OECD Workshop on Agriculture & Water : Sustainability, Markets & Policies

Challenges of Water for Food, People and Environment – ICID's initiative on *'Country Policy Support Programme'*

M.Gopalakrishnan, Secretary General
ICID

Specific objective of the CPSP

- **To evolve, improve and identify interventions to the present country policies related to water resources development and management addressing the competing needs of Food, Environment and People**

Present Paper

- India and China
  - Two Basins in each of these two countries have been studied in depth completing all envisaged Processes
  - The Paper brings out in brief out come of the basin studies in respect of India
- Extrapolation to other basins in India
  - A new approach to categorise the water stress indicators for basin (SW and GW)

Shift in the concept of "Water Resources"

Considering rainfall (and not runoff/GW recharge) as the primary resource to facilitate the consideration of strategies involving management of evapotranspiraton, water shed management, effects of land use changes etc.

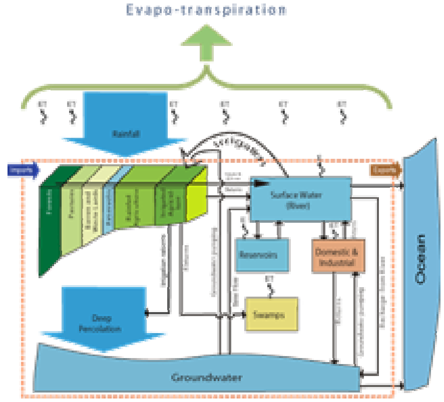
Total modelling of the land phase to facilitate accounting for evapotranspiration by uses accounting of returns and base flows etc.

Accounting water use by the sector, and integration

Consumptive use for terrestrial ecosystem (forests,grasslands and lands not under agricultural use), agricultural lands including irrigated lands etc. are acknowledged to be accounted for separately.

In each, beneficial and non-beneficial uses can be segregated.

Consumptive use of the "People" sector is taken on board and impacts studied (return after use and reuse potential after treatment)



THE RATIONALE

- **The need for depicting the *entire* land phase, stems from basic hydrologic premise that precipitation *(and not river flow/ aquifer recharge)* constitutes the primary resource**
- **Evapotranspiration management to increase the flows in rivers/ aquifers is a <u>potential development strategy</u> ……. *either for***
  - **improving river flows *or***
  - **the traditional resource**

India – River Basins

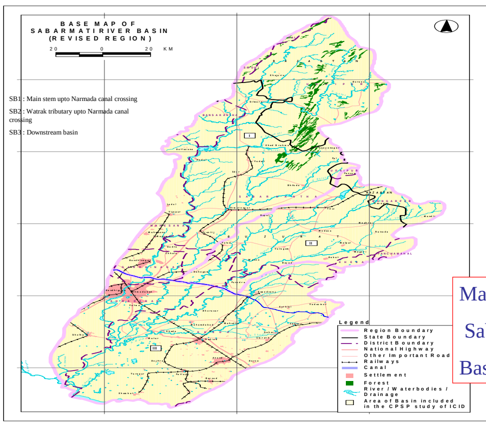
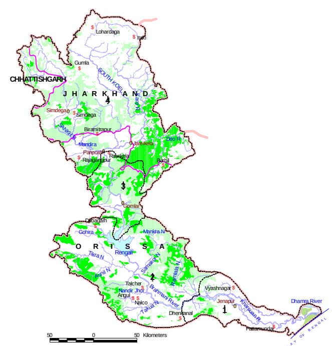


