Training of Trainers Manual

on

Climate Proofing Watershed Management in Chhattisgarh

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on
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TABLE OF CONTENTS

Training Agenda

Time	Session Title
9:30-10:00	Registration
10:00-10:15	Agenda & Participant Interactions
10:15-11:00	Session 1A Climate Change Overview Basics and India Scenario
11:00-11:30	Sesson IB Climate Change Overview Chhattisgarh
11:30-11:45	Tea /Coffee Break
11:45-12:30	Session 2: Climate Change in Watersheds
12:30-13:00	Discussons
13:00-14:00	Lunch Break
14:00-15:00	Session 3A Case Study Bihar & Madhya Pradesh
15 00-15:15	Tea / Coffee Break
15:15-16:00	Sesson 38 Case Study: Karnataka
16:00-16:45	Session 4A Challenges & Actions Required - Discussions
16:45-17:00	Session 4B Summary and Conclusions

Session 0: Agenda & Participant Interactions

Objective: The objective is to introduce the participants to the one-day training-of-trainers programme.

Duration: 15 min

Learning Outcome

Participants will get:
- A first overview on what will be covered during this training.
- To know that certain states have proceeded ahead with climate proofing of watershed management
- To realize that climate change as a topic has moved from a pure science-based topic to one, which has an implementation and operational relevance.

Material, Tools, Equipment
- Computer/Laptop & screen, projector and microphone

Teaching Aids
- Power Point Presentation

Session Plan

Time Slot	Key Points	Method
5 min	Session structure, overview and agenda	Lecture with Power point presentation.
10 min	Participant interactions & expectations	Group Discussion

Further Guidance

Training agenda

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Additional notes:
- Session 1 has been divided into A and B. The first session has been the focus of most climate discussions in the past. While it is important to know, that is not the focus of this training. This aims to build the capability of the participants to relate with climate change and proofing in the implementation / operational context.
- Session 2 is a new topic in the context of watershed management.
- Session 3 is also divided into A and B. The first session is from a GEF project where two pilots were done. The second session draws from the science-based planning for watershed development that is presently being done in Karnataka. This is state-of-the-art work, which is likely to reach Chhattisgarh through the Neeranchal project.

- Session 4B is a discussion session on how progress can be made in Chhattisgarh – challenges and actions required.
- Session 4B aims to summarize and provide a way forward for the individual participants to take-away. Also, collectively, to realize the directions that the state's Watershed Development Department should take.

Participant interactions

Additional notes:
- The emphasis should be on discussion and collective learning; not on lecture-driven learning.
- Participants know about their individual contexts and should be encouraged to ask questions that would arise from those contexts.
- The trainers should determine which areas of the agenda should be the focus based on the participants profile.

TRAINING MANUAL

Session 1A: Climate Change Overview - Basics & India Scenario

Objective: The objective is to provide a very brief introduction to the basic information on climate change, and also first-level information on the India response to the climate change problem.

Duration: 45 min

Learning Outcome
Participants will be:
• Equipped with basic information in order to respond to basic questions on climate change and
• Equipped with what the Government of India's stand / response to this global environmental problem.
Material, Tools, Equipment
• Computer/Laptop & screen, projector and microphone

Teaching Aids
• Hand out, Power Point Presentation, Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
10 min	Very basics science – Causes, Contributions and Consequences	Lecture with Power point presentation.
10 min	South Asia's Vulnerability	Lecture with Power point presentation + Group Discussion
10 min	India scenario – Assessment, NAPCC	Lecture with Power point presentation.
10 min	Paris' Agreement and India's Nationally Determined Commitments (NDCs)	Lecture with Power point presentation.
5 min	Conclusions	Lecture with Power point presentation.

Further guidance
Entire session:
Additional notes:
- The basic information on climate change is an interesting topic but can consume a lot of time for some participants. For other participants, it can be tedious. It is required to keep it light and easy.

- The session does NOT result in the participants becoming experts on the basics of climate change. It is only to be used as a backdrop for building capability on aspects relevant to watershed management.

Causes, Contributions and Consequences

Additional notes:

- Focus on the parts relevant to watersheds, i.e. agriculture and water.
- Bring out the importance of climate variables in watershed planning.

South Asia's Vulnerability

Additional notes:

- Focus on the climate-induced events in general.
- Pick examples of floods in the recent past from India, e.g. in 2018, it would be the Assam Floods where 76 villages were washed away and Kerala Floods which caused wide-ranging impacts across the state

India scenario – Assessment & NAPCC

Additional notes:

- In both the Assessment & NAPCC, focus on the water and agriculture. For instance, the NAPCC slides on the Water Mission and Agriculture Mission should be expanded upon.

Paris' Agreement and India's Nationally Determined Commitments (NDCs)

Additional notes:

- Restrict as far as possible on elaborating on the Paris' Agreement. The general view is that the Paris' Agreement fell short of expectations of the climate-responsible fraternity but a major step for the mainstream. Indicate that the climate-induced events seem to suggest that the climate-responsible fraternity was correct.
- Focus on the NDCs relevant to the water and agriculture. Briefly cover the work being done by the Multi-lateral Development Banks and the bilateral agencies on climate and water.

Conclusions

Additional notes:

- Appeal for both individual action and collective action, particularly on dealing with resilience.
- Indicate the need is for climate-resilient water resources management, which is a pre-cursor to various use sectors, e.g. climate-resilient agriculture.

Session 1B: Overview: Climate Change & Chhattisgarh

Objective: The objective is to provide a very brief introduction to the climate change-related activities in Chhattisgarh.
Duration: 30 min

Learning Outcome

Participants will:

- Have information on what's been done in Chhattisgarh – both the Government as well as the multi-lateral and bilateral agencies.
- Appreciate how the climate change agenda is gradually entering the development agenda in Chhattisgarh.

Material, Tools, Equipment

- Computer/Laptop & screen, projector and microphone

Teaching Aids

- Hand out, Power Point Presentation, Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
10 min	SAPCC – Why sub-national plans and Contentsin general and	Lecture with Power point presentation.
10 min	Water & agriculture contents of the SAPCC	Lecture with Power point presentation
5 min	Activities being done through schemes, such as MGNREGA	Lecture with Power point presentation.
5 min	Participants' interaction on the SAPCC	Group Discussion.

Further guidance

SAPCC

Additional notes:

- Focus on why and how the SAPCC was prepared.
- Also, focus on what its contents are.

Water & agriculture contents

Additional notes:

- Bring about the difference between what's good water and agriculture management, and what is climate-proofing.
- Use the various points given in the SAPCC to elucidate what that really means in the watershed context.

Activities being done through schemes& discussions

- Indicate how MGNREGA is being used to address the climate resilience
- Encourage discussion as each of the participants will have his / her own view about MGNREGA, how it is relevant to building climate resilience and how it can be further strengthened.

Session 2: Climate Change & Watersheds

Objective: The objective is to link climate change with watersheds planning, design and implementation in a generic way.
Duration: 45 minutes

Learning Outcome

Participants will be able to realize:

- Why climate adaptation is necessary for watershed management.
- What climate proofing / adaptation means in the context of watershed management.

Material, Tools, Equipment

- Computer/Laptop & screen, projector and microphone

Teaching Aids

- Hand out, Power Point Presentation, Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
5min	'Waterman' Rajendra Singh views on climate change	Lecture with Power point presentation and discussions
5 min	Watersheds & Key Climate Change implications	Lecture with Power point presentation.
5 min	Watershed Management Aspects	Lecture with Power point presentation.
15 min	Watershed Management Evolution & present schemes	Lecture with Power point presentation.
15 min	Watershed management & Climate Change: Key Points	Lecture with Power point presentation.

Further guidance

'Waterman' Rajendra Singh views on climate change

Additional notes:

- As most would have heard about him, have a discussion on why he holds these views.
- Appeal to the basic absence of commitment or respect for water.

Watersheds& Key Climate Change implications

Additional notes:

- Bring out the three distinct routes: Variability / Uncertainty, Temperature and Extreme Events
- Indicate that this is a constantly evolving area where more research studies are being done.

Watershed Management Aspects

Additional notes:

- Cover the different Watershed management aspects to consider.
- Indicate how climate change has implications to the basic aims, detailed aims and objectives of watershed management. See it from different perspectives.

