

# International Conference on Water Harvesting, Storage and Conservation

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Secretary General

International Commission on

Irrigation and Drainage

# WHSC '09 recognises in the preamble statement that ..

- The water cycle on the Earth is essentially a closed system.
- For sustainable growth it is necessary to recycle the fresh water to make a balance between the supply and demand of fresh water and also preserve present water resources from getting polluted.
- There are several gaps in the available technologies and policies related to water management which includes both quantity and quality issues.
- For minimizing these gaps, issues related to water management must be addressed together by the scientists, technologists, policy makers, implementers, and the society at large.

## **ICID's CPSP aimed at bridging the gaps.....**

**(i) interconnectivity of Land and Water**

**(ii) Surface & G Water with basin as a Unit**

- **Establish a good process and science for an in-depth understanding of a basin for its better management (this includes future development objectives)**
- **Help to focus on implications of present policies and support Policy Revisions / Guidelines**
- **Help to objectively assess the water development or management programmes promoted or funded by Funding Agencies**
- **Contribute objectively to the discussions on Water for Food, Nature etc**

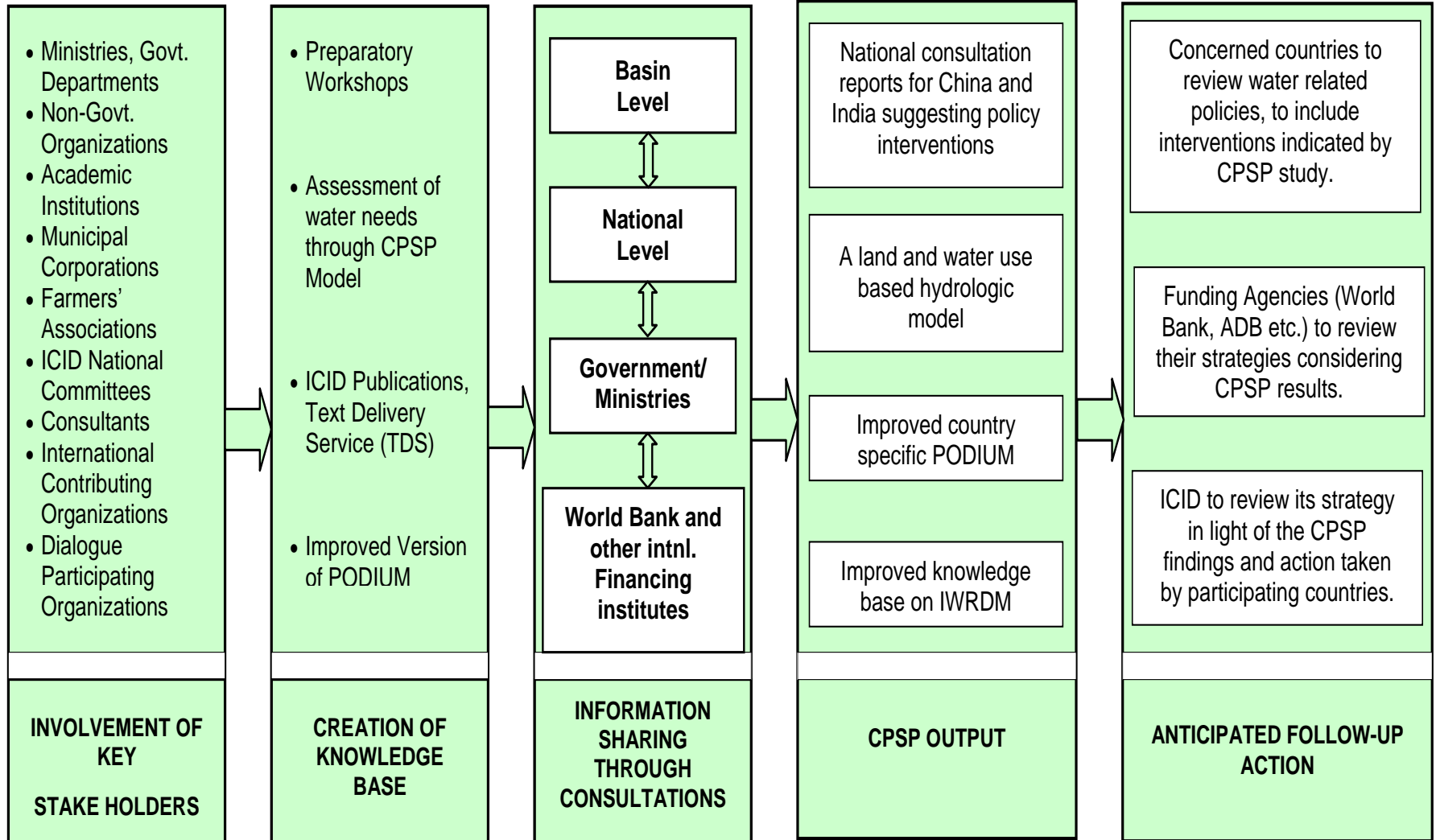
# Science as a tool for Policy

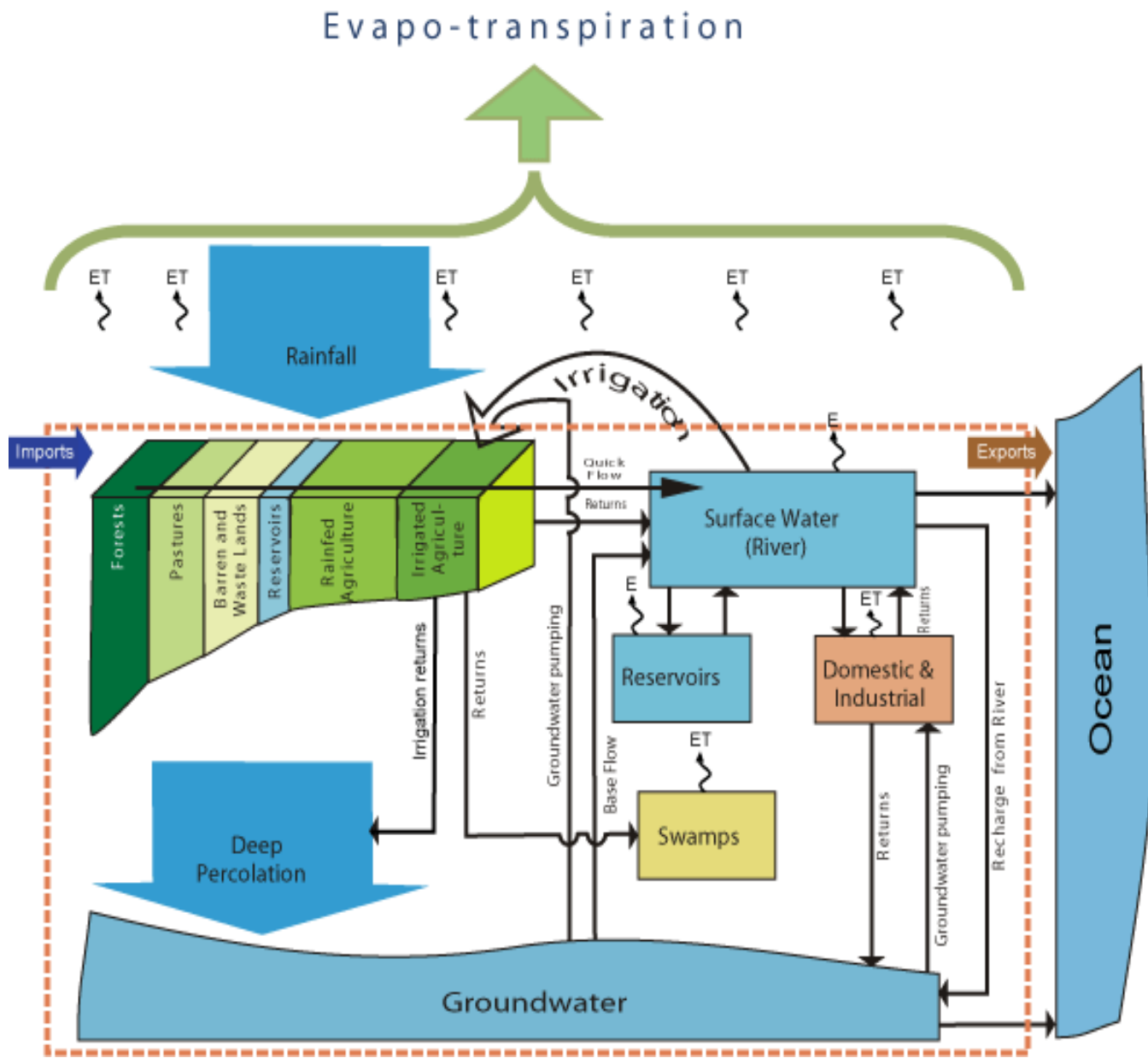
- Basin as an Unit for Water Accounting
- Water accounting can be done at various levels such as the field, irrigation service, basin or sub basin levels
- Establish the importance of a proper role for the Water Accounting &
- the key role played by hydrology
- Net result is providing fairly meaningful solutions to Policy makers for various options...

# Science as a tool for Policy ..2

- The proportion of the available water that is consumed is an important indicator of development of a basin
- The *desirable* level of such consumption depends on the land use apart from the season, the precipitation, and the quantity of water that is needed to support
  - consumptive and
  - non-consumptive usesthat depend upon stream flow and groundwater recharge
- Importance of land use (present and future)
- Importance of terrestrial ecosystem needs and its relevance to Nature Sector Uses
- Approach in State level or Basin level kept these aspects in view

