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Claims of the City? Rights of the Countryside? Politics of Water Contestation in the Mumbai-Thane Region of India

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Graduate Program in Geography
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy
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Claims of the City? Rights of the Countryside?
Politics of Water Contestation in the Mumbai-Thane Region of India

Integrated-Article Thesis

By

Bharat Punjabi

Graduate Program in Geography

A thesis submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

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Abstract

This dissertation comprises three papers that focus on the interplay of formal and informal institutional processes in the sharing of water between the Mumbai Metropolitan region and an agricultural area to its north and east in Thane district. The first paper focuses on the interests and motivations that influence the everyday practices of the canal bureaucracy in the Surya project in Dahanu. This paper is largely a critique of the application of rational choice theory to analyzing bureaucratic corruption in a literature in development studies that was pioneered by Robert Wade. Using an ethnographic narrative style, the paper seeks to provide an account of bureaucratic corruption by focusing on tensions within the local Irrigation Department over bribes and transfers. The poor maintenance of the canal system by engineers in Dahanu and the consequent wastage of water are highlighted as providing a rationale and justification for diversion of water to the Mumbai Metropolitan Region. The second paper traces the historical evolution of institutional practices and local water policy in the Tansa-Vaitarna (T-V) water district, a major source of water for Greater Mumbai and others towns in the Mumbai metropolitan region. It analyzes the failure of collective action in the water district over local water needs and identifies prior appropriation and the fragmentation of metropolitan water governance as the two major factors that are constraints in meeting the water needs of the rural population in the T-V water district. The third paper focuses on the experiences of farmers with water scarcity and dispossession from land on a canal system in two villages in Dahanu. The paper uses survey and interview data from interviews with farmers to understand how water

scarcity is manufactured on the canal minor system and discourses of efficiency, abundance and waste are deployed by wealthy commercial farmers and local elites to deprive small and marginal tribal farmers from water.

Key Words

Water Politics; Urban Geography; Mumbai; Canal Irrigation; Political Ecology; Institutions; Peri-Urban; Adivasi; Thane District; Dahanu; Vasai-Virar; Konkan; Maharashtra; India.

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List of Abbreviations, Symbols, Nomenclature

Nomenclature

Adivasi:	Subjugated Communities Designated as a Scheduled Tribe in India
Bahujan:	Lower caste groups. Term used to connote the unity of the lower castes and scheduled tribes
Brahmins:	Dominant Caste Group
Eksali laws:	One year land lease in forest areas in Thane district and the Konkan region
Ghat:	Typically refers to area east of the Western Ghats, but in the context of this dissertation, it refers to the irrigated area in Western Maharashtra, south-east of Mumbai.
Junglepatti:	Forest belt in Palghar and Dahanu, Thane district.
Kashtakari Sanghatana:	Social Movement in Thane district fighting for rights of access of tribal communities to resources
Kinparpatti:	Coastal belt in Dahanu and Palghar, Thane district.
Konkan:	Coastal belt in Maharashtra state.
Kunbi Sena:	Caste based political party in Thane district dominated by
Kunbi	Maratha caste group
Macchi:	Local caste group in Sakhare village engaged typically in fishing with origins in coastal Dahanu
Maratha:	Dominant Caste group from Western Maharashtra
Maratha-Kunbi:	Intermediate caste group in the Konkan and Maharashtra

Marathi:	Language native to the state of Maharashtra
Navshakti:	Marathi newspaper printed in Mumbai
Parsi:	Ethno-Religious group with origins in Gujarat and presently centred around Mumbai and Dahanu
Sahyadri:	Mountain Range in the Western Ghats in the state of Maharashtra
Taluka:	Administrative sub-division below District Level
Vadaval:	Caste group based in Thane District. Considered a community that specializes in horticulture.
Varkas:	Customary land tenure in Thane district and Konkan region
Wadi:	Horticultural Farm
Warli:	Tribal group based in Thane district
Zilla Parishad:	District Council.

Abbreviations

BMC Act:	Brihan Mumbai Municipal Corporation Act (1888)
CA:	Command Area
CCA:	Culturable Command Area
CPI (M):	Communist Party of India-Marxist
CPR:	Common Pool Resource
MCM:	Million Cubic Metres

MLD:	Million Litres per Day
MMR:	Mumbai Metropolitan Region
MWRRA:	Maharashtra Water Resources Regulatory Authority Act (2005)
MSRWSSC:	Maharashtra State Rural Water Supply and Sanitation Corporation
MIDC:	Maharashtra Industrial Development Corporation
MJP:	Maharashtra Jeevan Pradhikaran
NDTV:	New Delhi Television.
SANDRP:	South Asia Network on Dams, Rivers, and People
SES:	Social-Ecological Systems Framework
SMIP:	Surya Multipurpose Irrigation Project
TMC:	Thane Municipal Corporation
T-V:	Tansa-Vaitarna Water District
UNDP:	United Nations Development Programme
VVSR:	Vasai Virar sub-region
WB:	World Bank

1. Introduction

There is more than enough water in the world for domestic resources, for agriculture and for industry. The problem is that some people – and notably the poor - are systematically excluded from access by their poverty, by their limited legal rights or by public policies that limit access to the infrastructures that provide water for life and for livelihoods.

(UNDP, 2006, p. 2)

1.1 Introduction and Research Aims

The increasing contestation of water resources in various parts of India is at the very centre of social struggle and academic debate about the environment there (Shiva, 2002; Anand, 2004; Joy et al., 2008). On one hand there are claims of the World Bank (WB) and development economists who perceive those conflicts as an indicator of growing water ‘scarcity’ and of weak water governance in India (Briscoe & Malik, 2005; World Bank, 2006; Ballabh et al., 2009). On the other hand, critical scholars, social movement leaders and organizations such as United Nations Development Program (UNDP) emphasize unequal access to water as a more significant issue. According to the latter perspective, the main problem with the water sector in India is that current institutions governing water use and resource planning have historically excluded the poor and are in urgent need of reform (Shiva, 2002; Mehta, 2003 & 2005; Joy et al., 2008). As such, assuming that water is (always) a scarce resource distorts and limits how we perceive the issue, since “physical availability is only one dimension of water insecurity as issues around access to water also hinge around local context and institutions” (UNDP, 2006, p. 133). For example, this dissertation focuses on case

studies where scarcity is actually a *policy induced* consequence of water resources *mismanagement*. The academic debate on unequal access and water 'scarcity' also arises in a context of rapidly-expanding urban centres and increasing *inter-sectoral* conflicts over water, wherein institutional arrangements governing water-sharing between urban, suburban and rural areas have consistently marginalized small-scale, poor farmers in the urban hinterlands of Asia (Janakrajan, 2004; Ruet et al., 2007). In India this continuing exclusion of the poor derives from laws and public institutions governing water access (Singh, 1992).

India's policies towards water resources have two main dimensions: geographical and political-economic. The first involves a historical tendency of the federal state to prioritize large, multipurpose dam projects in order to address problems of growing urban and agricultural demands for water. Many argue that this preference for 'megaprojects' persists largely at the expense of poor farming communities in the rural hinterlands (Baviskar, 1995; Gadgil & Ramachandra, 1995; World Commission for Dams, 2000; Phadke, 2003; Mollinga, 2010). Since the 1990s, academic and activist critiques of such large dam projects have increasingly argued that they cater to the demands of prosperous, industrial-scale farmers and cities downstream, resulting in displacement and disenfranchisement of the poor (Dreze et al., 1997). The second, political-economic aspect of India's experience with large dam projects involves the growth of centralized, bureaucratic, metropolitan water supply systems (that have been underwritten by the World Bank). Such systems have also been criticized for catering to the needs of rich and middle-class urban and suburban inhabitants, while

simultaneously minimizing the needs of the rural and urban poor (Gandy, 2008; Anand, 2011).

These geographical and political-economic dimensions are central to current critiques of Indian water policies and provide a backdrop to my own investigation. What remains little-understood is *how and why* the Indian State — in developing, controlling and centralizing water allocation between urban, suburban and rural areas — has helped concentrate political-economic power in ways that continue exacerbating differential access and status among various consumers of this resource (Wittfogel, 1957; Vaidyanathan, 1999 & 2004; Gidwani, 2002; Wagle et al., 2012). That is, India's centralized, hierarchical water management system — *in both its publicly and privately owned aspects* — has enabled a few to (unofficially) monopolize control over water-access, and profit from it as they increase their control over that resource. That multi-pronged critique informs a large body of political ecology literature in human geography and water policy (Bond, 2002; Mollinga, 2003; Swyngedouw, 2004; Linton, 2010; Budds & Linton, 2014), as well as key arguments in this doctoral dissertation. The persistence of the centralization of water policy decision-making by the State in the Indian context is a problem this dissertation attempts to analyze with a case study of water politics in the Mumbai-Thane region. The absence of any form of participatory institutions is particularly a serious problem in the context of water transfers from rural to urban areas. The principal focus of my dissertation is how the increasing conflict over access to water (among castes/classes of farmers in Mumbai's geographical hinterland) is a *consequence of growing urban demands* upon that water, *exacerbated* by the

systematic mischaracterization of a supposed water scarcity. This problem is examined in the context of the state's claims of the *underutilization of water* by agriculturists and the claims of the latter that water institutions in the hinterland actually aid the state in claiming underutilization of water and help it divert water quotas to urban areas. Underutilization of irrigation water is a common problem identified in surface irrigation projects in Maharashtra. However, the factors behind underutilization have not been examined through a field study. Underutilization is the central research problem examined in this dissertation's two papers (Paper One and Paper Two) and it is of empirical interest because it places the state's claims on water distribution between urban and rural areas under critical scrutiny. Furthermore, it also helps us understand the role of formal and informal water institutions in managing the distribution of water between a fast growing metropolitan region and its rural hinterland. This helps the dissertation make a contribution to the theoretical literature on water institutions and the political ecology of water.

My central aim is to identify and examine the causes and impacts of apparent water scarcity among poorer, small-scale farmers in the Command Area (CA) of the *Surya Multipurpose Irrigation Project (SMIP)* which is located in the Dahanu block of Thane District in Maharashtra State, India. The Surya Project comprises two large reservoirs that provide water to Greater Mumbai and smaller cities in the Mumbai Metropolitan Region (MMR).

A secondary aim is to understand how and why local administrative units and jurisdictions within Thane District continue to coordinate water distribution poorly in

relation to the goals of dam projects there. In this context, my dissertation presents a case study conducted in the Tansa-Vaitarna (T-V) lakes area of Shahpur, an administrative subdivision (*taluka*) of Thane District that lies outside of Mumbai and includes five separate dams (see Figure 1.1, below).

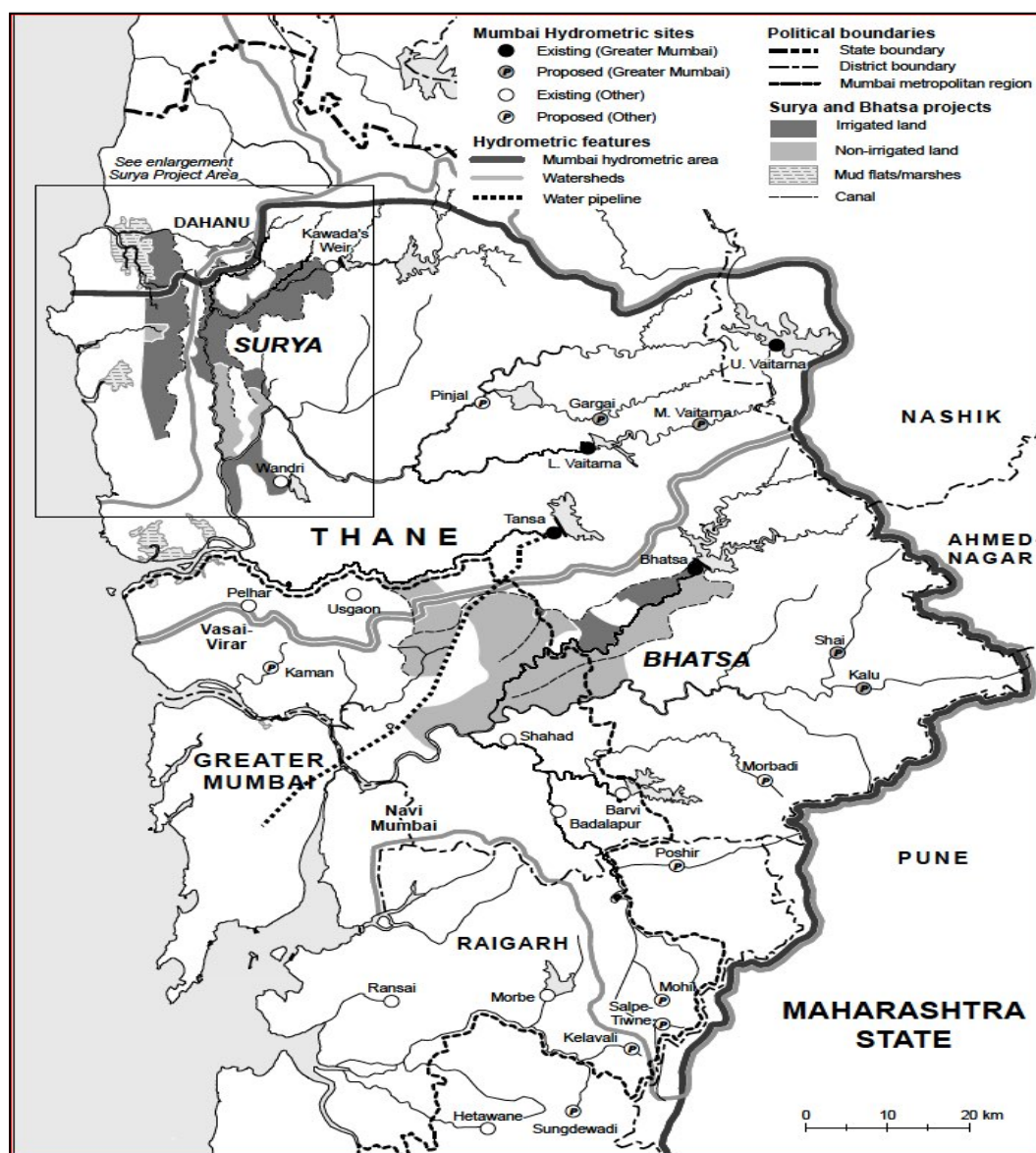


FIGURE 1.1: Map of Mumbai Hydrometric Area which extends into Thane District. Note the Greater Mumbai area (lower left) and the Surya area (upper left). Shaded portions indicate areas served by Surya, and Bhatsa Multipurpose Dam Projects (respectively).

1.2 Political Ecology of Water and Urbanization: The Broader Theoretical Context of Research

Within the literature on urban-rural relationships in the developing world, there are three distinct strands of research that inform theoretical aspects of my dissertation. They concern: (1) institutions; (2) development geography; and (3) political ecology.

The first strand of research deals with institutional and common-pool resources (Ostrom, 1990), and generally adopts a wide definition of resource governance. It focuses mainly on rules and norms that shape dynamics of public policy making and civil society, within a broader context of complex, sociopolitical relations. Rights over access and use of water and land, in a quickly urbanizing region, influence institutional relationships among a vast range of administrative, agricultural, civil society and government actors who variously co-operate or contest one another's claims to water. Moreover, allocation of water between large urban jurisdictions, smaller towns and rural water districts is also governed by property rights and historical uses of water in each region. Thus, local laws and state policy (and their interaction) play important roles in determining how water is shared, and requires analyzing existing water governance structures and practices in the region. The wide body of work on urban water in India has not adequately utilized theoretical and empirical work of the common-pool resource tradition to sufficiently analyze and understand the politics of urban and regional water governance. Therefore, in addition to social relations, this dissertation emphasizes how rules, laws, practices and governance frameworks inhibit or enable water sharing between jurisdictions.

The second research strand is the field of urban political ecology and is concerned with urban-rural relationships. In particular, with how the environmental transformation of cities and their respective hinterlands (including suburbanization of peripheries) is closely entwined with the broader geographical scale and processes of capitalist development (Cronon, 1992; Swyngedouw, 2004; Keil et al., 2013). For example, growth and expansion of metro Mumbai and its peripheries largely depends upon the commodification of natural resources. That produces new interactions that reshape (materially and symbolically) how natural and social resources are valued and constrained - for instance, water and access to water. This perspective highlights that, while water is a necessity and a crucial common resource, it has also become a key focus for political manipulation involving various classes and caste-groups, including emerging urban interest groups in and around MMR.

The third, more recent strand of political ecology research on India considers agrarian change, emphasizing political economy and cultural factors - specifically, how upwardly mobile caste-groups function as vanguards of capital accumulation. This strand emphasizes how specific cultural, economic and geographic trajectories drive accumulation processes (Gidwani, 2000, 2001 & 2008; Chari, 2004). In other words, development (in various local contexts) contributes to particular social dynamics that guide specific trajectories of political, economic and ecological change (Gidwani, 2000; Dubash, 2002). South Asian human geographers have made especially significant contributions to this literature, and have expanded our understanding of the role that caste- and class-relations play in shaping the political economy of rural and urban India.

The dynamics of urbanization at the fringes of Mumbai have broader implications too, since we can also observe similar, urban-periphery dynamics in the shadow of other large, Indian metropolises such as Calcutta (Roy, 1997 & 2003), Bangalore (Ranganathan 2014; Mehta et al 2014), Delhi and even Chennai. Certainly, macroeconomic processes of economic liberalization and globalization play important roles in transforming cities and regions. But it is only by examining important local relationship differences (in politics, institutional arrangements and capital-state relations) that we can see how the progressive absorption of agricultural land into metropolitan rhythms and structures can produce quite divergent trajectories of urban and regional change - including how water resources are governed and used within the 'orbit' of large, urban centres. The urbanization of formerly rural parts of Thane District (and the increased pressure on natural resources there) thus overlaps with processes of metropolitan expansion — including increasing claims by the city on neighbouring water sources — and with the larger transformation of the hinterland environment.

These three important strands of scholarship all consider how notions of 'nature' are produced, and how regional changes in natural environments are shaped by social relations, water governance practices and institutions. In the MMR, processes of urban growth are closely linked to successive waves of ecological conquest and the extension of the 'water frontier' into its rural hinterlands (Gandy, 2008). As such, the institutional underpinnings of extending that frontier undergo close analysis in my research. In order to understand the dynamics of underutilizing water on the canal system specifically, this dissertation combines the political ecology of water with an institutional analysis of

water governance, and situates critical literature from the political ecology of irrigation (in South Asia) within institutional frameworks (Mollinga 2013).

1.3 Regional Resources and Livelihoods

1.3.1 Historical and Geographical Context of Inter-Sectoral Water Politics in Thane District

The empirical focus of my research is an ethnographic study I conducted with key actors in the Command Area of Surya Multipurpose Irrigation Project (SMIP) in Thane District, Maharashtra.

Surya Project was the first significant effort on the part of the Indian and Maharashtra State Governments, respectively, to harness water for local irrigation purposes - in particular, the west coast rivers of Konkan Region. The SMIP Command Area lies directly outside the peri-urban fringes of Mumbai Metropolitan Region and contains agricultural land increasingly being targeted for urban uses, including expressway projects meant to connect metro Mumbai with other cities in northern and western India. Surya Project taps the waters of the Surya River - which is a perennial tributary of a larger river, the Vaitarna, that flows through Thane District. Another major dam project in Thane is the Bhatsa Multipurpose Irrigation Project, also built on the Vaitarna River. The Bhatsa Project taps the Vaitarna upstream in eastern parts of the District, also for the benefit of metropolitan Mumbai, as well as for the benefit of a wide agricultural belt in Bhiwandi and Shahpur blocks of eastern Thane District.

Both the Vaitarna and Surya Rivers have their sources in the Sahyadri Mountains, both rivers flow down from eastern parts of Thane to the Arabian Sea. SMIP

was the second built of these two major multipurpose irrigation projects in the District. The Bhatsa Project was completed in the late 1970s and, like Surya, was intended to benefit a large number of farmers in the Shahpur area. However, the Bhatsa Project (like Surya) has since come to cater mainly to the needs of suburban Mumbai. Since developing Bhatsa as a water source, the population of MMR has risen by 40%, along with similar increases in demand for water to support such growth.

There are five major watersheds in Thane District that lie outside the political boundaries of MMR, yet within its hydrometric area (see Figure 1.1): the Vaitarna, Ulhas, Patalganga, Amba and Damanganga watersheds. Greater Mumbai depends upon water from Ulhas watershed (where Bhatsa Dam is located), as well as from Vaitarna watershed (where both Tansa-Vaitarna Dam and Surya Dam are located). Controversies now surround water from Bhatsa, Tansa-Vaitarna and Surya Dams, respectively, as conflicts increase between urban versus rural water needs - as well between domestic and irrigation water needs within rural areas of the watersheds. The Surya Multipurpose Irrigation Project in Vaitarna watershed is the focus of this study since conflict has been sharpest there between urban/industrial versus rural/irrigation water needs, and since its valley communities have been the focus of the most intense controversies (see Figures 1.2 and 1.3 for data on urban versus agricultural water allocations in this area). The Damanganga watershed (shared by Maharashtra State, the Daman Union Territory and Gujarat State) is another that will likely see displacement of rural communities and thus also become a focus of similar controversy (see Figure 1.2). New dam projects to connect with existing Vaitarna watershed reservoirs are scheduled for construction there

during the next decade, in order to further expand the amount of water available to Greater Mumbai.

The geographical area of these dam projects also bears highlighting. Most of the large and medium reservoirs in Thane are located in the predominantly tribal¹, hilly and forested parts of the District. Surya Multipurpose Irrigation Project is located in the sub-administrative block of Jawhar, and its canal system benefits both tribal and non-tribal parts of Dahanu and Palghar blocks. Other dams on the Vaitarna and Bhatsa rivers are located in Shahpur block, about 80 km east of Surya Dam. This dissertation has thus focused on watersheds in the tribal parts of Thane District, north of Greater Mumbai and the MMR (see Figure 1.1); similar conflicts in the southern watersheds, south of the city of Navi Mumbai in the Amba and Patalganga valleys, have yet to be researched.

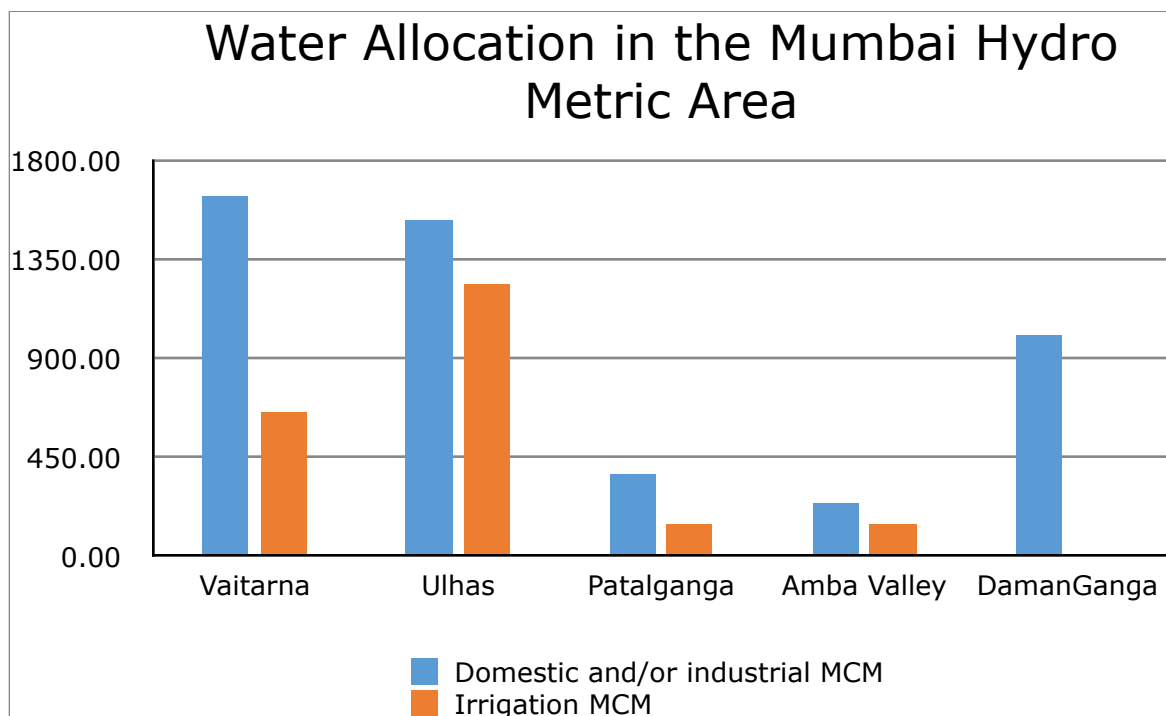


FIGURE 1.2: Industrial/Urban and Irrigation use in major watersheds of Mumbai Hydrometric Area (in million cubic metres). Source: Irrigation Commission Report (1999); Government of Maharashtra, Irrigation Status Reports. Water Budgets (2003-2010).

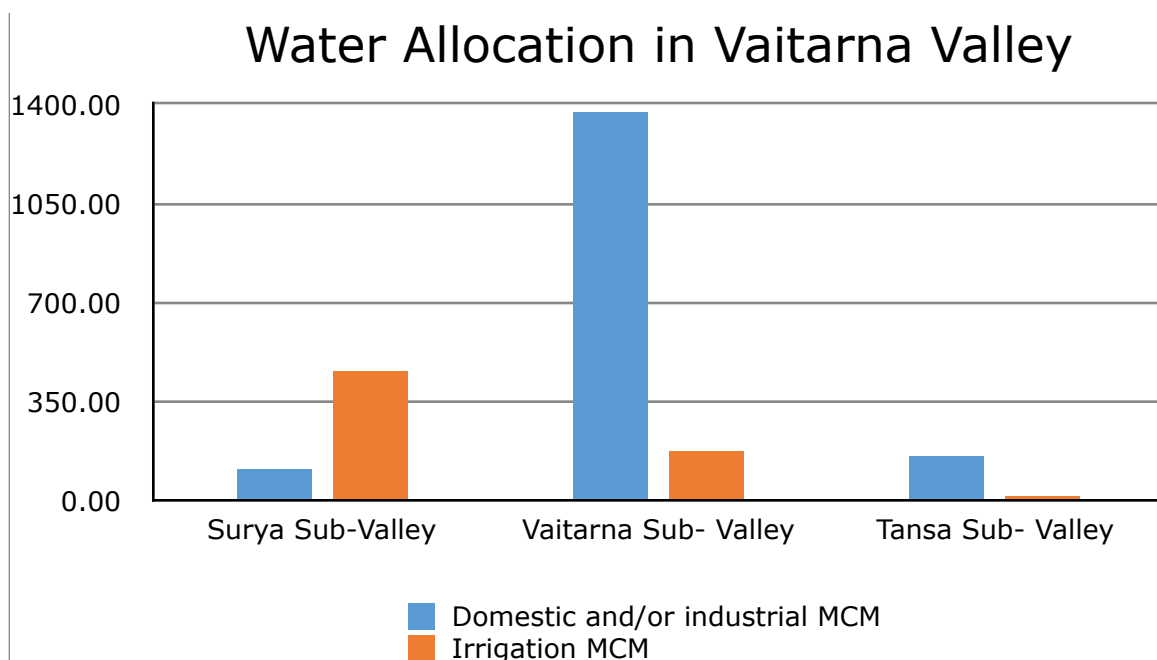


FIGURE 1.3: Industrial/Urban and Irrigation use in the Vaitarna Valley (in million cubic metres). Source: Government of Maharashtra, Water Budgets (2003-2010), Irrigation Commission Report (1999).

Prior to the development of Bhatsa and Surya Multipurpose Irrigation Projects in the Post-Colonial period, other reservoirs dating to the early Colonial period were also constructed in northern Thane District for the exclusive purposes of Mumbai. The execution of such projects was also facilitated by implementing new laws that denied farmers in the neighbourhood of reservoirs access to water, even for domestic use. A consequence of those and other construction projects was widespread displacement of Thane farmers - along with several major legal claims to agricultural land which remain unsettled to this day. Thus, since the early Colonial period, there have been successive waves of activity in which farmers and agricultural communities in Shahpur, Dahanu and Palghar blocks of Thane have been prevented from accessing local water and consequently displaced. As well as preventing local communities from accessing water from Bhatsa and Surya reservoirs, respectively, planning and construction work has

been underway since 2012 for two new dams (the Middle Vaitarna and Pinjal Projects, respectively). Similarly designed for the exclusive benefit of MMR, those projects have also led to increased social and political ferment in Thane.

Given such dynamics, Thane District is historically known for its class-based social movements, and has taken on great *national* significance among progressives mobilizing around agrarian and environmental issues. For instance, since the early 1950s the Communist Party of India (Marxist) helped mobilize local tribal peoples against agricultural working conditions nearing servitude - which led the Maharashtra Government to enact land reforms. From the 1970s to the 1990s, Thane also witnessed a number of significant movements led by marginalized tribal farmers defending their timber and cultivation rights. However, poor implementation of land-ceiling laws and regulations governing access to forests, resulted in only modest changes to relations of production in Thane (Ambasta, 1998). The net outcome of such reform has simply been to create a new class of peasant landowners, largely belonging to the Maratha Kunbi community (Ambasta, 1998; Dewan, 1999). They (and the Vadavals in coastal Dahanu) are a politically influential, socially dominant farming 'caste-cluster' who have led mobilizations occasionally against new dams and industrial projects in Thane District.

1.3.2 Irrigation and the Transformation of Class Relations in Thane District

During the past decade, urban expansion from metro Mumbai has increased pressure on land and water resources across the MMR and exacerbated livelihood difficulties already facing Thane farming communities there. Small-scale farmers in the

district now face problems related to water scarcity such as depleted groundwater aquifers and seasonal shortages of drinking water - as well as the looming prospect of further displacement among communities directly in the shadow of new dam projects. Indeed, growing scarcity of water poses new and immediate challenges for the future development and present welfare of rural Thane farming communities. Moreover, extreme variation in rainfall patterns - including a less predictable monsoon - has in the past decade transformed what, for many, used to be annual single-crop, subsistence farming into periodic episodes of drought (Menon, 2006).

Yet, such dire water 'shortages' for small-scale farmers starkly belies the fact that, in recent decades, considerable funds have been invested to build two multipurpose irrigation projects and a medium scale irrigation project (ostensibly to benefit Thane farmers). Such projects were to irrigate over 50,000 hectares of land belonging to mostly small-scale, marginal farmers (tribal and non-tribal). Yet, according to data from the 2004-2012 Water Audit (Maharashtra Government, 2012) less than 10% of those areas have actually benefitted so far (see Table 1.1). The incomplete works on canals in Surya and Bhatsa Projects has also led to surplus water in those reservoirs, and an issue of '*underutilization.*' For instance, in 2008-2009 an average of only 10% of agricultural land was being irrigated by canals of the two large and medium irrigation projects. Surya Project fared worst, compared to Bhatsa and Wandri Projects (respectively), with *under 10%* of land in its Command Area irrigated. While utilization in small and minor projects is far better than in large and medium projects, some canal water management issues plague large and small projects alike. For example, just over half of the 7,564

hectares of irrigable land in various areas of Thane's small and minor projects is actually being irrigated. Thus, we see the '*problem of underutilization*' in the management of small and minor irrigation projects too (see Table 1.2). The tardy pace at which surface and groundwater irrigation is being implemented in Thane District in the past 50 years is reflected in the data of Table 1.3. It clearly illustrates how the amount of net irrigated versus net sown area has not significantly increased during that period. Indeed, from 2001-2011 the amount of irrigated land in Thane District has *dropped* to just 1.97%.

TABLE 1.1: Water Storage, Utilization and Underutilization in Large & Medium Irrigation Projects in Thane District, 2008-09.