Watershed Management Evolution& present schemes

Additional notes:

- Present a possible way of presenting the evolution of watershed management in India.
- Indicate that "climate proofing" or building resilience may be the next big stage in its evolution. Make a strong case. State that the case studies being shared will provide some insights on how this will be done.

Watershed management & Climate Change: Key Points

Additional notes:

- Make a strong case on why it is inevitable.
- Go through the long list on what needs to be done in a generic way.
- Remember that the subsequent sessions on case studies will give enough examples; therefore, be generic here.

Session 3A: Case Studies: Bihar / Madhya Pradesh

Objective: The objective is to share information on how the climate change agenda was implemented in watersheds management in Bihar / Madhya Pradesh as pilots.
Duration: 1 hour

Learning Outcome
Participants will be able to:

- Understand what Bihar / Madhya Pradesh have done as pilots under the GEF project.
- Appreciate what are the ground realities in implementing these pilots.

Material, Tools, Equipment

- Computer/Laptop & screen, projector and microphone

Teaching Aids

- Hand out, Power Point Presentation, Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
5 min	Farmer in Chhattisgarh: How does climate change affect?	Discussion
15 min	SLACC: Background and Framework	Lecture with Power point presentation and film
15 min	Participatory Climate Adaptation Planning	Lecture with Power point presentation.
10 min	Key takeaways from SLACC experience for Chhattisgarh	Lecture with Power point presentation and discussion

Further guidance

Farmer in Chhattisgarh: How does climate change affect?:

Additional notes:

- Indicate that adapting to climate change is increasingly becoming a must-do for farmers to sustain their livelihoods.
- Cite examples where unexpected changes in rainfall have caused enormous damage.

SLACC: Background and Framework:

Additional notes:

- Explain the pilot project being done under SLACC as a first of its kind attempt to make operational climate change considerations.
- Indicate the need for focus on weather much more than earlier. Using the historical information about "monsoon" season to take decisions on crop planning is getting more dependent on weather.
- Query about what weather-based advisories exist in the state and how it is to evolve.
- Draw the importance of connecting crop / livelihood planning, markets, financial aspects and the need for integrated considerations. Emphasize the significantly enhanced role of weather in the crop planning.

Key takeaways:

Additional notes:

- Against each of the key takeaways, conduct a discussion on what this implies in the context of Chhattisgarh. (Initiate this discussion and lead it to the Session 4 which will be more in-depth)

Session 3B: Case Studies: Karnataka

Objective: The objective is to share information on how science-based approach to watershed management in Karnataka is an effective way to adapt to climate change.
Duration: 45 minutes

Learning Outcome
Participants will:
- Be able to appreciate how modern science can assist in watershed management planning, design and implementation.
- Know of the various tools that exist and how they can be gainfully used to strengthen watershed management.

Material, Tools, Equipment
- Computer/Laptop & screen, projector and microphone

Teaching Aids
- Hand out, Power Point Presentation, Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
5 min	Introduction to a science-based approach	Lecture with Power point presentation.
10 min	Land Resource Inventory (LRI) – What & How?	Lecture with Power point presentation.
10 min	Hydrology in watersheds	Lecture with Power point presentation.
10 min	Synthesis of LRI and Hydrology Geo-portal and inventory	Lecture with Power point presentation.
10 min	Key takeaways for a science-based approach in Chhattisgarh	Lecture with Power point presentation.

Further guidance

Introduction to a science-based approach
Additional notes:
- Ask whether science is being used in watershed planning today? Lead the discussion to how watershed interventions are decided based on one-size fits all thumb rules without location-specific considerations

Land Resource Inventory (LRI) – What & How?
Additional notes:
- Emphasize on the importance of such local land resource information for decision-making on watershed interventions
- Indicate how available technology makes it possible.

Hydrology in watersheds
Additional notes:
- Bring about the difference between current practices and what would be recommended as science-based practices.

Synthesis of LRI and Hydrology – Geo-portal and inventory
Additional notes:
- Note that the synthesis is critical for effective decision-making at a local level.
- Indicate the role of the field officers is ground-truthing based on science-based information. Emphasize the need for that change from current practices.

Key takeaways
Additional notes:
- Against each of the key takeaways, have a discussion on what this implies in the context of Chhattisgarh. (Initiate this discussion and lead it to the next session which will be more in-depth)

Session 4A: Challenges and Actions Required- Discussions

Objective: The objective is to bring about the key challenges and what enabling measures are required to overcome them.
Duration: 45 min

Learning Outcome
Participants will be able to:
- Obtain a first-level understanding of the challenges at different levels, e.g. state, district, village levels and individual levels.
- Identify the enabling measures required collectively and individually to bring about this change towards adopting climate proofing.

Material, Tools, Equipment
- Microphone

Teaching Aids
- Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
20 min	List the challenges at different levels	Discussions
20 min	List the enabling measures against each of the challenges	Discussions
5 min	Summary of actions required	Discussions

Further guidance

Challenges
Additional notes:
- Draw from the collective knowledge and experience of the participants.

Enabling measures
Additional notes:
- Draw from what has been covered in the session on Watershed & Climate Change, and the case studies

Summary of actions required
Additional notes:
- Link what emerges from this discussion with the SAPCC – what it describes as a status and what actions have been included in the water & agriculture sectors.

Session 4B: Summary & Conclusions

Objective: The objective is to synthesize the day's session in terms of key takeaways for the participants and then to conclude the session.
Duration: 15 min

Learning Outcome
Participants will have key takeaways from the day's training to reflect and incorporate in their respective functions / jobs.

Material, Tools, Equipment
- Microphone

Teaching Aids
- Notepad, White board and Marker

Session Plan

Time Slot	Key Points	Method
5 min	Session Coverage – Key Points	Lecture Presentation
5 min	Discussions – Key Points	Lecture Presentation
5 min	Conclusions – Key Points	Lecture Presentation

Further guidance

Session coverage
Additional notes:
- Adhere to the session structure and emphasize the key points covered in each session

Discussions
Additional notes:
- Include the key points that emerged during the discussions, particularly the one on challenges and action required.
- Bring about how climate-proofing watershed management is different from integrated watershed management

Conclusions
Additional notes:
- Provide a high-level conclusion of what's the direction that Chhattisgarh should take.
- Circulate a training feedback form and obtain verbal feedback.

Detailed Presentations

Climate Proofing Watershed Management in Chhattisgarh

One-day Training-of-Trainers Programme
Revised Draft, Sep 11, 2018

Session 0: Agenda & Participant Interactions

Session Structure

1. Overview of Climate Change
   (a) Basics.
   (b) Climate Change & India
   (c) Climate Change & Chhattisgarh
2. Climate Change and Watersheds
3. Case Studies
4. Summary and Conclusions

Training Agenda

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9:30-10:00	Registration
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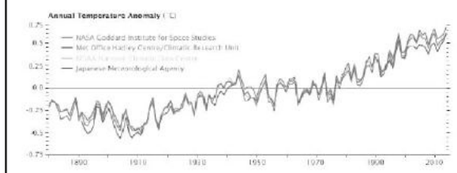
11:30-11:45	Tea / Coffee Break
11:45-12:30	Session 2: Climate Change in Watersheds
12:30-13:00	Discussions
13:00-14:00	Lunch Break
14:00-15:00	Session: 3A:Case Study: Bihar & Madhya Pradesh
15:00-15:15	Tea / Coffee Break
15:15-16:00	Session: 3B:Case Study: Karnataka
16:00-16:45	Session 4A: Challenges & Actions Required - Discussions
16:45-17:00	Session 4B: Summary and Conclusions

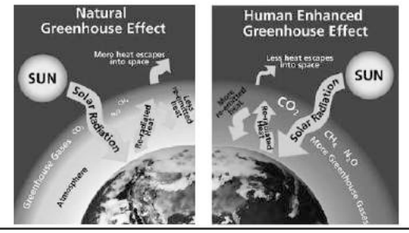
Participant Interactions

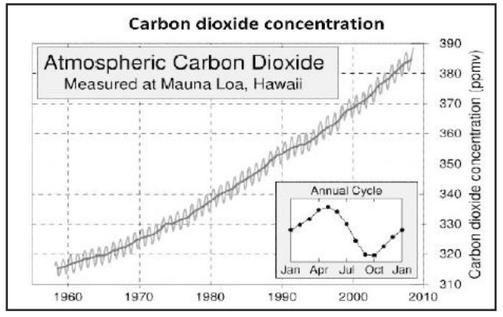
- Participant Introductions
- Participant Expectations

