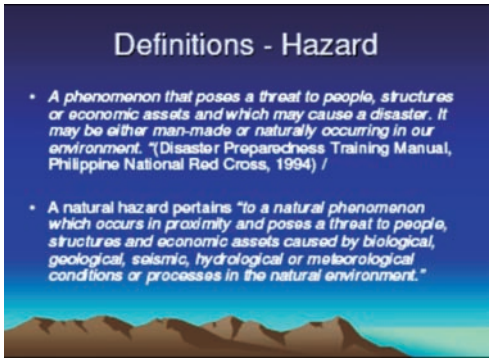


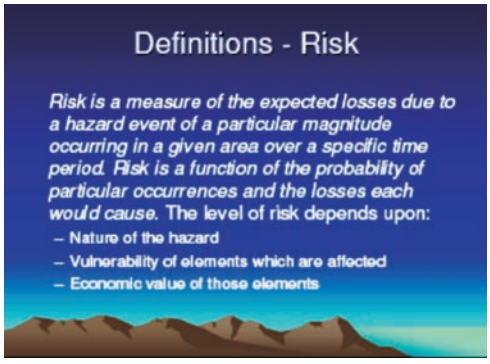












Handout 1.1.2.1

Definitions - Vulnerability

A system, or part of system, may react adversely to the occurrence of a hazardous event or an understanding of the level of exposure of persons and property to the various hazards identified. (Timmenmen, 1981).

- ***Physical Vulnerability***
- ***Socio- economic Vulnerability***

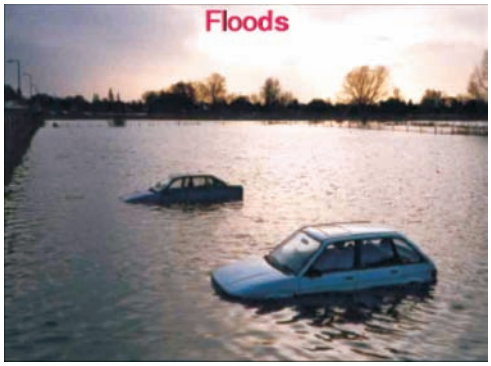
Definitions - Disaster

Disaster is an event or a series of events which gives rise to causalities and/or damage or loss of property, infrastructure, essential services or means of livelihood on a scale that is beyond the normal capacity of the affected communities to cope with unaided.

Natural Disasters in India

- Floods
- Droughts
- Earthquake
- Landslides
- Cyclone
- Forest Fire

Floods



Droughts

Historical Background

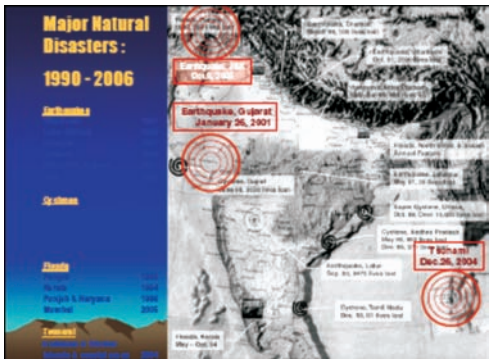
- Famine Code (1900)
- Yokohama World Conference 1994
- National Centre for Disaster Management 1995
- World Conference on Disaster Reduction 2005
- Disaster Management Act-2005
- National Institute of Disaster Management
- National Disaster Management Authority
- ???

Understanding HAZARDS and DISASTERS

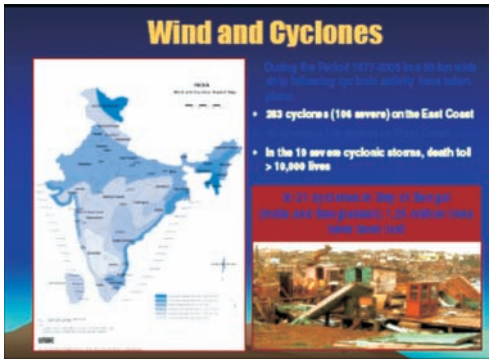
A RARE OR EXTREME NATURAL OR HUMAN-MADE EVENT THAT THREATENS TO ADVERSELY AFFECT HUMAN LIFE, PROPERTY OR ACTIVITY TO THE EXTENT OF CAUSING A DISASTER

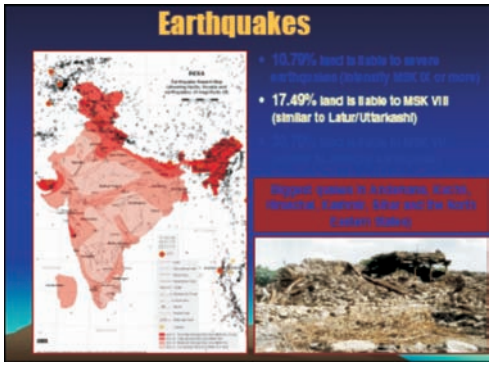
WHAT IS DISASTER

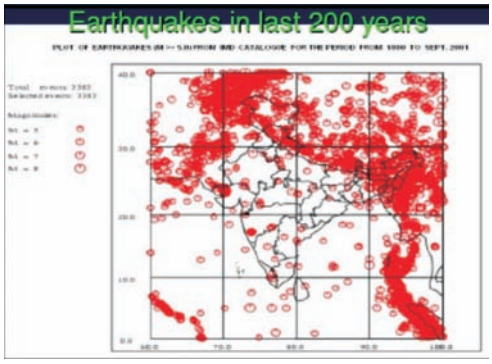
A SERIOUS DISRUPTION OF THE FUNCTIONING OF A SOCIETY, CAUSING WIDESPREAD HUMAN, MATERIAL, OR ENVIRONMENTAL LOSSES WHICH EXCEED THE ABILITY OF THE AFFECTED SOCIETY TO COPE USING ONLY ITS OWN RESOURCES

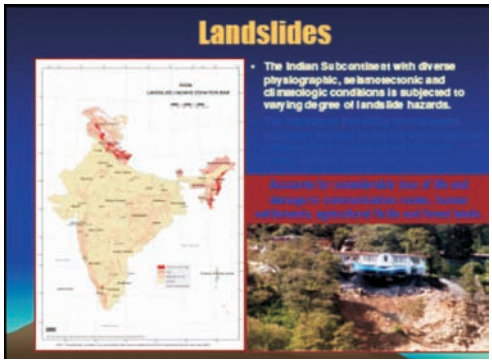

Major Natural Disasters :
1990 - 2006
Earthquake, Gujarat January 26, 2001
Tsunami Dec.26, 2004

Floods
• Floods in the Indo-Gangetic-Brahmaputra plains are an annu feature
• Millions are rendered homeless

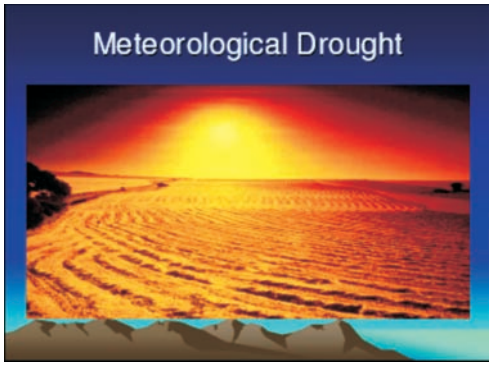

Wind and Cyclones
• 283 cyclones (104 severe) on the East Coast
• In the 19 severe cyclonic storms, death toll > 10,000 lives


Earthquakes
• 17.49% land is liable to MSK VIII (similar to Latur/Uttarkashi)

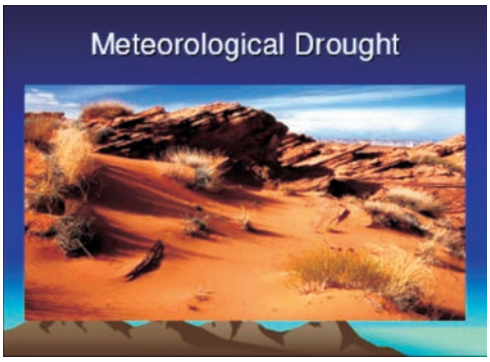

Earthquakes in last 200 years

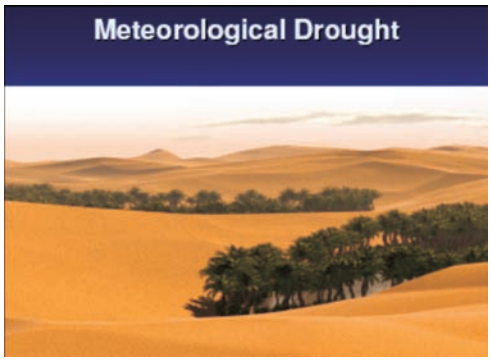

Landslides
• The Indian Subcontinent with diverse physiographic, seismosecionic and climatologic conditions is subjected to varying degree of landslide hazards.

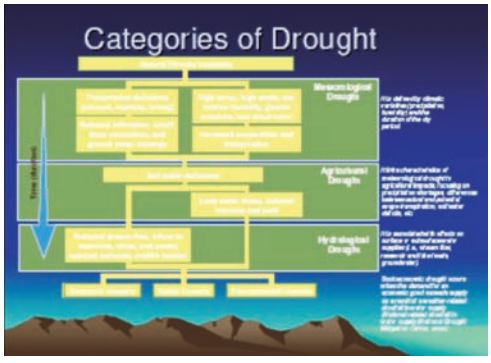
Droughts
CDMH

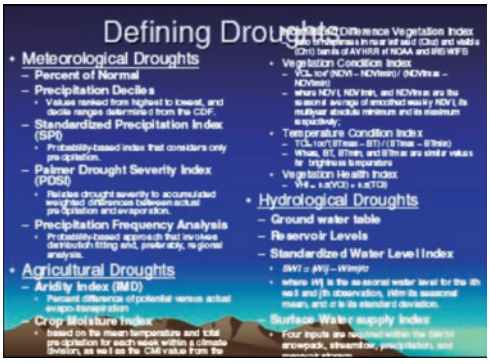

Meteorological Drought

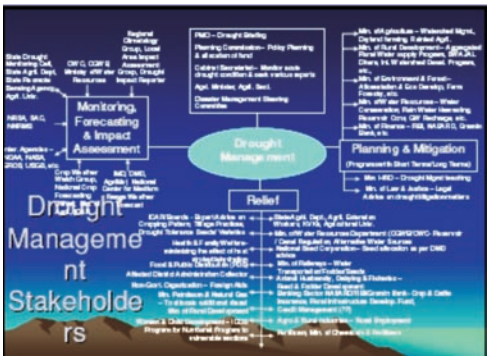
Handout 1.1.2.1

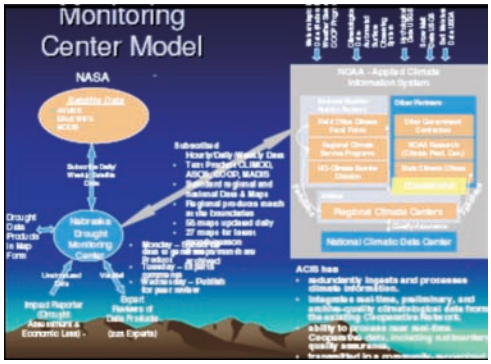


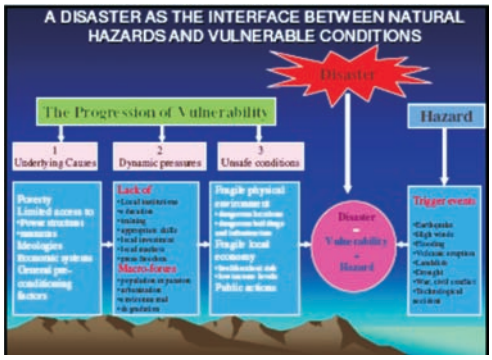


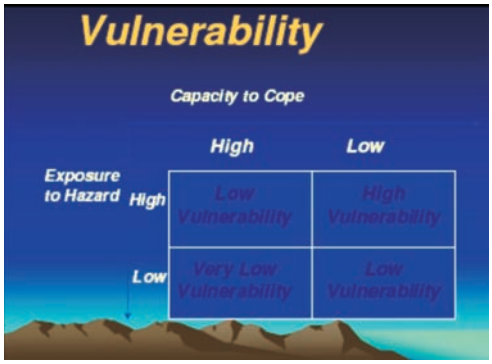


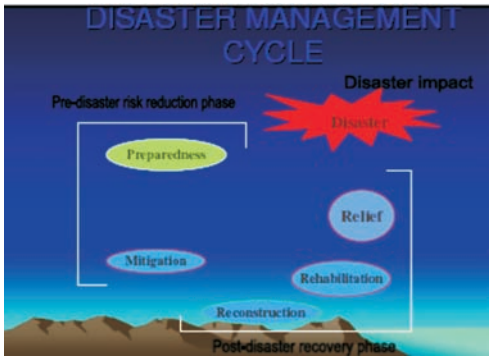


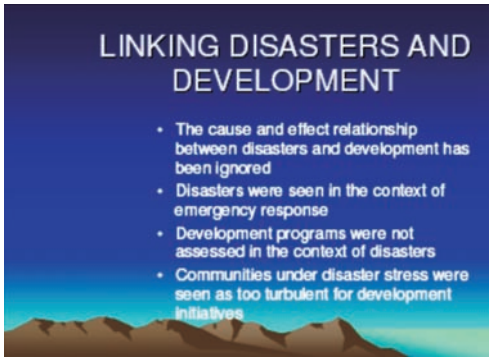




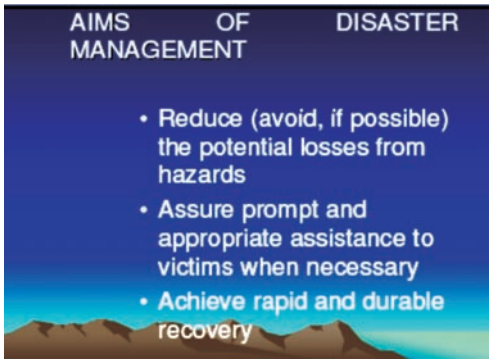

A DISASTER AS THE INTERFACE BETWEEN NATURAL HAZARDS AND VULNERABLE CONDITIONS
Disaster
The Progression of Vulnerability
Hazard
1 Underlying Causes
2 Dynamic pressures
3 Unsafe conditions
Poverty
Lack of
Macro-forces
Fragile physical environment
Fragile local economy
Public actions
Disaster = Vulnerability + Hazard
Trigger events


Vulnerability
Capacity to Cope
High
Low
Exposure to Hazard
High
Low
Low Vulnerability
High Vulnerability
Very Low Vulnerability
Low Vulnerability

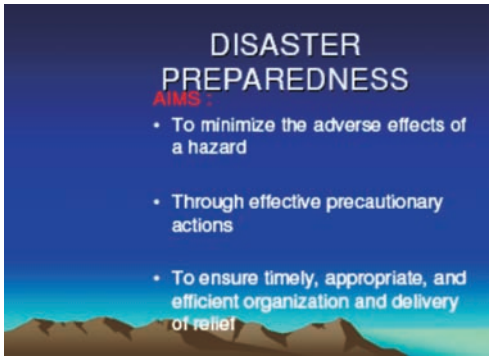

DISASTER MANAGEMENT CYCLE
Disaster impact
Pre-disaster risk reduction phase
Disaster
Preparedness
Relief
Mitigation
Rehabilitation
Reconstruction
Post-disaster recovery phase


LINKING DISASTERS AND DEVELOPMENT
• The cause and effect relationship between disasters and development has been ignored
• Disasters were seen in the context of emergency response
• Development programs were not assessed in the context of disasters
• Communities under disaster stress were seen as too turbulent for development initiatives

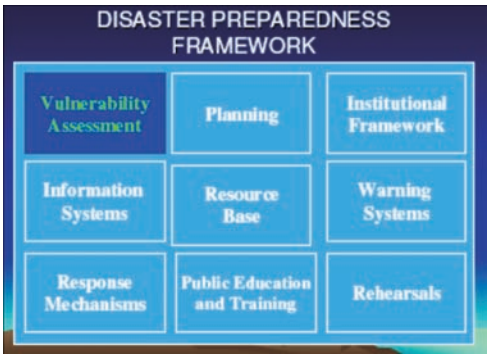
The Relationship Between Disasters and Development
DEVELOPMENT REALM
NEGATIVE REALM
POSITIVE REALM
Development can reduce vulnerability
Disaster can set back development
Disaster can provide development opportunities
DISASTER REALM

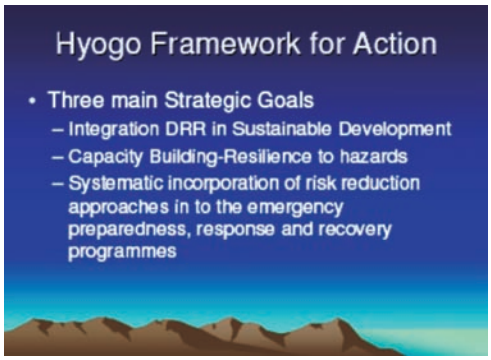

AIMS OF DISASTER MANAGEMENT
• Reduce (avoid, if possible) the potential losses from hazards
• Assure prompt and appropriate assistance to victims when necessary
• Achieve rapid and durable recovery

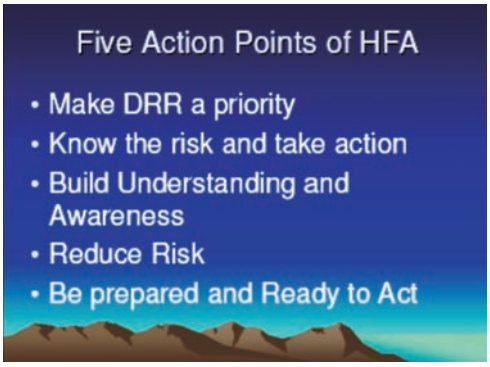
ELEMENTS OF DISASTR MANAGEMENT
• Disaster preparedness planning
- Vulnerability and risk assessment
• Disaster response
- Disaster assessment
• Rehabilitation & reconstruction
• Disaster mitigation


DISASTER PREPAREDNESS
AIMS :
• To minimize the adverse effects of a hazard
• Through effective precautionary actions
• To ensure timely, appropriate, and efficient organization and delivery of relief

Handout 1.1.2.1





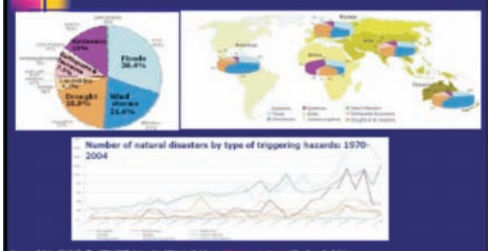


Flood Scenario in India and Risk Management Issues

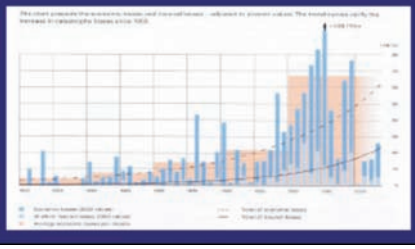
Dr. Anil K Gupta
Associate Professor (Policy & Planning)
National Institute of Disaster Management, New Delhi

Global Scenario

Regional distribution of disasters: by triggering hazards1995 - 2004



Flood risks and consequently flood disasters are on the rise



India and Natural Disasters

India is one of the most disaster prone countries in the world

- Over 65% land area vulnerable to earthquake;
- 68% of land under cultivation prone to drought;
- 12% of land (40 million hectares) to floods;
- 8% of land (8,000 km coastline) to cyclones.
- A Major Disaster occurs every 2-3 years;
- 50 million people affected annually
- During 1985-2003, the annual average damage due to natural disasters has been estimated at 70 million USD

What Is Flood?

- Flood is an overflow of water, an expanse of water submerging land (Wikipedia)
- "An overflowing of water onto land that is normally dry" (Oxford Dictionary)
- "A general and temporary condition of partial or complete inundation of two or more acre of normally dry land area" (National flood insurance agency, USA)
- "A relatively high flow of water that overtops the natural or artificial banks and comes in conflict with man" (Jha, R. 1993)
- Human conflicts with water courses??

Types of flood

- Flash floods – sharp rise and drop in water levels causing high velocity of flow damaging crops and property.
- Rain floods – high density rainfall over lowland areas.
- Monsoon floods – over spilling of major rivers usually rise slowly but causes extensive damages
- Storm surge floods – arising from cyclone/ tsunami induced storm surges in the coastal area.

Floods...

- Riverine floods
- Coastal floods
- Urban floods
- Dam breach floods
- Mine flooding

Causes of Floods

- Widespread heavy rainfall
- Inadequate river channel capacity
- Synchronization of floods in main river and tributaries
- Excessive silt deposition
- Drainage congestion
- Landslides
- Failure of dams, embankments
- Storm surges

Handout 1.1.3.1

Causes

- Environmental
  - Topography, soil characteristics, vegetation cover, impervious covered area
  - Inadequate drainage system and lack of their maintenance
  - Flat river gradients
- Meteorological
  - Cloud bursts
  - Short duration intense rainfall
  - Cyclonic storms- heavy downpour with very high wind velocities
- Climate change
  - Increase in extreme rainfall events
  - High snow and glacier melt
- Breach of the embankments, dams etc.

Floods- Secondary Causes

- High tides
- Siltation in river channels
- Increased urbanisation due to migration of people to urban areas
- Encroachment of flood plains
- Haphazard and unplanned growth of urban areas

Recent Increase in Floods

- Apparent increased turbulence in the climate (Climate Variability) owing to global warming
- Land degradation in upstreams catchments
  - Deforestation leading to loss of natural storage in vegetation and soil
- Land use changes down streams
  - Increased pressure on natural floodplain from rapidly expanding urban and industrial areas

Disasters in India - Vulnerability

FLOODS IN INDIA

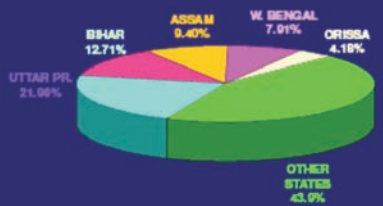
AVERAGE ANNUAL FLOOD DAMAGE (1953-2000)

TOTAL DAMAGE	: Rs.13,500 million
AREA AFFECTED	: 7.57 million hectare
CROP AREA AFFECTED	: 3.55 million hectare
HUMAN LIVES LOST	: 1595 Nos.
CATTLE LOST	: 94,700 Nos.

Indian Flood Scenario

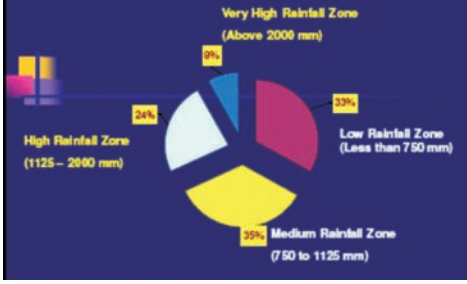
- India is the worst flood-affected country in the world after Bangladesh
- Flood-prone Area - 40 Mha
- Annual averages
  - Flood-affected area - 7.57 Mha
  - Affected crop area - 3.5 Mha
  - Property loss – Rs 13,000 M.
  - Human loss - 1595
- Chronic Flood Prone Rivers
  - Ganga, Brahmaputra
  - Mahanadi, Godavari

Flood prone states of India

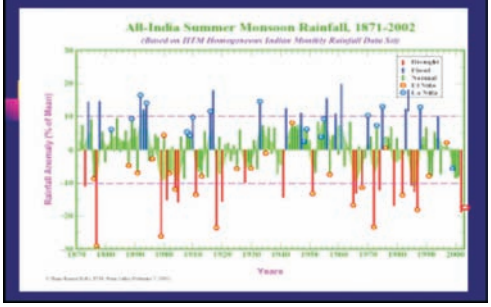


Source: Central water commission

Spatial Distribution of Rainfall

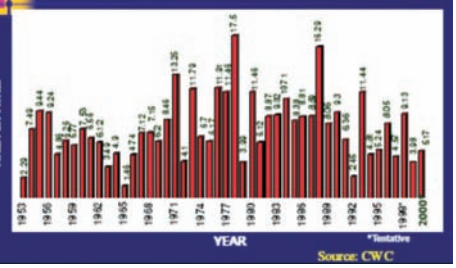


Monsoon - Inter-seasonal Variability

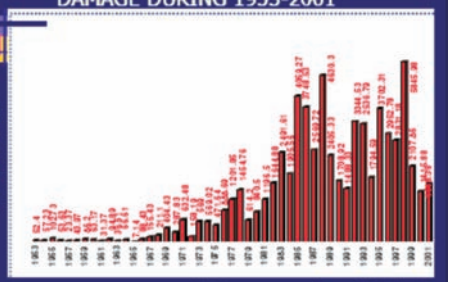


FLOODS IN INDIA

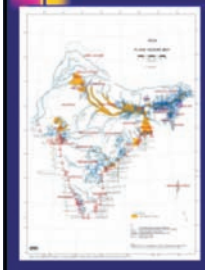
AREA AFFECTED BY FLOODS (1953-2000)



FLOOD IN INDIA
DAMAGE DURING 1953-2001

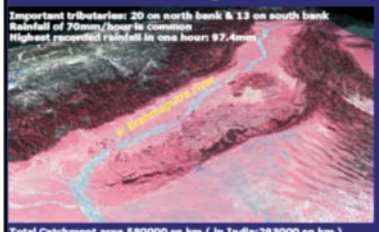


VULNERABILITY ATLAS- FLOOD



- 40 million hectres are prone to flood
- 8 million hectres affected by flood every year
- Brahmaputra and Gangetic Basin are most flood prone areas
- North-west region of west flowing rivers – Krishna, Cavery and Mahanadi – are other flood prone areas

Brahmaputra river basin



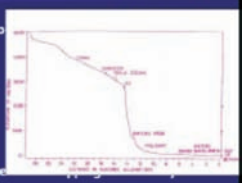
Total Catchment area 580000 sq km (in India:293000 sq km)
Length of the river in India: 918 km
Maximum Discharge: 72794 cumecs
Mean annual flood discharge: 51156 Cumecs
Average annual suspended load during floods: 4X10⁸ Metric tons
Daily mean sediment load during floods: 2.12 million metric tons
Mean basin rainfall (excluding Bhutan & Tibet) 230cm

BRAHMAPUTRA RIVER BASIN

- flows through Arunachal, Assam, Nagaland, Meghalaya, Sikkim, WB
- acutely flood-prone region
- awesome hazards of flood and erosion during monsoon
- major floods in 1954, 1962, 1966, 1972, 1974, 1978, 1983, 1986, 1988, 1996, 1998, 2000 and 2003
- Total length: 2880 km, drainage area of 580,000 sq. km (China:50.5%, India:33.6%, B'Desh:8.1%, Bhutan:7.8%)
- In India represents 30% total water resources and 40% of the total hydropower potential of the country.
- Brahmaputra valley is 32 lakh hectares which account for 9.6 percent of the country's total (40% is flood prone)
- 59% of basin area under forest in India
- average annual flood discharge has a magnitude of 48,160 m3s-1
- 75 percent of the total flood loss is to agricultural sector

BRAHMAPUTRA RIVER BASIN (ASSAM)

- CAUSES OF FLOOD
  - the extremely dynamic monsoo
  - unique physiographic setting
    - eastern Himalayas
    - limited width of the valley
    - abruptly flattened gradient
  - massive deforestation
  - intense landuse pressure
  - high population
- FACETS OF FLOOD
  - inundation of riverine areas due
    river and tributaries
  - drainage congestion especially near the outfalls of the tributaries during high flood stages
  - bank erosion and channel instability
  - High seismicity leading to landslides in hills changing river regime



ASSAM FLOODS OF 1998

- most severe one since 1950
- river remained above the danger level for 42 to 99 days at 6 major gauge sites
- floods came in four major waves from June to September
- fourth one occurring in September being the most severe
- 21 of 24 districts were flooded affecting a population of 47 lakhs in 5300 villages and damaging 9.7 lakh hectares of cropland
- 30900 houses damaged
- 156 human life and 7814 cattlehead lost
- 139 breaches of embankment – a major cause of flood intensification
- Kaziranga National Park submerged for almost a month with 1-3 m
- Lost 652 wild animals including 39 rhinos, 7 elephants and 23 wild buffalos

Handout 1.1.3.1

GANGA RIVER BASIN

- The Ganges basin with total area of 95,111,154 ha
- The Ganges river basin is one of the most fertile and has population density of about 530 persons/km²
- The river flows through 29 cities with population over 100,000 ; 23 cities with population between 50,000 to 1,00,000 and about 48 towns

GANGA BASIN

GANGA RIVER BASIN

- largest river basin of India
- Support 40% of country's population
- Facing severe pollution problem (GAP)
- UP, MP, Bihar, Rajasthan, West Bengal, Haryana, HP & Delhi
- Major Projects: Upper Ganaga Canal, Eastern & Western Yamuna Canal, Gandhi Sager Dam, Rana Partap Sagar Dam, Narora Barrage, Rajghat Dam, Rihand Dam, Gandak Barrage etc.
- Flood prone states: UP, Bihar, & West Bengal
- flood problem is mostly confined to the areas on northern bank
- flood problems are caused by northern tributaries such as Kosi and Mahananda (spill over & changing course)

GANGA RIVER BASIN

Causes of Floods

- intensity and duration of rain fall
- sedimentation in riverbed
- natural and man-made obstructions

- Eastern Uttar Pradesh : spilling of Rapti, Sharada, the Ghaghra and Gandak
- Western Uttar Pradesh: drainage congestion in Agra, Mathura and Meerut districts
- North Bihar : spilling of Kosi, Gandak and Mahananda
- South & Central West Bengal : spilling of Mahananda, Bhagirathi, Ajay & Damodar due to inadequate capacity of rivers and tidal effects.
- Haryana : marginal area in south & south west due to poor drainage

MAHARASHTRA RIVER BASINS

- Godavari
  - 312,812 sq km, 9.5% of Geographical area
  - Maharashtra: 152,199 sq km
  - Tributaries: Pravara, Purna, Majra, Wardha, Penganga, Weinganga, Indravati, Kolab
- Krishna
  - 258,948, sq km, 8% of Geographical area
  - Maharashtra: 69,425 sq km
  - Tributaries: Ghataprabha, Malaprabha, Bhima, Musi
- Tapi
  - 65,145 sq km, 2% of Geographical area
  - Maharashtra: 51,504 sq km
  - Tributaries: Purna, Girna, Panjhra, Vaghur, Bori

EXTENT OF DAMAGE DUE TO FLOODS.