NO.	SUBJECT	LARGE MULTIPURPOSE DAM PROJECT	LARGE MULTIPURPOSE DAM PROJECT	MEDIUM DAM PROJECT
1	PROJECT NAME	BHATSA	SURYA	WANDRI
2	PROJECT LOCATION	SHAHPUR, BHIWANDI (THANE DISTRICT)	DAHANU and PALGHAR (THANE DISTRICT)	PALGHAR (THANE DISTRICT)
3	YEAR of PROJECT COMPLETION	(in progress)	(in progress)	1983
4	HEIGHT of DAM (in metres)	89	58.08 (Dhamni) 28 (Kavdas)	28.27
5	APPROVED HEIGHT of RESERVOIR (in metres)	89	58.08 (Dhamni) 28 (Kavdas)	28.27
6	COMPLETED HEIGHT of RESERVOIR (in metres)	89	58.08 (Dhamni) 28 (Kavdas)	28.27
7	APPROVED LENGTH of CANALS (in kilometres)	67/50	29/47	8/17
8	COMPLETED LENGTH of CANALS (in kilometres)	54/3.40	29/34	8/17
9	TOTAL CAPACITY (in million cubic metres)	976	285.31 (Dhamni) 13.7 (Kavdas)	37.11
10	TOTAL CULTURABLE LAND in COMMAND AREA (hectares)	48,910	30,547	4,038
11	NET CULTIVABLE LAND (hectares)	37,260	14,696	3,066
12	CULTURABLE LAND in COMMAND AREA that can be BROUGHT UNDER IRRIGATION after PROJECT COMPLETION (hectares)	23,000	14,696	2,044
13	IRRIGATED LAND AREA, 2008-09 (hectares)	2,038	1,701	600
14	WATER USE (in million cubic metres)			
15	DRINKING	604.2	24.56	-
16	IRRIGATION	60	200.71	35.93
17	INDUSTRIAL USE	2.5	47.83	-
18	POWER GENERATION	-	-	-

Source: Thane District Socio Economic Statistical Abstract, 2008-09.

TABLE 1.2: Area of Underutilization in Minor Irrigation Projects in Thane District in 2009 (in Hectares).

ADMINISTRATIVE SUB-DIVISIONS in THANE DISTRICT	TOTAL COMPLETED PROJECTS	TOTAL COMMAND AREA	PRESENT IRRIGATED AREA	AREA TO BE BROUGHT UNDER IRRIGATION
TALASARI	4	0	0	0
DAHANU	19	285	50	235
VIKRAMGAD	2	380	127	253
JAWHAR	30	495	0	495
MOKHADA	15	115	8	107
VADA	47	2407	1198	1209
PALGHAR	30	1412	654	758
VASAI	18	799	60	739
THANE	3	0	0	0
BHIWANDI	12	211	85	126
SHAHAPUR	80	2031	338	1693
KALYAN	16	728	419	309
ULHASNAGAR	0	0	0	0
AMBERNATH	15	440	412	28
MURBAD	85	2066	454	1612
TOTAL	376	11369	3805	7564

Source (for above): Thane District Socio Economic Statistical Abstract, 2008-09

TABLE 1.3: Area Irrigated in Thane District in the Period 1961- 2011.

NO.	AGRICULTURE & IRRIGATION	1960-61	1970-71	1980-81	1990-91	2000-01	2009-10	2010-10
1	NET IRRIGATED AREA (in 100 hectares)	50	40	220	70	204	204 (2001-02)	188
2	NET SOWN AREA (in 100 hectares)	3570	4410	3330	4480	4067	4740	4740
3	NET IRRIGATED to GROSS CROPPED AREA (percent)	0.48	0.33	0.13	0.06	2.18	2.18	1.97
4	NET SOWN to NET CULTIVABLE AREA	38.8	46.16	34.84	46.87	42.55	41.13	49.6
6	IRRIGATED to NET SOWN AREA (percent)	1.23	0.7	0.36	0.13	4.62	5.31	3.97
7	TOTAL AREA UNDER CANAL IRRIGATION (in hundred hectares)	-	-	-	N/A	N/A	12	52
8	AREA UNDER WELL IRRIGATION (in hundred hectares)	437	299	104	480	186	138	71
11	AREA IRRIGATED BY OTHER THAN WELLS OR CANALS	-	12	11	112	2	54	31

Source: Maharashtra Govt., Various issues of Socio Economic Statistical Abstracts, 1960-61 until 2010-11, Thane District.

Like many rural parts of Asia, access to irrigation in Thane is vital to expanding areas of land under cultivation. For small paddy farms in Mumbai's hinterland, availability of irrigation water critically determines agricultural productivity (as well as demand for workers). Derivatively, it also affects opportunities for agricultural workers to gain bargaining power in seasonally-tight labour markets (Gidwani, 1996; Vaidyanathan, 1999). Thus lack of access to irrigation water has reduced several Thane farming communities to seasonal, highly casual labour forces in post-monsoon seasons.

Since the 1970s, water policies for Mumbai and Thane District have oscillated between meeting urban and agricultural needs. But as local irrigation water is

increasingly diverted to Mumbai, agrarian crises in Thane District have intensified along with conflict over dwindling supplies. During the past five years even 'middle farmers' in the District (who own 4-5 hectares of land and are in the upper tiers of the peasantry) are also struggling to sustain their families (Interview, June 2006)¹.

Massive demand for water by MMR has led to over-reliance on large dam projects in Thane that has maximized water production for urban and suburban needs — but also undermined sustainable irrigation for local, tribal farmers. The rural water crisis, including rising rural-urban tensions over access, has thus driven new waves of seasonal migration from Mumbai hinterlands to peri-urban areas (Punjabi, 2005; Gandy, 2008). The human dimension of the water crisis has been pivotal in recent politics of the district. For instance, in most parts of Thane, farmers of Kunbi and tribal communities historically often shared the same socio-economic status. In some interior areas where large dam projects are completed, both communities have similarly suffered water scarcity (for agricultural and domestic use) and displacement. But water shortages in Thane now result in intensifying struggles between those communities over water access. In that context, shortages have exacerbated nascent, inter-caste rivalries that emerged in the post-1945 political mobilization of tribal communities.

As discussed, water made available by construction of Surya Project was to irrigate lands of tribal farmers and mitigate the need for seasonal economic migration. However, in 1998 a portion of water from Surya was officially allocated to development needs in *Vasai-Virar sub-region* (VVSR) of MMR. Further, a 2009 decision saw more water diverted from Surya to Mira-Bhayandar, a municipality of MMR (see Figure 1.1).

Thus, today the historical, seasonal migration of small-scale, marginal (tribal) farmers persists from November through April each year between Surya Command Area, the coastal plains, and Mumbai. Moreover, Kunbi groups have also lobbied the Maharashtra State Government (with some success) to re-allocate them irrigation water already earmarked for tribal populations. And Kunbi farmers from coastal parts of Dahanu have begun laying claim to water from Surya for irrigation (Navshakti, 2006). As such, Surya Project is now the focus of an intense, *intra-rural* conflict over water. In part, this is a result of logistics, i.e. geography-based differences in need. Yet it also contains strong class/caste motivations, including simmering Kunbi resentment over affirmative action policies aimed at supporting local tribal communities.

The intensification of such claims and conflicts highlight the critical issue of water-access in the broader political economy of Mumbai-Thane region. They also raise questions about how water is differentially used and valued by different groups, depending on their respective geographical (and social) locations.

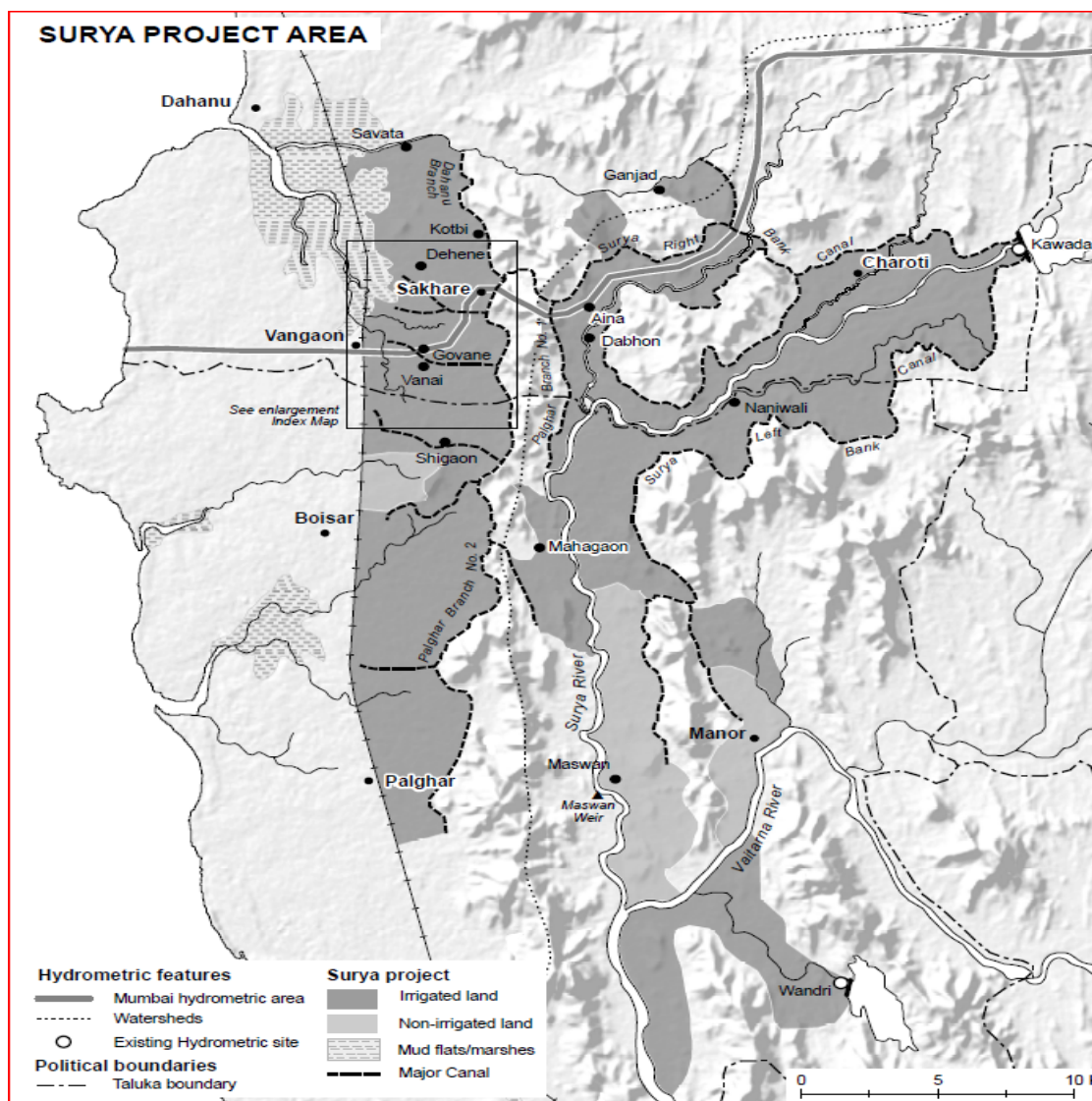


FIGURE 1.4: Details of the Surya Command Area.

1.4 Geographical and Social Context of Thane District

1.4.1 Rural-Urban Contestation over Water, and the Sprawling Influence of the MMR

One of the key developments of the past two decades in the Mumbai Metropolitan Region is the fast-paced growth of the *Vasai-Virar sub-region* (VVSR) at the northern fringes of MMR. From a population of 700,000 people in the 2001 census, to 1.2 million in the 2011 census, VVSR is now the fastest growing (and 6th largest)

town in Maharashtra State, as well as the fastest growing city in all of urban India (Census of India, 2011). The VVSR was reserved as a green belt in the 1970s, but controversially was opened up for urbanization in 1988. Subsequently, throughout the 1990s, more and more agricultural land - and even ecologically sensitive coastal areas - were also re-zoned for urban development. Thus the re-zoning for urbanization of what was previously designated agricultural land has also become the subject of ongoing controversy in VVSR and the Mumbai region.

Urban research on the VVSR belt has confirmed that the role of organized crime (including a prominent Vadaval caste-leader, Hitendra Thakur, from Palghar, Thane District) has also been instrumental in 'grabbing land' from the local tribal community (Punjabi, 2005). Thus, local '*boss-ism*,' and a nexus of politicians and gangsters, have also been central in the water-politics of this area.

The rapid growth of the Vasai-Virar sub-region also reflects the urban transformation of Greater Mumbai. Gentrification in this island city has meant that populations of Mumbai and its inner suburbs - as well as migrants from others parts of Maharashtra State - are increasingly moving to outlying areas such as VVSR (Bhagat and Jones, 2013). Indeed, within the Mumbai Metropolitan Region, cities of VVSR are growing the fastest, almost doubling their populations in a decade (see Figure 5, below). Other towns in the MMR, such as Navi Mumbai (with 1.5 million people) and the town of Thane, also host large populations. Significantly, it is also the location of Vasai-Virar sub-region (on a major South Mumbai commuter railway line) that has led the towns of

this sub-region to outpace all other towns outside Greater Mumbai, in terms of demographic growth (Bhagat and Jones, 2013: p. 7-8).

One characteristic of the pressure that Mumbai's urban expansion has placed upon VVSR is a chronic scarcity of potable water among the urban population there. For more than a decade, until the 1990s, the town had to rely on privately owned water tankers (a business dominated by local criminals and politicians), until the Maharashtra Government decided to divert water there from the Surya Dam, on the grounds that water was being under utilized in the Irrigation Project. However, contestation of that diversion in Mumbai High Court by social movements in Dahanu resulted in VVSR's access to Surya water being deemed temporary by the State Government. Although Maharashtra State Government submissions to the High Court in the early 2000s claimed that diversion of water from reservoirs on Tansa, Vaitarna and Bhatsa rivers in northern Thane District would be temporary (High Court Affidavit, 1996), the VVSR was unsuccessful in accessing water from those reservoirs. Subsequently, there were also fresh attempts to source water from other parts of Thane District. However, the mushrooming population of VVSR, along with a priority in State Government policies on water for drinking use, has ensured that the Maharashtra Government has renewed VVSR's access to Surya water four times during the past 17 years.

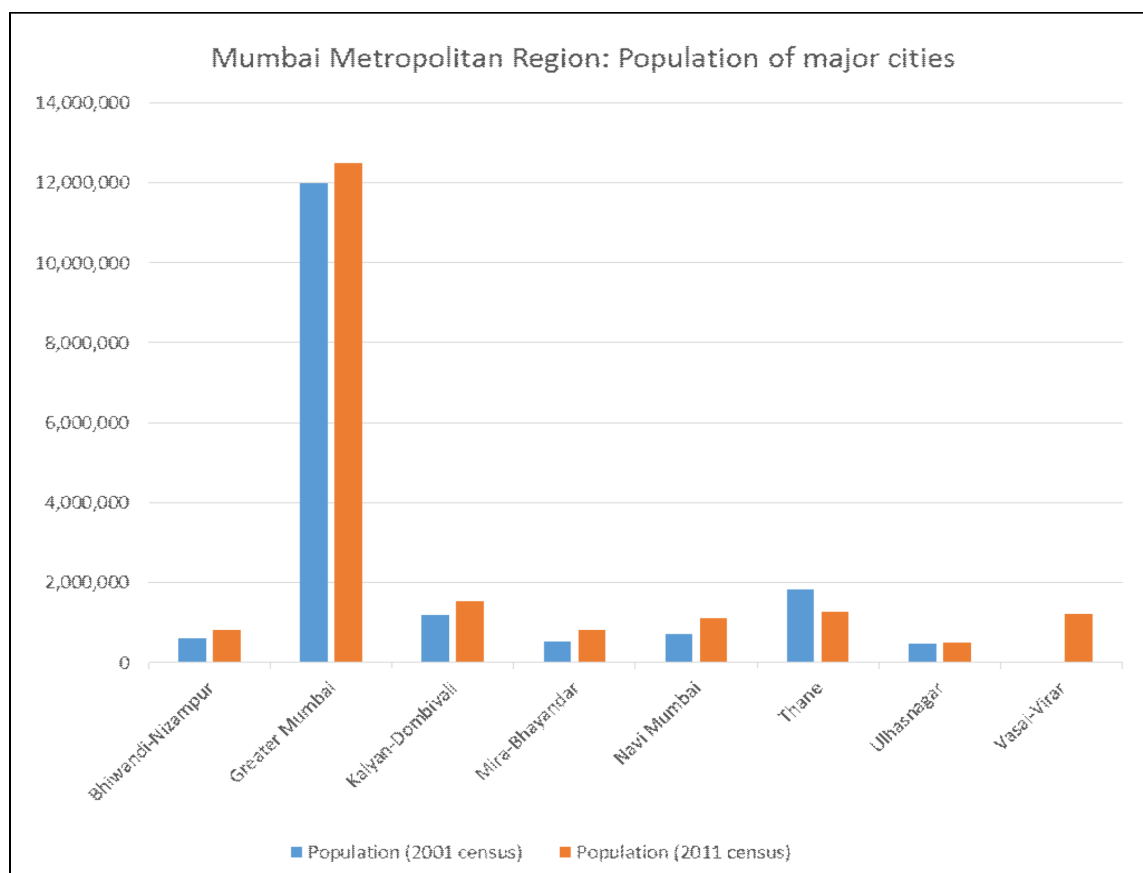


FIGURE 1.5: Population of Mumbai Metropolitan Region, 2001-11. Source: Census of India (2011).

Almost 75% of the demand for water in VVSR is now being met by the Surya Project. In 2009, the State Government also decided to divert water to Mira Bhayandar, a sprawling suburb of Greater Mumbai to the south of VVSR. But a growing resistance of a section of the sub-region's rural population (in the western coastal belt) to ground water mining has pushed the State to renew water diversions from Surya Dam (Punjabi, 2005). That has also led to a proposal for a new dam in Dahanu called the *Susari Project*. All of these factors - including expanding populations on the northern fringe of the Mumbai Metropolitan Region, and growth of towns in the absence of reliable water

supplies - have set the stage for a very contentious scalar politics of water in the Surya Command Area of Dahanu region, which is the subject of this study.

1.4.2 Topography of the Surya Command Area

The geographical area of the Surya Multipurpose Irrigation Project can be divided into two parts: (1) the developed coastal belt (the *bandarpatti*) where various commercial crops flourish; and (2) the area east of the Sahyadri Mountains (the *jungle patti*).

The *bandarpatti* is about 30 kms wide, extending west from the railway line situated at the foot of the Sahyadri range. The area has a fairly well-developed, fairly evenly-distributed infrastructure including roads, transport facilities, banks, cooperatives, schools, factories, etc. The main crops cultivated are fruits, vegetables and paddy rice, which are sold commercially and consumed domestically. A fairly large portion of this area enjoys good irrigation. The main farming castes are the Kunbis and Agris, respectively; tribals do not traditionally inhabit the area. However, tribals do have a regular presence, since they increasingly migrate from the *jungle patti* to satisfy demands of commercial crop farmers for cheap, abundant labour on their expanding operations.

The *jungle patti* lies to the east of the railway line, extending up to the Mumbai-Ahmedabad National Highway. The land is barren during dry seasons and the hills are thinly forested. Villages, which tend to be isolated and are sometimes inaccessible during monsoons, are characterized by an almost total lack of infrastructure facilities. The (virtually non-irrigated) subsistence-economy there is based on producing a single

crop – paddy – with grass grown on some pasture land. Nearly 70% of the *jungle patti* population consists of tribals who have historically lived in forested areas there. Today, most tribals are agricultural labourers and small farmers, with few holding more than 5 hectares of land.

The Surya Multipurpose Irrigation Project is located in the *jungle patti* area and was designed to irrigate 24,000 hectares of land. Rainfall in the Surya Command Area is very high (3,000 to 4,000 mm annually), making paddy the largest crop in the area, under both rain-fed and irrigated conditions. Project planners did allow for some crop diversification, and projected that 40% of the area's irrigation potential would eventually facilitate commercial crops such as vegetables (Borude et al., 1986). Indeed, the potential for surface irrigation to transform production relations in the region was touted by other researchers during the construction phase of Surya:

Irrigation in Dahanu significantly affects the entire organization of production methods of cultivation, the cropping pattern as well as the relations of production. On the one hand it may lead to greater differentiation in terms of proletarianization of the small and the marginal peasant. On the other, the topmost class, the developed technology, HYV seeds, etc. A few better off adivasi middle peasants may improve their conditions by making use of the irrigation facilities. Extension of irrigation in Dahanu and other talukas in Thane may be an important factor in boosting agricultural production at least temporarily, on the one hand, and in establishing clearer capitalist relations on the

other. (Munshi, 1983, p. 221)

And yet, paddy remains the dominant crop in the Command Area today. And even though the Surya Project has been funded under the Tribal Sub-Plan and was intended to primarily benefit small-scale, marginal, tribal farmers, over time it has come to cater to the needs of agricultural populations in western parts of coastal Dahanu. It also irrigates the fields of Kunbi farmers in Saphale Village (Palghar block). And, as discussed, it now also serves the needs of the rapidly urbanizing Vasai-Virar sub-region on the periphery of Mumbai. Such persistent diversion of water from its originally intended purpose is an issue that is currently being challenged in Mumbai High Court by local activists.

Also, almost half of the total cultivable land in the Surya Command Area lies in the middle of one of the District's largest protected forest areas. The canals and sub-minors (water channels designed to convey water to fields from canals) of the irrigation project criss-cross this forested area through a very hilly region, and irrigate only a very small portion of agricultural land owned by tribal farmers. At several places, the canal network and sub-minors are left incomplete due to non-clearances for construction from the Forest Department. In contrast, the canal system is soundly in place near Vanai Village (on the eastern side of the Project's Command Area), where some sections of the tribal community there have managed to benefit from irrigation water. Nearby, close to the Mumbai-Ahmedabad Western Express Highway that passes through the Command Area, a substantial portion of agricultural land has also been opened up for urban and industrial development. That too creates further social, economic and environmental

pressures on the tribal community there - who seldom find employment in new establishments that arise.

A majority of inhabitants in the 105 villages of the Surya Command Area are also some of the poorest in Thane District. The area is characterized by chronic poverty and malnutrition; poor infrastructure; poor access to water for domestic use; and an absence of basic literacy. Most of its inhabitants migrate to Mumbai and coastal Dahanu from September to April in the post-monsoon season for seasonal employment.

While the Surya Command Area is populated by the tribal community, the adjoining areas of Surya Project (in the western coastal belt of Dahanu and Palghar blocks, on the Arabian Sea) are mostly inhabited by farmers of the Kunbi Maratha and Vadaval caste-clusters. In contrast to the economic stagnation of the Command Area, farmers from those communities have enjoyed a period of relative prosperity since the land reforms and Green Revolution of the 1960s. That largely stems from their proximity to Mumbai railway line, as well as from access to ground water for their fields. Thus, Kunbi Maratha and Vadaval farmers have good connections to markets in Mumbai where they sell their produce, and so have developed proximate relations with the economy of the city. The farmers there rely mostly on tribal labour from the interior of Thane (a majority of whom come from villages in the Surya Command Area) to work their fields between November and May. After that, tribal farmers return to their own fields to sow their monsoon crop.

However, that 'symbiotic' relationship is not exactly mutually enriching. The tribal community continues to face exploitative practices from the larger scale,

commercial, coastal farmers who pay them quite meagrely. Indeed, relations between the tribal community and the non-tribal, coastal community have become antagonistic. One of the leading social justice organizations in Thane District - the Dahanu-based *Kashtakari Sanghatana* - has been at the forefront of organizing protests and marches over the Surya Dam issue. During the past two decades they have also been organizing seasonal labourers into a labour union.

In terms of land use, agricultural development is uneven in the Dahanu block. Paddy is the main staple crop in the adjoining coastal belt, and is cultivated on 4,141 hectares in 32 villages there. Slightly above 53% of paddy production in *Surya Command Area* is located on this coastal strip of Dahanu (even though there are a greater number of villages in the interior of the Command Area, and in other tribal areas of Dahanu block). In fact, that coastal acreage accounts for almost 24% of the total area under paddy in Dahanu, which reflects very uneven agricultural development in the region. Indeed, this extremely productive coastal area of Dahanu (about 6 km long by 12 km wide) is known as the 'vegetable bowl' of Thane District (Dewan, 1999).

However, in the past 5 years (because of proximity to the Arabian Sea), coastal farmland has suffered from the intrusion of salinity into groundwater aquifers, which has caused sometimes serious declines in agricultural production. The polluting presence of power plants on Dahanu coast since the late 1990s (to feed Mumbai's energy needs) have also adversely affected the agricultural economy there (Dewan, 1999). Consequently, to ameliorate their declining economic conditions, coastal area

Vadaval farmers have made access to water from Surya Project a key point in their demands of the State Government to help revive agriculture in their area of Dahanu.

1.5 Understanding Conflicts over Water in Thane District: *Urban-Rural or Intra-Rural Competition?*

1.5.1 Questioning a Structural Interpretation of Water Politics in Thane District

It is widely acknowledged by most social movement and political leaders in the interior of Thane that the largely agricultural Kunbi community - now caught in a downward economic spiral - has begun to recognize that problems of economic underdevelopment faced by local tribal peoples are likewise affecting their own caste-group. In this sense, the Kunbi community now appears keen to forge a common alliance with tribals against water policies of the Maharashtra State Government that negatively affect both groups. This interpretation of current politics in the context of crucial access to water was vividly conveyed by Vishwanath Patil of the Kunbi *Sena* organization. Patil uses the term “*Bahujan unity*” (lower caste unity) in various *Sena* pamphlets and in public meetings to support an alliance between tribals and Kunbis (Interviews, August 2006 & August 2008). Thus, two significant political organizations in the District - the Communist Party of India (Marxist), and the Kunbi *Sena* - continue to press the importance of common mobilization, and during the past two years have even organized joint rallies of poor tribals, and Kunbis around water access in the Thane District.

However, during my fieldwork in Dahanu that interpretation of the District's water politics was contested by Brian Lobo of the *Kashtakari Sanghatana* (KS). The Sanghatana is a social movement well recognized in India for its concern about the welfare of Thane tribal communities, particularly in its advocacy on environmental and developmental issues that affect them. Lobo and KS view the conflict over water in Thane as unfolding in a different direction. His contention is that the tribals there are economically worse-off than both the local Kunbi and Vadaval communities, who have inflicted *caste-ist* oppression upon them in recent decades. As such, Lobo believes that local tribals' interests are distinct, and that they would not benefit from an alliance with Kunbi or Vadaval communities around water issues. To buttress his claim, Lobo points to developments in Dahanu, where Kunbi communities are increasingly claiming water from the Surya Project that was meant to irrigate lands of the tribal community there. According to Lobo, some of the non-tribal communities from coastal areas in Dahanu and Palghar have even secured formal approval that the Maharashtra Government will pipe water from Surya Project onto their lands. As such, while acknowledging how Mumbai's urban water demands have driven the dispossession of Thane farmers, Lobo points out that irrigation water is also being diverted away from tribal users to benefit rural, non-tribal farming communities such as the Kunbi (not just to benefit urban Mumbai).

In Lobo's view, this is evidence that one reason or another will always be found to justify government water allocation policies that persistently dispossess Thane's tribal peoples. In this sense, he emphasizes that such policies essentially serve urban and

agricultural *capital interests* and that, therefore, Thane tribal communities will never politically benefit from a 'class-based alliance' involving the Kunbi Sena and the Communist Party of India (Marxist). According to him, the *nature of existing relations of production* in that area of Thane simply outweigh the potential benefits of the proposed alliance. In other words, the importance of the ongoing availability of large numbers of marginal, small-scale, tribal farmers to work as labourers for Kunbi and Vadaval farming caste-clusters on the Dahanu coastline makes it unlikely for tribal and non-tribal political interests to coincide around the water issue. The relationship between caste-clusters and the Thane tribal community constitute my focus in Paper Three of this dissertation.

1.6 Research Questions and Dissertation Outline

Research literature on water politics in India and Asia has generally emphasized that the *intra-rural* dimension of water conflict is characteristic of regions where water resources are under pressure from growing, nearby urban demands. In that context, competing demands for water also emerge *within* such rural areas, where there is always a segment of the population with only small, subsistence landholdings who become further marginalized in struggles over access to water (Mollinga, 2003; Janakarajan, 2004). However, the sizeable literature focusing on such intra-rural water conflict has mainly focused on policy aspects of the problem, as well as a rather narrow definition of water governance that relies on rules and government policy (Meinzen-Dick & Bakker, 2001). As such, the social, cultural and political-ecological processes involved in the governance of water and irrigation remain largely obscured. Analysis of water

management (and associated conflict) must consider wider sets of social networks, political relationships, and cultural values and meanings that also underlie and inform the norms and conventions surrounding access to water (Mosse, 2003).

With this dissertation on water politics in Thane District (India), I build upon recent research that views access to water as a lens through which a *variety of social relations* in local contexts become structured (and vice-versa). Within such literature, caste-identity and the changing nature of caste interactions - as well as the manner in which those are entwined with broader relations of production - are viewed as determinants of resource politics and of agrarian change in India (Gidwani, 2000 & 2002; Mollinga, 2003 & 2010). Related literature on water research in the agrarian contexts of Gujarat and Tamil Nadu similarly argues that it is the *interface* of such relations of production *with* water institutions (including ways that such relations and institutions have historically co-evolved) which critically shapes local water politics and local water management practices (Dubash, 2002; Mosse, 2003).

My research project was guided by two central and interrelated questions:

1) What aspects of farmers' social and economic locations (within overarching relations of production) influence their access to water? (For instance, do size of landholdings influence access to water? Does proximity to canals? Do farmer's relative class- or caste-positions affect access? And *how* is water scarcity *experienced* by farmers in Surya Command Area?).

2) What are the rules, institutions and governance structures underpinning water transfers from rural to urban areas (and water management more broadly) in Mumbai-

Thane region? (For instance, what factors lead to water being [paradoxically] under-utilized for agriculture in locations such as Surya Command Area? And, how do broader structures and practices of water governance interact with the social/class divisions in such rural areas?).

Building upon that research, my dissertation is presented in the form of three manuscripts.

PAPER ONE uses a case study to illustrate a *nexus of corruption* among politicians, engineers, contractors and a dominant local caste-cluster (the Vadavals), in the context of a canal system of Surya Multipurpose Irrigation Project (in the agricultural belt of Dahanu, Thane District, Maharashtra). That paper begins with a critical analysis of Robert Wade's work on the corruption nexus he observed at the Andhra Pradesh Irrigation Department (Wade, 1982 & 1985). Through my own ethnographic research on divisions and tensions inside the irrigation bureaucracy at Dahanu, I learned that the *rational choice* framework employed by Wade - including his conceptualization of '*the corruption nexus*' - was useful. Yet, I have also argued that it was insufficient for analyzing and understanding the *motivations* of main bureaucratic actors within that corruption nexus. Therefore, while not entirely dispensing with Wade's arguments, my first paper asserts that the *hierarchy between engineers* at various levels - and the *incentives that motivate them* to participate in or refrain from corrupt practises - were not sufficiently investigated in Wade's research. And, as such, the overlapping interests and relations of rural elites with politicians and Irrigation Department staff have not yet been well understood. Through a narrative analysis of

interviews I conducted with department engineers, Paper One emphasizes how the rural poor in Dahanu (mostly small-scale, marginal, tribal farmers) have been most disadvantaged by that nexus of corruption.

Thus, while critiquing Wade for not recognizing the serious impact of hierarchies and potential conflicts within ‘the bureaucracy,’ my paper also confirms Wade’s insight that (in its developmental role) the Indian State remains inhibited by an increasing entrenchment of the corrupt nexus connecting bureaucrats, politicians, contractors and rural oligarchs.

As a study of water politics in the Mumbai-Dahanu region, Paper One also presents new ethnographic research concerning the local and regional politics of water. Indeed, the water made available by the Surya Project is at the heart of fierce, ongoing competition between Vasai-Virar sub-region and (tribal and non-tribal) agricultural areas of Dahanu. As well, the commercialization of local water is a result of increasing demands from urban and industrial areas of Mumbai - and a major factor facilitating the local corruption nexus which resembles that described by Wade.

PAPER TWO applies field research and ethnographic observations to explain the politics of water access and of the provision of basic water entitlements for domestic use in villages of the Tansa-Vaitarna water district. That water district happens to be the main source of water for Greater Mumbai and other towns in the MMR. This paper attempts to answer the question of how the city of Mumbai has come to exert such enormous influence over local water policies (officially the purview of Maharashtra State) within and beyond the boundaries of MMR. Ironically, that influence coincides

with the State's apparent inability to meet basic water needs of rural populations in watersheds of Thane District. It is not insignificant that this water district is primarily controlled by *Mumbai Municipal Corporation* (in tandem with the Forest Department).

