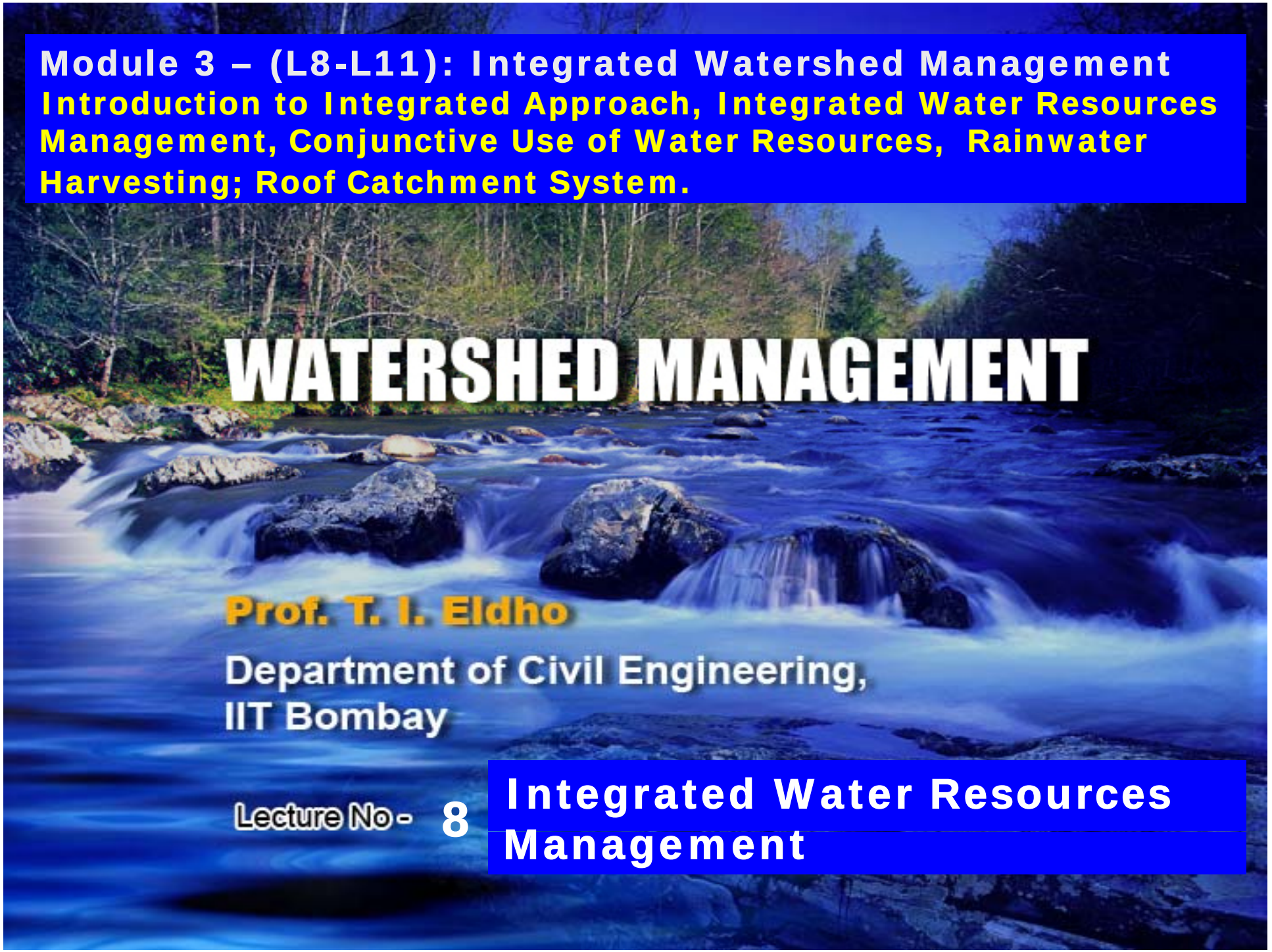
Module 3 – (L8-L11): Integrated Watershed Management

Introduction to Integrated Approach, Integrated Water Resources Management, Conjunctive Use of Water Resources, Rainwater Harvesting; Roof Catchment System.



