From micro watershed to river basin: Issues and prospects of up-scaling

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Structure of the paper

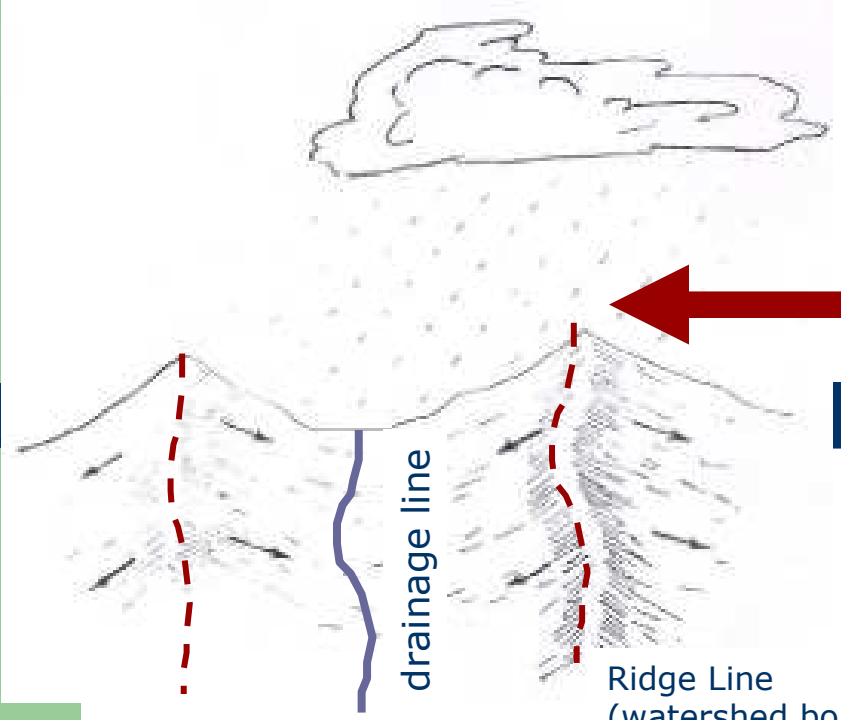
- Introduction
- Understanding watersheds and watershed interventions
- Evolution of watershed development polices and programmes in India
- Performance of watershed development programmes: Evidence from the field
- From micro watershed to river basin: Way forward
- Conclusion

Introduction

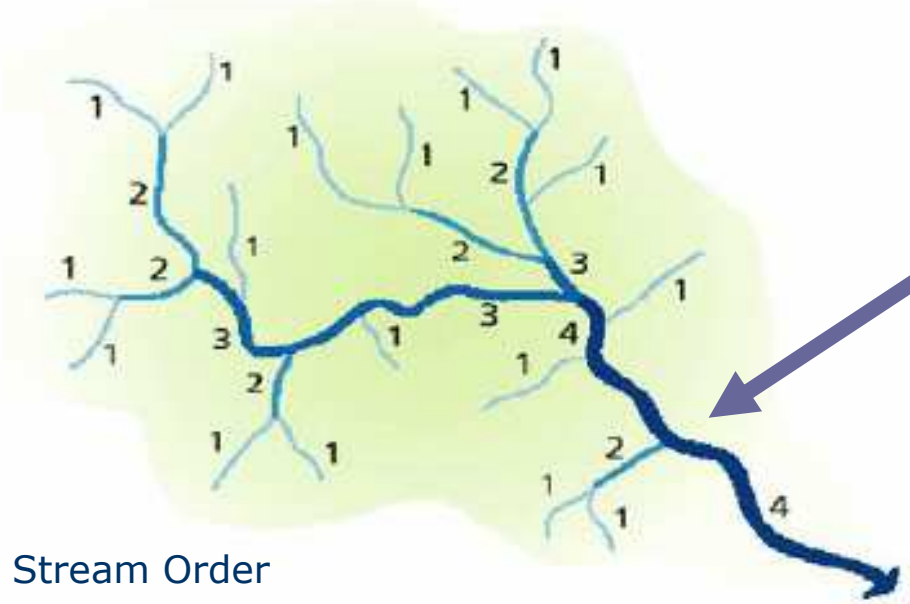
- Why is it watershed based development important?
  - Can tie together the twin concerns of ecological regeneration and livelihood needs
  - In tune with the spirit of decentralization and direct democracy
  - Can go beyond the sectoral approach to development