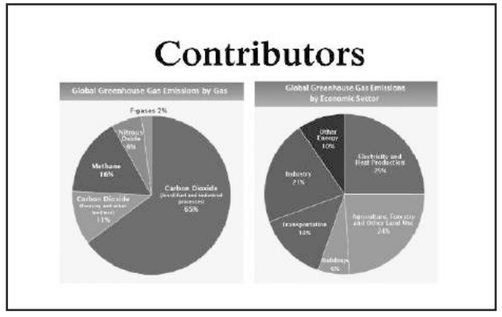
Session 1A: Basics & India Scenario

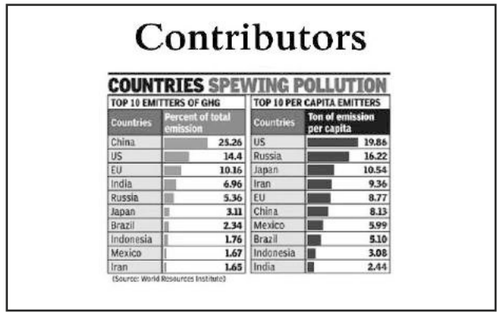


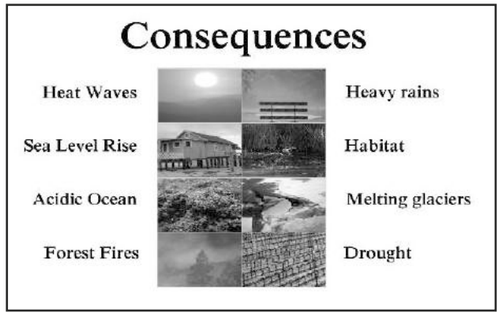
Causes

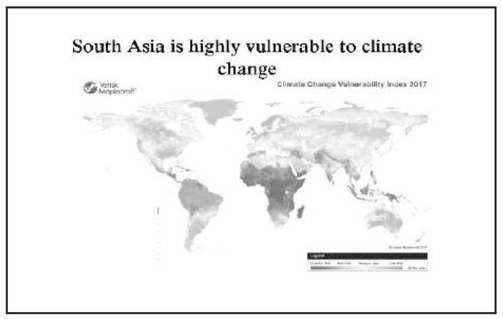


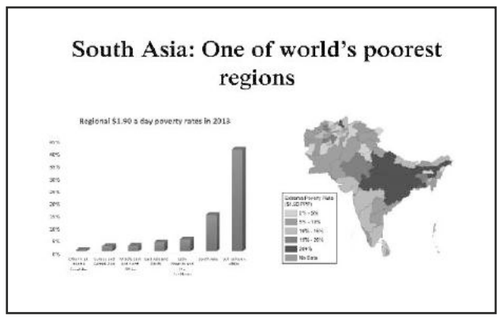












Climate Solutions

- Global / economy wide
  - + Low or no carbon economy
  - + Climate resilient economy
- Community level
  - + Collective, participatory actions integrating best available technologies with practices
- Individual level
  - + Changing work and personal lifestyles

Climate Change Assessment

- IPCC (2007) - threat of climate change is *'unequivocal'*
- Effects of rising temperatures on Asia:
  - declining crop yields; reduced fresh water supplies; rising sea-levels; increased floods, droughts and extreme weather events; biodiversity loss; higher risk of diseases
- India-specific assessments:
  - **NATCOM (2004):** General country-wide vulnerability assessment; post-2070 scenarios
  - **INCCA (2010):** Finer-grained 4x4 assessment; 2030 time-horizon
    - Western Ghats, Himalayan Region, Coastal India, North-East
    - Agriculture, Water, Forests, Human Health

Session 1B: Climate Change – India Scenario

Climate change impacts in India - what the IPCC 4th Assessment Report has found:

- Frequency of hot days and multiple-day heat waves have increased in past century. **Increase in deaths due to heat stress in recent years** [10.2.3].
- The entire Himalayan **Hindu Kush ice mass has decreased in the last two decades** and the ratio of melt accelerates. Hence, water supply in areas fed by HKH glacier melt, on which hundreds of millions of people in China and India depend, will be negatively affected [3.4]
- **Serious and recurrent floods in Northeast states of India during 2002, 2003 and 2004;** A record 944 mm of rainfall in Mumbai on 26-27 July 2005 led to loss of over 1000 lives with loss of more than US$250 millions; Floods in Surat, Barmer and in Srinagar during summer monsoon season of 2006 [Table 10.3]

Climate change impacts in India - what the IPCC 4th Assessment Report has found:

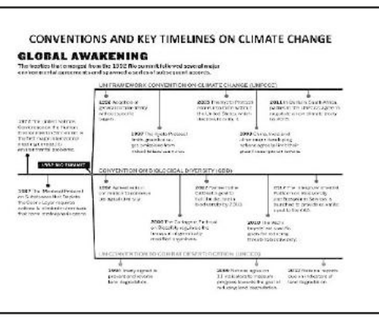
- Sea-level rise **leads to intrusion of saline water into the fresh groundwater** in coastal aquifers and thus adversely affects groundwater resources. For two small and flat coral islands on the coast of India, the thickness of freshwater lens was computed to decrease from 25 m to 20 m and from 35 m to 28 m, respectively, for a sea level rise of only 0.1 m [3.4].
- Ganges-Brahmaputra delta (also Bangladesh): **More than 1 million people will be directly affected by 2050 from risk through coastal erosion and land loss**, primarily as a result of the decreased sediment delivery by the rivers, but also through the accentuated rates of sea-level rise [Box 6.3, T10.9, 10.6].
- Warmer climate, precipitation decline and droughts in most delta regions of India have resulted **in drying up of wetlands and severe degradation of ecosystems** [10.2.4.4].
- **The gross per capita water availability in India will decline** from ~1820 m3/yr in 2001 to as low as ~1140m3/yr in 2050 [10.4.2.3].

Climate change impacts in India – what the INCCA Report has found:

- **Warmer seasons**
  - Avg. temp rise: 2.0 deg C predicted
  - 1.0-4.0 deg C at extreme ranges
- **Increased annual precipitation**
  - lower frequency of rainy days; increased intensity
- **Cyclonic disturbances**
  - lower frequency; increased intensity
  - increased risk of storm surges
- **Sea-level rise**
  - 1.3 mm/year on average

Climate change impacts in India - what the INCCA Report has found:

- **Agriculture**
  - Up to 50% reduction in maize yields
  - 4-35% reduction in rice yields (with some exceptions)
  - Rise in coconut yields (with some exceptions); reduced apple production
  - Negative impacts on livestock in all regions
- **Fresh water supply**
  - High variability predicted in water yields (from 50% increase to 40-50% reduction)
  - 10-30% increased risk of floods; increased risk of droughts
- **Forests and natural ecosystems**
  - Increased net primary productivity
  - Shifting forest borders; species mix; negative impact on livelihoods and biodiversity
- **Human health**
  - Higher morbidity and mortality from heat stress and vector/water-borne diseases
  - Expanded transmission window for malaria



Paris Agreement: India NDCs

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.

2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.

3. To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.

4. To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).

Paris Agreement: India NDCs

5. To create an additional carbon sink of 2.5 to 3 billion tons of CO2 equivalent through additional forest and tree cover by 2030.