Thus, the second paper traces the original decision to reserve unexploited water resources in Thane District (for the anticipated future use of Mumbai) to a key debate from the mid-1940s. It also traces the subsequent (yet retroactive) territorial extension of jurisdiction arising from that decision to deliberations of the 1950s and 1960s. The paper also shows how the subsequent creation (in the 1970s) of a '*hydrometric area*' for Mumbai Metropolitan Region further exacerbated rural-urban water conflicts. In that context I drew upon Elinor Ostrom's socio-ecological systems framework, and her *action situation analogy* to identify how local ecological, economic and legal factors constrain the outcomes of local government efforts to provide rural water access to villages in the T-V water district.

PAPER THREE emphasizes agrarian change and *politics of the commons* in Dahanu, after the onset of canal irrigation from the Surya Project. That paper utilizes interview and survey data, as well as maps from the local Irrigation Department. It also makes use of information gleaned from legal affidavits about local challenges over land and water access, involving small-scale, tribal farmers and commercial Kunbi and Vadaval agriculturalists. All of that data provides evidence around which a cohesive narrative about the politics of resource conflict in two villages of Dahanu is presented. The main finding of Paper Three is that in both of those villages land has also been central to conflicts over resources - even as water from canal minors at the head, middle

and tail reaches of the system has been increasingly monopolized by commercial farmers of Vadaval-caste. Paper Three thus identifies the importance of a land-water resource nexus, and examines the social and political paradoxes that accompany the introduction of new water technologies (as implemented by Vadaval commercial farmers to help them conserve water resources on their holdings). The paper also critically analyzes the canal technology prevalent in the Surya irrigation system, as well as political claims about wasted and under utilized water there. Studying how intra-rural water conflict results from (or is exacerbated by) the pressures of geographically distant urbanization also urges us to answer important contextual questions about the major actors who are facilitating changes to the 'waterscape' of Mumbai-Thane region.

Overall, my research into the issues described above has yielded significant insights about contestation of water rights and access - including the commodification of water and the political dimension of conflicts - all situated within local, environmental contexts. Insofar as there has not yet been a substantial treatment of water conflict (in this way) in the context of the rural hinterlands of a major Indian metropolis, this doctoral research represents a significant step forward.

Situated within the frameworks of *human geography*, *institutional theory* and *political ecology*, this dissertation project has focused on contributing an integrated understanding of the *social and economic geographies* of development, as well as the *politics of resource conflict*, all within the context of the rural hinterland surrounding the City of Mumbai and its Metropolitan Region.

Notes

1. The 'tribals' in this context refer to those communities in Thane District who have been categorized as *Scheduled Tribes* under the Indian Constitution (i.e. eligible for what North Americans call 'affirmative action'). Historically and culturally in India, the term *tribals* refers to communities who comprise the (substantial) indigenous minority of India's population. Several tribal communities in India follow their own tribal religions which are different from the mainstream faiths. Also known as *Adivasis*, tribals are particularly numerous in Bihar, Orissa, Jharkhand, West Bengal and the western Indian states of Maharashtra and Gujarat. Such communities are direct beneficiaries of affirmative action policies. For example, they are entitled to reserved electoral seats in the Indian Parliament. In Thane District there are three ridings (seats) in the state assembly reserved for representatives of tribal communities, and one riding reserved for them in the Indian Parliament. According to the 2001 Indian Census there are about half a million tribals living in rural parts of Thane District.

2. Interview with Mr. Raju Paranjpe (June 2006), local politburo member and state politburo leader for Communist Party of India (Marxist), Thane District. Interview with Mariam Dhawle (August 2008).

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2. Methodology

In this chapter, I will present the methodology that guided the overall field, archival and library research that informs this dissertation. This includes the justification of researching the canal system in two villages as the unit of analysis, the strategy of *following the water* within the Surya command area and to other parts of Thane district, and finally a description of the analysis of data gathered during the research.

I begin with a general description of the methodology (in Section 2.1), where I will outline the reasons for my use of qualitative methods. I provide details on the time spent around field, archival and library research during field research in 2006 (Section 2.2). I follow this up by providing the rationale for choosing the canal system in the Surya project as the unit of analysis (Section 2.3). A description of the methods chosen to interview engineers who manage the irrigation system for the Surya project is presented in Section 2.4. A description of field research in the Tansa- Vaitarna water district conducted in 2006 and in March 2008 in the interior of Thane district follows in Section 2.5. From Section 2.6 until Section 2.9, I provide more details about the sampling strategy and field and library research. Finally, I conclude this chapter in the last two sections by explaining the methods used to analyze the data.

2.1 Qualitative Methods: Human Geography and the Political Economy of Water in India

This dissertation relied on qualitative research methods for gathering fieldwork data. Research on the human geography and political economy of small town and rural

India respectively provided a methodological model for my research (Chari 2004; Dubash, 2002; Gidwani, 2000, also see Introduction to the dissertation for further background). While Chari's work is on labour and the politics of capitalist accumulation in a small town of South India, Gidwani and Dubash's ethnographic research on irrigation focuses on the ecological and cultural dimensions of agrarian change in Gujarat. Their research used a combination of methods, largely to triangulate findings from various modes of data collection, and revolved around a central ethnographic fragment discerned and unearthed in an earlier phase of fieldwork. In this thesis, I examined how the various narratives and findings on the politics of water and the impact of urban expansion on water governance square with existing theories of water politics in the Mumbai region and also other metropolitan regions in India. My fieldwork adopted a contingent, open-ended and process-oriented approach, one which tried to develop an understanding of the role of institutions, rules and the formal and informal mechanisms of water governance. It combined this institutional analysis with a study of social relations in the rural communities in the water districts outside Mumbai through interviews and survey research.

In the context of Thane district, my earlier fieldwork in June-September 2006 identified the perception of declining economic status within the Maratha-Kunbi community as a central feature of the recent political economy of social relations. Interviews conducted with leaders of the community revealed that the Maratha-Kunbis and Vadavals had begun to contend that contesting the inequity in the distribution of water between Mumbai and Thane was key to reversing their flagging economic

fortunes in agriculture. Further interviews conducted with farmers from both the Maratha-Kunbi and Vadaval communities also revealed that they had started perceiving the tribal community as sharing their sense of crisis, which emanated from an unremunerative agriculture, seriously affected by the lack of water access. “*Aamhi Maratha-Kunbi pan Adivasi sarkhya jalo*” (the state of Maratha-Kunbis has started resembling the economic condition of the tribals) is a cryptic comment in Marathi, which is often heard in conversations with political leaders and activists from the community in the district. Along with this is the demand of the Kunbi Sena, which represents Maratha-Kunbis to place access to *water, land and employment* at the centre of the new resource politics in the district and the Konkan region. However, in contrast to its stated objectives of attaining ‘farmers unity’ in Thane, the Maratha-Kunbi and the Vadaval communities in the coastal area of Dahanu under the aegis of their separate caste associations had also sought to consolidate their numbers and demand water for farmers from their own caste groups. They tried to use their influence to garner a share of water from dam projects at the expense of the tribal community (Navshakti, 2006). With this background information on social relations between the tribal and non-tribal communities from various parts of Thane district, I had focused on researching both social relations and the institutions that had evolved around water governance in the region during the 2006 trip.

2.2 Research in Regional Planning and Government Offices on Water Governance

The role of water institutions and social geography became quite central to the dissertation's three papers after the first fieldwork trip to the Surya command area in 2006. Data gathered during the interviews with metropolitan planners and engineers during this trip also led to some of the research questions around formal and informal water governance in this dissertation. The "abundant" availability of water and underutilization of irrigation quotas in Thane district was pointed out by both metropolitan planning officials in the Mumbai Metropolitan Regional Development Authority (MMRDA) and the Irrigation Department in Thane. This data gathered from interviews later led to research in the metropolitan planning reference libraries on the history of water planning. Here, various committee reports on large dam and canal projects in the Western Ghats and the regional planning aspects of urbanization were researched. Since these reports were from the 1970s, 1980s and 1990s, the importance of developing a more contemporary picture of water management through field research surfaced. At the same time, the information from these reports (on the early experiences of communities in the Konkan Western Ghats with irrigation) provided a very useful window into my observations during field research in 2008.

This later informed my overall methodological strategy when I was reading and analyzing more contemporary metropolitan planning and Irrigation Department reports on water. I used some of these early insights on local water politics and information gathered from an analysis of both planning and irrigation reports to pose pointed

research questions around social relations, institutions and water politics. The incomplete state of the Surya irrigation project, the continued “underutilization” of irrigation water, the issues around access to irrigation water which vary from social to physical factors and the relationship between the tribal and non-tribal communities led me to devise a research design based on two villages in what became a study of regional water politics. At the same time, this dissertation did not plan on producing village studies. The choice of two villages (Sakhare and Vanai) in Dahanu was primarily used to address research questions around the underutilization of water in systems such as the Surya.

The rest of this chapter outlines the fieldwork strategy that was employed during research for this dissertation. I begin with providing some social and geographical context to justify the rationale behind my choice of the canal system as a unit of analysis. I then move on to providing more justification about my strategy to using open ended interviews for my research on water governance in the Surya command area and other parts of Thane district. I finally end with a section that describes the analysis of qualitative and survey data for this dissertation.

2.3 Canal Irrigation as the Unit of Analysis

My ethnographic investigation over a period of four months in the summer of 2006 in the Surya command area revealed that the incomplete condition and the poor maintenance of the canal conveyance system, and the increasing per capita water

demands of the Mumbai Metropolitan region were the major causes of underutilization of irrigation water in the Surya project ¹.

For the purposes of my fieldwork and in order to answer my research questions around water politics in papers one and two, I divided the command area of the Surya irrigation project into two ecotypes. Most of the Vadaval farmers in the coastal area, who belong to caste Hindu communities, have large land holdings which are mostly irrigated by groundwater and are officially outside the Surya project command area. On the other hand, the interior areas which lie eastward, within the command area, are dominated by members of the tribal community, but have seen Vadaval farmers lease in land in the horticultural belt around the village town of Vangaon. Within these two ecotypes (see Fig 2.1, Zones I and II), detailed qualitative information was available for one village, Sakhare, located at the upper reaches of the canal system of the Surya, and qualitative data was available on Vanai village, which was downstream on the canal.

Both villages lie in the Dahanu block of the Surya command area. Sakhare village was located in an area that has been the focus of a study on agrarian change by a University of Mumbai sociologist in the 1980s (Munshi,1983). This study was very useful as a baseline survey for my research. Ethnographic data on class relations was also available on this area from this study. The district census which is done once every decade is another useful source of data on population and agricultural land. My initial interviews with Surya dam project staff revealed that some of the richer Vadaval farmers have been default beneficiaries of the irrigation project because of the higher

groundwater tables in the village and the consequent prosperity they have come to experience.

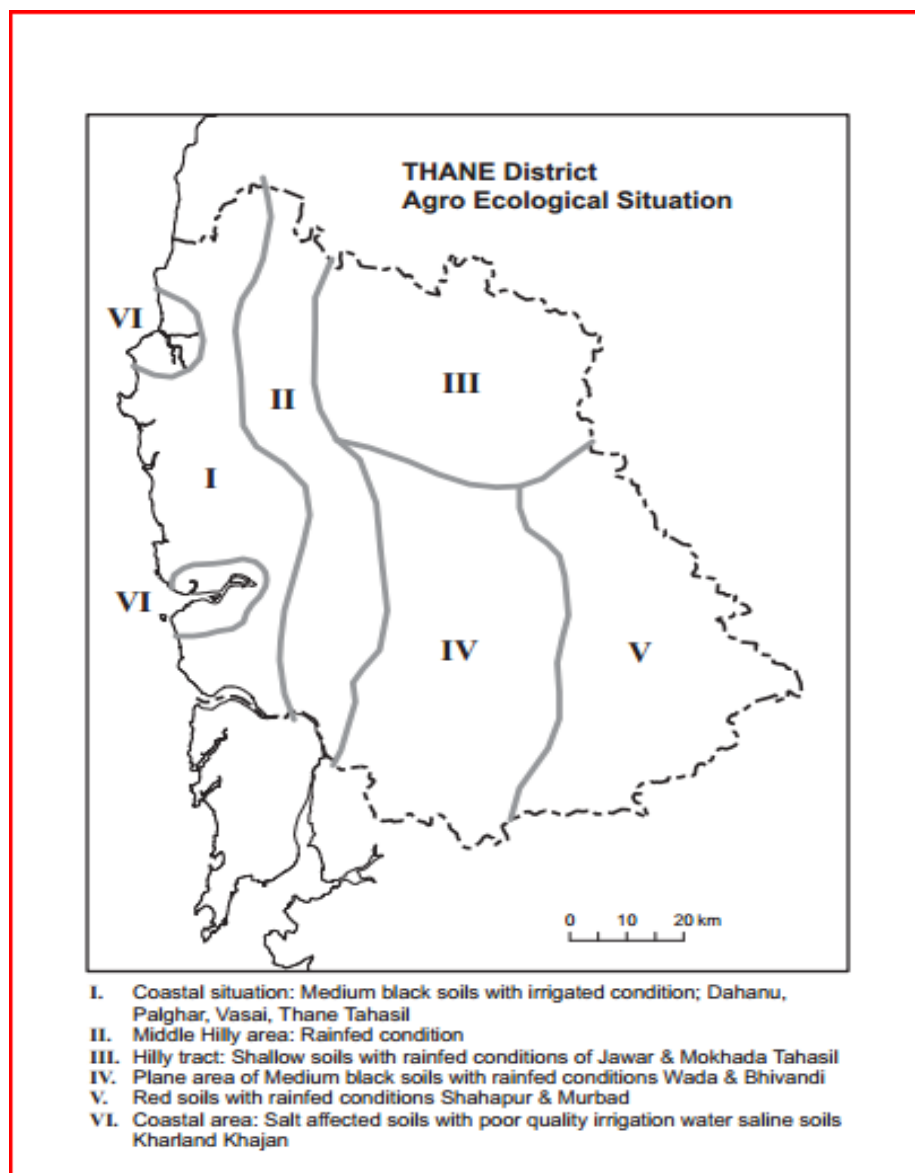


Figure 2.1: Agro ecology situation in Thane district. Source: Irrigation Department, Thane Irrigation Circle.

The access to groundwater had played a role, but their access to canal irrigation has further enabled them to improve their prospects in horticulture.

Very little ethnographic data from the past was available for Vanai village. My choice of this village was facilitated by a local NGO, the Kashtakari Sanghatana, which had a strong presence in the village as they had developed a grassroots presence for advocacy work done on behalf of the tribal poor. Vanai lies in the lower reaches of the canal system of the command area of the project and some tribal farmers have benefited from irrigation water of the project, while there are substantial segments of the village which had not experienced access. Both villages also had a significant seasonal migrant population which travels to other parts of Thane district for work. Moreover, given the history and the formation of caste and class-based identities in the district, the importance of studying social dynamics in the aftermath of irrigation proved to be very insightful. Sakhare and its surrounding settlements in Dahanu are at the centre of an interesting, evolving regional water politics where the farmers from the coastal parts are increasingly laying claim to the canal water of the Surya irrigation project due to their political influence in the state capital in Mumbai. In addition to the conflict on the canal system, this imparts an interesting intra-rural caste and class dimension to water politics in the region.

I chose villages purposively, with the main criterion being the strength of contacts in both villages and the possibility of obtaining credible information. The location of the villages on the canal system played an important role in my decision. Sakhare was located in the northern reaches on the Palghar Branch Canal 2 while Vanai was located on the southern reaches of the same canal. Both Sakhare and Vanai villages have benefited from irrigation water, but these villages also witnessed the inward

movement of Vadaval farmers from the coast who had leased in or purchased agricultural land for horticulture. Moreover, both villages are at the centre of a fast changing rural landscape, are geographically central to major transport routes, and lie on a geographical continuum (the right bank canal coming down westward from the mountains extending from Suryanagar across the Western Express Highway via Sakhare to Vanai on Palghar Branch 2) which allowed me to “follow the water” as part of my methodological strategy to study regional water politics.

Access to irrigation water has historically been an important marker of class relations in agriculture in Dahanu. The following quotation from a 1983 ethnographic study of a village neighbouring Sakhare (pseudonym used: Gavataon in Munshi, 1983) highlights the importance of water to production relations in the villages in this belt.

While livestock and implements, especially the plough and bullocks which are necessary for cultivation may be borrowed on standard terms from the rich of the village, water remains a serious problem. The marginal peasants, the poor peasants and some middle peasants are entirely dependent on the rain water as the only source of irrigation. Wells are an extremely expensive proposition beyond the capacity of these classes. A few of the middle peasants, all the rich peasants and most of the landlord-trader-creditor own a well and a motor pump each, some even two. As a result, those without a well cannot grow a second crop, and get only one crop of rainfed paddy. Even more important is the harsh truth that the vagaries of nature which may affect all, may spell

ruination for the small peasants. “Last year the rains failed, we did not get even the seeds we sowed. (Munshi, 1983:213)

In Sakhare, there was a rich segment of Vadaval farmers who have done well in horticulture in Dahanu. Each farmer from this community on average owned more than twenty hectares of agricultural land and had good access to groundwater irrigation (Question 1 in the introduction chapter of this dissertation around the relationship of land ownership to water access). Using the study by Indra Munshi (Munshi, 1983) as a baseline, the canal system was the unit of analysis in this village. Both my fieldwork in 2006 and past research such as Munshi’s dissertation documents that this rich segment of farmers have been the mainstay of the rural economy in Dahanu, since they have marketed their vegetable produce in various parts of India and the Middle East. These farmers who belong to the Vadaval community have good access to credit, a ready supply of tribal labour for their agricultural operations and command political influence in the state capital, Mumbai, which they have used from time to time for their commercial interests in horticulture. Vanai village was more homogenous in its ethnic composition and a majority of inhabitants are small and marginal tribal farmers who own up to two hectares. Like Sakhare, the village population was divided between farmers who had large land holdings and came from outside the village and tribal farmers who were from within the village. So access to water is an important marker of production relations in agriculture in the village.

Canals constituted the major form of irrigation in Vanai village and the experiences of farmers with water availability and scarcity can be elicited only with an

extended stay as temporary resident in this village. In this village, as in Sakhare, the canal system was the unit of analysis. Canals are better maintained at certain points than others, depending in part on the political and social connections of the farmers. All these factors affect utilization of canal water and often contribute to the varying economic fortunes of farmers. The two research sites were part of the official beneficiary area of the Surya irrigation project. There is a major dimension of variance across the two communities in the two villages and purposive selection within these villages enabled me to seek answers to the questions on water access and its relationship with the state of production relations in this region. While I chose these villages for further field research in 2006, an IDRC grant made it possible for me to return to India at the end of 2007. I returned for field research in Thane district at the end of December 2007 and stayed in Dahanu until September 2008 to cover the irrigation season between November 2007-May 2008. The latter research trip involved a prior round of semi-structured interviews in the villages with farmers and engineers and a survey that was administered to farmers in both Sakhare and Vanai in May, 2008. I had made initial contact with engineers in the Thane Irrigation Department as well as the Surya irrigation project in 2006. While the frequent transfer of executive engineers with whom contact was initiated meant that I had to renew my contacts with new personnel, my strategy being to write persistent letters to the Thane Irrigation Department seeking access to the Surya project, finally met with a positive response in January 2008.

Given that a pure focus on production relations is insufficient (Harris, 1982; Mollinga, 2003), the role of the state, in particular, the local Irrigation Department in

water development in this area was closely examined for it to serve as an important background to the study of canal irrigation in this dissertation. My interviews with engineers constitute the focus of paper one. The methods and the context for this component of the research are outlined in some detail in section 2.4 below.

2.4 Following the Water: Institutions and Politics in the Surya Project

Throughout my research in Dahanu in 2006 and 2008, engineers from the Surya project had repeatedly drawn my attention to the fact that canal irrigation in villages such as Sakhare and Vanai faced tremendous challenges from the terrain and how this had come in the way of the project's ability to meet its objectives. These constraints had also led to a high underutilization of water. Therefore, I chose not to restrict myself to studying canal irrigation within villages, but also observe irrigation rotations on the main canal level. A schedule of canal rotations from November 2007 until May 2008 was shared with me by the Irrigation Department. Since one of the villages (Sakhare) was located on the junction of the Palghar Branch and Dahanu (main) canals, I kept a diary on whether the actual water rotations adhered to the schedule. This gave me important insights into the political economy of water in the entire region where the two villages were located. The Irrigation Department shared several reports with me on the state of the project, environmental reports and a socio-economic survey from 1996. Some of these reports had a description of the state of the canals, experiences of farmers with the early reception of canal technology in this area and the early technological rationale behind the water conveyance systems in the Surya project. These reports also

gave me important information on water diversions outside the project's command area. Interviews with engineers were used to verify some of my observations both on the state of the main canals, but also some of the irregular events (such as the stoppage of water rotations on the main canal in May, 2008).

I interviewed ten engineers (of various ranks) and while most of the names used in this dissertation are pseudonyms, I made sure that I do use their ranks to describe the politics and responsibilities within the administrative hierarchy of the department (see Paper One). I also established a rapport with other employees of the irrigation project to triangulate my interviews with engineers. For Paper One, which describes the role of engineers, I have used a narrative style combining interview data with an analysis of the local Marathi media reports on corruption in the Surya project. It was impossible to understand all the layers of corruption because of the sensitive (and potentially dangerous) nature of the problem and the implications it had for my own safety in the field. But one that constantly came up was the resentment of the lower level of engineers towards their counterparts at senior levels. I made several notes from my interviews in June 2008 that helped me piece together the account of institutional corruption. The interview data gathered from fieldwork was brought into its proper perspective only after the state wide Maharashtra irrigation corruption scam was unearthed in 2012, which was also covered in the national press in India. The analysis of the persistent problem of graft in the Maharashtra Irrigation Department by the national and state level media helped me place the formal and informal politics of water transfers in the Mumbai-Thane region in a broader political context. It also helped me

confirm findings from the coverage of the local Marathi media in Dahanu (in 2008) on the poor maintenance of the canal system and the corruption in the Surya project.

The open-ended nature of my field research and research with engineers helped me understand water governance issues and the reasons behind underutilization at the main canal level. The political pressures on executive engineers in the Surya project came up a lot during conversations. While they were unwilling to talk about their experiences initially, they often opened up to conversation when they were close to being transferred to other locations in the state of Maharashtra. The socio-technical nature of canal irrigation and the political dimensions of water management emerged powerfully during these interactions. These conversations helped me place the reports on water underutilization made available by the Irrigation Department in their appropriate social context. Finally, this research on the irrigation bureaucracy helped me answer the question on formal and informal mechanisms of water governance in the region (see Introduction for Research Question 2).

2.5 Study of Tansa-Vaitarna Water District

The Tansa-Vaitarna water district entered the scope of my field research in the context of a major agitation on water in the interior of Thane district in February and March 2008. This agitation was a continuation of the protests against water scarcity that had been going on in the interior parts of Thane district throughout the 2000s. I had also travelled to this area in the summer of 2006. A study of this area was carried out mostly

through key informant interviews with planners, municipal engineers, activists, and conservation officers in the Tansa Wildlife Sanctuary and political leaders in the water district and Mumbai in 2006 and 2008. Newspaper archives, planning reports, and dam project reports were also gathered to draw a picture of the causes of the water conflict in this area that revolved around the growing water demand from Greater Mumbai and its impact on the basic water needs of the villages in the area. The T-V water district is located 80 kms north east of the Dahanu area, but its significance to the water security of the Mumbai Metropolitan Region and Greater Mumbai in particular, drew me to travel to this region and gather information on the situation with rural water entitlements.

Laws and governance entered the discussion during my interviews in this region. However, given that the local engineers at the dams in the T-V water district were not authorized to speak to researchers, I had to interview engineers and municipal officials in Mumbai at the headquarters of the Mumbai Municipal Corporation. The Mumbai Metropolitan Regional Development Authority's planners provided information on the city's water rights in Thane district and their library had several reports that were useful in helping me understand the water planning in this area. I also made careful notes from my interviews with engineers and planners in their offices.

For my research on the T-V water district, three regional planners at the Mumbai Metropolitan Regional Development Authority (MMRDA), one forest conservation official, three engineers from the Irrigation Department in Thane, three municipal officials from the Mumbai Municipal Corporation and four political leaders belonging

to various parties were interviewed. I have chosen to keep all their identities anonymous. They shared some of their own experiences in dealing with water scarcity in the T-V water district and spoke at length about how the entire area was committed for Greater Mumbai's urban use. The Irrigation Department in Thane district had shared with me reports of the Bhatsa Multipurpose project, one of the largest projects in Thane district. The objectives of the project were outlined in this report and the rights of the local population also found a mention in this document. Dam project reports (DPR's) for the Surya project (Dahanu, Thane), the Kal project (Raigad district) and the Bhatsa project (Shahpur, Thane) helped me understand the local rights situation in the T-V water district better. I used these dam reports to place the water rights situation in the T-V water district in a regional context. These dam reports also helped me understand the engineering rationale behind the planning of the five urban water supply dams in T-V water district.

Crucial material on the planning of the T-V water district was gathered from the University of Chicago's Crerar Library and the University of Chicago's South Asia collections in the summer of 2009. Archives of the *Times of India's* Bombay edition 1954 at Robarts library's Media Commons also helped place the long term evolution of the water district in context. These were supplemented by Claude Inglis's original article that was found in an 1945 issue of an old Indian engineering journal in the basement of Gerstein Science Library at the University of Toronto. The absence of data from one single source was thus compensated by accessing these different sources of information. Information on water use statistics in the Water Budgets from the State

Government of Maharashtra and the various planning reports from the Mumbai Metropolitan Planning Authority were used to confirm, verify and validate findings obtained from interviews with engineers and urban planners on the water problem in the T-V water district. Information from all these sources was triangulated through an analysis of the media coverage of the water district in newspapers in Mumbai city and Thane district.

2.6 Research Design for Village Interviews

The core of my methodology for the study on canal irrigation is based on semi-structured in-depth interviews with villagers and a sample survey on water access on the canal system in both villages. However, since conducted face to face, observation of agricultural practices, the state of dwellings in villages and the geography of settlement, maintenance of canal systems and wells and group relations played a supporting role. Most villagers are not trusting of filling out interview schedules or survey questionnaires in India and therefore I had to make handwritten notes with the help of a research assistant. Moreover, since water is a much contested resource and a source of political tension in the command area of the Surya project, qualitative research remained the best way of eliciting responses on access to irrigation. I conducted these semi-structured interviews (with my knowledge of the local language, Marathi) and observation with farming communities and their experiences with water scarcity in order to construct a picture of political and economic changes and livelihoods in the project area.

A census of farmers from the irrigation project in both villages was gathered from the data shared by the Irrigation Department on the canal minor systems in Sakhare and Vanai. The Department also maintained topographical maps on the canal minor system that were used to mark the locations of the large Vadaval farmers on the canal system. Later these maps were used to map social differentiation in the villages. Before conducting a 35% random sample survey with farmers who owned or leased land on canal systems in both villages, an earlier round of semi-structured interviews was conducted as part of a snowball sample on experiences with water scarcity on canal minor systems. Purposive snowball sampling was used to choose farmers for the first round of semi-structured interviews. 50 farmers (mostly heads of households were interviewed) in each of the snowball rounds in both villages during the irrigation season, December 2007-June 2008. A total of 154 farming households were covered in this entire period. In the later survey round in May, a 35% random sample of farmers based on their landholdings was created from the census and the survey (attached in appendix) was administered after the snowball survey was completed. Farmers who owned, leased or accessed land plots which were two or less hectares were classified as small and marginal farmers (Mollinga 2003). Farmers who owned or leased ten hectares or more were categorized as large farmers. Access to land holding data and the stark inequality in land ownership and control made the task of researching social differentiation easier. Questions in both rounds focused on access to the canal system and experiences with access to water. Care was taken not to repeat the survey with farmers who were interviewed in the earlier qualitative snowball round. I chose only

those farming households which listed agriculture as their main occupation. The survey questionnaire and the interview schedule are attached as an appendix to this thesis.

2.7 Qualitative Interviews

Semi-structured interviews with farmers and engineers were conducted only after a social rapport was established. In addition to semi-structured interviews, I also conducted open-ended conversations which were used to supplement information from the interviews. These conversations took place at farmers' homes, in their fields and in public settings such as local grocery shops, tea shops (cafes) or the local dairy cooperative. Interviews with the engineers of the Surya project took place at their homes (often in Mumbai) and in tea shops. Respondents tend to be open during informal interviews and people in rural India are eager to chat when one runs into them in the village. Such interviews and conversations were supplemented by continued analysis of secondary data, such as maps and agriculture data, procured from the village revenue officer and the Irrigation Department, on land and water use.

I used village maps that indicate type of irrigation facility and which are available from the canal officer. Information from these sources were used to provoke discussion with farmers about patterns of water use and also to place material gleaned from interviews in their appropriate physical context with help of maps of the canal minor system in the villages. During my stay in the villages, I also observed local village society in an anthropological mode of investigation, focusing particularly on social relations between various castes and classes of farmers, the role of water and land

institutions and the experiences of farmers with water access on the canal system in the villages. Most of the recent ethnographic research done on irrigation in agrarian studies in India on which this study is modelled has been done with the help of a long extended stay in villages as a temporary resident (Dubash, 2002; Mollinga, 2003). I have also had work experience in Thane district as a social worker, which makes me familiar with the customs, language and mores of the tribal, Maratha-Kunbi and Vadaval communities. Since I often stayed in the two villages in this period, the economic polarization between the tribal community and the Vadavals became far more obvious. I simply chose to be an observer and not openly participate in the various political agitations and lobbying around water which take place in the district. I was present only at one protest meeting in Dahanu in August 2008 as an attendee, but this was primarily to take notes on a new anti-dam movement. Nevertheless, I did depend on second hand accounts of such political activity through local newspapers and activists, which provided me with more clarity on the broader politics of water in this particular area in Dahanu block. These are aspects of water politics which can only be discerned through fieldwork and such ethnographic presence. Ethnography in this context is more about a mode of data collection where fieldwork is central and pays attention to the interlocking of multiple socio-political sites and locations in Dahanu and Thane district (Gupta and Fergusson, 1996).

2.8 Logistics of Qualitative Research

A record of the names of respondents throughout the fieldwork was maintained, along with the time and location at which I spoke to them and their contact address. Some of the names of the respondents, especially engineers were kept confidential to meet the research and ethics protocol of Western University, where this dissertation was drafted. Some farmers also wished to stay anonymous, though a majority were comfortable giving their names. The politically sensitive nature of fieldwork in this area also meant that I have assigned pseudonyms to people who made such requests.

Two further kinds of records were kept while conducting this research:

1) **A field note log** where I jotted down notes from an interview as the communities were not comfortable on my reliance on tape recorders. Notes were also taken to assist in debriefing myself after an interview about the encounter – the nature of context and interaction in situations relevant to the research. This log included notes on any ad-hoc encounters with participants (e.g., a social gathering attended by many participants).

2) **A research diary** was maintained. The diary was a record of how I tried to obtain interviews, my encounters with farmers and my concerns and further questions that arose during the research process. I also included comments on my shifting positionality during the interviews and recorded my initial reactions to the interview sessions. Although some of this information was jotted down in my field note log, the research diary recordings provided context to the interview process.

I see these methods (semi-structured interviews combined with field log and diary) as the most appropriate in seeking to answer my questions around access to irrigation water and experiences with water scarcity. Ethnographic approaches complement surveys because village economies and economic relationships within and between villages are embedded within social relations, and these are best understood through the sort of in-depth “thick description” that an ethnographic approach can provide. Given the centrality of caste-based politics and institutions in the distribution of water in this context, the use of such qualitative research tools were key to understanding the socio-political processes which underlie access to water.