Understanding watersheds and watershed interventions

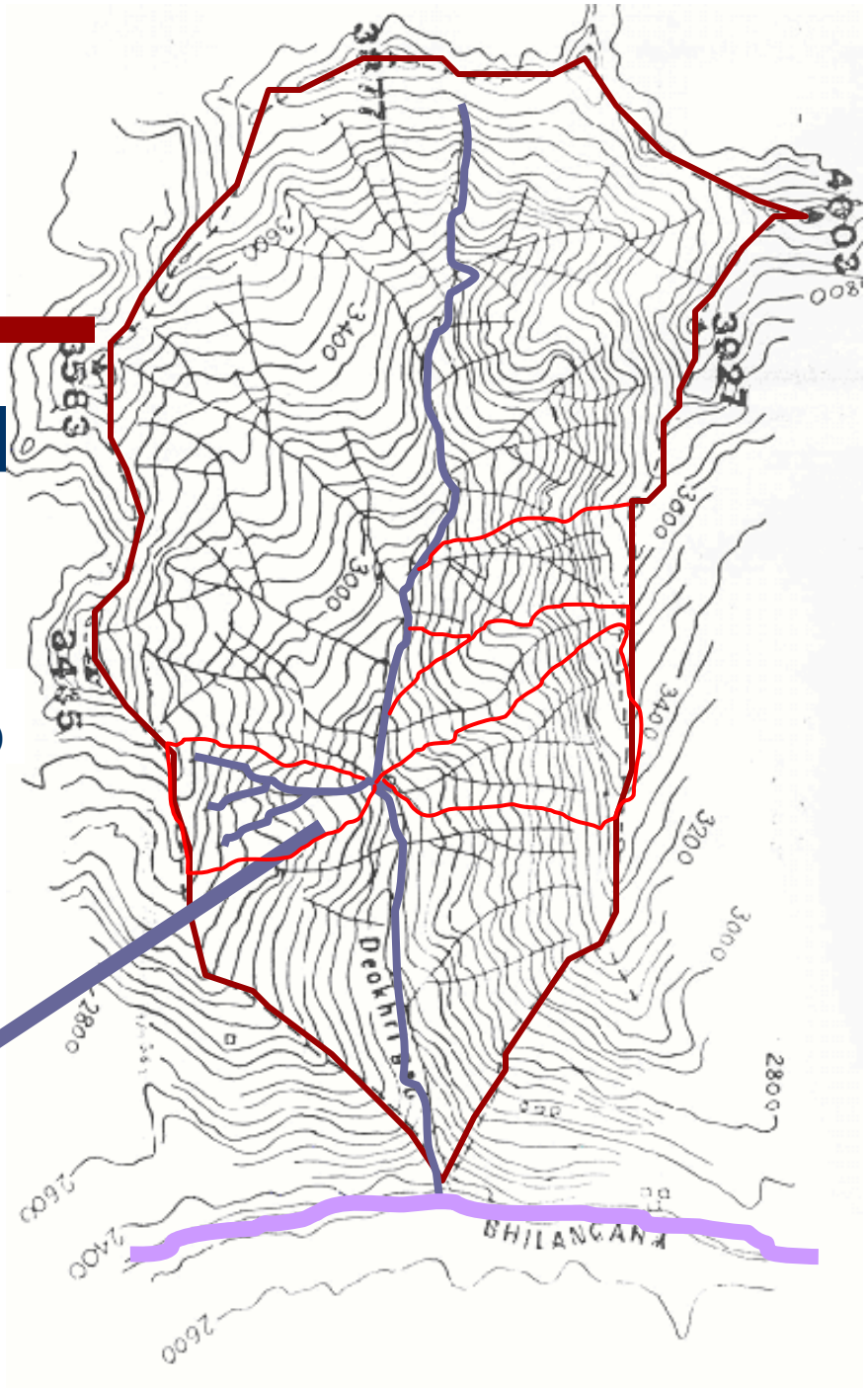
- What constitutes a watershed?
  - a region bounded by a water divide with a common exit point



Ridge Line
(watershed boundary)



Stream Order



Watershed: size

Category	Size Ranges (sq km)	Number
Basins	30000-250000	35
Catchments	10000-30000	112
Sub-catchments	2000-10000	500
Watersheds	500-2000	3,237
Sub-watersheds	100-500	12,000
Milli-watersheds	10-100	72,000
Micro-watersheds	5-10	400,000

