

# WATERSHED MANAGEMENT

Module 2 – (L4) Sustainable Watershed Approach  
& Watershed Management Practices

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Lecture No -

4

**Sustainable Watershed  
Management**

# WATERSHED MANAGEMENT

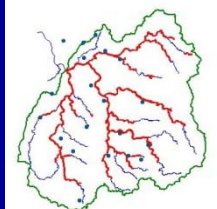
## L4–Sustainable Watershed Management

- **Topics Covered**
- Introduction to the concept of sustainable watershed management, Principles of sustainable watershed management, Natural resources management, Case Study.
- **Keywords:** Sustainable watershed management, Natural resources Management



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## Sustainable Development

- **'Sustainable Development' (SD):** "Meeting the needs & aspirations of present generation without compromising the ability of future generation to meet their needs".
- Aims at global security – integrating economics – science of development & ecology – science of environment.
- SD – must deal with threat of poverty, population growth & environmental degradation
- It preserve & enlarge: physical, human & environmental capital
- **"Growth – woven around people, not people around growth"**



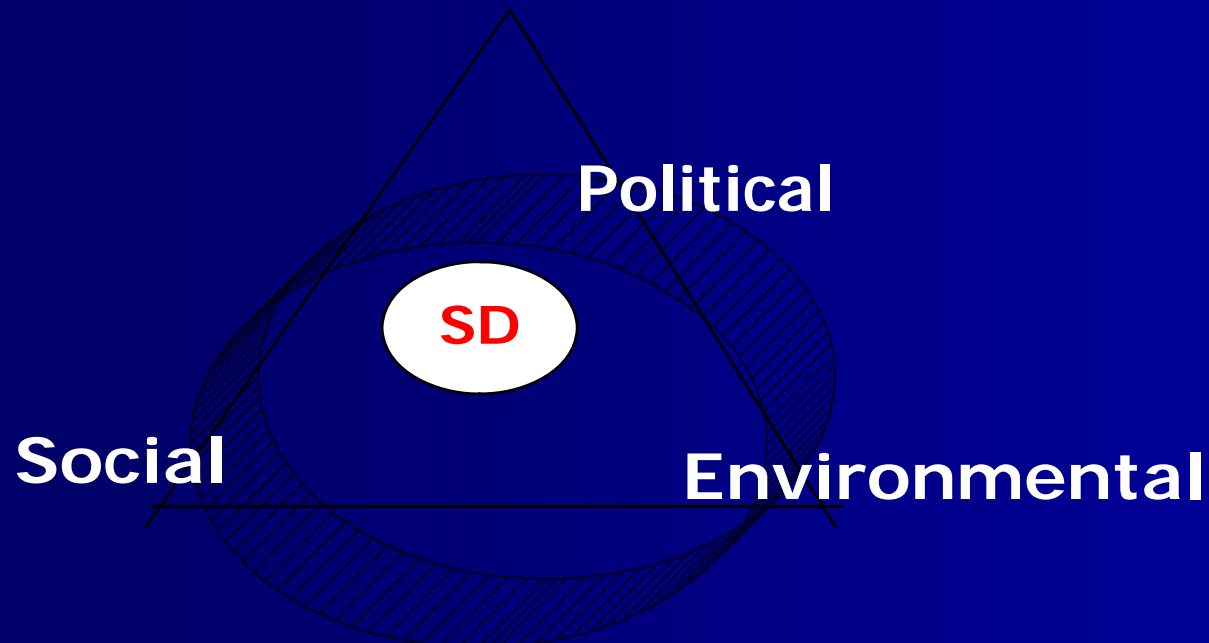
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# WATERSHED MANAGEMENT

## Sustainable Development Economic



To achieve sustainability: Socially acceptable, economically & technically viable project, multi-disciplinary approach, social institution, involvement of stake holders – **Holistic approach** - Capacity Building- **“good science & smart planning”**

# WATERSHED MANAGEMENT

## Sustainable Development & Water Resources Management

- Development & management of water, land, biomass & energy within a time frame:
  - to meet with minimum needs of the ultimate size of population, without irreversibly affecting the resource base and while containing adverse effect on people, flora and fauna.
- Economic development decisions by the present generation without compromising capacity of future generations:
  - to take decisions according to their perceptions for themselves and for their future generations. **FLEXIBILITY, RESILIENCE** have to be the hallmarks.