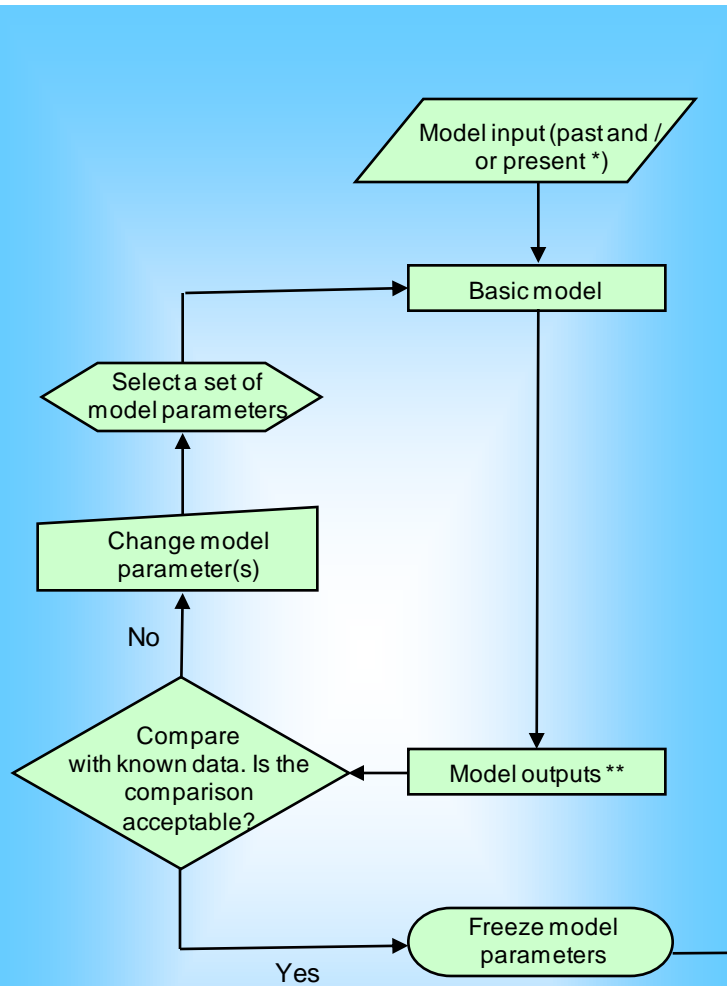
# CPSP Contents and Approach





**Basinwide Holistic Integrated Water Assessment (BHIWA)**

## CALIBRATION MODE

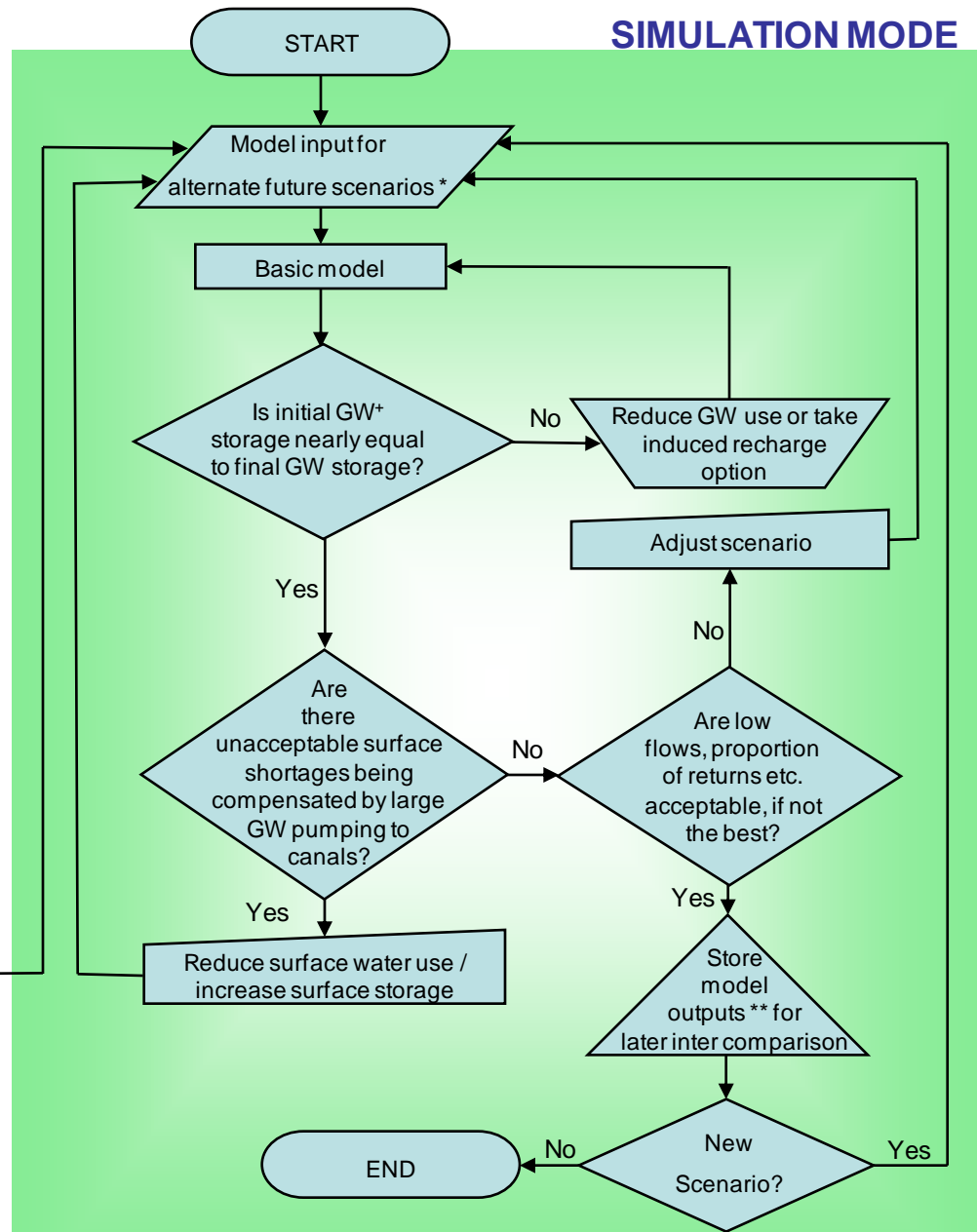


- Model inputs include hydrological, demographic, D&I related land use, crop related (both rainfed and irrigation), water development and management information, including imports, exports and environmental flows required.

\*\* Model outputs include monthly flows, inter and intra annual GW fluctuations, GW recharge, surface and ground water withdrawals, and water balance (overall, surface & GW)

+ Ground Water

## SIMULATION MODE





# Scenario Development

- Stakeholders' consultations were held so that future Scenario projections are realistic. Indeed, these consultations were valuable and a pre-requisite.
- The Scenario developer & model user could have a fair appreciation of local situations, policies at present & good options, to help a quicker exercise.
- Governments / Other Agencies in Basin were fully consulted in the process, *pari-pasu* with results as it emerged.

# Policy related Issues covered

- Shift in the concept of “Water Resources”
- Accounting water use by the sector & integration
- Proper accounting of return flows; they constitute a ‘reuse’ resource; it can depict *‘hazard potential’*
- Consumptive use (evapo-transpiration) as a tool for management strategies
  - Beneficial water use
  - Non beneficial water use – to minimise
- Watershed Management and water harvesting
- Concept of competition even in respect of beneficial water use

# Policy related Issues covered..2

- Integrating in planning process ...
  - surface water and groundwater use in irrigation
  - management of land and water resources
  - livelihoods in land and water planning
- Water for people: Dimensions of priority
  - the first charge on available water
  - the most reliable water, considering availability temporally
  - the best quality of raw water amongst the alternative raw water sources: even if this asks for a re-allocation amongst sources & uses.
- Water allocation by uses (People / Food Sector & Env't.)
- Estimating water use and Requirements for 'Nature' sector
  - Environmental Flow requirements

# NWP & Some aspects of CPSP

- Integration of Rural Livelihood income
- Promoting Rainfed agriculture
- WSD to support Rainfed
- Pros and cons to be kept in view
- National Level Solutions for Food Security ask for irrigated agricultural development and management
- IWRDM is the key in looking at Basin options

# **Integrating livelihoods in land and water planning**

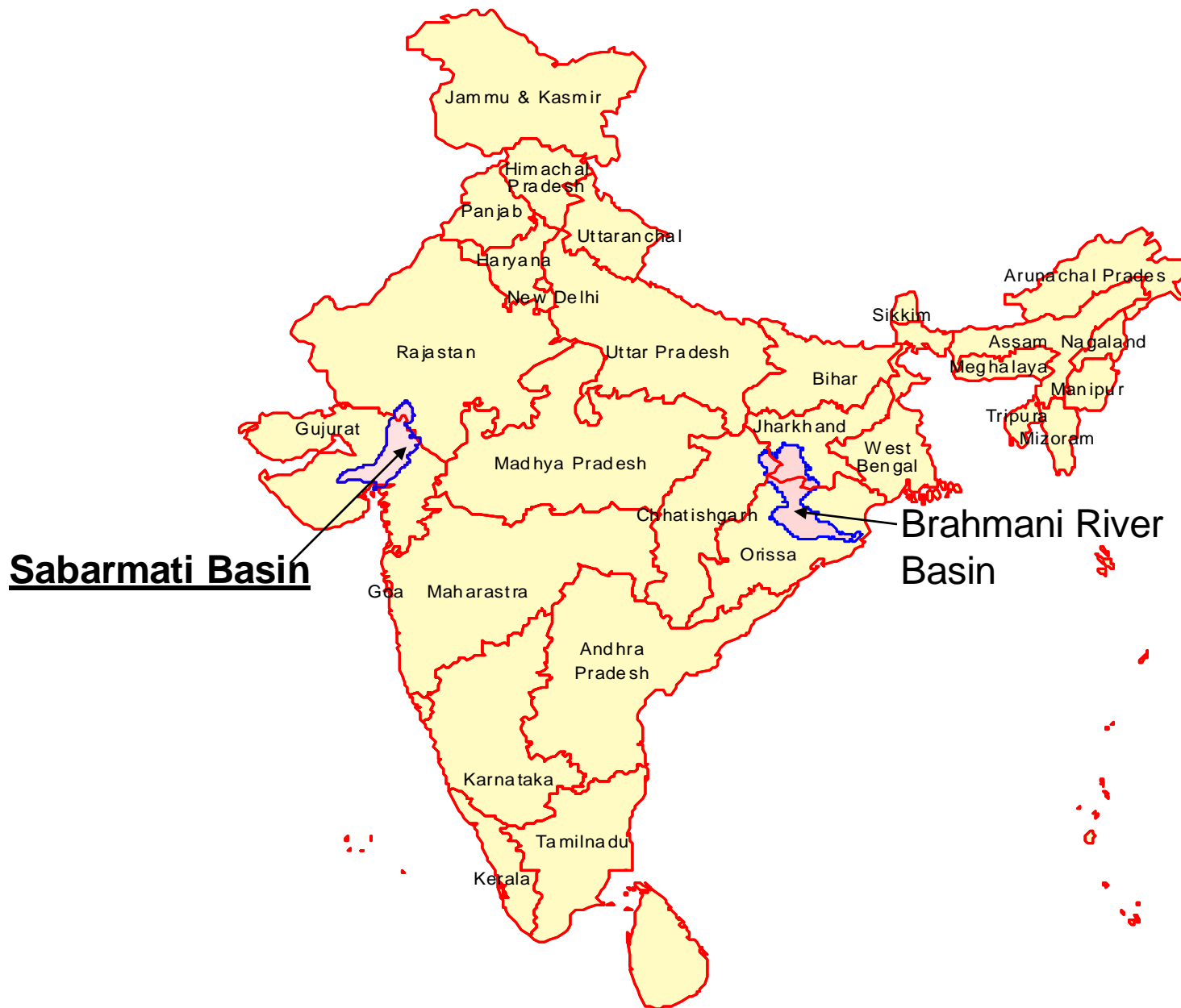
- I) In low rainfall plain areas with sizable population densities, the carrying capacity of the area, in terms of rural livelihoods, is severely constrained by local water availability**
- II) Water from outside, either from wetter part of the basin or other basins would have to be applied to the land 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 reconised as essential at this stage of Indian development**

# CPSP - Study Basins in India

*{Typical & Demonstrative, 2 basins were chosen for consideration}*

Water Stress Situations is seen in **Sabarmati Basin**

**Water Surplus situation in Brahmani**



27 November 2006

# Location of Sabarmati and Brahmani River Basins

# Scenarios studied



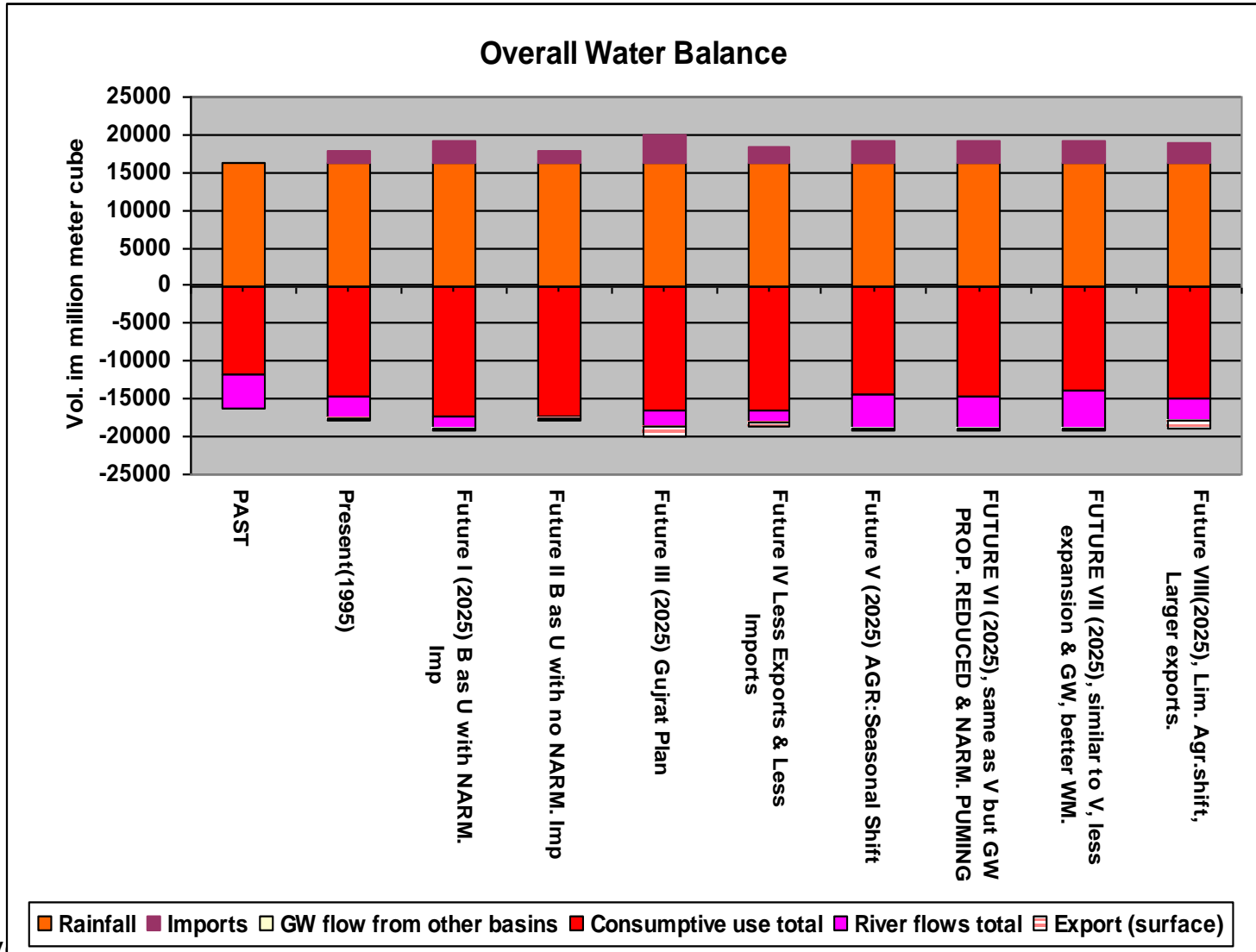
ICID-CIID

Sr. No.	Name	Year	Abbreviation	Explanatory Notes
1	<b>Past</b>	1960	-	<b>No water development</b>
2	<b>Present</b>	1995	-	<b>Considerable storage, groundwater and surface irrigation, and imports</b>
3	<b>Future I</b>	2025	BAS U	<b>Irrigation expansion with similar composition Additional Narmada Import</b>
4	<b>Future II</b>	2025	BAS U, no Narmata import	<b>Same as Future I, without Narmada Import</b>
5	<b>Future III</b>	2025	Gujarat Plan	<b>Larger imports and exports, pumping imported water in upper reservoirs</b>
6	<b>Future IV</b>	2025	Less Imports and Exports	-
7	<b>Future V</b>	2025	Seasonal shift	<b>Irrigation expansion mostly in wet season</b>
8	<b>Future VI</b>	2025	-	<b>Similar to Future V but groundwater irrigation reduced. Reduced pumping to reservoirs</b>
9	<b>Future VII</b>	2025	-	<b>Groundwater irrigation further reduced. Less irrigation expansion. Improved water management and more drip irrigation</b>
10	<b>Future VIII</b>	2025	-	<b>Smaller Seasonal Shift and improvements in water management</b>

