THE HYDRO-INSTITUTIONAL CHALLENGE OF MANAGING WATER ECONOMIES OF TRANS-BOUNDARY RIVERS: A STUDY OF NARMADA BASIN, INDIA

M. Dinesh Kumar
Executive Director
Institute for Resource Analysis and Policy
Hyderabad, India
Email: dinesh@irapindia.org

Paper presented at the World Water Congress XV,
Edinburg, Scotland, 25-29 May 2015

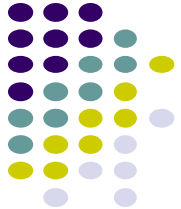
Introduction

- Many Indian river basins in the semi arid and arid parts are inter-state basins, and therefore are also federal
- Most important are Narmada, Cauvery, Krishna, Sabarmati & Pennar
- These basins are facing severe environmental water stress due to excessive diversions to meet water demand from various sectors, but mainly agriculture.
- Competition and conflicts over the use of water from the basin states has been increasing with time

Institutional arrangements for managing water allocation

- Inter-state Water Disputes Act (1954) provides for setting up tribunals for adjudication in case of dispute amongst states
- Cauvery Water Disputes Tribunal (1990)
- Krishna Waters Disputes Tribunal I & II (1969 and 2003)
- Narmada Water Disputes Tribunal (1969)
- The water sharing agreements arrived at through tribunal awards only consider surface flows

Emerging issues in trans-boundary water allocation



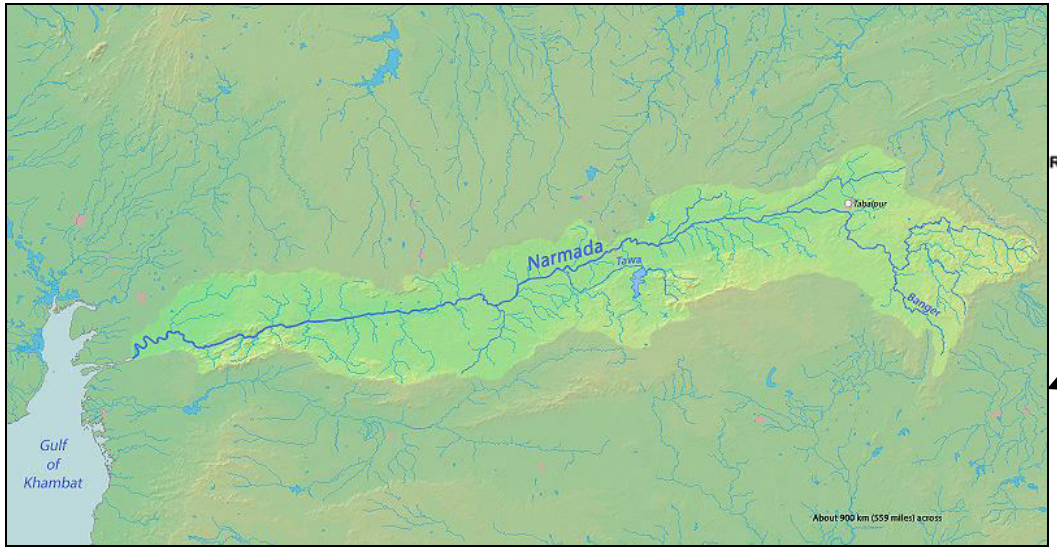
- Upper catchments of most basins are not ideal for groundwater exploitation; regions were agriculturally backward; dominated by tribes; received low priority for institutional financing in 60s and 70s.