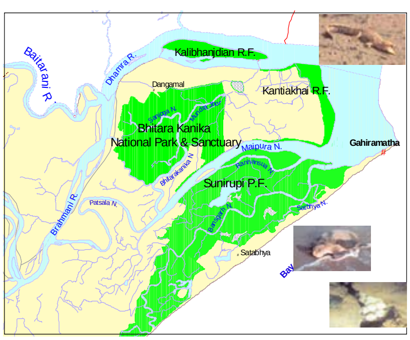
Figure 2. Sabarmati River Basin

Map of Sabarmati Basin

Brahmani basin

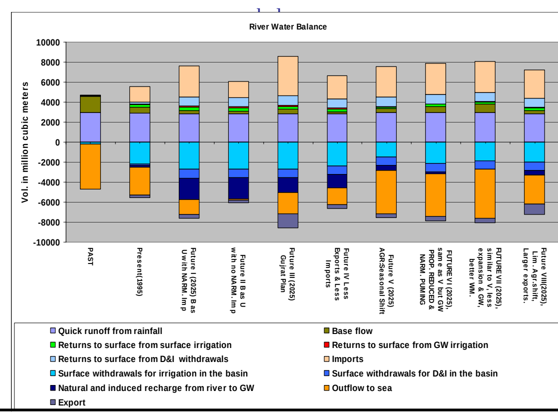


Brahmani basin – Estuarine Environment

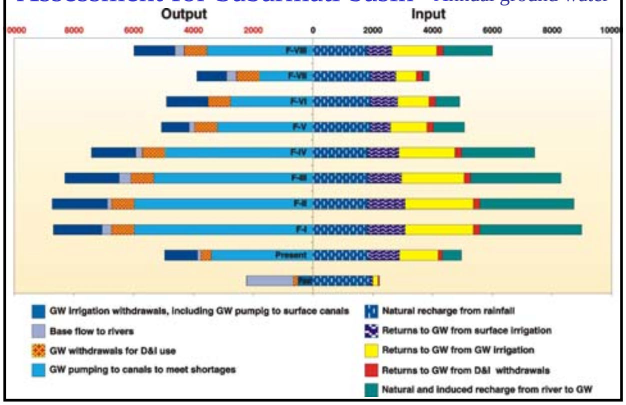


Bhitar Kanika
Richest in mangrove diversity
2nd largest mangrove
 in Indian Mainland
1330 crocodiles
(Largest in this part)
Gahirmatha
0.7 to 0.9 million Turtles visit during breeding season

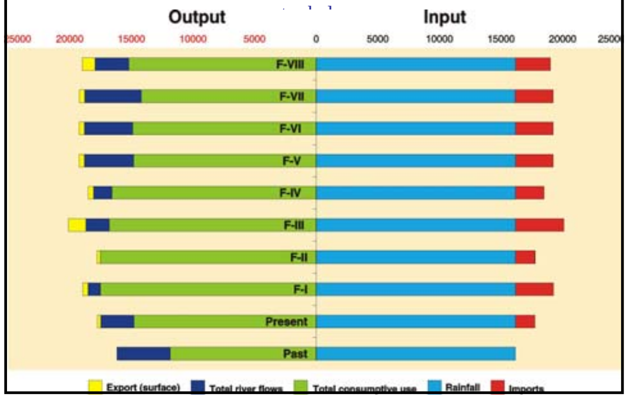
Assessment for Sabarmati basin – Annual river water balance



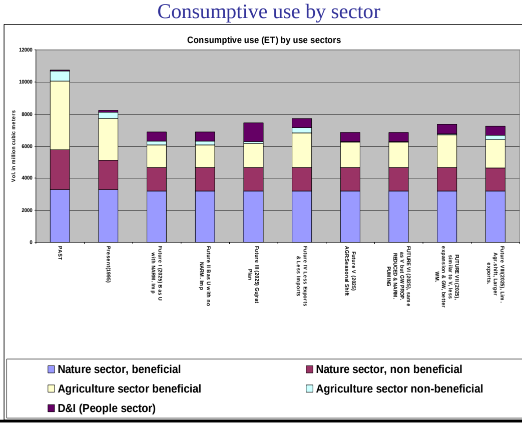
Assessment for Sabarmati basin – Annual ground water



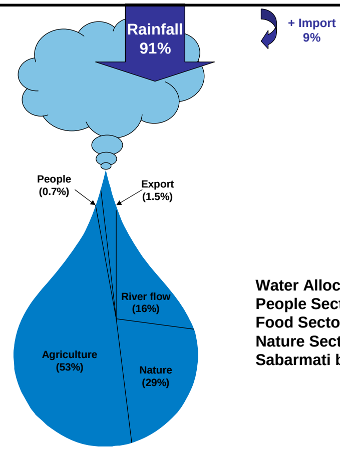
Assessment for Sabarmati basin – Overall basin annual



Assessment for Sabarmati basin – Consumptive use by sector



Sabarmati River Basin (1995)

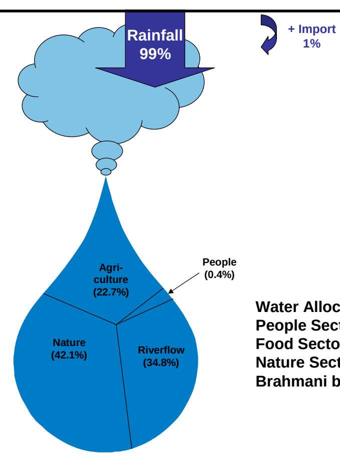


Water Allocation for People Sector, Food Sector (Agric) & Nature Sector in Sabarmati basin