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## Development & Management of Water Resources

For 3 Sectors

Food- Irrigation; People- Drinking, Sanitation;

Nature - Ecology

- Water is a basic natural resource which nurtures life.
- Less than 3% is freshwater and less than 0.03% is accessible to mankind.
- Due to variability of its availability in time & space, it needs 'development' i.e. storage for surface water & pumpage from groundwater.
- A developed (D) resource needs management (M). D & M go hand in hand.
- To be integrated (IWRDM)- to be sustained.



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## Sustainability Issues for IWRDM

- **People:** Stable population, survival & fulfillment of minimum needs; deprivation, poverty, hunger, thirst, malnutrition, unemployment, lack of hygiene-sanitation-health, migration, rehabilitation & resettlement. Photo, A.K. Singh, 2002
- **Water:** Loss of storage due to siltation; fall of groundwater table; recession of glaciers, incidence of drought and floods, quality degradation, salinity ingress, recycling and reuse, drying of rivers.
- **Land:** Water logging & salinity, wetlands-marshes-mangroves, drainage and reclamation, desilting of water-bodies & canals, protection for watersheds, erosion, inundation and sea-level rise, advance of deserts, submergence, fertility, productivity of land, reclamation.



## Sustainability Issues – con.

- **Product:** Level of food production, balanced composition, quantity-quality-timeliness of supply, energy generated, healthy environment.
- **Facilities:** Dams, canals, pumps, turbines, embankments - their repairs, modernization, replacement, enlargement; safety, longevity, desiltation, serviceability, upkeep, special repairs.
- **Biomass:** Conservation of bio-diversity, gene banks, tissue culture, energy plantations, irrigated forestry, biosphere conservation zones, glass houses.
- **Develop 'SUSTAINABILITY' Performance Indicators.**



## Sustainable Watershed Management (SWM)

- **Sustainable watershed management** - approach of taking water resources management practices in a holistic fashion - taking into account of the usage behavior of various sectors and their effects on land & water use that include political, economic, social technological & environmental considerations.
- Widely used concept for government, bilateral and multilateral development agencies

## Sustainable Watershed Management

### Purpose of sustainable watershed management

- To protect the land & water resources
- Habitat supported by resources for future generations
- Balance future growth while protecting existing

### Major task of the watershed manager

- To integrate all planning & management activities
- To fulfill the main management objectives and sustainability of precious resources

### Improvement - definition of watershed management

- By adding concept of integration & sustainability
- of land, water, economic & social resources to upgrade human welfare in a quality environment.



## Motivation for SWM

- The term “**sustainability**” was popularized in Burtland report in 1987 (**World Commission on Env. & Dev.**), where sustainability was implied as an equitable distribution of the resources not only spatially between users in a given location, but temporarily between users over time.
- Later on, the main recommendation from the report was integrated into –
  - Agenda 21 of Rio summit 1992 and Dublin Principles
  - International Hydrological Programme (by UNESCO) after 1992 phase

# WATERSHED MANAGEMENT

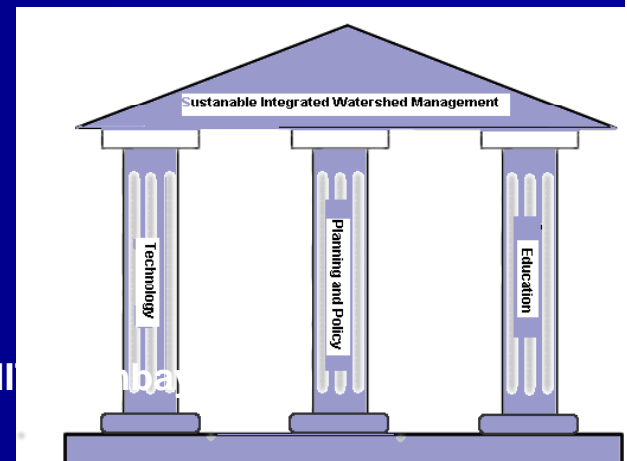
## Principles of SWM

- Technical & socioeconomic measures -based on sound data & experimental investigation
- Successful activities in a small watershed may lead to integration of achievements in a large river basin
- Good coordination among the institutions who are working towards fulfilling IWM goals
- Avoid local politics to lead people in misuse, when designing policies and legislative measures
- Community participation