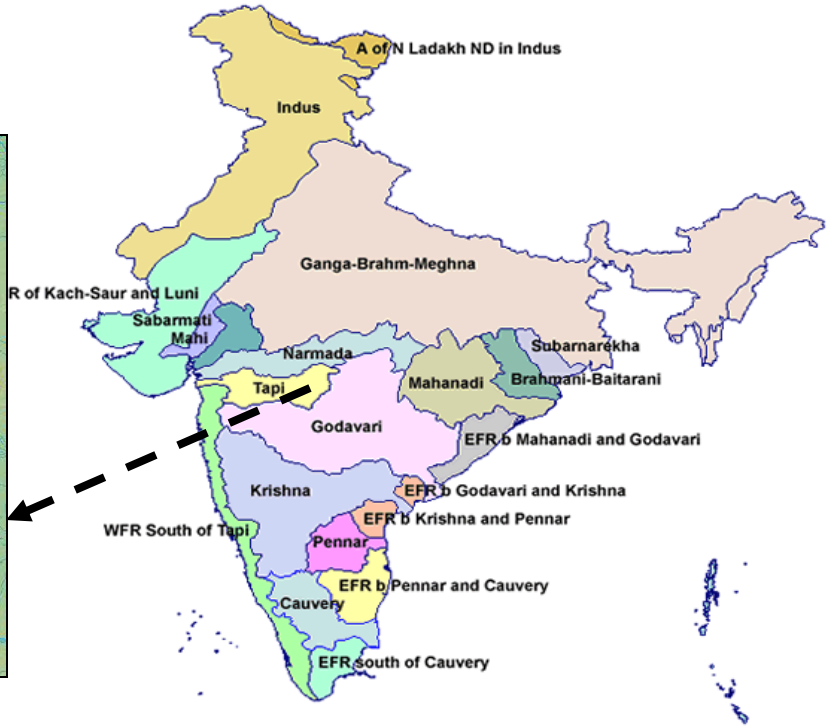
- Scenario changed in early 80's. Farmers adopted energized wells for intensifying cropping.

- Rural electrification & energy subsidies accelerated the process.

- In 90's, intensive watershed development & water harvesting activities affected downstream flows & basin water balance.

Narmada River Basin, India





Source: Wikipedia and MoWR, India

Changing socio-economic features of Narmada basin: since the 80's

- Agriculture intensified in the basin since early 80s
- With increase in human & cattle population, area under crops and irrigation increased substantially; % area under irrigated food crops increased from 4.6 to 35.
- Blue water use increased from 600 MCM to 4530 MCM. Major explosion in groundwater irrigation over 30 years.
- Several new large surface irrigation schemes came up. Water demand for domestic and livestock use also increased.

Changing groundwater-surface water Interactions in the basin

- Stream-flows in the basin had reduced over time.
- But, this is not due to changes in rainfall, but due to changing rainfall-runoff coefficient
- Groundwater withdrawal had increased over time in upper catchment areas; recharge-draft balance reduced
- But, long term changes in average annual water level trends do not corroborate with this
- This phenomenon can be explained by reducing groundwater outflows into surface streams (base flow reduction)

Upstream water harvesting and downstream impacts

- Post water harvesting interventions, downstream flows had reduced in Kundi sub-basin
- The reduction in runoff in the sub-basin is not explained by the reduction in rainfall
- Recharge ration for two sub-basins, viz., Hathni and Kundi had increased post watershed interventions
- The augmented recharge is pumped out for expanding irrigation
- The recharge ratio for the treated watershed is higher than the untreated watershed in all years post interventions

Key challenges in water management in Narmada basin

- Understanding the dynamics of interaction between groundwater-surface water over time, and its effects on stream flows.
- Understanding the green water economy & how changes in green water use over time affects the basin hydrology.
- Understanding scale of water harvesting & watershed management and their effects on basin hydrology.
- Predicting the nature of change in climate and its impact on basin yields; monitoring the use of groundwater by private well owners and direct use of soil water for crop production.

Suggestions for improving institutional capacities

- Mapping changes in land use & well irrigated area in the basin over time.
- Estimation of effects on surface water flows.
- Sharing of these estimates with MoWR to ascertain any need for reviewing inter-state water sharing agreements.
- For arriving at water sharing agreements for basins that are not covered by any earlier agreements, allocation can be done for stream flows on principle of 'prior appropriation rights'

Suggestions for improving institutional capacities

- But, the agreement should be explicit about the stage of development of groundwater, and extent of rain-fed crop area and SWH in the basin, to avoid future conflicts
- Designing robust basin hydrological models, to analyze the effect of various hydrological stresses on stream flows.