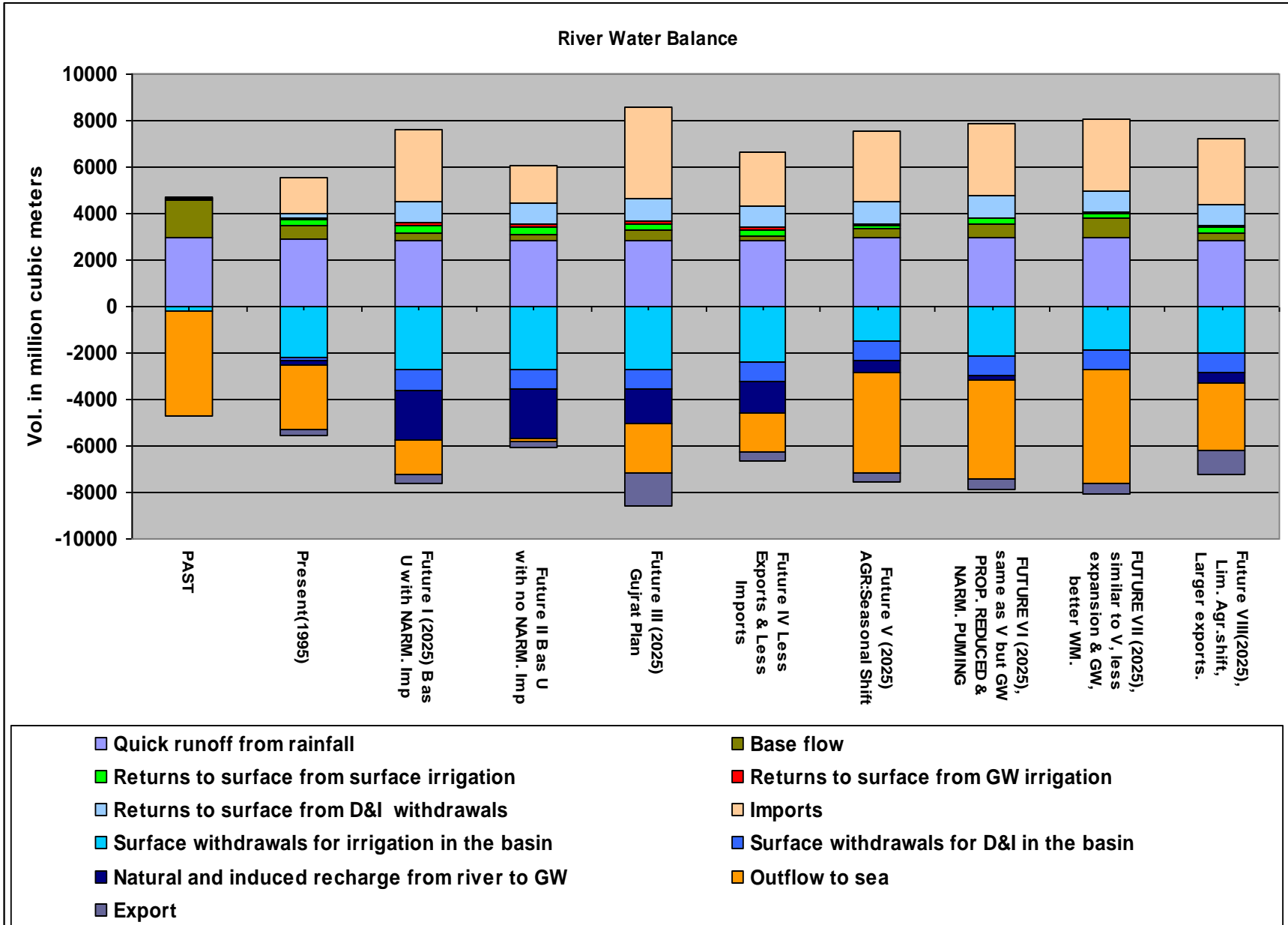




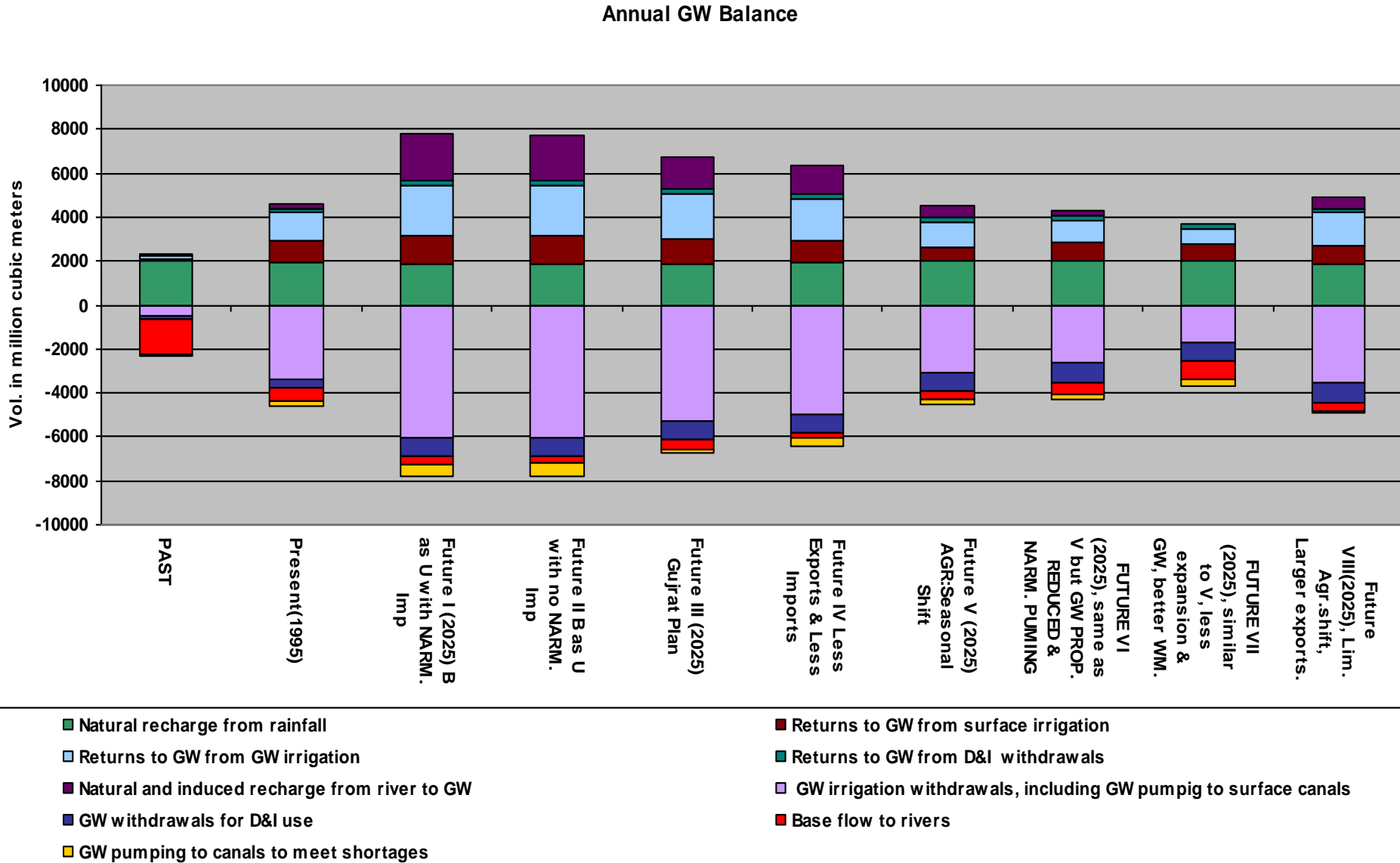
# Overall annual water balance



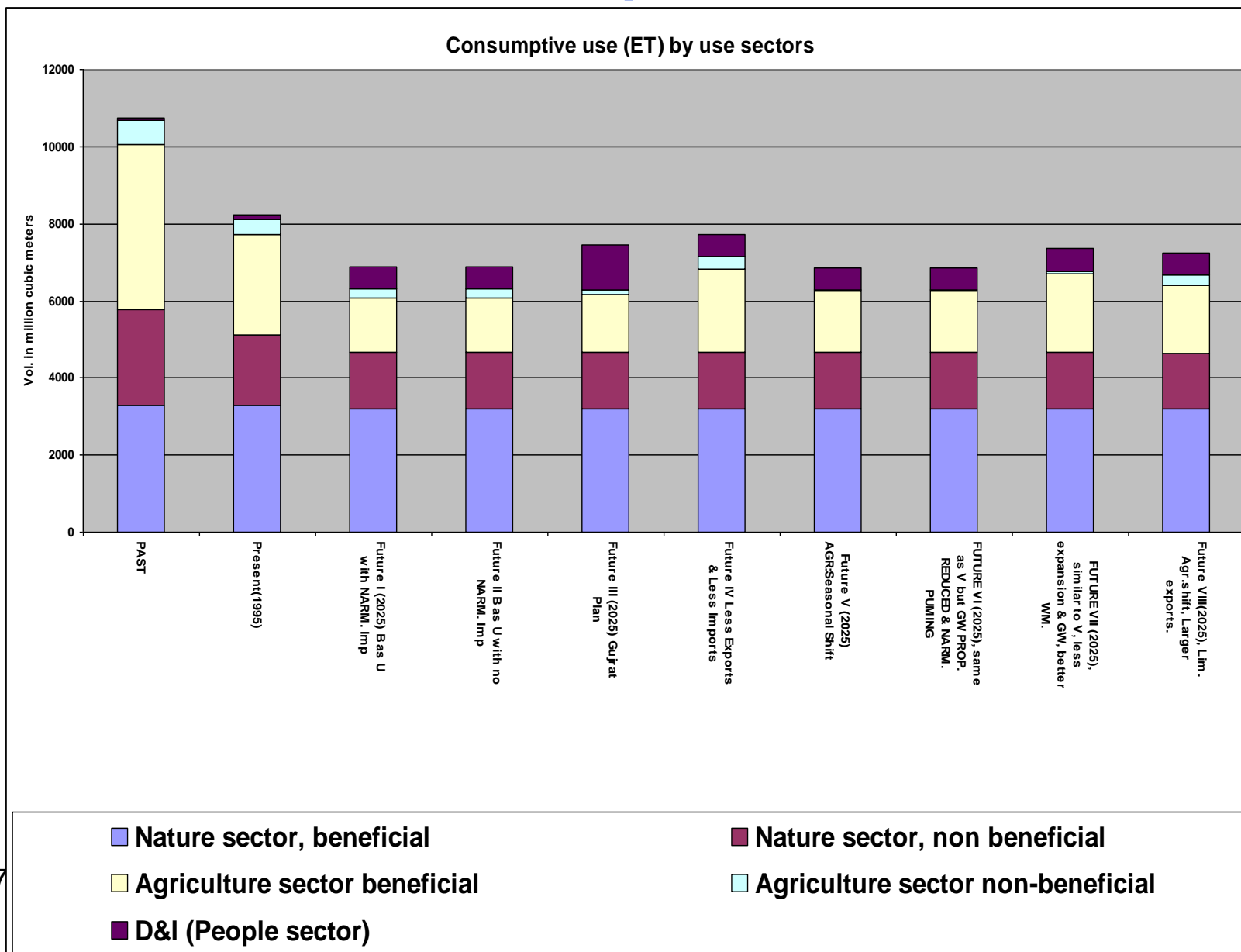
# Annual river water balance



# Annual groundwater balance



# Consumptive use



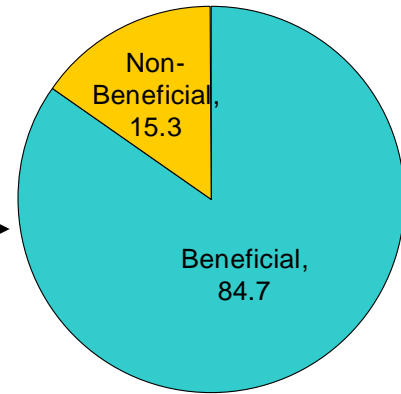
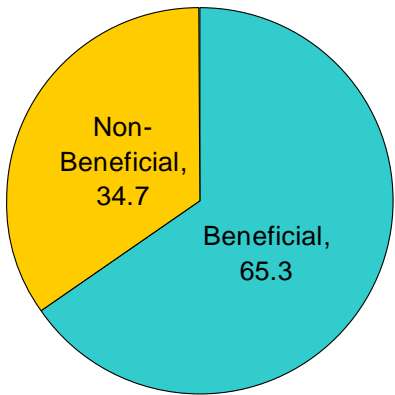
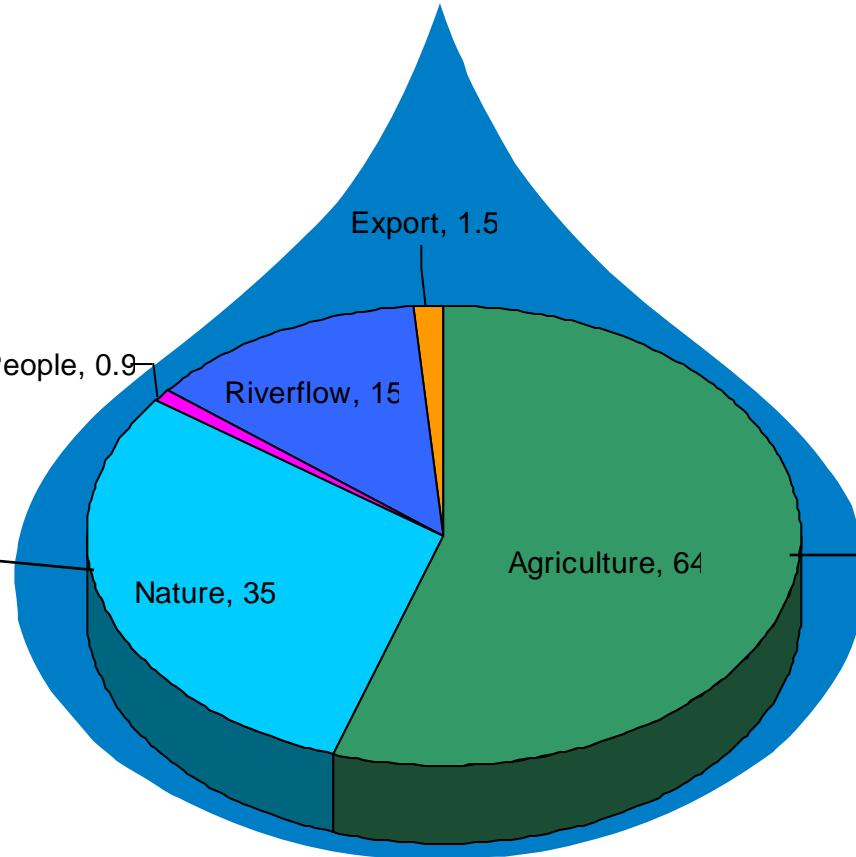
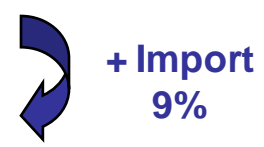
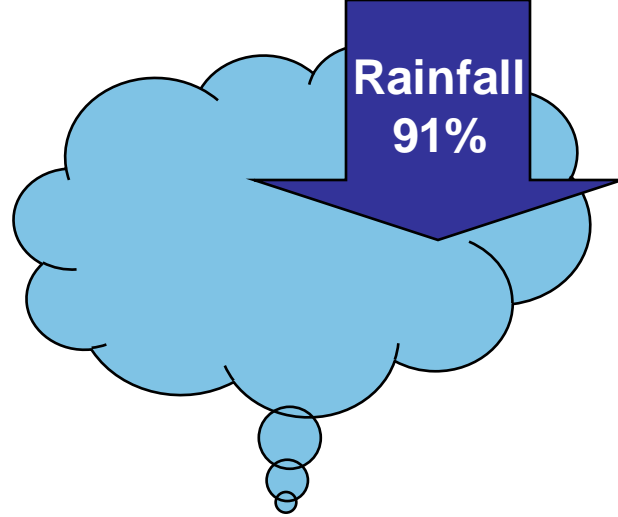
# Typical Findings

- **Non-beneficial ET in the nature and agriculture sectors exceeds quantum of annual river flow in Sabarmati Basin**
- **Reduction of non-beneficial ET through rain harvesting, soil and agriculture management is a potential strategy for improved water management**

# Typical Findings (Sabaramti) ..2

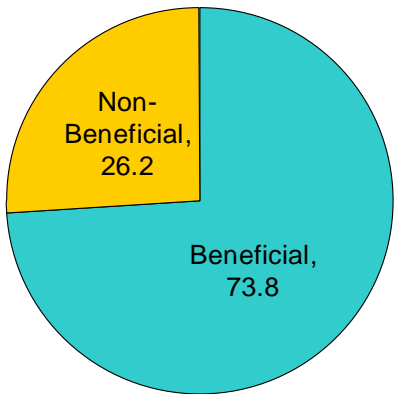
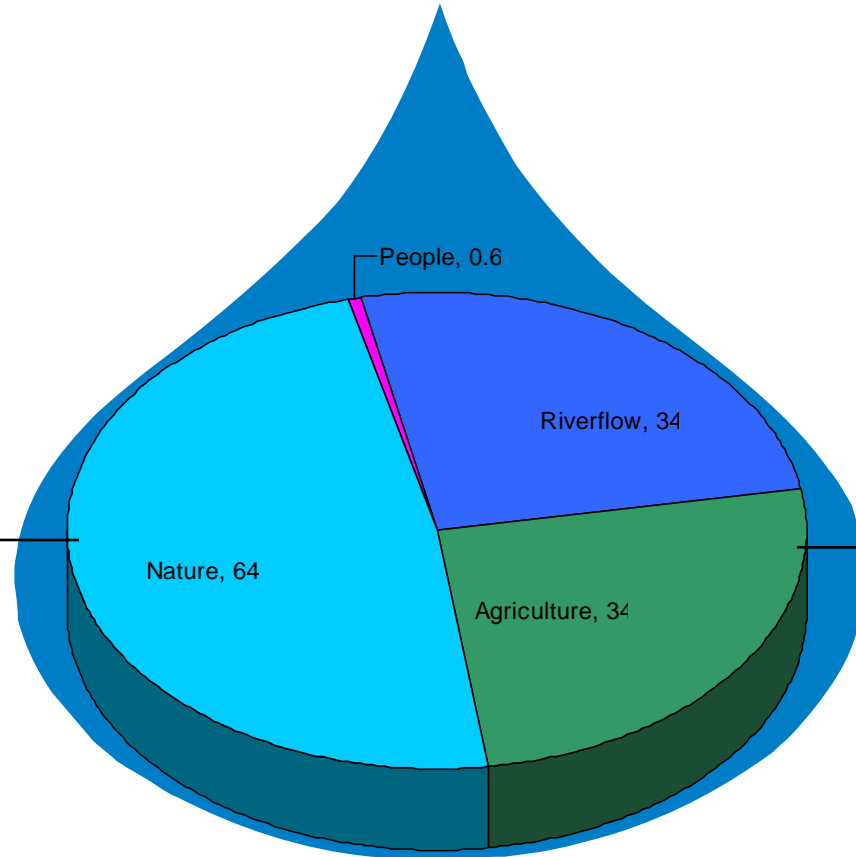
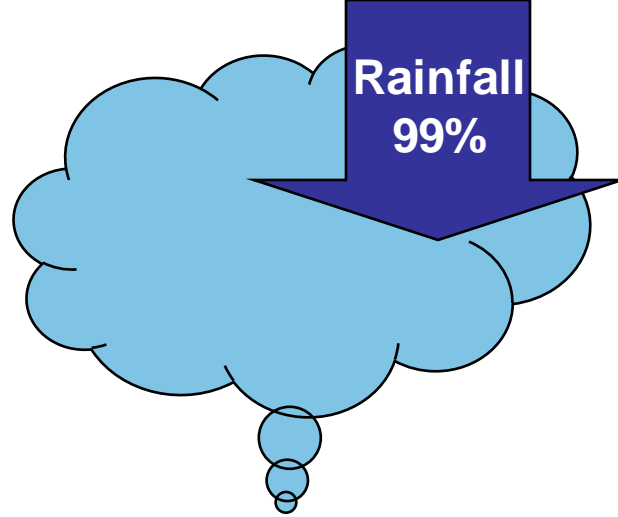
- **Import of Narmada water is necessary to sustain the present withdrawals and meet future needs, including that for improvement of low flows**
- **Present ground water use is unsustainable**
- **While the situation would improve slightly in future due to large additional Narmada imports, composition of return flow indicates much higher risk of ground water pollution**

# Sabarmati River Basin (1995)

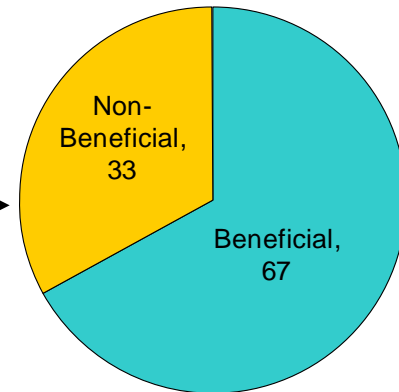


27 November 2006

# Brahmani River Basin (2000)



27 November 2006





# Extrapolation to National Level?

- Some attempts to extrapolate for other basins in the country to obtain a Macro scenario
- Essentially, the effort is restricted to obtain a general, just understanding of the implication on water stress in future, basin wise, with growing and competing demands