	2004	2005	2006
States affected	20	26	17
Districts affected	128	307	--
Population affected	37.7m.	26.07m	42.1m
Human lives lost	1951	2722	2631
Livestock perished	12297	111047	1,15,783
Cropped areas affected	3.1m.ha.	3.57m.ha.	4.78m.ha
Number of houses damaged	1.5m.	2.16m.	3.1m

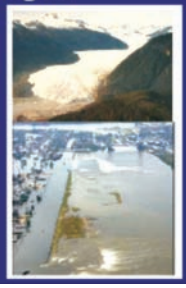
Shortcomings of past FM Practices

- Emphasis has been on 'Control' rather than 'Management'
- FC measures have been Ad-hoc and stand alone
- Reactive rather than proactive
- Emphasis has been largely on structural measures
- Monodisciplinary
- River morphological behaviour is not factored
- Lessons from past failures have rarely been learnt
- Shortcomings of past FM Practices

Flood management policy is a neglected policy issue on the international as well as, in many cases, the national level

New challenges!

- Increasing Flood Risks
- Environmental changes and challenges
  - Climate-change uncertainty
- Absolute safety against floods is a myth
- Increasing Vulnerability



Integrated Flood Management

Flood Management in the context of Integrated Water Resources Management, aiming at:

- Sustainable development: balancing development needs and flood risks
- Maximising net benefits from floodplains: ensure livelihood security and poverty alleviation thereby reducing vulnerability
- Minimising loss of life: in particular through end-to-end FF&W Systems and preparedness planning for extreme events
- Environmental preservation: ecosystem health & services

IFM: Principles

Risk Management

- Mitigation and Preparedness
- Response
- Recovery and rehabilitation
- Residual risks

IFM: Principles

- Risk Management
- **Water Cycle as a whole**
  - Flood and drought management
  - Effective use of flood waters
  - Ground water and surface water interaction in flood plains

IFM: Principles

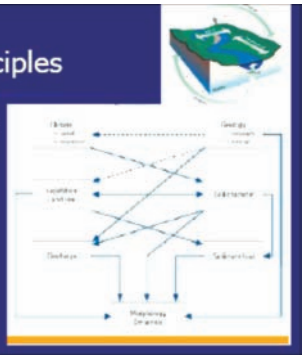
- Risk Management
- Water Cycle as a whole
- **Multi-hazard approach**
  - Particularly within a basin where there is interaction between various hazard development mechanisms
  - Cross-sectoral integration of disaster
  - management strategies
  - Disaster risk assessment
  - Early warning and forecasts

IFM: PRINCIPLES

- Risk Management
- Water Cycle as a whole
- Multi-hazard approach
- **River basin as a planning unit**

IFM: Principles

- Risk Management
- Water Cycle as a whole
- Multi-hazard approach
- River basin as a planning unit
- **Inter-disciplinary**

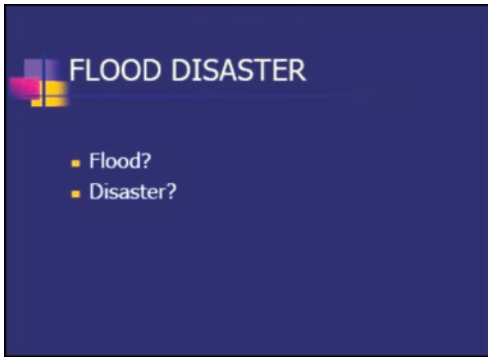


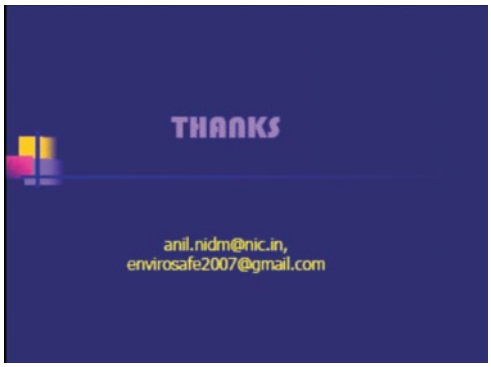
IFM: Towards a sustainable development

- Integrates and mixes strategies
  - Structural, Non-structural and Living with Floods
  - Short-term and Long-term
  - Local and basin level measures
- Balances development needs and environmental concerns
- Addresses all aspects of Flood Management
  - Engineering & Construction
  - Social Aspects
  - Environmental Aspects
  - Economic Aspects
  - Legal and Institutional Aspects
- Adaptive Management

Overview of functions in IFM

Handout 1.1.3.1





Annexure: Handout 1.2.1.1

Flood Mitigation Measures- Structural and Non-Structural

A Presentation by
C. LAL
Director(FMP), CWC

Floods in India

- Most frequent and devastating natural disaster
- Frequent with varying magnitude
- Hydro-meteorological conditions: Monsoon during four months
- Flood risk to **unprotected** as well as **protected** areas
- Total Geograhical Area (India): 329 mha
- Flood Prone Area : 40 mha (RBA)
  : 45.64mha (WGs)
- Area reasonably protected : 18.22 Mha (upto X Plan)

River Systems of India

- Brahmaputra River Region
- Ganga River Region
- North West River Region
- Central India and Deccan Region

AREA LIABLE TO FLOODS

Major Flood Prone States In India

- States affected by floods almost every year
  - Assam
  - Bihar
  - West Bengal
  - Uttar Pradesh
  - Orissa
- Other states are also affected occasionally. Coastal states also affected by floods & water logging caused by cyclones & intense local rainfall

Flood Damage (India)
1953 -2009

Item	Average	Maximum(Year)
Area Affected (Million Hectare)	6.951	17.59(1976)
Crop Area Affected (Million Hectare)	3.302	10.15(1988)
Population Affected (crore)	3.014	7.04(1976)
Human Lives Lost (Nos.)	1464	11,316(1977)
Cattle Lost (Nos.)	86298	6,18,24(1979)
Houses Damaged (Nos.)	1133604	35,07,542(1976)
Value of damage to crops (crore)	545.67	4246.62(2000)
Value of damage to house (crore)	246.55	1307.89(1995)
Value of damage to public utilities (crore)	749.96	5604.46(2001)
Value of damage to crops, houses & public utilities (crore)	1549.77	8864.54(2000)

Flood Management- Basic Facts

- Absolute flood control and protection to all flood prone areas for all magnitudes of floods is not possible
- Flood management, to give a reasonable degree of protection from floods at economic costs is necessary
- Flood Management with a combination of structural and non-structural measures is the most feasible solution

Flood Management Measures

- **Engineering/Structural Measures**
  - aim to modify flood magnitude
- **Administrative/Non-structural Measures**
  - aim to reduce & mitigate flood losses

Handout 1.2.1.1

Structural Measures

- **Long Term**
  - Dams and Reservoirs
  - Natural Detention Basins
- **Short Term**
  - Embankments, Flood Walls
  - Channel Improvement works
  - Drainage Improvement works
  - Diversion of Flood Water
  - River Training Works

Structural Measures

- Engg. Measures for flood control which bring relief by reducing flood flows
  - Dams and Reservoirs
  - Natural Detention Basins
  - Diversion of Flood Water to another river or basin
  - Construction of bypass channel
- Engg. Measures to prevent spilling
  - Embankments, Flood Walls
  - Channel Improvement works
  - Drainage Improvement works
- Anti-erosion measures
- River Training Works

Administrative Measures

- **The administrative Measures endeavors to mitigate flood damages by**
  - Facilitating timely evacuation of people by giving advance warning i.e. Flood Forecasting
  - Discouraging settlement of people /creation of valuable assets in areas subjected to frequent floods i.e. Flood Plain Zoning

Structural Measures

Reservoir

- Moderates the intensity and timing of the incoming floods. Stores water during high discharge and releases afterwords.
- Other benefits as irrigation, hydropower, water supply etc. also achieved.
- More effective for flood Management if specific flood space is earmarked e.g. reservoirs of Damodar valley.
- Needs to be operated with a carefully planed regulation schedule taking into account safety of dam and related structures and safe carrying capacity of lower reaches of the river.

Structural Measures

- **Natural Detention Basins**
  They are formed by utilising natural depressions e.g. Ghaggar detention basin in Rajasthan, and MokamaTal in Bihar
- **Diversions of Flood Waters**
  Intercepting flood flows in a river upstream of a damage prone area and route them through an artificial channel to point downstream of the same river or to a river or lake in nearby basin.

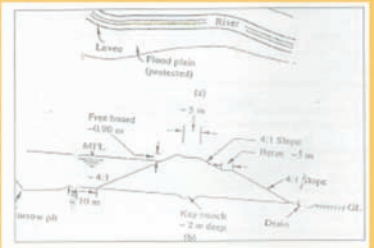
Structural Measures

FLOOD EMBANKMENTS

Embankments (including ring bunds and town protection works) confine flood waters to the Stream and Prevent Spilling and thereby reducing the damage.

- Cheap, Quick and Effective Method of Controlling Floods.
- Serves to prevents inundation when stream spills over its natural section and safeguards land villages and property against damage.

Typical Section of Leevee/Embankment



Structural Measures

- **Channel improvement**
  - Reduces flooding by increasing flood carrying capacity of stream channel by desilting, dredging, deepening/widening of channel etc.
- **Drainage improvement**
  - Construction of new drainage channels and improvement in discharge capacity of the existing drainage system.

RIVER TRAINING WORKS

– Adopted to train the river to follow a specified path so that tendency for eroding nearby areas along the course of river is brought under control.

– Specifically required for alluvial rivers as river banks are subjected to erosion due to high velocity during floods.

– Various river training works attempts to chanalise the flow that the current does not attack the banks but are deflected away from banks.

Types of River Training Works

– Groynes or Spurs

– Guide bank system

– Marginal embankments

– Bank pitching and launching aprons

– Deflectors

– Bed bars

– Cut-offs

Groynes or Spurs

Groynes are structures constructed transverse to the river flow and extends from bank into the river

❑Aligned either normal to dominent flow or at an angle pointing upstrem or down stream.

– Trains the river along the desired course,

– protects banks by keeping flow away from it

– Creates a slack flow by silting up

Groynes or Spurs

Classification of Groynes

– Method and Material of Construction - Permeable, Impermeable and Slotted

– Action – Deflecting, Attracting & Repeling

– Special Shapes – T-head, hockey type

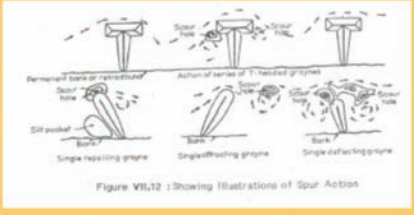
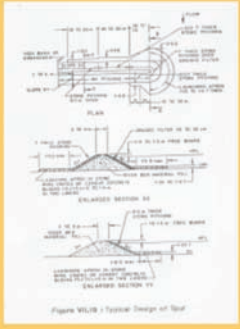


Figure VII.12 : Showing Illustrations of Spur Action



One of the spurs constructed at Hasanpur (Dist : Vaishali, Bihar) executed under central assistance

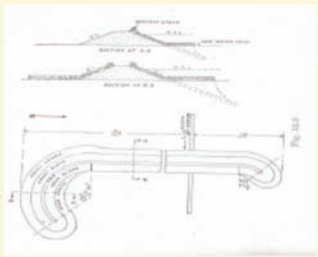
Guide Banks

– Confine flood water of alluvial rivers within a reasonable waterway and provide straight non-torturous approach towards Engg. Structure

– Engg. Structure as barrage, or a bridge is extended in small portion of river and river water is trained to flow almost axially with help of Guide banks.

Handout 1.2.1.1

Typical Section of Guide Bank



Bank Pitching & Launching Aprons

- Protects a given stretch of bank from erosion. The river banks ate made stable by giving stable slope varying from 1:1 to 2:1 and then pitched so as to make them strong to resist erosion.
- Launching apron is projected from the toe of bank into river so as to prevent scour at the toe and consequently fall of stone pitching.

Boulder Apron and Earth cutting in slope and berm

Boulder apron and 1st slope & Berm boulder pitching

Achievements on Structural Measures (Till March 2006)

- **Short Term Measures**
  - Embankments — 34399 km
  - Drainage Channels — 51318 km
  - Town Protection Works — 2432 Nos
  - Villages Raised — 4984 Nos
  - Flood Diversion — Flood spill channel of Jhelum outside the Srinagar city
- **Long Term Measures**
  - Dams & Reservoirs-live storage — 381.47 BCM
    - Completed Projects — 173.73 BCM
    - Under Construction — 76.42 BCM
    - Under consideration — 132.32 BCM
  - Few dams/reservoirs like DVC reservoirs, Ukai, Rengali, Kangsabati, Subernarekha have specific flood cushion. Other dams/reservoirs such as Hirakud, Bhakra etc. do not have specific flood storage but they provide substantial flood moderation

FLOOD PROOFING

- Raising of villages above flood level
- Previously adopted in Uttar Pradesh, West Bengal and Assam
- Currently in North Bihar under Central Sector
- Proposed to be extended to U.P., Orissa, Andhra Pradesh, West Bengal and Assam in 10th Plan

Non-Structural measures

- Flood Forecasting and Warning
- Flood Plain Zoning
- Flood Proofing
- Disaster Preparedness and Response Planning
- Disaster Relief

Flood Forecasting

- It is the process of estimating future stages / flows and its time sequence at selected points along the river during floods
- **Flood forecasts are prediction of :**
  - **Crest (peak) and its time of occurrence.**
  - **Stages expected at various points of time during the period of rising and falling stages of the river above or the specified water level called the warning level.**

Flood Forecasting Network of CWC

Basin-wise FF Stations

SN	River-system	Level	Inflow	Total
1	Ganga & Tributaries	77	10	87
2	Brhamaputra & Tributaries	27	-	27
3	Barak-System	5	-	5
4	Eastern-Rivers	8	1	9
5	Mahanadi	3	1	4
6	Godavari	14	4	18
7	Krishna	3	6	9
8	West flowing Rivers	9	6	15
9	Pennar	1	-	1
	Total	147	28	175

Development of Flood Forecasting Network of CWC

Year	No. of Forecasting Stations
1958	1
1965	2
1970	43
1975	79
1980	84
1985	145
1990	157
2001	159
2004	172
2005	173
2006	175

Flood Forecasting
Processes involved

- Data Collection
  - Hydrological data collection at 878 stations
  - Hydro-meteorological data collection at more than 400 raingauge stations
- Data Transmission
  - through wireless, telephone, FAX in conventional system
  - Through satellite based system in modernised network
- Data Analysis and Flood Forecast Formulation
  - With appropriate catchment models
  - MIKE-11 in modernised network
- Dissemination of Flood Forecasts
  - Manually, wireless, telephone, FAX, E-mail , VSAT system.

Methodology of Forecasting

- Conventional Methods
  - Statistical approach
  - Simple correlation
  - Mathematical Equations
  - Multivariate correlation
  - Rainfall Stage approach – not in use
  - Unit hydrograph
  - Flood Routing-Muskingum method
- Catchment Models
  - Physical Model
  - Analogue Model
  - Mathematical Model

Methodology of Forecasting

- Data scrutiny at divisional headquarters
- Data processing for flood forecast formulation
- Various methods in use
- Type of method depends upon
  - ✓ data availability
  - ✓ physiographic characteristics of the watershed
  - ✓ Available warning time
  - ✓ facilities/ infrastructure available
  - ✓ purpose of forecast.

Methodology of Forecasting

- While simple statistical correlations using gauge to gauge, gauge & discharge data are being used for some forecasting sites; multiple coaxial correlations using gauge, rainfall, Antecedent Precipitation Index (API) data are being used for other stations.
- Mathematical models/ rainfall runoff models like MIKE-11 FF are also in use for some of the sites in Damodar Basin, Godavari Basin, Mahanadi Basin & Chambal Basin.

Importance of Level Forecasting

- Flood Forecasting has been recognized as the most important, reliable and cost effective non-structural measures for flood mitigation and reduction of :
  - Damages to roads, railways, communications
  - Loss of movable properties
  - Loss of cattle, other pet animals
  - Loss of human lives
  - Loss of immovable properties like houses, heavy personal effects

Dissemination of Forecast

- Dissemination of forecasts to the users agencies, such as civil/ engineering authorities of concerned States, defence, railways/ highways authorities, industrial and other important establishments located in the flood prone areas through telephone/ fax/ e-mail/ special messenger for taking advance action for flood fighting & evacuating population from the areas likely to be flooded along with movable properties and other actions towards flood damage mitigation.
- Forecasts being given to Radio, Television and News Agencies for the benefit of the likely flood affected population.
- Daily flood bulletins hosted on the website www.india-water.com for quick dissemination.

Handout 1.2.1.1

Importance of Inflow Forecasting

- Inflow Forecasting essential for :
  - Accounting the flow at Reservoir/ Barrage/ station, or reach of river.
  - Estimation of added flows/ extraction between any given reach, during any given duration.
  - Optimum reservoir regulation
  - Flood moderation
  - Evaluation of reservoir regulation methodology.

Evaluation of Flood Forecast Performance

- On an average, 6000 forecasts at various places in the country are issued during the monsoon season every year.
- A level forecast is considered reasonably accurate if the difference between the forecast and the corresponding actual observed river level lies within +/- 15 cm.
- Inflow forecast – variation of inflow volume within +/- 20% is considered acceptable.

Modernisation of FF Network of CWC

- State- of- the-art Technology :
- Data Collection: with Sensor based equipment
- Forecast Formulation: with Automated mathematical models (MIKE-11)
- Data Transmission/ Dissemination: Through Satellite / VSAT System
- FF Network Modernisation :
- IX Plan: 55 Stations (Chambal and Mahanadi Basins)
- X Plan: 168 Stations
- XI Plan (Proposed): 222 Stations

FLOOD PLAIN ZONING

- Flood Plain is also the Domain of the River just as the River Channel is
- Flood Plain Management is essential for reducing Flood Damage

FLOOD PLAIN ZONING REGULATION

PRIORITY – I	PRIORITY – II	PRIORITY – III
Defence installations, Industries, Public Utilities like Hospitals, Power houses, Water supply, Telephone exchange, Aerodromes, Railway stations, etc. Activity limited to water levels corresponding to 100 years flood frequency and drainage congestion for 50 years rainfall.	Public institutions, Government offices, Universities, Public Libraries, Residential areas, etc. Activity limited to levels corresponding to 25 years flood frequency and drainage congestion for 10 years rainfall frequency.	Parks, Play grounds, etc Less economic and community activity in areas vulnerable to frequent floods.

FLOOD PLAIN ZONING CONCEPT

THANK YOU

Rain water Harvesting for Flood Risk Mitigation

Dr. K.J. Anandha kumar
Associate Professor
National Institute of Disaster Management

Exceptionally Heavy rains in Indian Metro

Are we responsible for this situation?

Mumbai: 26 July Delhi: 15 September Visakhapatnam: 16 October

Kolkata: 21 October Bangalore-22 October Chennai: 26 October

Why is it important to study

- Impact can be very serious because the areas affected are densely populated and contain vital infrastructure

How it happens

- Ageing drainage infrastructure
- More buildings
  - New developments cover previously permeable land;
  - amount of run off to drains and sewers increase manifold during rains with reduction in recharge
- Increased paving
  - Pavements for road and parking area is increasing without any application of mind about GW recharge.

How it happens ...Contd

- Combining of storm water drain & sewage water drains - like in Delhi
- Climate change
  - Wetter winters and heavier summer showers are expected
  - Climate models predict winter rainfall increase by 20-30% which may increase risk of flooding by manifold.

What happens

- Flooding
  - Flooding can cause costly drainage distress and sometimes loss of life
- Pollution
  - Drainage overflow can be a major source of pollution
  - It picks up potentially harmful substance from surfaces, including oil, household chemical and faecal material and transfers them to urban water courses.

What happens ...Contd

- When combined sewers overflow at times of heavy rainfall
- Excess foul water is discharged directly into urban water courses.
- Untreated discharges pose risk to human health as they may contain toxins and pathogens such as the virus that causes hepatitis A and E coli.

What is Rain Water Harvesting?

- **Process of capturing and storing rain water for its efficient utilization and conservation.**
- **An effective tool to utilize a large quantity of fresh water which otherwise goes as runoff.**
- **Rainwater harvesting has two components i.e. Collection of Rain Water for Surface Storage and Recharge to Ground Water Aquifers.**

Handout 1.2.3.1

What is Artificial Recharge to Ground Water?

- Process by which the ground water reservoir is augmented at a rate exceeding the rate of natural recharge.
- Any man-made structure that facilitates augmentation of groundwater is an Artificial Recharge system.

Why Rain Water Harvesting and Artificial Recharge?

- To augment the availability of water resources for meeting various demands.
- To arrest the declining trend in water levels of an area.
- To conserve and store excess surface water for future requirements, since these requirements often change with time.
- To reduce runoff, which otherwise chokes the storm water drains in the urban areas
- To prevent/ reduce flooding of roads and parks etc.
- To prevent depletion of ground water reservoir in over exploited areas.
- To arrest/prevent sea water ingress in coastal aquifers.

Advantages:

- Raises ground water levels.
- Improves availability of water in wells/ tubewells during lean period
- Improves quality of existing ground water through dilution.
- Saves energy in lifting of ground water- one meter rise in water level saves about 0.40 KWH of electricity.
- Improves vegetation cover
- Reduces soil erosion due to reduced runoff
- Improves health/living conditions in rural areas.

DESIGN CONSIDERATIONS:

- The important aspects for designing a rainwater harvesting system to augment ground water resources are:-
- Hydrogeology of the area including nature and extent of aquifer, soil cover, topography, depth to water level and chemical quality of ground water.
- Availability of source water, basically assessed in terms of non-committed surplus monsoon runoff.
- Area contributing runoff like area available, land use pattern - industrial, residential, green belt, paved areas, roof top area etc.
- Hydrometeorological characters like rainfall duration, general pattern and intensity of rainfall.

FEASIBLE AREAS:

- Where ground water levels are declining on long term basis.
- Where substantial amount of aquifer has been de-saturated.
- Where availability of ground water is inadequate in lean months.
- Where due to rapid urbanization, infiltration of rain water into subsoil has decreased drastically and recharging of ground water has diminished.

FACTORS CONSIDERED FOR PREPARATION OF ARTIFICIAL RECHARGE SCHEMES

- HYDROGEOLOGY
  - SOIL COVER
  - NATURE OF AQUIFER SYSTEM
  - DEPTH TO WATER LEVELS
  - CHEMICAL QUALITY OF GROUND WATER
- AREA CONTRIBUTING RUNOFF
  - HOW MUCH IS THE AREA
  - LAND USE PATTERN
- HYDROMETEOROLOGICAL CHARACTERS
  - HOW MUCH IS THE RAINFALL
  - PATTERN OF RAINFALL

Rain Water Harvesting and Artificial recharge to Ground Water System – Components to monitor

- **Source Water**
  - -Rainfall – runoff ,swimming pool, overhead tank overflow
- **Catchments- and drainage system**
  - - In-house, outside, known-unknown
- **Conveyance system**
  - - Spouts, Channels, Chambers
- **Precautionary filters and mesh**
  - - Overhead nets, inlet mesh, borehole mesh, slotted pipe wire/coir mesh, inverted filters, online filters, flush tanks and valve
- **The media- Storage tanks and filter medium**
  - Filter Material, thickness of filter layered media,
  - Placement of filter media and slotted pipe

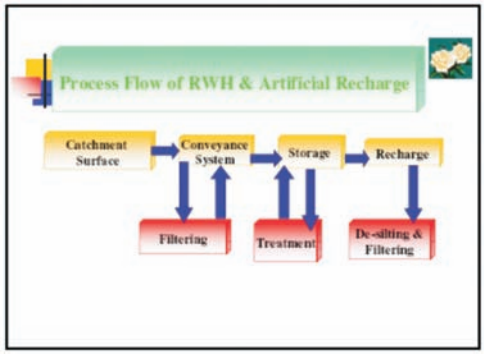
The fundamental question need to be answered before implementing the recharge scheme

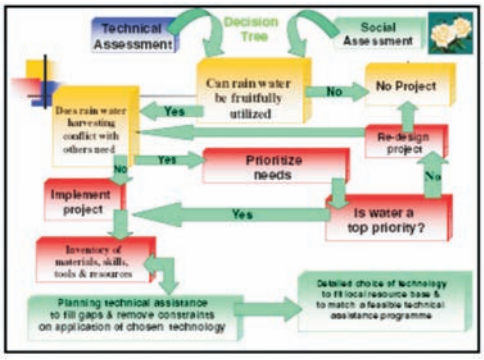
How fast will the water infiltrate in to the ground and what is the capacity of the system, what are the evaporation rates?

How water moves down to the ground water? Are there any slowly permeable layers in the vadose zone that will restrict the downward flow?

How high will the ground water mound in the recharged aquifer eventually rise and how much water can be stored?

