



➤ Institutional Design and the
Geography of Rural-Urban Water
Conflict in Mumbai, India

Bharat Punjabi

Post Doctoral Fellow

Institute on Municipal Finance and Governance

IMFG
Institute on Municipal
Finance & Governance

at the

MUNK
SCHOOL
OF
GLOBAL
AFFAIRS



**UNIVERSITY OF
TORONTO**

Why Mumbai? Why Water?

- Huge disparities of water access within Greater Mumbai and between cities in the metropolitan region
- Paradox of water shortage amid plenty in the region
- Greater Mumbai: Largest Municipal Corporation in the country with access to Central and State funds
- Huge resentment and conflict in the Mumbai countryside - in particular, Thane district
- Displacement and rural water shortage
- The influence of colonial era laws and regulations poorly understood in the policy and social science literature on Mumbai.

The Central Role of Water Institutions and Institutional Design

- Rules and institutions matter
- With bad rules, even if water is sufficient, we will face poor outcomes
- Rules that disproportionately favour one institutional actor over others will lead to inefficient outcomes
- Better water resource planning needs institutional co-ordination and better rules between water districts, villages and cities
- Badly needed: A regional water sharing council in the Mumbai region

Outline

- I. Background on water in Mumbai
- II. Questions for research
- III. Theoretical Framework
- IV. Case Study One: The Surya Project
- V. Case Study Two: Tansa-Vaitarna Water District
- VI. Regional water governance in the context of the two case studies
- VII. Conclusion

I. Background on water in Mumbai

Some important facts

Background on water in Mumbai

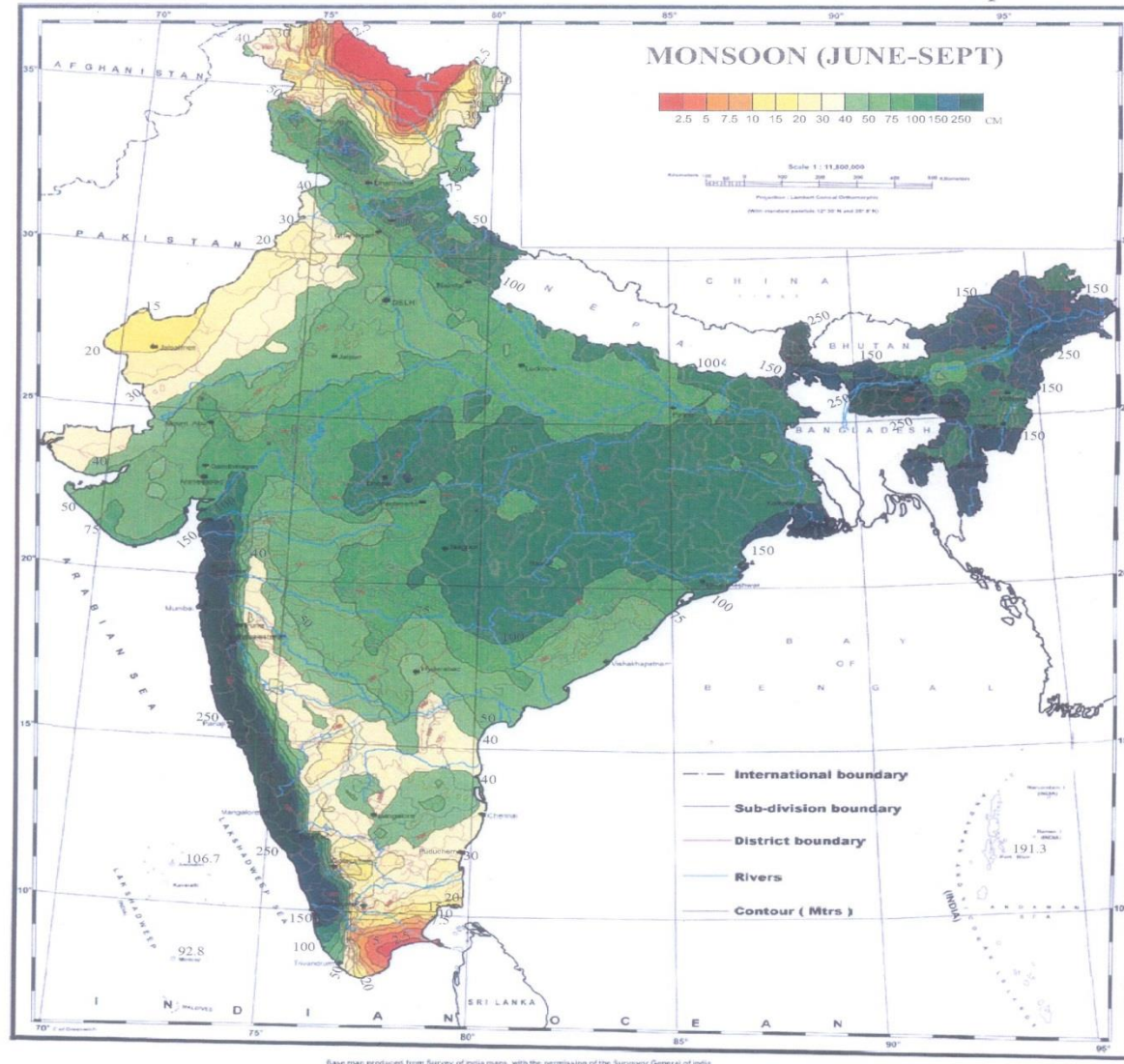
- Maximum average consumption is 200 litres per capita in Greater Mumbai
- Lower average consumption in the secondary towns and municipal council areas
- Only 18.5% of urban poor have access to piped water supply at home
- 92% of non slum homes have piped water
- Some areas within Greater Mumbai get 300-350 litres per capita
- Poor demand side management within Greater Mumbai

I. Background on water in Mumbai

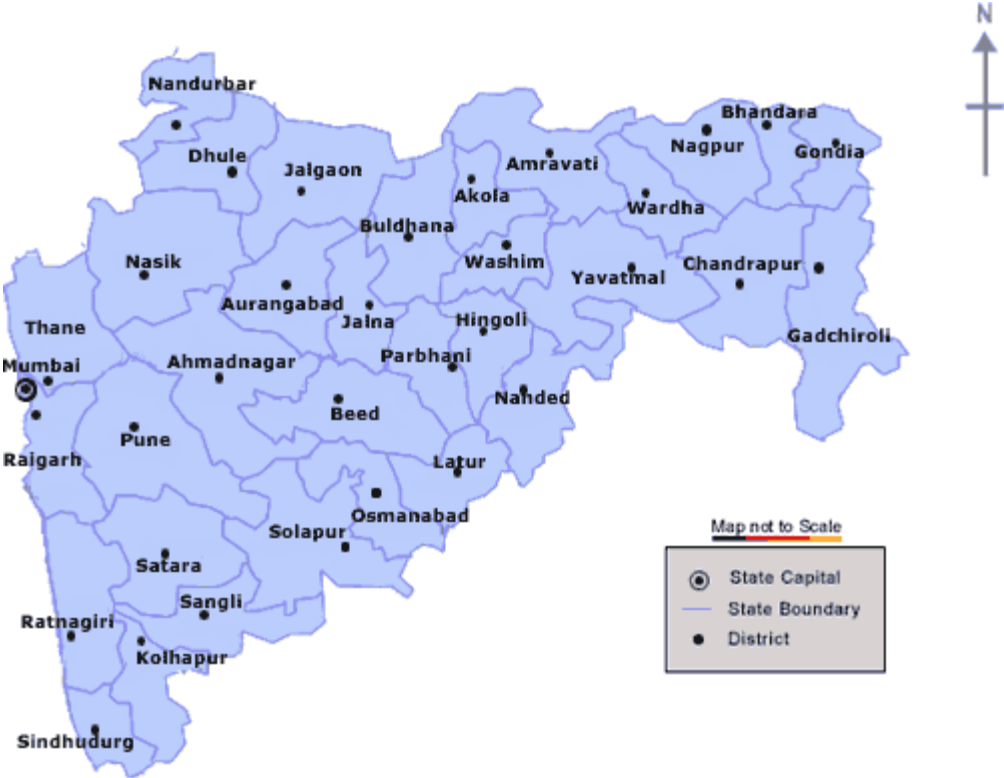
- Largest urban water supply network in Asia serving 22 million people
- Largest city is Greater Mumbai, population 14 million
- First dam outside city boundaries in the 1890s in Thane district
- Hydroelectric dams built by the Tatas in Lonavala in 1919 (Raigad district)
- Successive projects until the 1930s
- Two more dams planned in the hinterland district of Thane in 1940s and 1950s
- Three more dams in the 1960s - all in Thane district
- Multipurpose dams in the 1970s
- Watershed reserved for Mumbai in the 1960s during bifurcation of Bombay into Gujarat and Maharashtra states (see map); river basins in neighbouring Gujarat state being tapped now for water