- This might be of general interest to Policy Planners notwithstanding several limitations in such extrapolations –
  - Short term strategy ; and then for the Long term strategy..
- Options available are factored to the extent feasible

# Suggested Indicators

*Four indicators proposed for describing state of water resources*

Indicator 1: Withdrawals/total input to S.W

Indicator 2: Returns/total input to surface water

Indicator 3: Withdrawals/total recharge to G.W

Indicator 4: Returns/total recharge to G.W

*Indicators 1&3- depict **quantitative** stress due to withdrawals;*

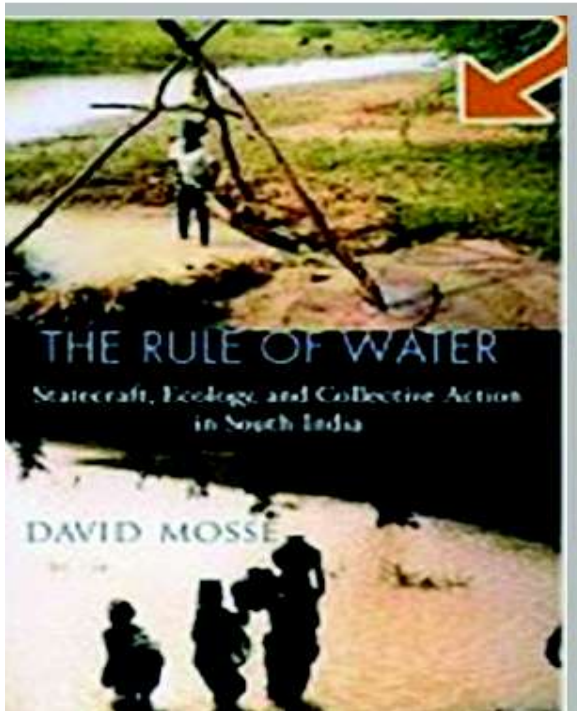
*Indicators 2&4- depict **hazard to water quality***

CPSP results amply demonstrated that science can and should participate - project the different scenarios and their likely impacts

One can also get an insight on the stresses faced in different River Basins, quantitatively as well as qualitatively

One has often felt that the typical Conflicts of integrated basin plans are not well analysed as seen in several past cases .....

## Important caveats about reviving traditional water bodies...



as documented in David Mosse's "The Rule of Water", the quest for regaining the glorious past of the tanks has been pursued without success for 150 years

- World Bank experience with tank restoration in Karnataka is that many of the tanks have not filled for years..
- In heavily-stressed basins it is close to a zero sum game, in which creation of new rights for some means curtailing existing rights of others...