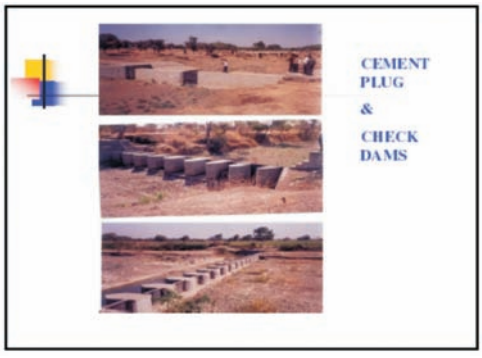
Rain Water Harvesting and Artificial recharge to Ground Water System
what may be wrong....
Slotted pipe , gravel media around the pipe
Hurdles in constructions the services and service lines, sewerage lines etc.
The spreading of cement /admixture used for construction
Dumping of filter media from vehicle directly into recharge structures (wash/screen/check for fines/slimes)
Extra ordinary/excess excavations
Delay in excavation and filling of filter media
Construction during rainy season/ instant rains during construction
The tree roots
Kitchen and toilet waste water seepage and/or leakage from lines
Proximity to source of water pollution
The cattle and cattle farms, stray animals
Property without ownership – Universal dustbin

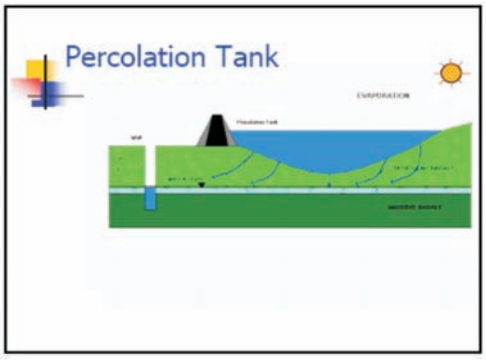

Process Flow of RWH & Artificial Recharge
Catchment Surface
Conveyance System
Storage
Recharge
Filtering
Treatment
De-silting & Filtering

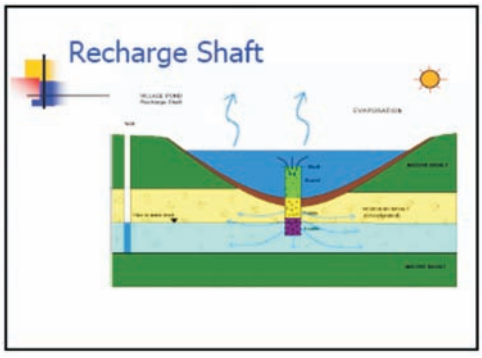

Technical Assessment
Decision Tree
Social Assessment
Can rain water be fruitfully utilized
No
No Project
Does rain water harvesting conflict with others need
Yes
Re-design project
Yes
Prioritize needs
No
Implement project
Yes
Is water a top priority?
Inventory of materials, skills, tools & resources
Planning technical assistance to fill gaps & remove consraints on application of chosen technology
Detailed choice of technology to fit local resource base & to match a feasible technical assistance programme

AR Structures in Watershed

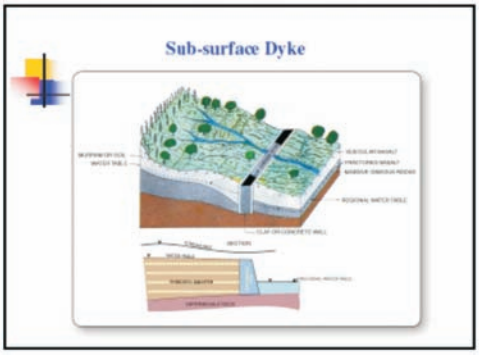
Gabion Structure

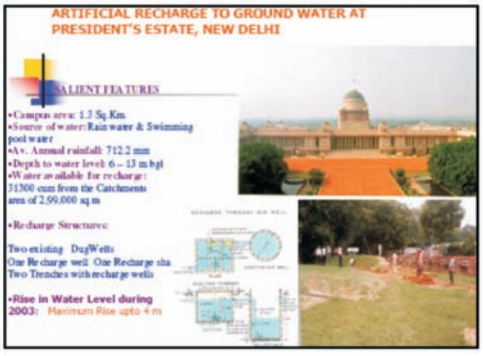

CEMENT PLUG
&
CHECK DAMS

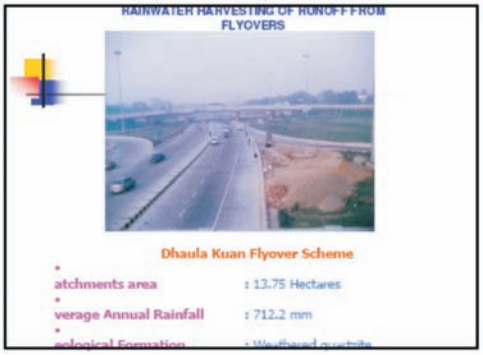

Percolation Tank
EVAPORATION

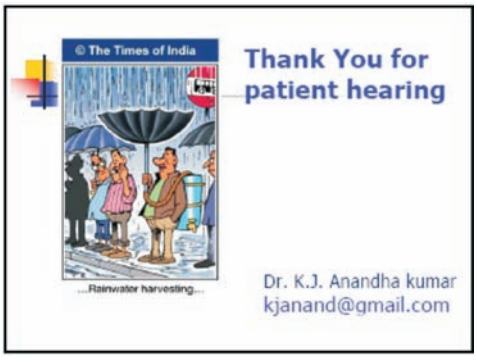

Recharge Shaft
EVAPORATION

Handout 1.2.3.1

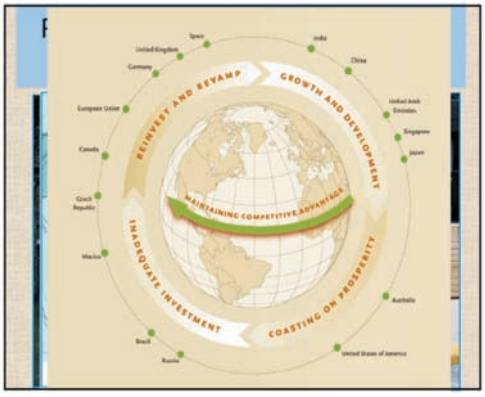








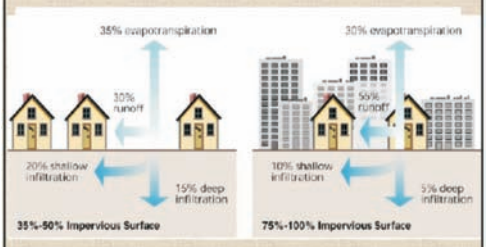
FLOOD RESILIENT STRUCTURES
Prof. Chandan Ghosh, NIDM



Check the bits!!!

- What is annual rain fall required to balance water demand & supply thru' the year?
- [per head – 140 litres/day – 270 litres/day= 200 litre => total demand = 200x365=73 m3;
- Delhi 1.5 crore people living in 1500 km sq area, annual rain fall- 70cm = rainwater per head = 65 m3]
- Why same place having >20m annual rainfall faces drought?

Rain fall & Runoff



Facts & Enforcements

- The number of people living within 1 meter of high tide level exceeds 150 millions
- many urbanization processes take place either without any planning or with plans that ignore or underestimate flood risks. Often the construction and land use regulations, the underlying legal basis, as well as a set of concrete plans do exist but are not enforced.

Flood & floating options

Diversion from "Surplus" to "Deficit" Regions

Handout 1.2.5.1

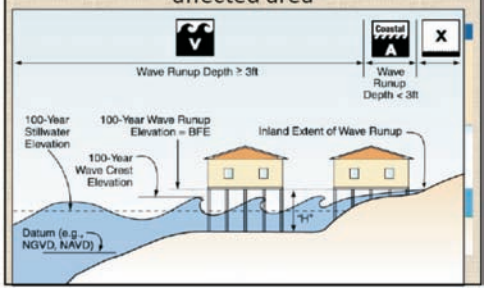
Human factors

- Land-use changes (e.g. surface sealing due to urbanization, deforestation) increase run-off and may be sedimentation
- Occupation of the flood plain obstructing flows
- Inefficiency or non-maintenance of infrastructure
- Too efficient drainage of upstream areas increases flood peaks
- Climate change affects magnitude and frequency of precipitations and floods
- Urban microclimate may enforce precipitation events

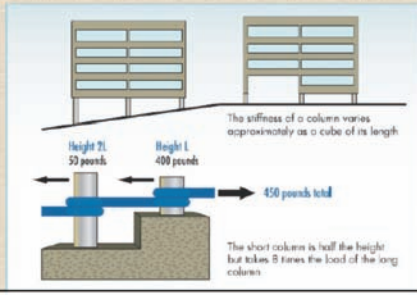
How to cope WITH Flood

- Have the flood prone zones been identified?
- Are there warning system in place?
- Are the community aware of the rain fall & runoff rates in the water bodies
- Is there any routing and special measures in place?
- What is anticipated year by year in terms of Flood risk & (soft & hard) mitigation measures?

Recommended houses in flood affected area

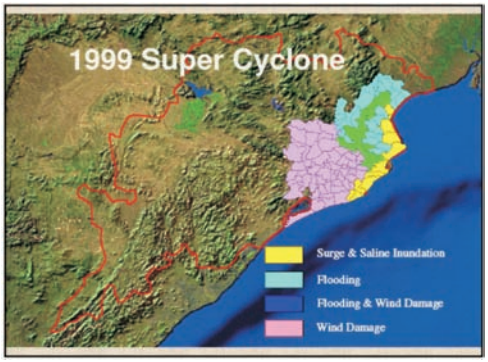


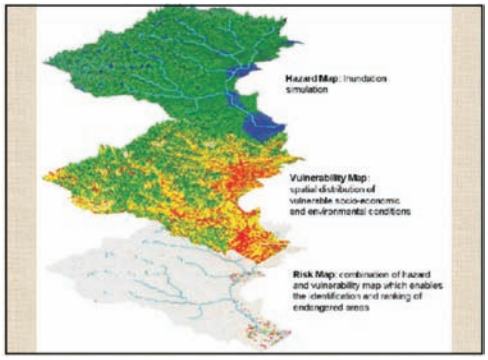
Stilted houses – a matter of concern

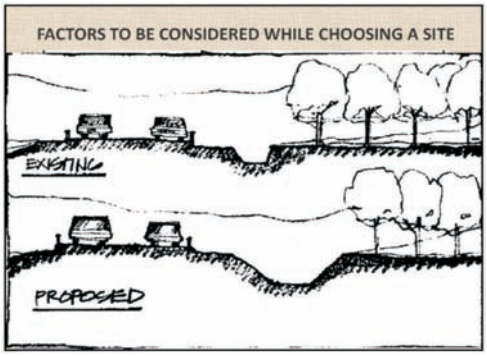


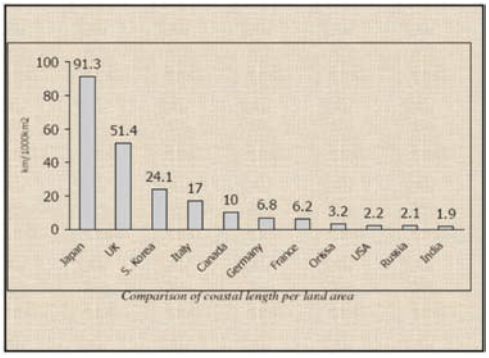
Buildings to be OR not to be!

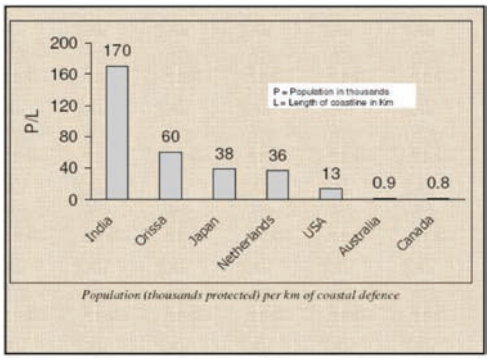
- Extreme Cyclone storm surge flooding may be a very low-probability event, but the flood depths and wave heights may be much more severe than the conditions of the base flood
- It is always best to avoid locating lifeline facilities e.g. hospitals in areas subject to extreme storm surge flooding/riverine flooding zone.

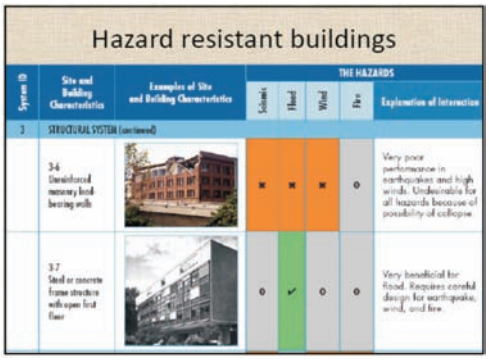


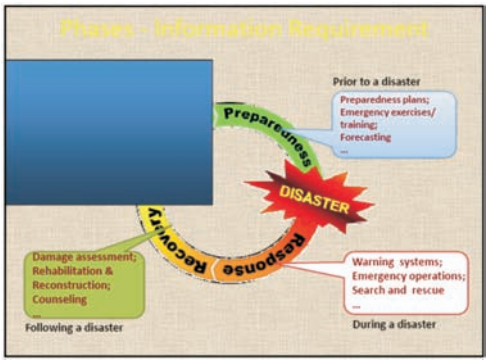












Disaster response: issues

- Build houses and infrastructure to withstand future disasters (for example, provide roofs with straps to protect against cyclones, ...
- Make hospitals disaster-resistant, including road, water, and electricity access.
- Preserve social networks when relocating people away from hazardous areas.
- Provide livelihoods opportunities, and where possible, help people to take charge of their own reconstruction.
- .....

Human factors

- (a) Area per Occupant - 1sq. M, FEMA 0.45 sq. m
- (b) Occupancy Duration – 36 hrs
- (c) Lighting – 40 lux
- (d) Safe Movement and Access
- (e) Access for People with Disabilities
- (f) Ventilation
- (g) Amenities – 1 toilet / 40 people
- (h) Communications
- (i) Emergency Power
- (j) Emergency Provisions
- (k) Waterproofing and Weatherproofing

Handout 1.2.5.1

What high winds does to building?

Crisis coping after disaster

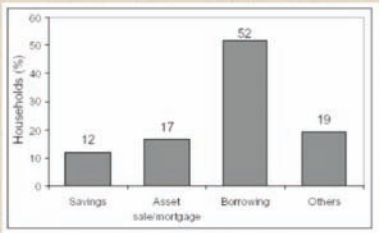


Figure 10: Crisis coping by poor Households

Disastrous Disaster response

- **Ignoring local leadership, and not involve beneficiaries in the planning process of their** houses.
- Rushing with **reconstruction without recycling useful materials from the disaster site, ...**
- **Relocating people away from their jobs and social contacts.**
- **Missing the planting season when distributing seeds in drought-stricken areas.**
- **Imposing grief counseling where it is inappropriate for many family-based cultures.**
- **Reacting instead of planning ahead, especially where we know disasters will surely** happen

Local scour undermined the footing of this exterior stair tower (Hurricane Ivan, 2004).

Effect of Flood on buildings

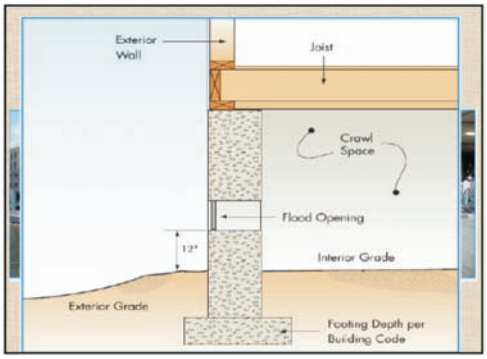
- E

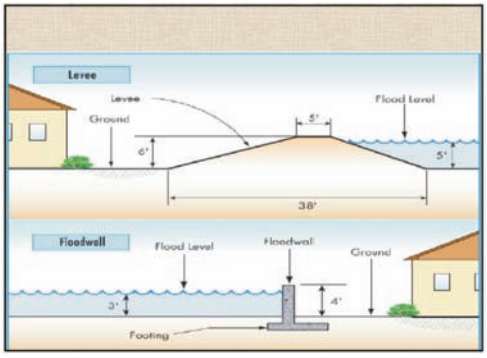
The South Cameron Memorial Hospital, Cameron, LA, was damaged by debris carried by Hurricane Rita's storm surge (2005). SOURCE: LSU AG CENTER

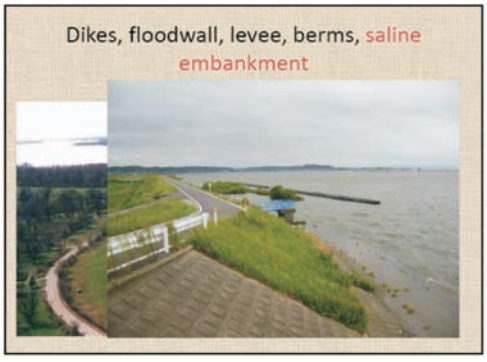
Facilities went out of service – Hancock Med centre (Katrina 2005)

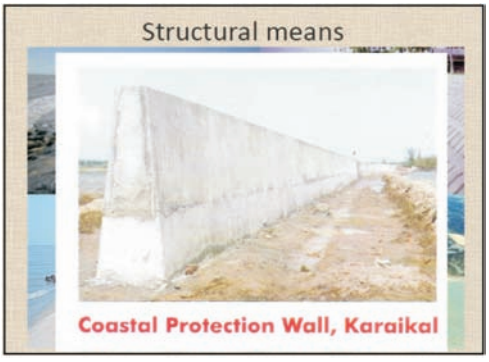
LIVING in Flood prone area?

- WET flood proofing & DRY flood proofing
- Site modifications are not appropriate in floodways along riverine waterways, where obstructions to flows can increase flood elevations.
- **Evacuation**
- **Elevation fill**
- Earthen LEVEE
- Flood wall
- Flood resistant materials

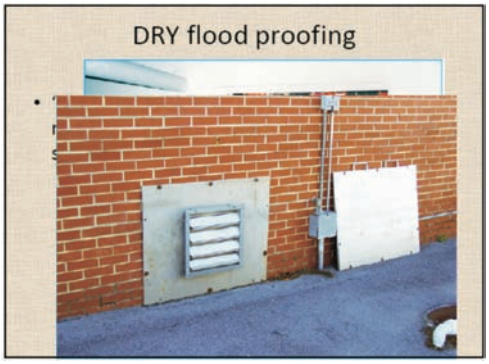

Exterior Wall
Joist
Crawl Space
Flood Opening
12"
Interior Grade
Exterior Grade
Footing Depth per Building Code

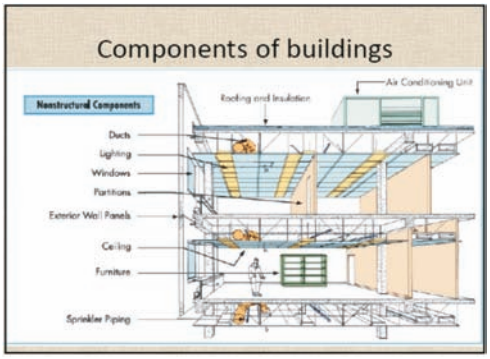

Levee
Levee
Ground
Flood Level
5'
6'
5'
38'
Floodwall
Flood Level
Floodwall
Ground
3'
4'
Footing

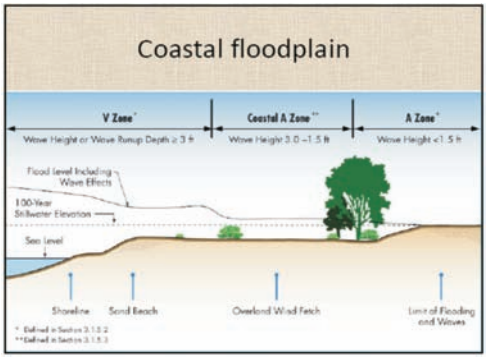

Dikes, floodwall, levee, berms, saline embankment


Structural means
Coastal Protection Wall, Karaikal

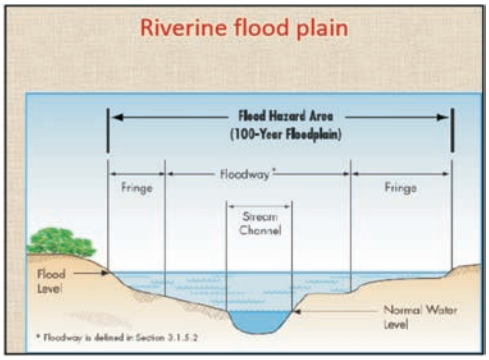
Flood Protection - structural
Walls
Sand Bund

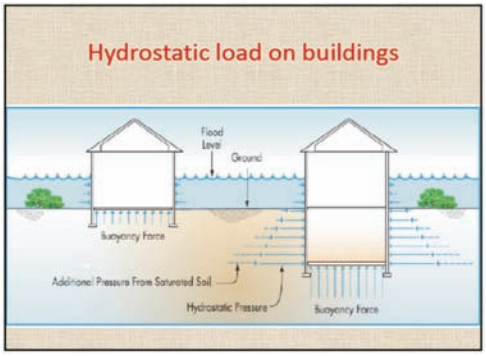

DRY flood proofing

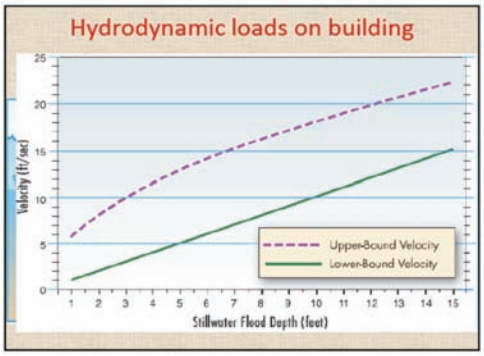

Components of buildings
Nonstructural Components
Ducts
Lighting
Windows
Partitions
Exterior Wall Panels
Ceiling
Furniture
Sprinkler Piping
Roofing and Insulation
Air Conditioning Unit

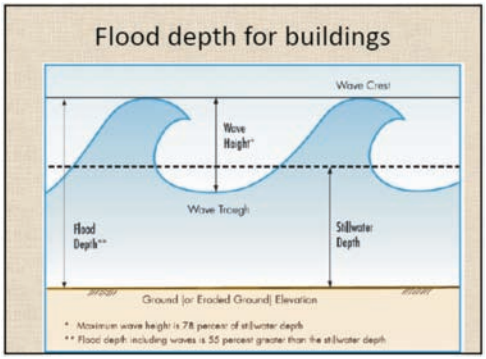

Coastal floodplain
V Zone*
Coastal A Zone**
A Zone*
Wave Height or Wave Runup Depth ≥ 3 ft
Wave Height 3.0 – 1.5 ft
Wave Height <1.5 ft
Flood level including Wave Effects
100-Year Stillwater Elevation
Sea Level
Shoreline
Sand Beach
Overland Wind Fetch
Limit of Flooding and Waves

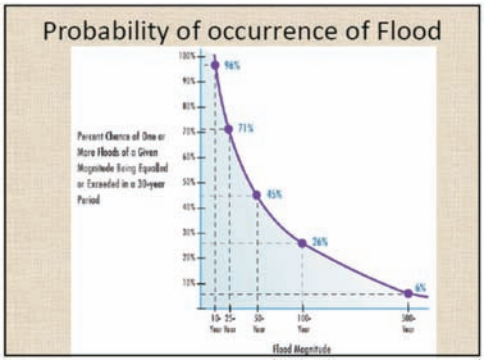
Handout 1.2.5.1

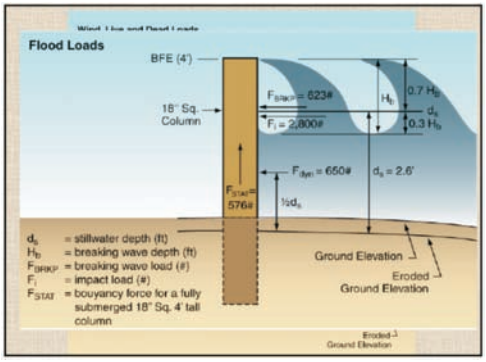


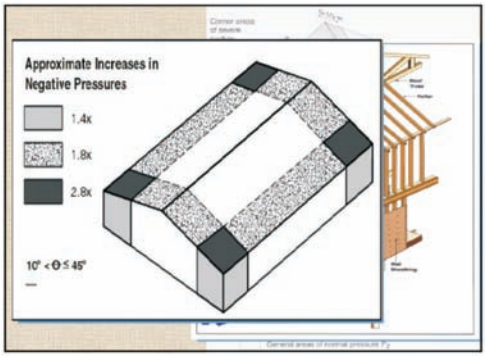


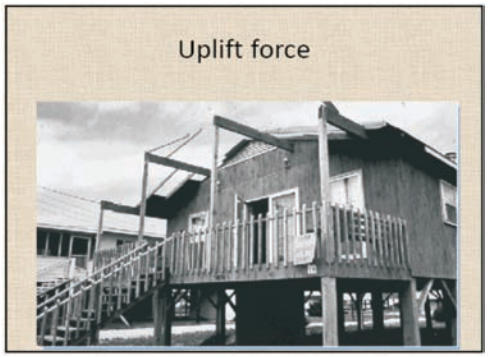












Flood risk hazard mapping – cost benefit analysis

- Benefits are characterized and measured as future damages avoided if the mitigation measures (including avoiding flood hazard areas) are implemented.
- Costs are the costs associated with implementing measures to eliminate or reduce exposure to hazards.

Damage reduction measures

- Replace interior walls that have cavities with flood-resistant construction or removable panels to facilitate cleanup and drying.
- Abandon the use of below-grade areas (basements) and fill them in to prevent structural damage.
- Permanently relocate high-value or sensitive functions that are often found on the ground floor of hospitals (e.g., offices, records, libraries, and computer laboratories) to higher floors or elevated additions.
- Install backflow devices in sewer lines.

Reduction measures

- Rehabilitate and retrofit the building envelope with openings specifically designed to allow floodwaters to flow in and out to minimize hydrostatic pressure on walls (called wet flood proofing)
- Replace wall, flooring, and finish materials with flood-resistant materials.
- Install separate electric circuits and ground fault interrupter circuit protection in areas that will flood.
- Relocate chemicals to storage areas not subject to flooding.
- .....

Available BIS codes

- **IS 11532: 1997 "Construction and maintenance of river embankments (levees) – guidelines".**
- **IS 12094: 2000 "Guidelines for planning and design of river embankments (levees)".**

References

- *Openings in Foundation Walls, FIA-TB-1, April 1993.*
- *Flood Resistant Materials Requirements, FIA-TB-2, April 1993.*
- *Non Residential Flood proofing—Requirements and Certification, FIA-TB-3, April 1993.*
- *Elevator Installation, FIA-TB-4, April 1993.*
- *Free of Obstruction Requirements, FIA-TB-5, April 1993.*
- *Below Grade Parking Requirements, FIA-TB-6, April 1993.*
- *Wet Floodproofing Requirements, FIA-TB-7, December 1993.*
- *Corrosion Protection for Metal Connections in Coastal Areas, FIA-TB-8, 1996.*
- *Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings, FIA-TB-9, 1999.*
- *Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding, FIA-TB-10, 2001.*
- *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas, FIA-TB-11, 2001.*
- *International Code Council, Inc. (ICC), 2006a,*
- *ICC Performance Code for Buildings and Facilities, Country Club Hills, IL.*
- *International Code Council, Inc. (ICC), 2006b,*
- *International Building Code, Country Club Hills, IL.*

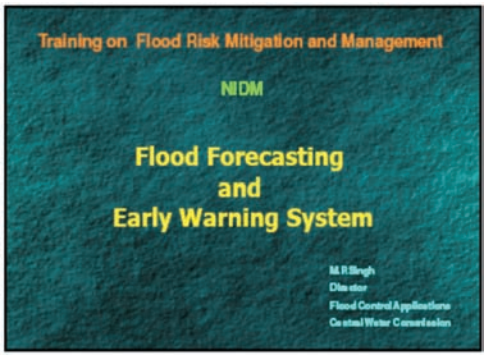
How Should We Deal with Our Conflicts Over Water Resources?

