Environmental flows in India: Case studies, achievements and future work

September 15, 2016
Outline

• E-flows: Our journey so far
• Understanding trade offs and economics
• Setting the scene for E-flows Implementation
1. E-flows: journey so far

temporal and spatial variations in quantity and quality of water required for freshwater and estuarine systems to perform their natural ecological functions (including material transport) and supports the spiritual, cultural and livelihood activities that depend on them
Holistic Methodology

- Cultural and religious
- Hydraulics
- Fluvial geomorphology
- Hydrology
- Biodiversity
- Socio-economical
- Water Quality
River Health Classes

• **Near-pristine:** Reaches with minimal human interference

• **Slightly Modified:** Reaches with some evidence of human interference, but still functionally intact.

• **Moderately Modified:** Reaches with clear evidence of human interference, but still largely functionally intact.

• **Degraded:** Reaches with evidence of considerable human interference and functionally disturbed.

• **Critically Degraded:** Reaches dominated by human interference
• Himachal Pradesh E-flows Policy 2005
  – 15% of lean flows
• Expert Appraisal Committee on Hydropower and River Valley Projects (66th meeting)
  – Lean season: 20% of average discharge in four leanest months
  – Non monsoon, non lean season: 20-30% of inflows
  – Monsoon period: 30% of the cumulative inflows during the monsoon period
• GRBMP (2015): Aviral Dhara
• Committee on E-flows
E-Flows during Kumbh 2013

The X-axis indicates the levels, which has been marked at a pillar of Shastri Bridge (u/s of Sangam, Allahabad); whereas the Y-axis shows the dates from 12 January to 31 March 2013.
Discussion points

• How to go beyond Ganga and few hydro power projects?

• Basin wise E-flows assessments under a national programme
  – Is this possible?
  – Capacity & resources needed?
  – Responsibility? Centre, State and/or both
  – Timelines
2. Understanding tradeoffs
8 Branches

28 distributaries

86 minors

126 villages

19 Districts

9 Divisions

Sample size: 540

400 women

35 officials
Understanding trade-offs

Water allocations

Water use

Agriculture practices

Policy and pricing

Institutions

- Fazrakhabad Branch Canal: Q 1100 cusec, Length 97.5 km
- Bewar Branch Canal: Q 900 cusec, Length 91 km
- Kanpur Branch Canal: Q 4000 cusec, Length 211 km
- Bhognipur Branch Canal: Q 1800 cusec, Length 168 km
- Etawah Branch Canal: Q 4000 cusec, Length 211 km
- Deoband Branch Canal: Q 875 cusec, Length km
- Anoopshahr Branch Canal: Q 1650 cusec, Length 132 km
- Mat Branch Canal: Q 2100 cusec, Length km
Leaving water for the Ganga

UGC
Disagree: 6%
Agree: 94%

LGC
Disagree on Canal water transfer to maintain depth: 20%
Agree on Canal water transfer to maintain depth: 80%
Transfer of saved water to Ganga

**UGC**
- **Sacrifice for E-Flow**: 42.0%
- **Intensive irrigation**: 2.4%
- **Extension of cropped/irrigated area**: 1.6%
- **Change in cropping pattern**: 53.9%

**LGC**
- **Sacrifice for E-Flow**: 49.4%
- **Intensive irrigation**: 21.4%
- **Extension of cropped/irrigated area**: 5.8%
- **Change in cropping pattern**: 23.3%
Groundwater use

UGC

Head: 92.4%
Middle: 80.7%
Tail: 92%

LGC: Reach wise % of farmers using ground water usage

Head: 97.9%
Middle: 94.4%
Tail: 91.9%

% of farmers using ground water
Soil health and input management

UGC

- Soil testing done: 11.7%
- Soil testing not done: 88.3%

Fertilizer application based on testing

- Soil testing done: 8.0%
- Soil testing not done: 92.0%
Water Shortage Analysis (w.r.t. recommended E-Flows)

- E-Flows Water requirement
  - Recommendations under various scenarios

Additional water required as compared to present day flows

Present Status
- Hydrology (Present day flows)

Water Budgeting
- Withdrawals (Power, Irrigation, Domestic)
- Water availability under various levels of withdrawals

Water availability
- Historical flows
- Barrage operations and policies
- Upstream Dam operation (Tehri)
- Release d/s of barrages
- Inter basin transfers (Ramganga)

Decision making and Tradeoffs
- Barrage re-operation policies
- Cost benefit analysis of water diversions and re-allocations
- Irrigation efficiency (Long term goals)
Trade off analysis

Environmental flow assessment (Upper and Lower Ganga)
- Site/stretch selection
- Hydrological/geomorphologic/biodiversity and socio-cultural status
- E-Flow requirements analysis
- Recommendations under various scenarios

Water Shortage Analysis (w.r.t. recommended E-Flows)
- E-Flows Water requirement
  - Recommendations under various scenarios
- Present Status
  - Hydrology (Present day flows)
- Additional water required as compared to present day flows

Water availability
- Historical flows
- Barrage operations and policies
- Upstream Dam operation (Tehri)
- Release d/s of barrages
- Inter basin transfers (Ranganga)

Water Budgeting
- Withdrawals (Power, Irrigation, Domestic)
- Water availability under various levels of withdrawals

Water allocation and Tradeoffs
- Barrage re-operation policies
- Cost benefit analysis of water diversions and re-allocations
- Irrigation efficiency (Long term goals)
Costs and benefits

- Millennium Ecosystem Assessment: 4 groups of ecosystem services: provisioning, regulating, supporting, and cultural.
  - Provisioning: Fishery, Agricultural crops (Food); River bed farming; Drinking Water
  - Regulating services: Carbon Sequestration; Microclimate regulation;
  - Cultural: Forest Tourism; cultural/religious tourism

- Various flow regimes are associated with various services provided by the ecosystem, and might entail changes in the target groups who receive the services.