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Lecture No - **8**

Integrated Water Resources Management

WATERSHED MANAGEMENT

L8– Integrated Water Resources Management

- **Topics Covered**
- Introduction to integrated approach, Integrated water resources management, Integrated watershed Management approach, Case study
- Keywords: Integrated approach, Integrated Water Resources management, IWMA

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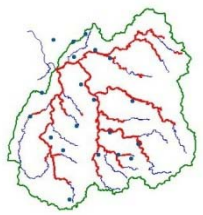

Introduction to Integrated Approach

- **Issues:**
  - Resources under pressure
  - Population under water stress
  - Impact of pollution
  - Water governance crisis
- **Challenges**
  - Securing water for people
  - Securing water for food production
  - Developing other job creating activities;
  - Protecting vital ecosystems;
  - Dealing with variability of water in time and space
  - Managing risks
  - Creating popular awareness and understanding
  - Forging the political will to act;
  - Ensuring collaboration across sectors and boundaries

Drought problems

Integrated Approach

- Natural system - Critical importance for resource availability & quality
  - Integration of freshwater & coastal zone management
  - Integration of land and water management
  - Integration of surface & ground water management
  - Integration of quantity and quality in water resources management
  - Integration of u/s & d/s water-related interests
- Human system- Determines resource use, waste production & pollution & development priorities etc.
  - Mainstreaming of water resources
  - Macro-economic effects of water developments
  - Influencing economic sector decisions
  - Integration of all stakeholders in planning & decision
  - Integrating water and wastewater management

Integration of Land & Water Management

- Land use developments & vegetation cover (crop selection) influence the physical distribution and quality of water
- Consider in overall planning & management of water resources
- Promotion of catchment and river basin management – Logical planning unit for IWRM
- **Green water:** Water directly used for biomass production and lost in evapotranspiration
- **Blue water:** Water flowing in rivers and aquifers
- Mostly water management focus on the blue water only
- Management of green water having significant potential for water savings, increasing water use efficiency

Human system integration

Integration of all stakeholders in the planning and decision Process

- Key element in obtaining balanced & sustainable utilization of resources
- Generally stakeholders represent conflicting interests & their objectives concerning water resources management may substantially differ
- Hence IWRM should develop operational tools for conflict management and resolution
- Essential to identify the water resources management functions based on lowest level of implementation
- In that process, relevant stake holders should be identified and mobilized

Efficiency, Social Equity & Sustainability

- Efficiency in water use is core principle of IWRM: water must be used with maximum possible efficiency
  - Economic efficiency
- Social equity: Means all people must have access to water of adequate quantity and quality
  - Participation in water management by all stakeholders – Best way to ensure equity
- Sustainability: To achieve ecological sustainability
  - Current water use should be managed in such a way that does not affect future generations
- **IWRM**: Integration of: Efficiency, Equity & Sustainability

WATERSHED MANAGEMENT

Integrated Water Resources Management

- **IWRM**- “A process which promotes -coordinated development & management of water, land & related resources, to maximize resultant economic & social welfare in an equitable manner without compromising the sustainability of vital ecosystems." (by Global Water Partnership GWP).
- involve applying knowledge from various disciplines as well as insights from diverse stakeholders to devise & implement efficient, equitable and sustainable solutions to water & development problems.
- A comprehensive, participatory planning & implementation tool for managing & developing sustainable Water Resources
- Open & flexible process – involve stake holders & decision makers

Ref: www.gwp.org

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Photo, A.K. Singh, 2002

WATERSHED MANAGEMENT

IWRM Principles - GWP

- From Dublin Statement:
  - Fresh water - a finite & vulnerable resource, essential to sustain life & development.
  - Water development & management - based on a participatory approach- users, planners & policy makers at all levels.
  - Women play a central part.
  - Water – public good with socio- economic value.
  - Equitable & efficient management – sustainable use.
- IWRM: Feeding the world, A world of cities, Depleted resources, working together across sectors, social change, Water is key to development.