Assessment for Sabarmati basin – Main Findings

- Non-beneficial ET in the nature and agriculture sectors exceeds quantum of annual river flow. *Reduction of non-beneficial ET through rain harvesting, soil and agriculture management is a potential strategy for improved water management*
- Import of Narmada water is necessary to sustain the present withdrawals and meet future needs, *including that for improvement of low flows.*
- Present ground water use is unsustainable. While the situation would improve slightly in future due to large additional Narmada imports, composition of return flow indicates much higher risk of ground water pollution

Brahmani River Basin (2000)



Water Allocation for People Sector, Food Sector (Agric) & Nature Sector in Brahmani basin

Assessment for Brahmani basin – Main Findings

- ✓ Nature sector is by far the largest consumer of water.
- ✓ Contribution of groundwater to base flow is increasing, indicating risk of water logging
- ✓ Future withdrawal requirements would need full use of Rengali storage as well as creation of additional storage
- ✓ Considerable land would remain rainfed, and productivity increase may require watershed management of uplands.
- ✓ Basin would not have overall water shortages even in the projected scenario for increased agricultural and industrial use

Extrapolation of Water Situation Indicators from Selected Basins {viz: Sabarmati & Brahmani Basins} to Other Basins in India

Suggested Indicators

In the Study framework following 4 indicators are proposed to describe the State of Water Resources *(Water Situation Indicators)*

Indicator 1: Withdrawals/total input to surface water
Indicator 2: Returns/total input to surface water
Indicator 3: Withdrawals/total recharge to ground water
Indicator 4: Returns/total recharge to ground water

Indicators 1&3- depict quantitative stress due to withdrawals and Indicators 2&4 depict hazard to water quality

Categories of surface and groundwater indicators

Indicator 1 – Surface water quantity	**1. Very high stress – value of indicator more than 0.8 2. High stress – value of indicator between 0.4 and 0.8 3. Moderate stress – value of indicator between 0.2 and 0.4 4. Low stress – value of indicator less than 0.2**
Indicator 2 – Surface water quality	**1. Very high threat – value of indicator more than 0.8 2. High threat value – value of indicator between 0.2 to 0.8 3. Moderate threat - value of indicator between 0.05 and 0.2 4. Low or no threat – value of indicator less than 0.05**
Indicator 3 – Groundwater withdrawals	**1. Very high stress – value of indicator more than 0.8 2. High stress – value of indicator between 0.4 and 0.8 3. Moderate stress – value of indicator between 0.2 and 0.4 4. Low stress value of indicator less than 0.2**
Indicator 4 Ground water Return flows (Quality indicator)	**1. Very high threat – value of indicator more than 0.8 2. High threat - value of indicator between 0.4 and 0.8 3. Moderate threat – value of indicator between 0.2 and 0.4 4. Low threat – value of indicator less than 0.2**

Findings of Extrapolation

- Inferences drawn from Sabarmati assessments are of much relevance to Pennar, Cauvery, Indus, Ganga, Subarnarekha, Mahanadi and Tapi in regard to surface water
- Ground water problems of Indus, Ganga, Subarnarekha, Krishna, Pennar and Cauvery have similarity with Sabarmati
- Problems of Brahmani resulting out of the high flows and low use of ground water have similar implications for Brahmaputra and Godavari

Integrating livelihoods in land and water planning

I) **In low rainfall plain areas with sizable population densities, the carrying capacity of the area, in terms of rural livelihoods, is severely constrained by local water availability.**

II) **Water from outside, either from wetter part of the basin or other basins would have to be applied to the land to increase this carrying capacity.**

III) **Even if self sufficiency in food is not targeted, food would have to be produced for generating local incomes, and for avoiding migrations.**

IV) **Integration of water, land and livelihoods is essential at this stage of Indian development**

Some conclusions….

- Water Resource Development redistributes terrestrial waters to land from where it runs-off, and hence has *so far* considered it as eco-friendly. Maximise productivity of terrestrial eco-systems consuming significant quantity of waters. Quantify it.
- Assess lengths of river systems presently supporting aquatic eco-systems. Try to sustain them. Assess goods and services provided by eco-systems for humans. Where reservoirs have already come if possible, compare fishery yields from reservoirs with flow systems.
- Collect, treat and recycle all wastewater. Don't allow release of polluted water directly rivers. Industry should only avail make-up water.

Some conclusions … contd..

- Dispassionately examine EFRs and Minimum Flow Needs (MFN) based on realistic studies / needs. They are expensive and do not reach the targets if needs of en-route human systems are unattended.
- Investment needs for addressing Water for Food, People and Nature have many tacit returns and quantify them independently and collectively so that there is propensity to allocate these by Policy makers and National Governments.
- Visit ICID web site www.icid.org for more details.