Conclusions

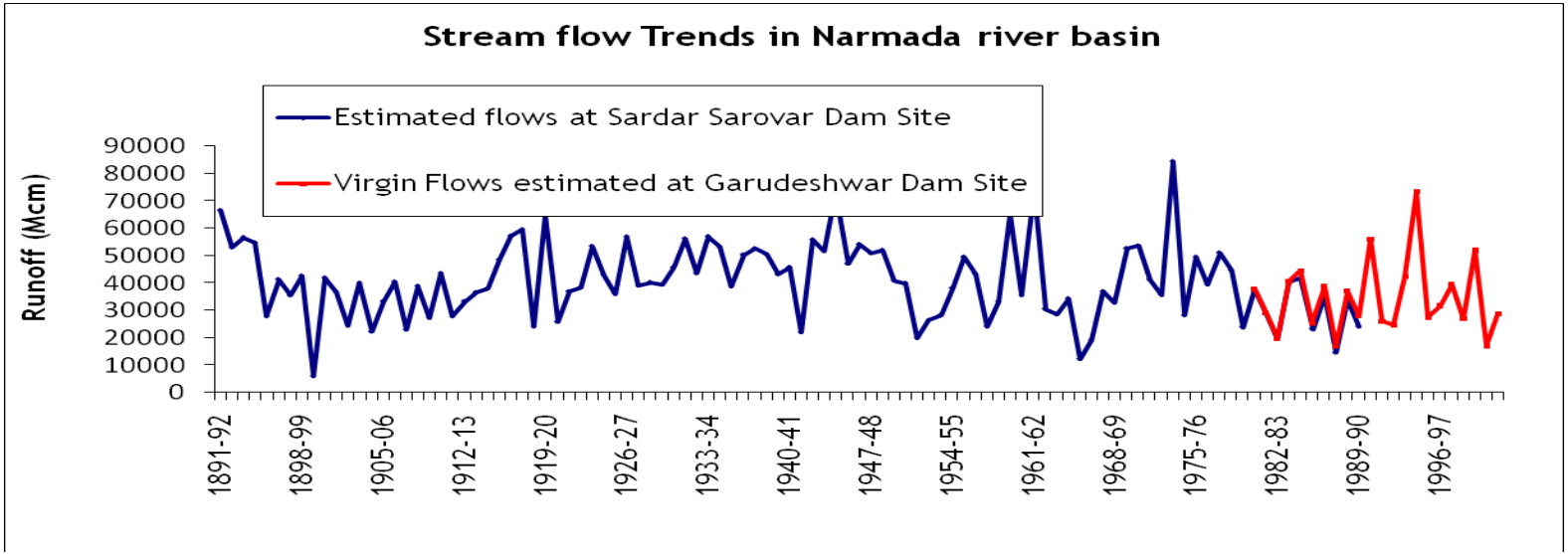
- In India, interstate water sharing agreements have so far only considered surface water resources.
- Water dispute tribunals have not been able to consider the effect of groundwater use, and the changing land use patterns on basin yields.
- While federal agencies are required for enforcing water dispute tribunal "awards", their scientific capabilities need to be strengthened for reviewing the awards periodically
- If a review of the existing agreement is necessary, then the new tribunal can be set up.