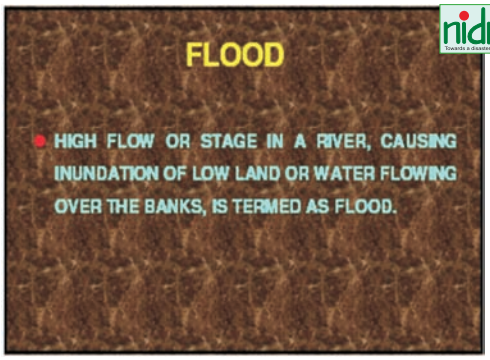
"Come together, speak in concord, let your minds comprehend alike, let our efforts be united, let our hearts be in agreement, let our minds be united so that we all live in peace." – Riga Veda

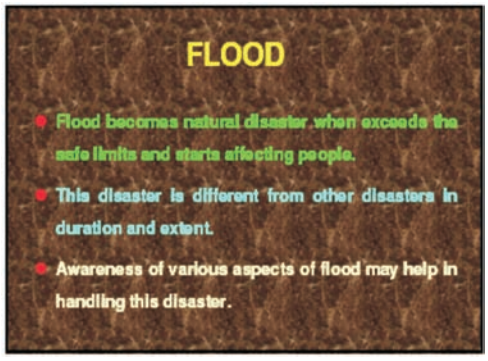
Thanks

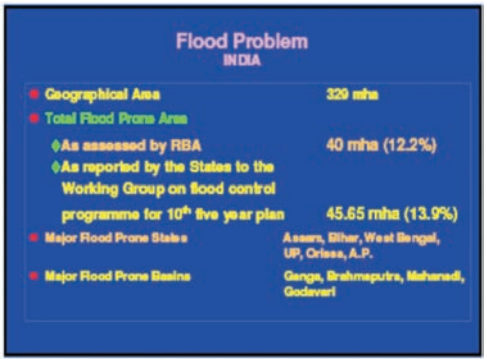
Annexure:

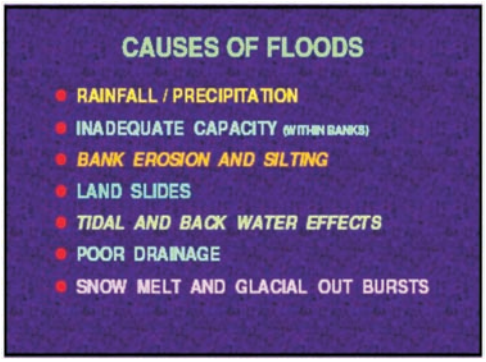
Handout 1.3.2.1

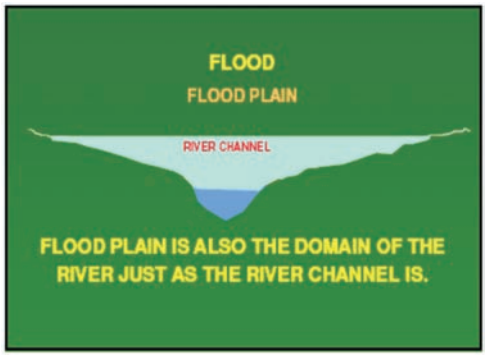












FLOODS

- FLOODS ARE WATER RELATED DISASTER
- WATER RESOURCES MANAGEMENT INCLUDES MANAGEMENT OF THESE DISASTERS

FLOOD MANAGEMENT

APPROACH

- FLOODS CAN NOT BE ABSOLUTELY CONTROLLED
- FLOODS CAN ONLY BE MANAGED TO REDUCE FLOOD LOSSES

FLOOD MANAGEMENT

MEASURES

- STRUCTURAL MEASURES : PHYSICAL WORKS FOR MODIFYING FLOOD MAGNITUDE (TO KEEP FLOODS AWAY FROM PEOPLE)
- NON-STRUCTURAL MEASURES : PLANNED ACTIVITY TO MODIFY SUSCEPTIBILITY TO FLOOD DAMAGE (TO KEEP PEOPLE AWAY FROM FLOODS)

Flood forecasting and warning system

- One of the Non-Structural measures
- Flood forecasting and warning system
  - Importance
  - Background
  - Network
  - Steps
  - Methodology
  - Issues at ground

FLOOD FORECASTING

ESTIMATING

- FUTURE STAGES OR FLOWS
- ITS TIME SEQUENCE

AT SELECTED POINTS ALONG THE RIVER DURING FLOODS.

Flood Forecasting and Warning System

- Flood Forecasting & Advance Warning System plays an effective role in reducing the loss of lives and movable properties during floods.
- One of the effective measure of Flood Management and Disaster Risk Reduction.

Flood Forecasting

- In India, Flood Forecasting is done by Central Water Commission (CWC) of MoWR.

INDIA

FLOOD FORECASTING

BEGINNING

- STARTED BY CENTRAL WATER COMMISSION
- YEAR 1958
- RIVER YAMUNA
- FORECASTING STATION DELHI RAILWAY BRIDGE

Handout 1.3.2.1

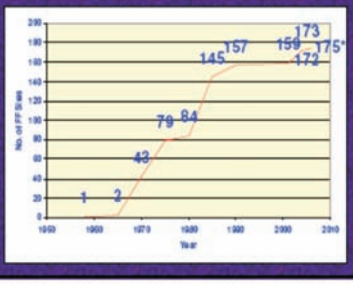
Flood Forecasting Activities of CWC

- The disastrous floods in 1968 in many parts of the country necessitated the setting up of forecasting centers on many other Interstate rivers

Development of Flood Forecasting Network in India

Year	No.
1959	1
1965	2
1970	43
1975	79
1980	84
1985	145
1990	157
2001	159
2004	172
2005	173
2006	175

Development of Flood Forecasting Network in India – a timeline



Flood Forecasting

- CWC maintain a National Network of 175 Forecasting Stations in 9 major river basins covering 70 Inter-State Rivers

Flood Forecasting

- Out of 175 stations, 147 stations are Water level forecasting stations and 28 stations are inflow forecasting stations.
  - About 6-7 thousand forecasts are issued during monsoon season
  - Accuracy of forecasts is about 96%

Flood Forecasting Network

River System-wise

River System	Level	Inflow	Total
Ganga & Tributaries	77	10	87
Brahmaputra & Tributaries	27	-	27
Barak-System	05	-	05
Eastern-Rivers	08	01	09
Mahanadi	03	01	04
Godavari	14	04	18
Krishna	03	06	09
West flowing Rivers	09	06	15
Pennar	01	-	01
Total	147	28	175

Flood Forecasting Stations

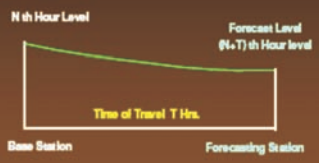
State-wise

State	Nos.	State	Nos.
Andhra Pradesh	16	Madhya Pradesh	3
Assam	24	Orissa	12
Bihar	32	Tripura	2
Chattisgarh	1	Uttar Pradesh	35
Gujarat	11	Uttarakhand	3
Haryana	1	West Bengal	14
Jharkhand	5	NCT Delhi	2
Karnataka	4	Dadra & Nagar Haveli	1
Maharashtra	9		
Total No. of Stations:		175	

FLOOD FORECASTING AND WARNING concept

FLOOD FORECASTING

WATER LEVEL FORECASTING



FLOOD FORECASTING AND WARNING

STEPS

- DATA COLLECTION
- DATA TRANSMISSION
- DATA ANALYSIS & FORECAST FORMULATION
- DISSEMINATION OF FORECAST

Methodology of Forecasting

- Hydrological (water level) data observation on hourly basis during whole monsoon season.
- Rainfall observation twice a day/ 3 hourly/ hourly.
- Data communication from the site to divisional headquarters through wireless, telemetry, telephone etc. for scrutiny and processing for forecast formulation.

Methodology of Forecasting

- Simple statistical gauge to gauge correlations using gauge & discharge data are being used for some forecasting stations; multiple coaxial correlations using gauge and rainfall data are also being used for some stations
- Mathematical models like MIKE-11 are also in use for some of the stations in Damodar, Godavari, Mahanadi and Chambal Basins

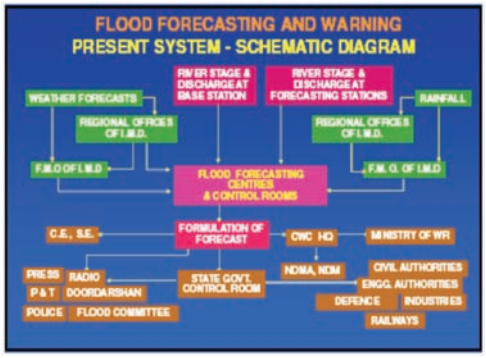
Forecasting Schedule

- **Major rivers (Travel time >24 hours)**
  Forecasts are being formulated based on 0600 hrs/ 0900 hrs water level data and issued once in a day at 1000 hrs with advance warning time from 24 hrs to 36 hrs
- **Medium rivers (Travel time 12-24 hours)**
  Forecasts are being formulated based on 0600 hrs and 1800 hrs water level data and issued twice in a day at 0700 hrs and 1900 hrs with advance warning time from 12 hrs to 24 hrs
- **Flashy rivers (Travel time < 12 hours)**
  Forecasts are being formulated based on any main hr water level data and issued multiple times (more than twice) in a day with advance warning time less than 12 hrs

Handout 1.3.2.1

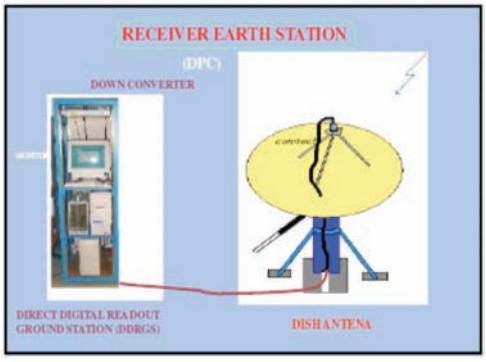
Dissemination of Forecast

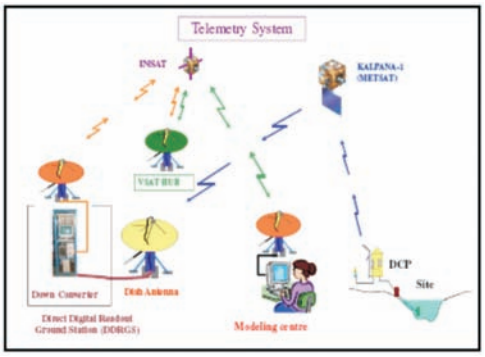
- To user agencies, such as civil authorities of concerned States, Defense, Railways, Highway, Industrial and other important establishments located in the flood prone areas through telephone/ fax/ e-mail/ special messenger for taking advance action for flood management & evacuating population to safer places
- Forecasts being given to Radio, Television and News Agencies for passing on to the likely flood affected areas



Flood Forecasting Modernisation

- Data Collection: By Automatic Sensors
- Data Transmission: By Automatic Data Transmission Techniques e.g. Satellite, VSAT, Internet/Email, Mobile Phones etc
- Forecast Formulation: Using Comprehensive Catchment Models - Computer Based
- Forecast Dissemination: By Using Internet, E-mail, SMS





Modernisation of FF Network

- TELEMETRY SYSTEM

Mahanadi basin	– 36 stations
Chambal basin	– 20 stations
Godavari basins	- 63 no.
Krishna basin	- 41 no.
Brahmaputra basin	- 21 no.
Damodar basin	- 20 no.
Yamuna basin	- 15 no.
Mahanadi basin	- 8 no.

Total - 223 no.

Modernisation of FF Network

- 13 modeling centre at Jaipur, Burla, Dibrugarh, Asansol, New Delhi, Agra, Hyderabad (2), Kurnool, Bhadrachalam, Guwahati, Bhubaneswar and Maithon.
- MIKE-11 Software for inflow as well as level forecast

Flood warning and action (at State flood control rooms)

- Preparedness for fighting the flood.
- Action on Flood forecasts.
- Review of flood situation and dissemination of information to all concerned.
- Issuing flood warning and dissemination among all concerned and people in time.

Flood warning and action (at State flood control rooms)

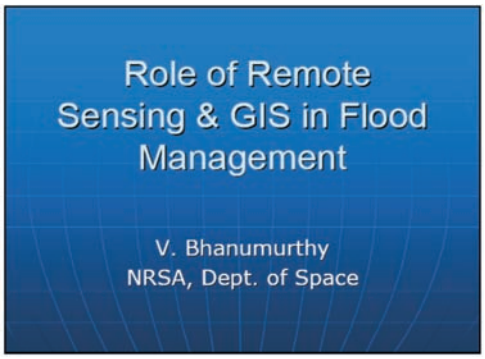
- Direction and Action for evacuation/ shifting of people to safe places.
- Management of relief camps.
- Maintaining hygiene in camps and prevention of epidemics.
- Rehabilitation of displaced people after floods

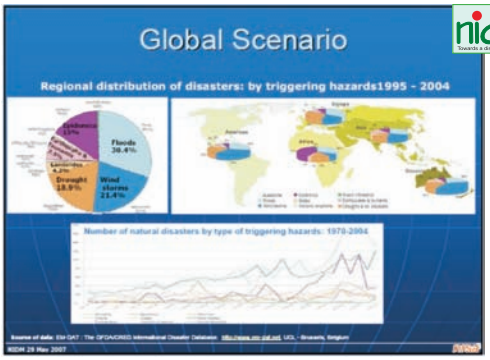
Issues needing attention by States

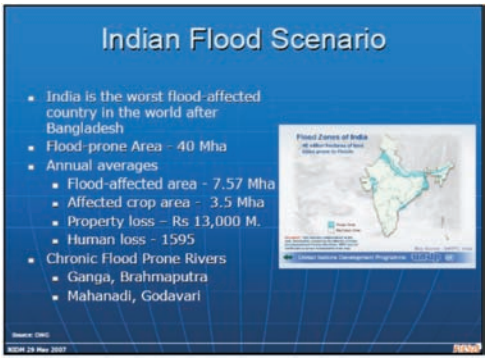
- Review of all the danger levels and warning levels of the forecasting sites
- Development of large scale maps for generating inundation maps/ flood risk maps
- Demarcation of flood zones at various levels on ground
- Creation of Awareness among people / Prior guidance

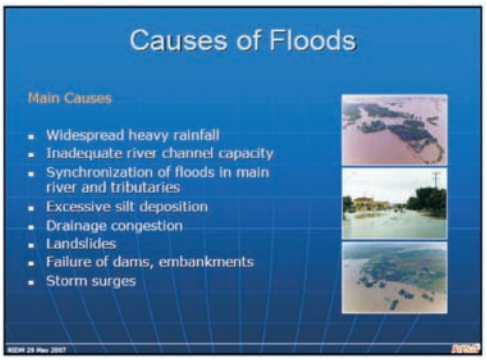
Flood Forecasting and Early Warning

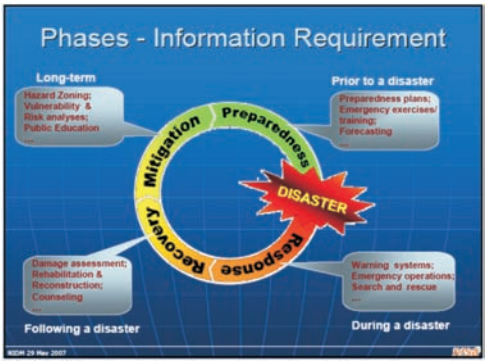
- Is time sensitive
- Must travel faster than the floods
- Warning must reach well in advance
- Time for action should be available
- It should be relevant and accurate

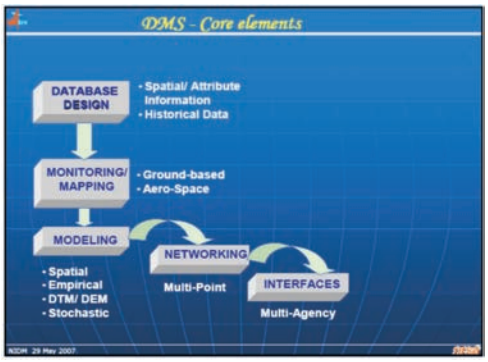

Role of Remote Sensing & GIS in Flood Management
V. Bhanumurthy
NRSA, Dept. of Space


Global Scenario
Regional distribution of disasters: by triggering hazards1995 - 2004
Floods 38.4%
Wind storms 21.4%
Drought 18.9%
Number of natural disasters by type of triggering hazards: 1970-2004

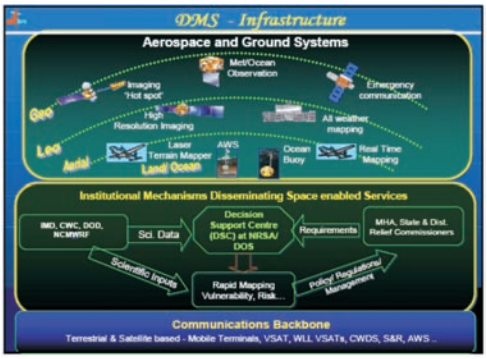

Indian Flood Scenario
India is the worst flood-affected country in the world after Bangladesh
Flood-prone Area – 40 Mha
Annual averages
Flood-affected area - 7.57 Mha
Affected crop area - 3.5 Mha
Property loss – Rs 13,000 M.
Human loss - 1595
Chronic Flood Prone Rivers
Ganga, Brahmaputra
Mahanadi, Godavari
Flood Zones of India

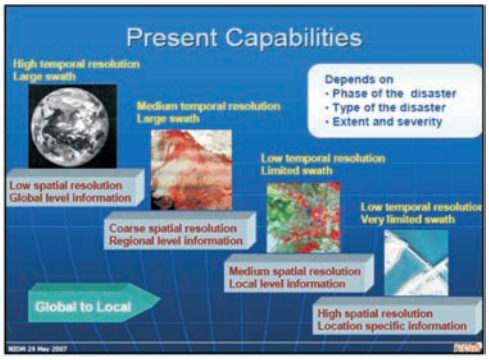

Causes of Floods
Main Causes
Widespread heavy rainfall
Inadequate river channel capacity
Synchronization of floods in main river and tributaries
Excessive silt deposition
Drainage congestion
Landslides
Failure of dams, embankments
Storm surges

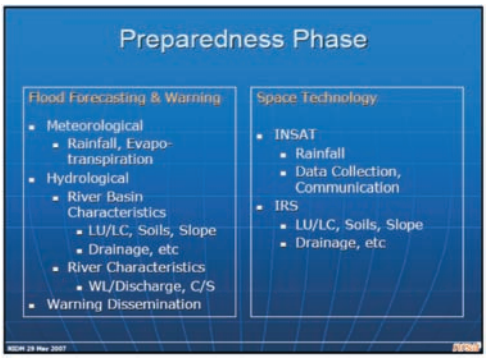

Phases - Information Requirement
Long-term
Hazard Zoning; Vulnerability & Risk analyses; Public Education
Prior to a disaster
Preparedness plans; Emergency exercises/ training; Forecasting
Mitigation
Preparedness
DISASTER
Response
Recovery
Damage assessment; Rehabilitation & Reconstruction; Counseling
Following a disaster
Warning systems; Emergency operations; Search and rescue
During a disaster

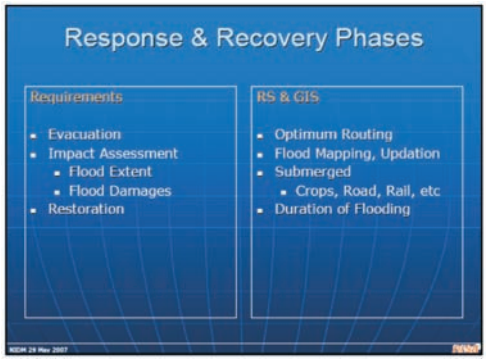

DMS - Core elements
DATABASE DESIGN
Spatial/ Attribute Information
Historical Data
MONITORING/ MAPPING
Ground-based
Aero-Space
MODELING
Spatial
Empirical
DTM/ DEM
Stochastic
NETWORKING
Multi-Point
INTERFACES
Multi-Agency

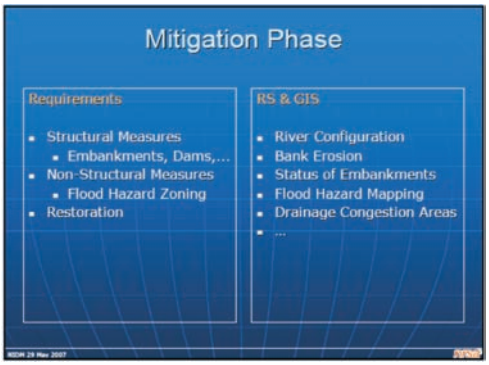
Space in Disaster Management
Observation for Information
Preparedness
Disaster event
Relief
Rehabilitation
Reconstruction
Mitigation
Information for Decision
Decision for Action


DMS - Infrastructure
Aerospace and Ground Systems
Met/Ocean Observation
Imaging 'Hot spot'
Emergency communication
Geo
High Resolution Imaging
All weather mapping
Leo
Aerial
Land/ Ocean
Ocean Buoy
Real Time Mapping
Institutional Mechanisms Disseminating Space enabled Services
IMD, CWC, DOD, NCMWRF
Sci. Data
Decision Support Centre (DSC) at NRSA/ DOS
Requirements
MHA, State & Dist. Relief Commissioners
Scientific Inputs
Rapid Mapping Vulnerability, Risk..
Policy/ Regulations/ Management
Communications Backbone
Terrestrial & Satellite based - Mobile Terminals, VSAT, WLL VSATs, CWDS, S&R, AWS ..

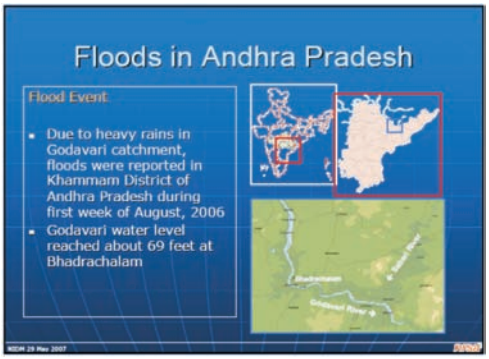

Present Capabilities
High temporal resolution
Large swath
Medium temporal resolution
Large swath
Low temporal resolution
Limited swath
Low temporal resolution
Very limited swath
Depends on
• Phase of the disaster
• Type of the disaster
• Extent and severity
Low spatial resolution
Global level information
Coarse spatial resolution
Regional level information
Medium spatial resolution
Local level information
High spatial resolution
Location specific information
Global to Local

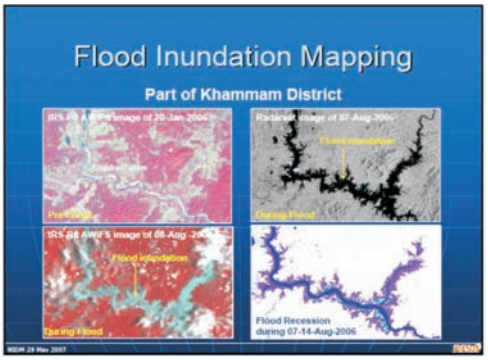

Preparedness Phase
Flood Forecasting & Warning
Meteorological
Rainfall, Evapo-transpiration
Hydrological
River Basin Characteristics
LU/LC, Soils, Slope
Drainage, etc
River Characteristics
WL/Discharge, C/S
Warning Dissemination
Space Technology
INSAT
Rainfall
Data Collection, Communication
IRS
LU/LC, Soils, Slope
Drainage, etc

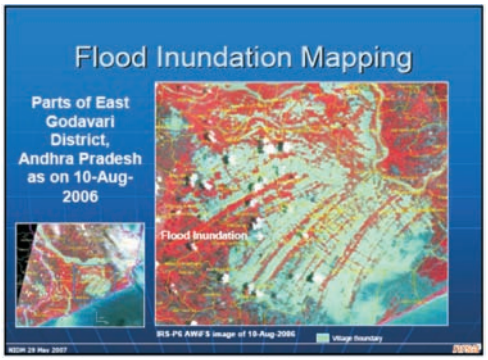

Response & Recovery Phases
Requirements
Evacuation
Impact Assessment
Flood Extent
Flood Damages
Restoration
RS & GIS
Optimum Routing
Flood Mapping, Updation
Submerged
Crops, Road, Rail, etc
Duration of Flooding


Mitigation Phase
Requirements
Structural Measures
Embankments, Dams,...
Non-Structural Measures
Flood Hazard Zoning
Restoration
RS & GIS
River Configuration
Bank Erosion
Status of Embankments
Flood Hazard Mapping
Drainage Congestion Areas
...