RAINFALL (cm)

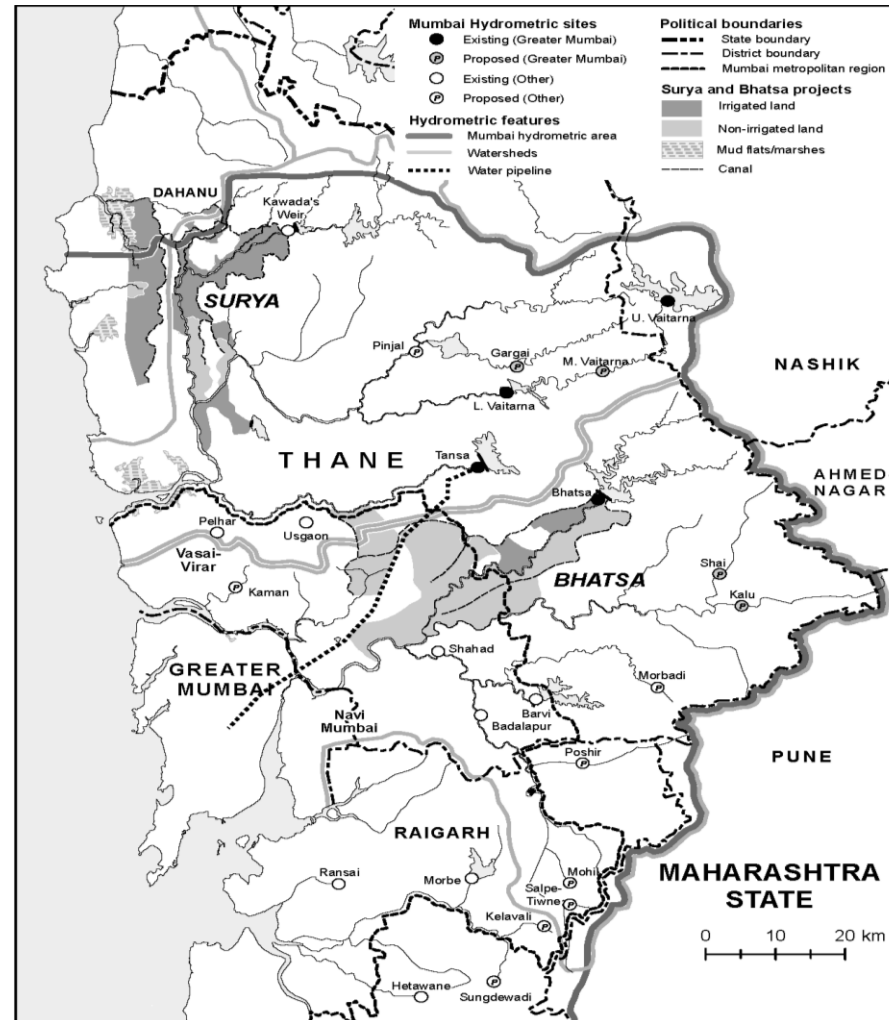
Map No. 43



State of Maharashtra

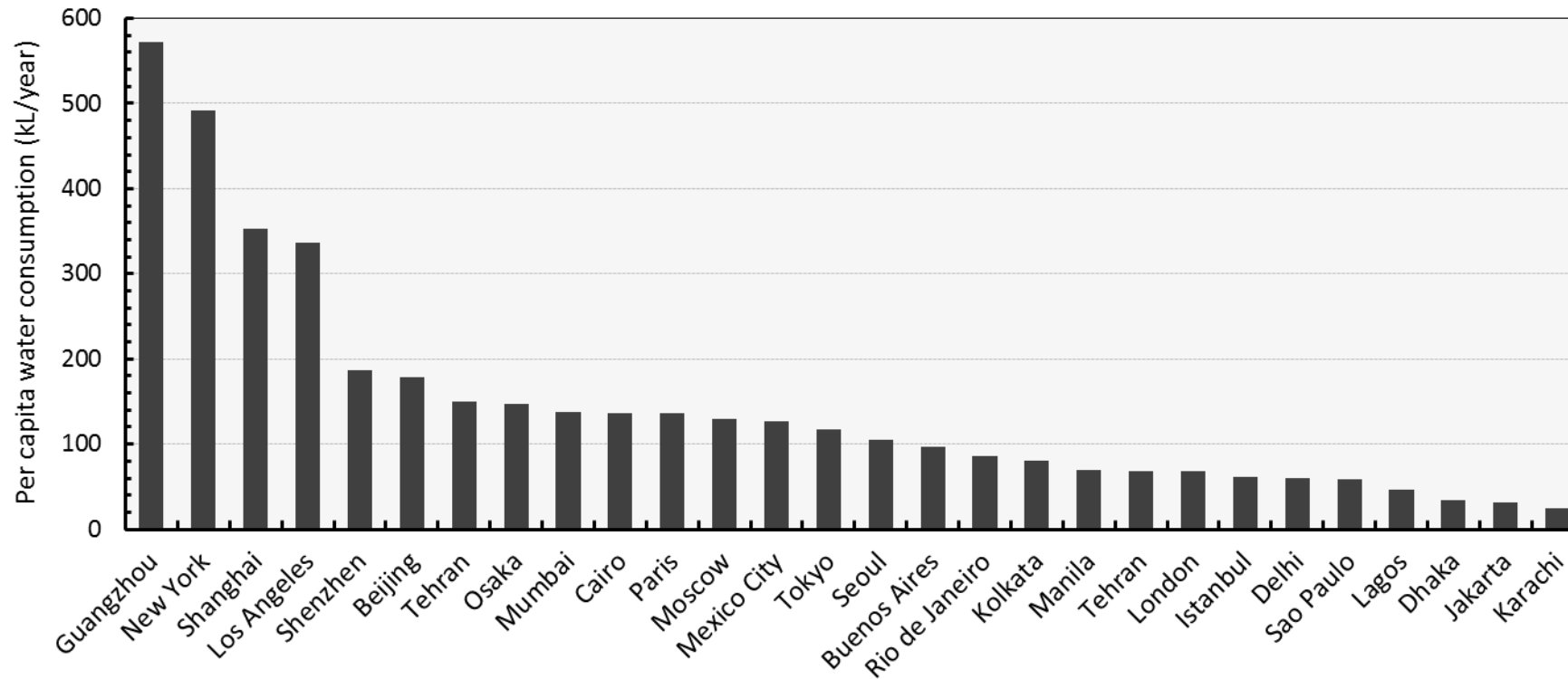


Mumbai Hydrometric Area



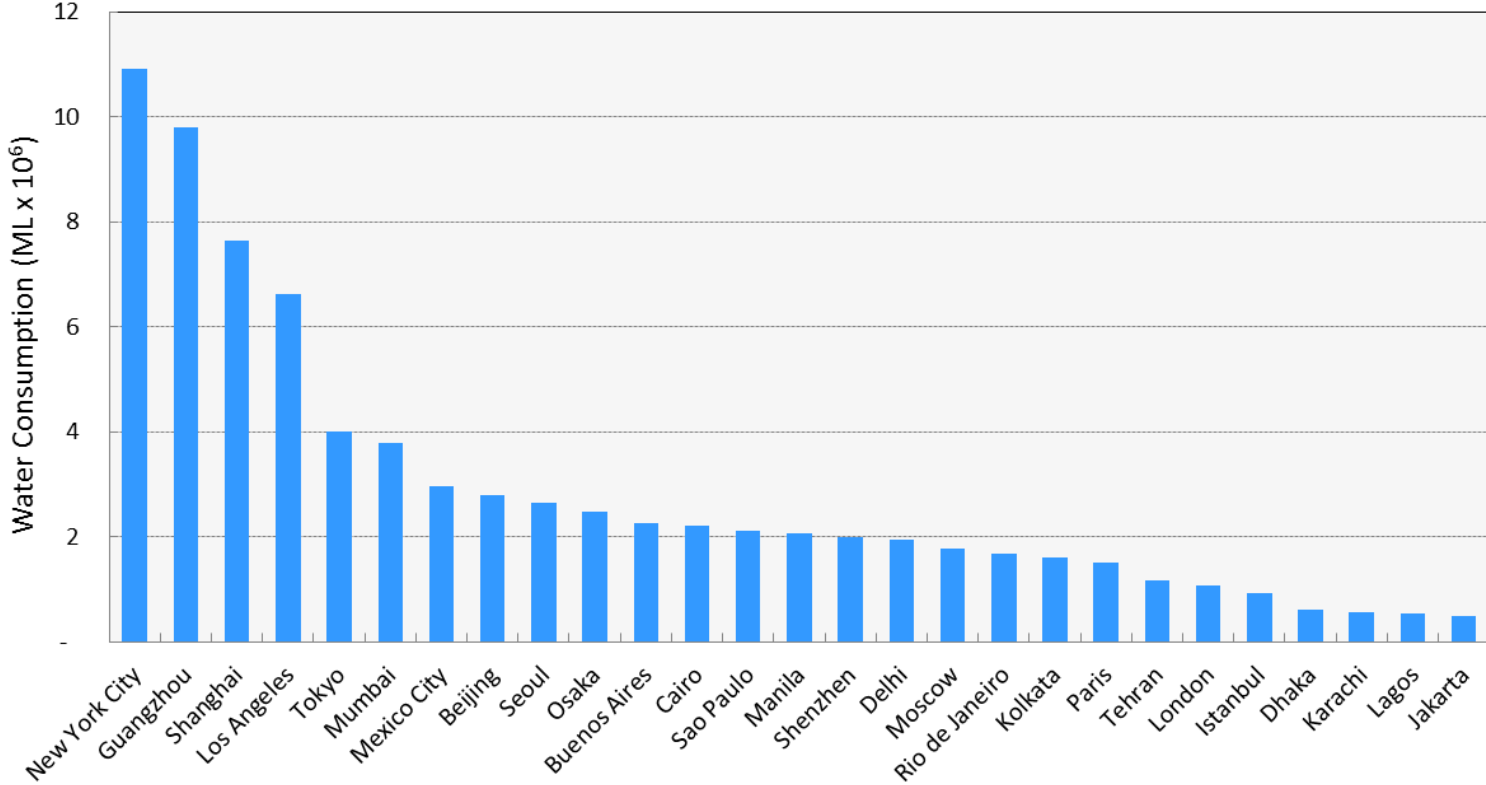
Background on water in Mumbai

Per capita water consumption -- 2011



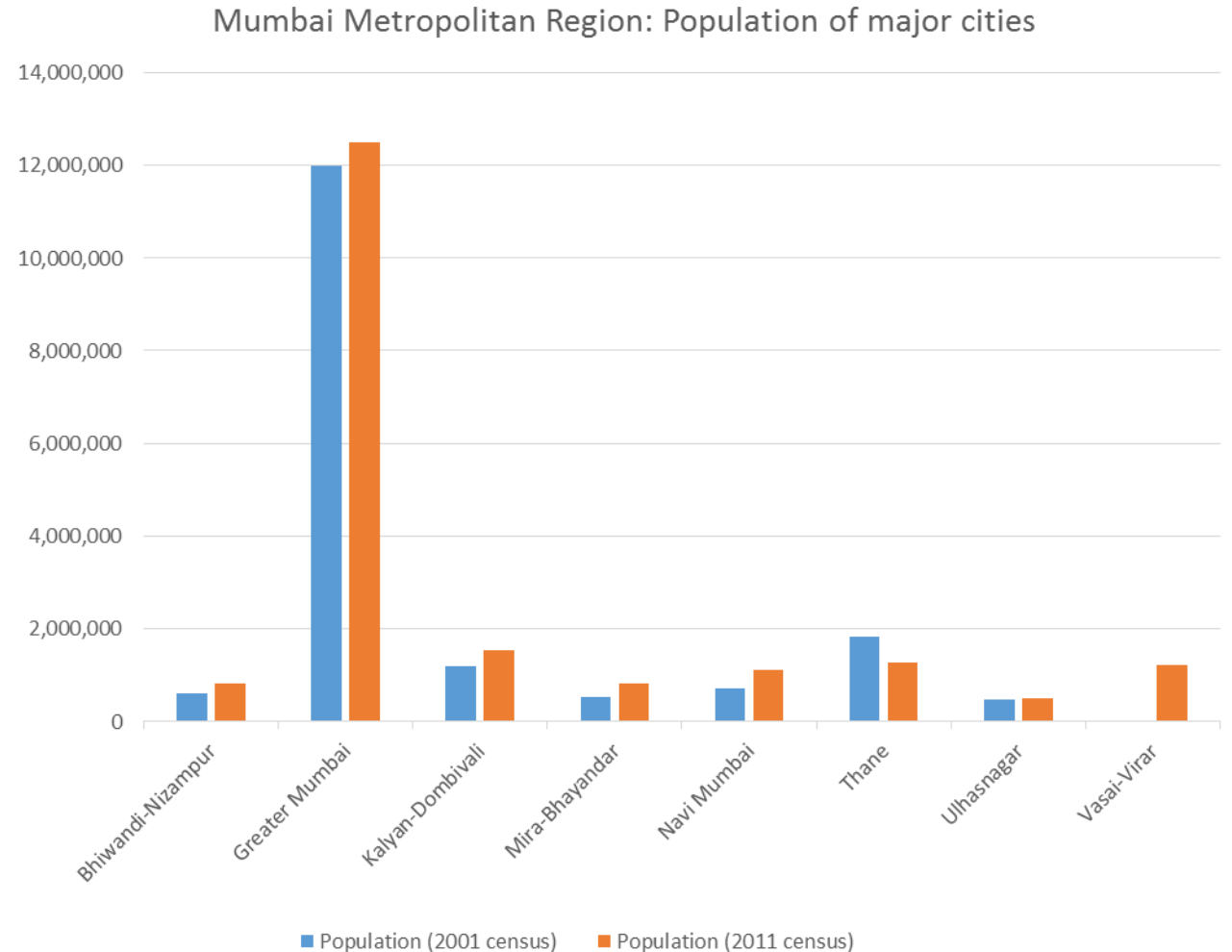
Background on water in Mumbai

Total water consumption in megacities -- 2011



Population

- Statistics from 2001 and 2011 census
- Total population of the metropolitan region is 20.5 million (2011 census)
- Largest urban centre is Greater Mumbai at 12 million
- Vasai -Virar is the fastest growing urban centre. Fastest growing city in India according to Census of India 2011
Population is 1.4 million