India's Water Economy Bracing for turbulent future  
John Briscoe World Bank - Report 2005

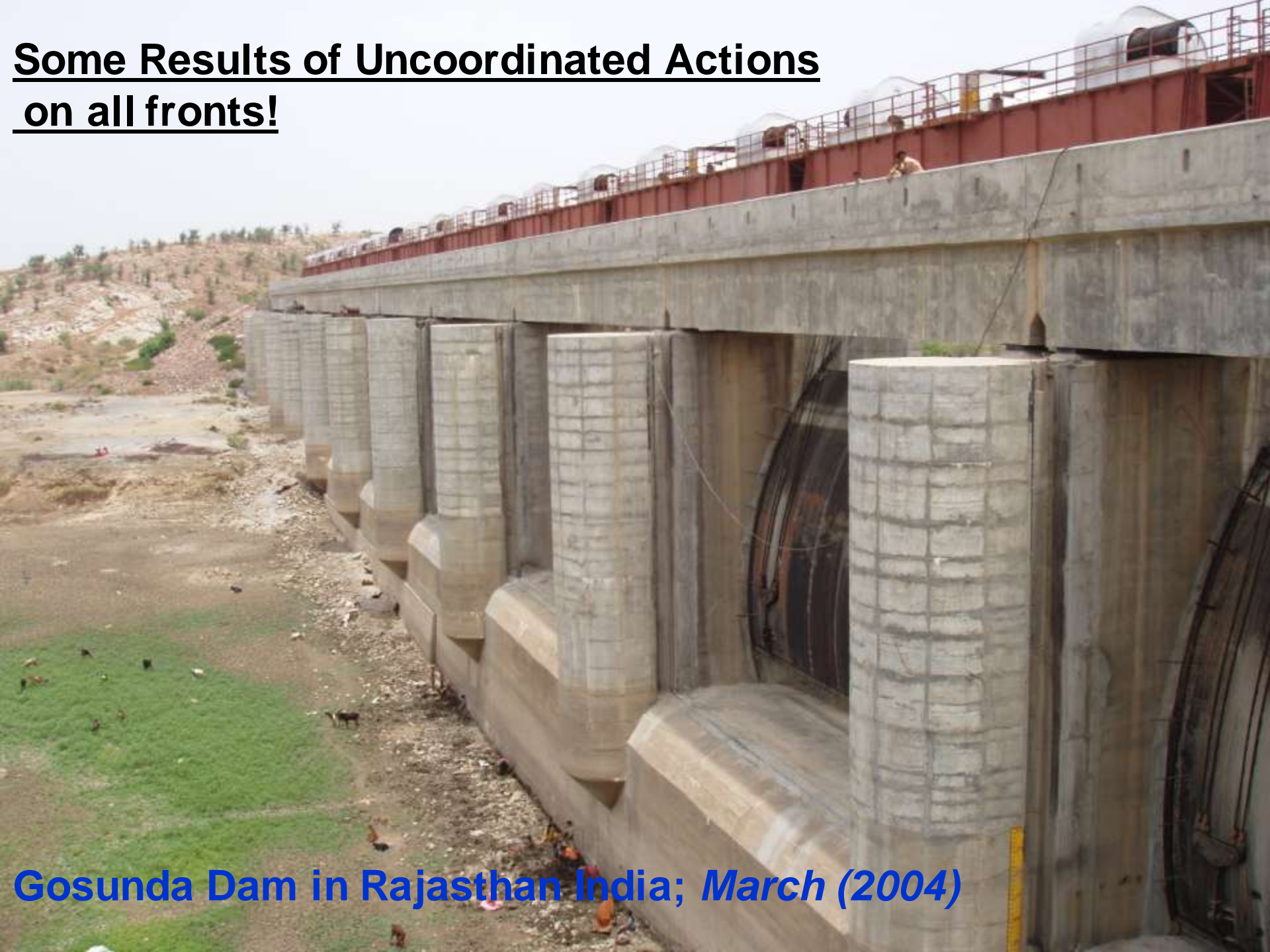
# Peninsular India : Vaigai River Basin in Tamilnadu



Over time more and more dams and diversions upstream.....

But every time depriving someone downstream of a little more water...

**Some Results of Uncoordinated Actions**  
**on all fronts!**



**Gosunda Dam in Rajasthan India; *March (2004)***



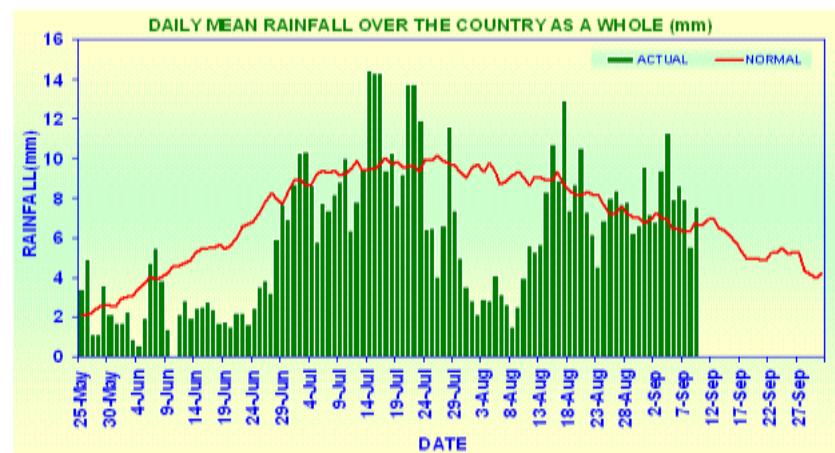
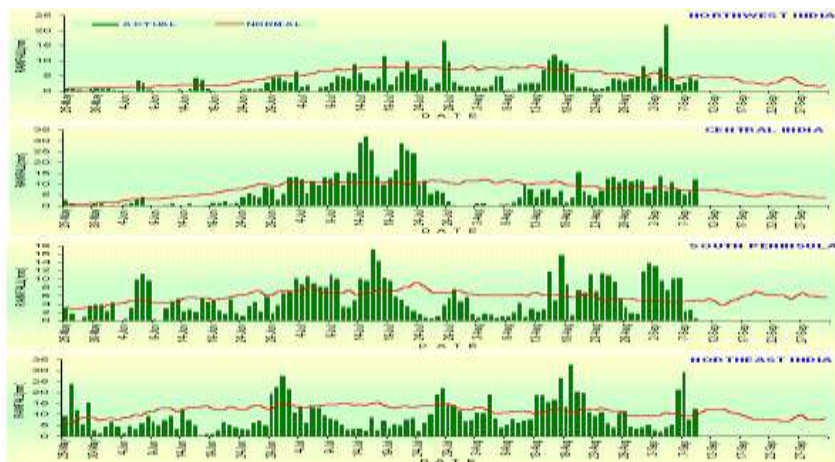
**Watershed management Upstream  
A large number of Check Dams  
Case of U/s D/s conflicting Interest**



**One can still notice  
water in the d/s  
plunge pool  
after the cessation of  
flows in the previous  
monsoon**



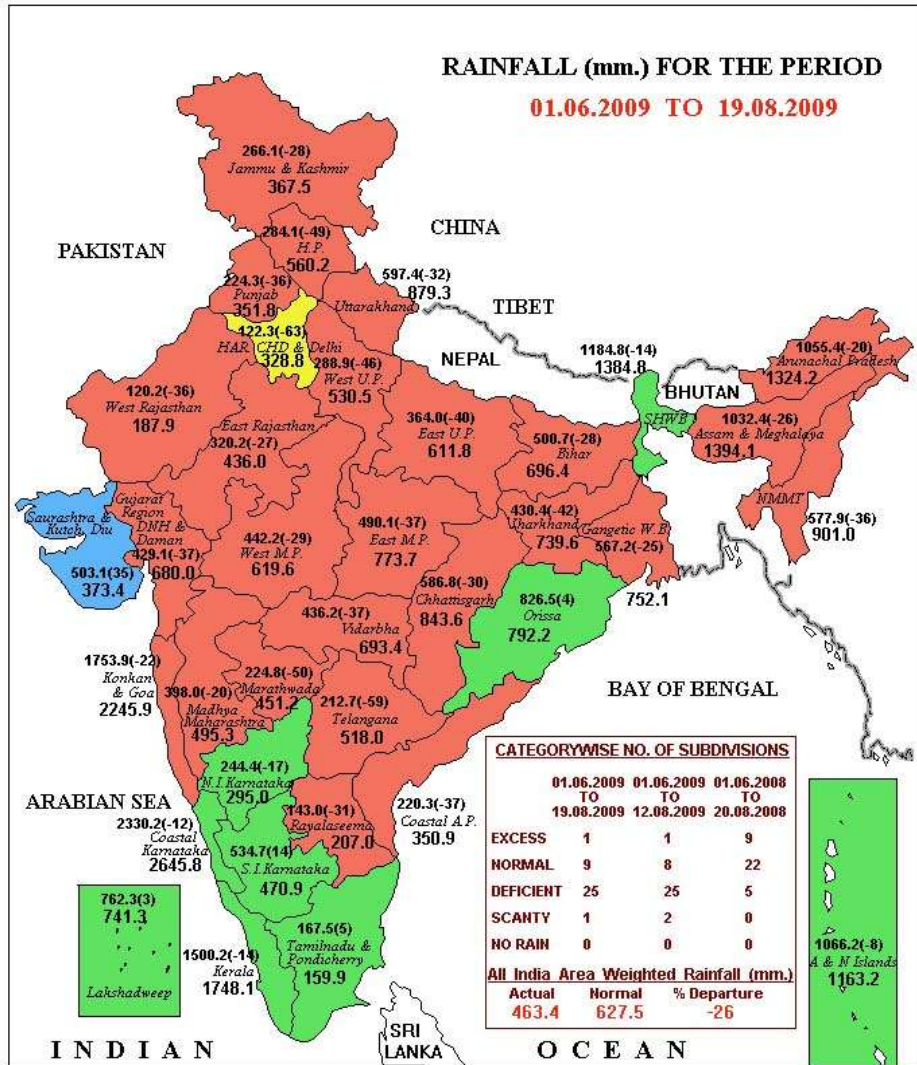
# 2009 Monsoons



The regional patterns as seen show worst suffering region as NW, Central and southern peninsula

All India seasonal precipitation averages were also not encouraging; may leave many reservoirs empty

# भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT



LEGEND: ■ EXCESS (+20% OR MORE) ■ NORMAL (+19% TO -19%) ■ DEFICIENT (-20% TO -59%)  
■ SCANTY (-60% TO -99%) ■ NO RAIN (-100%)  NO DATA

NOTES:

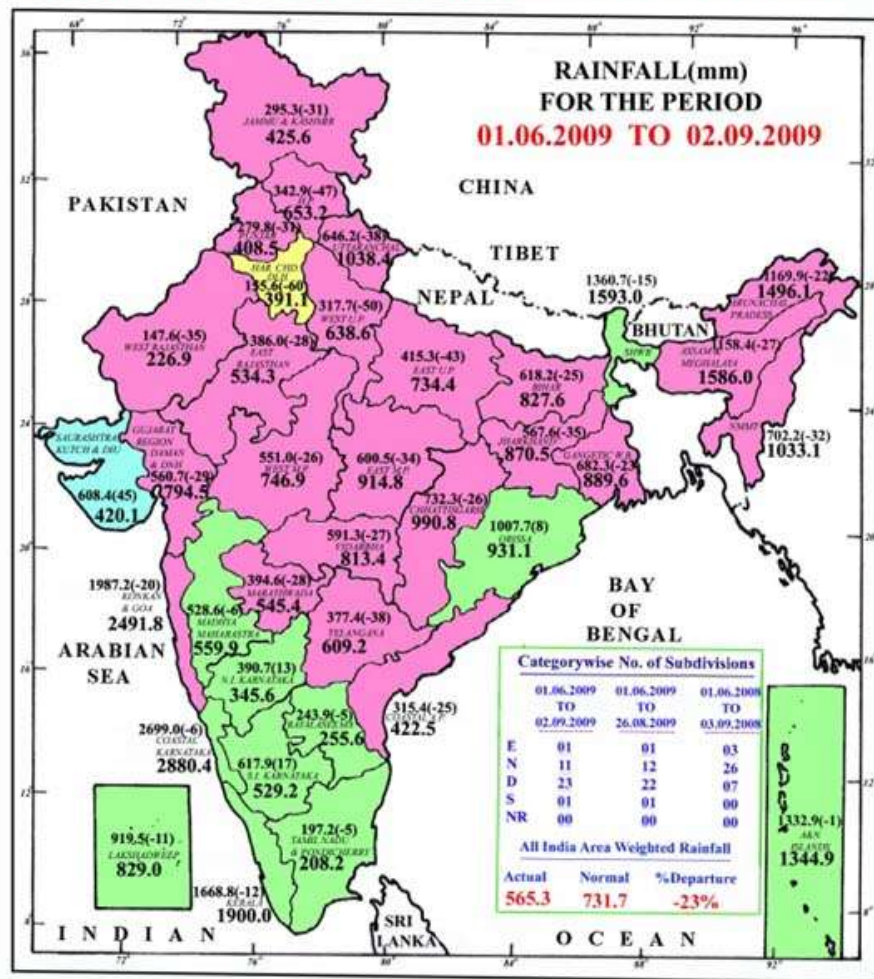
- [a] Rainfall figures are based on operational data.
- [b] Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)  
 Percentage Departures of Rainfall are shown in Brackets.