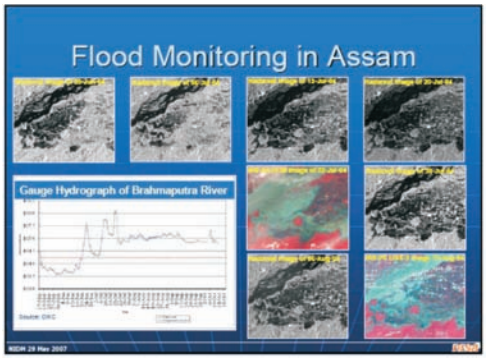
Response
Preparedness
Response
Recovery
Mitigation
DISASTER

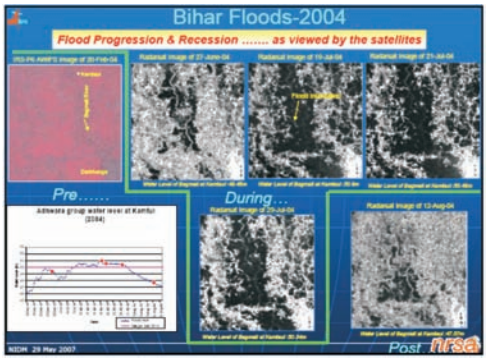

Floods in Andhra Pradesh
Flood Event
Due to heavy rains in Godavari catchment, floods were reported in Khammam District of Andhra Pradesh during first week of August, 2006
Godavari water level reached about 69 feet at Bhadrachalam

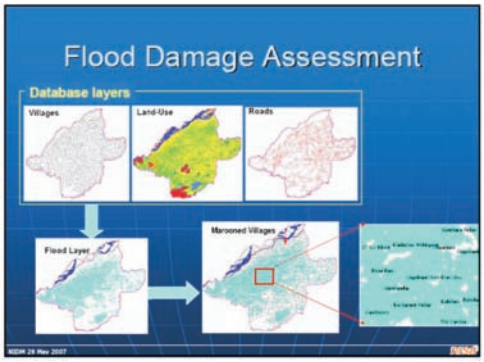

Flood Inundation Mapping
Part of Khammam District
Flood Recession during 07-14-Aug-2006

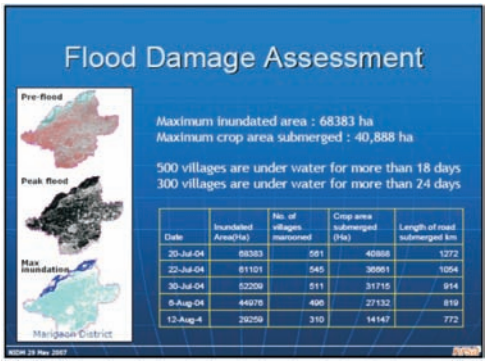

Flood Inundation Mapping
Parts of East Godavari District, Andhra Pradesh as on 10-Aug-2006
Flood Inundation
IRS-P6 AWiFS image of 10-Aug-2006
Village boundary

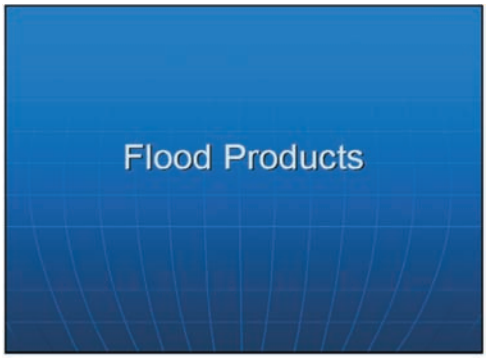
Handout 1.3.3.1

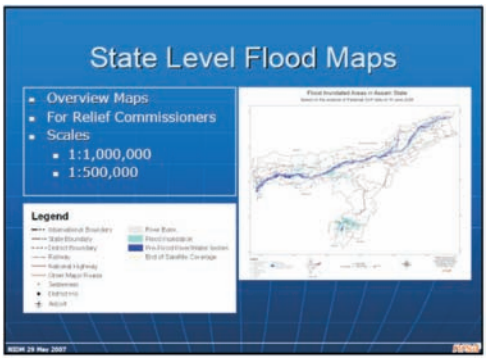


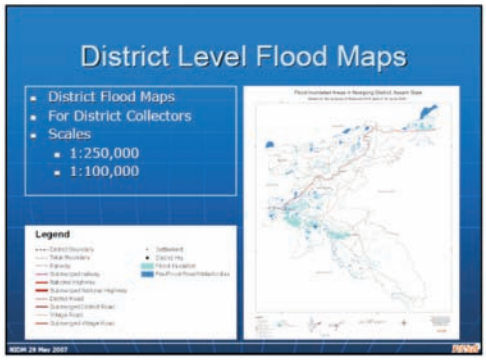


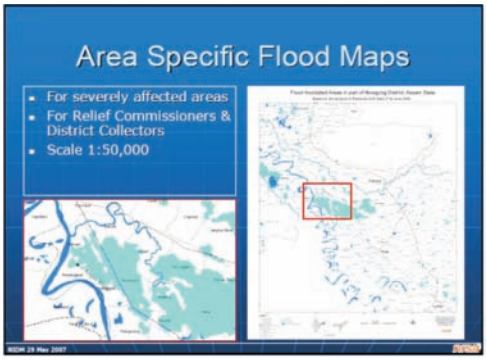


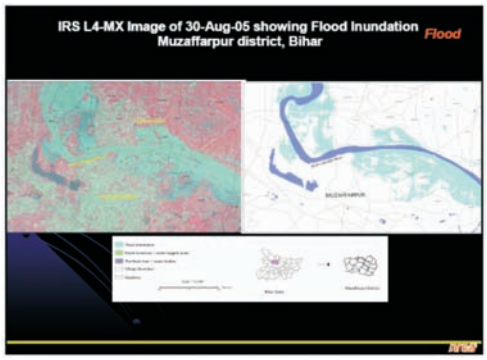


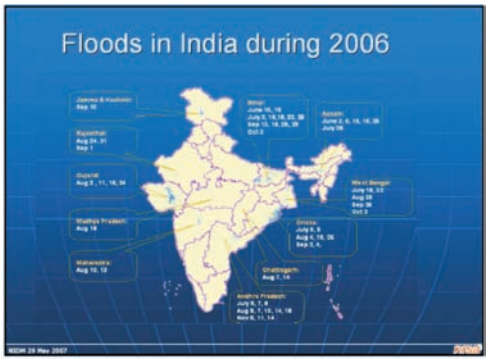




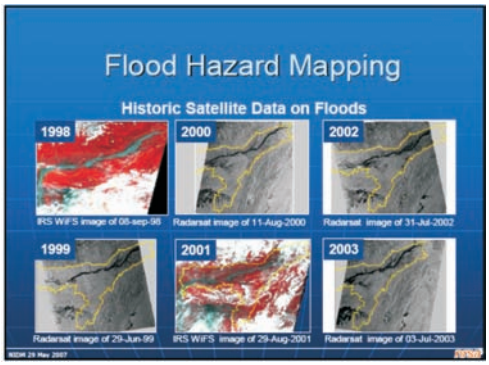


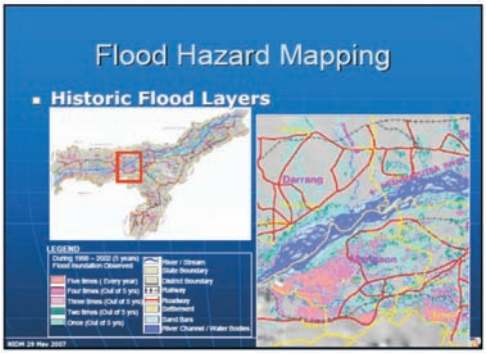


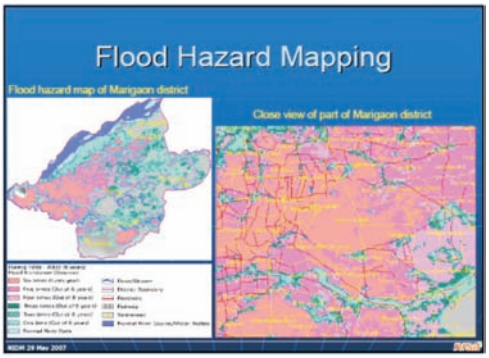

IRS L4-MX Image of 30-Aug-05 showing Flood Inundation
Muzaffarpur district, Bihar
Flood

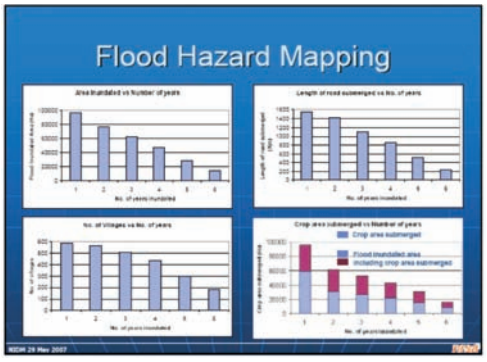

Floods in India during 2006

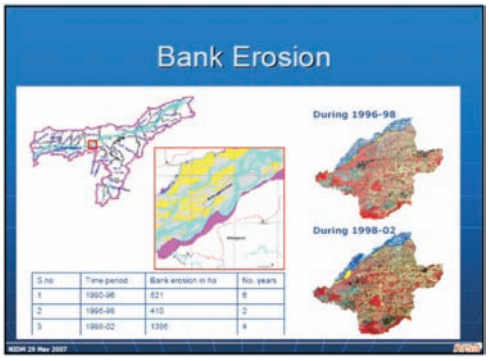
Mitigation


Flood Hazard Mapping
Historic Satellite Data on Floods
1998
2000
2002
IRS WIFS image of 06-sep-98
Radarsat image of 11-Aug-2000
Radarsat image of 31-Jul-2002
1999
2001
2003
Radarsat image of 29-Jun-99
IRS WIFS image of 29-Aug-2001
Radarsat image of 03-Jul-2003

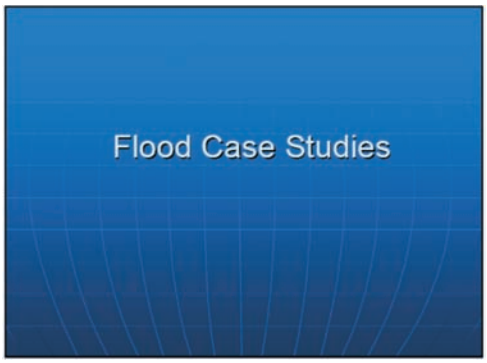

Flood Hazard Mapping
Historic Flood Layers
LEGEND
Darrang
Morigaon

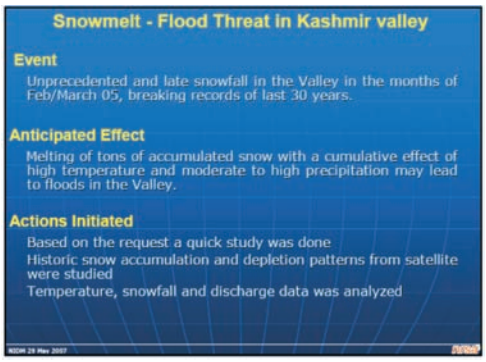

Flood Hazard Mapping
Flood hazard map of Marigaon district
Close view of part of Marigaon district

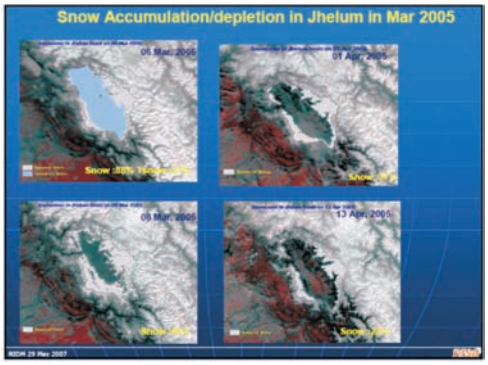

Flood Hazard Mapping

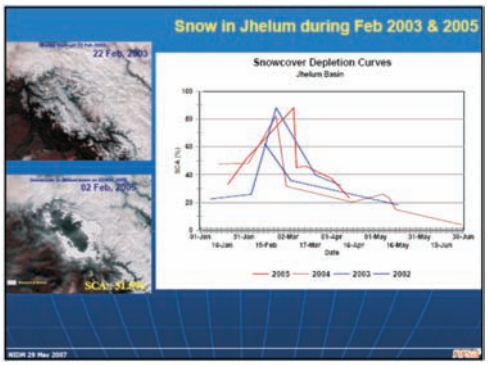

Bank Erosion
During 1996-98
During 1998-02
S no
Time period
Bank erosion in ha
No. years
1
1990-96
521
6
2
1996-98
410
2
3
1998-02
1396
4

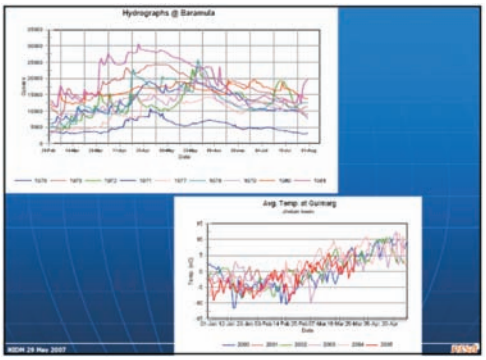
Handout 1.3.3.1

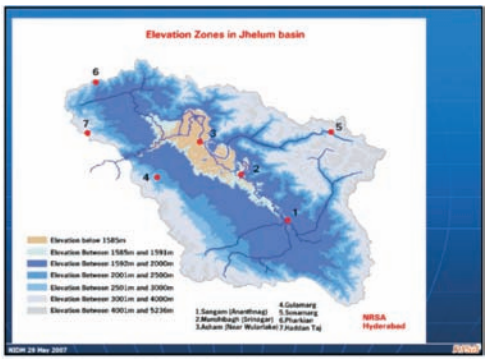


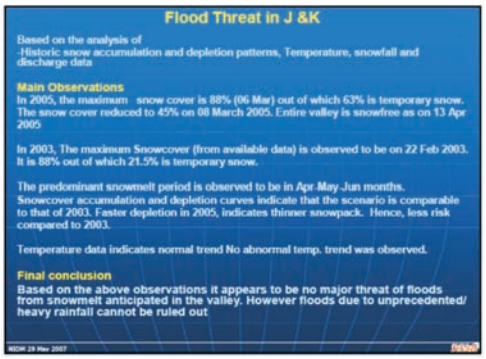


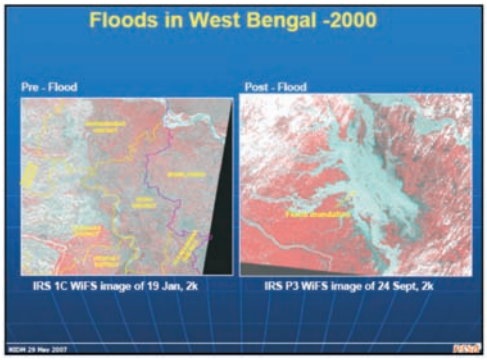


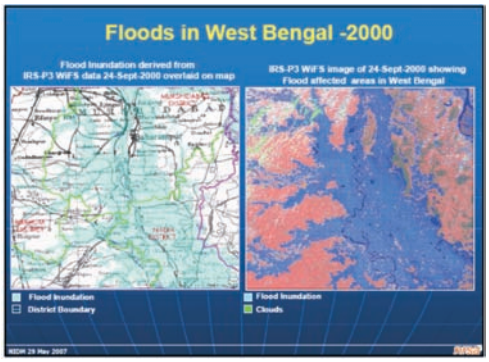


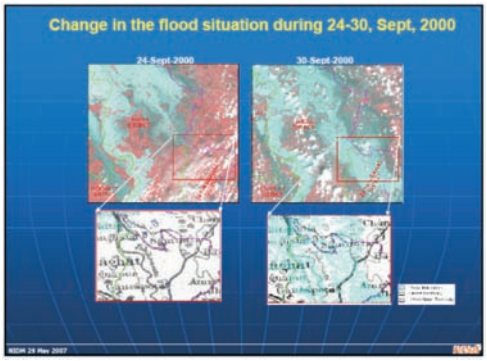


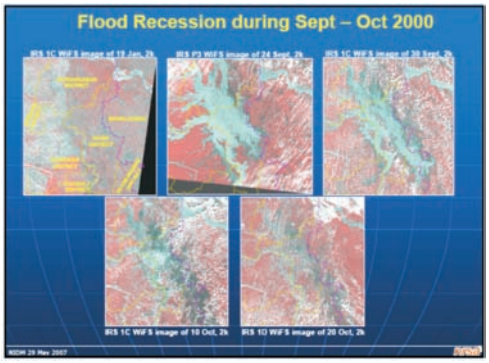


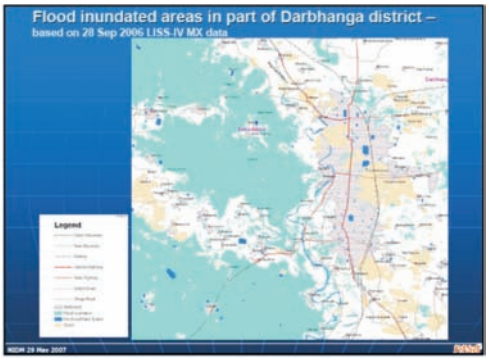



Floods in West Bengal -2000
Pre - Flood
Post - Flood
IRS 1C WiFS image of 19 Jan, 2k
IRS P3 WiFS image of 24 Sept, 2k

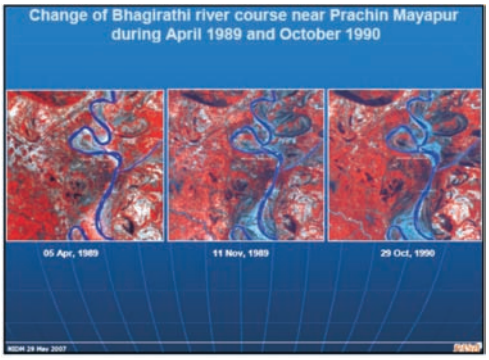

Floods in West Bengal -2000
Flood Inundation derived from IRS-P3 WiFS data 24-Sept-2000 overlaid on map
IRS-P3 WiFS image of 24-Sept-2000 showing Flood affected areas in West Bengal
Flood Inundation
District Boundary
Flood Inundation
Clouds

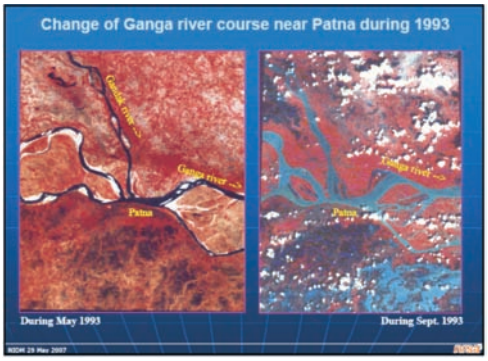

Change in the flood situation during 24-30, Sept, 2000
24-Sept-2000
30-Sept-2000


Flood Recession during Sept – Oct 2000

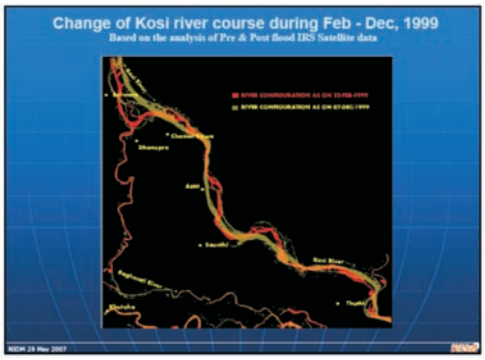

Flood inundated areas in part of Darbhanga district –
based on 28 Sep 2006 LISS-IV MX data
Legend

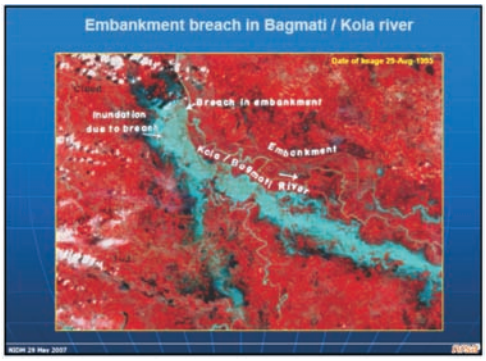
Change of River course

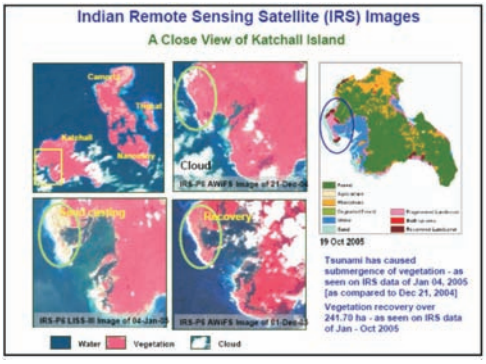

Change of Bhagirathi river course near Prachin Mayapur during April 1989 and October 1990
05 Apr, 1989
11 Nov, 1989
29 Oct, 1990

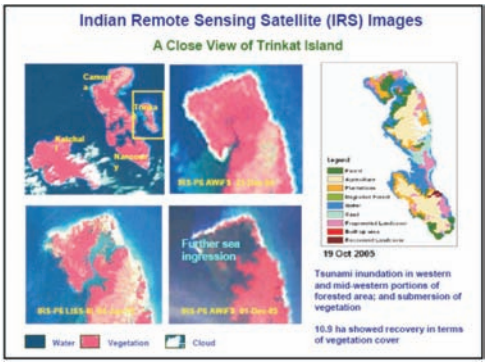

Change of Ganga river course near Patna during 1993
Patna
Patna
During May 1993
During Sept. 1993

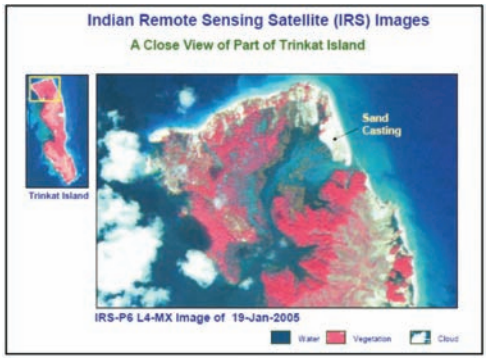
Handout 1.3.3.1

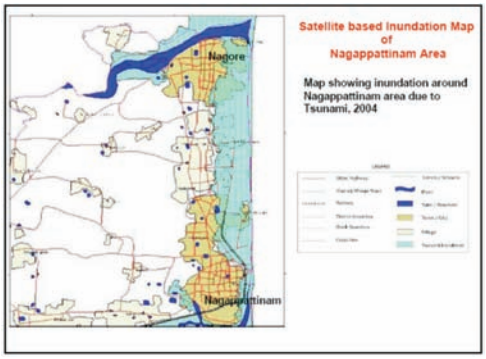


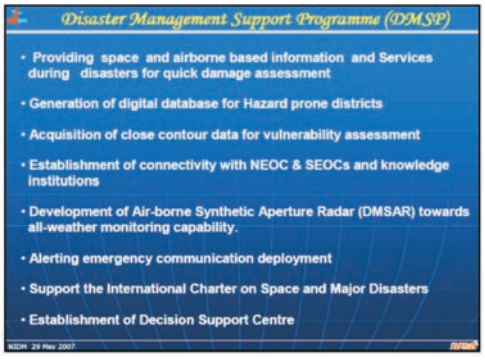












Decision Support Centre

Disaster Watch, Satellite data planning & Acquisition
Information Dissemination
Video conferencing facility

Servers for database, Web and floating licenses management networked storage systems

Satellite based VPN for Disaster Management:
.. an additional, secured, communication layer

- Linking NEOC with SEOCs, Knowledge Institutions & Key Offices of Govt.

Hub + 35 Nodes

Future Trends

Future Sensors

RISAT

- First Indian Microwave Sat
- Frequency – C-band (5.35 GHz)
- Dual-polarization
- Beam Modes (Single/Dual)
  - CRS-240Km – 50-60m
  - MRS-120Km – 24m
  - FRS-30Km – 3m
  - HRS-10Km x 10Km (SPOT) – 1m

DM-SAR

- Air-borne SAR
- Advantage
  - Any-time Flying
  - Total Coverage
- Frequency – C-band
- Beam Modes
  - Coarse – 30m
  - Medium – 5m
  - High – 1m

Lidar Mapping

Details

- High-resolution, high-accuracy, digital elevation data
- Day and night operation
- Independently geo-referenced intensity and elevation data
- Ranges to trees and to the ground beneath in a single pass
- Rapid coverage and data output

Future Activities

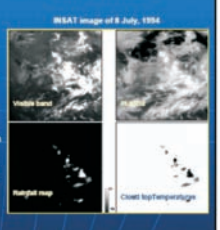
Details

- Rainfall Estimation
- Flood Forecasting & Warning
- Disaster Info through ERCs

Rainfall Estimation

- TRMM
- MeteoSat
- Insat

- Two rainfall event during 8-11 July, 1994 and 31 Aug-2 Sept, 1995 were studied.
- 3-hourly INSAT pictures were analysed.
- Cloud top temperature was taken as main parameter
- Observed daily rainfall was related to the average daily cloud top temperature for different threshold temperatures.
- Temperature threshold for best line of fit was determined



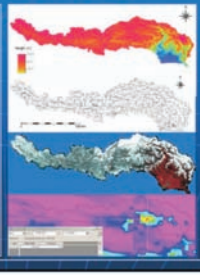
Flood Forecasting

Requirements

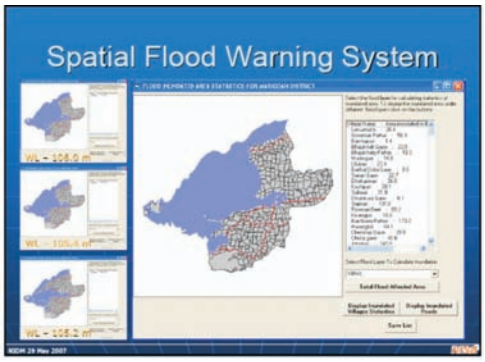
- Landuse/landcover
- Soil Map
- DEM
- Daily Rainfall Data derived from Meteosat 7 Satellite

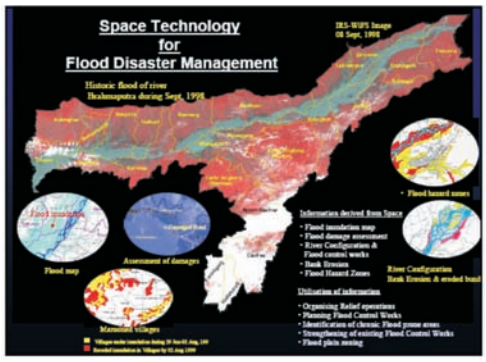
Models

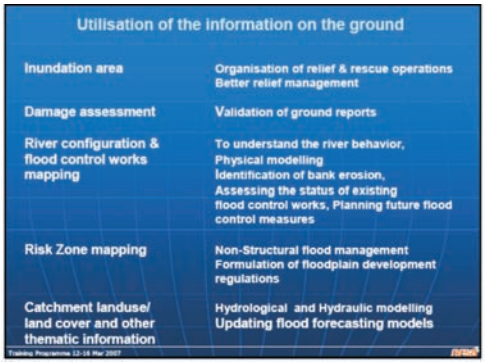
- Runoff Estimation: Modified SCS Model
- Modelling Direct Runoff: SCS Unit Hydrograph
- Flood Routing: Muskingum and SCS Lag methods Daily Rainfall Data derived from Meteosat 7 Satellite

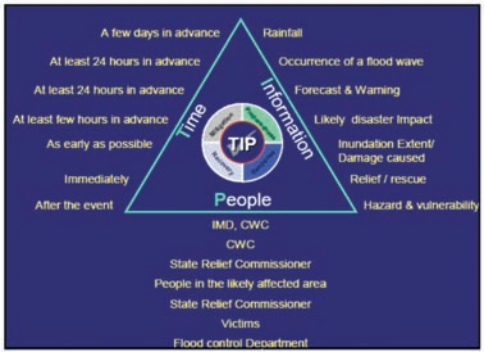


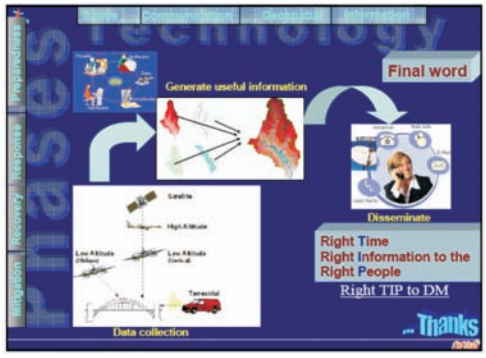
Handout 1.3.3.1











Annexure:

Handout 1.3.4.1

Effect of Flood on Health

Dr U.K.Tamuli, MS (Ortho)
Academy of Trauma, Assam

Natural disasters

Timing and Categories

Timing

- During flood
- Days and weeks after flood
- Long term effect after months and years

Category

Direct
Indirect

Direct effect

- Mortalities during drowning, heart attacks etc- topographical features
  - Absence of warning
  - Deep flood water
  - Contact with polluted water
  - Behaviour of the victim.
- Injuries- sprains, strains etc

Indirect Health injuries

- Infectious diseases-
  - Damaged water supply system
  - Damaged sewage system, underground piping.
  - Standing water
  - Rodent migration
- Poisoning and vector borne diseases.
- Clean up activities- electrocution.
- Inadequate transport system- food shortage
- Damage to normal health services.
- Post traumatic stress disorders

Health Risks

- Potential dangerous material
- Diarrheal diseases
- Wound infections
- Chemical hazards

Injuries

- Drowning
- Animal and insect bites
- Electrical hazards
- Wound

Safe drinking water

- Potable water
- Supply from government machineries.
- Chlorination of water

Handout 1.3.4.1

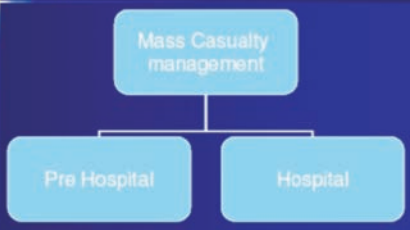
Hygiene and sanitation

- Sewage disposal
- Excreta disposals

Hand washing

- Before and after preparing food
- Before and after taking food
- After use of toilet
- During times of illness
- After handling an animal and animal waste
- After handling garbage

Planning and technical programme of MCM



Timely intervention

FIRST HOUR AFTER MEDICAL EMERGENCY IS THE GOLDEN HOUR

Training and capacity building

- Training in basic life saving skills,
- Training workshops
- Training in Triage
- Training in evacuation plans