Source: Bali 1979

1 sq.km = 100 Ha

Performance of watershed development programmes: Evidence from the field

- Productivity gains are often limited and temporary
- Landless and marginal farmers often benefit only marginally or not at all, increasing inequities within the village
- Common lands do not get adequately treated, and revegetation does not take place as expected
- Gains from recharge of groundwater are rapidly dissipated through increased withdrawal
- Domestic, livestock & ecosystem water needs often do not get addressed

Performance of watershed development programmes: Evidence from the field

- Downstream impacts of intensive upstream water conservation are not being considered
- People's participation is limited to the implementation stage; often there is no building of institutions for long-term collective governance and management of resources

Some of the reasons

- Excessive focus on engineering structures; social processes and institutions are either ignored or de-linked from the biophysical interventions
- Inadequate knowledge of local biophysical conditions, poor technical analysis and no integration of local knowledge
- Limited focus on common property land resources and the livestock sector
- Issues of water management or rural domestic water supply needs are typically not addressed

Some of the reasons

- 'Self-help groups' and 'user groups' are promoted without addressing deeper issues of democratisation and empowerment
- Lack of transparency on the part of implementers and rigidity of guidelines
- No clear normative framework as to what 'rural development' is all about: equity or sustainability concerns do not figure in the frameworks
- Problems arise because the interaction between the biophysical and the socio-economic processes in WDP is not understood and addressed in an integrated manner

Some of the reasons

- For example:
  - WDP converts surface flows to groundwater: property regime changes, privatising and concentrating common pool resources
  - Increased water harvesting, coupled with intensification of water use, can lead to depletion of aquifers
  - Agricultural water use acquires higher priority and this may result in shortages of water for drinking and domestic use, or force a shift to deeper aquifers leading to problems of salinity and toxicity
  - Cumulative effects of treatment of a contiguous set of micro-watersheds can be significant and can impact downstream water bodies

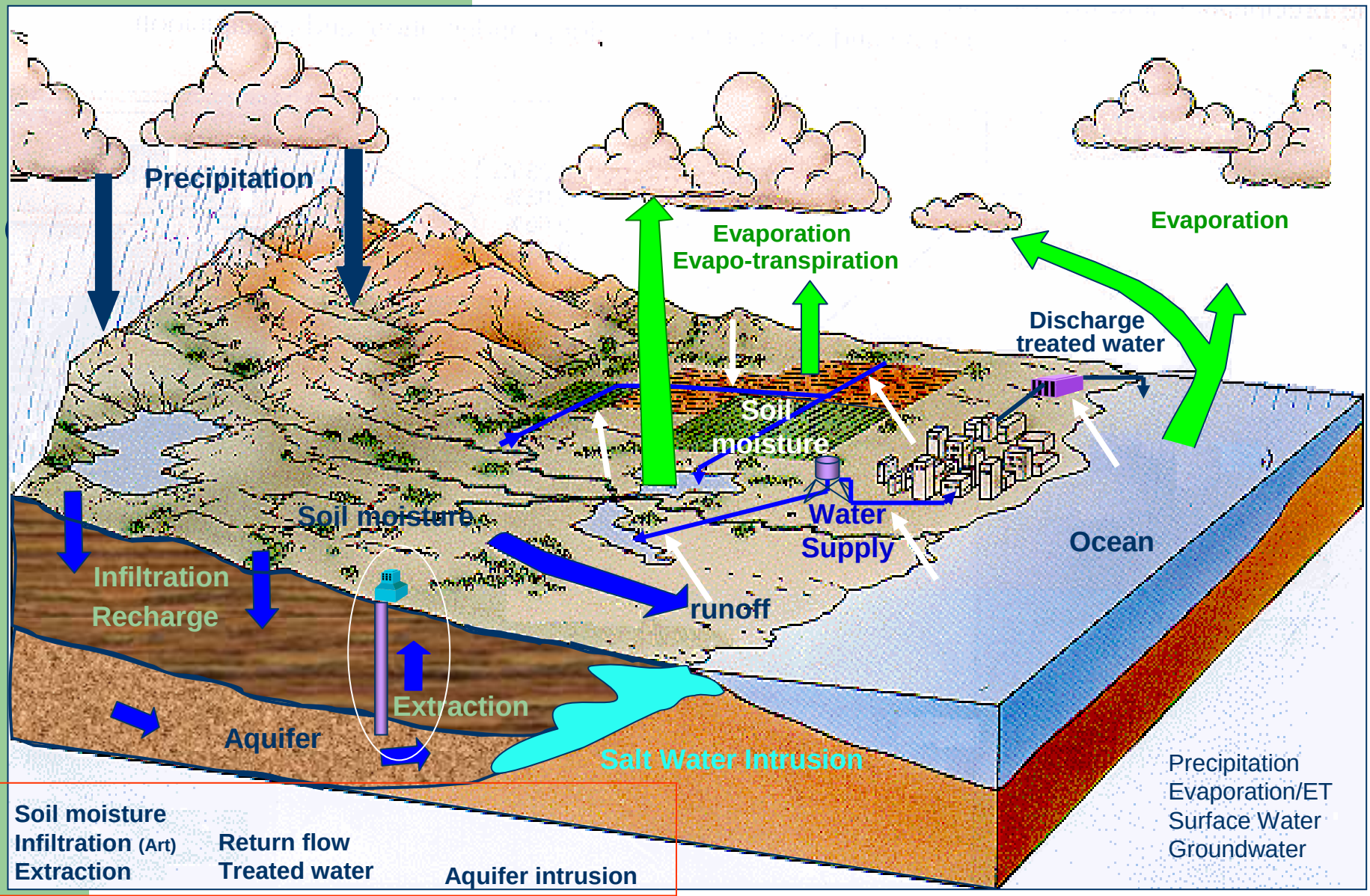
From micro watershed to river basin: Way forward