6. To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.

7. To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.

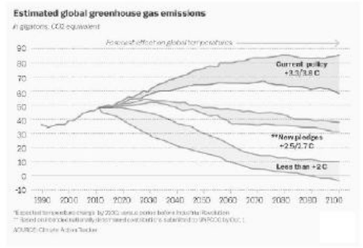
8. To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

TRAINING MANUAL

Paris Deal - Features

★Overall temperature goal
★Overall emissions goal
★Pledges reviewed
★Transparency
★Financing for developing countries
★Loss and damage

Expectations



Vulnerability in India …

Landslides in Arunachal Pradesh July 2018

Vulnerabilities in India

Nagpur Floods, July 2018

Countries are taking action…

- *Bangladesh:* Climate Change Strategy and Action Plan
- *Bhutan:* National Adaptation Plan
- *India:* National Action Plan on Climate Change, State Action Plans
- *Maldives* Strategic National Action Plan for Disaster Risk Reduction and Climate Change Adaptation
- *Nepal* National Framework on Local Adaptation Plans for Action
- *Pakistan* National Climate Change Policy
- National Adaptation Plan for Climate Change Impacts in *Sri Lanka*

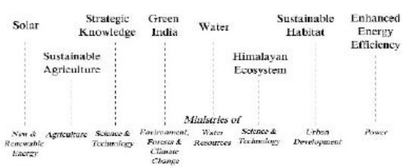
National Action Plan on Climate Change (NAPCC)

- Released on 30th June
- India is the first country to release such a plan
- India's proposed efforts to combat climate change
- Create a prosperous, non-wasteful self-sustaining economy

NAPCC

NAPCC

National Missions



National Water Mission

- Ensuring integrated water resource management
- Increasing water use efficiency by 20% through regulatory mechanisms with differential entirtlements and pricing
- Ensuring that water needs of urban areas are met through recycling of waster water
- Adoption of new and appropriate technologies such as power temperature desalination technologies that allow for the use of ocean water
- Incentive structures will be designed to promote water-neutral or water-costive technologies, recharging underground water sources and adoption of large scale irrigation programmes which rely on sprinkersl, drip irrigation and ridge and furrow irrigation

National Agriculture Mission

- Strategies for make Indian agriculture more resilient o climate change
- Identify and develop new varieties of crops and especially thermal resistant crops and alternative cropping patterns
- Convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology
- New credit and insurance mechanisms will be devised to facilitated adoption of desired practices.

National Green India Mission

- Improving quality of the forest
- Improving the ecosystem services of the forests
- Involvement of the Gram Sabha in implementation (strengthening of local institutions)
- Generation of livelihood for local communities
- Provision of fuel wood and fodder for local communities
- Strengthening of regulatory framework for conservation

Multilaterals & Bilateral Initiatives on Climate Change

- Climate Change Innovation Program: A bilateral partnership programme between DFID-UK and MOEFCC - Action on Climate Today (ACT): Assam, Bihar, Chhattisgarh and Odisha
- DFID-UK in collaboration with Ministry of Rural Development has launched Infrastructure for Climate-resilient Growth through Mahatma Gandhi NREGA: Bihar (35 blocks), Odisha (35 blocks) and Chhatisgarh (30 blocks)
- Development Projects of the World Bank and ADB have integrated climate change, e.g. Maharashtra Project on Climate Resilient Agriculture

Multilaterals & Bilateral Initiatives on Climate Change

- Community-based climate adaptation plans: Selected villages of Bihar and Madhya Pradesh (under the GEF Sustainable Livelihoods and Adaptation to Climate Change Project)
- Dissemination & Adoption of climate change adaptation and mitigation measures - State-level, District-Level and Sub-watershed level (Karnataka's Sujala Project)

C-SAPCC Features

- Objective: To draw specific guidance, in terms of understanding of impacts of climate change as well as vulnerability of these sectors to climate change in Chhattisgarh.
- Scope: Implications of climate change on key sectors in Chhattisgarh i.e. agriculture and allied sectors, forests & biodiversity, *water resources*, urban development, Transport, energy, industries, mining and human health.
- Methodology: Large consultative process involving the UNDP, various state level departments, National and State level institutions, sectoral experts, NGOs, CSOs and local Communities.

C-SAPCC Sectors Covered

- *Agriculture* and Allied Sectors
- *Forests* and Biodiversity
- *Water Resources*
- Urban Development,
- Transport,
- Energy,
- Industries and Mining
- Human Health

C-SAPCC Sectors - Aspects Covered

- Overview, characteristics and status;
- Key issues;
- Existing / ongoing initiatives;
- Priorities;
- Perceived climate Impacts;
- Strategies
- Institutional linkages and stakeholders
- Linkages with the NAPCC.
- Sectoral Action Plan and Budgets under the CSAPCC

Agriculture: CSAPCC initiatives

- Develop action plans at the agro-climatic zone levels and adopt early warning forecasting.
- Focus on food, nutritional, and economic security
- Build sustainability and conserve agricultural biodiversity
- Address crop depredation, man-wildlife conflicts
- Revitalise extension services and address last mile support issue
- Address fodder deficits
- *Address water stress – mainstream watershed approaches*
- Increase per animal milk productivity through breed improvement & replacement.
- Upgrade and strengthen veterinary infrastructure
- Improve doorstep extension services
- Mobilise financial instruments and strengthen market linkages
- Increase egg productivity and animal protein for rural food

Water Resources: CSAPCC initiatives

- Develop State Water Policy as the highest priority
- *Carry out vulnerability and risk analyses (to both resources and infrastructure);*
- *Build hydrological and hydro-met evidence base*
- *Foster IWRM, improve governance and coordination among the multiple water related organisations*
- *Strengthen water conservation, protection, & storage*
- *Build capacities*

Climate Change Initiatives in CHH

- Mahanadi & Water Resource Assessment
- Modelling using WEAP with climate scenarios
- Institutional Analysis also done
- Future demand-supply shortages in particular stretches, allocation planning to different sectors, water efficiency improvements, decentralised storage and groundwater recharge.

Climate Change Initiatives in CHH

- Linking MGNREGA and Climate Resilience
- Designing structures that are resilient to climate impacts / Climate proofing MGNREGA assets
- Criteria for selection: List of most backward blocks, frequency of drought, vulnerability of agriculture to Climate Change (using the Atlas having climate vulnerability at district level based on sensitivity indicators, exposure indicators and adaptive capacity)
- Project coverage: Bihar (8 districts), Odisha (5 districts) and Chhattisgarh (9 districts, 33 blocks)
- Focus on harvesting water, bringing waste land under cultivation, benefitting the marginalised / vulnerable and sequestering carbon

Session 2: Climate Change & Watersheds

'Waterman' Rajendra Singh on climate change …

Q: Even if it rains well in some areas, the water never proves to be enough to meet needs. Why is this?

A: Due to climate change, the pattern of rainfall has changed. Now we don't have uniform rains, we now have erratic rains that are untimely most of the time. And the saddest part is – the last man in the queue has not been able to understand this change and make alternative arrangements. Due to excessive use of chemical fertilizers, the character of the soil has changed. Its porosity has been altered and it is no more able to hold water. The absorption and retention capacity has suffered. It flows with the rainwater, causing floods and droughts simultaneously.

'Waterman' Rajendra Singh on hope …

Q: So is there no hope?

A: Honestly, I have lost all hope. I am tired of saying things on this issue. I don't even know why I am talking to you. You will write about this, but do you think people will follow the message that you convey from your article? Nobody is reading the people who are writing, and unfortunately those who are reading, they are not doing anything.

W/S & Key Climate Change implications

- Variability and uncertainty in precipitation (The Indian economy is substantially dependent on its monsoon rainfall.)
- Temperature increases causing heat stress
- Extreme events, e.g. floods and droughts

W/S Management Aspects: Agriculture

- Rainfed agriculture - about 60 percent of the net cultivated area in the country - is expected to be significantly impacted by climate change for two reasons:
  - ★ Practised on fragile, degraded and sloping lands which are prone to erosion.
  - ★ People dependent on it are less endowed in terms of financial, physical, human and social capital.

W/S Management Aspects: Climate Change & Other Livelihoods

- Climate change can impact the welfare of rural households through a variety of channels through its negative effect on:
  - ★ Health
  - ★ Labour productivity
  - ★ Financial capacity
  - ★ Extreme events-induced impacts on natural and infrastructure assets

W/S Management Aspects

Basic aims *Climate Change Implications*

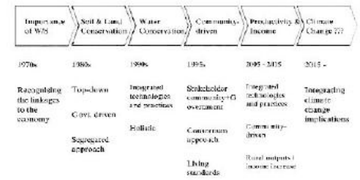
W/S Management Aspects

Detailed aims *Climate Change Implications*

W/S Management Aspects

Objectives *Climate Change Implications*

W/S Management Evolution



W/S Management Programmes

Past	Present (Late 2014)
Integrated Watershed Management Programme	Pradhan Mantri Krishi Sinchaye Yojana (PMKSY)
★ Drought Prone	Convergence of three centrally supported schemes covering water, agriculture and watershed management.
★ Desert Development Programme	Ministry of Agriculture is the designated national nodal agency for PMKSY.
★ Wasteland	Integrated Watershed Management Program (IWMP) to become the watershed development component of the new PMKSY scheme
National Watershed Development Project for Rainfed (NWDPRA)	
Watershed Development Project in Shifting Cultivation	

W/S & Climate Change: Summary of Key Points - Why?