2.9 Timeline of 2008 Field Research and Organizations that Helped in Research

In between the stay in villages, the period January-February 2008 was also used to gather reports and data from district offices on irrigation. Secondary information on land records was gathered from the village revenue officer on landownership within the village. Data on net sown area and irrigated area (from canals and wells) in villages as held by the Surya project irrigation office. I gathered data for the last ten years and this helped me make some broad observations on changes in cropping patterns and agrarian structure in the villages. I also renewed contacts with organizations such as the Kashtakari Sanghatana in Thane district once I returned for field data collection to India in December 2008. Prior contact was established during an earlier field session in 2006. Other organizations with which I renewed contacts during the 2008 field research are the Maratha-Kunbi Sena, the Kashtakari Sanghatana and the Communist Party of India

(Marxist) as well as individuals such as Mr Navneet Shah who lives in Palghar block and was central to the legal advocacy efforts on the Surya dam issue. Further information and progress on the advocacy front was gathered from these organizations and individuals and their respective opinions and evaluation of the local politics was sought and analyzed to summarize the developments around water politics in the area in the past year. Due to the presence of the Surya project, the Dahanu area is at the centre of an intense political contestation around water. It was vital to update my understanding of the social, political and economic context through my access to these individuals and organizations. It also helped me develop a better understanding of the rural context which I was going to research. All the above mentioned organizations and individuals maintained good written records and documentation of the media coverage of the issue, which was also accessed and provided the much needed context for my interviews and ethnographic research. This part of Thane district had been witnessing social and political ferment over water throughout the 2000's and local newspapers covered the events around water very well. Such secondary accounts from the media do not address any research questions on their own, but supplement and provide broad support to the data gathered from semi-structured interviews with villagers, engineers, officials and activists.

The bulk of interviews, surveys and ethnographic research in Dahanu block were conducted between January and June 2008. I also stayed for a brief period in both villages during this period. Most of the interviews and the surveys were conducted before the start of the monsoon (rainy) season in June, 2008.

2.10 Analytical Strategies

All names of farmers, engineers, planners and most politicians provided in the dissertation from the interview and survey data are pseudonyms. This was in keeping with the ethics protocol of Western University to impart anonymity to all respondents. All interviews that inform the three papers were first hand written in the local language, Marathi (with the explicit permission of respondents) and duly transcribed. Respondent confidentiality was strictly preserved at all stages during transcription. Interview data was supplemented by field logs. A monthly report submitted to my PhD Committee also helped me summarize fieldwork. These data were ordered and interpreted using the qualitative data management software package NVivo. At the end of all the interviews, interpretative reports were built on the descriptive reports to suggest what findings might mean and take alternative explanations into account. Themes arising from the interviews (corruption, land grabbing, fencing of canals, hydrometric area, laws, Mumbai) were coded with different colours and different answers were given to different colours. A count of the various themes (e.g. land, political contacts, water, canals, rules, rotations, corruption, outlets) which emerged, was maintained. I kept electronic copies of the data on a computer so as to make analysis easier later. In terms of coding, I reviewed data documents, stored electronically, line by line, developing codes to represent themes, patterns and categories. Discourse analysis guided my conceptual development of the themes, patterns and categories, which emerged as the data were transcribed. I often returned to the conceptual and empirical literature around

water in human geography, political economy and agrarian studies for guiding my further fieldwork strategy.

Due to the lack of literature on irrigation in this region, I had to rely majorly on the reports provided to me by the Irrigation Department and the reports I found at the Mumbai Metropolitan Regional Development Authority (MMRDA) during my fieldwork. Thus, though my approach was inductive, this does not mean that I approached fieldwork devoid of any theoretical expectation. I deployed both institutional theory and tools I had learned from political ecology to determine situations that appear anomalous and aimed to reconstruct theory to address these anomalies as fieldwork proceeded. An instance of this was my attempt to develop a grasp of the rules that were used to regulate canal irrigation in this area around Mumbai. As secondary literature on Konkan irrigation was lacking, I relied on making very detailed notes from my conversations with engineers and villagers that eventually helped me write Paper One and Paper Three in this dissertation. Comparisons of the Konkan with research literature on the drier canal irrigated regions of interior Maharashtra and India helped me understand the formal rules and also the informal norms that influenced the day-to-day governance of water in the Surya project.

All hundred interviews with farmers in both villages during the first round (where I had snowballed respondents) gave me a clear idea of the causes behind the scarcity on the canal minor system. A map that provided a layout of the canal minor system from the Irrigation Department for Sakhare village was printed and plotted on the basis of crop patterns with the help of local villagers. The map was used to verify

claims made by farmers in this round of interviews. Canals and large farms were traced on the map by actually walking through the entire length of both villages. Since most canal sub-minors were breached at certain points and fenced off into large farms, and the latter were inaccessible to outsiders, accounts narrated by neighbouring farmers and wage labour who worked on these farms were used to develop a picture of social differentiation and water conflict. Often, the large farmers invited me to their farms, but the access was limited to viewing the vegetable crops and wells. The sub-minors and canal minors (that were government property) were concealed from my view, however I did manage to take one picture of how water was stolen on a canal minor from within a large farm that had illegally encroached on the system. Visits to other villages in the horticultural belt confirmed that this was part of a widespread pattern of water grabbing in this entire area.

The first round of interviews was conducted at the head, middle and tail reaches of the canal minor system in both villages. It helped me answer questions on how location on the canal minor system was a major determinant for the small and marginal tribal farmers in their access to water on the system. However, for the large farmers, due to their control of land on various reaches of the canal minor system, location did not really matter. The interviews also revealed difficulties with the canal system and the heavy flow of water that was experienced by both tribal and the large non-tribal farmers, an aspect that would not have been revealed, if I had relied purely on a closed ended survey questionnaire.

The produced nature of water scarcity became obvious during this first round. At the same time, the theory and empirical research on Indian canal systems did not help me a lot during field research as the canal system was designed to meet water on demand from farmers. More importantly, the system also witnessed massive wastage of water. Therefore, I relied on developing good field notes and also took pictures that were later used to understand experiences of farmers. These notes and pictures became useful after the publication of Bruce Lankford's book (Lankford, 2013) that dealt critically with the conventional academic and policy analysis of the wastage of water and underutilization in irrigation systems and water policy. The Surya canal system was a productive irrigation system where water was available for a second paddy crop, but suffered from underutilization. While it had some protective features, it was a project designed mostly to increase agricultural production in a water rich belt.

Lankford's theoretical understanding of water wastage in irrigation systems like the Surya arrived only during my writing stage, but proved to be very useful in developing the institutional and political-ecological framework that informs this dissertation. It also became useful in understanding the phenomenon and politics of water underutilization (see Paper Three and Question 1 & 2 in the Introduction). Thus, the detailed field notes on scarcity (in the context of massive water wastage on the canal systems) from the interviews and observation during this round eventually proved to be very beneficial.

During fieldwork, analysis of the qualitative data from the earlier round of interviews helped me develop a picture of social relations in this area and a survey

questionnaire for the next round was developed in April, 2008 for the two villages under study (attached in the Appendix). While the first round of interviews was very useful and yielded a lot of information on experiences with water access on the canal system, I saw the importance of a survey round to triangulate findings from my interviews with engineers and farmers and their experiences of water scarcity and management on the system.

2.11 Survey Data: Triangulating the Interview Data

Since the canal system in the villages was the unit of analysis, *a census of farmers on the canal minor system according to land ownership* was created from the data provided by the Irrigation Department. The methodological strategy followed for this round of research was based on Mollinga (2003). The village command area was subdivided into sub-commands on the maps provided to me by the Irrigation Department. Canal Minors that were chosen for the sample survey were different from the minors and sub-minors that were covered in the semi-structured interviews. Once a census of beneficiaries was developed, a total of 31 farmers (in both the small and marginal and large categories and based on a 35% random sample of the census) were surveyed on two canal minors in Sakhare. Similarly, a total of 23 farmers (based on a random 35% sample of the census) were surveyed on the canal minor system in Vanai.

All rice cultivating small and marginal tribal farmers in both villages came under the small and marginal category as they owned or accessed less than 2 hectares of agricultural land which was often sub-divided between family members. There wasn't a

single large landholding tribal farmer who grew commercial crops in this particular region. The large Vadaval farmers (who owned more than 10 hectares of land on average) had already been identified during the earlier round of interviews. The objective of this round was to investigate water access on the canal system and verify findings made during the earlier round of semi-structured interviews. Data on questions relating to water access (non-access to irrigation water) on the canal minor system was tabulated from the survey in the second round in the villages and is presented in the tables and empirical analysis in paper three, which deals with canal irrigation. Responses to specific questions on water were counted and the reasons behind lack of access to water (unlevelled land, enclosed canal, poor maintenance of canals, cattle problem etc.) were categorized. Other socio-economic data not directly related to access to water was gathered during the survey, but is not used in this dissertation.

The surveys were conducted with the help of a research assistant who was familiar with the geography of the canal minor system and the issues with water access and land titles in both villages. The experiences of farmers with issues relating to access to the canal system were also collated during the socio-economic survey. These were later assembled and triangulated with the findings from the earlier round of qualitative interviews that were conducted during the snowball round. The survey round mostly confirmed the findings of the earlier round of interviews on water scarcity, but yielded some additional information on the loss of land by tribal farmers on the canal system.

Data on the extent of landownership of large farmers in both villages had been gathered during the initial snowball round, but was confirmed with more recent revenue

tables that were made available from the engineers. The revenue tables also revealed the presence of conjunctive use of water by the large farmers who had constructed wells to tap into the re-charge of groundwater made possible by canal irrigation.

During the survey round itself, I also sought information on the experiences of the villagers with the engineers. This was done to verify the information provided by engineers on the canal system and their own impressions about the rural population. My stay in the villages and the informal conversations yielded rich information on the irrigation engineers, the guards on the canal system and the maintenance work on the canals. Most members of the tribal community were conspicuous by their absence from employment in the Irrigation Department, at the same time, since they worked as wage labour on maintaining the main canal levels, they were well informed on the quality of the maintenance work and the water rotations on the canals.

2.12 Conclusion

Field research undertaken as part of this dissertation was closely complemented by library and archival research (already outlined above). The narrow specialized research on the Konkan region's irrigation by local economists (Mitra, 1990) provided some empirical data, but was more of a hindrance in understanding local water policy. Policy and committee reports, archival data and the easier availability of data on the internet on issues around Maharashtra irrigation helped me more in framing the arguments and developing a historical understanding of how water policy had evolved in this region. This policy dimension finds its place in all three component manuscripts

in the dissertation. This became especially important when I was drafting the dissertation, as one of the objectives was to understand the role, governance and policy had played in shaping the water conflict in the Mumbai-Thane region. The focus on institutions was greatly enabled by access to historical data on the Mumbai water supply system (made available from libraries in the UK, US and Canada) that was woven into the dissertation's theoretical framework.

The qualitative methodological tools and strategy that informed research for this dissertation proved to be very useful in developing a broader institutional-geographical profile of the water situation in Mumbai-Thane region. At the same time, I was unable to utilize the rich census data that was available because of the focus on social and political processes that underlie water access in this region. However, where possible, background statistics on local demography and water use from the Indian Census, Water Budgets of the Government of Maharashtra and reports provided by the Irrigation Department have been provided throughout the dissertation. This will give the reader an idea of the changing geography of water utilization in the Mumbai-Thane region.

Notes

1. Underutilization of irrigation water in a particular project is measured in two ways. If the actual irrigated area irrigated under different crops during a season turns out to be less than the area visualized, proposed and designed by project planners to be irrigated during the season, then it may be termed underutilization. Alternatively, if the volume of irrigation water used by farmers during the season turns out to be less than the quantity of

water designed to be supplied during that season, it may be termed underutilization (Mitra 1986, 1990; 1998).

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3. Canal Bureaucracy and the Corruption Nexus around Water in the Mumbai Hinterland: Questions for Development and Governance in Maharashtra, India

3.1 Introduction

As a case study of an irrigation project, this paper examines corruption in the context of the Surya Dam Project located in the Konkan, west coast region of Maharashtra State, India, just outside the boundaries of the Mumbai Metropolitan Region (MMR). Surya is one of six large dam projects constructed since the 1980s, and was designed as a multipurpose dam to tap the waters of a major and important river outside Mumbai. Its primary purpose was to produce hydropower and irrigation for 24,000 hectares of agricultural land in a predominantly tribal belt of Konkan. Yet it has also come to supply one of the fastest growing peri-urban regions of Mumbai with water for domestic and industrial use - especially two urban townships of the MMR.

The paper begins with a review and evaluation of existing literature on development and political economic corruption in India. From there it can be argued that, to understand the politics of water in that context, it is also essential to understand the role of the lower level bureaucracy in greater detail. In particular, lower level engineers tend to be the chief instruments and purveyors of development benefits from large multipurpose dam projects to rural populations. One of the objectives of the paper is to provide a general theoretical background for a critique of existing literature on water-sector corruption in India. This paper will thus examine a range of theoretical and case study research on corruption, by a wide range of social scientists. It will also

analyze the organizational structure of Surya project, as well present a case study on chronic corruption in the Maharashtra Irrigation Department. This paper concludes by making a case for a more layered understanding of the lower level bureaucracy (including its treatment of lower caste and tribal communities), as well as for reform of governance in irrigation projects. The conventional understanding of the political-bureaucratic nexus around corruption in irrigation projects in India has been firmly represented in Indian social science scholarship by Robert Wade's classic papers of 1982 and 1985 (Wade, 1982, 1985). While acknowledging the strengths of Wade's arguments, this paper points to the weaknesses in his use of the rational choice framework to explain the behaviour of junior bureaucrats who are unwilling or are uninterested in transfers to other locations. The chapter identifies possible reasons for junior bureaucrats not to seek promotions or transfers because of the potential for skimming off developmental subsidies in economically backward areas. In the context of this paper, I highlight the nexus of politicians, bureaucrats and rural oligarchs who project a myth of undeserving poor tribal farmers in helping justify water diversion to urban areas.

3.2 Corruption and Bureaucratic Transfers: Rational Choice, and Ethnographic Research on Corruption in the Water Sector of India

3.2.1 Geography of the Project

Historically in the state of Maharashtra, areas of low rainfall have been the focus of large dam building projects. Since the Colonial period, such projects have been

concentrated in the Western Ghats and the drier, southwestern region, to benefit interior areas. Dams built on the eastern end of the Western Ghats mostly conveyed water to agricultural fields of Western Maharashtra via long aqueducts, ensuring that the drier, southwestern parts of the state were sheltered from threats of drought (Government of Maharashtra, 1984; Gadgil and Guha, 1995; Government of Maharashtra, 1999). However, by the late 1960s and 1970s, new engineering technologies made it possible to build large dams in western parts of the Sahyadri mountain range (part of the Western Ghats) in coastal Konkan region. Subsequently, this potential was publicized and projects for irrigation in this region were expanded (Government of Maharashtra, 1981a, 1981b).

Until then, dam projects in the Western Ghats around Mumbai had mainly focused on building medium, independent reservoirs to supply water and hydroelectricity for the city. Constructed at a huge cost of millions of rupees, the two large storage reservoirs of the Surya project were completed in the late 1970s, while the staff quarters and divisional offices (where I conducted field research) were completed in the early 1980s. Like many large, multipurpose projects in Maharashtra State, the canal building work for Surya was obstructed by hilly terrain and a lack of environmental clearances from the Forest Department. It was only in the early 1980s that the project began to provide irrigation for about two thirds of the command area and only in the late 1990 was a greater area brought under irrigation. More than three quarters of the canal works for Surya project are now complete, but the rest remain

unfinished due to a continuing lack of environmental clearance for raising the height on one of the project reservoirs.

Currently, most of the project income comes from urban and industrial revenues, while the bulk of water storage remains utilized for canal irrigation. At least 20% of total water from the two Surya reservoirs is conveyed to industrial areas just outside metropolitan Mumbai, including one of the fastest growing townships in the MMR. As such, the Surya project has become a lightning rod for contentious water politics in the region. This involves, on one hand, NGO's and social movements representing rural, mostly tribal, agricultural communities. On the other hand are real estate lobbies with an interest in profiting from the urban expansion of the MMR at its fringes. For local, tribal farmers, access to canal irrigation from a large project like Surya facilitates a second yearly crop, which reduces their dependence on seasonal migration. Access to such irrigation also enables them to diversify food grains production to include vegetables, fruits and other cash crops. It is estimated that such irrigation also helps to reduce poverty by about 50%, compared to Maharashtra households without access to irrigation (Panda, 2007).

3.2.2 Wade's Research on Corruption

Robert Wade's classic studies of corruption in the bureaucrat-politician nexus set the standard in the field of development studies for research on corruption and governance (Wade, 1982, 1985). Wade's framework for studying reasons behind bureaucratic corruption is especially useful and important here, when we consider

methodologies and theoretical framings in the specific context of Maharashtra and the MMR. This analysis and summary of Wade's work begins with a review of his methods and theory, highlighting their strengths and weaknesses. It then lays out the foundations of an alternative strategy that provides for a more context-specific account of bureaucratic corruption.

Two of Wade's papers are rooted in ethnographic research conducted on the canal system and irrigation bureaucracy in Andhra Pradesh, India during the late 1970s and early 1980s. Wade sought to analyze the reasons behind the sub-optimal performance of large scale canal irrigation systems in India by combining a focus on the governance of water distribution (on the main canal level) with the administrative functioning of the state Irrigation Department. He later used these findings to produce a generalized framework that focused on transfer turnover to explain the underperformance of the Indian state in overall economic development (Wade, 1985). Borrowing extensively from disciplines as diverse as economics, political science, social anthropology, public administration and irrigation science, Wade's framework for understanding the bureaucratic-political nexus in Indian irrigation highlighted how corruption has been facilitated by a market in public office (Wade, 1985). Wade's main argument was that the control exercised by politicians over the postings of bureaucrats has engendered a corrupt, hierarchical structure, where bribes become exchanged for lucrative postings. That, in turn, results in a distorted and malevolent structure of water governance.

That structure facilitating the exchange of bribes has had negative implications for the performance of irrigation systems in modern India. Another important contribution of Wade's research is his policy prescriptions for reform, to mitigate the negative impact of the politician-bureaucrat nexus - which still inform policy research on administrative corruption in India¹.

Wade identified five major causes underlying the persistence of corruption in the Indian irrigation bureaucracy. According to him, some causes can be generalized, while others are very specific to the irrigation sector. First I will examine whether the causes identified by Wade still persist in the contemporary Indian water resources sector. Then I will review the social sciences and policy literature on corruption that pertains to Indian development.

Wade's five underlying causes of political-administrative corruption in the irrigation sector are as follows:

- Electoral institutions that amplify pressure toward corruption and make it systemic;
- Political control of the irrigation bureaucracy through transfers of bureaucratic staff;
- Lack of user participation and control in irrigation projects;
- Scarcity of water resources;
- A wide gulf (in education and status) between Irrigation Department officials and rural, user-populations.

Today, all of the factors observed by Wade that characterize poor governance continue to persist in the public administration of Indian water agencies. And elections and election funding remain as major factors underlying the Indian politician-bureaucrat nexus (Government of India, 2007). Politicians also continue to exercise their control over water-sector transfers and regulation in order to earn rents, which then fill ‘war chests’ that help them maintain or expand their power during elections, or after fragmented electoral outcomes (Das, 2002; Debroy and Bhandari, 2012; Corbridge, 2013). Indian daily newspaper reports of politicians with wealth and assets disproportionate to their declared sources of income also indicate that political power is used to amass wealth. Thus, Indian politicians' influence and control over bureaucratic transfers persists at several levels (Jenkins and Goetz, 2005; Heston and Kumar, 2008) - despite recommendations of the Second Administrative Commission which recommended reducing such political involvement in the bureaucracy (Government of India, 2007, Ch. 6).

In terms of Indian water-sector reform, Wade's advocacy for greater user-participation in irrigation planning has seen only limited success (Ballabh, 2008; Joy and Paranajpe, 2008; Vaidyanathan, 2010; Shah, 2012). Although some canal-irrigated parts of the country have witnessed some successful participation by farmers' water-user associations, such involvement in large irrigation projects has generally failed to bear fruit in large parts of rural India that are serviced by canals. The consequence of low participation at the local level, and farmers' inability to administer water systems they rely on, is that the water-resources sector remains largely centralized, and tightly

controlled and regulated by the irrigation bureaucracy. In this context, scarcity of water resources in India also persists as an influential factor.

Table 3.1: Average Annual per capita Water Consumption in India
Source: UNICEF (2013)

YEAR	POPULATION (in millions)	PER CAPITA AVERAGE ANNUAL AVAILABILITY M ³ /YEAR
2001	1029 (2001 Census)	1816
2011	1210 (2011 Census)	1545
2025	1394 (Projected)	1340
2050	1640 (Projected)	1140

The rapid growth of Indian cities, along with increased cultivation of water-intensive commercial crops (including more harvests per year) has only exacerbated stress and inter-sectoral competition over control of water in several parts of India (see Table 3.1) (Joy et al, 2008b; UNICEF, 2013). Interestingly, recent political-ecological studies on water by anthropologists and geographers emphasize that local scarcity of water may *often be artificially produced* (Swyngedouw, 2004; Mehta, 2005; and UNDP, 2006). Such literature broadly considers how water scarcity has been created/produced, both materially and discursively.² (Mehta, 2005, p. 9). However, produced scarcity is a concept that remains under-utilized in water policy literature. A goal of this paper is to illustrate the role of the politician-bureaucrat nexus in creating such scarcity; how that dynamic supports a myth that poor, tribal communities are unable to use water efficiently for irrigation; and how these help justify diverting water to rapidly growing metropolitan regions. Finally, the wide gulf that Wade highlighted (Wade, 1982) between bureaucrats and farmers, in terms of social status and ability to navigate

administrative bureaucracy, remains true of rural India. While some scholars have attributed this to India's particular evolution and local level structural factors (Harris-White, 2003), recent anthropological and political economic studies support Wade's view of corruption and dysfunction in rural India as a result of socioeconomic differences between upper- and middle-caste government employees, and poor, lower-caste citizens (Shah, 2010; Dreze and Sen, 2013, Ch. 4; Harris and Jeffrey, 2013).

However, although the strengths of Wade's analytical framework remain, his analysis of the corruption nexus in the irrigation sector relies primarily on a model of bureaucratic behaviour in which the influence of non-economic factors is excluded. Both his 1982 and 1985 papers also use a theoretical framework influenced by public choice literature.³ The underlying assumptions there are that bureaucrats and politicians are self-interested, rent-seeking actors solely motivated to maximize their budget allocations, from which they regularly siphon off funds. To a large degree, with minor variations, this simple framework informs Wade's research on corruption. It also informs his framework on how bribes are exchanged, and transfers and lucrative postings are traded, at various levels of the irrigation bureaucracy with collusion from elected politicians. The diagram below illustrates the structure of bribery that facilitates the flow of funds and gifts-in-kind between: 1) various ranks of engineers; 2) senior engineers and politicians; and 3) farmers, engineers and other irrigation staff, which is primarily funded by the theft of resources from operations and maintenance contracts (see Fig.3.1, below).

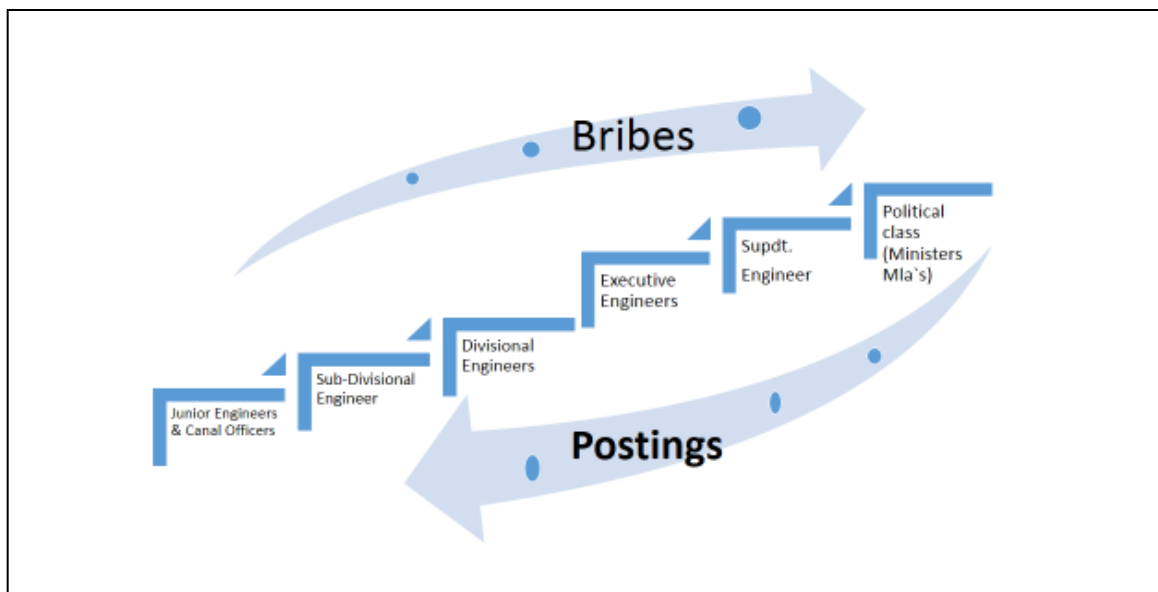


Figure 3.1: Diagram showing the power structure of an Irrigation Department, and the upward and downward flow of bribes and transfers/postings in Wade's framework. Illustration by this paper's author based on (Wade, 1982 & 1985).

Corruption is also exacerbated through the illegal distribution and sale of scarce water, which is in turn facilitated by the subversion of rules on the canal network. The entire explanation is embedded in a framework of how power relations and money or non-monetary exchange flow upwards within the irrigation bureaucracy and the political structures of water governance (Wade, 1985).

In addition, Wade's theoretical framework on corruption synthesizes political and economic approaches to corruption. The political aspect of Wade's model relies on an understanding of formal political structures (i.e. a competitive electoral system) as the dominant independent variable. Complementing this, the economic aspect of his model helps us understand the willingness of a bureaucrat to sell official goods in an informal market driven by scarcity. However, as the political scientist Robert Price writes in his account of administrative corruption in Ghana, there remains a problem

with such a model. Specifically, economic and political approaches to understanding bureaucratic corruption are not by themselves sufficient to help us understand *why* a bureaucrat is willing to participate in corruption (Price, 1975). In other words, Wade's approach does not sufficiently anticipate the extent to which corruption can take complex cultural and organizational forms, and so ignores the influence of certain contextual factors. For instance, the hierarchy of the Irrigation Department in Wade's research is presented as a structure that functions independently of contingencies that are a feature of local politics, such as the social background, aspirations and training of engineers; the social and official hierarchies within the bureaucracy; and the history and geography of water resource development in the region.

An alternative view is that, through his ethnography of the Irrigation Department, Wade was actually attempting to develop a framework to explain the dysfunctionality of the developmental state in India more broadly. In fact, Wade himself acknowledged in his 1982 paper that, while his study on corruption may generally reflect the state of irrigation governance and administration in India, the corrupt administration-political nexus in irrigation might also manifest itself differently in other settings (Wade, 1982, p. 292).

Thus, while Wade's ethnographic work is partly informed by social and geographical particulars of Andhra Pradesh (where he conducted field research) and the influence of certain agro-ecological circumstances surrounding water politics, he does not address how the nexus integrates with patron-client relations in the local state (Khan and Sundaram, 2000; Harris-White, 2003). That omission may partly be due to the

anonymity Wade needed to extend to the main actors and to the irrigation project itself in his ethnography. As such, Wade's account of corruption largely relies on interviews with senior executive engineers, and his 1982 paper communicates a certain kind of deference that assistant engineers, section officers and supervisors are expected to afford their senior engineers. It follows, then, that this dynamic could be changed by the cultural dynamics and local politics of a different context, i.e. where water scarcity is not a defining factor in the design of an irrigation project, and where junior engineers are not motivated by promotional opportunities.

Therefore, in general accounts such as Wade's, which are informed by rational choice and seek universal and parsimonious explanations, the complexity of individual motivations and of administrative and political decision making processes are necessarily excluded. For example, variations in personal identity and interpersonal relations are underemphasized, in a perspective that prefers to see decision-making as predictably stable over time, among individuals commonly motivated by rational, instrumental, utility-maximizing priorities (Griggs, 2007). However, rational choice alone cannot explain how self-interest develops or may evolve (Marglin, 2008), and thus, socio-historical and discursive frameworks remain useful (Mollinga, 2008)⁴. Besides, if we need to understand corruption as a social problem with many layers, highlighting local configurations of corruption could be crucial for effectively informing policy (Corbridge, 2013). Table 3.2, below, highlights methodological differences between researchers who rely more on qualitative and case study methods

(i.e. anthropologists, geographers), versus those who develop more formal approaches (i.e. economists, political economists).

Table 3.2: Corruption in India: Various Methodological Approaches to Research, Across Disciplines.

APPROACHES	PRINCIPAL AGENT APPROACH (Economics)	RATIONAL CHOICE and INSTITUTIONAL APPROACH (Economics, Economic Anthropology, Political Economy)	DISCURSIVE APPROACH (Social and Cultural Anthropology, Human Geography)	ETHICAL-ECONOMIC and COLLECTIVE ACTION APPROACHES (Economics, Political Economy, Human Geography and Anthropology)
FOCUS and METHOD	Institutional and Incentive Structure; self-interested actors. Models	Bureaucratic political nexus; budget maximizing bureaucrat; rules of the game and institutions; self-interested actors Ethnography	Socio-cultural norms, individual subjectivity. Ethnography and case studies	Public Action, social norms, governance of monopolies, social justice, politics of citizenship, affirmative action. Case Studies
CAUSES	Information asymmetry, uncertainty, hierarchy of organizations and risk, natural monopolies	Over centralization, hierarchies, lack of transparency, public sector monopolies, scarcity, transition societies	Neo-Patrimonialism, patron-client relations	Lack of enforcement and punishment, corruption as a problem of public ethics in a fast transforming society.
ADVOCACY	Changing the incentive structure, institutional reform, reducing distortions arising out of resource allocations, electoral competition and a system of checks and balances	Decentralization, access to information and collective action	Social Change and transformation	Legal democratic reform, Role of Media in exposing corruption, strengthening investigative systems, decentralization, transparency, audits & accountability
AUTHORS	Ajit Mishra,(2005) Kaushik Basu, (2011)	Robert Wade (1982 & 1985)	Akhil Gupta,(2012) Alpa Shah (2010), Stuart Corbridge, et. al (2005) Kumar and Corbridge, (2002)	Jean Dreze and Amartya Sen (2013) Stuart Corbridge, (2008) Jonathan Parry (2000)

3.2.3 Critiquing and Reformulating Wade's Framework

Overall, most of the factors that Wade identified through his own research on water-sector corruption in India remain relevant. What essentially makes corruption common in many Asian countries with large canal systems is that it is almost impossible for cultivators to assess water availability independently (Transparency International, 2008, p. 68-69), or to assess the performance of government bureaucracies. For instance, irrigation management agencies are not accustomed to sharing information for the sake of transparency. And with bureaucrats firmly controlling information that remains inaccessible to irrigators, opportunities open up for corruption. For example, large irrigation subsidies for both construction and maintenance are generally provided to bureaucracies in the form of maintenance budgets, without a direct link to performance or output. Then, construction and maintenance tasks are privately outsourced with insufficient accountability for results. As such, large scale dam and irrigation projects are unlikely to succeed unless incentives for corruption among various stakeholders are reduced.

A prime illustration of this culture of non-transparency is the discovery of a recent irrigation scam in Maharashtra State (Jog, 2012) in which a nexus of politicians, contractors and bureaucrats are allegedly involved in fraudulent transactions amounting to hundreds of millions of dollars. On the whole, 14 billion dollars have been spent on dams and canal systems for irrigation since 1999, yet practically this has only increased Maharashtra's irrigation potential by a minuscule 0.1%. Government audits reveal that root causes for such underperformance comes down to poor project governance,

especially through processes that inflate costs. For example, Indian and Maharashtra media have reported of the recent scam that projects were often approved at lower cost, and then costs were gradually increased based on rationales such as augmenting project capacity, or improving the poor state of existing infrastructure. Given the crucial importance of water, and the importance to economic development of its fair and equitable distribution, the entire issue of effective governance over water resources in India has become an important subject in the public policy domain (Shah, 2012 for a review).