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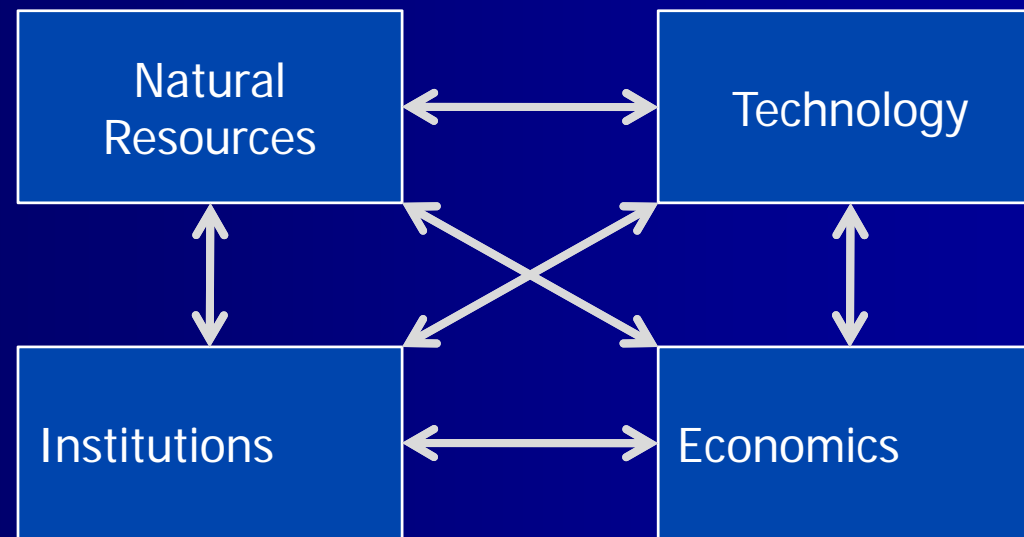


## Frame work for SWM

- **Purpose:** To introduce program that balances growth with natural resource protection for sustainability
- Three stages: Technical, Planning and Watershed Community Outreach.
- **Technical stage:** Identifies the impacts of rapid growth on a watershed's resources
- **Planning stage:** Develop management strategies that balance regional growth with natural resource protection
- **Watershed community outreach:** Innovative approach to protect the region's resources through community-wide public events

## Elements of SWM

- Four basic elements (shown in figure below) and they are inter-connected. Therefore the need to look at all these elements in an integrated way



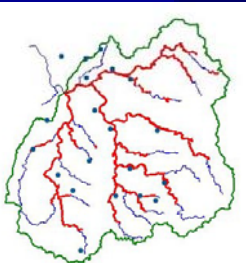
## SWM - Natural Resource Management

- **Natural resource management**- focuses on scientific & technical understanding of resources & ecology & life supporting capacities of these resources.
- In addition, it also focuses on to understand right of stakeholders with regard to use of natural resources
- **Natural resource management** may include interventions related to – Reducing soil erosion
  - Increasing water availability
  - Increasing productivity
  - Improve adaptability especially in context of climate change



## SWM element - Technology

- **Technology** - improved way of use of information system to understand the natural resources and also implementation by engineering or biological measures
- **Technological measures in SWM** include-
  - Its suitability to the environ-climatic system of locality
  - Should be simple to construct so that can be maintained by unskilled labor
  - Should address material as well as labor availability
  - Can be indigenous
  - Provide better access to information





## SWM Element – Institutions

- **Institutions** - formal & non-formal group of individuals bound together by some common purpose to achieve set objectives. Eg. Government departments, gram panchayats, farmer's group, women group, water users associations etc.
- **Institution involvement in SWM includes –**
  - Address governance issues that includes accountability, transparency, equity, efficiency & participation
  - Helps to understand the rules and customs of a locality including land tenure system, property rights and collective actions
  - Looks into inter-stakeholder issues



Photo, A.K. Singh, 2002

## SWM Element - Economics

- **Economic** - financially viable approach for any planning implementation (both social & technical) measures; **Focuses** on development, operation & maintenance of the activities; **Address** - cost effectiveness as well as affordability concept of development activities.
- Cost-effectiveness means
  - Low cost of construction and maintenance at easier availability of labor and material
  - High output income from activities
- Affordability means
  - Access to capital and ability to pay
  - Eligibility to subsidies



## SWM Approach

For a **successful SWM** approach - activities should be designed in phases that should essentially involve four core elements as discussed earlier.