## August 2009 Scenario

India's official weather map is a mass of red -- the colour the weather office uses to show "deficient" rains, defined as 20 percent to 59 percent below normal.

Some 177 out of India's 626 districts are in the grip of drought with rice crops the worst hit. Only a thin strip along the western coast has received normal rain during this monsoon season, which runs from June to September.

# भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT



**LEGEND :**

EXCESS (E) + 20% OR MORE	NORMAL (N) +19% TO -19%	DEFICIENT (D) -20% TO -59%
SCANTY (S) -60% TO -99%	NO RAIN (NR) -100%	NO DATA

**NOTES:**

(a) Rainfall figures are based on operational data.  
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 Percentage departures of rainfall are shown in brackets.

## September 2009 Scenario

For millions of Indian farmers, especially the smallholders eking out a living, a bad monsoon is a real disaster, in a financial sense as it wipes out their livelihoods.

In 2004, rainfall was minus 13 percent normal and in 2002 minus 19 percent. The monsoon 2009 is minus 23 %

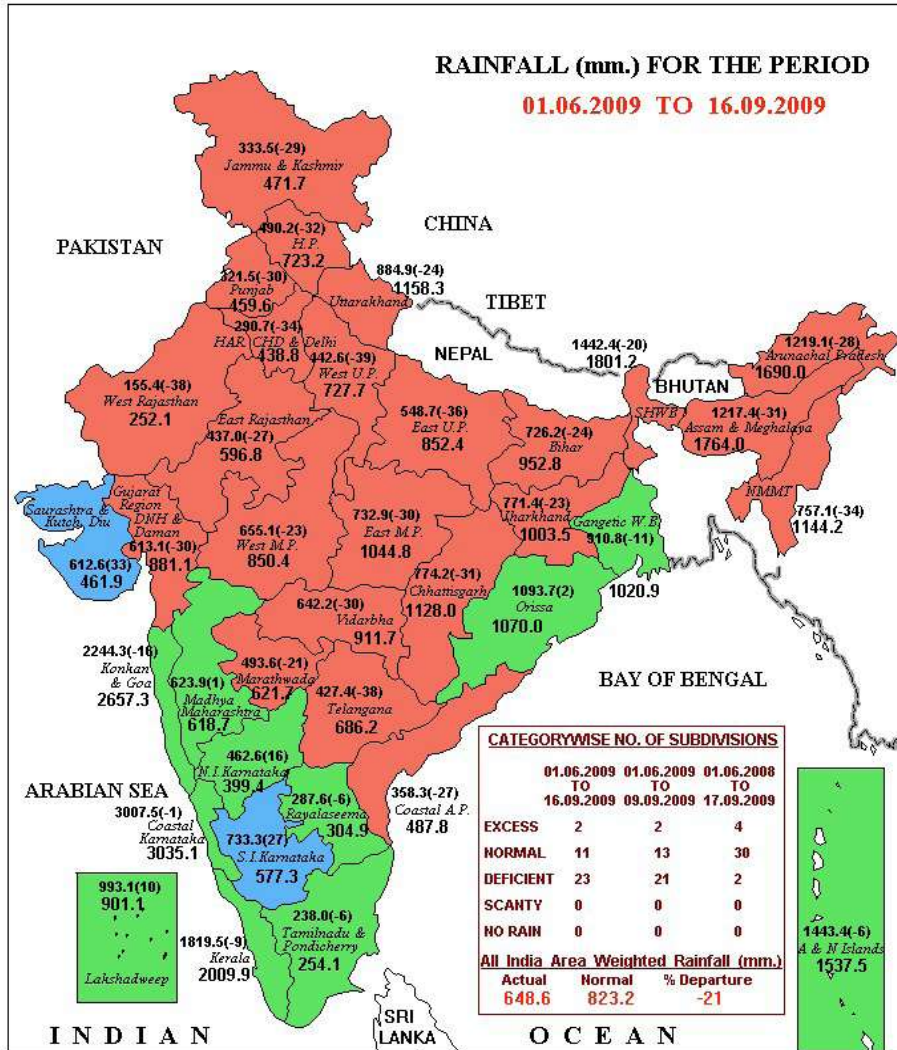
2002 drought reduced growth to 3.8 %, the lowest in 11 years. Growth then rebounded to 8.5 percent the next year when the monsoon revived.

But the worst hit rice bowl areas in Indo-gangetic plains could impact more as it contributes quite sizably

# भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT

## RAINFALL (mm.) FOR THE PERIOD

01.06.2009 TO 16.09.2009



LEGEND: ■ EXCESS (+20% OR MORE) ■ NORMAL (+19% TO -19%) ■ DEFICIENT (-20% TO -59%)  
■ SCANTY (-60% TO -99%) ■ NO RAIN (-100%)  NO DATA

**NOTES:**

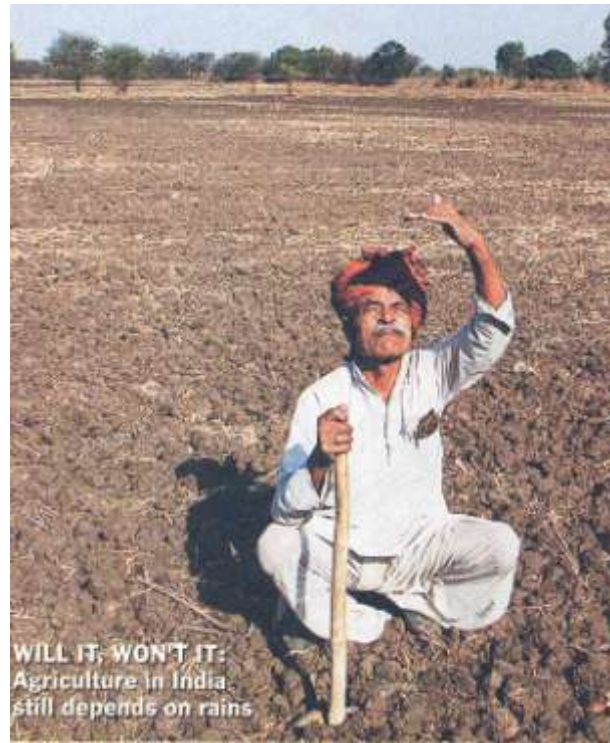
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September 18, 2009  
 Monsoon starting to withdraw  
 From North West (Rajasthan)

Overall deficit for the country as a  
 is adjudged at 21%

Hopes to get the best out of  
 Rabi crops in upper India as the last  
 Spell of rains in early December  
 Was a little above normal

The hope to fill in reservoirs with the  
 Last few spells of rains diminished



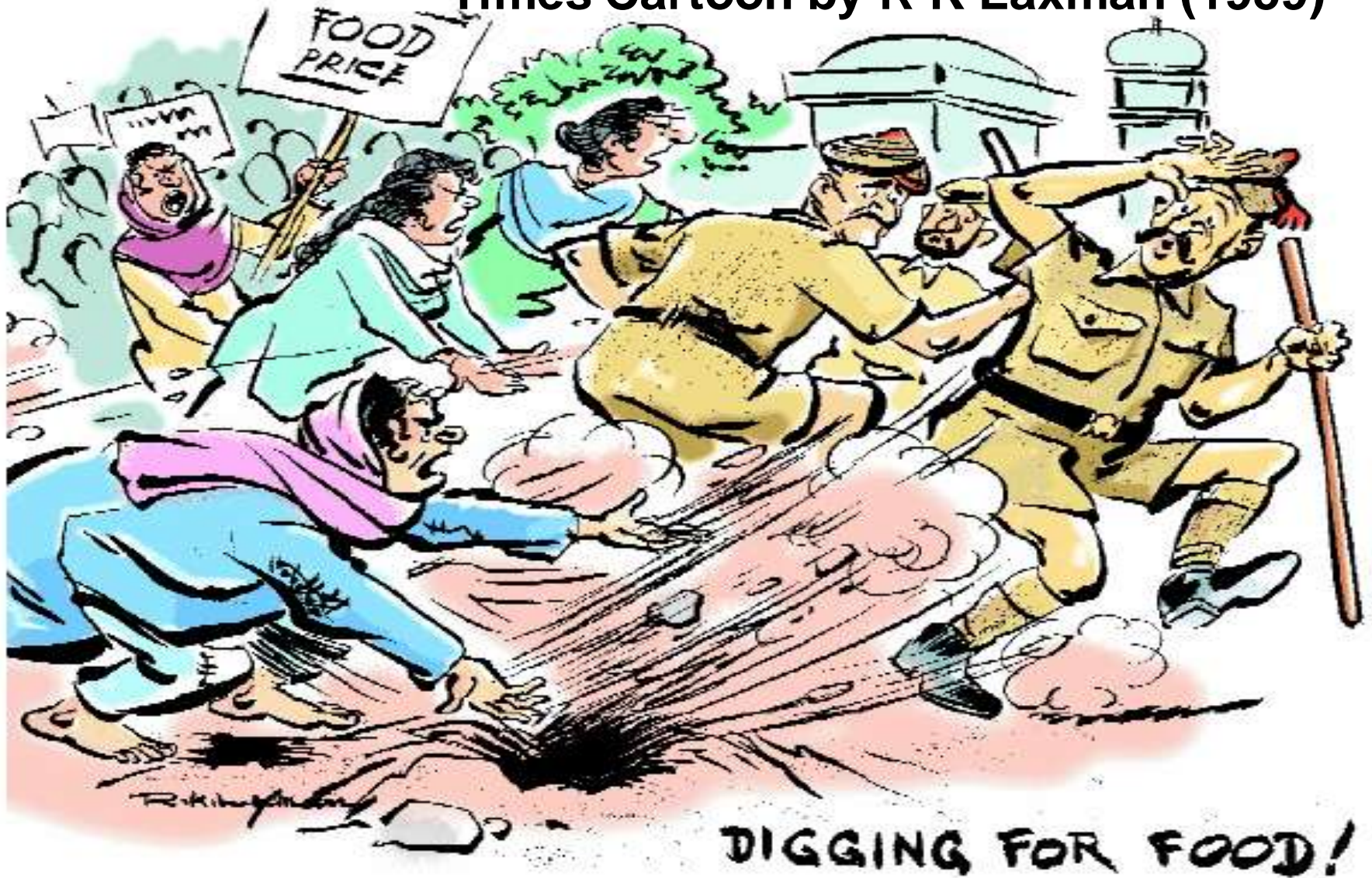
## The India Case

Focusing on the current situation  
and Preparing for the future

The country has not yet moved away from its high dependency on rainfall and rainfed conditions;

And the 'never vanishing' population pressures with rural population figures hovering around 50% shifting up the percentage of urban poor