Yet, public ownership of water resource development makes reform institutionally challenging. Writing about the challenge posed by corruption in India's government and public service agencies, Pranab Bardhan (an economist) framed the situation squarely within a post liberalization environment defined by growing industrialization and political fragmentation:

Several scholars associated corruption with the excessive regulation of the Indian state and there was also a belief that a reduction in regulation would reduce the incidence of corruption in the bureaucracy and also undermine the bureaucratic-political nexus. While economic liberalization has meant a significant reduction in the discretionary power of the central bureaucracy, particularly in trade policy and industrial regulation, the state governments still retain a great deal of leverage on the industrial sector at the ground level through their control of land, water and electricity and labour and environmental standards. It

is in the regulatory apparatuses of the state and local governments that a lot of the corruption in contemporary India is concentrated. (Bardhan, 2012: p.4)

This paper describes just one instance of the corruption nexus, situated in an important tribal belt in coastal, western Maharashtra, India. I am not attempting as comprehensive or ambitious an explanation as did Wade, through his study of the corrupt administrative-political nexus and market for transfers. Indeed, my original research plan did not even focus on corruption in the bureaucracy. Rather, my field research primarily aimed to better understand the social, economic, cultural and geographical impact of a large irrigation project on a rural society located in the hinterland of a large metropolitan city. However, in the course of my ethnographic research I frequently encountered endemic corruption in the state Irrigation Department. I also observed the persisting, generally poor state of the canal system - despite its massive maintenance budgets. Local farmers also repeatedly described to me their own encounters with bureaucratic corruption. And, during my research, the Maharashtra media's reporting of corruption in the irrigation project pertinent to my study provoked several interesting insights for me about this phenomenon.

By focusing on corruption, I am also responding to recent pleas by both economists and other social scientists for more case studies to help us understand this phenomenon of corruption better. For instance, advocating for more case studies on corruption in the water resources sector, Peter Mollinga has written:

We need such analysis to understand better the structural dynamics of the sector, which includes the systemic features of corruption and many other issues to engage more effectively with the policy process and to establish more constructive engagement among the interest groups concerned. (Mollinga, 2008: p. 346)

3.2.4 Organizational Structure of the Surya Project

In many ways, the hierarchical structure of Wade's Irrigation Department in Andhra Pradesh mimics itself in Maharashtra. Given that the Surya project was handed over for at least a decade to the Command Area Development Authority, there is some overlap between the general structure for the Maharashtra Irrigation Department and the organizational structure of the Surya Project (see Fig. 3.2, below). Within the Surya Project there is one division under an Executive Engineer, who is responsible for the maintenance of irrigation works and management of irrigation in the field. The Executive Engineer is responsible for executing irrigation policy as per the Superintendent Engineer's directives. The Superintendent Engineer in the Irrigation Circle Office is the administrative head at the regional level. He has full authority to sanction the allocation of irrigation water in the region for different purposes, and approves the annual utilization of storages, as well as the irrigation program from year-to-year. The Executive Engineer of the project plays an important role in the day-to-day supervision, management and regulation of canals. He is assisted by: a) Assistant/Deputy Engineers; b) Sectional Officers; c) a Canal Officer; and d) Measurers.

Operations and maintenance tasks remain the responsibility of the project's construction wing. Within the construction wing, each division has a subdivision that is entrusted with operations and maintenance tasks.

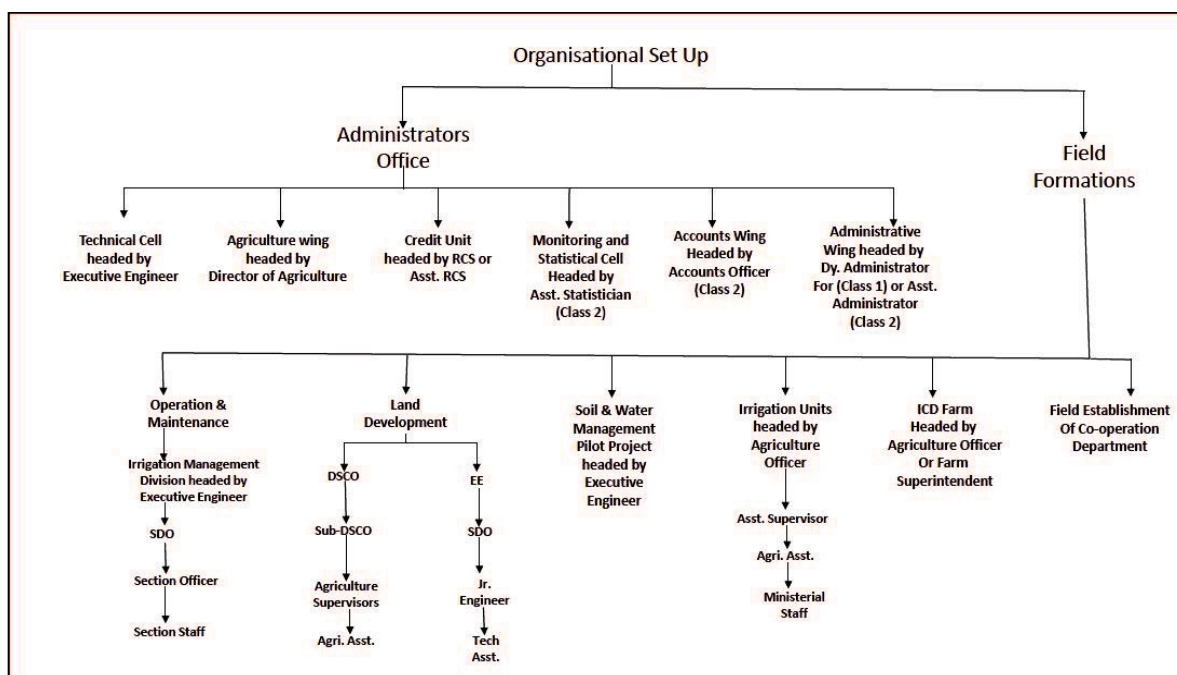


Figure 3.2 - Organizational Setup of Surya Multipurpose Irrigation Project. Source: WAPCOS (1996). *Socio Economic Survey Report: Evaluation Studies for Command Area Development Programme* New Delhi. Surya-Maharashtra. New Delhi: Water and Power Consultancy Services (India) Ltd.

Contrary to Wade (who in his Andhra Pradesh study posited a correlation between corruption and a high turnover/transfer rate of engineers), my Maharashtra case study argues that the Junior Section Engineers and Canal Officers on Surya Project have largely avoided transfers to other locations and managed to keep their positions in a tribal belt for two decades. Lower level bureaucrats tend to be information-rich, have a good understanding of how local society and politics work, and by virtue of their residence in the command area of dam projects often have close relations with the dominant caste-groups in rural/tribal regions of India. I use the term 'recalcitrant

bureaucrats' to explain both the resilience and the ability of these Junior Engineers to retain their posting in a tribal belt for such an extended period. I attribute their staying power to their ability not only to earn unofficial rents from corruption, but also their skills at navigating the administrative system and local politics.

This case study thus focuses on *lower level bureaucrats* who prefer to remain in tribal areas of Maharashtra and who are central to the entrenched nexus between local bureaucrats, politicians and powerful economic interests (Meeta & Rajivlochan, 1997). Such *recalcitrant bureaucrats* in water departments prefer to remain in their locations because their particular regions attract huge subsidies and cash transfers from the state and central governments. To their further advantage, such regions usually have illiterate populations, weak structures of checks and balances, and administrative systems that continue to function in isolation from other systems of self-government that have evolved in tribal areas of Maharashtra since the late 1970s.

This administrative structure is important to analyze and understand if one is to gain a better grasp of how and why development projects in tribal areas often fail to deliver benefits to local people there. This case study should also be considered in the broader context of political and social ferment within contemporary irrigation politics in Maharashtra, including growing contestation and disputes between cities, rural hinterlands, and various other regions in the state over allocation of water resources (Wagle et al, 2012).

Within this study I present data on the resistance of this lower section of the Irrigation Department bureaucracy towards the stratagems of Senior Engineers,

highlighting fissures between executive-level Senior Engineers and lower-level Section and Assistant Engineers. This focus on lower-level bureaucrats supports and affirms the recent direction that geographers and anthropologists (Corbridge et al, 2005; Shah, 2010; Gupta, 2012) have charted in researching frontline bureaucracies responsible for supervising and administering welfare and development programs in rural India. This approach is crucial in order to understand the role of lower-level bureaucracy in rural, tribal areas of India which has often been blamed for poor development outcomes (Government of India, 2008; World Bank, 2011; Meeta & Rajivlochan, 1997).

Moreover, this study has been conducted in the context of a *productive* irrigation project. Unlike *protective* irrigation projects, in a productive irrigation project water is not rationed, and is available to meet revenue and food production objectives. Productive irrigation is characterized by high irrigation intensity, is demand oriented, and production is geared towards the marketplace. The operational design and organizational structure of productive irrigation projects are geared towards meeting demand for water, which is not scarce in this context (see Table 3.3, below, to further understand the difference between protective and productive irrigation).

Table 3.3: Protective and Productive Irrigation - Source: Narain (2003)

TECHNICAL CHARACTERISTICS	PROTECTIVE IRRIGATION	PRODUCTIVE IRRIGATION
IRRIGATION INTENSITY	Low (around (100%))	High (200% and more)
DUTY (acres/cusec)	High (low water supply)	Low (meeting crop water requirements)
CROPS	Low water demanding (Sorghum, millet, oilseeds, so forth)	High water demanding (rice, sugarcane)
OPERATIONAL DESIGN; ORGANIZATIONAL CHARACTERISTICS	Supply-oriented	Demand-oriented
WATER AVAILABILITY	Planned scarcity requiring rationing	Planned sufficiency, no rationing needed
CROPPING PATTERN	Prescribed, or controlled by government (except warabandi system)	Farmers choice
WATER-FLOWS; SOCIO-ECONOMIC CHARACTERISTICS	Constant	Varying with demand
YIELD OPTIMIZATION PER BENEFITS	Unit of water spread	Unit of land concentrated
MAJOR OBJECTIVE	Food security/poverty alleviation	Agricultural growth
FARM LABOUR	Emphasis on family labour	Emphasis on wage labour
ORIENTATION	Towards subsistence	Towards the market

3.2.5 The Centrality of the Lower Level Bureaucracy

This case study focuses on divisions and tensions in a local irrigation bureaucracy in the broader context of researching the Surya Dam Project at the main canal level. This case study emerged from my dissertation research, which largely focused on the impact of a large surface irrigation project in a small agricultural belt upon the local tribal community. My units of analysis were two villages located at the middle and tail-end of the main canal system. My research used mixed methods including semi-structured interviews; ethnographic research; and review of newspaper articles from 2008 that focused on the activities of Sub-Divisional Officers, Section and Assistant Engineers, and Technical Officers in the irrigation bureaucracy. While conducting qualitative interviews and surveying farmers who experienced water scarcity, I also came across numerous media reports of chronic corruption in the Surya Project. Most of the newspaper articles focused heavily on corruption in the irrigation project, including accounts of corrupt practices related to canal system maintenance contracts.

My examination of the engineering bureaucracy was largely centred around junior-level officials (mostly Section Engineers and Canal Officers) who had risen through the ranks yet in some cases remained posted to the Surya Project for more than twenty years. My research of junior-level officials was conducted at a Sub-Divisional Office where engineers of various ranks were interviewed. My focus on the junior ranks of the bureaucracy is deliberate. While I enjoyed close access to senior (executive-level) engineers, two of the Executive Engineers I interacted with commuted to suburban

Mumbai and so could not devote enough time to my queries. In contrast, the junior-level of the bureaucracy resided on-site in living quarters constructed by the dam project, and were always available to answer my questions.

This lower segment of the bureaucracy has tremendous clout in the implementation of project goals because of their familiarity with everyday, local politics and their experience with micro water management in command areas of irrigation projects. Their mastery and application of operational routines thus puts power in the hands of such Section Engineers, who have little formal authority in the department's hierarchical structure, but who still exercise significant control over implementing policy day-to-day. These frontline staff carry out day-to-day tasks for the Irrigation Department, enjoy discretion in how they implement project objectives, and are information-rich because they know the farmers and other local stakeholders well. In that sense, they are close to what the political scientist, Michael Lipsky, defined as street level bureaucrats (Lipsky, 1981). In general, such lower level employees also have different priorities than their superiors, as well as interest in minimizing danger and discomforts of the job while maximizing official and unofficial income.

My focus on this section of frontline staff is partly inspired by a wide body of recent ethnographic literature from geographers and anthropologists on corruption and governance that focuses on the treatment of the rural poor in India by lower level bureaucrats. (Kumar and Corbridge, 2002; Corbridge et al, 2005; Shah, 2010; Gupta, 2012). In the context of Asian irrigation, Wade has himself pointed out the importance of studying 'street level bureaucrats' (Wade, 1992, p. 306), although his paper on the

subject focuses more on irrigation guards rather than Section and Assistant Engineers. Moreover, even with his focus on the irrigation guards who police the canal network, Wade's paper is ethnographically 'thin.' Thus, while I remain in agreement with Wade that incentive structures play a role in corruption, I modify his framework by focusing on the lower level bureaucracy and the lack of bureaucratic turnover at that level to provide a more thick and contextual description of corruption in the local Irrigation Department.

In my work I attempt to describe how fissures within the Irrigation Department may cause the bureaucratic-political corruption nexus to manifest differently in a tribal context, albeit with still serious social and economic consequences for poor, tribal farmers. This consideration of water politics is in the context of a dam project that not only caters to a wide agricultural belt, but also delivers water to an important, rapidly growing town in the northwestern Mumbai Metropolitan Region. Essentially, it is the *socio-spatial transformation of a major tribal-agricultural region* directly under the influence of a major metropolitan centre (Mumbai) that has caused a change in *the incentive structure for corruption at the main canal level*. This, in my view, points toward a new moral geography and political economy of the expansion of large Indian cities. This 'intermeshing of scale' necessitates an analysis that combines both a geographical and anthropological framework. This case study also critically analyses the consequences of two parallel administrative systems (tribal and Irrigation Departments) that function in this region. I argue that the absence of any tribal

personnel in the local irrigation project has facilitated an administrative environment in which corrupt practices flourish.

3.3 Social Relations, Politics of the Commons, and the Role of the Lower Level Bureaucracy

This section is based on detailed interviews with two Executive Engineers, four Section Engineers, one Technical Officer, one Administrative Clerk and two Sub-Divisional Officers over a period of nine months in 2008. I also had the opportunity to visit various field sites during my time at the Surya project, which provided me with unfettered opportunities to observe relations between engineers and their superiors, and between engineers and farmers. That also afforded me insight into how everyday work on the irrigation project was carried out. I also had substantial interaction with local politicians (one of whom held official responsibility for the public irrigation corporation that owned and maintained the Surya Project). It was not possible to select a representative sample of engineers, as I spent my time mostly with staff from one particular sub-divisional office that was engaged in construction and maintenance of the main canal and distributor canal system. I also undertook two visits to the Irrigation Circle Office in the district headquarters, and numerous visits to the Dam Office near the reservoir. Given that I spent about nine months in the villages and project area in 2008, I developed an easy rapport with the engineers. My fluency in Marathi and Hindi helped me further. I was also able to triangulate data from my interviews with articles that appeared in local newspapers. Besides the engineers and local politicians, I also spoke to representatives of local, social movement organizations, caste-association

leaders, and large and small farmers who utilized irrigation water from the Surya project and so had some kind of relationship to it.

Canal water is distributed to agricultural fields based on a cycle of rotations and at different levels (Main Canal, Distributaries, and Direct Minors). These are meant to cater to the needs and demands of agricultural plots that vary in size. At the main canal and distributary levels, water is first conveyed to agricultural fields located in villages at the tail end of the main canals; this rule is supposed to be followed even at the level of the direct minors and the sub-minors (lower level branches in the canal system - see Figure 3.3, below). Farmers are then expected to construct field channels so that they can convey water into their plots from the direct minors and sub-minors that lie adjacent to their fields. Outlets and Gates are used to control the flow of water at this level. An even and fair distribution of water in this context depends both on co-operation between the farmers, but also on the effective regulation of the canals by the engineers.

3.3.1 Attitudes of Lower Level Engineers towards Tribal Farmers

Engineers in general expressed views that were largely dismissive about the abilities of tribal farmers in the irrigation project. This section highlights such attitudes of lower level engineers in the project towards the tribal beneficiaries of the irrigation project and presents data to support this argument.

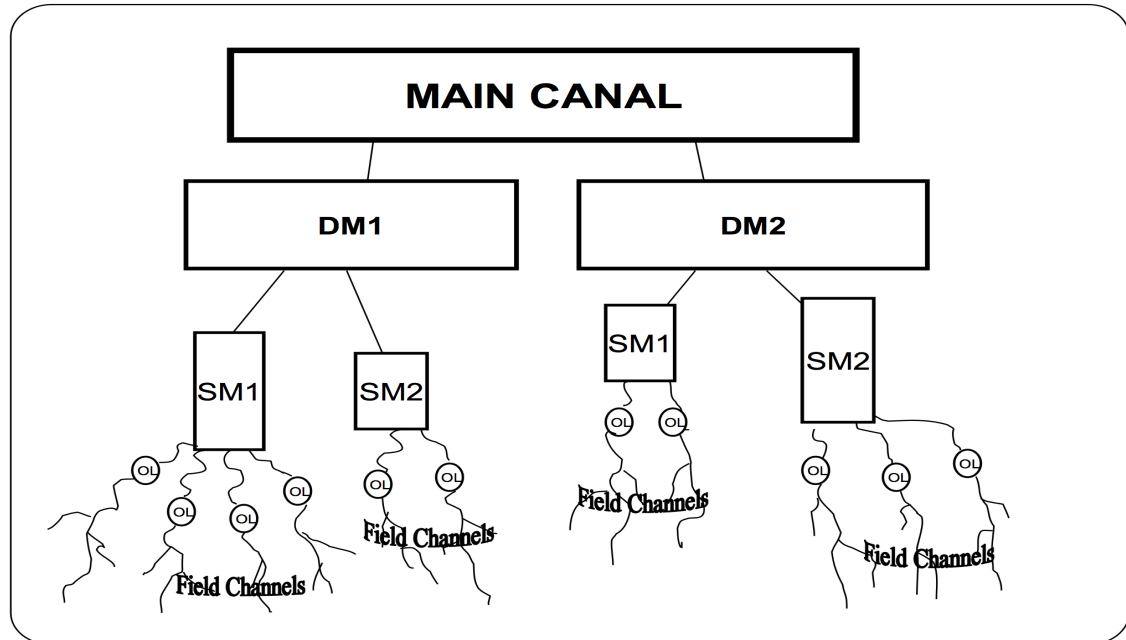


Figure 3.3: Schematic Layout of a Typical Canal System in India.
DM1= Direct Minor #1; **DM2** =Direct Minor #2;
SM1= Sub Minor #1; **SM2**= Sub Minor # 2; **OL**= Outlet

This junior level cadre in the department had more interactions with the farmers and also had day-to-day knowledge of the social profile of irrigation beneficiaries. This placed them in a somewhat advantageous position as far as their knowledge of the politics and society of the area was concerned too. Most engineers (irrespective of rank), were unanimous in their view that Konkan tribal farmers did not deserve a large dam and canal project because they had little experience with modern, canal-irrigated agriculture. According to one Section Engineer, ‘the Ghat area (canal-irrigated western Maharashtra) farmers are better at using canal water, the tribal farmers in the Konkan are inept.’ Though there was cynicism and prejudice exhibited towards tribal farmers, engineers also displayed ambivalence towards tribal users of the project by viewing them as victims of the machinations of the political class who ultimately controlled allocation of water in the command area of the dam. “All this water,” remarked a

Section Engineer, “will end up in Mumbai because of the wastage in the canal system. These tribals don’t deserve water because they waste it. They have no experience in using canal water. They are fortunate to have access to water, but they excel in wasting it.” Gaikwad, a Section Engineer further remarked:

We have had some successful farmers in the project area. They are all horticulturists and have been engaged in this occupation because their caste is a caste of gardeners and horticulturists. They are from the coast and are using modern sprinkler and drip irrigation techniques (that optimize the use of water) and they brought this technology to the project area from periodic trips to Israel and Oakland, California. The tribals, on the other hand, do not know how to utilize the water. They waste the water and do not know its value. Moreover, they do not know how to cultivate anything other than rice. Agreed that this is a project that was designed to cultivate rice, but you just have to compare the sheer ingenuity of the horticulturists with the lack of initiative and risk taking of the tribals. (Interview: February, 2008)

The skill and enterprise of horticulturists was contrasted with the supposed lack of ingenuity of tribal farmers. However, engineers seldom discussed the influence of social relations or the state of the canal system. That was perplexing, since my understanding from field research in a horticultural belt benefiting from the Surya project was the opposite. Most tribal farmers on the middle reaches of the minor canal system complained of the widespread theft of water by horticulturists who fenced off

entire canal minors and sub-minors, and that Section Engineers did nothing to stop the illegal practice (see Fig. 3.4, below and Paper Three, section 5.6.2 for how unfair water allocation entailed large farmers taking siphoning water from canals). Tribal farmers and their families were typically employed on the farms of horticulturists, and their labour was crucial to the profitability of such operations. Paradoxically, the vegetables and fruits grown on such farms did not require a lot of water and, for that reason, sprinkler and drip irrigation served the purpose.



Figure 3.4: Photo of large horticultural farm. This photo was taken at a large agricultural farm near Sakhare Village served by the canal. The outlet on the canal minor was choked by a gunny bag to restrict flow to smaller, tribal farms downstream. Further, the canal itself was fenced off so tribal farmers could not access it.

The large farmers simply wanted to make sure they got their adequate share of water, and dumped the rest into the natural drainage system in the Command Area. At first, I never confronted engineers about the unfairness of arrangements as I knew of a nexus between large horticulturists and the bureaucracy. That changed later towards the end of fieldwork when I developed a better understanding of the canal rotations and schedule for releasing water. While my field observations of the canal system began in

January, 2008, the irrigation season started in December, 2007. One village where I conducted interviews and a sample survey was located near a small downstream reservoir where the main canal system branched into two canals (see Figure 3.5, below).

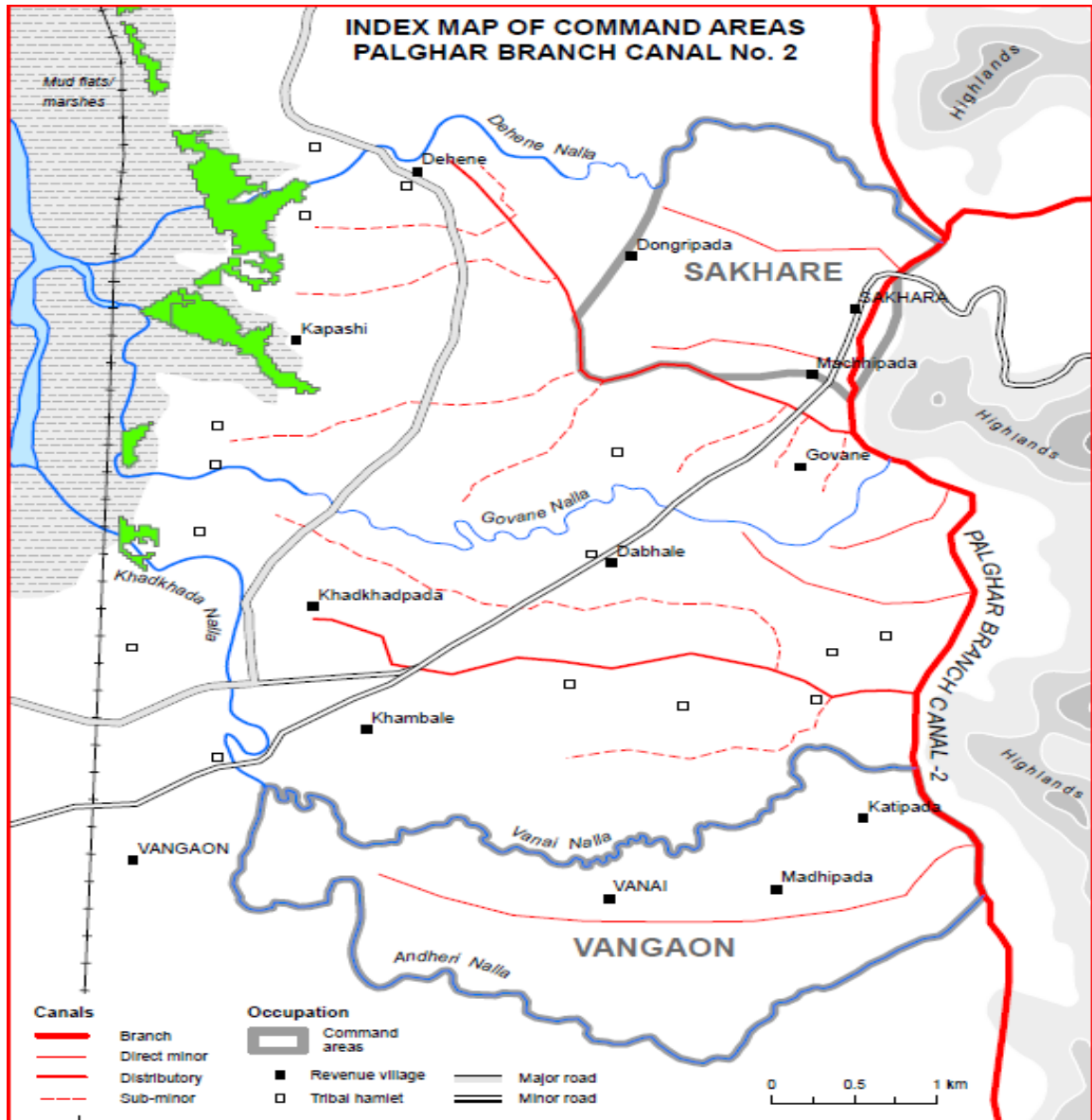


Figure 3.5: Map of the Horticultural Belt in Dahanu that provides the larger geographical context for this case study. Parts of the canal network (in red) intersect with natural drainage features (in blue) of the area. It was at the intersection of the main canal system at Sakhare Village where I observed the sluice gates to the rivulets being kept open illegally.



Fig. 3.6: 'Waste' canal water being released into Khadkhada River in midsummer (May 2008). Khadkhada River is a non-perennial stream that forms part of the natural drainage of the Surya Project command area. The river meets the Arabian Sea less than half a km. from this spot. See Index Map 1.4 for more detailed view of natural drainage system for this area.

That reservoir met the water needs of a small local town. Perplexed by the vast quantity of canal water in the rivulets and natural drainage system leading to the Arabian Sea during irrigation season, I investigated the operation of the main canal system. From January to May, 2008 sluice gates leading to a natural rivulet (Dehene Nalla) were kept open by engineers. Those gates were clearly meant for the contingency of excess rainfall and floods in the main reservoir areas. That channel led to a small river near the Mumbai-Ahmedabad railway line that joined the sea (see Khadkhada River in Figures 3.5 and 3.6). On inquiring about this in the department with Gaikwad, who flatly denied it, I was brusquely told that I was spending too much time in the tribal villages and should check facts better. Yet on inquiring with tribal farmers I was told that those gates were basically always kept open during irrigation season. That water (categorized as 'wastage') was picked up by horticulturists via pumps, said the farmers. Moreover, 'waste' water from Surya project was referenced to weave a local discourse

asserting tribal backwardness (Lankford, 2013). As such, it also fuelled much resentment in a rapidly growing, nearby town bordering the command area, given the apparent paradox of a tribal region constantly contesting Mumbai's right to that water, which at the same time seemed to be wasting it. In this context, tribal farmers' lack of knowledge and experience regarding operational rules of canals also stood out starkly.

With some engineers, prejudice also gave way to sympathy. On one occasion, for instance, in an oblique reference to social relations in the area, the engineers remarked, 'the large horticultural farmers do not want the small tribal farmers to succeed. We brought in modern pipeline technology to this area and set up water user groups for the tribal farmers through the World Bank funded Command Area Development Program.' A Section Engineer vividly described what had happened:

The large farmers subverted the entire program by periodically destroying the infrastructure with the help of their goons. This would happen at night, but we wondered who the beneficiaries were, it was indeed the large farmers who wanted agricultural labour on their farms and much of it comes from tribal families in the area. Most of the horticultural farmers are interested in enhancing their own wealth, even if it comes at the expense of the poor tribal farmers. (Interview: June 2008)

The Command Area Development Programme was thus a failure in its efforts to re-engineer the water conveyance system in Surya Command Area. Some engineers pointed out to how social relations in the area worked against making the irrigation

project work for small and marginal tribal farmers. Others pointed out to the lack of cooperation amongst tribal farmers who would not contribute to the maintenance of the new pipeline conveyance system. Employees in the Surya Irrigation Department who were not engineers also pointed to graft in management of the Command Area Development Programme as being a major factor behind its lack of success.

3.3.2 Making Large Projects Viable and the Cultivation of Informal Norms in Water Management at the Main Canal Level

During my interactions with engineers I gained much insight regarding their geographic origins in Maharashtra State, where they were trained, and how they managed blackmail and threats of transfer by local politicians. I later discovered that most engineers (at all levels) paid off the local Member of the Legislative Assembly (from the tribal community) as well as the powerful, local leader of the Congress Party in order to keep their positions on Surya Project. Once, while interviewing the Executive Engineer (EE) of the Project in a first class commuter train car, I observed him take a call from the MLA's personal aide, who asked him to purchase an expensive cell phone for the MLA. The EE called it 'blackmail.' Yet he said he had to comply, as "the MLA calls the shots on the project and could stop work on maintenance tomorrow, if he wanted." This particular engineer was also ambivalent about his posting to a remote tribal area. He had been posted to other parts of Konkan and believed that only small reservoirs could work in the region. He considered it a bad idea to build large projects there, but said the expansion of the city and industrial spillover created a need for more water. "Everything here works on percentage," he said. When asked about the

revenue earnings of the project, he said “we survive because of the revenue we get from the township in Mumbai. Without the revenue from non-irrigation use, we would be shut down tomorrow. We earn very little from the tribal farmers, and the large horticultural farmers don’t pay a paisa as they have political clout. On the other hand, the city pays for the water.” (See coloured graphs below, in Figures 3.7a & 3.7b).

Better cost recovery rates from non-irrigation use means that more water continues to be diverted for urban and industrial use. The deliberate wastage of water from the canal system made more sense now. I realized that engineers in Surya project had very little incentive to maintain the rural canal network since most of the revenue (almost 98%) for the dam now came from the city. P.S. Purandare is a commentator and former professor of irrigation at the Water and Land Management Institute; he writes insightfully on this new dynamic of water management, especially with regard to the attitude of engineers towards urban-industrial demands:

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.⁵ (Purandare, 2012, p. 19)

The two graphs below (Figures 3.7a & 3.7b) illustrate the low cost recovery rates of water for agricultural use in Thane District, and the increasing dependence of such projects on non-irrigation revenue from Mumbai's hinterland. Note that dams in two neighboring districts of that hinterland are owned by Mumbai Municipal Corporation; the Tata Corporation; the Maharashtra Industrial Development Corporation; the local Irrigation Department; and various corporations in smaller towns, respectively. While the bulk of water storage in the three large multipurpose dams owned by the local Irrigation Department is intended for agriculture, an increasing portion of their revenues comes from non-irrigation use. This helps the dam projects remain profitable year-to-year.

Water Cess Recovery from Irrigation

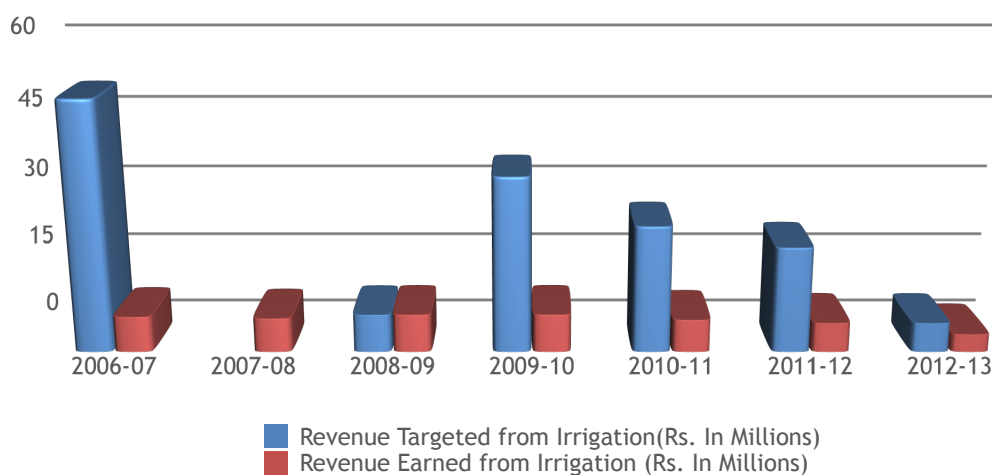


Fig. 3.7a: Source: Computed from Water Cess Recovery Tables for Thane Irrigation Circle Accessed June 1st, 2013 from <http://www.seticthane.org/water-cess-recovery>.