- W/S management has to become climate resilient:
  - Climate change is a reality and not within the control of any watershed; requires collective effort of mankind as a whole
  - Climate proofing or adaptation is doable; under the control of the watershed. affects plans and implementation efforts to maximise outputs

TRAINING MANUAL

W/S & Climate Change: Summary of Key Points - What?

- Redoubling efforts towards water conservation:
  - Improving water efficiency in farming further, i.e. more crop per drop. Choosing climate-resilient seeds and planting methods.
  - Water budgeting - using tools or principles - at the W/s held
  - Increased attention to hydrology, percolation and actual run-off
  - Insitu and Exsitu water conservation

W/S & Climate Change: Summary of Key Points - What?

- Redoubling efforts towards soil conservation:
  - Soil testing to focus beyond nutrient composition to organic content, i.e. water retention.
  - Increased attention to the soil run-off
  - Land management / resource inventory at a watershed & village level.
  - Crop diversification to retain soil conditions.

W/S & Climate Change: Summary of Key Points - What?

- Enhancing decision-making at the farmer level:
  - Establishing automatic weather stations and rain gauge stations to enable decision-making on actual (not estimated) data
  - Two-way interactions on weather & rain data with IMD to enable crop advisory services at individual village level
  - Providing crop advisory services through new technology such as smart phones and SMS / text messages.
  - Rethinking the balance regarding dependence of farm and non-farm livelihoods.

W/S & Climate Change: Summary of Key Points - What?

- Access to insurance against climate risks:
  - Better risk planning for the farmers
  - Building capacity within the watershed on insurance aspects.

W/S & Climate Change: Summary of Key Points - What?

- Building community capacity in all villages within the watersheds:
  - Creating awareness on the variability and uncertainty of precipitation.
  - Building capacity to deal with extreme climate-induced events.
  - Enabling community and technology / practices to be fully integrated

W/S & Climate Change: Summary of Key Points - What?

- Re-establishing the soil-water ecosystems at the watershed level
  - Appreciating the history and evolution of the watershed.
  - Focusing on interventions to restore the ecosystems in the short- and medium-term.
  - Discouraging an immediate- term focus solely on productivity enhancement that are detrimental towards sustaining the ecosystems.

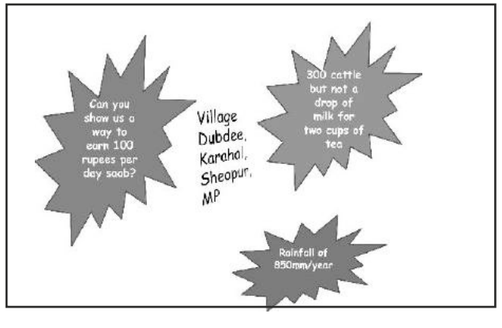
Session 3: Case Studies

Session 3A: Bihar / Madhya Pradesh

GEF Initiative in Bihar / MP

GEF-funded Sustainable Livelihoods and Adaptation to Climate Change (SLACC) Project comprises working with communities across different dimensions of climate adaptation:

- Production system: participatory selection of climate-resilient varieties/breeds;
- Ecological system: Soil moisture conservation with a focus on organic carbon.
- Knowledge system: Local weather-based agro-advisories
- Financial system: Insurance to cover climate/ weather-induced events



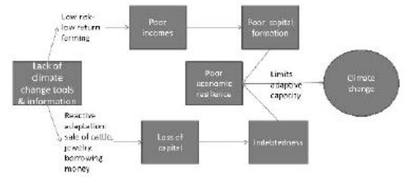
Why watersheds?

To improve lives of people living in the watersheds through improving livelihoods

If you are a farmer, how does climate change affect you?

Farmers are fighting climate variability rather than climate change.... Is climate change, simply a trend in climate variability happening over time. Now, it seems to be happening at a faster speed...

Lack of adaptive capacities and climate-risk information perpetuate a low level economic equilibrium ...



The very nature of this crisis necessitates adding an explicit climate lens to livelihoods planning and implementation

How has climate changed in your area in the last 5 years?

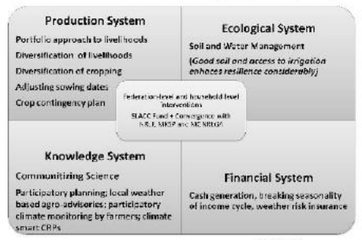
Number of rainy days, number of run off events, early onset, late onset, dry/wet periods and their impacts on crops?

Sustainable Livelihood &Adaptation to Climate Change (SLACC)

*To improve the **adaptive capacity** of the rural poor engaged in **farm based livelihoods** to cope with climate variability & change*

Being implemented in 2 blocks each in Gaya and Madhubani in Bihar and 2 blocks each in Sheopur and Mandla in MP in a total of 200 villages covering >10,000 farmers that are members of SHGs under NRLM(DAY)

SLACC Framework for Enhancing Adaptive Capacity

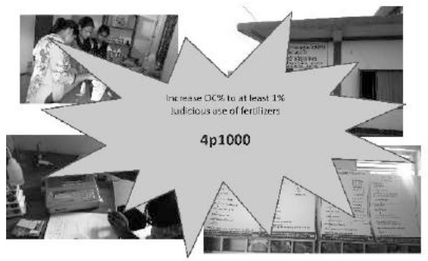


SLACC Film

Some key interventions of SLACC

- Communitizing soil knowledge
- Mechanization to combat climate impacts
- Weather based agro-advisories
- Importance of cash income in rural households

Communitizing Soil Knowledge



Zero tillage

- Climate risk:- Heat stress, western wind (pachita) that affects in milking stage, unseasonal rain and hailstorm.
- Adaptation measure:- Zero tillage – Advance sowing date to escape "pachua"
- (Conservation technique to retain soil moisture, maintain organic carbon content and saving of 15 days sowing time, optimum use of input (seed/fertilizer)

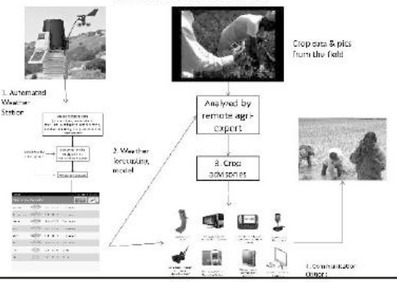
Evidence based crop planning and analysis

Weather Based Agro-advisories

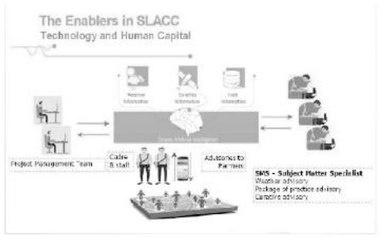
Why WBAAs

- Climate/weather and market are two large risks for farmers. Neither are under their control.
- Climate is a primary risk since it not only impacts production, but can also determine markets
- Farming is not only gamble with monsoon. Even rabi and zaid have their own problems.
- Weather also influences pest and disease attacks

WBAAS in SLACC



CropIn – Tech Partner for WBAAS



WBAAS in Action

- Forecast has max takers among community, VRPs finds Alerts useful tool to give curative measures and PoP acts as practice notification.
- Scheduling of DSR in villages is based on short term weather forecast.