**The phases** are-

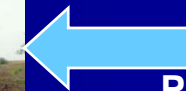
- Planning Phase
- Implementation Phase
- Post-implementation phase



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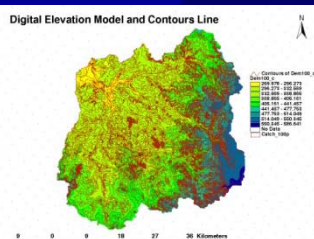


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## SWM - Planning Phase

Activities proposed (in general) -

- Natural resource Management
  - Developing understanding of local resources available
  - Generally resource mapping - includes blend of scientific and local knowledge.
- Technology
  - Scientific understanding about the problems and possible solution that leads to sustainability
  - Water resources modeling approach blend with application of remote sensing and GIS techniques



## SWM - Planning Phase

### ■ Institution

Photo, A.K. Singh, 2002

- Identification of formal & non-formal groups & individuals in the area- **stakeholder analysis**
- Identification of existing government policies for dovetailing of funds and ensuring that the proposed activities should be in line - **Policy analysis**

### ■ Economy

- Financial management plan of individual activities
- Ensuring community participation either in monetary terms / in form of kind (material or labor)
- Ensuring financial transaction- in transparent manner



## SWM- Implementation phase

- **Implementation phase** - cover development of necessary infrastructure with community participation.
- **Capacity building** - Important activity during the phase. The activities under the phase are-
- **Natural resource Management**
  - Identifying land tenure status of the areas for which interventions has been proposed under planning phase
  - Carrying out dialogue with land owners for effective utilization



Photo, A.K. Singh, 2002



## SWM - Implementation Phase

- **Technology**
  - Engineering surveys for identifying feasibility of interventions for a particular location
  - Carrying out related scientific studies for identifying beneficiaries from interventions
- **Institutions**
  - Capacity building of local institutions
  - Developing effective delivery mechanism for each interventions
- **Economy**
  - Cost analysis for individual intervention
  - Affordable cost contributed by the community to cover partial capital.

## Post –Implementation Phase

Post-Implementation phase objectives: To –

- Ensure **sustainability** of proposed interventions even after closure of the intervention
  - Design of effective institution mechanism where local community take charge of management of interventions
- **Assess the impact of interventions taken**
  - Working on methodology of monitoring and evaluation approach for individual interventions
  - Using key performance indicators approach for assessing progress of the project
  - Using input-output approach



Photo, A.K. Singh, 2002



## Case Study- Success of Pani Panchayat

- **Pani Panchayat** (Water Council)- voluntary activity of group of farmers committed through sustainable development of village - through equitable distribution of water to all - through sustainable watershed development to improve life of inhabitants with participation of communities.
- **'Pani Panchayat'** is the name first given to a movement for motivating farmers of Naigaon Village of the drought-prone Purandhar taluka of Maharashtra State.
- **Conflict over water solved** – through people participation, water management & Lift Irrigation.
- **Overall community development** – formulated by Vilasrao Salunkhe – 1970s

## Objectives – Case study

- To identify local needs, local resources, local talents, local strength and to integrate them.
- To carry out experiments for optimum use of natural resources like water, land and solar energy.
- To carry out experiments to demonstrate effective water conservation and maintain soil fertility.
- To carry out experiments for implementation of organic farming / natural farming and setting small village industries for value addition in the agricultural products.
- Interact with decision makers to incorporate proved rural development methods into the policy of the Government.
- To provide education, training and infrastructure in order to implement the above objectives.