Ref: **www.gwp.org**

IWRM - Concepts & Components

- IWRM Concepts: Multiple uses, Holistic management, Multiple perspective, Participatory approach & Women involvement.
- IWRM Components:
- Water allocation – to major users & uses
- River basin planning – priorities
- Stake holders participation – basis of decision making
- Pollution control - Managing pollution using polluter pays principles & appropriate incentives – minimize environmental & social impacts
- Monitoring – implement effective monitoring system
- Economic & financial management – sustainable benefits
- Information management

Ref: **www.gwp.org**

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IWRM – Planning

- IWRM – Basic Pillars:
- **Enabling environment** - suitable policies, strategies & legislation for sustainable IWRM
- Institutional frame work – practice the policies, strategies and legislation
- Setting the Management Instruments for implementation
- **IWRM Planning Cycle:** Study the system -> Analyze gaps -> Building commitment to actions -> Implement framework -> Monitor & evaluate progress ->Establish status & goals -> Build commitment to reform process -> Continue

Ref: **www.gwp.org**

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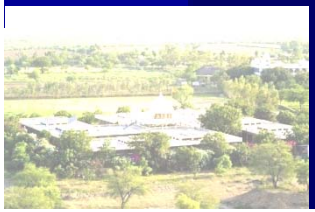
IWRM Procedure

- Managing water at the basin or watershed - integrating land & water, upstream & downstream, groundwater & surface water, & coastal resources.
- Optimizing supply – conduct assessment of surface & groundwater; analyze water balance; water conservation & reuse
- Managing demand – water efficient technologies
- Providing equitable access – effective water user's association
- Establishing policy – eg. implementation of the polluter-pays principle, water quality norms and standards
- Inter-sectoral approach- decision making, implementation & management.



IWRM - Basis

- Basic principles: water as social & economic good, holistic perspective, involvement of stakeholders
- Balancing economic efficiency, environmental sustainability, social equity
- Aligning interests and activities that are traditionally seen as unrelated or not well coordinated (horizontally and vertically)
- Not just water - integrating water in overall sustainable development processes.
- IWRM Incorporates: Integration, Equity, and Efficiency to achieve Sustainability

How to Implement IWRM?.

- The enabling environment: National/ provincial/ local
  - From top to bottom; From companies to communities
- The role of government: enabler, controller, regulator, service provider, improvement of public sector, Gov. & private sector, water markets,
- Water legislation: framework, political will to enforce, requirements.
- Cross sectoral & u/s d/s dialogue: allocation, coordination & implementation.
- Financing structures and investment allocations for water resources infrastructure: public investments, private sector, cost of water
- Co-operation within international river basins
- The institutional roles: capacity building.
- Management instruments
- Water resources assessment: availability and demand
- Communication and information systems
- Water allocation and conflict resolution
- Regulatory & economic instruments, Direct control, Self regulation

Integrated Water Resources Management

- Maximum development of water resources from a basin based on the quantitative information for planned beneficial use
- Involves awareness of present status of development, socio-economic considerations and policy formulation
- Flood routing
- Reservoir regulation
- River forecasting
- Conjunctive use of water resources

IWRM is Prerequisite

- Concentration of population irrespective of natural resources situation – Migration to cities
- IWRM involves Conjunctive use, deferred & maximum perennial yield computation of gross additional reserves available in basins
- Involves integration of scientific inputs into the local management

Photo, A.K. Singh, 2002

IWRM – Development & Management

- Water is a basic natural resource which nurtures life.
- Water for 3 Sectors: Food – irrigation; People – drinking, sanitation; Nature - ecology
- Due to variability of its availability in time and space, it needs 'development' i.e. storage for surface water and pumpage from groundwater.
- Developed (D) resource need management (M). D & M go hand in hand.
- They have to be integrated – IWRDM: Integrated Water Resources Development & Management.
- Product has to be sustained.

Integrated Water Resources Development & Management

- Integration of -
- River basin resources- surface and groundwater.
- Demands - consumptive and non- consumptive, and supplies.
- Facilities - mega to micro.
- Human and eco-systems.
- S&T and engineering with social, economic, synergic needs.