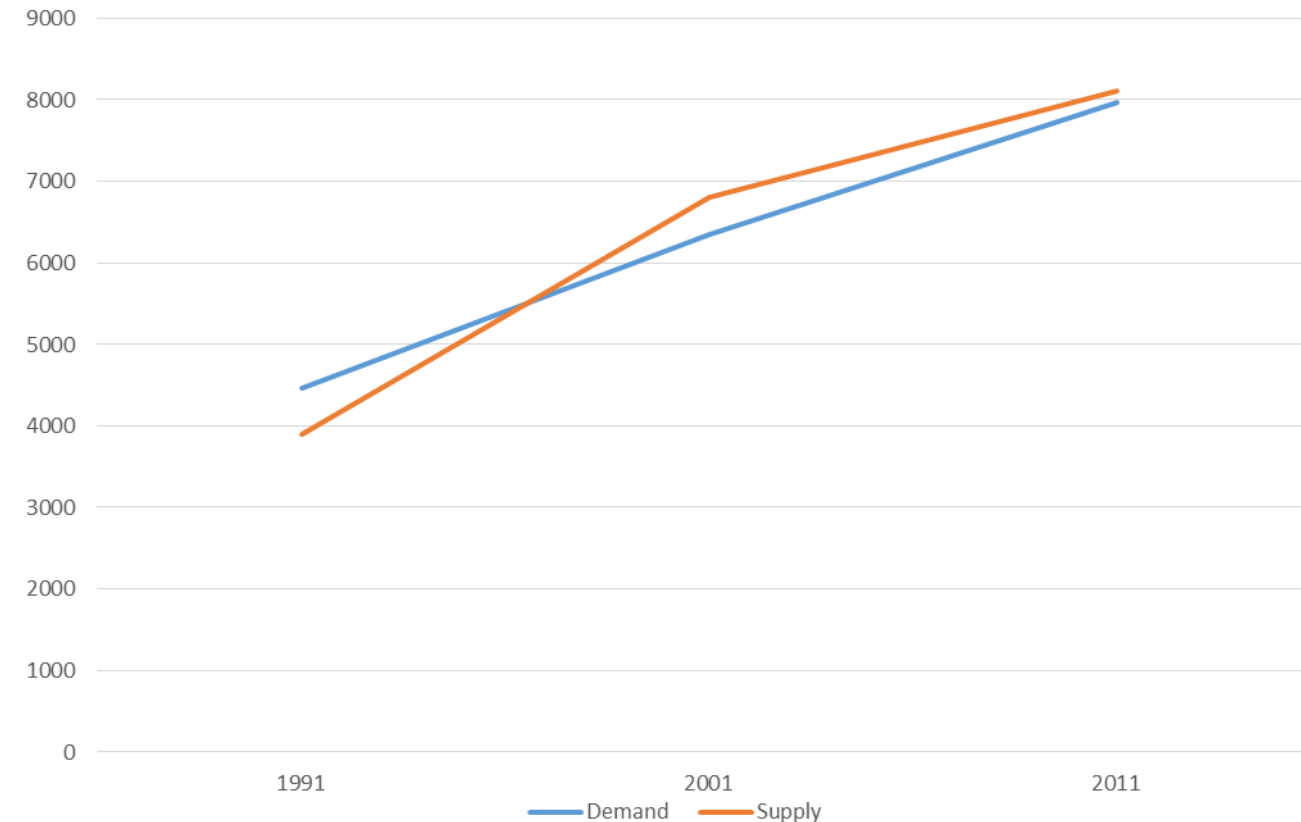


Source: Census of India, 2011

Demand and Supply across sectors- Domestic use

- Scarcity of the 1990s has not been repeated
- Supply has always kept pace with demand
- 8,000 million litres per day supplied for domestic and industrial use
- 200 lpcd (litres per capita per day) in non informal settlements in the city
- 100 lpcd in informal settlements in the city
- Urban water demand shortfalls are compensated by diversion of agricultural water quotas

Water Demand and Supply in the Mumbai Hydrometric Area



Source: Water Budget for Maharashtra (2003-2010), Tables on Major, Medium and Minor projects in North and Middle Konkan Irrigation Circles, Metropolitan Planning Report. Water stats in Million Litres Per day

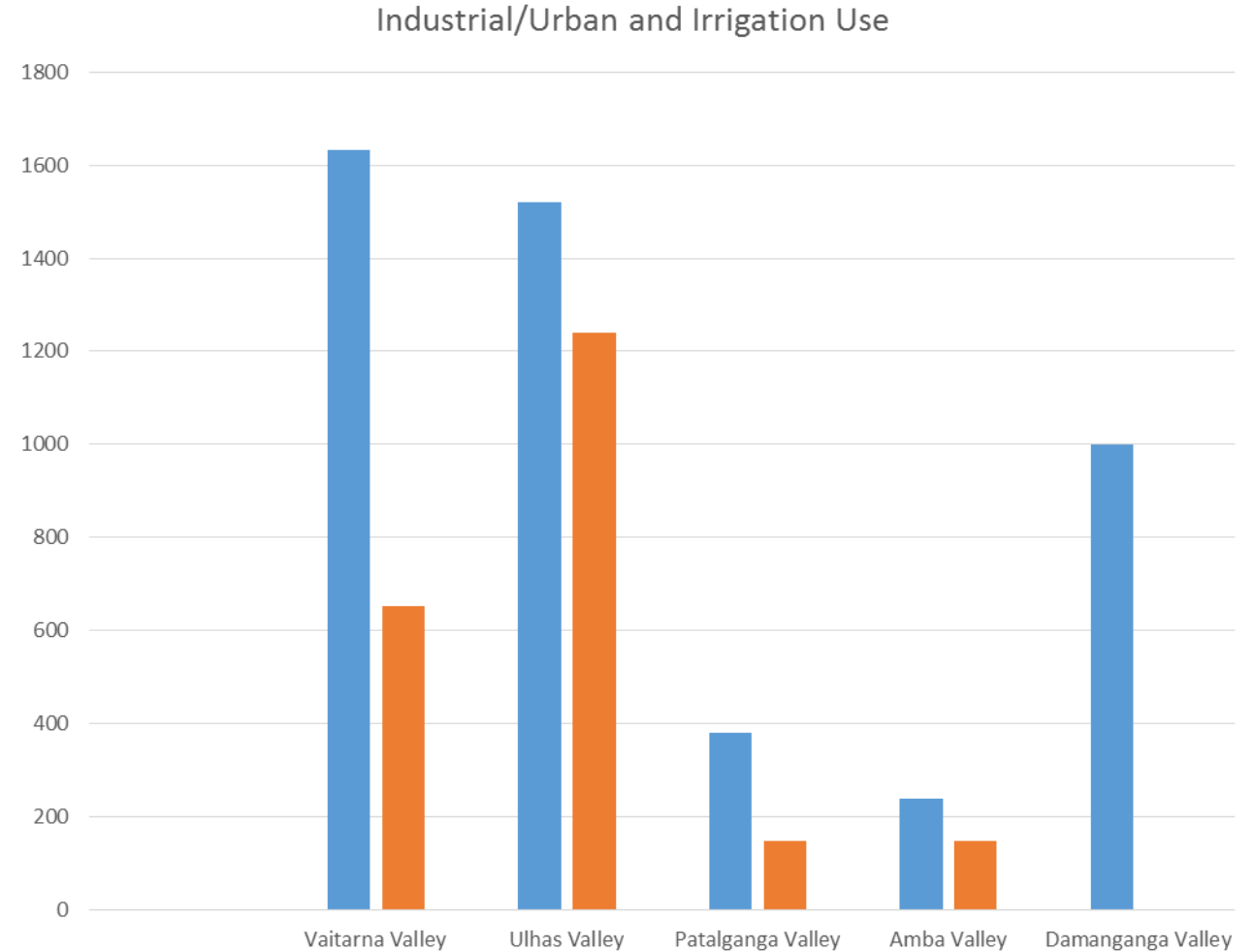
Highlight: Sufficient water

1. Computed from Water Budget (2003-2010), Government of Maharashtra and Regional Plan 1996
2. Projections for various river basins in the Mumbai hydrometric area for the year 2030
3. Extension of water frontier for Mumbai with water transfers from Gujarat-Damanganga.
4. Irrigation uses more water
5. Greater re-allocations anticipated for region's domestic and industrial use