## Principles of Pani Panchayat

- **Sustainable water use**
- **Equity**- Every family in the village - allowed water for cultivation, allocation based on family size not land holding
- **Efficiency**- water intensive crops should not be grown in the village – Protective irrigation
- **Participation**- cropping schedule should be decided by mutual agreement with member farmers
- **Economy**- water taxes should be paid by all members by the dates fixed up, failing which water supply should be cut for member's farm

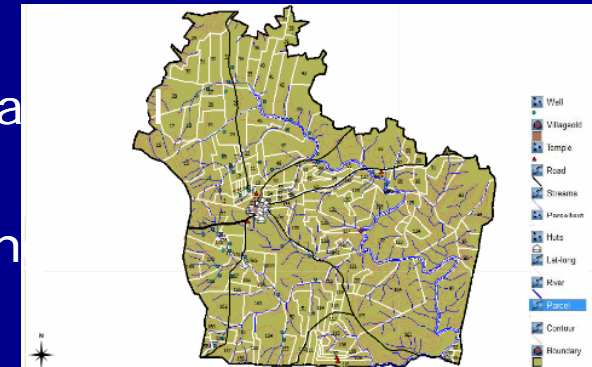
## Case study - Ponde Village model of Pani Panchayat

### ■ Problems in the village

- Area experiencing low rainfall ~ 500 mm
- Over abstraction of groundwater - serious concerns

### ■ Activities undertaken

- Resource Mapping- Developed geographical information system for better understanding of project area
- Well monitoring – identified recharging wells as well as discharging wells
- Pumping test- to identify potential pumping regions
- Water quality test – to understand surface water and groundwater interaction



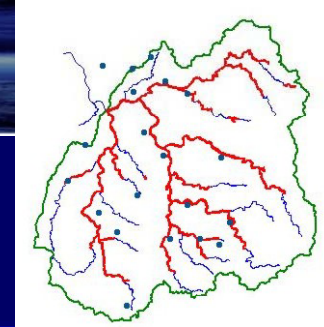
<http://panipanchayat.org/pondemodel.html>

## Case study Outcomes

- Migration from the village has stopped
- Agriculture yield has increased due to increased water table and in situ moisture.
- Lift irrigation schemes has increased in the village and are functioning sustainably.
- Villagers are able to produce two crops a year with an irrigation provision of about 8 months.
- Increase in local employments opportunity in the village
- **Overall socio-economic & community development**

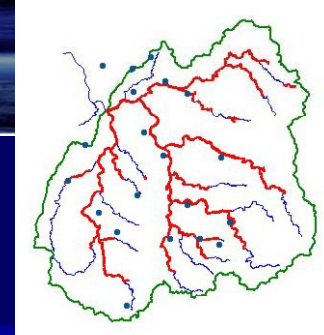
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- <http://panipanchayat.org/service.html>
- Hariyali guidelines of government of India
- <http://sdnp.nic.in/casestudy/cases/panipanchayat.html>
- <http://mowr.gov.in>



## Tutorials - Question!..?.

- **Illustrate solution approach for SWM for your watershed?.**
- Identify the extent of watershed- watershed delineation using appropriate GIS based analysis
- Carry out resource mapping
- Identify the problems
- Identify areas having problems such as soil erosion, floods, deteriorating water quality and also trace out possible reason for that.
- Important step for identifying the problems and attributing reason is that the local people should be involved with the team of scientist and engineers.



## Self Evaluation - Questions!.

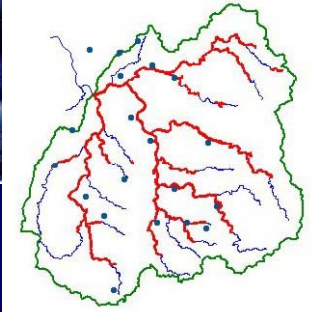
- What are the common sustainability issues for IWRDM?.
- Discuss the principles & framework for Sustainable Watershed Management approach.





## Assignment- Questions?.

- Explain the elements of Sustainable Watershed Management.
- Illustrate Sustainable Watershed Management Approach.
- Discuss a case study of Sustainable Watershed Management.



## Unsolved Problem!

- Traditional soil and water conservation plans has failed due to its single point emphasis on building engineering structures. In addition the villagers neither understand the basic purpose of creating these structures nor find any incentives of maintaining them. Also, these structures are vanishing after few years of completion of project.
- **Identify suitable sustainable watershed management approach to address the problem?.**
  - Carry out stakeholder analysis
  - Consider traditional practices of farmers
  - suggest local methods
  - Identify soil conservation measures
  - Identify proper monitoring and evaluation strategy and involve local people

# WATERSHED MANAGEMENT

# THANK YOU

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