Photo, A.K. Singh, 2002

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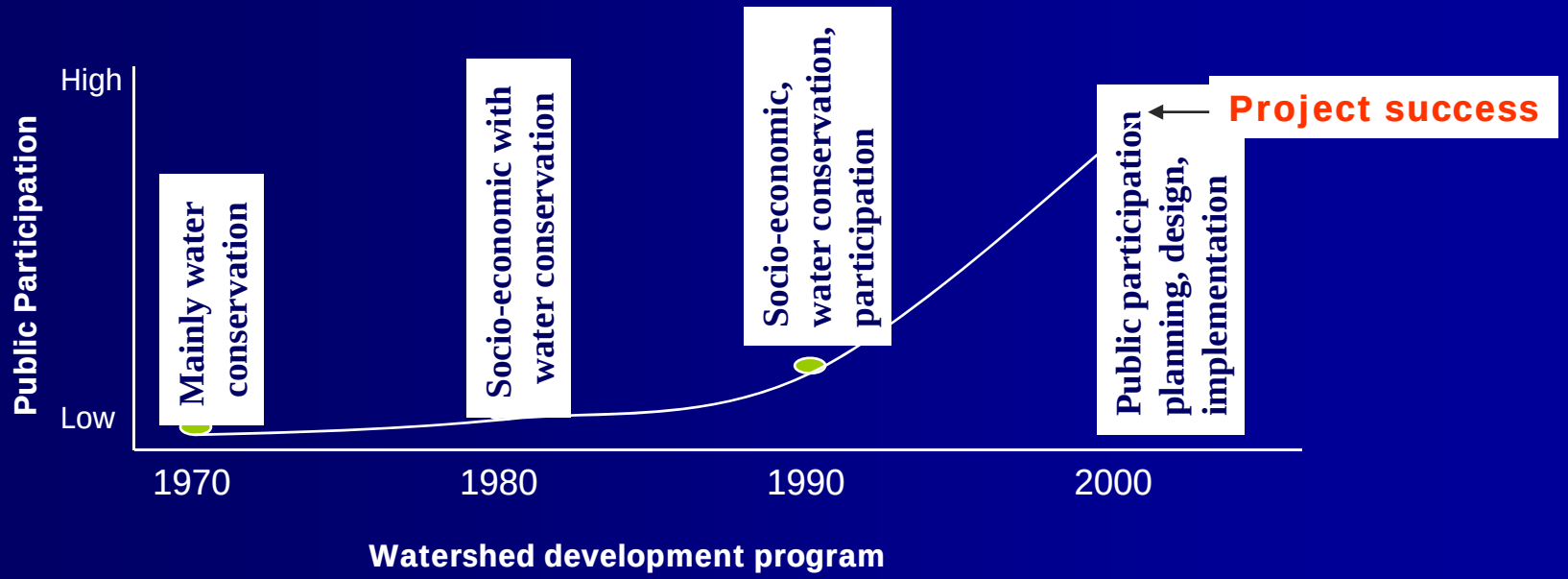
Integrated Watershed Management

- Objectives:
  - Water has multiple uses & must be managed in an integrated way.
  - Water should be managed at lowest appropriate level.
  - Water allocation should take account of the interests of all who are affected.
  - Water should be recognised & treated as economic good.
- Strategies:
  - A long term, sustainable future for basin stake holders.
  - Equitable access to water resources for water users.
  - The application of principles of demand management for efficient utilisation.
  - Prevention of further environmental degradation (short term) & restoration of degraded resources (long term).

Integrated Watershed Management Approach

IWM is the process of planning and implementing water and natural resources …… an emphasis on integrating the bio-physical, socio-economic and institutional aspects.



Social issues: involvement of women and minority.

Community led water users groups have led the implementation efforts.

IWMA

- The four engineering and management tools for effective and sustainable development of water resources in semi-arid rural India: -
  - Appropriate technologies
  - Decentralised development system
  - Catchment based water resources planning
  - Management information system
- In past the efforts were more on the soil conservation and taking measures on the land where as we used to neglect the welfare of the land users.
- For sustainable watershed management there is need to integrate the social and economic development together with soil and water conservation