- Monetary valuation of each flow regime is one of the ways to evaluate the scenarios, understand the trade-offs, and help in allocation of water across sectors.
Cost-benefit analysis of environmental flows

Flow Regimes → Ecosystem Structure and Functions → Ecosystem Services

Framework to implement E-flows

Costs & benefits of E-services attributed to E-flows

Nilanjan Ghosh, Suresh Babu
Scenarios

• Business-As-Usual: Baseline valuation of the ecosystem services of the current hydrological regime;

• Alternate scenarios:
  – Flow Regime Change: Degraded, Improved, Diversionary.
  – Institutional Changes: Pricing regimes, participatory irrigation management
How do we redraw the pie?
Discussion points

• Lessons from integrating e-flows into water allocations?
• How trade-offs analysed and managed
• Examples of research on surface-groundwater interactions?
• Understanding the impacts on ecology
3. Setting the scene for implementation
Timeline for E Flows development

1st EFA training
2nd EFA training
Pilot EF Implementation
Main River Implementation

E Flows assessment and implementation
IWRM Process
Stakeholder Engagement
Policy & Legislation

At national level

10 to 20 years

Source: Prof Jay O Keefee
Guideline 1. Undertake a phased approach to implementation

Guideline 2. Be opportunistic

Guideline 3. Don’t exceed available capacity, while building capacity from the onset of policy development

Guideline 4. Limit allowable water abstraction and flow alteration as soon as possible

Guideline 5. Develop a clear statement of objectives for environmental flow policy based on an inclusive, transparent, and well-communicated process.

Guideline 6. Develop a clear institutional framework, including independent oversight

Guideline 7. Create sustainable financing mechanisms, in particular financial resources where re-allocation of water is required

Guideline 8. Conduct proof-of-concept pilot projects

Guideline 9. Allow flexibility for implementation methods, while setting a clear deadline and goals for implementation
Rāmgangā river is rejuvenated, by ensuring aviral dhara, nirmal dhara and maintaining ecosystem services and functions, providing long term water security to all stakeholders.

**Benefits to society**
- Water supply for people, agriculture, and industry
- Freshwater-related livelihoods supported
- Cultural and spiritual opportunities
- Ecotourism developed and expanded
- Risks from flooding and water borne diseases reduced

**River and ecosystem health**
- Breeding populations of critically endangered species established
- Water quality meets prescribed standards
- Flows and connectivity are maintained in the river and floodplains
- Groundwater recharge areas protected and water levels maintained or improved
- Urban wetlands and floodplains maintained or improved
- Flows and connectivity are maintained in the river and floodplains

**Basin Governance (management & stakeholder behaviour)**
- Planning regulations to support habitat protection
- Pollution load reduced
- Sustainable water management
  - E-flow releases required
  - Improved water use efficiency
- Integrated urban water management adopted
- Improved knowledge of risks and resilience to climate change and natural disasters

**Vision, goals, and objectives**
- Integrating into basin plans
- Support for collective conservation action by stakeholders
### Basin Governance Management & Stakeholder Behaviour

- **Regulation and Policy**
  - Improved water use efficiency
  - Improved knowledge of risks and resilience to climate change and natural disasters

- **Research, Assessment, & Monitoring**
  - Climate change and biodiversity
  - Future development

- **Strategy and Actions**
  - Improved river bed farming
  - Improved farming (land, water, agriculture) practices
  - Improved river bed farming

- **Goals**
  - Planning regulations to support habitat protection
  - Pollutant load reduced
  - Sustainable water management
  - E-flow releases required
  - Improved water use efficiency
  - Integrated urban water management adopted
  - Ecosystems-based urban planning
  - Contingency planning for disasters
  - Climate change policy
  - Response to natural disasters
  - Climate change and biodiversity

- **Capacity Building & Stakeholder Engagement**
  - Capacity building for government agencies, Panchayati Raj Institutions, Civil Society
  - Capacity building of stakeholder groups
Key challenges

• Lessons from E-flows policies
• How to integrate E-flows into basin plans
• Road map for E-flows mainstreaming and implementation
• Examples of implementation, monitoring
Implementation Challenge

Understanding of socio-economic costs and benefits: 148
Political will: 145
Legal, institutional and monitoring arrangements: 113
Effective stakeholder involvement: 106
Financial resources: 101
Expertise / technical support: 95
Public acceptance: 68
Capacity for modelling and scenario development: 63
Hydrological data: 59
Other: 39

Number of times selected