Conclusions

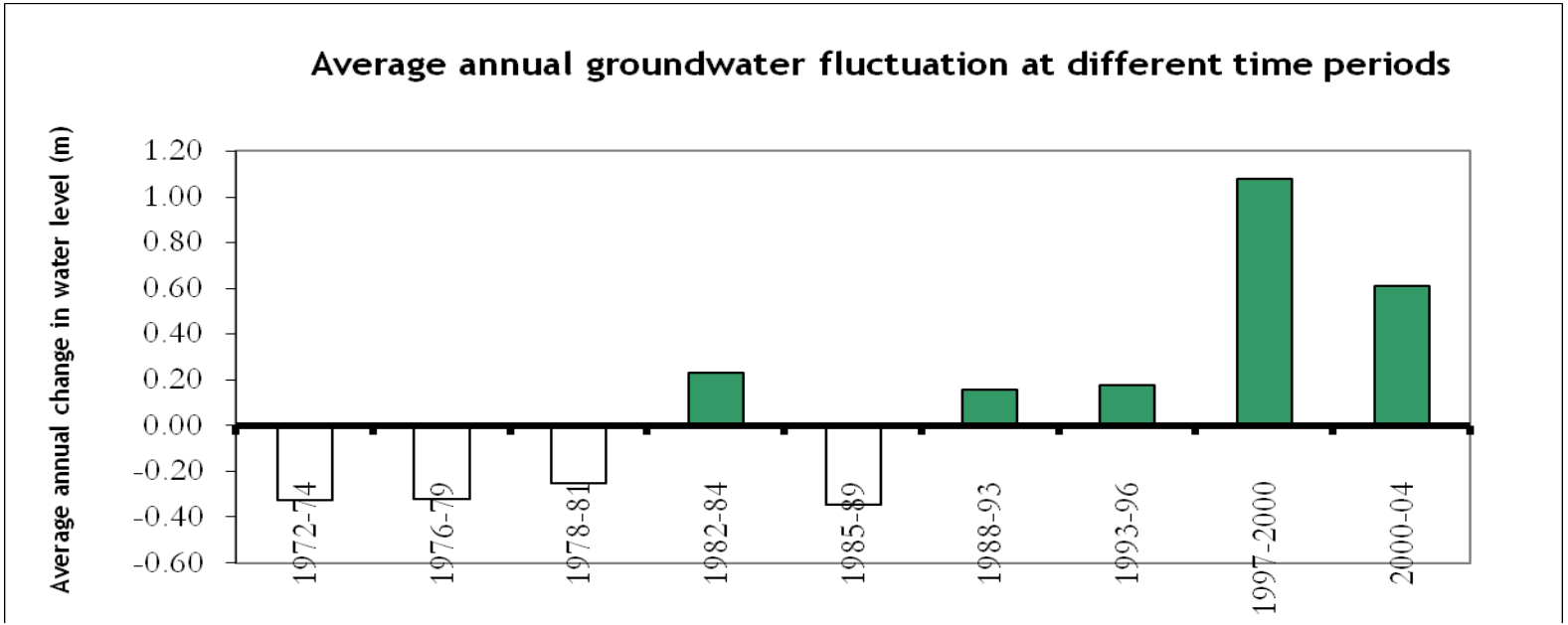
- It can factor in the additional developments that have come up in the basin
- But, existing legal framework concerning inter-state water disputes may require amendments, to make it mandatory for state governments to share the data with federal agencies, and to enable them carry out field inspections
- The greatest challenge is to make the basin states agree to the inter-state water allocation decisions.