- Normative framework
  - Productivity enhancement and livelihoods
  - Sustainability
  - Equity
  - Democratization

Bio-physical and socio-cultural peculiarities of water

- Water is a resource embedded within ecosystems; not a freely manipulable resource; nor is it a resource to be indiscriminately mined
  - Concept of environmental flows, minimum flow required for the preservation of ecosystem services
  - Issues related to water quality: who is returning how much of water to the ecosystem and in what condition

Hydrologic Processes in Human Environments



Bio-physical and socio-cultural peculiarities of water

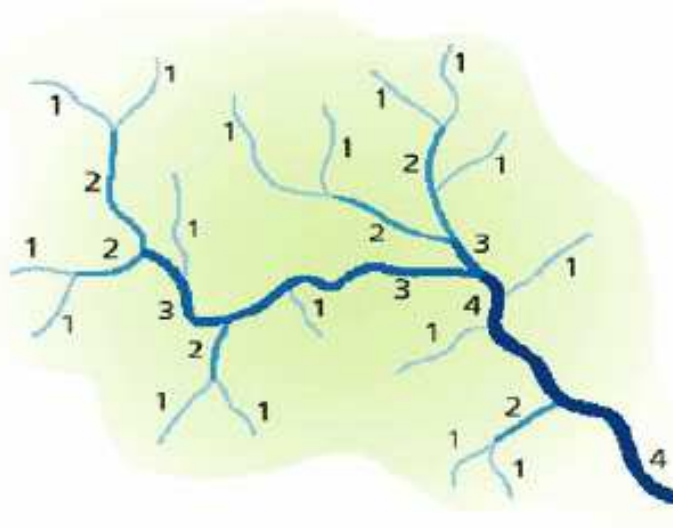
- Water is a common pool resource
- Water is present at many scales
- The way watershed is planned, used and managed causes externalities
- Unidirectionality and asymmetric relationship
- It needs an approach that nests different scales – from micro watershed upwards to basins and further up to states and countries

Bio-physical and socio-cultural peculiarities of water

- Water is both a local and non-local resource
  - It has implications for our idea about rights
- Assured and variable nature of water
- Spatial or locational disadvantages emanating from the bio-physical characteristics of water
- Historical inequities on the basis of class, caste, ethnicity, patriarchy and so on

The issue of tiling and nesting

- Increasing size and its relationship to a change in the nature of hydrological processes within a watershed
  - The balance between surface processes and channel processes
  - Issue of nesting: cannot treat each watershed as independent; needs to take into account the impact of nesting on a particular location
    - It becomes all the more important as we move downstream



The issue of tiling and nesting

- We cannot uniformly 'tile' a basin with independent, un-nested micro watersheds
  - Needs different handling of surface dominated and channel dominated watersheds
  - One possible way is to treat streams differently; demarcate a channel dominant zone from the 3rd or 4th order stream onwards
  - Intensive watershed development in the upstream can have mixed impact on the downstream, channel dominant zone

The issue of tiling and nesting

- Conventional watershed approach may not be applicable to the downstream watersheds that depend much more on exogenous flows
  - importance and significance of planning for resources `endogenous' to the watershed together with `exogenous' water becomes important

Productivity oriented hydrological planning

- Watershed development can reconcile the apparent conflict between conservation objectives and productivity enhancement objectives
- Conservation approach:
  - Tries to minimise run-off as a unilinear strategy
- Productivity-oriented hydrological planning approach:
  - Tries to change the components of the water balance
    - maximise biomass production
  - How do we handle storages?