Basic life support training

A: Airway with C-spine control.
B: Breathing to achieve adequate tissue oxygenation.
C: Circulation with haemorrhage control
D: Disability
E: Events and environment

RESCUE

- **Personal safety**
- **High index of suspicion for spinal cord injury**
- **Spinal immobilisation is important in high speed injury with drowning**

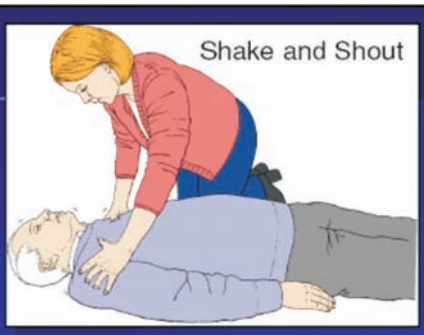
RESCUE

- **Rescuers must get professional help at the earliest**
- **Ideally victim should be in a horizontal or head down position**
- **This can be achieved by floating a victim supine onto a spine board .**

RESUSCITATION

A B C

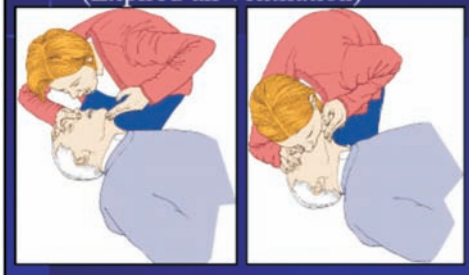
- AIRWAY: Air (Oxygen) >>> Lung
- BREATHING: Air (O_2 in Lung) >>> Blood
- CIRCULATION: Pumping Heart
  Blood (O_2) >>> Brain



Opening the airway

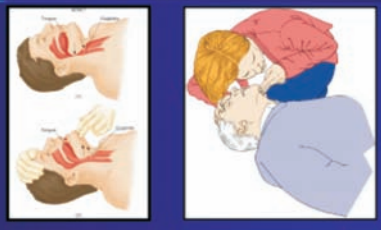
- Head tilt
- Chin lift
- If cervical spine injury suspected:
  - jaw thrust

Rescue breathing
(Expired air ventilation)



- Watch for chest fall

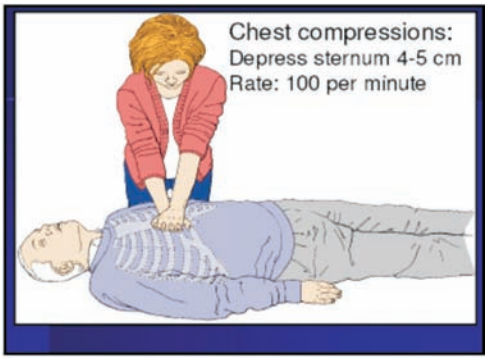
Airway maintenance and breathing

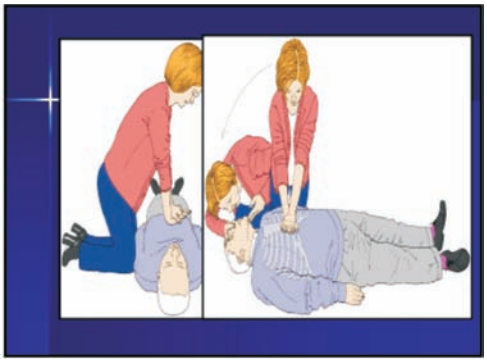


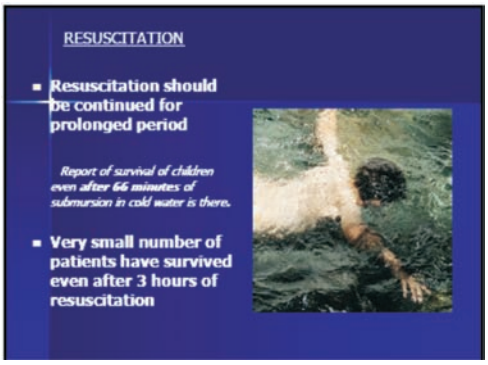
- Finger sweep

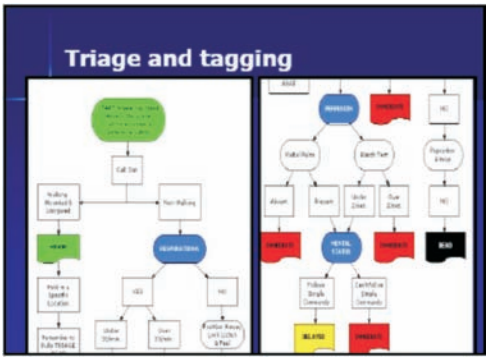
Assess Circulation

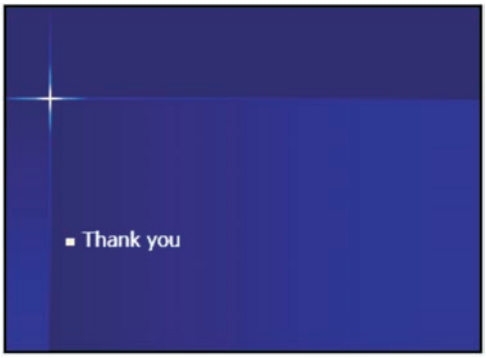
Handout 1.3.4.1



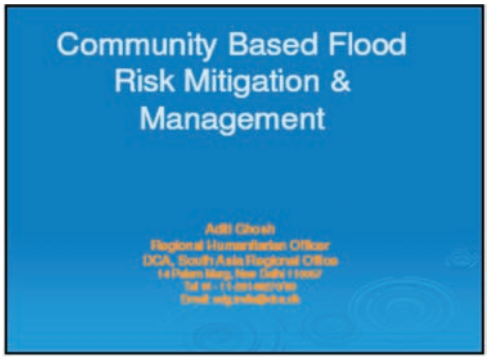


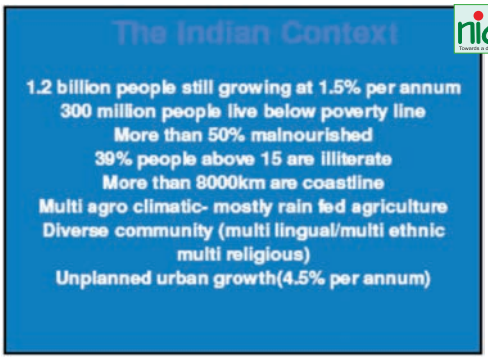


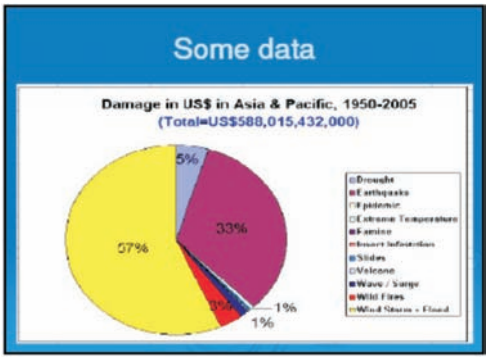


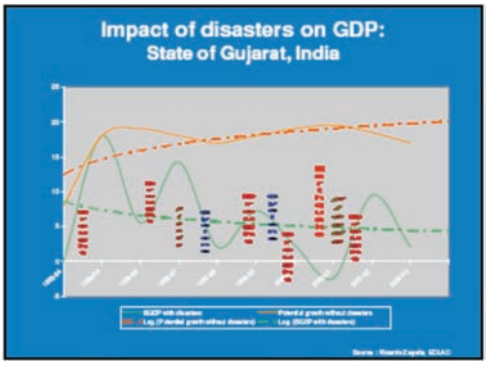


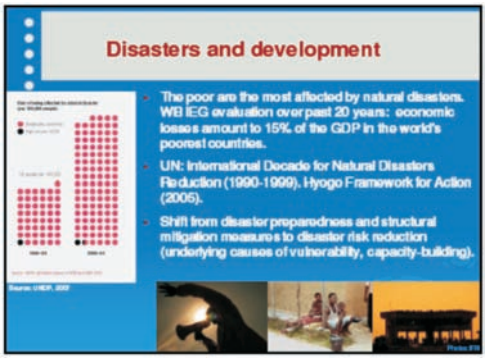
Annexure: Handout 1.3.5.1











Handout 1.3.5.1

Lessons from Recent Disasters

- Lack of disaster preparedness at all levels.
- Lack of mitigation planning
- Lack of communication networking and dissemination of information among states
- Delayed response due to mismanagement of relief, resources, manpower and duty delegation
- Lack of Interface and Coordination with State, District Administration & Community

HUGE LOSS OF LIFE & PROPERTY

Community Based Disaster (Risk) Management

- a process of disaster risk management in which at risk communities are actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in order to reduce their vulnerabilities and enhance their capacity.

Relevance of CBDRM

- Community is the first responder
- Maximum impact on the poorest and most vulnerable
- Community has its own strengths and resources
- Risk Management is a inclusive process
- Integral part of effective development
- Risk Management needs to be context and community specific

Various CBDRM

Preparedness Activities:

Awareness – Mobilization; Capacity Building; Village level task forces; Village contingency Plan; Drills

Mitigation Activities:

Construction of flood shelter, Raising plinth of house above flood level, deep tube-well with raised platforms

Risk Reduction Activities

Integration of DRR in to ongoing development (NREGA, NRHM, IAY, etc); Promoting safe practices- livelihood, water sanitation; Preparing and equipping the department to meet with the contingencies; Preparedness audit

Features of CBDRM

- Science and an Art
- Techno-Social-Admin - Policy related
- State of Mind
- A process - needs to be evolving
- 360 approach
- Emphasis on inclusion
- Proactive

CBDRM - Issues

- **Community level**
  - Ability to mobilize vulnerable and disempowered – Inclusion
  - Lack of interest of the community
  - Lack of capabilities
  - Resources
- **Administration level**
  - Lack of interest of the line staff
  - Lack of earmarked resources
  - Integration of DRM various line department is a challenging job
- **Management related**
  - Standard modules for training
  - Lack if trainers
  - Complexity and diversities of issues
  - Diverse or less understanding

Issues related to mobilization and participation

- Low awareness
- Other competing priorities
- Lack of hope, trust, information
- Continuous exploitation
- Fatality
- Support
- Linking with needs and future

Issues related to sustainability

- Lack of resources for continuation of efforts
- Lack of resources for mitigation activities
- Need is overwhelming
- Need vs Standard Approaches (IAY)
- Weak Baseline
- Weak Policy framework

Some Recommendations

- Set Goals
- Initiate individual, department & community level planning
- Identify and motivate champions
- Department level scoping & planning
- Integrate and monitor plans
- Check for impact of actions (Audit)
- Identify opportunities (Employment Guarantee Schemes etc)
- Establish village level mechanism enhancing preparedness, action plans
- Ensure availability of resources - PRI
- DRM Audit

Some Examples of Disaster Risk Reduction practices

Interim Shelter

Existing Hand Pumps

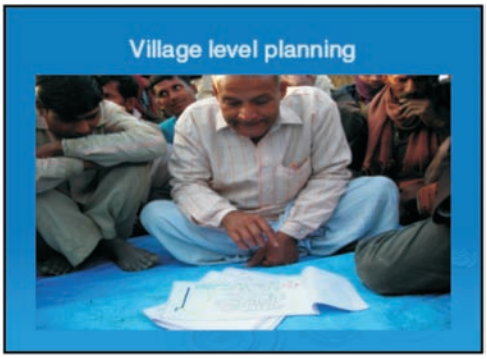
Hand Pumps installed by CARE

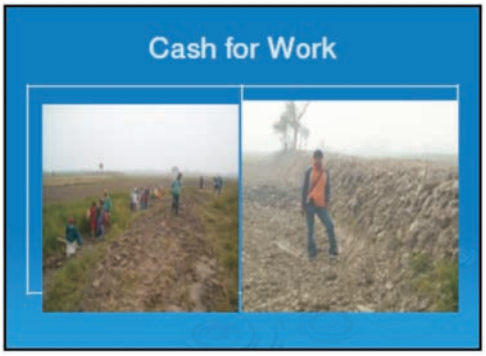
Social Inclusion

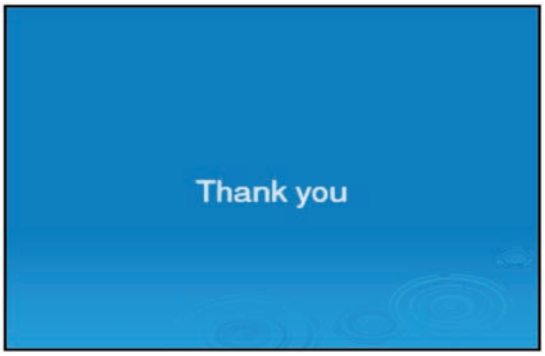
Sanitation

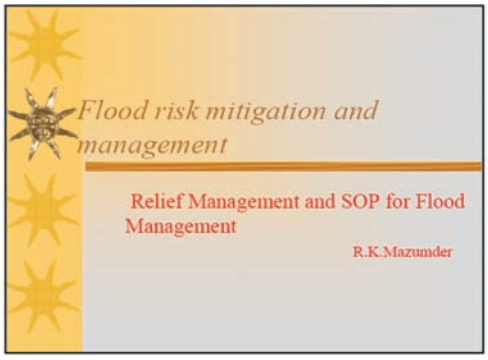
SANITATION

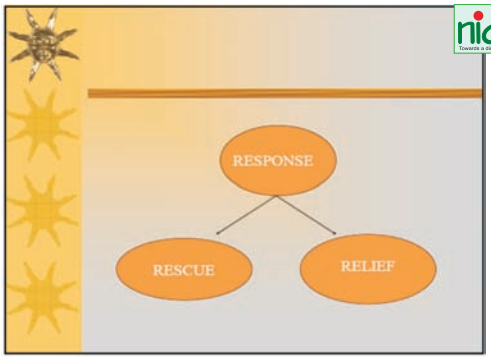
Handout 1.3.5.1

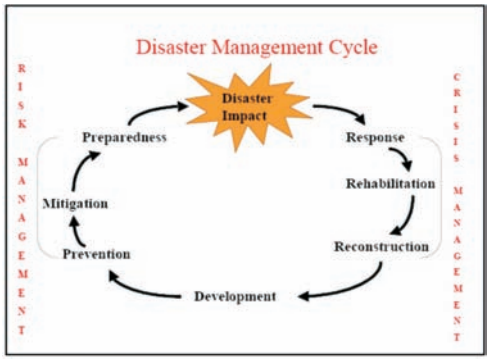


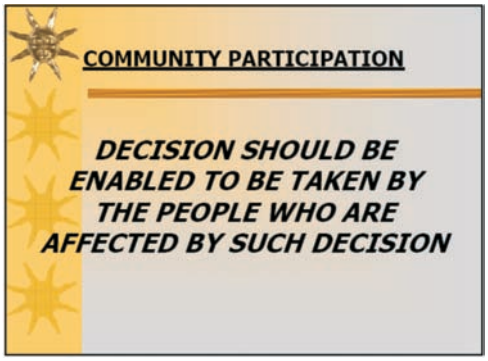


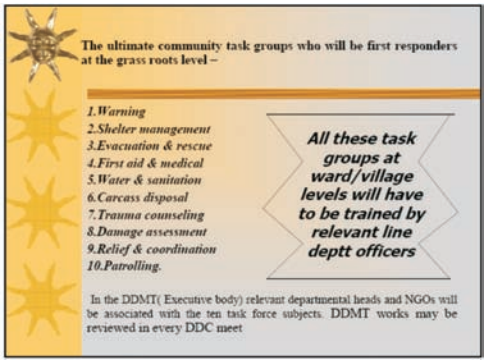


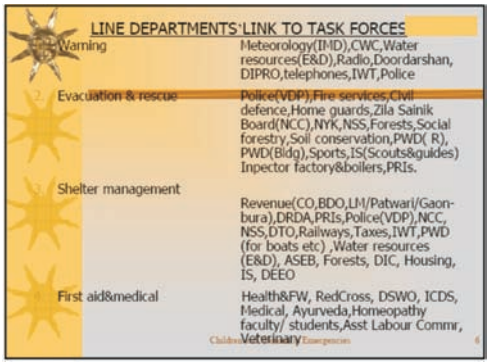

Flood risk mitigation and management
Relief Management and SOP for Flood Management
R.K.Mazumder

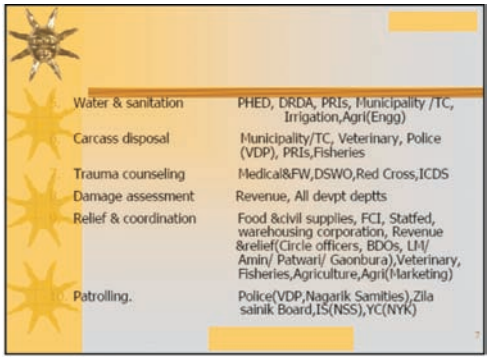

RESPONSE
RESCUE
RELIEF

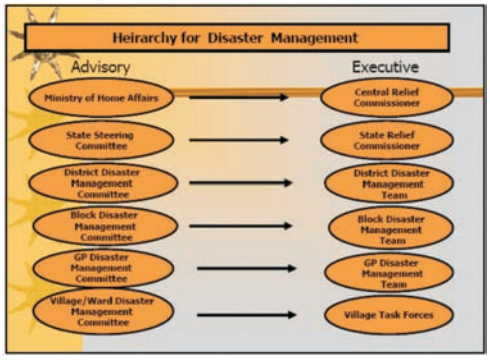

Disaster Management Cycle
RISK MANAGEMENT
CRISIS MANAGEMENT
Disaster Impact
Preparedness
Response
Rehabilitation
Reconstruction
Development
Prevention
Mitigation


COMMUNITY PARTICIPATION
DECISION SHOULD BE ENABLED TO BE TAKEN BY THE PEOPLE WHO ARE AFFECTED BY SUCH DECISION

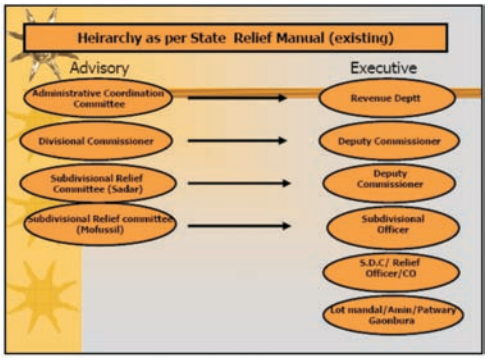

The ultimate community task groups who will be first responders at the grass roots level –
1.Warning
2.Shelter management
3.Evacuation & rescue
4.First aid & medical
5.Water & sanitation
6.Carcass disposal
7.Trauma counseling
8.Damage assessment
9.Relief & coordination
10.Patrolling.
All these task groups at ward/village levels will have to be trained by relevant line deptt officers
In the DDMT(Executive body) relevant departmental heads and NGOs will be associated with the ten task force subjects. DDMT works may be reviewed in every DDC meet

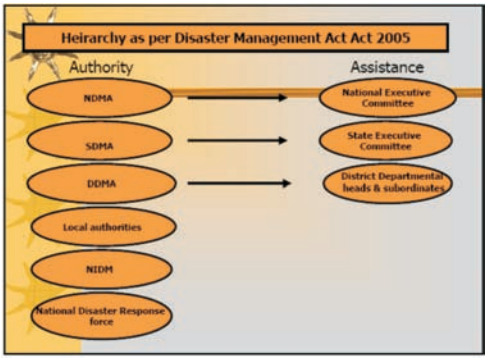

LINE DEPARTMENTS'LINK TO TASK FORCES
Warning
Meteorology(IMD),CWC,Water resources(E&D),Radio,Doordarshan, DIPRO,telephones,IWT,Police
Evacuation & rescue
Police(VDP),Fire services,Civil defence,Home guards,Zila Sainik Board(NCC),NYK,NSS,Forests,Social forestry,Soil conservation,PWD(R), PWD(Bldg),Sports,IS(Scouts&guides) Inpector factory&boilers,PRIs.
Shelter management
Revenue(CO,BDO,LM/Patwari/Gaon-bura),DRDA,PRIs,Police(VDP),NCC, NSS,DTO,Railways,Taxes,IWT,PWD (for boats etc) ,Water resources (E&D), ASEB, Forests, DIC, Housing, IS, DEEO
First aid&medical
Health&FW, RedCross, DSWO, ICDS, Medical, Ayurveda,Homeopathy faculty/ students,Asst Labour Commr, Veterinary

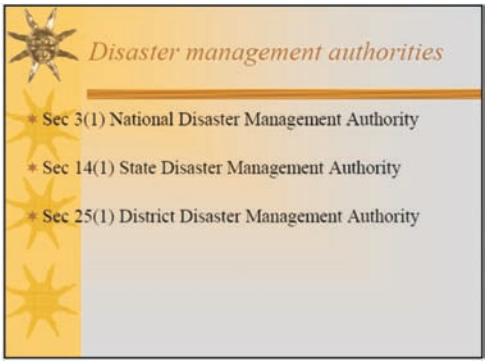

Water & sanitation
PHED, DRDA, PRIs, Municipality /TC, Irrigation,Agri(Engg)
Carcass disposal
Municipality/TC, Veterinary, Police (VDP), PRIs,Fisheries
Trauma counseling
Medical&FW,DSWO,Red Cross,ICDS
Damage assessment
Revenue, All devpt deptts
Relief & coordination
Food &civil supplies, FCI, Statfed, warehousing corporation, Revenue &relief(Circle officers, BDOs, LM/ Amin/ Patwari/ Gaonbura),Veterinary, Fisheries,Agriculture,Agri(Marketing)
Patrolling.
Police(VDP,Nagarik Samities),Zila sainik Board,IS(NSS),YC(NYK)

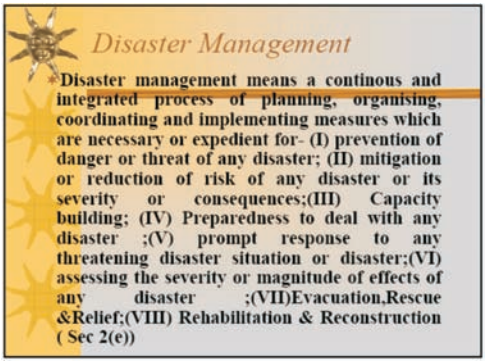

Heirarchy for Disaster Management
Advisory
Executive
Ministry of Home Affairs
Central Relief Commissioner
State Steering Committee
State Relief Commissioner
District Disaster Management Committee
District Disaster Management Team
Block Disaster Management Committee
Block Disaster Management Team
GP Disaster Management Committee
GP Disaster Management Team
Village/Ward Disaster Management Committee
Village Task Forces

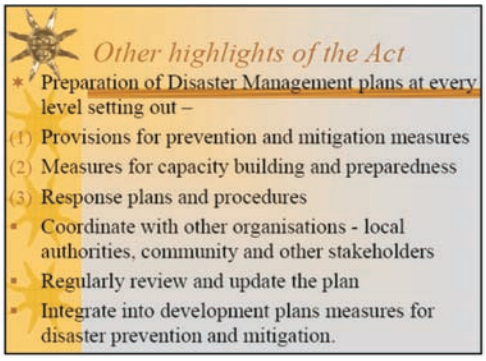
Handout 1.4.2.1

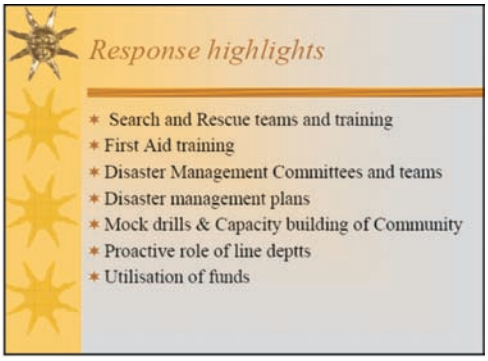


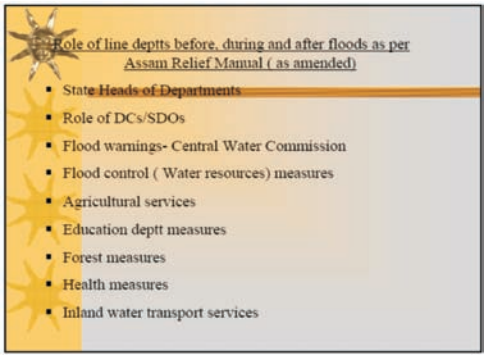


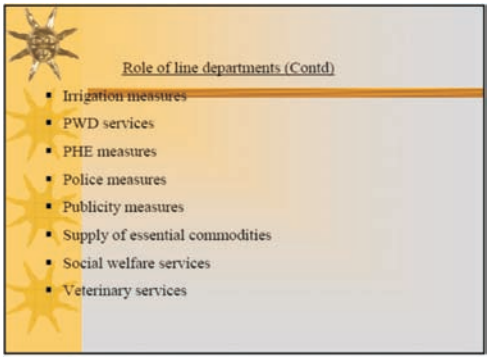












Scales of assistance under Assam Relief Manual(Standards)

(as amended as per Calamity Relief Fund norms)

Rice- 600 gms per adult per day

Pulses- 400 gms per adult per day

Salt- 30 gms per head per day

Mustard oil- 30 gms per head per day or

Chira – 600 gms per adult per day / 400 gms for minor

Gur-100 gms per head per day

In Relief camps- above plus Rs 4.00 per head per day and cost of temporary shelter.

Calamity Relief Fund operates under a **corpus** where the ration of contribution between the Central and State Govt is 75:25.. The share is contributed in **two instalments** in the months of May and November of each year.State Government should provide the share in the budget.UC, Annual report and constitution of State level committee for CRF is compulsory. Restoration of damaged capital works should ordinarily be met from the normal budgetary heads, except when it is to be incurred as part of **providing immediate relief such as restoration of drinking water sources or provision of shelters etc. or restoration of communication links for facilitating relief operations. Training** of the core multidisciplinary group created in the State allowable. Upto 10% CRF funds may be spent for procuring equipments for disaster management

National Calamity Contingency Fund

Natural calamities of cyclone, drought, earthquake, fire, flood and hailstorm, considered to be of severe nature requiring expenditure by the State Government in excess of the balances available in its own Calamity Relief Fund by the National Centre for Calamity Management (NCCM) will qualify for relief assistance under the Scheme. Entire corpus to be borne by the Govt of India. **Ministry of Home Affairs in respect of natural calamities of cyclone, earthquake, fire, flood, hailstorm and Ministry of Agriculture in respect of drought. Deputy Prime Minister/Home Minister, Agriculture Minister, Finance Minister and Deputy Chairman, Planning Commission** shall assume the role of the High Level Committee in deciding the manner and extent of assistance required to be provided to the States

Sphere standards

Launched in 1997 by humanitarian NGOs, Red Cross and Red Crescent movement. They framed a Humanitarian Charter and identified Minimum Standards to be attained in five key sectors – Water supply and sanitation, nutrition, food aid, shelter and health services . The Charter points out the legal responsibilities of states and warring parties to guarantee the right to protection and assistance.

The National Disaster Management Act 2005 has carved the role of NGOs in disaster management .