Seasonality of Income, Cash Cycle & Risk profile

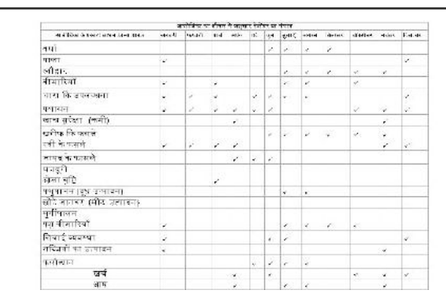
- Current income cycle is seasonal and dependent on kharif results
- Cash generation is very low and again seasonal
- Risk profile of livelihood is heavily loaded towards seasonal cropping (short cycle risks), with crops facing similar weather risks (mainly water and temperature)
- Tree crops (fruit, timber, fodder and manuring) is a much needed addition to portfolio
- Livestock has been rated most resilient by most villages in SLACC

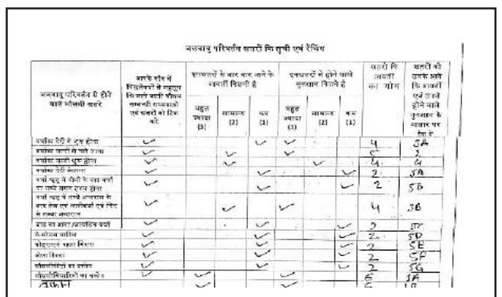
Season and Cash Cycle in SLACC Villages

How is all this planned?

Participatory Climate Change Adaptation Plan

1. Village resource mapping
2. Transect
3. Seasonal livelihood calendar
4. Weather/climate risks
5. Livelihood ranking based on perceived importance
6. Livelihood ranking based on income
7. Livelihood ranking based on weather/climate risk
8. Combined table based on 6 &7 and finding solutions through community and experts





जलवायु परिवर्तन अनुकूल कार्यक्रम नियोजन तालिका-Climate Change Adaptation Plan Matrix			
क्रमांक	आजीविका के प्रकार/ साधन	[illegible]	[illegible]
1	धान/ Paddy	[illegible]	1. Well Construction, 2. Solar based micro irrigation systems-Sprinkler, rain gun & drip. 3. short duration seed variety for kharif season, 4. seasonal weather forecast before start of the season 5. Weekly forecast of the weather data.
		[illegible]	1. Well Construction, 2. Solar based micro irrigation systems-Sprinkler, rain gun & drip. 3. short duration seed variety for kharif season 4. Increase in biomass content of soil
		[illegible]	Training on pest surveillance and Organic pesticides preparation, solar powered sprayer for spray
		[illegible]	1. Disease tolerant seed variety, 2. weekly weather forecast
		[illegible]	Contour bunds with outlets, Graded bunds that flow in to the stream, stabilization of bunds by grass plantation. Appropriate land & minor drainage line treatments to conserve soil and water following ridge-to-valley principle

Key Takeaways

- Farmers are fighting a battle with climate variability more than change. Therefore, address the immediate needs first.
- Accurate and timely weather information is a key weapon to fight this battle
- Diversification of livelihoods is very important to reduce risk, but seasonal cropping dominates. And for very many reasons...
- Soil and water are the bedrock on which this battle has to be fought. However, they cannot be seen in isolation from livelihood choices
- Cash is an important requirement to build and enhance resilience and if often neglected in our quest for higher productivity
- Knowledge of practitioners and community on exactly how weather is behaving and how it is impacting livelihoods is very low, since no one engages with weather data. But everyone talks of climate change.
- A course on weather, its parameters, its analysis is a must for any development practitioner

Framework for a Resilient household - SLACC

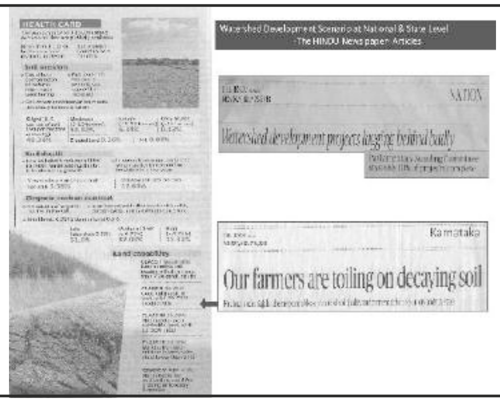
- Diversified livelihood portfolio (cropping, trees, livestock...)
- Diversified cropping (food, cash crops)
- Contingency plans for crops
- Soil with at least 1% OC and a resource base to maintain it
- Sufficient water storage to ensure "zero kharif failure"
- Access to timely and accurate (at least short term) weather forecast
- Access to technical support even in times of crisis
- Access to financial support even during times of crisis
- Access to inputs and machinery during times of crises
- Ability to actively engage at least at the community level with weather information, review livelihood performance and plan for the next season taking into account weather forecast

Session 3B: Karnataka

Sujala – Science based Approach to Smart Watersheds

Soil & Water – Most important resources to fight climate change

- Soil characteristics determine its ability to store water, supply nutrients and thus, support crops and livelihoods
- Quantum of rainfall, how much is stored in the soil, how much percolates to ground water, how much of the ground water flows away, how much is ET and finally how much is run-off determines how resilient the farming household is
- Do we know enough about soils and water in watershed to make meaningful plans?

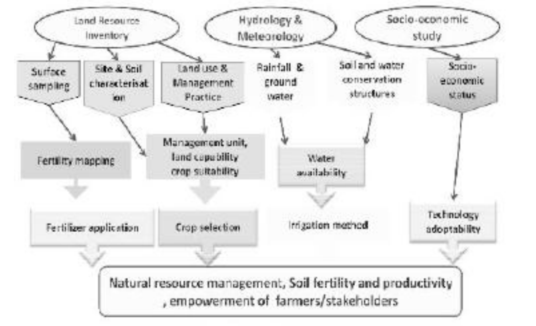


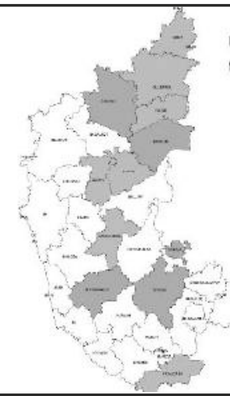
What is soil OC in your watersheds?

- Ridge
- Midlands
- Valley

Do you measure it when you design a watershed?

Sujala – Science based Approach to Watersheds





Uniqueness of Sujala approach to watersheds

- **Karnataka** :leading state in Watershed development
- Baseline database (LRI) used so far were coarse scale & not site-specific, resulting in anomalies in what actually is needed & what actually implemented: leading to sub-optimal success of projects.
- Site specific LRI database+Hydrology +weather+ socio-economics+: essential for integrated watershed planning, monitoring &evaluation

What is the use of plot level LRI?

- Spatial database(thematic maps) serves like a diagnosis report indicating the potentials & constraints of each parcel of land essential for site specific planning of interventions/treatments
- All the land based development projects in the state need site specific database for better planning
- Database remains relevant for minimum of next25-30 years (with periodical updating)
- Large number of user friendly applications can be developed using the database (useful for farmers, line departments, Researchers, NGOs etc)
- SAUs(5),KSRSAC, KSNMDC IISC +++++++are partners.
- Capacity, infrastructure & participation of state institutions in developmental projects being enhanced

LRI is the soil health Diagnostic report

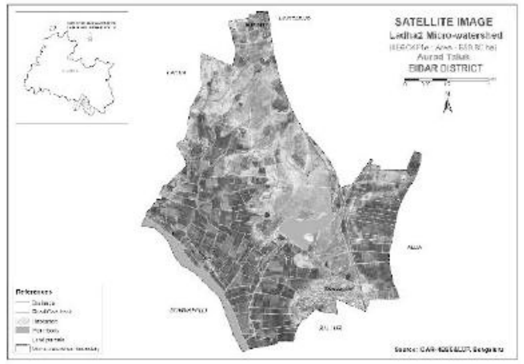
Site-specific Land Resource Inventory for

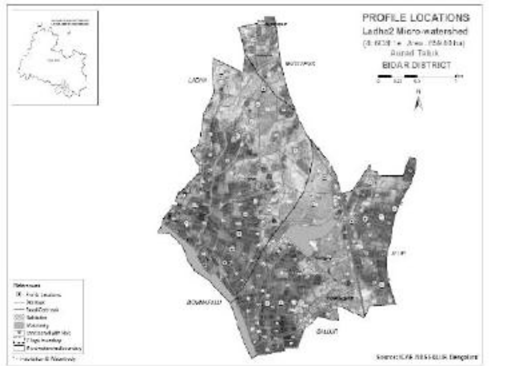
- Soil & water conservation planning
- Enhancing productivity of existing crops/livestock
- Crop diversification: perennial horticulture crops/live stock
- Forestry: Greening marginal lands with multi-purpose species
- Reclaiming physically/chemically degraded lands/soils
- Providing inputs for planning viable & sustainable land use options suitable for each land parcel.
- Securing better livelihood for dependents of the land

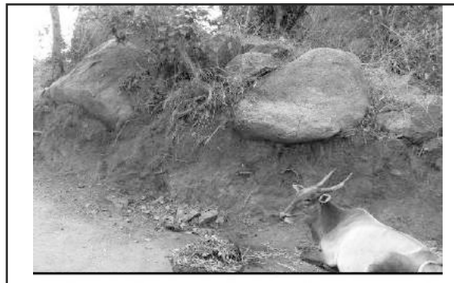
LRI- How is it done?