Livelihoods, biomass and water requirements

- Livelihoods: what does it constitute?
  - How many of these needs to be fulfilled locally, in kind?
- Biomass as a measure to estimate livelihood needs
  - 15 to 18 tons of biomass per family of five
- The required water
  - Using a productivity norm of 30 kg/ha-mm we get a water use of 6000 m^3/family/year
  - 200 m^3 for domestic water use + 200 m^3 for livestock
  - Total water use: about 6400 m^3/family/year
- Can watershed development meet this?

River basins are not clean slates

- As we move to higher scales we have to engage with the already existing developments in the form of large, medium, small water storages and diversions
  and the water and land use pattern around them

Basin level allocations

- Unlike in the western concept of watersheds, we have to allocate water for livelihoods
- Even at a micro watershed scale the issue of allocations has not been poorly understood
  - It becomes all the more complex as we move on the scale
- Historical trend has been increasing establishment of rights over water from downstream to upstream
- Watershed development makes it possible to tap water upstream and use for livelihoods
  - "robbing Peter to pay Paul"

Basin level allocations

- The issue of water use prioritisation
  - National and state water policies
- Issue is not one of simply changing the order of priorities
  - Sequential
  - Proportionate
- Change in nomenclature

Basin level allocations

- Other viewpoints about allocations:
  - minimum abstraction
  - water for other uses should be allocated only after setting aside the water required for ecosystem needs
  - river basins should have the freedom to decide on priorities across different uses excluding domestic water, environmental flows and water for livelihoods
- Needs to aggregate different uses and work out scenarios for average years, deficit years and "surplus" years

The issue of boundaries

- Hydrological vs. political/administrative
- May be at a higher scale (sub-basin), there may be better synchronisation
- Implications for data aggregation and institutions

Combining participative processes with scientific information and data

- Two sources of data
  - Participative methods – localised data sets
    - Participatory Rural Appraisal (PRA), Participatory Resource Mapping (PRM)
  - Data form the scientific establishments
    - Large scale surveys, Remotely sensed imageries
  - Both have problems
  - Issue is how do we integrate them
  - Data to be made available on public domain
- Resource literacy – ability to make informed choices

Matching of micro and macro

- Participative processes at micro watershed scale and top down approach at river basin scale and they seldom meet
- Effort should be to evolve plans at different scales through a bottom-up and top-down interactive process (iteration)
  - get away from "localism"
  - get away from externalities
  - internalise as far as possible the developments that have already taken place
  - match the micro with the macro

Matching of micro and macro

- Importance of matching micro and macro
  - Resource use norms at a micro watershed scale may be far out in comparison to the resource availability at a basin scale
  - Basin level estimates are often based on coefficients that estimate virgin flow disregarding modifications brought in by upstream use
- Need for water balance studies
  - Robust models required

Institutions and institutional structure

- Institutional fragmentation
- Absence of institutions at meso scale (sub-basin, river basin)
- IWRM and talk of RBOs
- Institutions:
  - norms, process and practices that govern the behaviour (norms regarding resource access)
  - specific institutional or organisational forms

Institutions and institutional structure

- Institution design principles of institutions at various scales:
  - Planning, conservation, allocation, use, management and regulation of water should be based on the principle of subsidiarity
  - The spirit of constitutional provisions for decentralisation of powers and functions in urban and rural areas (in the light of the 73rd and 74th constitutional amendments and PESA) should be respected
  - A nested/federated institutional structure where the higher level institutions are built from the lower ones and they are organically linked
  - Institutions should be inclusive and democratic

Institutions and institutional structure

- Institutions
  - Governance functions
  - Management functions
- Specialised institutions for:
  - Benchmarking, data collection, aggregation
  - Monitoring, reviews
  - Training and capacity building
  - Regulation

Conclusion

- Micro watershed to river basin: it is much more complex than mere tiling of the basin with micro watersheds or scaling up the micro watershed experience to the basin scale
- Way forward:
  - Concerted effort in re-orienting the watershed based development programme in the country
  - Scale up our micro watershed experience to one level higher, say the milli watershed scale of up to say 10,000 ha
  - Taking up a few pilot projects at a sub-basin/basin scale in an action research mode so that they become our learning grounds for further scaling up