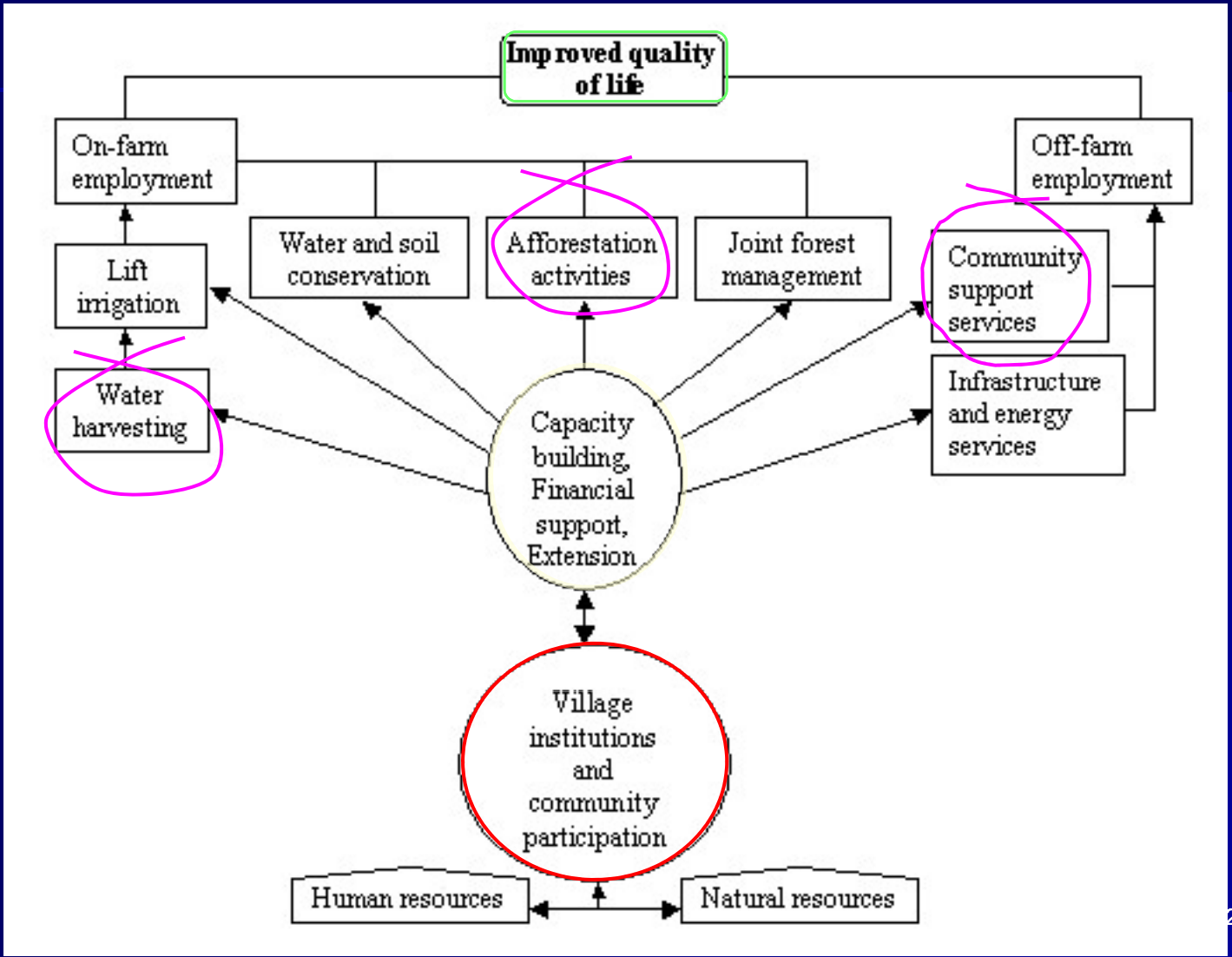
Integrated Watershed Management –Methodology

Important measures used are:

- Soil and water conservation
- Water harvesting for supplementary irrigation
- Community participation.
- Water regulation.
- Consideration of scale.
- Joint forest management.