Sr. No	Sub-Sr. No	Name of the Project	C.A. Sq Km	Yield Computed by		Planned Utilisation		Planned Total Utilisation MCM
				75% MCM	95% MCM	Domestic and/or Industrial MCM	Irrigation	
(i)		Vaitarna Valley						
	a	Surya Sub-Valley	509.98	760.71	606.24	113.36	461.48	574.84
	b	Vaitarna Sub- Valley	1197.16	2142.93	1659.34	1368.39	173.00	1541.39
	c	Tansa Sub- Valley	150.69	225.85	150.13	152.00	16.41	168.41
		Total (a+b+c)	1857.83	3129.49	2415.71	1633.75	650.89	2284.64
(ii)		Ulhas Valley						
	1	Ulhas Valley	1168.97	2621.53	2019.37	630.45	428.46	1058.91
	2	Kalu Sub Valley	1072.33	2057.50	1547.57	436.81	485.69	922.50
	3	Bhatsa Sub - Valley	926.39	1462.41	1073.43	436.30	308.03	744.33
	4	Ulhas Beyond Kalyan	37.04	52.51	40.54	17.53	18.74	36.27
		Total (1+2+3+4)	3204.73	6193.95	4680.91	1521.09	1240.92	2762.01
(iii)		Patalganga Valley						
		Patalganga Valley	327.79	712.38	489.12	379.07	146.58	525.65
(iv)		Amba Valley						
		Amba Valley	365.52	403.42	121.58	237.00	146.19	383.19
		DamanGanga						
(v)		DamanGanga			1000.00	1000.00	0.00	1000.00
		Total (i+ii+iii+iv+v)	5755.87	10439.24	8707.32	4770.91	2184.58	6955.49

Inter-sectoral Shares

- Vaitarna Valley includes dams that are major sources for Great Mumbai city and the fastest growing peri urban region
- Greatest differential in agricultural and industrial consumption in the Vaitarna Valley. More discontent in this Valley. Surya project in this Valley
- Allocation from new dams in the Damanganga Valley in Gujarat in this decade and next
- Dams in the Damanganga valley to be linked with dams in the Vaitarna Valley



Source: Water Budgets(2003-2010), Report of the Irrigation Commission (1999)

Background on water in Mumbai: Regional Water Planning

- Since the 1980s, the water budget has estimated that there was sufficient water for urban and rural use. Confirmed in a 2005 report
- Dams for agricultural use
- Dams for urban/industrial use
- Multipurpose Projects: Irrigation and agricultural development, domestic and industrial use
- From the 1970s until the mid-1990s the objective of water policy was to maintain a sectoral balance between agriculture and industry
- Conflation between the *urban as industrial* and the *rural as agricultural* in the rural agricultural surveys and reports

Background on water in Mumbai: Types of water conflict

- Intra-Rural water conflict --conflict between and within villages over water for agriculture in the region and the water districts
- Urban-Rural water conflict --direct conflict between cities and agriculture in the metro region
- Regional water conflict -- conflict between cities in the region and an absence of consensus over how water should be shared between various sub regions

II. Questions for research

Questions

- What are the rules, institutions and governance structures that underpin water transfers from rural to urban areas and broader water management in the Mumbai region?
- What are the causes of underutilization of water in agriculture outside Mumbai?
- Does common pool resource theory give us sufficient insights into understanding local water management in the water districts ?

III. Theoretical Framework

Elinor Ostrom's design rules for self governance for Common Pool Resources

- Clear group boundaries
- Matching rules governing resource use to local conditions
- Those affected by the rules can participate in modifying the rules
- Rule making rights of community members are respected by outside authorities
- System to monitor members behavior
- Sanctions for rule violators
- Accessible, low cost means for dispute resolution
- Responsibility for governing the common resource in nested tiers from the lowest level up to interconnected system

Common Pool Resource Theory and Property Rights

- Ostrom emphasized:
- User rights of access, withdrawal, management, exclusion and alienation all important and were cumulative when it came to property rights in common pool resources
- Analyzing bundles of rights within a hierarchy of possible rights
- Why Ostrom?
- Institutions of self governance emerge around the commons when there are enabling conditions
- Co-operation can occur only if there is an environment of mutual trust, co-operation and transparency
- Centrality of rules

IV. Case Study One: The Surya Project

Rural water management: Rules around water rotations and water conflict between farmers and peri-urban Mumbai

The Surya project and field research questions that informed the broader objectives

- To understand the role of formal and informal institutions that underpin the management of water in multipurpose dam projects
- To understand the changing historical patterns of water use in the projects both as a result of urbanization, but also changes in crop patterns
- Why is there underutilization of water channeled to agriculture?

Methods and location: Dams chosen for study in Thane district

- Multipurpose dam projects: 2009 agricultural season
- Main case study Surya dam project (in depth sample surveys, interviews and ethnography) located in the Vaitarna Valley
- Field work in the peri-urban area of Vasai Virar that benefits from the Surya project (seventeen months of field work)

Canals convey water through gravity for hundreds of kilometers,
and in some cases thousands of miles in southern and northern
India





Sample survey data from 1986 in the Surya dam area

Facts:

- A preponderance of agricultural labourers and self owning cultivators. Tenants and middle farmers mostly tribal, but a third are non tribal, according to the ethnographic part of the survey data
- 30% are engaged in occupations other than agriculture and industry
- Rural economists from local university administered the survey

Assumptions:

- Farmers would not work in industry or move away from agriculture
- Sufficient diversification: In the 1970s data from the Annual Survey of Industries showed that there was an increase of 30% in the industrial work force in Thane district as result of planned industrial sprawl from Mumbai

Workers in Palghar and Dahanu according to 1981 Census

Sr No.	Classification	Palghar		Dahanu	
		Total Numbers	Percentages	Total Numbers	Percentages
1	Cultivators	436.00	39.67	499.00	52.58
2	Agri. Labourers	268.00	24.38	153.00	16.13
3	Engaged in manufacturing, processing, service, repairs and household industry	32.00	2.91	17.00	1.79
4	Others (Engaged in Livestock, forestry, fishing, hunting, plantations, orchards, and allied activities, mining and quarrying, construction, trade and commerce, transport, storage and communication)	364.00	33.12	280.00	29.50
5	Total Workers	1099.00	100.00	949.00	100.00

Survey data from 2009. Field findings from Surya villages

- Horticultural belt
- 104 villages; ten surveyed; two in depth
- A third of the beneficiaries in the villages surveyed in depth were accessing water from the canal systems
- Small and marginal farmers on the middle reaches of the canal system did not get access
- Low demand in the rest of the command area of the project
- Diversified livelihoods
- Intended beneficiaries were tribal farmers who are faced with prospect of seasonal migration. But the project did not benefit them. Even the canals did not reach that part of the village
- Monitoring rotations in two specific villages

Politics of the commons: Canal Minor choked up

- This picture was taken inside a large horticultural farm that benefits from canal water. The outlet on the canal minor has been choked by a gunny bag to restrict flow to the small adjacent tribal farms that lie ahead
- Negative externalities: These practices directly affects utilization by other farmers who also access the same system
- Corrupt bureaucracy