Recovery from non irrigation use

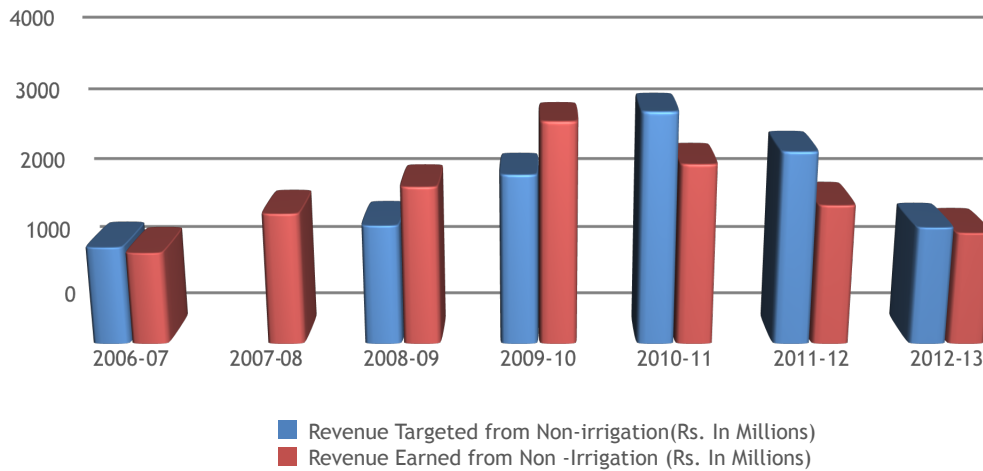


Fig. 3.7b: Source: Computed from Water Cess Recovery Tables for Thane Irrigation Circle Accessed June 1st, 2013 from <http://www.seticthane.org/water-cess-recovery>.

Closer interaction with Junior Engineers and Technical Officers also yielded greater information about their backgrounds, caste identities, and when they had first joined the project. I became intrigued by a number of Section Engineers and Junior Canal Officers who had managed to stay in their positions for more than two decades, since engineers normally stay in one location for no more than three years. The origins of most of these engineers turned out to be the Maratha-Kunbi community in western Maharashtra. Several Junior Section Engineers I spoke with preferred staying on the Surya project because, first, it was close to the commuter railway line to Mumbai, which afforded them the advantage of educating their teenage children in a suburban Mumbai college. And secondly, because working on a dam project that serves tribal areas where most farmers are illiterate and inexperienced with canal irrigation

bureaucracy afforded them opportunities to exploit circumstances for their own financial gain.

Alternately, the Executive Engineers always lived in the suburban and peri-urban areas of Mumbai and commuted to work at the Surya project. According to a clerk in the Division Office, this meant ample opportunities for Section Engineers to make money; indeed, the project was considered the most corrupt in the entire State of Maharashtra. The spread of the canal network into the edges of forests and ravines in the hinterland also meant that the Mumbai media never covered those dams or the quality of maintenance work on the canals in the Command Areas.

This particular group of Section Engineers had the maximum level of interaction with all classes of farmers as they were in charge of regulating the use and wastage of canal water, and maintaining conditions of the outer bunds and water seepage in various areas under irrigation. They were also in charge of counting the number of wells in the Command Area, mostly built by the large farmers, who used these wells for irrigation when the canal rotations were stopped. In any irrigation project in Maharashtra State, Section Engineers, Assistant Engineers and Technical Officers play a vital role. They are required to inspect field irrigation, and are responsible to superior officers for carrying out orderly irrigation management and noting the misuse of water. They are also expected to monitor the working conditions of the channels and courses. Such responsibilities afford this level of Section Engineers a great deal of influence. Given that they continued to live in the same area of the project, they also developed social and cultural links with the large farmers (who were also from a Maratha sub-caste); in

one case, the sister of a local Section Engineer married the wealthiest horticulturist in the region.

Such close ties indicate a certain local, moral economy of water use, wherein the Maratha engineers and horticulturist farmers see the latter's access to water as a symbol of their local power and material progress, as well as an indication that they have finally "arrived on the scene" as rich, successful farmers. "We Vadavals are dominant here," announced Raul, a farmer whom I interviewed in the summer of 2008. Such access to the irrigation project was also facilitated by a local leader and landlord from one of the ruling parties in Maharashtra, who was also Vice President of the local irrigation corporation. He used his control over the project to distribute contracts to cronies and to control the functioning of the local Irrigation Department.

The presence of a very junior class of engineers who have never been transferred does by no means completely contradict Wade's findings on the market for transfers, as transfers remain prevalent in this context for Senior Engineers at the executive levels. The fact that these Junior Engineers had to pay off the Executive Engineers only indicates a different kind of market for transfers operating in this region. The implication is that there was a relatively junior section of the bureaucracy who preferred living in the tribal area, as there were prospects to make money there and to take advantage of being fairly close to suburban Mumbai. Upon digging deeper I also found that some of these junior engineers did not have the clout to arrange for transfers out of the Konkan to western Maharashtra; pay rates in the Konkan for Junior Engineers

were lower at 200,000 to 300,000 rupees (approximately US \$3,500), thus more bribe money would be required to obtain a higher paid posting in Maharashtra.

The local newspapers in the Surya Dam Command Area repeatedly pointed out that the staying power of these recalcitrant engineers clearly indicated the presence of an entrenched nexus of local contractors and politicians at that level of the bureaucracy, and the persistence of patronage politics in the maintenance of the canal system. At the end of May 2008, the local Marathi media began reporting on huge mismanagement and corruption in the Surya Multipurpose Irrigation Project (see photo of newspaper article, Fig. 3.8). The newspaper reports, most of them in the local town's Marathi press, highlighted the brazenness of corrupt practices and the failure of the state government to address it - especially in the context of a project originally intended to benefit poor, tribal farmers. The articles carried graphic pictures of collapsed canals and distributaries from the interior, coupled with reports of how a chronic and malignant form of corruption had been afflicting this dam project for over a decade.



Figure 3.8: One of many 2008 Marathi newspaper articles reporting on the complicity of engineering staff in massive corruption at the Surya Project.

The central theme of the news

articles was how the poor sections of the tribal community were being divested of their rightful access to water from the irrigation project due to the shoddy maintenance of the

canal network and the diversion of water to Mumbai. I later discovered that tensions between the Junior and Senior Engineers had led to the selective leaking of information (by Junior Section Engineers) about specific instances of corruption regarding maintenance work. Invoking the plight of the poor is a common strategy employed by lower level bureaucrats when they are in conflict with superiors although, in fact, the interests of the poor are generally not important to those at that level of the bureaucracy (Gupta, 2012).

This tactic of using the media to blackmail senior bureaucrats and politicians is not new to rural politics. Most of the newspaper reports targeted Senior Engineers at the project's Irrigation Circle Headquarters in Thane. Later, the names of specific Senior Engineers (based at the Irrigation Circle and the Sub-Divisional Office) also began appearing in the news reports. The ethnographic extract below summarizes events over two weeks in June, 2008. The narrative describes how lower level engineers tried to navigate a situation that one of their own colleagues had been instrumental in creating. It speaks to the dynamics of intra-bureaucratic politics, as well as how local, rural politics and caste identities are inextricably linked with bureaucratic transfers and administrative corruption.

3.3.3 Tensions within the Bureaucracy

During interviews with farmers in the villages I was called on my phone by one of my informants (an administrative clerk) in the project. He conveyed news that the project's Sub-division and Division Offices would be shut down due to serious

mismanagement and corruption reports in the media. Given the significance of this news for my research, I rushed to the office and saw that the engineers were in a despondent mood. I met my main informant and he mentioned that most engineers would be transferred, and the project's Sub-Division Office which took care of operations and maintenance would also be shut down. As this news sank in, I was actually surprised by how forthcoming with details the Section Engineers and other officers were regarding the politics of the project. There was a clear feeling of uncertainty, and all of the Junior Engineers voiced how worried they were about their futures. As my chief informant came and sat next to me, I saw the engineers browsing cynically through the local evening newspapers for clues about the future of the dam project.

I was informed that the real turning point had come when the state Irrigation Minister's name had been mentioned in the reports of corruption. The newspapers then reported that the Minister had subsequently decided, with the local leader (the Vice President of the irrigation corporation) and the tribal MLA, to close down the project's office. It had been decided to move maintenance work and its supervision to the location of another multipurpose project located in a more remote part of the district. However, the minister had also summoned all class one officers to the city of Nasik, where he was then touring. It was during that period that all Class One officers (including Executive Engineers) were arbitrarily transferred out of the project. In the view of the engineers I spoke with, that was done to cover up the shoddy maintenance work, and also to shield local politicians and the Irrigation Minister himself from

culpability, since they had benefited from payoffs on contracts awarded during maintenance work.

My informant also noted that all of the engineers had made a beeline to the local leader's home to try and get their transfers revoked, as he was the Vice President of the irrigation corporation. I had personally seen two engineers visit the local leader's office, lobbying to retain their current positions and location in the project. My chief informant was himself transferred, but managed to get it revoked. Some of the Junior Engineers commented on how they did not want to go to the other dam because the project was in a very remote area, and they believed the educational facilities for their children were not good there.

On the other hand, my informant attributed Junior Engineers' unwillingness to relocate to their reluctance to surrender lucrative money-making opportunities they enjoyed by being associated with the project. He also attributed the controversy that had been generated over the project to the overzealousness of a newly appointed Executive Engineer. That particular Executive Engineer had apparently put the Surya Project into a deficit position of 40 crores (equivalent to US \$6.5 million), and had been responsible for overspending the allocated operations and maintenance budget. My informant and the engineers voiced constant slurs of the Chief Executive Engineer. They claimed that his approaching retirement had made him greedy, and that his lower caste background underpinned his failure to successfully manage the project.

That afternoon, the normally reticent officials also opened up further to my questions. Until then, this level of staff had co-operated only by sharing dam project

reports and environmental assessment reports. Also, two engineers I had never spoken to walked up and inquired whether I was affiliated in some way with a local non-governmental organization and whether my research project also included investigating the social dimensions of development. The junior engineers and technical supervisors began narrating how most of the large, commercial horticultural farmers were behind in paying dues and would never pay water charges to the Irrigation Department. When I inquired about the amount of arrears, I was at first met with silence; then they remarked that it ran into the millions of rupees (see figs. 3.7a & 3.7b for the low recovery rates from irrigation). Indeed, the clout that large farmers enjoyed with the local politician (who was also the Vice President of the Irrigation Development Corporation) meant that all of the money they owed the project was siphoned off by the local political class, which was proving to be the bane of the project.

I confirmed that the information obtained during those interviews was true, by triangulating it with reports that had appeared in local newspapers, and by actually visiting some of the sites at issue. Curiously, there was never any information reported about the involvement of Junior Engineers in corruption at the project. That lent credence to the dominant view that information was leaked about project contracts at the behest of Mr. Gaikwad (pseudonym), a Section Engineer who was unhappy with the work of a certain contractor.

Gaikwad had claimed that the shoddy maintenance work performed on a section of the distributaries canal could potentially fail and cause flooding in the area. However, the maintenance contractor had connections with the Executive Engineer as well as the

Superintendent Engineer and had paid them off. Given the circumstances, Mr. Gaikwad could not remedy the situation through official channels, but could raise awareness of the risk by leaking details to the media about the corruption of Senior Engineers, causing them to go on the defensive and, literally, do damage control. However, a major consequence of the leaks was that the local MLA and the head of the Irrigation Development Corporation sensed an increasingly negative public opinion about management of the project. Fearing that the news and negative mood would take hold in the Mumbai press too, they decided to shut down the project and transfer all operations and maintenance work to another dam project in the same irrigation circle.

Similar tensions between executive level Senior Engineers and Junior Section Engineers were also the subject of commentary during the irrigation scandal of 2012-13 in Maharashtra State. In a critical analysis of the state government's handling of expenditures on both new and existing projects, Pradeep Purandare noted:

The top heavy organizational set up of the Maharashtra irrigation department has meant that powers have been concentrated in the hands of Direct Class One officers and actual experience of work on site, barring exceptions, is mainly with the officers below the rank of Executive Engineers. Indifference towards grass root level functionaries & subordinate engineers has taken its toll on junior engineers and affected their morale. (Purandare, 2012)

By the end of June, 2008 the Sub-Divisional Office was forlorn looking, and gone were the long lines of contractors and local journalists who frequently came to

meet engineers for contacts and news of the project. Over subsequent months, the Junior Section Engineers, Technical Officers and Supervisors stayed back in their quarters at the Surya complex, as some successfully used their connections to retain their positions. My chief informant told me that most of them would manage to keep their current positions because most had some clout at upper levels, and could have even paid to keep their jobs. However, in the next few months it was decided that that level of staff from the Sub-Divisional Office would commute 100 kilometres to work at another major dam site on the fringes of the MMR, which also provided water to Greater Mumbai. This meant that the engineers and other staff would be away from their families for four days per week. The implication was that, while these engineers managed to keep their jobs, they were punished for leaking news of the collusion between Senior Engineers, local politicians and contractors to the media. As my chief informant told me: “there is a lot of money to make in tribal areas and they would do their best to keep their positions in the department.”

3.4 Conclusion: Governance Reform and Tribal Development in Rural India

The main contribution of this paper is to produce a different variation of the theoretical framework that Wade articulated in the 1980s, which has informed research on bureaucratic corruption in development over the past three decades. The layered and nuanced dynamics revealed by this case study suggest that it is too simplistic to focus on the turnover of bureaucratic transfers as a central cause of chronic corruption in India. In contradiction to Wade's contention that transfers encourage corruption, this

paper actually shows how a certain class of lower level bureaucrats has managed to ‘stay put’ in the same location for decades, playing an ambivalent but permissive role in facilitating corrupt practices in the local Irrigation Department.

Transferring such lower level employees in tribal areas might contribute to a solution. That needs to be complemented by rigorous auditing and supervision of how development funds are spent, along with a more meaningful decentralization of the water management. A reform of the pay structure could also provide more incentives to lower level employees for ethical behaviour. And establishing adequate representation from tribal communities in management decisions is also necessary to help ensure fair play.

The case study also shows that the problem of corruption involves several layers of ‘social transactions,’ and plays out differently in various parts of rural India, given the nation’s complex, hierarchical social structures and highly variegated forms of governance. We need more case studies and ethnographies that focus on corruption in organizational contexts, which highlight local, political and cultural dynamics of this phenomenon (Gupta, 2013). Not least, this paper highlights the need for a pointed examination of the general lack of accountability within Indian public services towards the lower caste poor. In other words, empirical research on India must ethically engage the persisting problem of mistreatment of the poor by the public bureaucracy (Dreze and Sen 2013, chapter 6, for a treatment of corruption and how it disproportionately affects lower caste communities).

In a landmark report by the Indian Planning Commission's expert group on extremism in tribal areas, the failure of governance in those areas has been explained as follows:

Overwhelmingly, large sections of the bureaucracy/technocracy constituting the delivery system in the tribal areas come from landowning dominant castes or well to do middle classes, with their attachment to ownership of property, cultural superiority, purity-pollution governed behaviour and a state of mind which rationalizes and asserts their existing position of dominance in relation to others. This influences their attitudes, behaviour and performance segment, which constitutes the power structure in rural and urban areas since colonial times. It is this coalition of interests and social background that deeply affects governance at all levels. (Government of India, 2008, p.19)

Any ethical engagement with governance in social science scholarship thus begs researchers to ask tough questions about lack of accountability in the public sector that manages water services in developing countries like India (Bakker, 2010). As such, two issues stand out in the context of tribal India. The first is a broader level political issue affecting the governance of water. Specifically, elites from dominant caste groups who hold power in tribal areas are too entrenched in their privileged positions, and are often in nexus with an equally entrenched, lower section of the water bureaucracy that is complicit in corruption. The second issue relates to governance in general. Specifically, there is insufficient awareness and understanding amongst tribal communities about the

laws and policies in place to further their development. This dearth undermines their political and economic enfranchisement, and too often makes it possible for non-tribal bureaucrats and dominant caste groups to appropriate their voice and misappropriate funds meant for tribal welfare and development (TR & TI, 2002).

This case study of the personnel structure in the Irrigation Department of tribal Maharashtra describes an anachronism that is actually similar to conditions which existed in the Tribal Development Department (and other jurisdictions outside irrigation) throughout the state and the rest of India during the 1970s, and which was first subject to critique by scholars such as B.D. Sharma (Sharma, 1978). Such critiques were followed by administrative reform in those areas, where a new class of bureaucrats from tribal communities subsequently came to be employed. The fact that one does not see even one tribal employee in the ranks of the local Irrigation Department in the Mumbai-Thane region represents a social and cultural vacuum that makes it much easier for corruption to thrive in the dam project there.

While aiming to contribute value to the research literature on corruption, this paper also aspires to help fill a specific ethnographic vacuum within recent urban-regional research in the Mumbai context, where there has been an interest amongst geographers to identify causal factors that influence unequal access to water within the Mumbai-Thane region (Gandy, 2008). The prevailing scholarship has not yet been able to throw much light on the internal workings of the local water bureaucracy, or the institutional architecture that plays a role in creating such a 'quasi market' in water. Given this, the present case study strives to make evident that unequal access to water

across the region is significantly facilitated by a bureaucratic apparatus engaged in the deliberate mismanagement of adequate and surplus water, resulting in serious consequences for the welfare of the poor sections of both rural and urban communities in the region.

In doing so, this paper places a central focus on the social dynamics and political legitimization that underlie the ad hoc nature of administrative, rural-urban transfers of water in the Mumbai-Thane region. The main argument here is that water in this region is actually abundant and available, but is mismanaged because of archaic rules around the allocation of water from rural to urban use. And that, in order to politically and socially legitimize the transfer of water to Mumbai from the Surya Dam Project, an informal alliance of politicians and engineers have successfully projected the tribal community as undeserving of the benefits of modern irrigation, while at the same time becoming complicit in the deliberate mismanagement of water in the rural hinterland. In that nexus there is little incentive for creating transparent and democratic water governance institutions, or for transforming the rules and administrative structures currently in place concerning rural-urban allocation of water in the Mumbai-Thane region.

Finally, this paper argues that understanding the regional governance of water in the (rapidly changing) Indian context also requires developing an analysis of the inner workings of a highly complex and layered water bureaucracy with multiple interests, including a wide range of formal and informal economic and social incentives. This paper therefore makes the case for a more grounded analysis of corruption in India, and

should be seen as a modest contribution to the ongoing public and intellectual debate on graft and governance in that country.

Notes

1. On Google Scholar the *World Development* article has been cited more than 325 times while the *Journal of Development Studies* article (Wade, 1982) has been cited more than 450 times. Both contributions helped develop a better understanding of corruption in the water sector in policy and academic circles in the South Asian context. However, except for Davis (2005), there has been no case study research on corruption in the water sector in India and even the Asian context since Wade's articles. The term “nexus” here means the conflation of politics and corruption around political spending rather than its other meaning of energy/food/water.

2. In her study of water politics in the Kutch region of Western India, Lyla Mehta (2005) argues for a distinction to be made between lived/experienced scarcity, which clearly affects the livelihoods of people and manufactured scarcity, where water scarcity is often manufactured to suit the interests of powerful actors (Mehta, 2005, p. 9).

3. Besides the influence of public choice approaches, Robert Wade's work on corruption and canal irrigation in India was equally influenced by the work of F. G Bailey, a Sussex social anthropologist who had worked on tribal Orissa in the 1950s and 1960s. Bailey is a political anthropologist with an interest in ‘prizes’ (hence resources of one sort or another and to that degree interested in economics) and attempted at developing an individualist account of politics in a classic work ‘Stratagems and Spoils: A Social

Anthropology of Politics, 1968.’ In retrospect, one can see Bailey’s work as a kind of ‘individualist’ (but non-theoretical, hence non-rational choice model) account of politics. In his book, *Village Republics: Conditions for Collective Action South India*, which he published in 1990, Wade clearly credited Bailey's perspective for his study of collective action by water user groups and blended the latter’s framework with the sharper analytical tools of rational choice theory, borrowed from the work of E. Ostrom (1990) and M. Olson (1965). The theoretical frameworks in Wade’s ethnographic studies of corruption are a hybrid of these three theoretical approaches. The papers on corruption try to analyze and marry the rules of the ‘political game’ by way through Bailey’s with the public choice conceptualization of the ‘rent maximizing’ bureaucrat and politician, which is later extrapolated to the study of the bureaucratic-political nexus in the Irrigation Department in India.

4. Having stated the distinction between rational choice and interpretative approaches, it should be pointed out that the logics of rational choice and interpretative approaches are similar in that they are intentional accounts that start with observed data (behaviour including documents and letters, practices and institutions and reconstruct actors and their inner attributes—meanings, beliefs and values) in such a way that the data are as fully explained or accounted for as possible (Griggs, 2007).

5. Water Auditing of Irrigation Projects in Maharashtra: Dams, Rivers and People. September-October 2012. p. 10-16 accessed on 18th May, 2013 <http://sandrp.in/drp/Sept_Oct_2012.pdf>.

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4. Institutional Design and the Geography of Rural-Urban Water Conflict in Mumbai

In the case study literature on the commons, there are few studies that examine the institutional implications of water demand for a growing metropolitan region on its rural hinterland.¹ Urban expansion and growth often leads cities to take water from distant rural watersheds that irrigate agriculture for urban use. Urban water appropriation is rapidly becoming an important policy question in developing countries. At the same time, the institutional mechanisms and regulatory frameworks that underlie access to water from rural areas are poorly understood. Through a case study on the city-region of Mumbai, India, this paper tries to develop a new understanding of an unexplored institutional dimension of inter-sectoral water politics.

This paper hopes to make a contribution to the institutional and metropolitan governance literature on water in large city-regions. The primary contribution is empirical where the paper seeks to examine how a large city's ability to access rural water quotas and infrastructure has been mainly aided by a very particular evolution of the legal-institutional architecture around water (and land). Its second contribution is to highlight the common ground between the geographical and institutional economics (including the CPR) literatures on this subject, and in doing so, it tries to identify some of the key distinctions and commonalities between these fields.

I begin with a critical evaluation of the literature on rural-urban water transfers in institutional economics and human geography and lay out the theoretical framework of the paper in Section 4.1. Sections 4.2 and Section 4.3 present the paper's theoretical

framework. From Section 4.4 until Section 4.8, I deal with the case study of the collective action² problem in local water management that has important implications for better understanding the mechanisms of rural-urban water transfers in the Mumbai context. I end with an institutional analysis of findings in Sections 4.9 and 4.10.

4.1 The Problem: Water Abundance and Metropolitan Water Governance

Large and growing mega-urban regions in the developing world often source water from distant rural watersheds; however the basic water needs of human habitations near the reservoirs get clubbed with the problem of water provision for peri-urban areas in the research literature. The abundant availability of water is a necessary, but not a sufficient prerequisite to meet basic water needs of rural communities living near source areas for large and growing cities. This paper focuses on two specific questions to answer the failure of communities and governments to meet the demand for basic water entitlements in such source areas outside Mumbai. The first question focuses on investigating the role of institutional arrangements in meeting the basic water needs of communities living near such source areas for large and growing mega city-regions? Furthermore, it investigates how these institutional arrangements on water sharing between urban and rural evolve at the level of geographical scale and how do they influence local collective action in rural areas? In the Indian context, the water problems of such source areas can often be a product of willful neglect by local and state governments, or of a larger exclusion of rural indigenous communities who usually live in proximity to dams located in forested watersheds. There has been a voluminous

literature in the Indian context on problems of peri-urban areas and rural-urban conflict in general (Joy et al., 2008a; Iyer, 2009), but very little research focused on institutional factors that influence the interpretation of local water entitlements in rural watersheds that serve as sources of water for large metropolitan cities.

The action situation described and analyzed in this case study is in the context of a major water district called Tansa-Vaitarna water district (henceforth T-V) where five major dams for the city of Greater Mumbai have been constructed in the last 100 years. The five dams are located in a conservation area and water storage in the dams is pre-assigned and quotas reserved for various cities in the metropolitan region, viz. Mumbai, Thane, Bhiwandi and some designated outlying villages. The T-V water district faces socio-economic problems typical of forested areas in tribal areas of Western India (Louw and Mondal, 2013, p. 50-51). Low levels of economic development combined with high rates of seasonal migration are central in the experience of these communities. Such problems of access to resources in forest areas and state monopoly rights are the focus of a large literature in South Asian political ecology since the 1980s.

The Municipal Corporation of Greater Mumbai had, during the completion of the Upper Vaitarna (1972) and Bhatsa projects (1983), promised water supply to villages and towns (Mulekar, 1985). Water is conveyed from this region through large aqueducts into the Bhandup complex of the Mumbai Municipal Corporation. These water mains, as they pass the villages near the source areas in the T-V water district, are all above ground. The sight of water being conveyed to a large metropolitan city while the inhabitants of the source area suffer from endemic water shortage became major

ground for resentment for inhabitants of this area. This led the Government to implement a rural water supply project that would source its water from the dams owned by the Mumbai Municipal Corporation under a water sharing agreement. The maintenance of the water supply scheme was handed over to the local government as part of state policy to decentralize water provision in rural areas.

It is useful to see T-V as a “problemshed” within the Vaitarna sub-basin. Conflicts over water in this area have ranged from demands for water quotas that were originally promised for irrigating agriculture, to demands for water for domestic consumption in the villages that lie in the proximity of the reservoirs. The Vaitarna basin is the largest amongst the North Konkan river basin groups that constitute water sources for metropolitan Mumbai and the region. The Second Irrigation Commission of the State Government of Maharashtra went into this region and recommended that water intensive agriculture be encouraged (Government of Maharashtra, 1999, p. 432). The Committee report stated “that the requirements of the megacity and that of industrial use are going to remain the principal determinant of planning and management of water in this area instead of irrigation” (Government of Maharashtra, 1999, p. 432). However, thirty nine percent of the area was found to be cultivable and the report concluded that conditions in the basin were favourable for water intensive agricultural production that was amenable to the needs of civic supply (Government of Maharashtra, 1999).

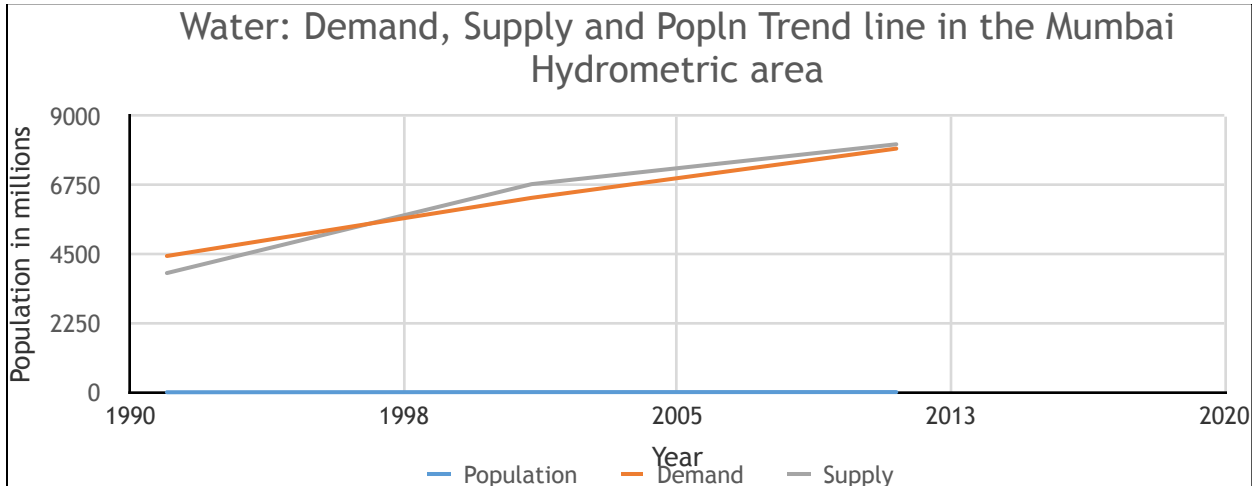


Figure 4.1: Urban water demand and supply in Mumbai Hydrometric Area in million litres per day (1991-2011). Source: Government of Maharashtra, 2003-2010 & 2005. Tables on Water Budget.

The report thus indicates a sufficient availability of water for meeting both irrigation, and domestic and industrial water needs in this region. While there are urban water supply dams constructed in this water district, there are also multipurpose dam projects that supply water to irrigate agriculture through canal systems. This imparts a variety of water rights to the rural population. However, the last two decades have witnessed significant water quotas from this area's largest dam, the Bhatsa multipurpose project, allocated for urban-industrial use (Government of Maharashtra, 2005). For this reason, Greater Mumbai and towns that access reservoirs with the city have not witnessed any significant shortfalls in supply since the early 1990s (See Figure 4.1 above). The Bhatsa presently irrigates land in downstream Bhiwandi (in Figure 4.5, red lines indicate canals that bypass predominantly tribal parts of the T-V water district).

An empirical focus on the main water district for Mumbai as a unique context for metropolitan water governance presents some advantages. Mumbai is one of the largest metropolitan cities in India. It is also an outlier in the Indian context on urban

per capita water consumption and ranks amongst the world's leading and more prosperous global cities on this indicator. However, its water sources are located in an underdeveloped tribal area of rural Maharashtra where there is a seasonal scarcity of water. A recent National Sample Survey on the reliability and availability of drinking water in rural Maharashtra shows that the state scores below the rural average for India on both the sufficiency and availability of improved sources of drinking water (NSS 2012,; p.15). This is despite the fact that the state has the largest and highest number of dams and per capita availability of water. This paper will thus explore disparities between rural and urban areas in India and will also shed light on how institutional arrangements crafted at the local level often influence regional water in one of the fastest growing metropolitan cities of the world. Secondly, this paper will explore how a city's demand for water can crowd out the needs of outlying rural areas. In addition to identifying the main legal principles that have played an important role in the evolution of water governance system in the Mumbai metropolitan region, the paper will highlight the role of local agro-ecology in shaping institutional arrangements on water.

4.2 Rural-Urban Water Transfers: Power or Institutions?

A review of theory from human geography (HG) and institutional economics (IE) in a case study on a rural-urban water conflict might seem strange to readers of an institutional economics journal. While there is an active program within economic and environmental geography on institutions (Gertler, 2004; Adger and Jordan 2009), there has not been a great deal of interest amongst critical geographers in applying institutional theory to resource problems such as water. The main distinction between

frameworks in both disciplines towards rural-urban water transfers lies primarily in the different theoretical paradigms that are dominant in these disciplines. In critical geography, the dominance of Marxism and post structuralism has focused on the role of power and politics in water appropriation by cities from rural areas. In his landmark study of the City of Guayaquil, the geographer, Erik Swyngedouw has argued that urban water capture can be attributed to the power of capital located in urban areas and considers water appropriation an inevitable outcome of capitalist urbanization (Swyngedouw, 2004; Gandy, 2008). The political-ecological analysis in this Marxian framework hinges on social and political processes and is chiefly informed by dependency theory and ecological economics. Both of these fields explain contestation over consumption of resources as a result of competition between urban and rural areas.

Another track within critical geography that uses power revolves around analyzing the governance of urban water appropriation and inter-sectoral water conflict by applying a Foucauldian lens. Here, the concept that has been utilized is “governmentality” where the argument is that governments control populations by using the knowledge acquired from their information gathering abilities. This post-structuralist framework takes the view that institutions, such as the government, its regulatory frameworks and even organizations promoting people’s participation in the management of public works, are part of a power gathering exercise, which in the process of development, craft a complex (but amorphous) system of governance.