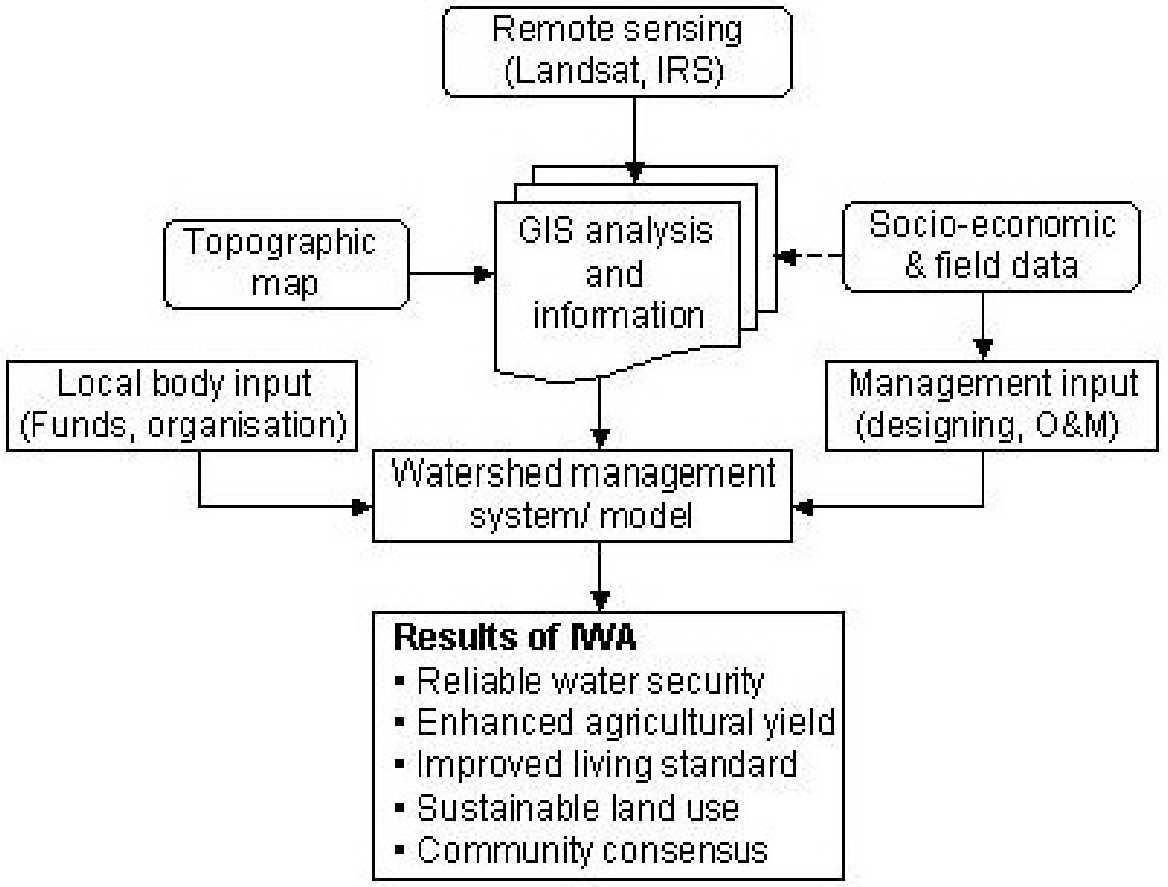
Photos: Singh, 07. 2001

IWMA Model



Ref: Singh, A.K., T.I. Eldho, D. Prinz (2002)

IWMA – Modeling through Advanced Technologies



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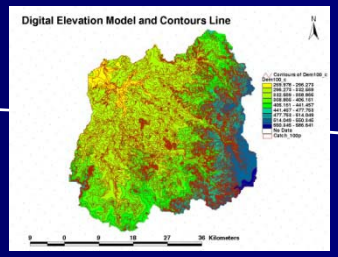
IWMA: Community participation & local capacity building

Rethinking development focus on people and community empowerment.