Thank You
Email: dinesh@irapindia.org
Web: www.irapindia.org

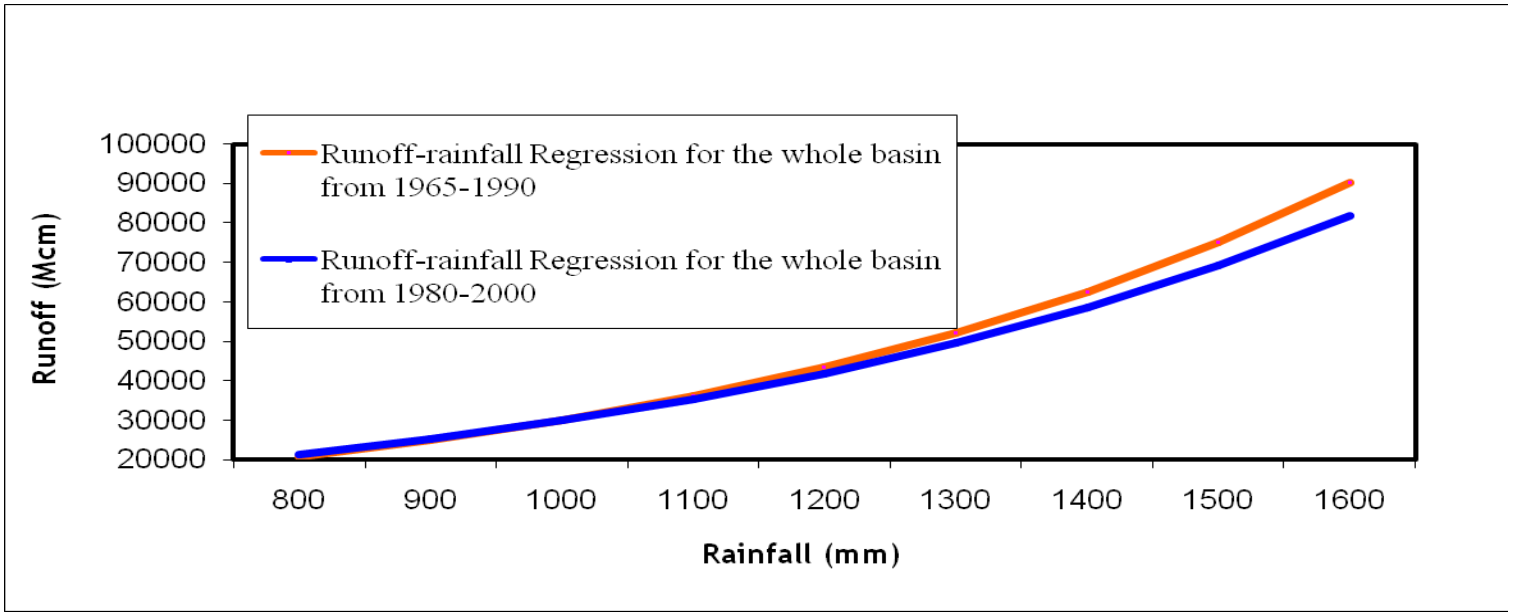
Reducing stream flows in Narmada river basin



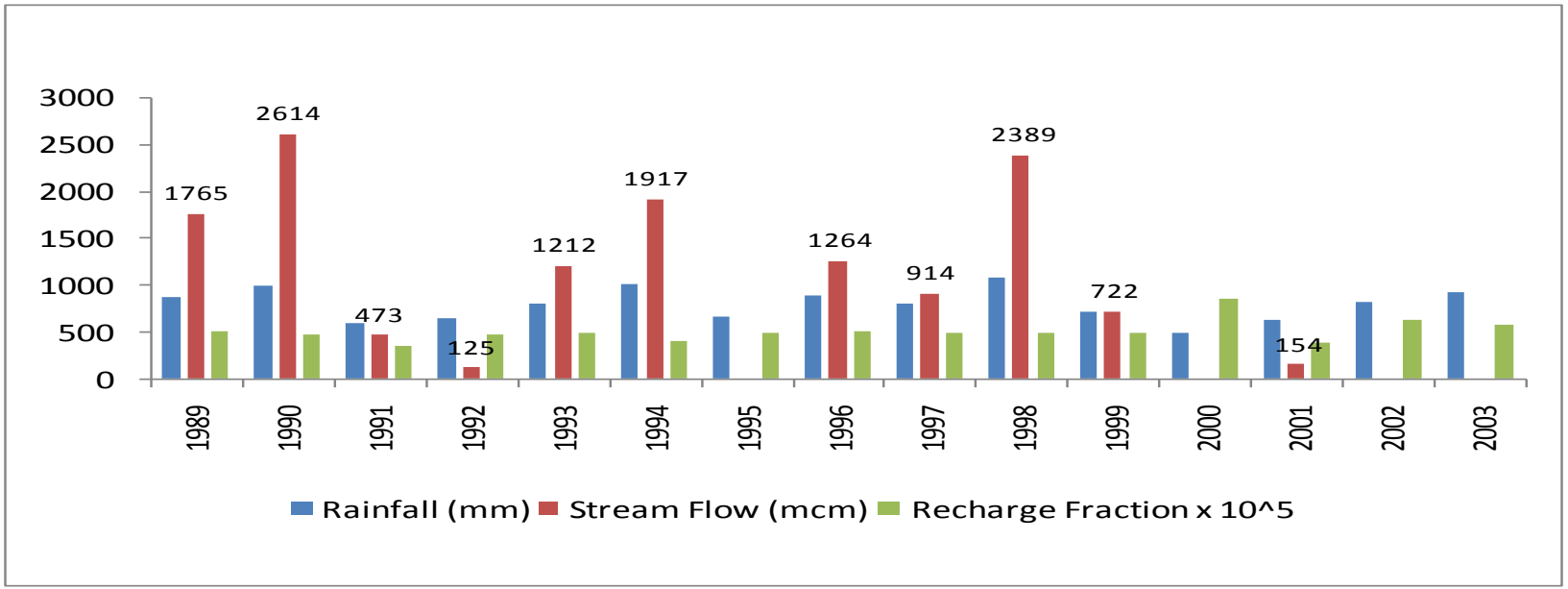
Long term changes in annual groundwater level trends