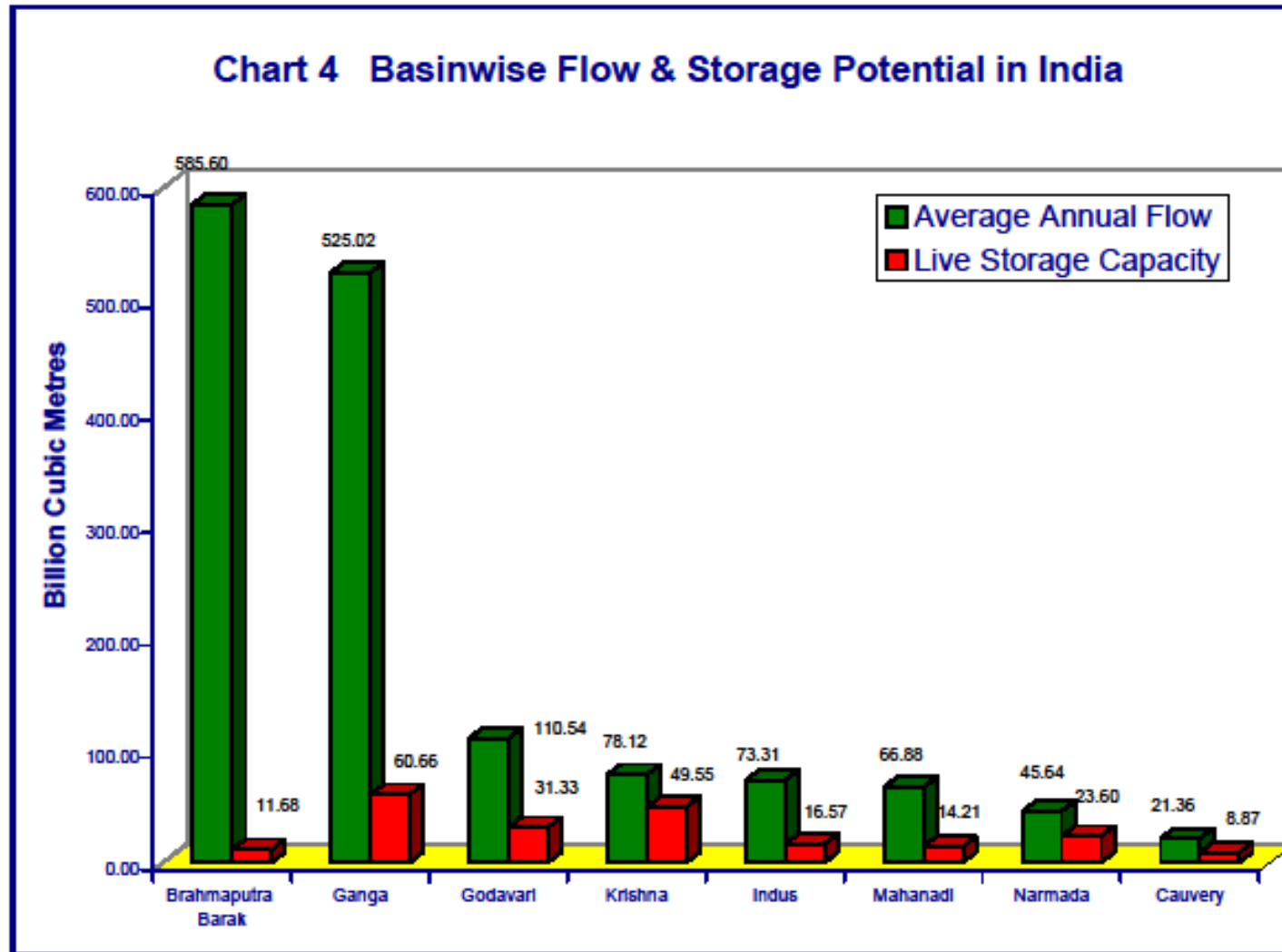
# Times Cartoon by R K Laxman (1959)



**DIGGING FOR FOOD!**

The shortage of foodgrain and consequent high prices led to violent protests by the people

**Chart 4 Basinwise Flow & Storage Potential in India**



**While some river basins do offer further scope for harnessing many do not ...**



A comparison of India's storage created with a few other major arid and semi arid situations around the globe will indicate that, half way through, India had slowed down ...

Why?

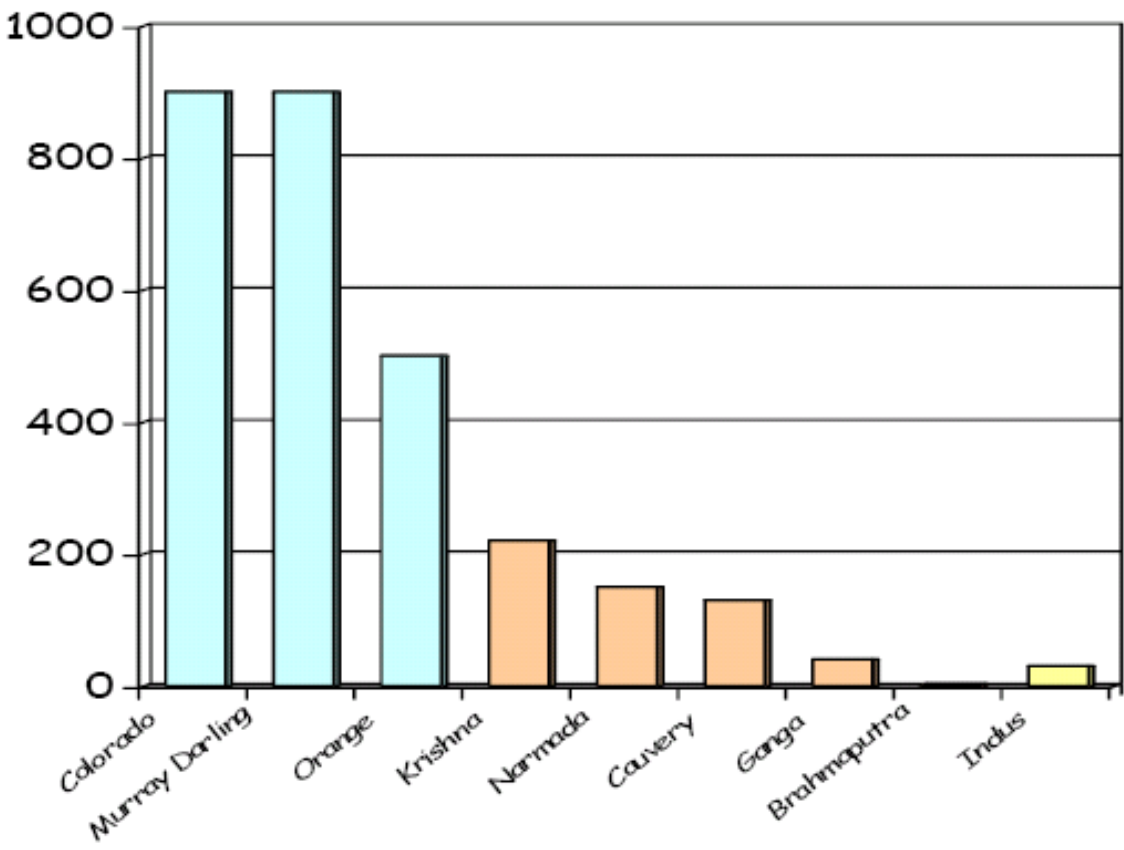


Figure 48: Days of average flow which reservoirs in semi-arid countries can store in different basins

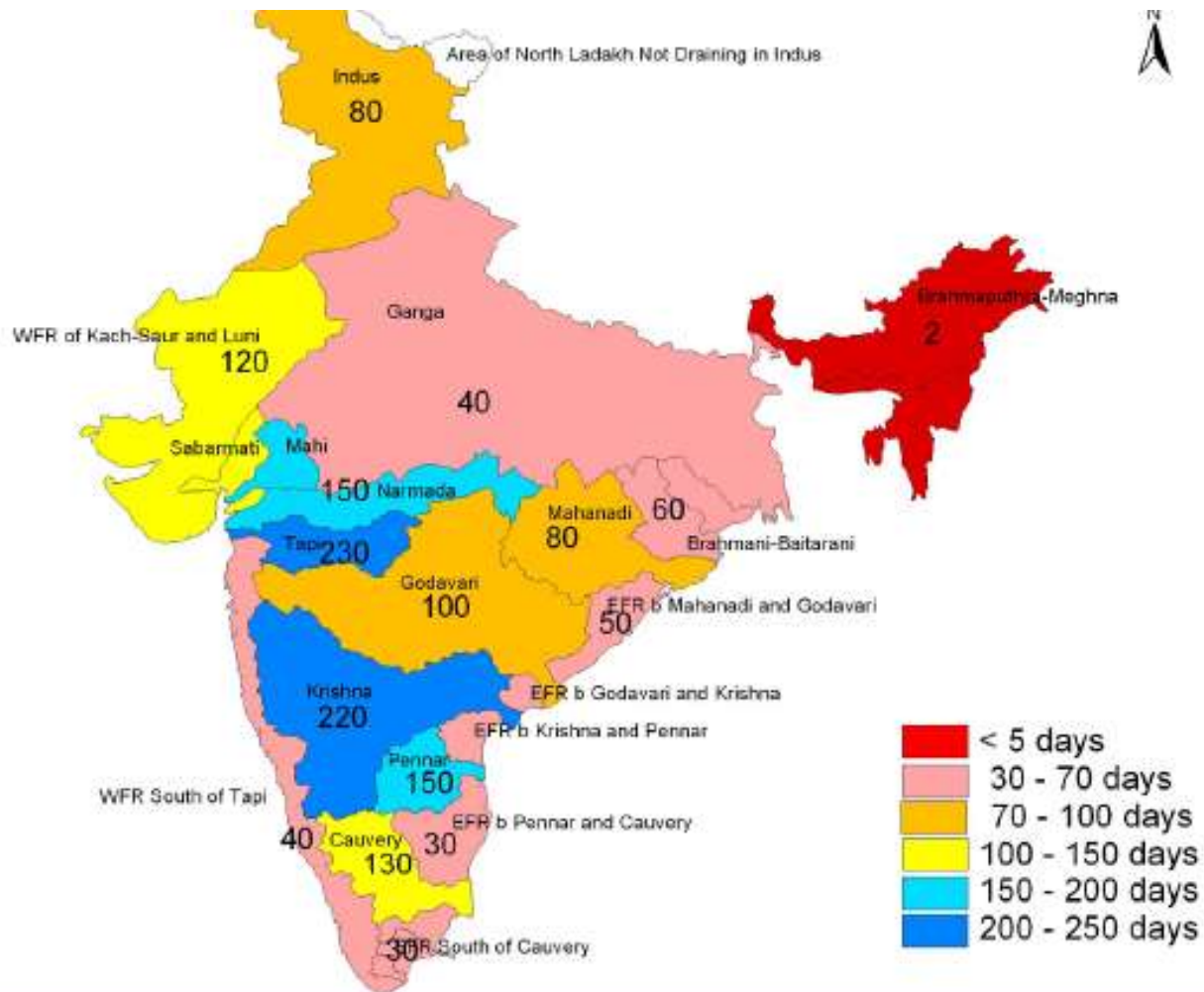
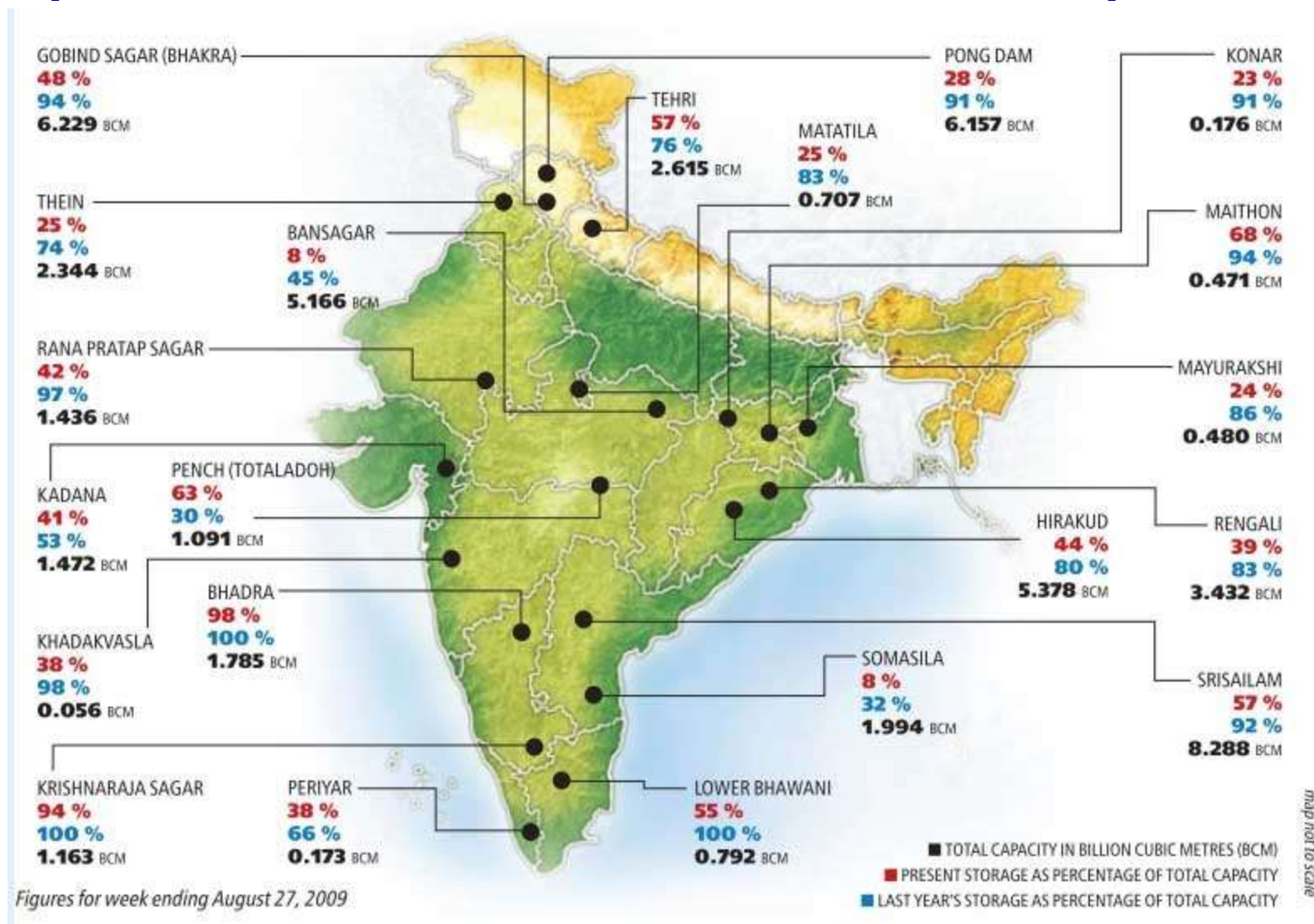