Site-Specific Database-A Hall mark of LRI

- Soil and water are the two key resources that need to be conserved and managed in a scientific manner for sustainable yield and profit.
- Land Resource Inventory (LRI) is an assessment of the status and changing condition of soil, water and related resources at the field level.
- The LRI database is generated on a geo-referenced cadastral map (1:7920 scale), superimposed on Cartosat/Quick Bird imagery.
- The land parcels are grouped into management units based on similarity in soil and site characteristics
- During LRI, land use details, weather & climate, hydrology, socio economic particulars, market infrastructure, existing schemes and other details of the area are also collected

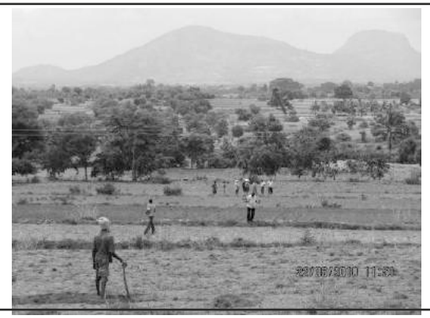


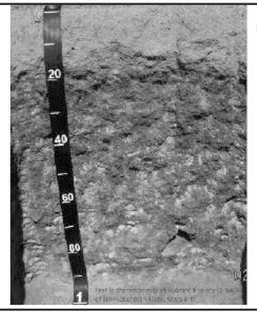




LRI Activities

- Traversing watershed area with the aid of cadastral maps and imagery
- Identifying landforms, geology, land use
- Selecting fields representing land units for transects
- Opening profiles up to 2 m
- Studying soil and site characteristics
- Grouping similar areas based on their soil-site characteristics into management units



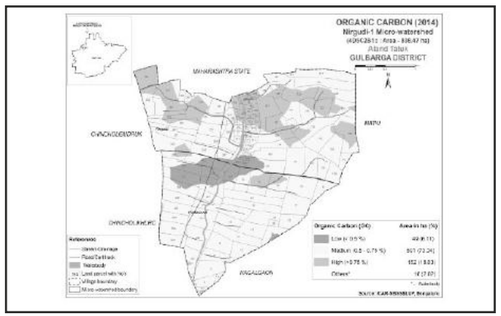


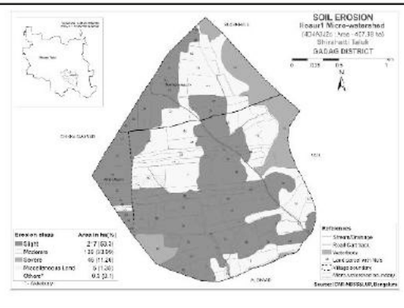
Soil Characterisation.

Soil colour
Pressure faces/Slickensides

Physical Characteristics:
Soil Depth
Soil texture
Soil structure
Amount of rock fragments
Infiltration rate
Permeability
Porosity
Soil moisture
(Water storage (cm/m)
Available water (cm/m

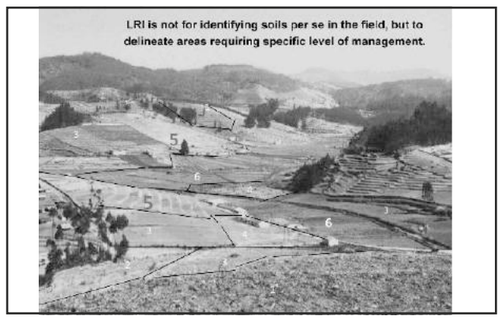
Chemical Characteristics
pH
EC – Electrical Conductivity
Exchangeable Bases
BSP – Base Saturation, Nutrient content

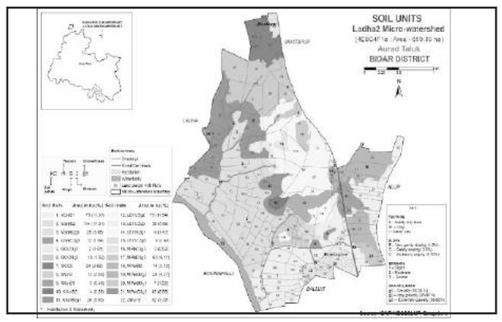


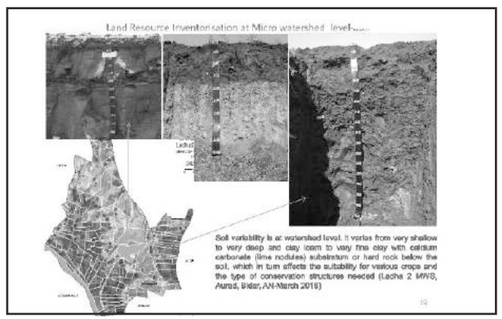


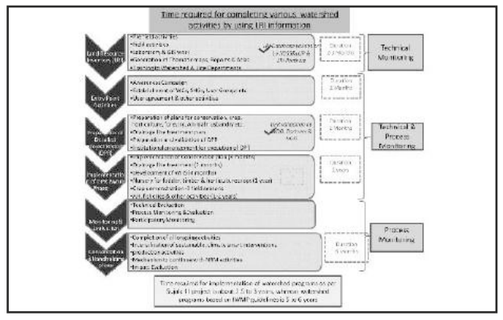
Role of Land Resource in Prioritizing Watershed Investment

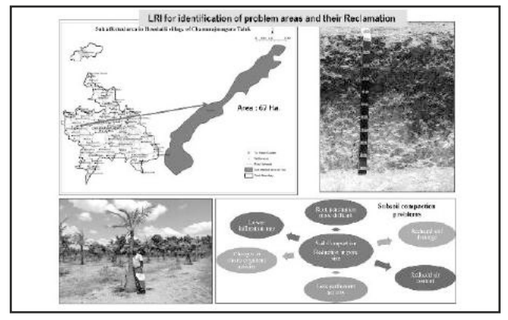
1. As per the Govt. Guidelines, allocation of funds for NRM/watershed development is made as fixed amount per ha basis(Rs/ha)
2. **LRI based watershed treatment saturation plan which is site specific, indicates that allocation needs to be done as per the need & priority.**
3. It should not be fixed amount per ha to make the watershed program successful.

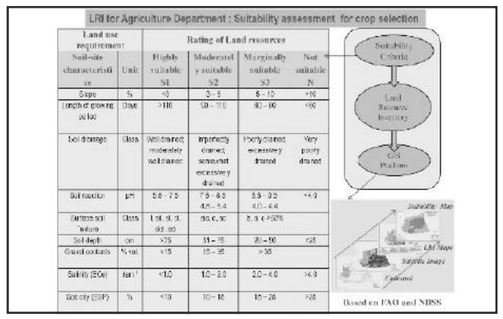












Hydrology in Sujala

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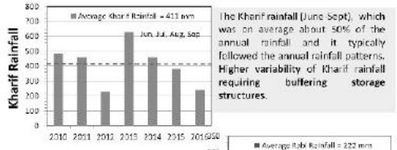
Hydrology Studies: Salient Outcomes

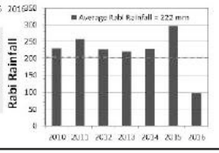
- Model for retrieving **soil moisture** at 500m spatial resolution at daily frequency from microwave remote sensing;
- **Groundwater recharge** model for the soil units in microwatersheds, which is upscalable to other microwatersheds based on LRI;
- Model for **evapotranspiration** at 5 km spatial resolution and 8-day frequency; for estimating water budgets, sustainability of microwatersheds and also evaluating changes;
- Crop-water budget model - for rainfed and irrigated conditions to assess the **water stress**, water gaps (if any), **water use efficiency** & productivity.