Case Study One: Main Canal level

Field findings from sustained seven month observation of the Surya Canal system







Main Canal branching off into Left and Right Bank Canal



Rules Broken: Canal Gates Leading to Rivulets Kept Open

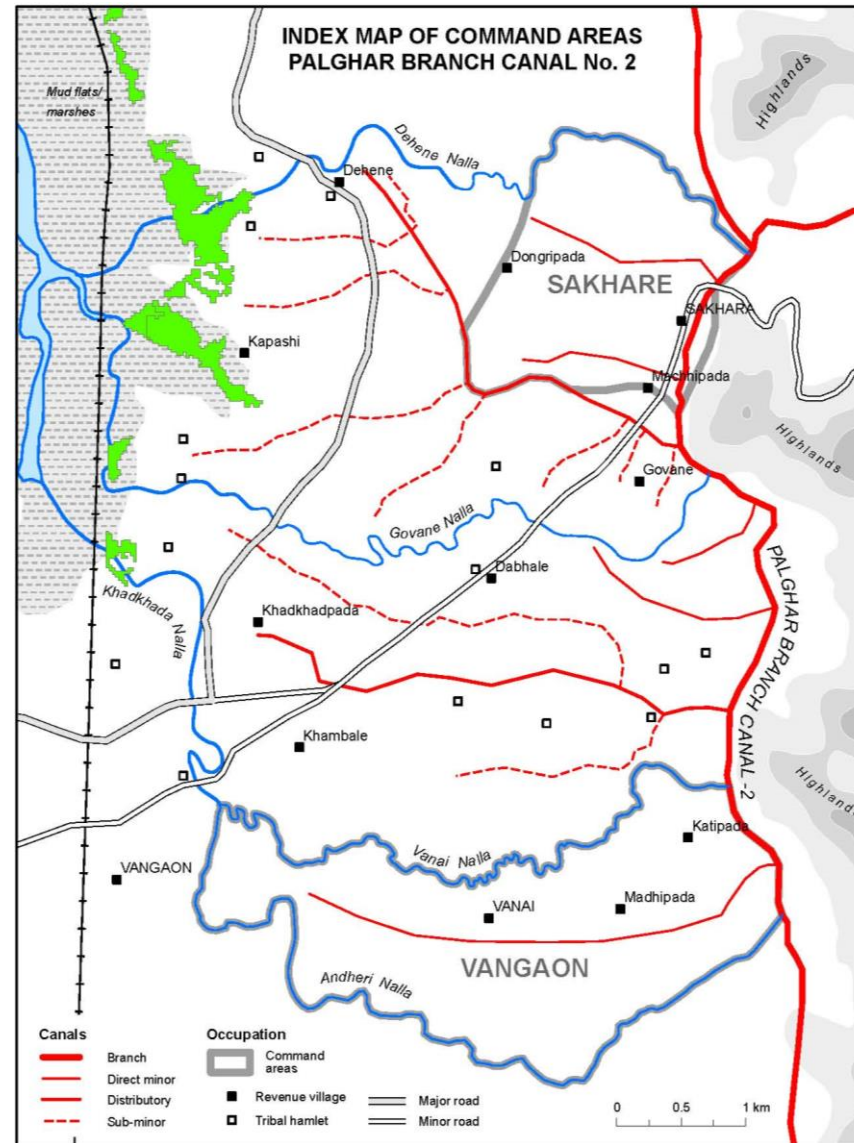


Rivers and Streams full of Canal Water

- Engineers called this “run off”
- Movie: China Town (1974)
- Khadkhada River that forms part of the natural drainage full of canal water release in the middle of summer (May 2009)
- This is a non-perennial stream that forms part of the natural drainage of the Surya project's command area. This river meets the Arabian Sea, less than half a km away from this spot. See Map 1.4 for the natural drainage system in the area
- Green shaded area-satellite data
- Water deliberately thrown into the ocean-Engineers deny this



Water Run Off Surplus from Canals



Canals in Dilapidated State



Case Study One: Excerpt from a state engineer's article

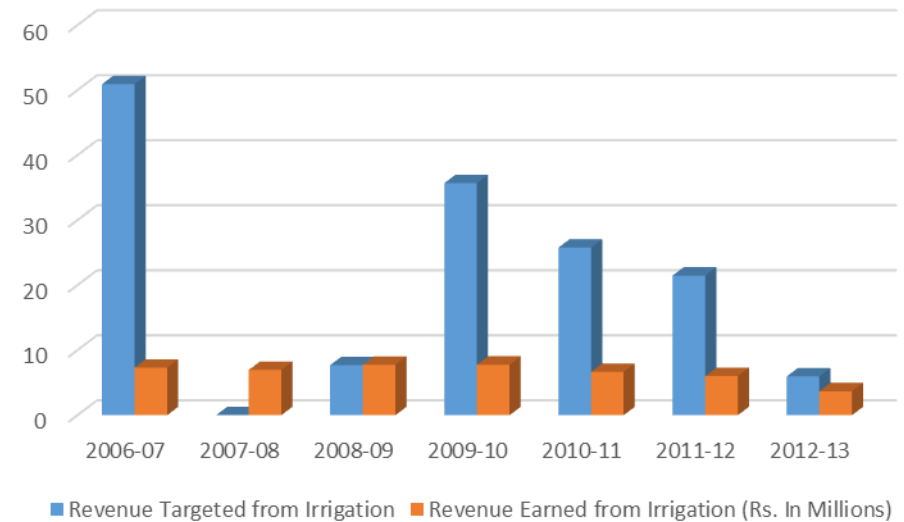
“As compared to day to day irrigation management, management of non-irrigation is easy. Moreover, assessment & recovery of water tariff is also comparatively better in case of non-irrigation. Hence, some canal officers reportedly prefer an increase in water use for non-irrigation. They even at times, it seems, discourage water use for irrigation. That perhaps leads to ‘unutilized water’. Showing unutilized water creates grounds and justification for more diversion of water from irrigation to non-irrigation.”

Pradeep Purandare 2012

Summary on Irrigation Revenue

- Revenue from agriculture(2006-13) has never been able to meet its target. Revised targets have not been achieved in 2012-13
- Source accessed June 30th, 2013: <http://www.seticthane.org/water-cess-recovery>

Irrigation Revenue from all dams in the Mumbai area: Targeted and Earned

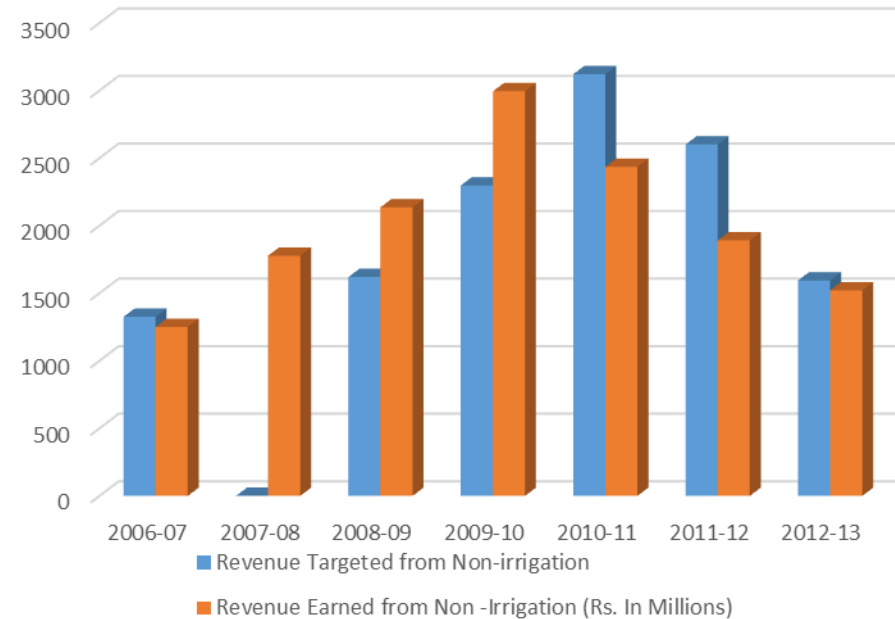


Source: Thane irrigation circle website

Summary on non Irrigation Revenue

- Better revenue collection from non-irrigation/agricultural sources. Includes revenue from domestic and industrial use
- More than 80% of the targeted revenue earned by the Thane irrigation circle
- Thane Irrigation Circle includes all the reservoirs/dams in the Mumbai hydrometric area including the ones that were researched

Non- Irrigation Revenue from all dams in the Mumbai area: Targeted and Earned



Source: Thane Irrigation Circle website

Case Study One: Institutions and Property rights

- Institutional vacuum: rights in land and water for rural populations not clearly defined
- Underutilization led to water diversions
- Sectoral view of regional economy since the 1970s has exacerbated conflict
- In areas where there is water demand, deliberately under maintained canal systems leads to underutilization which in turn leads to rationale for water diversion to Mumbai
- Massive corruption around maintenance contracts, political-bureaucratic nexus
- Poor recovery rates from agricultural use that makes the problem of maintenance worse
- Water rotations and the rules around canal management lack flexibility. Massive wastage due to paddy cultivation
- Topography a problem for canal irrigation in the Surya