Figure 53b: The number of days of average flow that can be stored in different river basins in India

GIS presentation by IWM

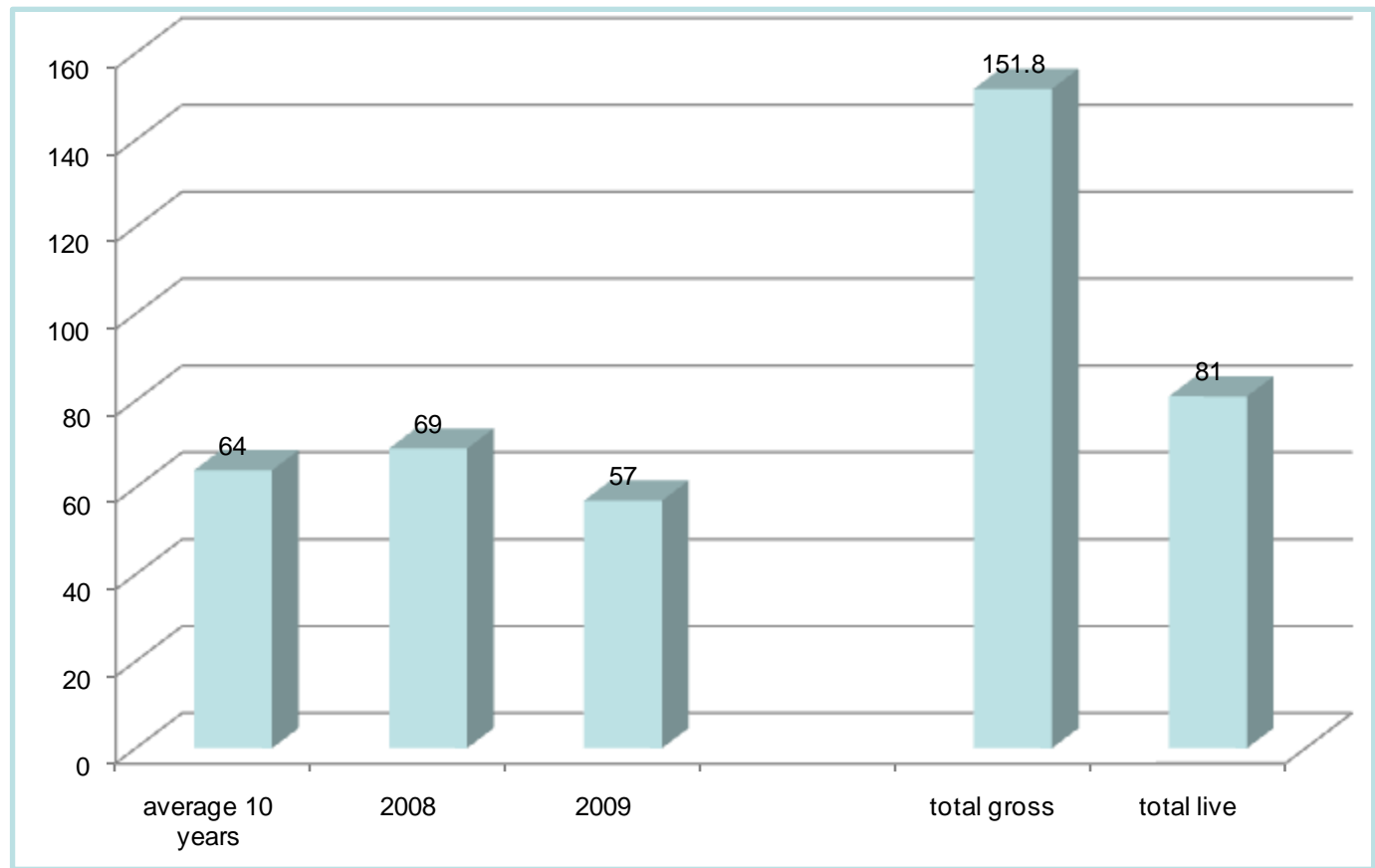
# Poor Storage available is to hurt adversely securing water for crops in 2009 -10; A substantial reduction in production ?



Storage situation in India had been abysmally low In 2009; there is a wide spread anxiety in regard to water availability to sustain irrigation & hence food production

# Total Reservoirs' Storage Situation – (as on 18 Sept 2009)

**Volume in million m<sup>3</sup>**



**situation in storage of large reservoirs > 10 million m<sup>3</sup>**

How India should proceed to  
insulate its food production  
capacity with limited land  
water and human resources  
in future

Demand Side Management only? *Or*  
More on supply side management, a  
necessity?

World Trade and the economic downturn are  
new drivers adding complexities....

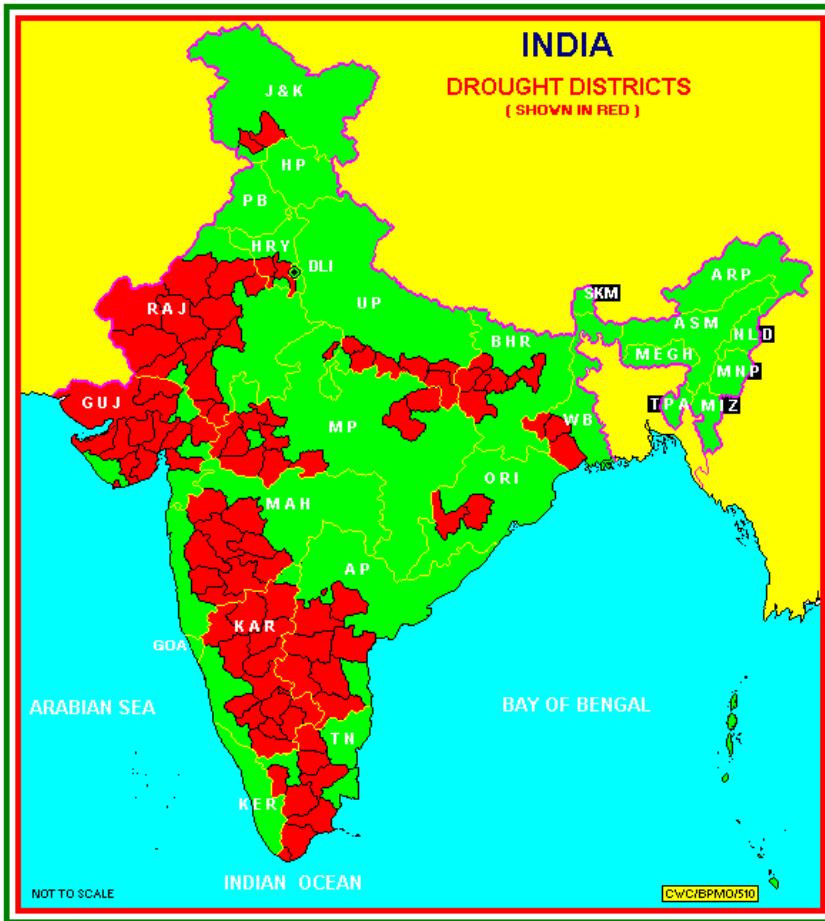
# The Flood and Drought Syndrome



Everything under Water!

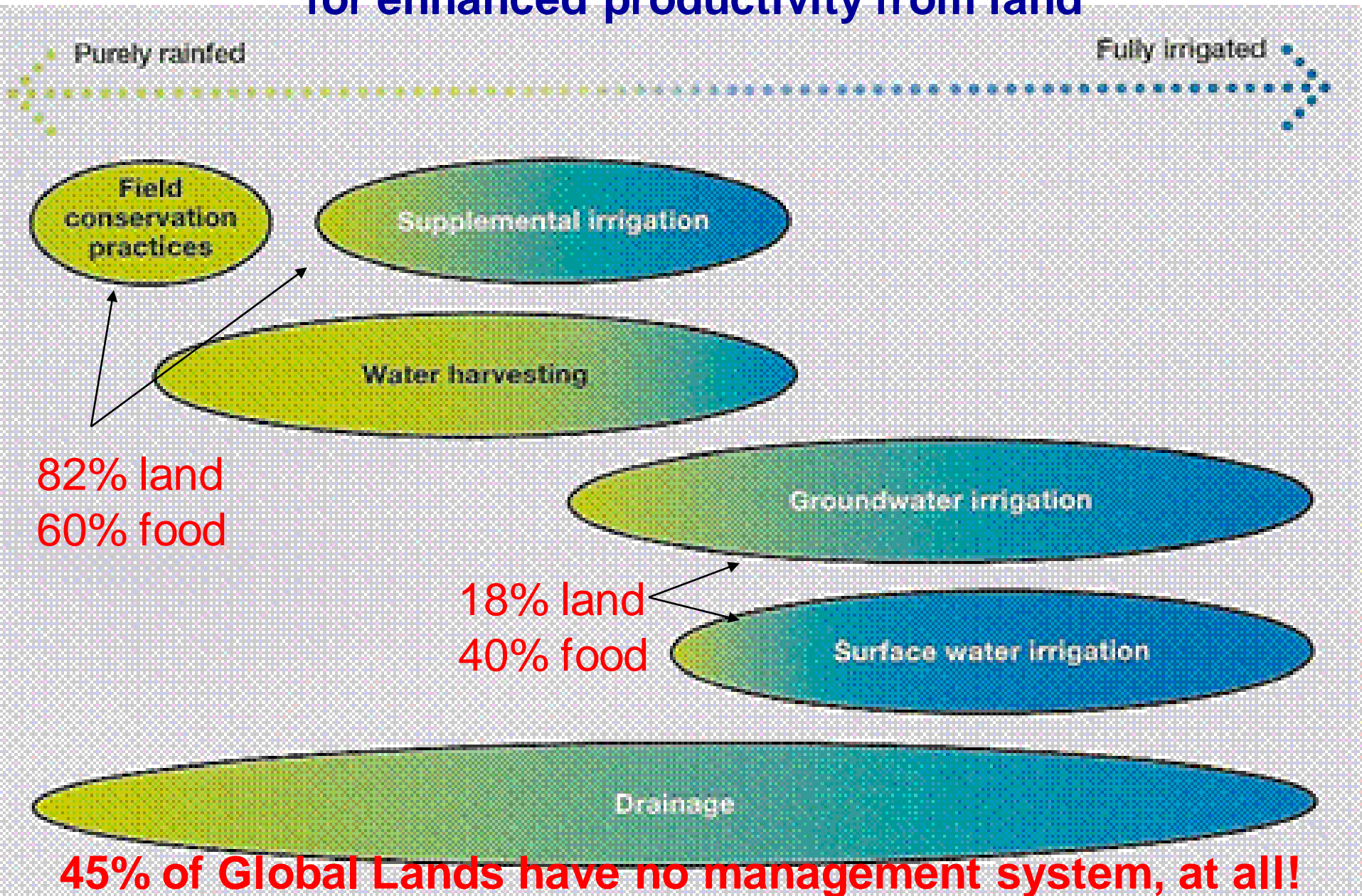


# The Flood and Drought Syndrome ..2



Parched Lands with drought!

# The 'continuum chain' in water management for enhanced productivity from land





# In the end, one finds that WHSC means a holistic consideration.....

- Small is beautiful; serves equity and should deserve all support
- But Big is Bountiful; One should not decry it
- Both have their own places and relevance: And one need not bounce on the other: We need all solutions
- India has to double their food production (& energy)
- May be, this asks us to re-examine regional projects of sizeable nature
- Are we too shy on large dams? Are they also rain water harvesting?
- The postulated pattern in Himalayan river flows with the Climate Changes, the likely changes in the pattern of precipitation are not only a threat for any one country but for all in the region

# In lieu of conclusions...

- If large scale, long distance water transfer can enhance overall regional benefits, how to reexamine them with better scientific tools?
- Can this help to enhance environmental quality, green energy, more food for the poor in the **region**? thus prepare all the nations (India, Nepal, Bhutan and Bangladesh) to face the impacts of GCC jointly?
- Can SA survive GCC impacts in the long run without a recourse to options like large dams, hydro energy that are available (in plenty) but remain unharnessed? Can long distance water transfer associate for more gains?
- Thank you for your patience!



**Thank you!**