Natural Resources Mapping



Social Mapping

Village Volunteers

Participatory Appraisal

Prioritising Options

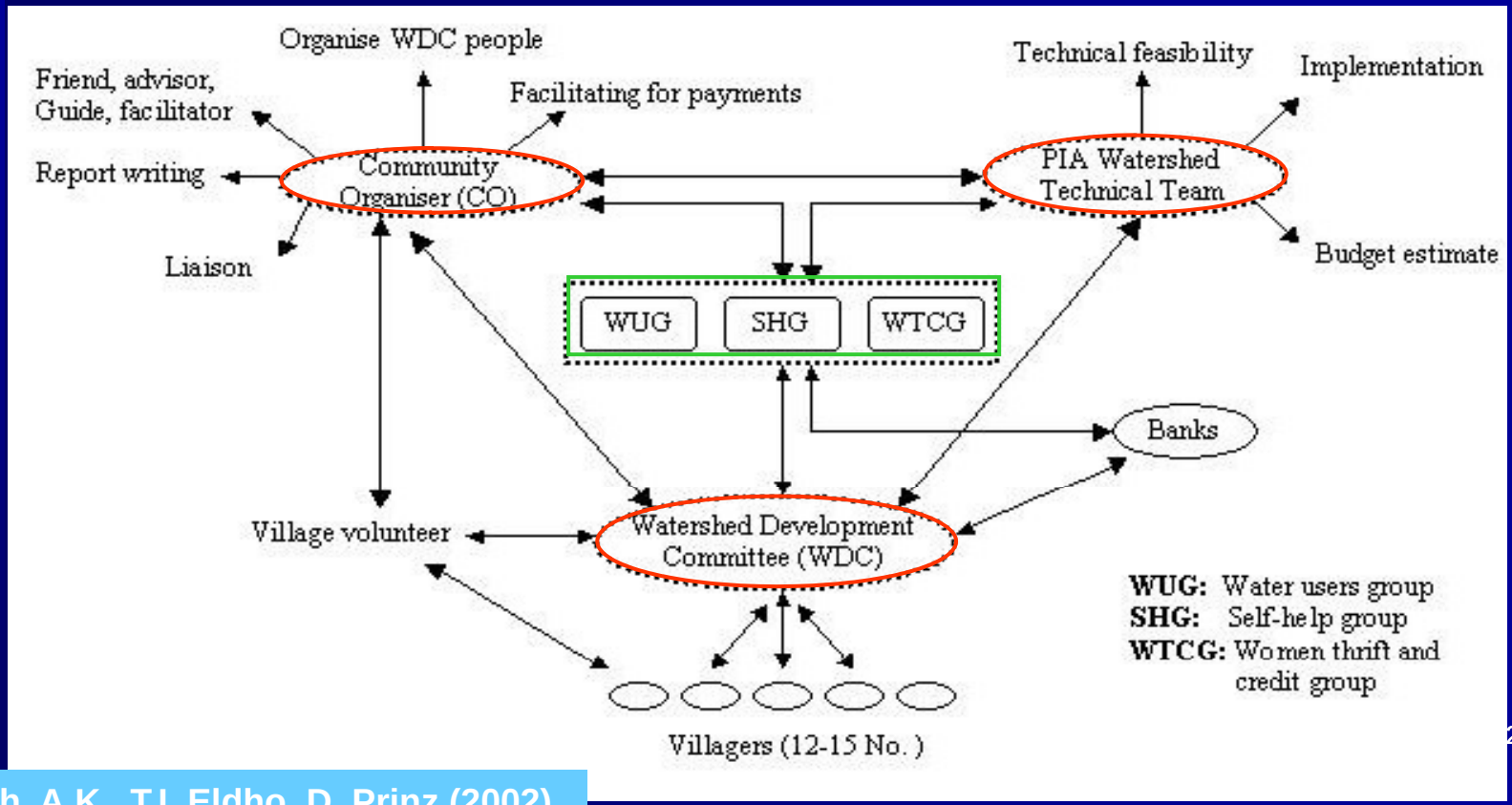
Implementation

Ref: Singh, A.K., T.I. Eldho, D. Prinz (2002)

Typical IWMA: Community Participation & Local Capacity Building

Development of new village level institutions & local capacity building.

Operation & maintenance of structures, regulation of financial matters, & conflict resolution.



Ref: Singh, A.K., T.I. Eldho, D. Prinz (2002)

IWRM Case Study: Integrated Management of Chilika Lagoon

- **Description: I**ntegrated lagoon basin management including interventions in both coastal processes & River basin - for restoration of a deteriorated lagoon with an ecosystem approach.
- Hydrologically, Chilika is influenced by 3 subsystems: i) Mahanadi river delta, ii) minor rivers flowing in lagoon from Western catchment & iii) tidal outlet to the Bay of Bengal
- Construction of major hydraulic structures upstream in the Mahanadi altered flow pattern & deteriorated Chilika.
- Long shore sediment transport along the coast of Bay of Bengal annually tend to shift lagoon mouth opening to the sea every year - affect the tidal exchange.
- Problems: Less flow, Siltation, weed growth, decrease in salinity

www.chilika.com

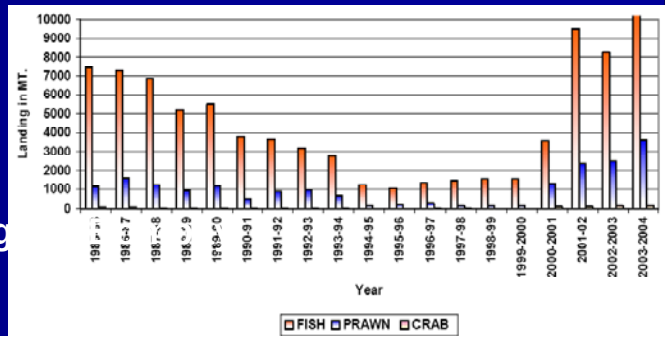
IWRM Case Study: Integrated Management of Chilika Lagoon