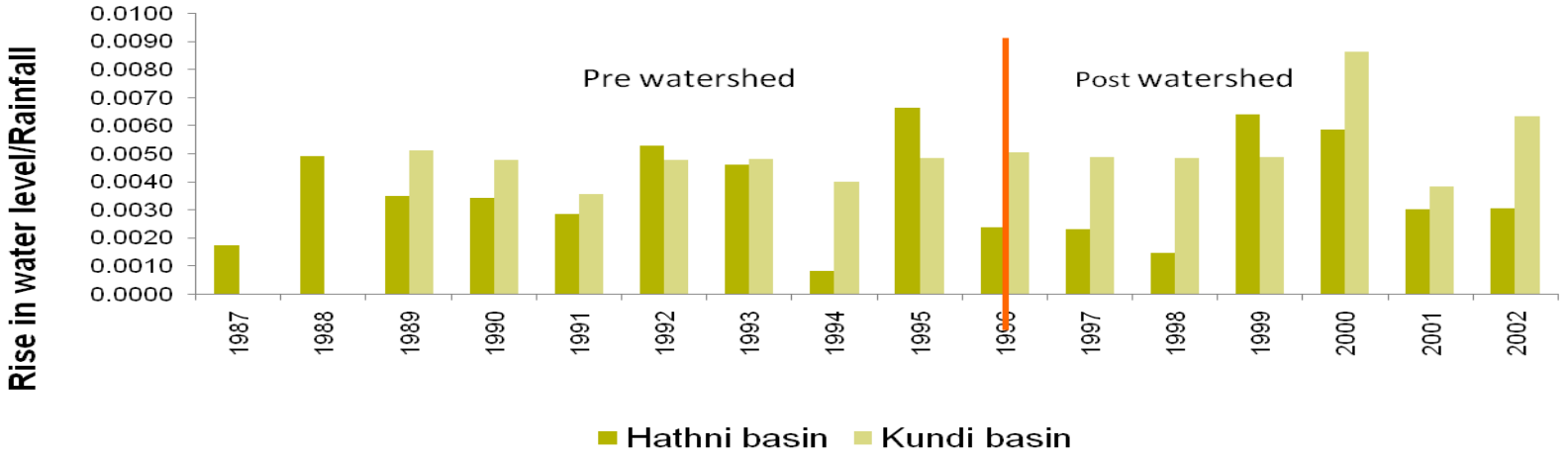
Trend in Runoff-Rainfall Regression for the Narmada Basin



Reducing stream flows in Kundi basin



Increasing recharge fraction with watershed development: Kundi and Hathni



Reducing runoff with intensive watershed development