Sphere Standards

Two core beliefs-

(a) All possible steps should be taken to alleviate human suffering arising out of calamity and conflict

(b) Those affected by disaster have a right to life with dignity and therefore a right to assistance

(c) It consists of a handbook, a broad process of collaboration and an expression of commitment to quality and accountability

EMERGENCY SUPPORT FUNCTIONS

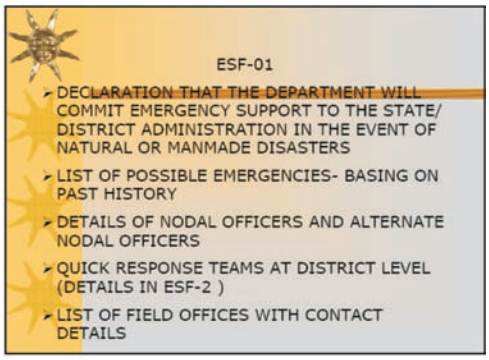
- TIMELY EFFECTIVE AND EFFICIENT COORDINATED ACTION FOR RESPONSE AND RELIEF RENDERED BY ALL MINISTRIES/ DEPARTMENTS DURING EMERGENCIES
- PREDETERMINED FUNCTIONS THAT SUPPORT THE CENTRE/ STATE / DISTRICTS
- STATE RELIEF MANUAL PROVIDES CONTINGENCY PLANNING BY DEPARTMENTS

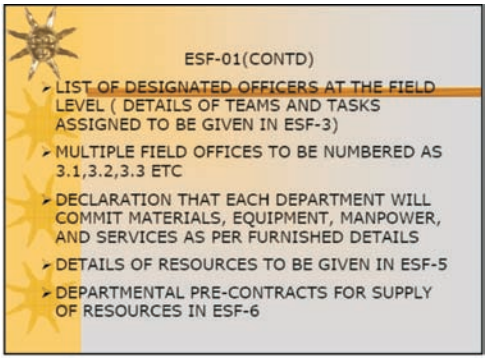
FEATURES

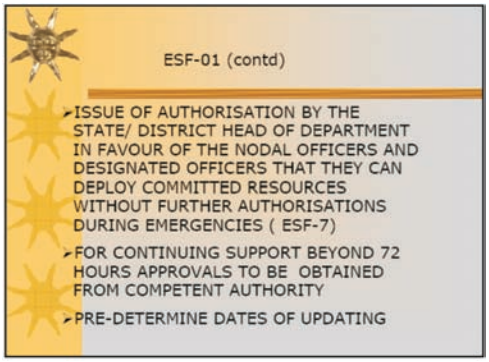
- THE PLAN FORMAT MUST BE COMPREHENSIVE
- IT IS TIME BOUND AND STRINGENT
- REQUIRES FREQUENT UPDATING
- FLEXIBLE TO ADJUST TO SITUATIONS AND NEEDS

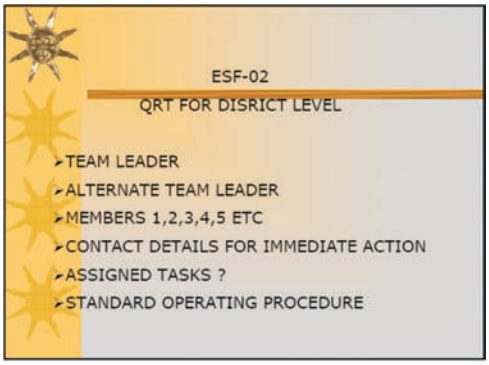
- RESOURCES ARE IDENTIFIED THAT REQUIRE TO BE PRE-CONTRACTED AND INCORPORATED
- FACILITATE TIMELY AND EFFECTIVE DEPLOYMENT OF MAN, MATERIAL, EQUIPMENT AND RESOURCES
- TWO DIMENSIONS OF ESF – OWN DEPARTMENT AND THE SUPPORT TO ADMINISTRATION

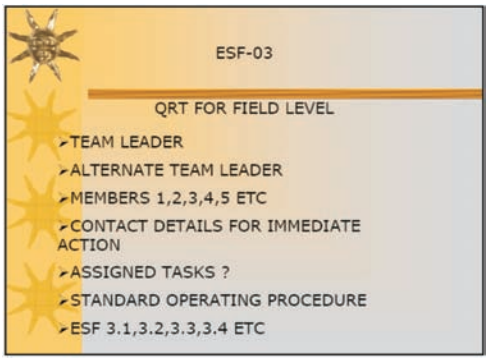
Handout 1.4.2.1

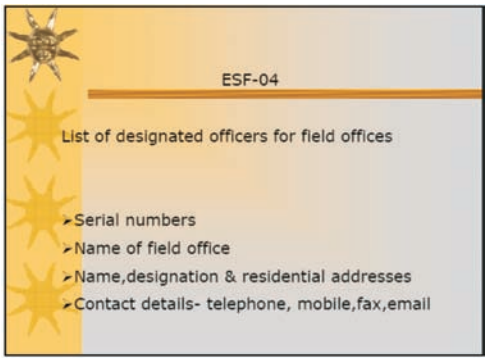


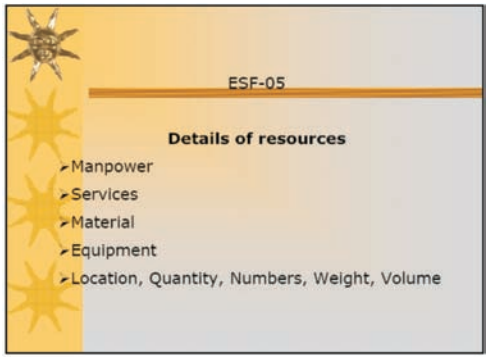


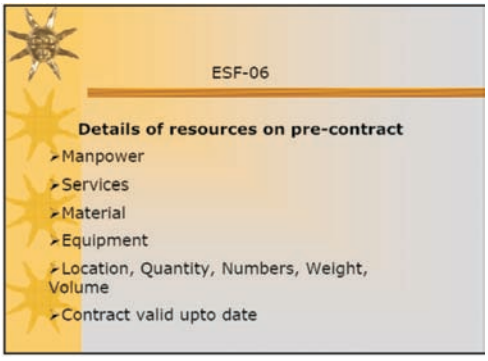












ESF-07

- AUTHORISATION BY HEAD OF STATE/DISTRICT HOD TO NODAL AND DESIGNATED OFFICERS FOR DEPLOYMENT OF RESOURCES WITHOUT FURTHER FORMALITIES DURING EMERGENCIES.
- BEYOND 72 HOURS –APPROVAL FROM COMPETENT AUTHORITIES

EMERGENCY SUPPORT FUNCTIONS FOR KAMRUP METROPOLITAN DISTRICT

ESF	FUNCTION	TEAM LEADER
1	Coordination	Deputy Commissioner
2	Communication	Senior Supdt Police
3	Search& rescue	District Fire officer
4	Medical response	Joint Director Health
5	Relief-food+shelter	ADC (F&CS)
6	Logistics(traffic/elect/water)	ADC
7	Transport	DTO
8	Damage assessment	ADC Relief
9	Volunteers& donations	Lions Club

(contd)

STANDARD OPERATING PROCEDURE FOR ADMINISTRATION

Pre-Arrangements

Convening meetings of the District Level Committee on Natural Calamities. It consists of Deputy Commissioner/Collector as Chairman with districts line department heads like electricity, police, revenue, home guard, irrigation, telephone, medical, rural development *etc* as members, to review the arrangements.

Check composition and functioning of the Control Room.

Closure of past breaches in rivers and canal embankments and guarding of weak points;

Rain-recording and submission of rainfall reports;

Communication of gauge-readings and preparation of maps and charts;

Dissemination of weather reports and flood bulletins issued by the Meteorological Centres, Central Water Commission, Flood Forecasting Organisation;

Deployment of boats at desired points;

Use of power boats at strategic stations;

Installation of temporary police wireless stations and temporary telephones in flood-prone areas;

Arrangements for keeping telephone and telegraph lines in order;

Storage of food in interior, vulnerable, strategic and key areas;

Arrangements of dry food stuff and oi.1}er necessities of life;

Arrangements of keeping the drainage system de silted and properly maintained;

Agricultural measures;

Health measures;

Veterinary measures;

Selection of flood shelters;

Advance arrangements for army assistance;

Training in flood relief work;

Organisation of relief parties;

Other precautionary measures; and

Alternative drinking water supply arrangements.

STANDARD OPERATING PROCEDURE FOR ADMINISTRATION

•Organizing Rescue Operations during

•Organising shelter for the people in distress. In case the efforts of civil authorities are found inadequate, Army, Para Military Force assistance should be requisitioned;

Relief measures by non-official and voluntary organizations may be enlisted as far as possible

Organise relief camps;

Provision of basic amenities like drinking water, sanitation and public health care and arrangements of cooked food in the relief camps;

Making necessary arrangements for air dropping of food packets in the marooned villages through helicopters;

Organising enough relief parties to rescue the marooned people within a reasonable time limit;

Disposal of dead bodies and animal carcasses;

Establish alternate communication links to have effective communication with marooned areas;

Organising controlled kitchens to supply food initially at least for 3 days;

Organising cattle camps, if necessary and provide veterinary care, fodder and cattle feed for the affected animals for atleast 3 days;

Grant of emergency relief to all the affected people;

Submission of daily situation reports and disseminate correct information through mass media to avoid rumours.;

Rehabilitation of homeless;

Commencement of agricultural activities - desiltation, resowing;

Repairs and reconstruction of infrastructure facilities such as roads, embankments, resettlement of flood prone areas;

Health measures;

Relief for economic reconstruction.

EMERGENCY SUPPORT FUNCTIONS FOR KAMRUP METROPOLITAN DISTRICT

ESF	FUNCTION	TEAM LEADER
10.	Public Works	SE PWD (Building)
11	Road debris clearance	Commissioner GMC
12	Helpline/ public information	DIPRO
13	Law & order	ADC
14	Carcass disposal, cattle resource Recovery and care	DVO

STANDARD OPERATING PROCEDURES

- STEP BY STEP SEQUENCING OF ACTIVITIES AND ORDERLY COMPLIANCE AS PER SPECIFIC DETAILMENT AND DEPLOYMENT
- CHECK LISTS
- PRE DECIDED AUTHORITY TO ACT IN COMPLIANCE
- ARE STANDARDS OF SERVICES TO BE DELIVERED WITH THE CHECKLISTS FOR FIELD MONITORING

Handout 1.4.2.1

STANDARD OPERATING PROCEDURE FOR ADMINISTRATION

Post Management

Speedy restoration of roads, rail routes and the postal services;
Normal water supply in the affected areas either by arranging tankers or fire tenders;
Repair of power, telephone and sewerage lines on priority basis;
Proper arrangements for the supply of food, shelter and clothing to the marooned people;
Ensuring adequate supply of POL and kerosene oil to keep the supply line moving;.
Constitution of a survey team to assess the loss and compensation to be given to the affected population;
Assistance to people in getting insurance claim, who have taken 'crop' and 'house' insurance;
Assistance for repair/rebuilding of private properties; and
Desilting and dewatering of the inundated areas.

Check list

* Pre-flood arrangements :
* Convening a meeting of the District Level Committee on Natural Calamities;
* Functioning of the Control Rooms;
* Closure of past breaches in river and canal embankments and guarding of week points;
* Rain-recording and submission of rainfall reports.
* Communication of gauge-readings and preparation of maps and charts;

* Assigning charge of flood Circles;
* Dissemination of weather reports and flood bulletins issued by the meteorological Centres, Central Water Commission , Flood Forecasting Organisation;
* Deployment of boats at strategic points;
* Use of power boats;
* Installation of temporary Police Wireless Stations and temporary telephones in flood-prone areas;

* Arrangement for keeping telephone and telegraph lines in order;
* Storage of food in interior ,vulnerable strategic and key areas;
* Arrangements of dry food stuff and other necessities and of life;
* Arrangements for keeping the drainage system desilted and properly maintained.
* Agricultural measures;
* Health measures;
* Veterinary measures;

* Selection of flood shelters;
* Advance arrangements for army assistance;
* Training in flood relief work;
* Organisation of relief parties;
* Other precautionary measures ; and
* Alternative drinking water supply arrangements;

* **ARRANGEMENTS DURING AND AFTER FLOODS:**
* Organising rescue operations.
* Organising shelter for the people in distress, in case the efforts of the Civil authorities are considered inadequate, Army assistance should be requisitioned.
* Relief measures by non-official and voluntary organisations may be enlisted as far as possible.
* Organise relief camps.
* Provision of basic amenities like drinking water, sanitation and public health care and arrangements of cooked food in the relief camps.

* Making necessary arrangements for air dropping of food packets in the marooned villages through helicopters.
* Organising enough relief parties to the rescue of the marooned people within a reasonable time limit.
* Establish alternate communication links to have effective communication with marooned areas.
* Organising controlled kitchens to supply foods initially at least for 3 days.
* Organising cattle camps, if necessary, and provide veterinary care, fodder and cattle feed to the affected animals.
* Grant of emergency relief to all the affected people.

* Submission of daily reports and disseminate correct information through mass media to avoid rumors.
* Rehabilitation of homeless.
* Commencement of agricultural activities-desiltation, resowing.
* Repairs and reconstructions of infrastructural facilities such as roads, embankments, Resettlement of flood prone areas.
* Health measures.
* Relief for economic reconstruction.

What should we do?

Be Prepared

✓Know your local flood risk - Do nearby streams and rivers flood easily?

✓Know and understand watches and warnings

✓ FLASH FLOOD WATCH - Flash flooding is possible within the designated WATCH area, be alert.

✓ FLASH FLOOD WARNING - Flash flooding has been reported or is imminent, take necessary precautions at once.

During the Flood

•

Avoid areas prone to sudden flooding

• If the water is above your ANKLES, STOP!!

• If you are driving and come to a flooded roadway, STOP!! - The road ahead could be washed out. The depth of the water can also be deceiving.

• Keep children away from flooding areas, flowing streams, storm drains, viaducts, and arroyos.

• Keep your TV or radio tuned for weather info.

• Listen for distant thunder runoff. The heavy rain from a thunderstorm could cause a flash flood. Be especially cautious if the soil is already saturated with water, flooding can occur much more easily.

COMPONENTS OF THE OPERATIONS PROCEDURE

Preamble

Planning assumptions- no compromise on standards,mobilise community participation,response plan , orientation & training, preventive measures

Disaster management action plan (DMAP)

Cancel leave- recall out of station officials, DM command, communications , Nodal officers, recruit casual labourers, tools & equipments, funds, reports & accounts, equipment protection drill, fuelling vehicles, water topping, emergency water,monitor water installations

[illegible]tal generators & pumps, acquire & hire tankers,networking all transit & relief camps, stock of pipes/connections/joints/hydrants/bleaching powder/tools,Covering machines and tools, buffer stock of fuel & lubricants, emergency work gangs

Relief – emergency repairs, identify sources of drinking water, seal unacceptable water, water storage in all selected points, test quality of water,emergency accomodation of staff, report and accounts

Water supply source- (piped – repair, flush with chlorine 50mg/litre, disinfection operation, bacteriological tests), Private,Springs and wells, (sanitary survey,30 mtr distance from possible contamination source, ensure platform,cover manhole cover and gates ,), Surface water(last resort due to e-coli infection caused by human etc wastes)

Chlorination through gas , hypochlorinators, continuous , physical protection of water supply sources, Stockpile of sanitation equipment and supplies.

Preparation and maintenance of checklist

SOP for Hospitals

Structural safety, Evacuation plan, Reception area, triage, information centre, Crowd control, Colour codes,Emergency supplies (Surgical packs, analgesics, antibiotics, dressings, splints,disposable syringes etc,) Simulation & mock drill, declaration of emergency, mass casualty management, training and role of personnel, blood banks & transit camps,constant rapport with District Administration, evaluation

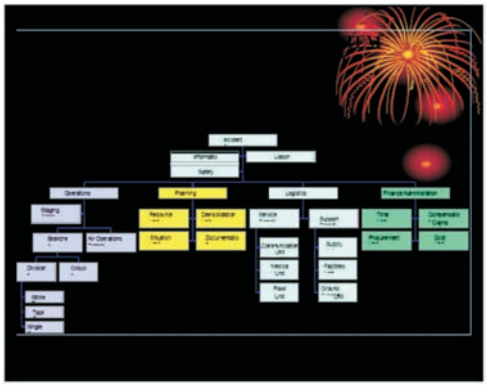
Last but not the least…….

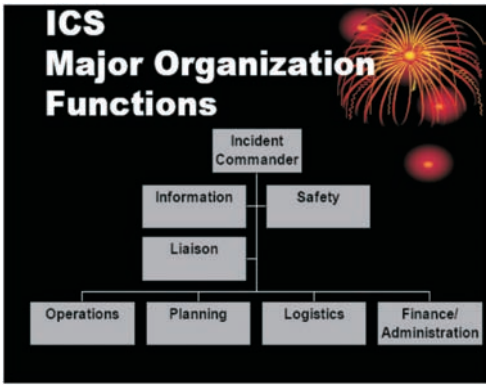
IF WE KEEP DOING THE SAME THINGS WE WILL KEEP GETTING THE SAME RESULTS. TO GET DIFFERENT RESULTS, WE WOULD HAVE TO DO THINGS DIFFERENTLY----

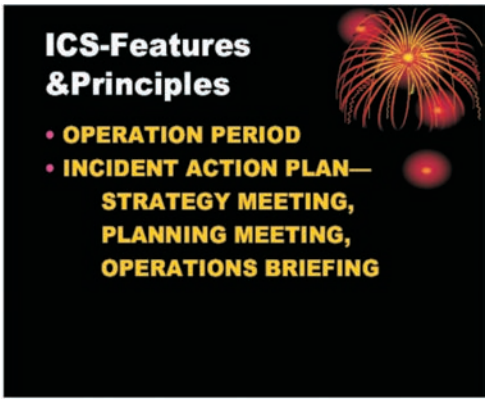
ALBERT EINSTEIN

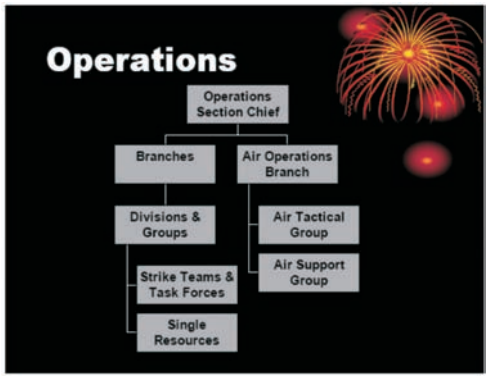
THANK YOU

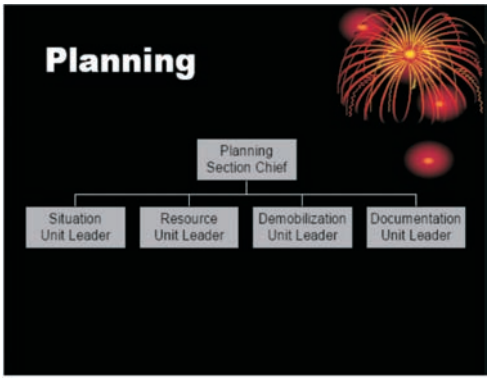
Presention - Shri Bishwanath Dash, Assitt. Professor, NIDM








Operations
Operations Section Chief
Branches
Air Operations Branch
Divisions & Groups
Air Tactical Group
Air Support Group
Strike Teams & Task Forces
Single Resources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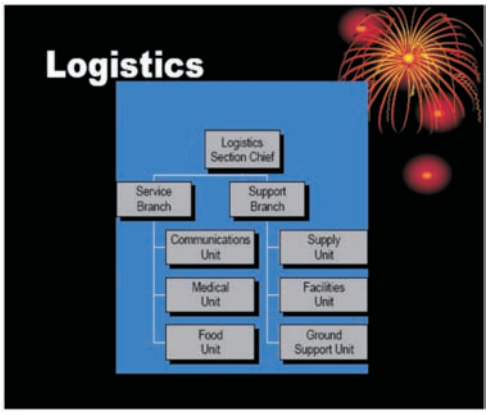
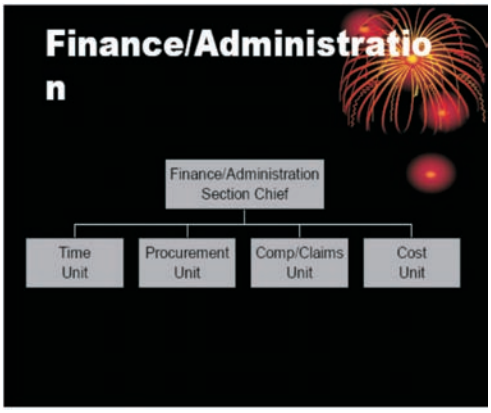
Situation Unit Leader
Resource Unit Leader
Demobilization Unit Leader
Documentation Unit Leader

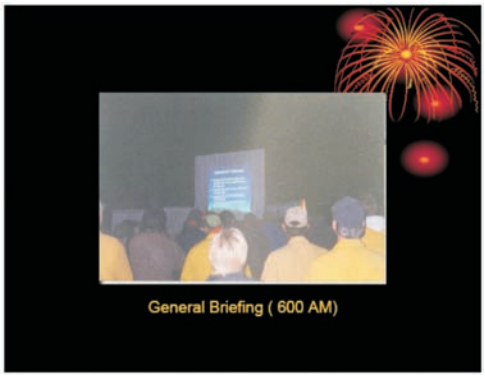

Logistics
Logistics Section Chief
Service Branch
Support Branch
Communications Unit
Supply Unit
Medical Unit
Facilities Unit
Food Unit
Ground Support Unit


Finance/Administratio n
Finance/Administration Section Chief
Time Unit
Procurement Unit
Comp/Claims Unit
Cost Unit

DISTRIBUTION CENTRE – Communication Equpts

TENTS – USED AT ICP/BASE/CAMP

Handout 1.4.4.1



Climate Change and Natural Disasters

Prof. Vinod K. Sharma
Indian Institute of Public Administration, New Delhi

Background

- World Conference on Human Environment 1972 (Stockholm Conference)
- World Commission on Environment and Development -1987
- Rio Earth Summit (2002)
- Agenda 21
- COP-15 Copenhagen Conference

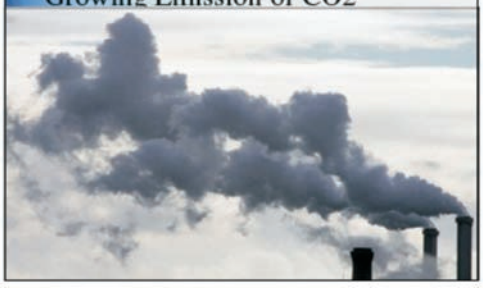
What is Global Warming

- Global warming refers to an average increase in the Earth's temperature, which in turn causes changes in climate.
- A warmer Earth may lead to:
  - changes in rainfall patterns
  - rise in sea level
  - wide range of impacts on plants, wildlife, and humans.

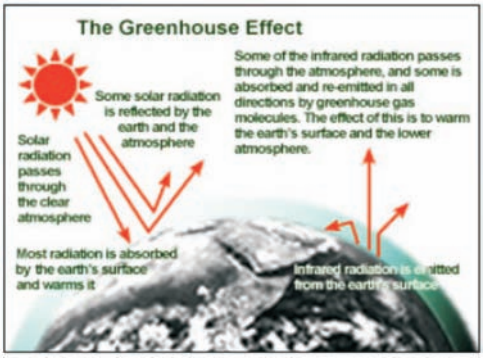
Global Warming

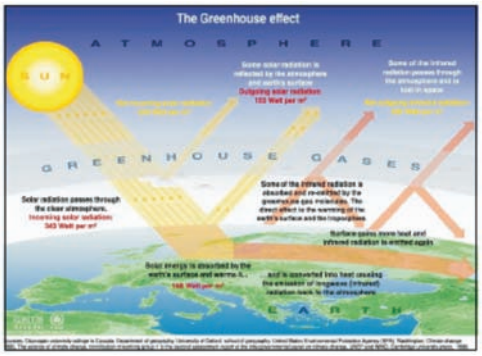
- Natural
- or Man Made
- or Both

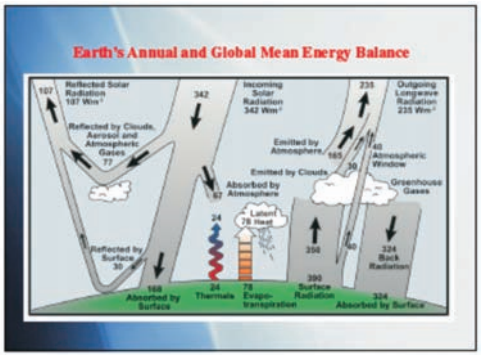
Growing Emission of CO2



The Greenhouse Effect







Handout 1.5.3.1

Greenhouse Gases

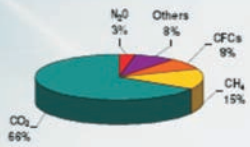
- Carbon dioxide (CO_2) 50%
- Methane (CH_4) 18%
- Nitrous oxide (N_2O) 6%

} 74%

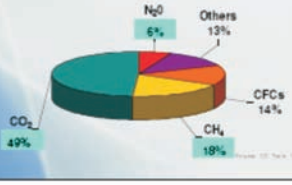
- Hydroflurocarbons (HFCs)
- Perflurocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

} 26%

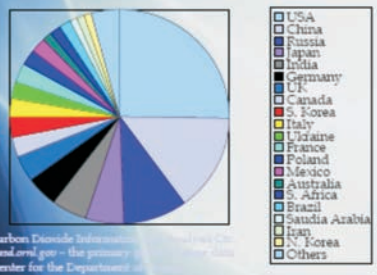
Contributions of GHGs to Global Warming: The Last 100 Years



Contributions of GHGs to Global Warming: The 1980's

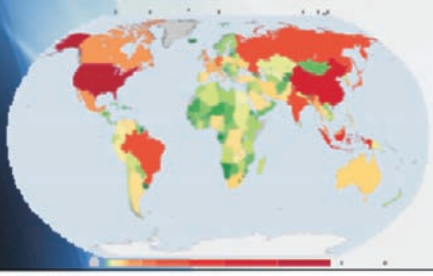


"The Top 20" Producers of CO_2 Emissions

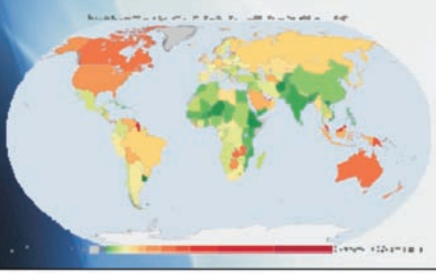


Source: Carbon Dioxide Information ... http://cdiac.esd.ornl.gov – the primary ... analysis center for the Department ...

Per Country GHG in 2000



Per Capita GHG in 2000



Greenhouse Effect

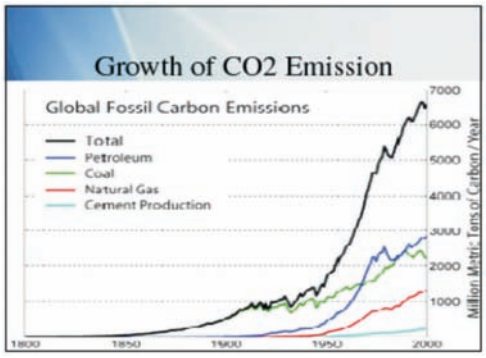
- The greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere trap energy from the sun.
- Without these gases, heat would escape back into space and Earth's average temperature would be approx. 20+ C colder.