- Action Taken: holistic approach of integration of coastal processes and lagoon basin in the management planning.
- Hydro-biological monitoring of the lagoon
- Application of GIS and remote sensing tools - monitoring and assessment of the lagoon.
- Based on studies - Location of opening of the inlet was moved closer to the central parts of the lagoon – artificial mouth
- Dredging of channel - reduced length of the outflow channel by 18 km
- Environmental impact assessment – before & after opening the mouth

IWRM Case Study: Integrated Management of Chilika Lagoon

- Outcome- Significant improvement of the ecological health of the lagoon.
- Significant improvements of the salinity gradient – less fluctuation
- Improvement in fish generation & productivity.
- Substantial per capita income of the fishing community
- Typical case of management frameworks of numerous important coastal wetlands in the Asian region.

www.chilika.com



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Case study: IWRM - Chilika Lagoon

- Implementation success of Chilika Development Authority (CDA)- related to the non-bureaucratic organizational setup.
- Supported by a Governing Body with political backing combines stability of a Gov. authority with flexibility of private sector
- CDA- Management philosophy- pragmatic & outcome-focused, implemented by innovative leadership.
- CDA -involved in local socio-economic activities in support of local communities.
- Backed by strong outreach programme with active participation of local communities, NGOs & community based organizations.
- Hydrological interventions - improved its fishery resources, water quality & positive impact on biodiversity of the lagoon.
- Contributed in increase of per capita income of the community
- Increase in productivity level - in wetland & watershed due to good environmental practices - poverty alleviation of the community.
- Community participation and stewardship made the success.

References

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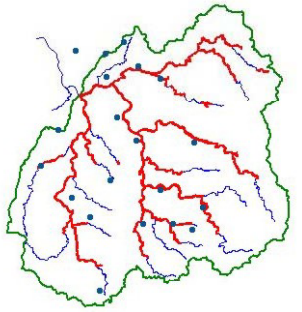
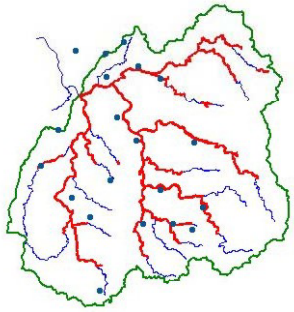


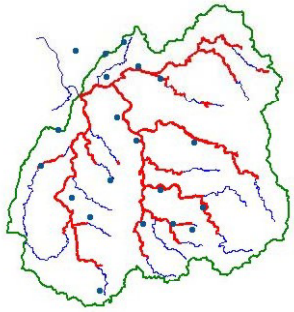
Tutorials - Question!.?.

- **Illustrate the Integrated Water Resources Management approach for Rural Watershed Management plan with a case study.**
- **For case studies Ref:** http://www.gwptoolbox.org/index.php?option=com_case&id=219&Itemid=45
- Identify the problems.
- Illustrate how IWRM approach used to solve problems.
- Discuss the lesson learnt.



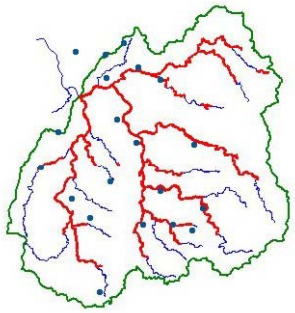
Self Evaluation - Questions!.

- Why integrated approach is needed in water & land management?.
- Discuss the importance of efficiency, social equity & sustainability relevant to IWRM.
- Discuss important components of IWRM.
- Illustrate Integrated Watershed Management Approach within the perspective of IWRM.



Assignment- Questions?.

- Discuss integrated approach in terms of “natural system” & “human system”.
- What are the important principles of IWRM?.
- Illustrate IWRM procedure.
- Discuss how to implement IWRM.
- Discuss role of modern techniques in IWMA.



Unsolved Problem!.

- For your Watershed area, prepare a master plan based on IWMA principles discussed.
- Identify the watershed problems.
- Check the applicability of modern techniques such as GIS & remote sensing.
  - Carry out detailed survey
  - Consider integrated approach for land & water
  - Consider options for water harvesting
  - Illustrate the stake holders participation in IWMA
  - Suggest IWMA based methodology
  - Illustrate: how to achieve efficiency, equity & sustainability

WATERSHED MANAGEMENT

THANK YOU

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