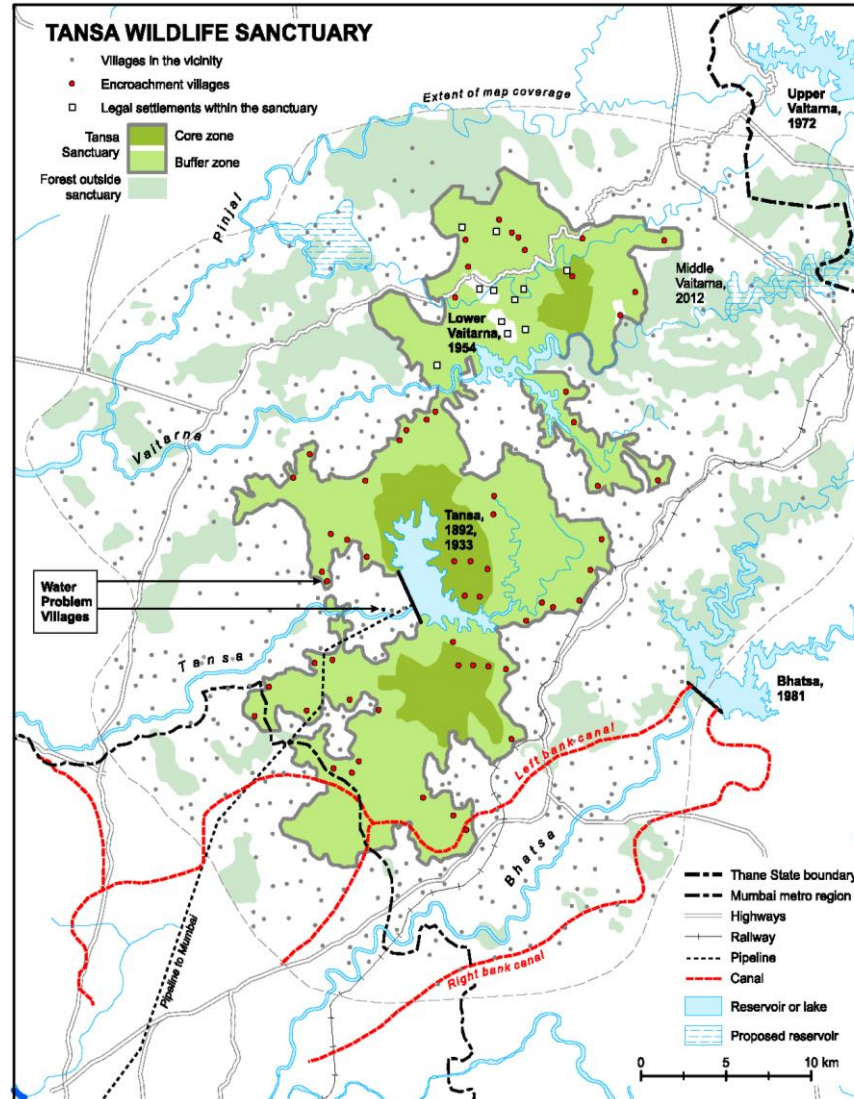
V. Case Study Two: Tansa-Vaitarna Water District

The struggle of rural communities for basic water access

Water Management in the Tansa-Vaitarna (T-V) Water District

- Watershed reserved in the 1950's for meeting future water demand from Mumbai
- Five reservoirs
- Collective action over local water problems
- Decentralization of water provision for domestic use in villages in the water district
- Failure of collective action

T-V Water District



Case Study Two: Reasons for failure of decentralization

- Fragmentation: Hydrometric boundaries do not coincide with metropolitan boundaries. Urban entities that own dams will not take responsibility for rural water demand
- Frequent clashes between organizations over land. Conservation boundaries do not coincide with watershed boundaries
- Low revenues of local governments
- State Government rules disputes in favour of Greater Mumbai
- NGOs and social movements ignored. Neglect of stakeholders

Protests in the T-V Water district

CEO dP *habitat*

April - 06

HH44

DNA, BOMBAY, 20 APR 2006

They could dry up your tap

Tansa farmers threaten to cut water supply if the BMC doesn't give them promised jobs, water

Soubhik Mitra. *shahpur*

Valves supplying drinking water to Mumbai for the past century might just be closed now. Nearly 5,000 farmers scattered across 82 villages around the Tansa water reserve near Shahpur are camping on the streets for justice. Natives threaten that if the government fails to respond to their demands, they will simply shut the valves used to manoeuvre water supply.

United under the banner of Kunbi Sena, the local political outfit, natives are protesting that promises made by the BMC be fulfilled before water pipes are laid on their fields.

On Monday, natives camped outside the main gate of the Tansa water reserve to protest against the injustice. "Rich people living in Mumbai have bought water from our neighbourhood. Today we buy water from tankers," says Sandip Gawde, a native from Atgoan. After coming to know of the protest, the civic body locked the gates.

When DP Kajbaje, hydraulic engineer, BMC was told about the matter, he said, "We are discussing it with the municipal commissioner. I cannot comment unless we find a solution".

elsewhere

What irks villagers most is that the civic body had promised jobs to one person from each house. "The first pipeline was laid in 1922. Thereafter, they acquired our lands thrice. Several years have passed and neither have we got jobs nor do we have water," says Vishwanath Patil, Kunbi Sena chief. This was the fifth protest by the people. On earlier occasions, the BMC had promised them a quick

Why they are angry

Promises
The BMC promised the farmers jobs and water in lieu of their lands.

Connection
The BMC is asking villagers for Rs 1 Lakh for a water connection

Agitation
This is the fifth protest by villagers



follow-up every time a protest happened. It also promised them free water.

"Today when we ask them for a water connection, we are asked to deposit Rs 1 lakh. If we had that much money, what is the need to protest?" said another villager. This time, locals have

threatened they will block the road unless government takes cognisance of the matter. Vimla Patil, who participated in the protest said, "We walk four to five kms every day to collect water but people sitting miles away get it at home just because they are rich. Is this fair?"

Case Study Two: Whither rules in the T-V Water district?

- Local water rights very important
- Prior appropriation: first come, first served. This favours Greater Mumbai over other towns and villages in the metropolitan region
- Ownership of reservoirs influences rules and rights of use
- Maharashtra Water Resource Regulatory Authority (MWRRA) as an independent regulator constrained by State policy
- State Policy: Priority of use (urban, industrial and agricultural) has changed twice over the past decade and a half at the state level

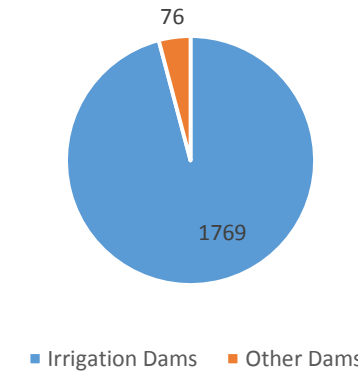
Maharashtra Dams: Location, design and priority of use

The Government of Maharashtra has been building more Irrigation Dams as compared to other dams. The data shows that out of the total dams built approximately 96% are built for irrigation and only approximately 4% are built for other purposes

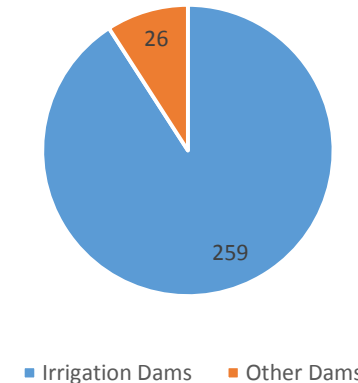
Original design impacts rules

Marginal Increase: The data on the dams built since 2000 in Maharashtra shows that the Government is still authorising more dams for irrigation as approximately 91% of the dams built are for irrigation and only 9% of dams are for other purposes.