Advanced hydrological equipment in all the pilot microwatersheds; Convergence with Land Resource Inventory.

Seasonal rainfall (Ex: Gopalapura watershed)

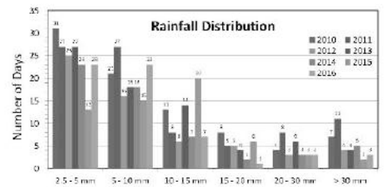


The Kharif rainfall (June-Sept), which was on average about 50% of the annual rainfall, and it typically followed the annual rainfall patterns. **Higher variability of Kharif rainfall requiring buffering storage structures.**

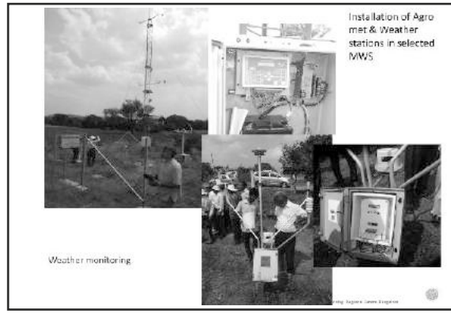


The Rabi rainfall (Oct-Jan) was on average about 27% of the annual rainfall. In general there was a low variability in this ratio.
Dependence on rabi rainfall for enhancing the **cropping intensity**.

RAINFALL DISTRIBUTION

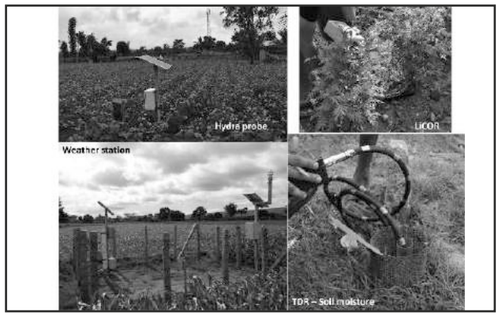


On an average for this decade, **the number of rain events likely to produce runoff** (>20 mm) are about 10 per year with a moderate variation across years. Even during the extremely lower rainfall years (2012 & 2016), there was not significant decline in **the number of events producing runoff**.

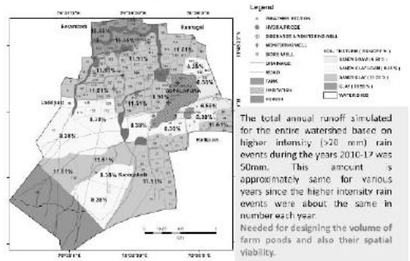


Installation of Agro met & Weather stations in selected MWS

Weather monitoring

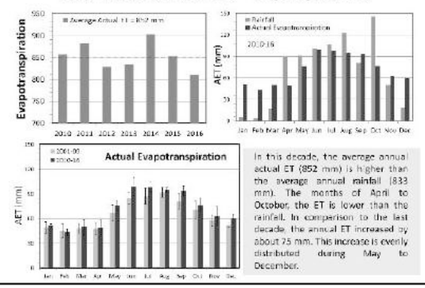


Runoff for Soil Units



The total annual runoff simulated for the entire watershed based on higher intensity (>20 mm) rain events during the years 2010-17 was 50mm. This amount is approximately same for various years since the higher intensity rain events were about the same in number each year.
Needed for designing the volume of farm ponds and also their spatial viability.

EVAPOTRANSPIRATION – Gopalapura WS

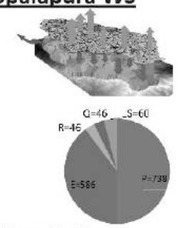


In this decade, the average annual actual ET (852 mm) is higher than the average annual rainfall (833 mm). The months of April to October, the ET is lower than the rainfall. In comparison to the last decade, the annual ET increased by about 75 mm. This increase is evenly distributed during May to December.

Water Budget – Gopalapura WS

$$P = Q + E + R + \Delta\theta$$

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- $\Delta\theta$= Change in soil moisture

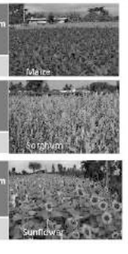


P = 738 mm E = 586 mm R = 46 mm Q = 46 mm

Soil Water Store available in Rabi = 738-586-46-46 = **60 mm**

Water Requirements – Crop water budget farm pond sizing

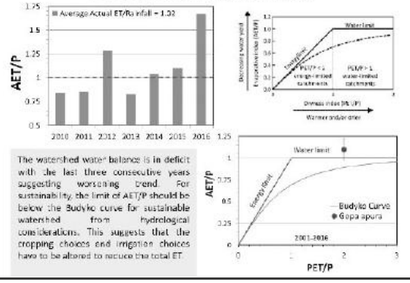
	Maize	2014 378 mm	2015 250 mm	2016 183 mm	2017 120 mm
Δw		320	-58	70	137	200
Δw	Sorghum	2014 378 mm	2015 250 mm	2016 183 mm	2017 120
Δw		300	-78	50	117	180
Δw	Sunflower	2014 378 mm	2015 250 mm	2016 183 mm	2017 120 mm
Δw		400	22	150	217	281



Irrigation water

	Sunflower (Kharif 2015)	Turmeric (Kharif & Rabi 2016)
Water applied based on soil moisture observations	236 (Rainfall) + 279 (irrigation) = **515**	453 (Rainfall) + 973 (irrigation) = **1426**
Water applied based on crop water requirement	236 (Rainfall) + 100 (irrigation) = **336**	453 (Rainfall) + 580 (irrigation) = **1033**
Excess irrigated water used	~180	~ 390
	ET = 60	ET = 100
	Deep Percolation = 80	Deep Percolation = 90
	Soil storage = 40	Soil storage = 200

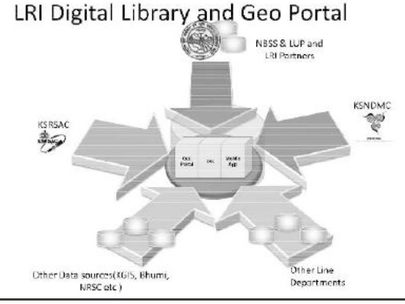
EVAPOTRANSPIRATION INDEX



The watershed water balance is in deficit with the last three consecutive years suggesting worsening trend. For sustainability, the limit of AET/P should be below the Budyko curve for sustainable watershed from hydrological considerations. This suggests that the cropping choices and irrigation choices have to be altered to reduce the total ET.

How is all this data and information used?

LRI Digital Library and Geo Portal



DSS for CSA

Sr. NO	Decision Support System
1	Crop selection (Based on physical suitability and cost benefit ratio
2	Delineating prime farm lands/arable and non-arable lands based on Land Capability Classification
3	Crop based Nutrient Management and soil health
4	Estimating Surface Runoff at farm/MWS/SWS levels
5	Estimating the Crop Water Requirement at MWS/SWS levels based on the existing land use or crops that are planned to be taken up for cultivation at MWS or higher levels
6	Estimating Water Balance at MWS or higher levels, taking into account the RF, crop requirement, Runoff, evaporation and other losses, soil moisture and ground water.
7	Water Budgeting taking into consideration the needs of various uses/users at MWS/ Village level- crop needs, human needs, livestock needs etc.

DSS for Adaptation to Climate Change

Decision Support System
Soil & Water Conservation plan to identify the type of structures, their design and estimate, for both arable and non arable lands/areas
Designing the size and location of farm ponds based on runoff model

Key Takeaways

- Practitioners need to learn to harness new tools to do more precise and SMART work
- A better handle on soil OC% and ET is needed in watersheds to make lasting impacts
- Using science to prioritise action in MWs and to make realistic plans and budgets, the Sujala approach is needed
- State government, SAUs have a big role to play in taking science to the doorstep of farmers. The Sujala approach is one of really taking "lab to land"

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Thank you

Session 4A: Challenges & Actions Required

Discussion

Session 4B: Summary & Conclusions

Summary: Lessons Learned

Facilitated interaction among the participants

Conclusions

Facilitated interaction among the participants

Training Feedback

Facilitated interaction among the participants

Thank You

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