It is important to see this framework as complementary to the Marxian approach. Both try to examine the role of power, but both often overlook the fact that

state power in relation to water is exercised through specific legislative mandates or executive decisions, especially in democracies. Empirical data on regulations and instruments of governance are also conspicuous by their absence in these frameworks. The complexities of geographical scale, boundaries and institutions that often manage through overlapping jurisdictions around large metropolitan cities are also ignored. An example of the application of a governmentality framework is Matthew Gandy's 2008 paper on Mumbai. While the main focus of this paper is the uneven distribution of water among rich, middle class and poor residents of the city over time, Gandy also grapples with the regional power and influence of Mumbai's claims to water over other towns and villages in the region. However, his use of governmentality does not help us to understand Mumbai's total control over water in the region, beyond an argument about the "performativity" of local right-wing populist politics and the influence of the Shiv Sena over local water policy through its influence within the Mumbai Municipal Corporation. This "performativity thesis" assumes that right-wing politics and neo-liberal ideology act in tandem and completely explain the phenomena he describes. This argument does not stand critical scrutiny as it ignores two important facts: a liberal/mainstream party, the Indian National Congress, enacted water policy for the entire state for the last fifteen years; and the state government's Irrigation Department owns two of the largest reservoirs that constitute the water sources for Greater Mumbai. Moreover, neo-liberal policies have made little headway in the transformation of the regional and urban water system -- which continues to be a state monopoly at both levels. Because Gandy seems to ignore these facts on the ground, the paper is unable to analyze why the

Municipal Corporation of Mumbai -- despite the construction of numerous dams and high per capita water consumption -- is unable to meet the water needs of the poor in the urban and rural areas. Formal state law on water and mechanisms of legitimation and enforcement that shape water rights and entitlements are treated as epiphenomena and ignored.

Research on rural–urban water transfers within IE has been primarily influenced by common pool resource (CPR) theory. Water’s characteristics as a renewable resource, its variable legal status within different contexts and the ability to store it in reservoirs makes it amenable for empirical analysis using CPR theory. In the last two decades, economists and even social scientists using institutional theory have also outlined a variety of market and non-market mechanisms that exist in the context of inter-sectoral transfers of water from aquifers and surface water storages (see Saleth and Dinar, 2004; Molle and Berkoff, 2006; Crase and Gandhi 2009). There has been a large range of theoretical approaches, from transaction cost analysis to empirical examination of rules that undergird rural-urban water transfers. From the water markets of the Western United States and Australia to administrative water transfers in Asia, one of the main strengths of this literature is a close attention to the wide variation in institutional arrangements on rural-urban water transfers that can exist in real world contexts.

While the gap between the HG and IE literatures on this subject of rural-urban water transfers can be wide, some scholars have recently tried to bridge the distance by producing case studies on water transfers that draw on insights from both disciplines. An instance is a recent contribution, by Celio et al., (2010) who in their case study of

Hyderabad, Southern India have pointed to the interesting complementarities that exist between both the IE and HG perspectives. Applying institutional and geographical tools to water transfers, their research finds that “appropriation of water” often has a spatial and temporal dimension and involves the capture of rural water infrastructure by cities (as Marxian geographers have argued). At the same time, the authors also present counter examples of water transfer that focus on two reservoirs and are part of the same context in the Hyderabad region. While transfers in the first example within this case study points to outright appropriation of water, the two other examples in the same case study also leads them to identify the importance of rules around such transfers that ensure compensation for farmers.

While common features to IE and HG have been highlighted, there are also gaps in both literatures on the subject of inter-sectoral water transfers. For example, the power and influence of complex water bureaucracies and the path dependence of institutional rules are not particularly well researched in either literature. On the other hand, the general problem with the IE literature (given the influence of common pool resource theory) is that resources are defined too essentially and “presuppose a cause and effect of ecological analysis that may or may not be universal” (Forsyth and Johnson, 2014, p. 9). Also, while institutional scholarship has been very useful in furthering our understanding of these processes and the dynamics of collective action in small scale communities, it is yet to develop a theory of local collective action could be influenced by the sharing of the commons with larger geographical entities (Harvey, 2013: p.68-72). However, scholars working within CPR literature have now begun to

point to the lack of attention to the interconnections between different institutions and resources, which are primarily a legacy of the decades of engagement with the tragedy of the commons argument within CPR theory (Cole et al., 2014). This is particularly relevant to developing our knowledge of how water is shared between geographically dispersed rural communities and large urban areas. Given the dependence of rural poor in developing countries on common resources and land, an evolutionary understanding of the relationship between various institutions that manage these resources is crucial.

4.3 Institutions and Action Situations: The Context of the Socio-Ecological System

This paper utilizes some of Elinor Ostrom's key insights and methodologies that she developed using institutionalism to research commons problems within the field of development studies. Ostrom (1990) inspired a wide body of work within development studies, economic history and other disciplines in the social sciences in India, in particular, and also by overseas scholars studying environmental problems in India and other parts of South Asia. This literature has consistently pointed out how the excessive authority and power placed in a centralizing colonial and post-colonial state and the consequent failures of governance and institutions had characterized the experiences of the rural poor in their access to the commons (Wade, 1988; Gadgil and Ramachandran, 1995; Chakravarty-Kaul, 1996; Agrawal, 1999). In a recent review of Ostrom's contributions to development studies, Tim Forsyth and Craig Johnson have highlighted the integration of theory from political science and economics that emerged from her

work on resources as her chief theoretical contribution to this field (Forsyth and Johnson, 2014).

For the purposes of this paper, institutions are systems of established and embedded social rules that structure social interactions between individuals and organizations (Hodgson, 2006). Though I explicitly identify and give a central role to formal rules and organizations that manage water in this context, my description and analysis of water politics in this paper does not strictly distinguish between formal and informal institutions. The role and presence of caste groups and associations, the media, political parties, and everyday enforcement of rules by various organizations viz. the municipal corporation, irrigation and forest departments as actors in the water district are examples of how the formal and informal interact. The treatment of institutions in this paper is thus different from that in the new institutional economics, which emphasizes the role of quasi-autonomous individuals (Hodgson, 2006; 2012; 2014).

Within common pool resource theory, a socio-ecological system is defined as an ecological system intricately linked with and affected by one or more social systems (Berkes and Folke, 2000). It can loosely be defined as an interdependent system of organism or biological units. In her initial outline of the socio-ecological system, Ostrom identified five design principles for the successful implementation of bottom up solutions for socio-ecological systems. The first was that a resource system has clearly defined boundaries. The importance of internal rules comes next, where it is critical that there should be rules that prevent users from appropriating too much of the resource. Third, rules work better when they are locally adapted as it helps prevent free riding.

Next, strong monitoring and enforcement mechanisms also play an important role and so do dispute resolution mechanisms. If dispute resolution mechanisms are transparent and clear and well-established procedures are in place, any decentralized resolution of common pool resource problems can be successful. Finally, it is also important to focus on the interaction between different systems of rules. Often governments try to decentralize resource management but the overall legal frameworks in place means that central authorities still assume responsibility for determining most of the rules that govern the use of resources (Pennington 2012, p. 26-29). All these factors affect the incentive structure that faces actors in the context of specific common pool resources and these incentives constitute what Ostrom calls “action situations.” In this paper, the term “commons” is used to describe water storage as well as water that is distributed through conveyance systems as public and club goods.

The case study I present in this paper uses social ecological systems (SES) and action situation methodologies, which are drawn from the CPR literature. The paper uses this framework to relate the water question in the action situations to conflicts around resources such as land within forests and tries to develop a more contextual understanding of the institutional arrangements around resources (Ostrom, 2009).

An action situation following Ostrom (2005) refers to a situation whenever two or more individuals are faced with a set of potential actions that jointly produce social outcomes. Within every action situation an individual occupies a certain social position. The same participant can interact in another action situation where they occupy different positions. An action arena combines the action situation, which focuses on the

rules and norms, with the participants who bring with them their individual preferences, skills and mental models. Action situation methodology has been employed by scholars investigating outcomes of collective action situations with respect to the decentralization of resource management, but also in general studies of the commons (Anderies and Janssen, 2013). Unlike other studies using the SES and action situation methodology, this paper draws on cartographic and archival data, and synthesizes ethnographic research with data collected from local newspapers, and dam reports.

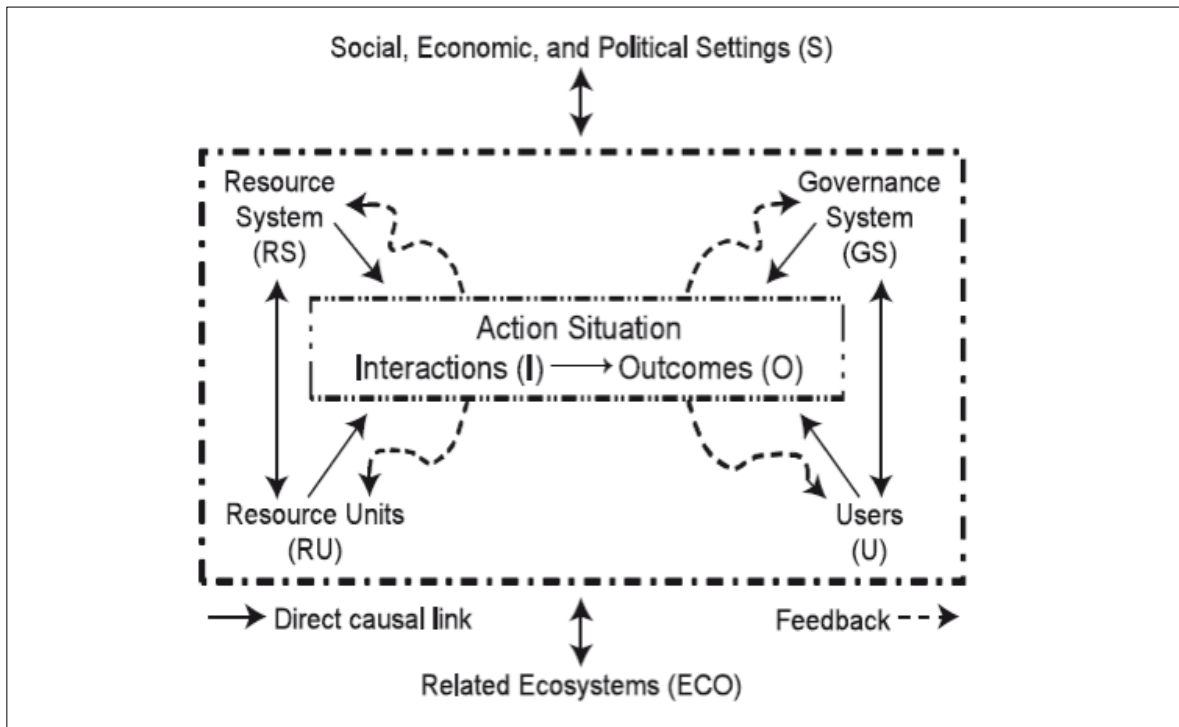


Figure 4.2: Action Situations embedded in socio-ecological systems.

The action situation (see Figure 4.2) described in this paper is located within what is called the Mumbai hydrometric area (see Note 2) in the T-V water district in Thane. Following Ostrom (2011), I utilize the Social - Ecological Systems framework to research a particular SES, namely the coastal plains and uplands in the region that are located between the Western Ghats and the Arabian Sea coast. The city of Mumbai has

identified a hydrometric area in this region on which it claims a priority of ownership of water use since the early 1970s. The Regional Map (see Figure 4.3) is a cartographic representation of the location of various dams for the entire Mumbai metropolitan region. The Mumbai hydrometric area has several reservoirs (large, medium and small) that impart a variety of local water rights to the various agricultural regions and smaller towns and villages adjacent to Greater Mumbai within and outside the metropolitan region (Government of Maharashtra, 2005; UNDP, 2009; SANDRP, 2013).

These local rights create grounds for contestation over the city's claims that the water belongs to it exclusively. The action situations analyzed below describe the state's attempts to resolve these disputes by the construction of a rural water supply system and the attempts of the communities to inject transparency into local water governance. Later, I examine how the attributes of a resource system (i.e., the coastal plains below the Western Ghats), resource units generated by that system and its ownership (i.e., the large dams), and a governance system affecting who is authorized to undertake what policies under what conditions jointly affect and are affected by outcomes of the action situation (See Table 4.1 and Table 4.3).

This paper uses a framework combining socio-ecological system and legal institutionalist (L-I) approaches in order to understand the role of law in access to resources (Rhodes, 2006; Deakin et al., 2015). The L-I approach helps to identify important legal principles and to analyze the influence of water laws and their evolution in particular local contexts. Thus, this paper departs from a spontaneous conception of law and property rights that downplay the role of the state, as in the transactions cost

literature. A weakness of that literature is an assumption of relatively small numbers of agents and an underdeveloped conception of the nature of law. The L-I approach on the other hand shares with other institutional approaches an emphasis on social rules. It argues that the “more important and powerful social rules are legal in character and they are backed by the power and authority of the state” (Deakin et al 2015: p 17).

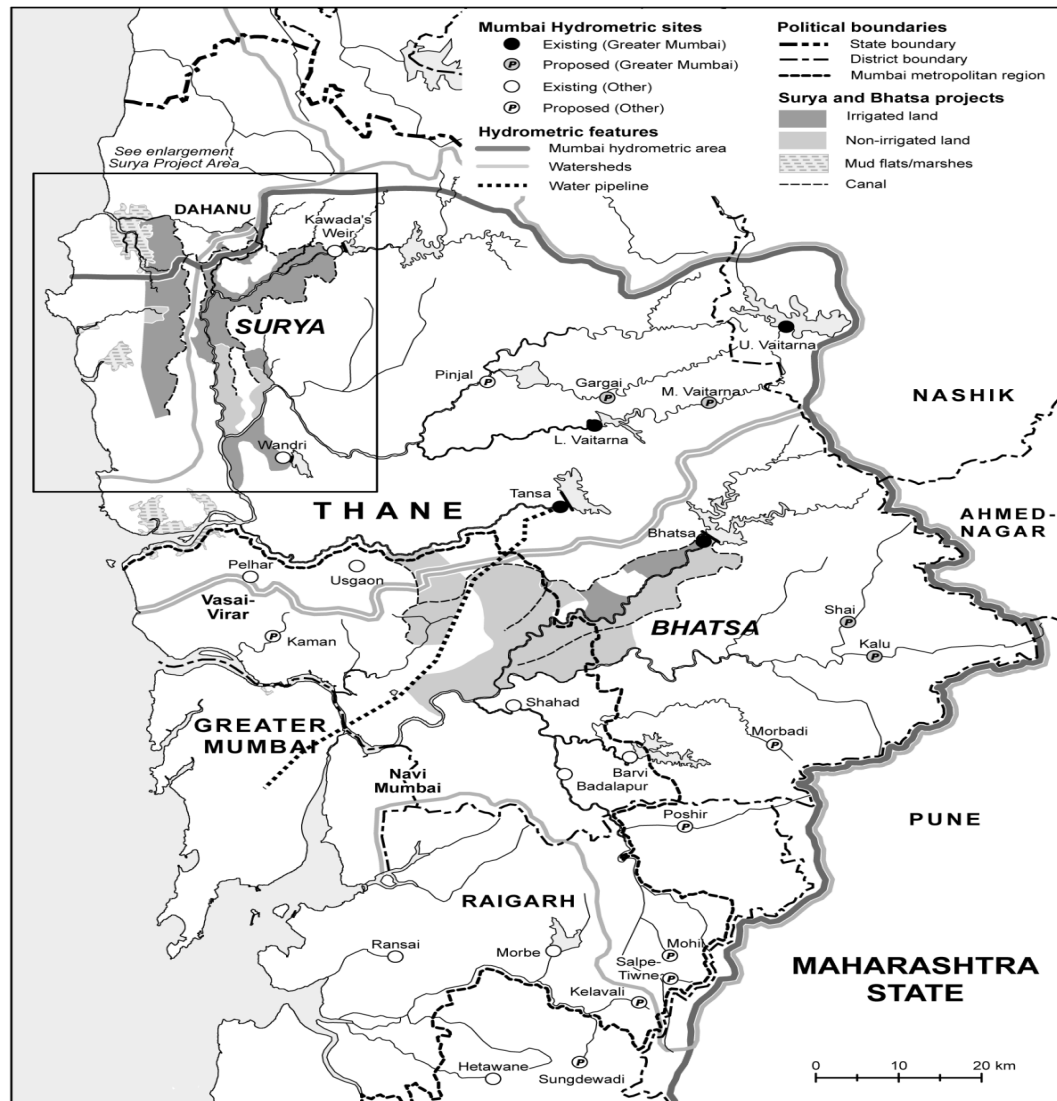


Figure 4.3 - Regional Map of Mumbai Hydrometric Area.

The institutional complexity of the Indian context makes one ask; “how should we frame and analyze institutions in all their contextual variety, so that our approach is

relevant for the purposes of institutional design?” (Aligicia, 2013, p.73). The analysis of contestation in contemporary India requires examining place specific laws and rights and how they emerged from constitutional provisions in relation to the socio-ecological context. For the purposes of this paper, legal rules and procedures are the independent variable and water governance and institutions in this region are the dependent variable.

In summary, this paper applies common pool resource theory by using SES and action situation methodologies to analyze how state actors attempt to resolve disputes between urban and rural water supply in the Mumbai hydrometric area. This action situation also analyzes attempts of communities to advocate for transparency in local water governance. A legal institutionalist (L-I) approach is applied to analyze influence of water laws and social rules in the institutional complexity of the Indian context.

4.4 Placing the Action Situation in a Historical-Evolutionary Context

In a critical review of the CPR literature, Arun Agrawal has pointed out that researchers within the common pool resource literature have paid more attention to the characteristics and functioning of institutions than to the social and historical context in which those institutions actually function and evolve (Agrawal, 2002). A large body of empirical research in the common pool resource literature has also ignored the evolutionary trajectory of institutions and the knowledge systems that influence resource management systems. The CPR literature also fails to analyze how institutions of resource governance interact with one another horizontally or across levels of social organization (McCay, 2002; Young, 2003). This gap is widely prevalent in CPR

research because it is considered impossible to combine the use of historical data with a socio-ecological framework (for two exceptions to this trend, see Chakravarty-Kaul, 1996; Mwangi, 2007). In a context where institutions managing varied resources intersect and overlap, a discrete approach to one resource may not be particularly insightful. While privatization and extractive practices around resources could be one vital aspect of social and ecological transformation, other factors such as choice of technology, organization and legal frameworks are also important to develop a better understanding of institutional evolution in the context of resources.

My focus on the evolutionary aspects of water resource management in the Mumbai context is thus informed by combining the substantive and methodological lessons from Ostrom's corpus of theoretical work on the commons, with Geoffrey Hodgson's recent collaborative research on legal institutionalism within institutional economics (Deakin et al., 2015). The broad lessons from this literature include embracing complexity and developing an understanding of how institutions have evolved in concrete and real situations through interdisciplinary empirical case studies (Frischmann, 2013, p. 393; Pennington, 2012). An understanding of rules that underlie water governance entails developing an in depth understanding of what legal principles have played an important role in the evolution of organizations that manage water systems for large metropolitan urban regions. From an institutionalist perspective, a closer scrutiny of debates on dam location in the Mumbai context yields important information on the institutional evolution of the regional water system. Urban water supply dams fall in a category of engineering projects where technological choices are

considerably influenced by the institutional framework around land, water, and geography. While planning these reservoirs, engineers have to be mindful of both the costs and efficiency aspects of these projects, but they also seek to provide a reliable water supply to large cities without creating conditions of legal insecurity around water rights. Such debates on dam location were and continue to be covered in great detail in engineering journals and Government reports and often reflect competing visions of what can be accomplished by these dam projects.

4.5 The Action Situation - Hydropower versus Urban Water Supply: Creating Mumbai's Property Rights over Water in the Mid-Twentieth Century³

In the mid-1940s, Mumbai was faced with severe water shortages. Financial constraints to expand the city's water supply network during the war had made the situation precarious. The Mumbai Municipal Corporation turned to two of the best experts in India, Sir M Viswesarraya and the English hydrologist Claude Inglis, for advice. Claude Inglis, in a paper in the *Journal of the Institute of Indian Engineers*, advocated the use of the tail race water of the Tata hydroelectric power project in the Lonavala area (also in the Western Ghats) (see Figure 4.4) for meeting the future needs of the city. Though located in the Western Ghats, the Tata project was an independent private sector project and developed independently of the Bombay water supply system.

This understanding of institutions and legal-evolutionary aspects of water governance help to contextualize the action situation in the Mumbai hydrometric area and illuminate the legal principles significant to this case.

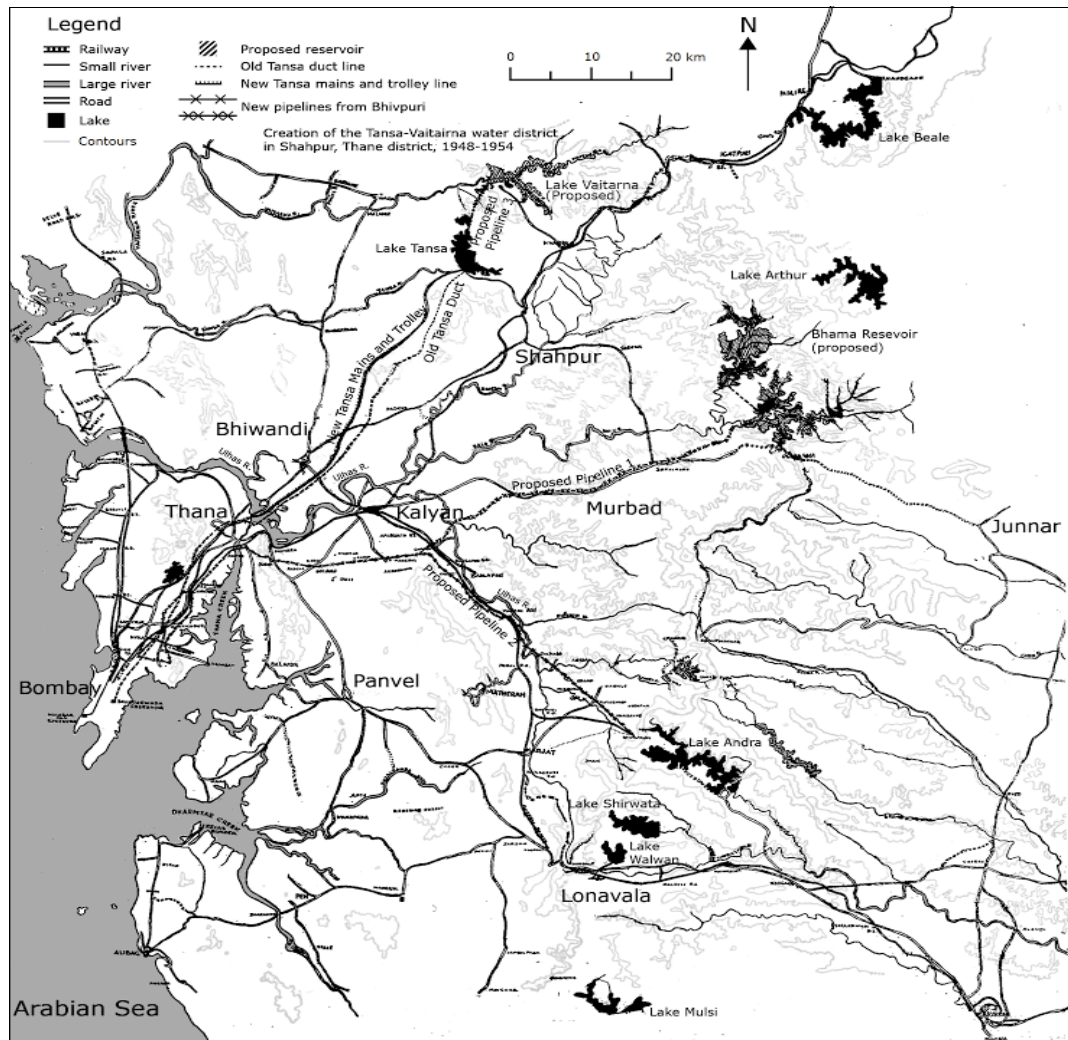


Figure 4.4: Creation of Tansa-Vaitarna water district in Shahpur, Thane District. **Note on Source:** This map was re-worked from a 1948 original by Modak. I thank the University of Chicago Crerar Library for making available the microfiche with the original map.

The Tata power project (Bhivpuri, Andra, Walwan, Shirwata reservoirs) (see Figure 4.4) was completed in 1919 to generate electricity for the city of Mumbai (Vora, 2009). Inglis advocated that Mumbai access the Lonavala reservoir system because he saw it as the most ‘efficient’ and cost effective solution to the city’s needs. These reservoirs were built in the 1920s and the water from the dams (after generating hydropower) drained into the Arabian Sea through the Ulhas River. This water was seen as being wasted. Inglis pointed out that thousands of acres of valuable agricultural and

forest land would be inundated in any potential project in Thane district and exercising the Lonavala option would therefore provide a good alternative.

4.6 Outcome of the Action Situation under the BMC Act of 1888

In a dissenting response, first in an interim report in 1947, and later in a final report in 1948, NV Modak, the special engineer of the Mumbai Municipal Corporation advocated the construction of a new dam in Thane district on the grounds of meeting future needs and the creation of an exclusive water district. He argued that the growth of the city due to industrialization and an influx of population after the partition of India, coupled with the existence of a massive forested watershed in tribal Thane, made the Tansa-Vaitarna area more attractive for building a new dam and could also become a future site of large scale dam building (Modak, 1948, p.47). He also argued that “an adequate infrastructure existed in Thane since the nineteenth century to haul the pipes and the various machinery to build a new reservoir.” This, according to him, would provide economy to any dam project and future dam projects undertaken in the next 100 years. The Tata project, in his view, had limited yield and the tail race water from the reservoirs was in fact accessed to some extent downstream by farming communities and smaller towns that lay along the Ulhas River, thus imparting towns and villages riparian rights (Modak, 1947). Along with the potential issues arising out of the riparian rights of rural communities, Modak also pointed out the legal complexity and uncertainty that a water sharing agreement with a private corporation producing hydro power would cause in years with erratic rainfall. That would create potential pitfalls in securing Bombay’s

future water needs from a legal perspective (Modak, 1948). In a 1948 report authored again by Modak, the two other interlocutors in this debate, Claude Inglis and the Indian engineer S. Visvesvaraya gave their written assent to Modak's proposals, one to build a new independent dam on the Vaitarna river and secondly, to link the new project with the Tansa dam (built in the 1890s) through an aqueduct (Modak, 1948) (See Figure 4.5). As the Bombay Municipal City Corporation decided to construct the next dam in Vaitarna, the region to the north in the Tansa-Vaitarna water district was reserved for meeting demand from Mumbai with all the attendant socio-ecological consequences for the local population (*Times of India*, 1954). The eventual choice to build a dam at Vaitarna highlights the importance of the local water rights situation in the 1940s. Indian water law in the late Colonial period was (and largely still is) informed by riparian principles (Singh, 1992; Cullet, 2010) and the Municipal Corporation used its knowledge of the local water rights situation in its eventual choice of dam location. Communities in T-V water district enjoyed weaker water rights since they lived in what were mostly forested areas. A broad local scholarship has highlighted the historic contestation over land rights (in tribal parts of Thane district) where T-V is located (Ambasta, 1998; Munshi, 1998). Since most communities in T-V did not have clear rights over land, Modak and the Municipal Corporation of Mumbai did not foresee any major legal challenge to the claims and authority of Mumbai over water in the area. In an American urban context, the late Vincent Ostrom pointed to similar strategies employed by the City of Los Angeles to secure and control its own water supply. Ostrom highlighted that "the phase of the cycle involving the movement of water across

the land represents the most strategic opportunity for human control and development” (Ostrom, 1953, p.232). He argued that while most governments are not based on that notion, Los Angeles was deliberately organized to assure control over the San Fernando Valley, a basic hydrological unit of the Los Angeles river system. He argued that having the hydrological unit as the area of government has been the basis of annexation policies for the Metropolitan Water District (Ostrom, 1953).

Similarly, in the Mumbai context, while advocating for a second dam in T-V water district, Modak foresaw how construction of a new dam project in the district would potentially strengthen the city's rights in a forested watershed where there were no other claimants to the water (Beaumont, 1943). Given that there was agricultural activity in T-V watershed, (as pointed out in Inglis' 1945 paper) the only way to secure the city's interests was to reserve the watershed and land around it for the future. In 1964, the technical report of the Bhatsa multipurpose dam further confirms this perception of the importance of the watershed and the role of land rights in influencing dam location. The Bhatsa report points to the “non-existence of riparian rights upstream of the river” where the reservoirs were built (Government of Maharashtra 1964, p. 10). The construction of more dams in the same water district in subsequent decades indicates a preference of Mumbai Municipal Corporation to construct reservoirs in forest areas and is further evidence of the important role of engineering perceptions of the relationship of local land and water rights in the region. The absence of strong riparian rights for local populations in T-V water district in the 1940s and the absence of water claims made it attractive to engineers for exploiting rivers in the area. The

subsequent reservation of the watershed in the 1950s weakened whatever future claim local communities might have to water resources there. Reservation, by default, recognized Mumbai as having prior appropriation rights to water in the area.

In the early 1970s, when metropolitan planning was introduced in Mumbai, the T-V water district was not included within metropolitan region boundaries. The two major institutional developments in this period were the creation of a local Water Resources Board in the late 1960's and the drawing of a hydrometric area that would help with water planning in the region; the hydrometric boundaries of the Mumbai region were extended far beyond those of the metropolitan region and included the T-V water district and the major watersheds to the north, east and south of the metropolitan region (see Figure 4.4). The Water Resources Board did not survive beyond a few years and was disbanded (Binnie's Consulting Engineers, 1971; World Bank, 1996), but the hydrometric area continues to inform water planning and is a term often used to affirm the city's claims over water (MMRDA, 1996). This period from the early 1970s until the late 1980s coincided with the planning of major new towns in the metropolitan region and an attempt was made to balance agricultural and industrial water demand by constructing large multipurpose dams in the T-V water district and in other parts of the hydrometric area. Some of these projects were designed to both irrigate agricultural land and supply water to Greater Mumbai and the metropolitan region, whereas some others existed to simply irrigate agricultural land (such as the Surya, that lies outside the T-V water district but within the Vaitarna basin, see Figure 4.5).

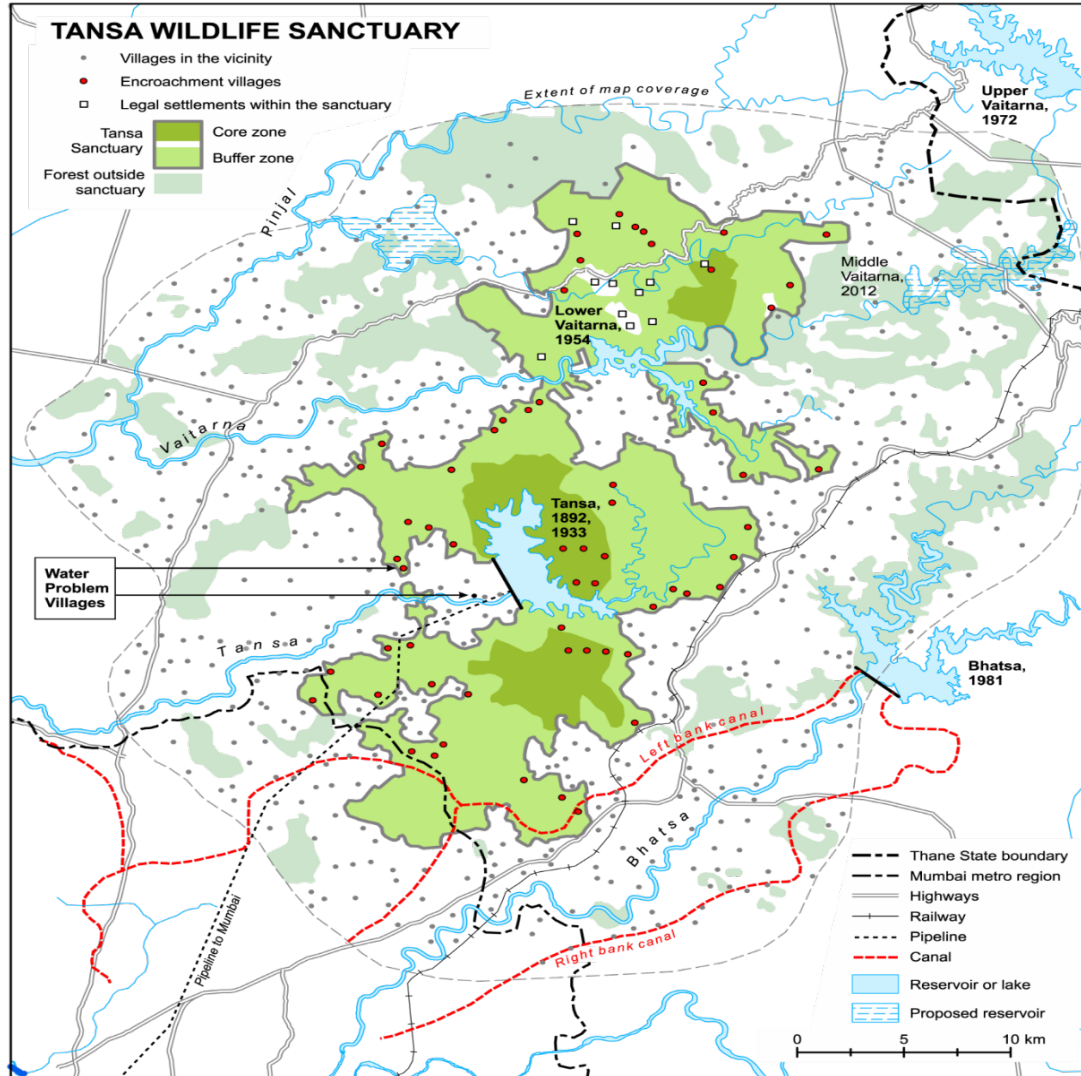


Figure 4.5: Tansa-Vaitarna Water District (Pathak, 2005). This map is a reworking of originals from Tansa Wild Life Sanctuary and GIS shape files from the Water Resources Information System of India at <http://www.india-wris.nrsc.gov.in>. Population of this 659.75 sq. km area was about 95,487 people in 1991 (Pathak, 2005, p. 449). Precise figures unavailable for current period.