Breakdown by Dam Design in Maharashtra
(1900- 2000)



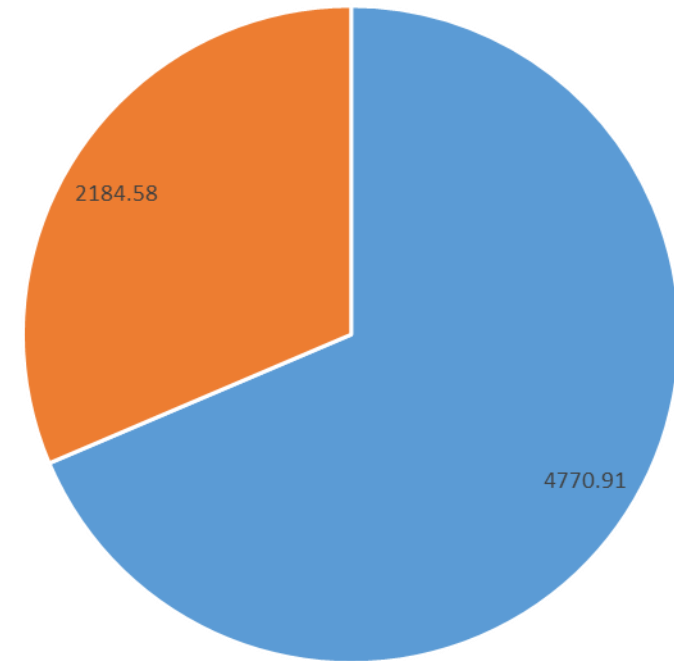
Breakdown of Large Dams built since 2000 in
Maharashtra



Source: National Register of Large Dams (2011)

Projected consumption in 2030

- Increase in projected consumption for domestic and industrial purposes
- Source: Water Budget for Maharashtra State (various years), Regional Plan 1996-2011
- Potential conflict looms if governance changes are not made



■ Water use for Domestic and Industrial Purposes MCM ■ Water use for Irrigation Purposes in MCM

VI. Regional water governance in the context of the case studies

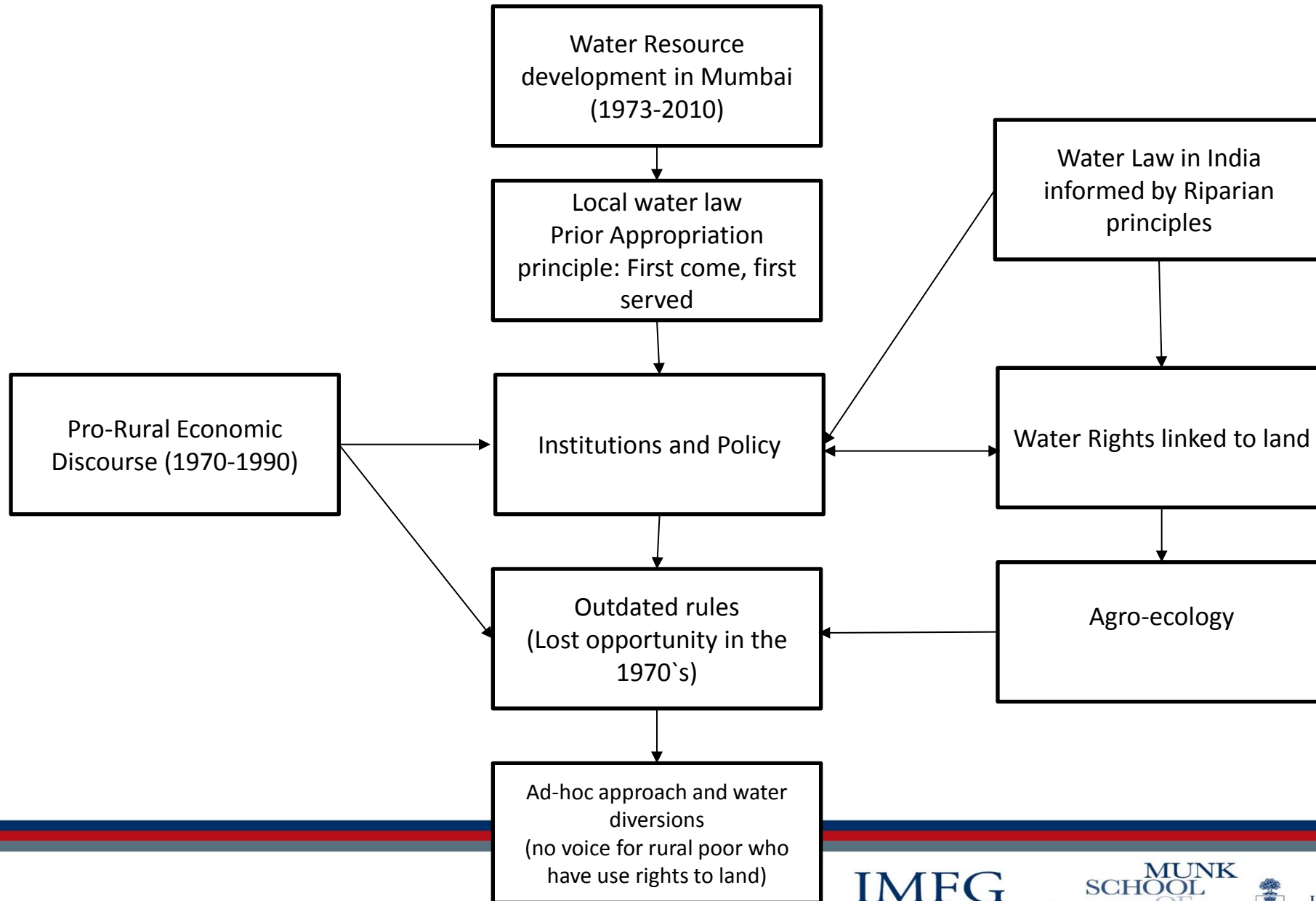
What have we learned?

Evaluation of regional governance: Bylaw of the BrihanMumbai Municipal Act

“The Municipal Commissioner of Mumbai may supply water from a municipal water-work to any local Authority or person without [Greater Mumbai] on such terms as to payment and as to the period and conditions of supply as shall be, either generally or specially approved by the corporation.”

(BMC Act 1988)

Evolution of Water Institutions in Mumbai since the 1970's



Regional water governance and the two case studies: Ostrom's design principles?

- Institutional fragmentation a huge problem in the T-V water district when it comes to meeting domestic rural water needs
 - Multiple ownership of dams in the hands of five para-statals in the T-V water district a problem
 - No communication between urban and rural stakeholders; absence of coordination
- Same problem in other Indian mega city-regions like Chennai, Hyderabad, Kolkata, Bangalore. Self-governance institutions not possible
 - The National Capital Region is an exception. The Delhi Jal Board is the regulator of all urban water supply. This agency also coordinates with rural units

Regional water governance and the two case studies: Ostrom's design principles?

- In other cities too, the main regulator of water, the state government, is unwilling to give up control over metropolitan regions - centralization of decision making with the state ministry, so decentralization a huge failure in water provision
- Boundaries of water planning for the Mumbai region do not coincide with metropolitan boundaries - lack of transparency on actual water storage in the region
- Absence of a monitoring system and impartial regulator for the region
- In some projects like the Surya, overestimation of demand from agriculture. The rural vote is important, but actual water policies and practices are anti-rural in orientation. Mismanagement of water rampant
- Policy hasn't kept pace with economic change

VII. Conclusion

- Importance of a regional water council; adjudicates water disputes, allocates quotas that meet local requirements and conditions, decides rules of allocation
- Urban and rural stakeholders participate in such a regional water council – could include other departments such as forest conservation etc.
- Balances the rights of Greater Mumbai which has senior water rights with those of other cities and rural communities
- Empirical evidence from Southern India that cites recent court judgements indicates that the state has an absolute right to regulate prior appropriation and use by legislation, and to change the entitlements and rules of allocation at its discretion
- Reform in local and regional water governance is possible only if it is realized that the power of the city over the water resources in the T-V water district and the rest of hydrometric area is written in rules that were crafted for another time