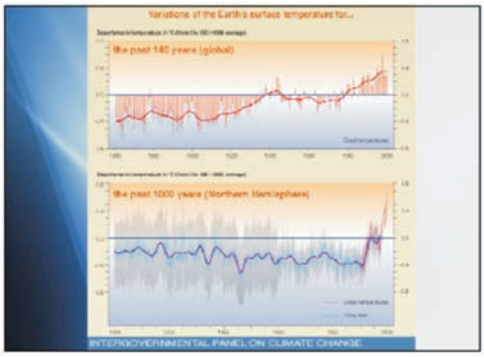
Carbon Dioxide Increasing in Atmosphere

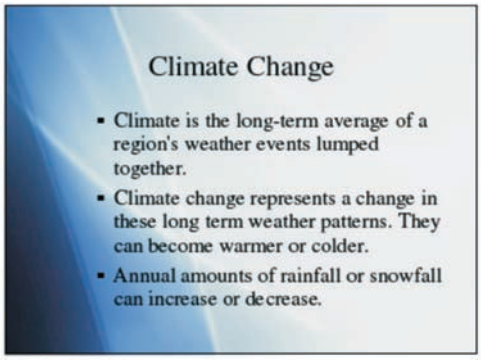
- Since pre-industrial times carbon dioxide, have increased from 280 to 380 ppm-- a 30% increase.
- Carbon dioxide concentrations in the atmosphere are the highest in last 160,000 years.
- Other green house gases are also increasing

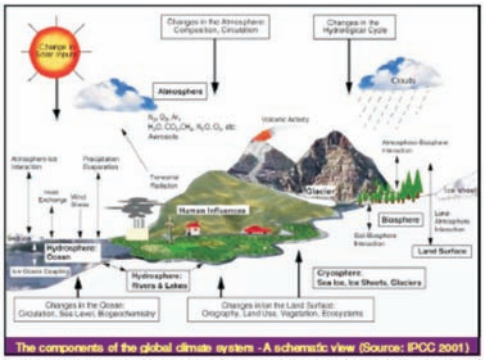
Carbon Dioxide increasing in Atmosphere

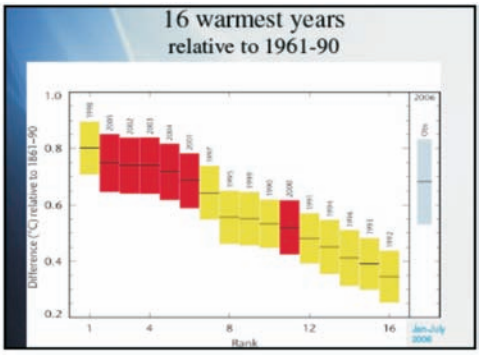
- **Carbon dioxide is a by-product of the burning of fossil fuels.**
- **The atmospheric levels of the greenhouse gas carbon dioxide, have increased since pre-industrial times from 280 part per million (ppm) to 370 ppm, a 30% increase.**
- **Carbon dioxide concentrations in the atmosphere are the highest in 160,000 years.**

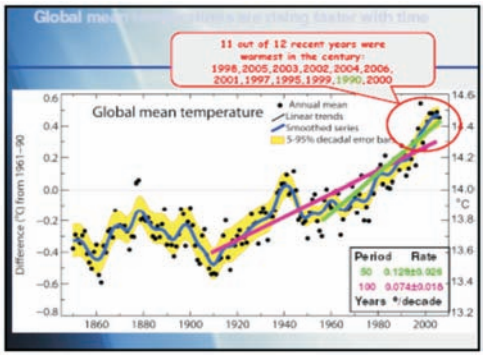

Growth of CO2 Emission
Global Fossil Carbon Emissions
Total
Petroleum
Coal
Natural Gas
Cement Production
Million Metric Tons of Carbon / Year
7000
6000
5000
4000
3000
2000
1000
1800
1850
1900
1950
2000

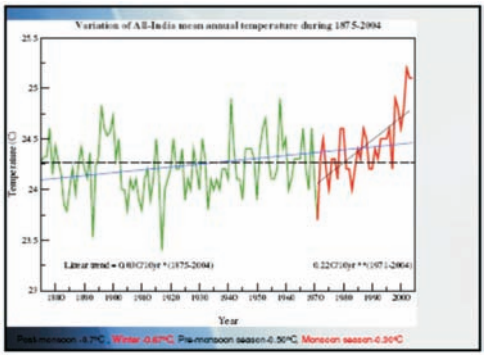

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

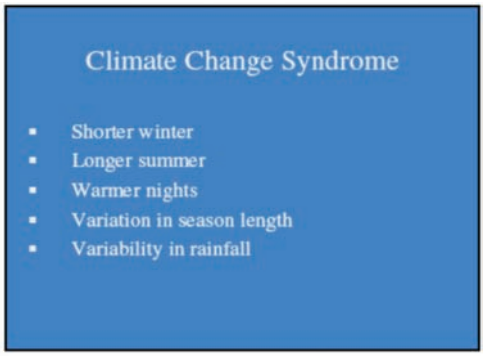

Climate Change
Climate is the long-term average of a region's weather events lumped together.
Climate change represents a change in these long term weather patterns. They can become warmer or colder.
Annual amounts of rainfall or snowfall can increase or decrease.


Atmosphere
Clouds
Glaciers
Biosphere
Land Surface
Hydrosphere: Ocean
Hydrosphere: Rivers & Lakes
Cryosphere: Sea Ice, Ice Sheets, Glaciers
The components of the global climate system -A schematic view (Source: IPCC 2001)

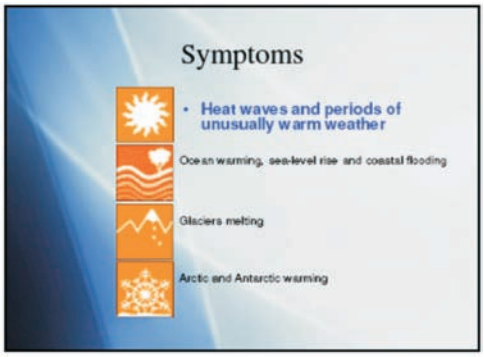

16 warmest years
relative to 1961-90
Difference (°C) relative to 1961-90
Rank

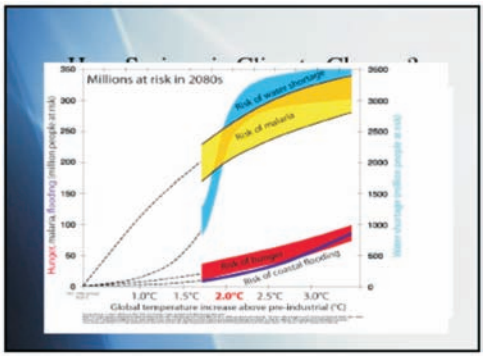

11 out of 12 recent years were warmest in the century:
1998,2005,2003,2002,2004,2006,
2001,1997,1995,1999,1990,2000
Global mean temperature
Annual mean
Linear trends
Smoothed series
5-95% decadal error bar
Difference (°C) from 1961-90
°C
Period Rate
50 0.12±0.029
100 0.074±0.018
Years °/decade

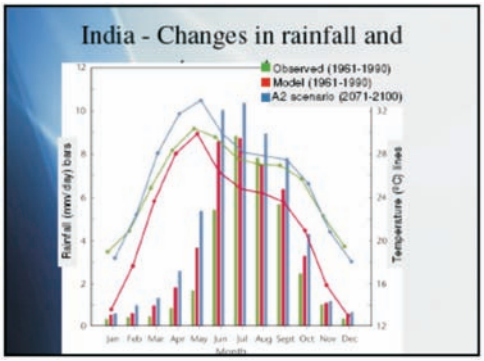

Variation of All-India mean annual temperature during 1875-2004
Temperature (°C)
Year

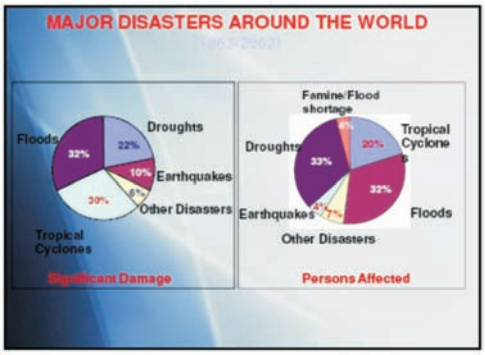

Climate Change Syndrome
Shorter winter
Longer summer
Warmer nights
Variation in season length
Variability in rainfall

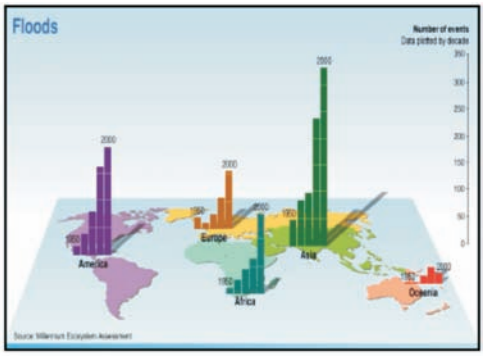
Handout 1.5.3.1

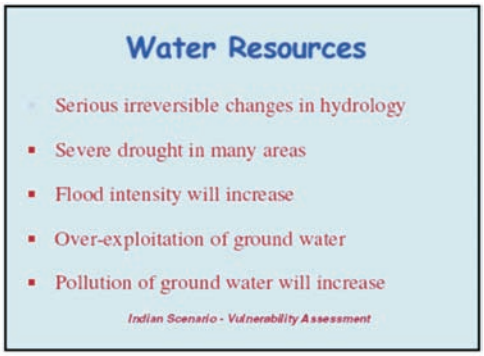


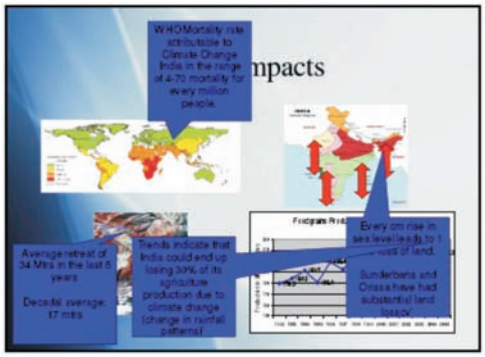












Climate Change and Wheat Production

- Climate change could strongly affect the wheat crop that accounts for 21% of food and 200 million hectares of farmland worldwide.
- By 2050, as a result of possible climate shifts in the Indo- Gangetic Plains (IGPs) – currently part of the favorable, high potential, irrigated, low rainfall mega-environment, which accounts for 15% of global wheat production – as much as 51% of its area might be reclassified as a heat-stressed, irrigated, short-season production mega-environment.

Wheat - Demand and Supply

- India's concerns relating to food grains, in general, and wheat, in particular, are becoming more serious.
- While demand continues to expand rapidly, output has turned unsteady in the last six or seven years, as much because of water stress and declining soil health as the effects of global warming.

Current Trends to watch

- Increased cloud bursts in Himachal Pradesh
- Rising temperature trends in Orissa (Talcher 52 degrees Celsius)
- Freak floods in Barmer, Rajasthan
- Drought in Assam
- Glacier depletion all along Himalayan Belt
- Crop failure due to rainfall variations
- Increased migration to large cities in search for work

Trends to Expect in Future

- Increased flooding and droughts due to rainfall variations
- Increased flooding for some years due to snow melt
- Droughts after some year due to disappearance of glaciers and water sources
- Severe cyclones, specially in WB, Orissa, AP, TN, Gujarat
- Crop failures

Examples of negative effects

- **Drought**
  - **Recent increases in drought are due at least in part to man-made greenhouse gases**
  - **Widespread increases in drought are predicted**
- **Moderate drought**
  - **Coverage has increased from 15% to 25% of the world's surface**
  - **Coverage is projected to double to 50% by 2100**
- **Regional effects**
  - **Drought may increase in South America and Africa**
  - **Likely to put stress on plants and water resources**

Why cyclones will be worse?

- Sea level rise will make more land area susceptible to storm surges, as its elevation will be reduced
- Temperature variations will result in increased wind speeds
- Due to lowered crop yield in inland areas, the population concentration will have increased more in coastal towns for work, resulting in more population at risk

Examples of limited positive

- All local and limited to particular factors
- India
  - General crop growth may increase ✓
  - Reason – increased rainfall ✓
  - BUT detail for groundnuts - reduced productivity in far north of India ✓ x
  - BUT – extra rainfall also means increased flooding x
  - Uncertainty – some models predict decreased rainfall and therefore more damage to crops x
- China
  - Climate effect – some crops increase others decrease ✓ x
  - Associated with some increases and some decreases in water availability ✓ x
  - Carbon fertilisation – enhances crop growth (note uncertainty in numbers) ✓

Handout 1.5.3.1

Who is at Risk?

- Particularly the poor
- Inhabitants of coastal towns and villages, fishermen hamlets, islanders
- Farming communities dependent on rainfed agriculture
- Hill communities dependent on natural water sources
- Megacities with high water demand

Global warming And Diseases

- Malaria
- Bird Flu
- Med Cow Disease
- Other Animal Diseases

Warnings

Spreading disease

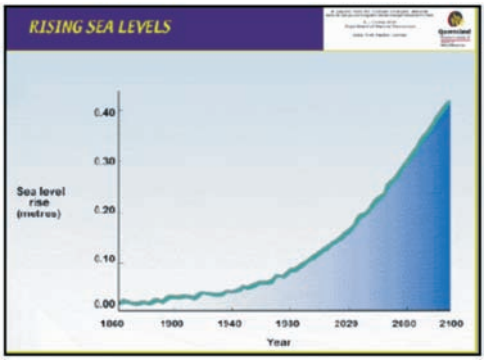
Earlier spring arrival

Plant and animal range shifts and population changes

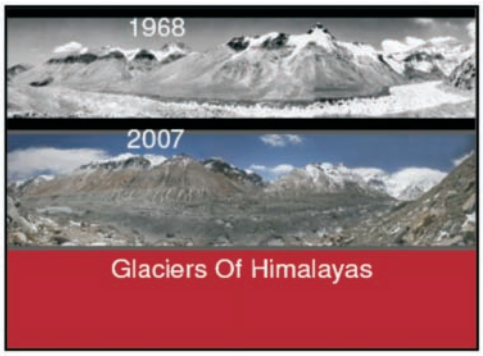
Coral reef bleaching

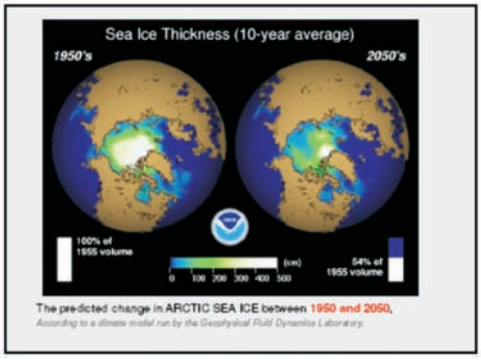
Downpours, heavy snowfalls, and flooding

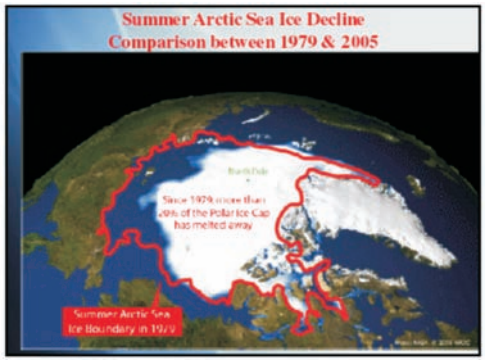
Droughts and fires

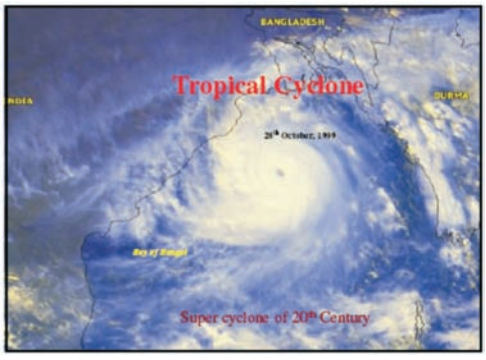


As the climate warms up mountainous regions may experience lower levels of snowfall. This image shows Mount Hood in Oregon, USA, at the same time in late summer in 1995 and 2002.









According to IFRC World Disaster Report 2006

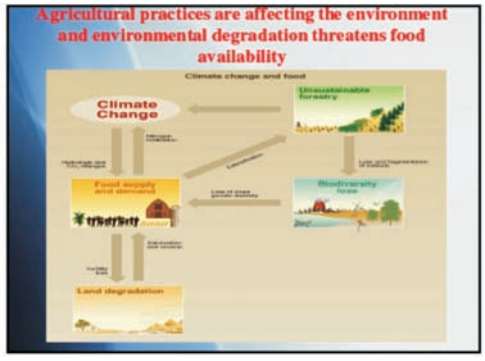
- In last 10 yrs 86% increase in natural disasters
- Drought and famine proved deadliest disasters

Expected Extra People at Risk From Future Climate Change

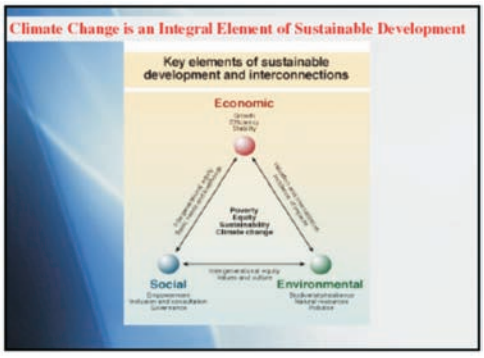
- 50 m 2020
- 132 m 2030
- 266 m 2080

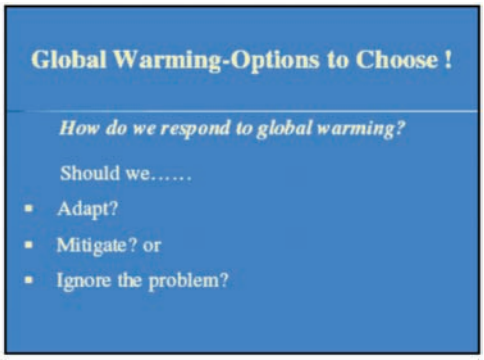
Direct Impact on All Areas

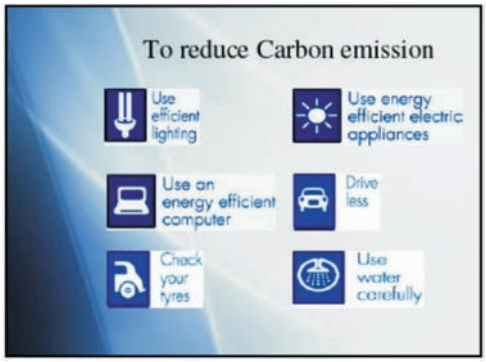
- Increased frequency, increased severity, and less predictability of :
  - Cyclones and Storms
  - Floods
  - Flash floods
  - Cloud bursts
  - Snow fall
  - Heat waves

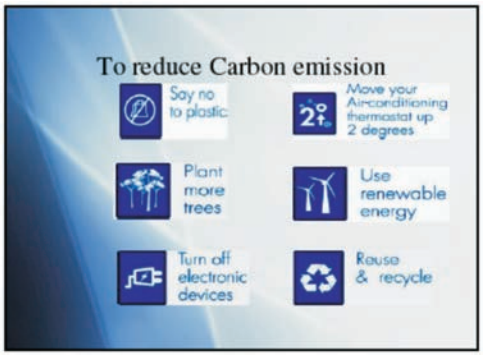


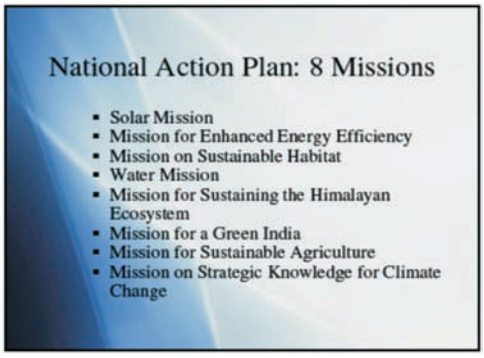
Handout 1.5.3.1

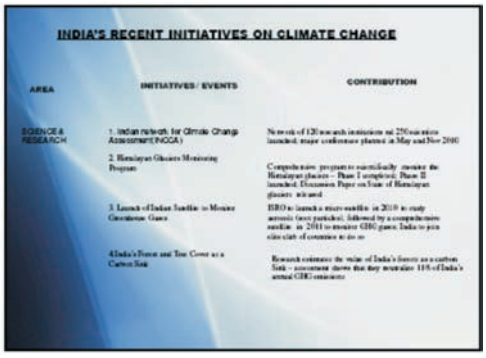




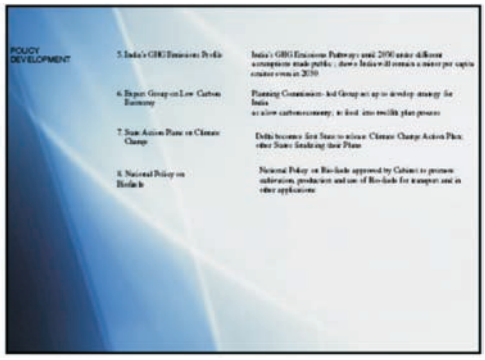


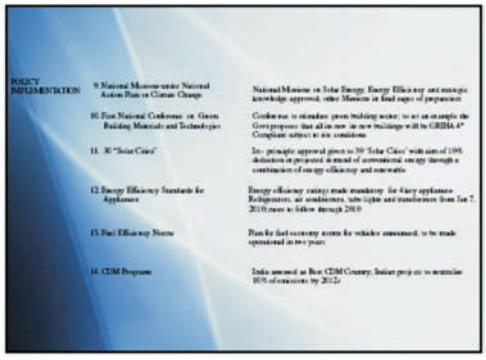


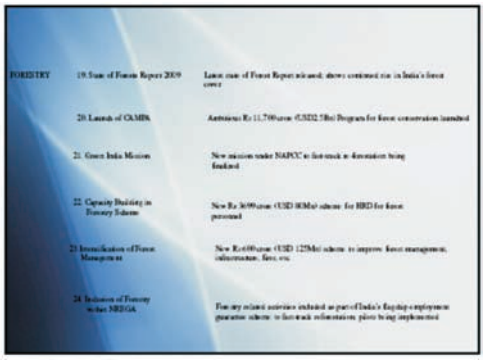




Handout 1.5.3.1







Annexure: 1.6.1

National Institute of Disaster Management

(Ministry of Home Affairs, New Delhi)

"Training of Trainers programme on Flood Risk Mitigation & Management"

Overall Evaluation/ Feedback

Name of the participant: _____

Thanks in advance for giving your assessment. Just ✓ the option that expresses you truly.

1. I think the structure and organization of the course fulfilled the objectives of the Training programme.

   ☐Very well ☐Well ☐Moderate ☐Average ☐Unstructured

2. I feel this programme would be useful to me immediately in my job.

   ☐Very much ☐Much ☐Moderately ☐limited use ☐Not at all

3. I believe this will help me in my future job related to Disaster Management

   ☐Strongly Agree ☐Agree ☐Neither agree nor disagree ☐Disagree ☐Strongly disagree

4. Practical orientation of the Training programme

   ☐Very high ☐High ☐Neither high nor low ☐Low ☐Very low

5. I feel this inspires me to take up assignments related to disaster management

   ☐Very strongly ☐Strongly ☐Can not say ☐Weakly ☐Feel very weakly

6. I have benefited from interaction with fellow participants in the course

   ☐Very much ☐Much ☐Neither much nor less ☐Less ☐Very less

7. I found the course materials supplied to us to be

   ☐Very relevant ☐Relevant ☐can not say ☐little relevance ☐no relevance

8. Your overall impression of the training programme

   ☐Excellent ☐Very Good ☐Good ☐Fair ☐Poor

9. As per the objectives of the training programme, any element that is left out of the Workshop in your view.

10. Which portion of the training programme you found least helpful?
11. Any specific observation/ comments you wish to make.
12. Any suggestion regarding the training methods.
13. Any suggestion regarding topic and speakers.
14. Any particular faculty you have in mind, give the subject and address of that faculty
15. Your comments on administrative arrangements (Just **encircle** the option that expresses you truly):

Sl. No.	Item	Comments				
a.	Reception & Registration	**Excellent**	**Very Good**	**Good**	**Satisfactory**	**Poor**
b.	Drinking water arrangements in the Lecture hall	**Adequate**		**Inadequate**		
c.	Lunch and Tea during the Programme	**Excellent**	**Very Good**	**Good**	**Satisfactory**	**Poor**
d.	Lodging arrangements	**Excellent**	**Very Good**	**Good**	**Satisfactory**	**Poor**
e.	Catering in the hostel	**Excellent**	**Very Good**	**Good**	**Satisfactory**	**Poor**

16. Any other recommendation/ suggestion, not covered above, to improve the programme

Signature

Assessment of Training Faculty

Kindly indicate how effective the following sessions / topics to you were:

S. No.	Day/ Date	Topic	Faculty Name (both internal and Guest Speakers)	Assessment			
				Excellent	Very Good	Good	Fair
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.							
2.							

5 day ToT course on Flood Risk Mitigation and Management

DESIGN BRIEF

Day 1: Learning Unit -1 : Basics of Disaster Management and Flood Vulnerability of India		
Time	**Session**	**Methodology**
0930-1115	Registration Introduction Inauguration & Vote of thanks	
1130-1300	DM Concepts and Institutional framework of Disaster Management in India	Lecture Presentation Discussion
1400-1530	An overview of flood vulnerability and risk mitigation & management in India	Lecture Presentation Discussion
1545-1700	Flood Risk and Development – A case of New Delhi	Lecture Presentation Discussion
Day 2: **Learning Unit -2 : Flood Preparedness**		
Time	**Topic**	**Methodology**
10:00-11:15	Quantitative Precipitation Forecasting for Floods	Lecture Presentation Discussion
1130-1300	Flood Forecasting and Warning network in India	Lecture Presentation Discussion
1400 –15.30	Space technology in flood risk management	Lecture Presentation Discussion
1545- 1700	Medical aspects for floods	Presentation Discussion

Day 3: Learning Unit-3 : Flood Mitigation		
Time	**Session**	**Methodology**
1000-1115	Rainwater Harvesting for flood mitigation	Lecture Presentation Discussion
1130-1300	Flood mitigation measures in India - Structural and Non- structural (flood zoning)	Lecture Presentation Discussion
1400-1530	River basin management for flood mitigation	Lecture Presentation Discussion
1545-1645	Role of strategic tools in flood management	Lecture Presentation Discussion
1645-1730	Group Exercise	Question/ Answer
Day 4: Learning Unit -4 : Flood Response		
Time	**Session**	**Methodology**
0930-1300	Visit to Field Site	Film Presentation Discussion
1400-1530	Incident Command System for Flood Response	Case Study Presentation Discussion
1545-1700	Community Response	Presentation & Discussion
Day 5: Learning Unit -5 : Cross cutting Issues & Lessons learnt		
Time	Session	**Methodology**
1000-1130	Changing Climate and flood vulnerability	Presentation Discussion
1145-1300	Urban floods : Experience, Lessons learnt and Challenges ahead	Presentation Discussion
1400-1500	Group Exercise & Discussion - Presentation by participants	Presentation Discussion
1500-1600	Feed back & Valediction	

About Module

The module entitled "Flood Risk Mitigation & Management: Training of Trainers" has been developed with the technical support of Central Water Commission, New Delhi to conduct the training programmes on flood for senior & middle level Officers of various sectors of Central and State Governments and trainers of various training institutes engaged in disaster management. There are five modules viz., Flood Disaster Management System in India; Flood Mitigation; Flood Preparedness; Flood Response and Cross cutting Issues & lessons learnt. Each module has further been classified as sub modules i.e. learning units to cover the related issues of flood risk mitigation and management. The module consists of 103 pages excluding annexure/ handouts. This module can be used or guided by a trainee who has already undergone the training or involved in conducting training programmes on disaster management. However, the module is self-explanatory and complete, so that a new person can use it effectively. The organizations such as Disaster Management Centres located in State Administrative Training Institutes (ATIs), National Disaster Response Force (NDRF), State Institute of Rural Development (SIRDs) and other training institutes at regional and district levels in the above-mentioned departments, people working in NGOs/CBOs and social organizations, Volunteers in NCC, NYKS, NSS may be the potential users of the module.

About Author

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