How does this specific account of water policy and politics of dam location help illustrate the role of water institutions and rules in an action situation today? Case studies on Indian water governance completely ignore the historical evolution of rules in local contexts. Moreover, it is often claimed that Indian water law comprises many formal and informal laws, norms and principles (Cullet, 2010). Yet the influence of common law tradition on Indian water law means local water rights and rules in any

context carry their own weight. Any exercise of state power in a democracy must depend on the prevailing legal system and local rules that evolve (or remain) over time.

The above account shows us that Greater Mumbai's claims to water in the T-V district were strengthened by the decision to reserve the watershed in the T-V water district (after the construction of the Vaitarna dam in the 1950s). The city's water rights were further entrenched in law by the creation of a wider hydrometric boundary which later became the basis for water planning and the assignment of quotas from the 1970s (MMRDA, 1996; Binnie's Consulting Engineers 1971: 37). Both these decisions to create boundaries had direct implications for the rights of local communities to the water of the T-V watershed. The paper now examines how these institutional choices impacted policies and state and grassroots-led collective action attempts to resolve local water conflicts in the T-V water district.

4.7 Action Situation in the T-V Water District: Outcomes under the BMC Act 1888, the 1976 Maharashtra Irrigation Act, the 1972 Wildlife Act and the 2005 Maharashtra Water Resources Regulation Act

In the early 1970s, a wide, forested and mainly tribal watershed in Tansa-Vaitarna water district was incorporated into the Tansa Wildlife Sanctuary. Figure 4.6 shows the evolution of water governance in Mumbai-Thane region from 1892 to today.

The map of the Tansa-Vaitarna Water District (Figure 4.5) displays more than four hundred habitations in the core and buffer zones of the Sanctuary (see Table 4.3 on the laws that govern resource management in the area). This development brought part of the Vaitarna watershed under the Wildlife Protection Act 1972 and its stringent

provisions governing access of farmers to water, land and forest resources. Since the nineteenth century, communities in T-V district have had a long history of conflict with the state over access, ownership and use of land plots in the forest area for agriculture (Tucker, 1979; Saldanha, 1992; Ambasta, 1998; Munshi, 1998; Bokil and Dalvi 2000; Louw and Mondal, 2012). Over the last 25 years, frequent conflict between the forest

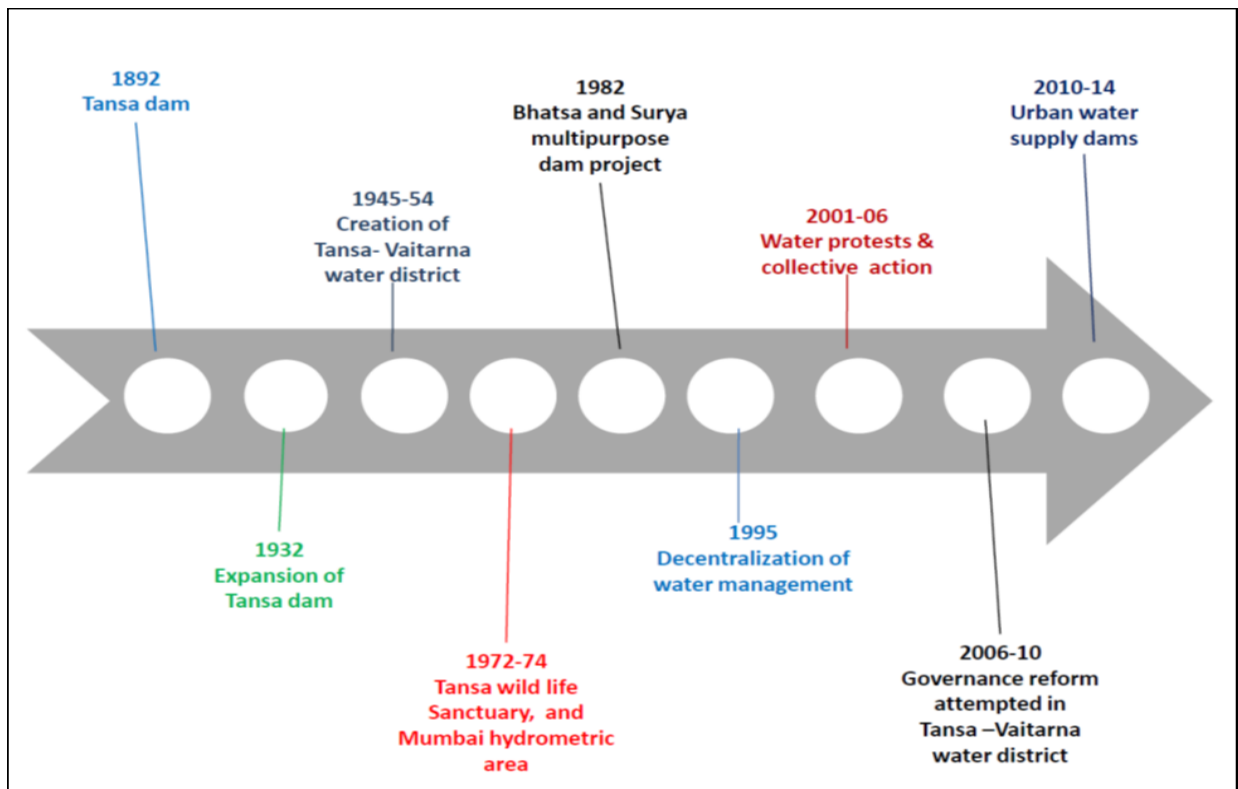


Figure 4.6: Chronological Timeline: Evolution of Water Governance in Mumbai-Thane region.

department and local inhabitants has intensified due to attempted evictions by the local Forest Department of the local tribal populations engaged in agriculture on their forest land plots within the sanctuary. The conflict has been amplified by a growing curtailment of various rights of the rural population over the last three decades (Draft Forest Plan, 1996; Pathak, 2005) that has seen the state declare more than forty human

Table 4.1: Resource and Governance Systems. **Sources:** Pathak (2005); Census of India. (2001). District Census Handbook, Thane District. Bombay: Government Central Press.; Louw and Mondal (2012); Gazetteer of Thane District (1981).

Resource System	Attributes of the Resource System
Type of resource system	Coastal alluvial plains and forest ecology
Location	Konkan; North of Mumbai city
Productivity	Varied, but high in the coastal alluvial plains in Thane district
Clarity of watershed boundaries	Clearly demarcated in the 1980s
Constructed infrastructure Not Well developed until the 1940s	
Diversion dams	Weirs mostly set up on rivers to convey water to cities from larger storages
Headworks	These are mostly located in forest areas
Channels and Canals	These have been constructed in very difficult terrain
Road and Rail network	Markets well developed because of an infrastructure
Resource Units	
Spatial distribution of rainfall	Concentrated in the monsoon (June-September)
Temporal distribution of rainfall	Heavy in the mountains and hills near storages
Economic value of land	High
Economic value of water	High
Actors	
Tribal farmers	Poor-below the official Indian poverty line
Non-Tribal farmers	Middle Farmers, owning more than 2 hectares
Landless	20% of farming population
Economic Status	
Tribal Farmers	Poor access to modern crops or industrial jobs, and they don't migrate to the city
Non-Tribal Farmers	Less poor; 50% are marginal cultivators with access to urban and industrial jobs
Central Government and State Government	
Members of Legislative Assembly	Can request water for their constituency, deny water for certain kinds of demand
National Water Development Agency	Planning large water projects
State officials	Mostly involved in water planning
Local Officials	Not involved
City Officials	City Corporation officers and engineers

Shared knowledge of resource system	
Shared norms among actors	Very low due to caste status of rural communities

settlements in T-V water district as “illegal” (see Figure 4.5). In the last 140 years populations living in settlements in this area have been periodically displaced to create a category of “protected forests” that serve to protect the watershed (Tulloch, 1872; *Times of India*, “Water Supply of Greater Bombay. A report Submitted to the Bench of Justices.” 1954; Ambasta, 1998). At least four thousand tribal cultivators, therefore, continue to live in the forests of Tansa (see “encroachment villages” in Fig 4.5), precariously clinging to patches of land while battling state forest department regulations that threaten their livelihoods. In order to understand the relationship of land and forest tenure to water, it is important to understand the institutional diversity of property rights around land and forests and the implications it has for collective action.

Forest regulations establish three categories of agricultural land. While a third of land holdings are recognized by the state, at least two thirds of the land plots fall under land tenure systems that are renewed every year. Some agriculture is also located within forest areas where cultivation is carried out in contravention of the state regulations around forest land. A majority of farmers in this region are small and marginal cultivators and are dependent on their land holdings and access to the forests for their livelihoods. In terms of pursuing an everyday existence and basic livelihoods, the population living in the Tansa-Vaitarna water district thus face a very difficult situation. A preliminary examination might fault the absence of clear land rights as a problem in resource management in this area (see Table 4.1). However, such a perspective would

be overlooking the problem of geographical scale in resource governance in the water district.

The changing agro-political-ecology of the T-V water district has had a more significant influence on the resource rights of the local communities. For reasons that are elaborated below, it can also be discerned that the institutional design and biophysical boundaries of both the forests and watersheds in the Sanctuary and the T-V water district show considerable overlap. This spatial fit and the legal architecture that has been created in the 1970s to draw a boundary around the forests in the watershed also completely leaves out the local communities (who are one of the main stakeholders) from the decision making and planning process around water and land. The Mumbai Municipal Corporation's stated policy for discouraging human habitations is not to allow pollutants from rural settlements to enter the water within the reservoirs. This has led to very tight regulation of human habitation and land use in the forested belts between the Upper Vaitarna and Modak Sagar Dams (Mulekar, 1985, Gokhale, 1995). However, the exclusion of local communities from the governance of the T-V water district by the various agencies also leaves out any potential co-operation between local communities and the state agencies.

Two local researchers have highlighted the following about the predicament of the local communities when it comes to livelihoods in the T-V water district:

Faced with the choice of either surrendering completely to the dictates of a market economy they are ill equipped to deal with or seeking to eke out a miserable living on small patches of land, most tribals have

chosen the latter option i.e. occupation of the conservation area in the T-V. The close symbolic attachment that tribals have to traditional forest land underpins this choice and determines, clearly, a rational choice that underpins their livelihood strategies. Not surprisingly, this reinforces a destructive circle, bringing tribals and conservation authorities into increasing conflict over the two critical resources discussed earlier, namely, access to land and water. (Louw and Mondal, 2012, p. 54)

The current institutional-geographical profile of the T-V water district has thus been influenced by past enclosures around land and forest resources. These struggles around forests and land have also helped shape place based collective identities in the action situation around water. Figure 4.5 vividly illustrates the spatial geography of land, forests and water resources which the rural communities have to deal with in the T-V water district. It also shows the spatiality of the commons problem and the spatial domains of resource users and the commons. These agro-ecological features and the resource governance system in the area are further delineated in Table 4.1. The poor economic status of farmers in the water district and high value of water (due to urban water demand) in what is a forested area makes water provision for local communities who are socio-economically poor a challenge.

The denial of basic amenities such as water to the local population in the T-V water district as part of a conscious policy by the Mumbai Municipal Corporation

(which owns most of the infrastructure in the area) led to the local self-government to plan and construct a rural water supply system in the T-V water district.

4.8 Rural Water Supply Project: Decentralization in Action

In the T-V water district, the provision of rural water services takes two forms. Rural water supply is a subject of local self-government in the state of Maharashtra. However, communities in rural Maharashtra are also reliant on their own village based wells. The presence of a large Municipal Corporation's reservoirs and water main infrastructure in the water district meant that the water problem could only be alleviated if the Municipal Corporation shared water from its reservoirs in the T-V Water district with villages. Traditionally, in the Indian context and in the state of Maharashtra, water storage and supply are within the domain of state owned enterprises and the state Irrigation Department. Partly, this is a historical inheritance from the Colonial period, more importantly "the characteristics of water with a high degree of natural monopoly, high capital intensity, the presence of sunk costs, the multipurpose and hydrologically interconnected nature of water itself ensures that the state continues to monopolize the provision of water in rural areas in India" (Sangameshwaran, 2010, p. 54). However, two dominant trends in the area of water distribution took over in rural areas of Western India from the mid-1990s onwards. One was sectoral decentralization which was particularly influential and the second was privatization. Noting wide disparities in water access between cities and rural areas, a White Paper on the Drinking Water Problem (Government of Maharashtra, 1995) had acknowledged and emphasized the needs of water in source areas that were located next to dams on a priority basis. In the

T-V water district, overhead water tanks were constructed as part of a project to alleviate the problem for eighteen villages with a total population of 15,000 people by decentralizing water provision. The Maharashtra State Rural Water Supply and Sanitation Corporation (MSRWSSC) now called the Maharashtra Jeevan Pradhikaran set up a Water Supply Division in the T-V water district to provide water to eighteen villages. The construction of water tanks to provide water to the villages in this region started in 1992. Upon completion in 1995, the scheme was to be handed over to the village councils for operation and maintenance. Water for this scheme came from the Mumbai Municipal Corporation reservoirs in the T-V water district. This water supply project in the T-V water district claimed to have involved participation of rural communities, but in fact this was a scheme mostly implemented by a parastatal corporation that supplied water to peri-urban areas in Mumbai (IRHDP, 1997).

The completion of the project and the transfer of water supply systems to local self-government, which did not have the technical capacity to maintain the project, caused recurrent failure in water provision within various villages (IRHDP, 1997). Water provision in rural areas in India is considered the domain of local self-government and village councils (also called Panchayats). However, local village councils that were put in charge of the project complained of shoddy work and poor maintenance, but the main complaint of the local villages was unavailability of water from the Municipal reservoirs and the exorbitant water tariffs. What made the water problem difficult to solve for the inhabitants was the scattered nature of the human habitations with the main villages cut off from several tribal settlements by forests and

rivers (see map in Figure 4.5). Given the forest department's control over land in the area, maintenance work on the water pipes that conveyed water to the tanks through forest land was often not allowed. The location of some of the eighteen villages within the buffer zone of the wildlife sanctuary also added to the challenge. Land use in the buffer zones of wildlife sanctuaries is always marked by a priority to the ecology of the area over human habitations. In the case of the T- V water district, the fact that the water district is located in the middle of a conservation area (where the interests of the local inhabitants on the one hand and the Forest Department and Municipality on the other have been in conflict) led to frequent impasse over the maintenance of the pipeline infrastructure. However, no such obstacles are encountered by the Municipal Corporation in maintaining its own water mains infrastructure for the city of Mumbai as it enjoys more rights of access in the T-V area. Section 263 of the Mumbai Municipal Act that applies to the T-V water district empowers the Municipality to access "any water work within or without the city, adjacent to or in the vicinity of such water-work, in whomsoever such land may vest" (BMC Act, 1888, p. 352). The hierarchy of local rules on land that privilege the BMC over the local self-government institutions in the maintenance of their respective water infrastructures was also perceived as a major cause of failure of the rural water supply project. Moreover, most of the village councils in this area did not have the revenue to purchase water from the Mumbai Municipality, as they are located in a conservation area where land use is severely regulated by the local Forest department and economic activity is severely curtailed. As a result, their

revenue base could not meet the expenditure required to maintain an independent rural water supply scheme in the T-V water district (*People's Daily*, 2007).

The policy to decentralize water through the rural water supply project for eighteen villages thus did not take into account the complex ecology of the area and the evolution of the socio-economic context through the 1980s and 1990s. In this period, the structure of local rules around water and land had further entrenched the interests of the city. The construction of a new dam and the reduced forest in the T-V water district in the 2000s (Singh and Mishra, 2012) as a result of dam building only further widened the lack of trust between various state departments that manage water, forests land and the local communities. The centralized policy making around water planning in the T-V water district where most of the decisions around dam building and water allocation were taken by bureaucracies in New Delhi and Mumbai further worsened the prospect of a good outcome. The role of geography, types of water storage, and water rights in creating a complex water governance system is highlighted in Figure 4.7 and Table 4.3 below. The over concentration of urban water supply dams in a forested watershed has only helped worsen the uneven geography of water entitlement between the city of Greater Mumbai and the T-V water district (see Table 4.2). Since the water district is outside the boundaries of the metropolitan region, per capita water consumption can be even lower than what is in the table.

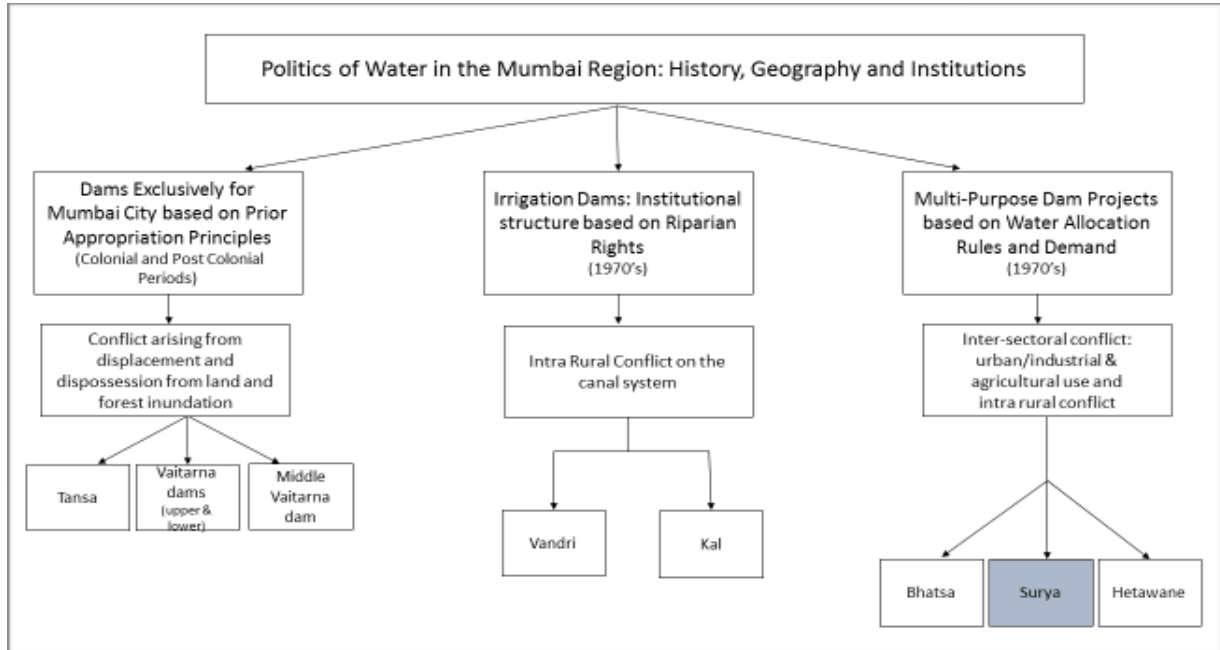


Figure 4.7: The Varieties of Water Conflict – Politics of Water in the Mumbai Region.

Table 4.2: Water consumption disparities between villages and towns in the Mumbai metro region (Government of Maharashtra, 2005).

Per Capita Domestic Water Use Per day in Liters (Mumbai region)	
Area	Water Usage in Liters
Greater Mumbai	240
Navi Mumbai	150
Other Areas	150
Villages to be incorporated in municipalities	70
Other Villages in Rural Areas	70

4.9 Nested Nature of Rules: An Obstacle or an Opportunity in Collective Action?

Problems with lack of access to domestic water such as the ones facing the T-V water district are not unique to this context. Where multiple and often competing policy and legal frameworks around water exist, the problem of rural water supply and

provision is difficult to solve. These issues are exacerbated by chronic corruption fostered by the lack of participation of local communities in water supply projects and drinking water laws that do not recognize the right of rural communities to a minimum per capita quantum of water. Given that the basic water entitlements of the local communities were not addressed by state agencies in the T-V water district through the water supply project, the only alternative to the population in the T-V water district and their representatives was to mobilize rural communities and seeking the intervention of higher levels of government.

The early 2000s witnessed the emergence of a local movement that managed to bring the local tribal and non-tribal communities on a common platform and widened the list of demands from domestic use to water for irrigation use. It also questioned the wisdom of the government constructing multiple urban water supply projects in an area where people displaced by past projects were yet to be rehabilitated within the same forested belt. Given that the local context was characterized by divisions of caste amongst the poor inhabitants of this water district, this rare moment of rural collective action was a significant development. Mobilizations, work stoppages on maintaining the Municipal Corporation's infrastructure (local communities are employed in maintaining the city corporation's infrastructure) and information campaigns on the water issue followed (Centre for Science and Environment, (CSE) 2013). In the summer of 2006, communities living in 104 villages next to the reservoirs threatened to break the valves of the water mains supplying water to Mumbai. The immediate cause for such direct action was an acute water problem and a localized crisis with non-availability of water

for irrigation. The State Government's persistence in going ahead with a new project led to a major change in the strategies of local actors in their advocacy on water issues in the T-V water district (CSE, 2012 see '*Mumbai's Water Fuels Rural Ire*').

In 2007, another local political party in the T-V water district revealed that the Mumbai Municipal Corporation which accessed the T-V water district owed millions of rupees in water revenue to local village councils and district level governments (*People's Democracy, 2006*). This symbolized a major change of strategy from action at the local level to a higher level of governance. The tax revenue according to the party was to be paid as part of an inter-governmental transfer of revenue from the Municipal Corporation to the local village governments as the Corporation had sourced water for decades from a rural area. This change in strategy by local political actors was an acknowledgement of the nested-ness of the water rules that governed the management of reservoirs in the water district. This change in strategy also revealed a major dilemma for the local movements with the governance arrangements in the water district. The ownership and management of various reservoirs in the T-V water district was found to be divided between the Mumbai Municipal Corporation and the State Irrigation Department. Three of the five major reservoirs in the T-V water district are owned by the Mumbai Municipality and two are owned by the Irrigation Department. Dams south east of the T-V water district are owned by parastatal agencies like the Maharashtra Industrial Development Corporation, smaller municipal councils while some others are owned by the Mumbai Municipal Corporation (see Table 4.3 for ownership and water rights to reservoirs in the T-V water district and the hydrometric area)

Given that there is no formal monitoring authority (other than a committee headed by the State Irrigation Minister of the state of Maharashtra) to manage the apportionment of water between various users and adjudicate water disputes, the higher status accorded to Mumbai's water demand in the T-V water district is identified in this paper as one of the major factors that led to frequent conflicts between the state Irrigation Department and the Municipal Corporation. These problems often reach their peak in the summer when the State Irrigation Minister has the sole authority to manage water conflicts between various large users in the T-V water district. Given Mumbai's senior water appropriation rights, the beneficial aspects of urban drinking water use, and the political clout of the city, water quotas are always allocated to Greater Mumbai, even if such a decision clashed with the water needs of other Municipal Corporations in the region that use the T-V water district as a source (Indian *Express*, 2010; *Asian Age*, 2012).

The unwillingness of the state government to reform the local institutional architecture around water in the T-V water district echoes a similar problem with water governance throughout the state of Maharashtra where the absence of water councils at the district level is noticed in the above analysis. Decisions around water allocation in the context of disputes are made by the state Irrigation Minister (or the Chief Minister) on an interpretation of existing state policy and local water laws and rights. This has led to a situation where there are conflicts between governmental authorities at various levels in the metropolitan region (Pethe et al, 2011) and growing discontent within rural communities that are faced with very poor per capita access. Thus, in some respects, the

action situation in the T-V water district is also characterized by ‘institutional opacity.’ The lack of co-ordination between the territory planned and governed by the metropolitan/municipal authorities and the so called hydrometric area has further contributed to a fragmentation of metropolitan water governance. The resulting fragmentation in water governance is further exacerbated by the ownership of reservoirs by different state and parastatal entities which in turn is sought to be coordinated centrally by the state ministry in Mumbai when a local district council in the Mumbai-Thane region could better adjudicate water disputes between different actors (see table 4.3 for data on institutional ownership of dams).

Identity politics in the water district with antagonistic relations between caste Hindus (locally called the Kunbi Marathas) and the tribal community also had their own negative impact on the outcome of the action situation. Culturally, tribals are placed outside the fourfold hierarchy of the Hindu caste system and past struggles around land have often pitted caste Hindus against the tribal community in the water district. Moreover, every village and the local self-government is structured in a manner where caste Hindus inhabit the main villages and tribal communities that are part of the same village are dispersed in settlements in the forest surrounding the villages. This geography of human settlements had its own impact on collective action. Political leadership in the villages is usually drawn from the tribal community, but caste Hindus tend to be dominant which tends to influence rural collective action (Varshney, 1995). In the water district, however, both Kunbis and tribals are equally impacted by the monopoly of the Municipal Corporation over the water in the T-V water district

However, the tribal community is poorer and faces high seasonal distress migration rates.

4.10 Prior Appropriation and Local Water Institutions: Implications for Water Governance and Mumbai's Senior Water Rights

The eventual outcome of the action situation was influenced by the social and economic constraints faced by participants that result from the structure of water governance in the T-V water district. The rural water supply project was also located in a forest area where at least a third of the farmers in the T-V water district did not have legal titles to their land plots, were mostly poor and also as a result faced high seasonal migration rates as a result of a lack of viable livelihood options within agriculture (see tables 4.1 and 4.3 on the governance system around land and water).

Access to information on the management of water and the vertical hierarchy between various organizations (the Mumbai Municipal Corporation, the State Irrigation Department and the Forest department) are also a major constraint to successful state led or bottom-up collective action.

The civic officials in the Municipal Corporation are not equipped to be sensitive or deal with the problem of rural water supply in the T-V water district.

Most importantly, the action situation highlights how the local institutional arrangements enable the regulator (in this case, the state Government of Maharashtra) to favour one user of water over another. This interpretation and use by the state

government of local water law to privilege Mumbai over other water users in the region is a significant finding from the above analysis.

Another example of appropriation in the T-V water district is the case of water diversion from the Bhatsa multipurpose dam project (*Mumbai Mirror*, 2010). When the World Bank funded this project in the 1970s, no known allocation rules from rural to urban use were tied into the dam's project design, though the Bank had advised state officials to manage water resources in a comprehensive multi sectoral way (World Bank, 1996:p.29; Binnie's Consultancy 1971: p.35-38). The city of Greater Mumbai has benefitted from a diversion of water from the Bhatsa project since the mid-1990s (Chitale, 1994). This is unlike the Hyderabad context, where the World Bank (perhaps due to its knowledge of the local rights of farmers in the Andhra Pradesh context) ensured that it funded a dam project that had allocation rules written into its objectives. This ensured that the state government could follow these rules when it regulated the re-allocation of water from rural to urban use (Celio et al, 2009). Not much is known whether such rules exist in the context of Mumbai.

How do Ostrom's design rules help us understand the working of institutions in this particular context? While the T-V water district has clearly defined watershed boundaries and Mumbai's water resource boundaries are defined by the hydrometric area that coincide with these boundaries, the internal rules of allocation do not prevent the main user, in this case, the Municipal Corporation of Greater Mumbai, from over-extracting water from the T-V water district (See Table 3 on dam ownership and Section 5.3.3 in Paper three below on how ownership and water rights affect rules of allocation

Table 4.3: Large and Medium Dam Project Ownership and Water Rights

Sources: Irrigation Department, Thane Irrigation Circle: [http://www.seticthane.org/storage-position_Data on dam completion dates from National Register of Large Dams, 2014:](http://www.seticthane.org/storage-position_Data_on_dam_completion_dates_from_National_Register_of_Large_Dams_2014)
<http://www.indiaenvironmentportal.org.in/files/file/NRLD%202014.pdf>²

Dam Name and year of completion	District	Institutional Ownership of reservoirs	Urban Water Supply (to Mumbai and other cities in metro region)	Irrigation	Industrial Water Supply	Hydro Power	Legal frame work that influences rights to stored water	Designed Live Storage in Mm ³
Dhamani (Surya project) 1987	Thane	Irrigation Department of Maharashtra	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		R	276.52
Kawadas (Surya project) 1979	Thane	Irrigation Department of Maharashtra	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		R	9.96
Bhatsa 1983	Thane	Irrigation Department of Maharashtra	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		R, PA	942.10
U.Vaitarna 1972	Nashik	Irrigation Department of Maharashtra	<input checked="" type="checkbox"/>				PA	331.31
Wandri 1987	Thane	Irrigation Department of Maharashtra		<input checked="" type="checkbox"/>			R	35.94
Mulshi 1927	Pune	Tata (Pvt. Corporation)				<input checked="" type="checkbox"/>	R	522.76
Andhra 1916	Pune	Tata(Pvt. Corporation)				<input checked="" type="checkbox"/>	R	339.14
Walvan 1916	Pune	Tata (Pvt. Corporation)				<input checked="" type="checkbox"/>	R	66.12
Shirawata 1916	Pune	Tata (Pvt. Corporation)				<input checked="" type="checkbox"/>	R	191.28
Lonavala 1916	Pune	Tata(Pvt. Corporation)				<input checked="" type="checkbox"/>	R	11.72
Modaksagar 1954	Thane	Mumbai Municipal Corporation	<input checked="" type="checkbox"/>				PA	128.93
Tansa 1892	Thane	Mumbai Municipal Corporation	<input checked="" type="checkbox"/>				PA	145.08
Vihar 1860	Mumbai	Mumbai Municipal Corporation	<input checked="" type="checkbox"/>				PA	27.07
Tulshi 1860	Mumbai	Mumbai Municipal Corporation	<input checked="" type="checkbox"/>				PA	8.05
Middle Vaitarna 2012	Thane	Mumbai Municipal Corporation	<input checked="" type="checkbox"/>				PA	194.72
Barvi 1978	Thane	Maharashtra Industrial Development Corporation	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		PA	180.03

in the Mumbai-Thane region). The following excerpt from a water bylaw of the Brihanmumbai Municipal Act (1888) provides some insight into the power of the Corporation in the water district,

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, Provision 288, p.188)

The excerpt above tells us that the Municipality of Greater Mumbai has the sole authority to decide if other towns in the metropolitan region and villages in the T-V district can share water from the dams owned and accessed by the Mumbai Municipal Corporation. Given the mandate provided to the state government by the Irrigation Act of 1976 as a regulator, the decisions on disputes over water allocation and the construction of more dams in the T-V water district by the Central and State government has only affirmed these senior rights of Greater Mumbai. This means that not only do the local rules of allocation in place favour the Municipal Corporation's rights to draw more water from the water district and build more reservoirs, but the higher level rules that are meant to balance that right of the Municipal Corporation with those of the rural communities have not been utilized optimally by the state government.

The status of the T-V water district being located in a designated tribal area actually empowers its elected representatives to advocate for the interests of the villages and their basic water needs under constitutional provisions that protect tribal areas.

However, the interpretation of the local water rights structure and the priority accorded to Mumbai's water demand coupled with the political clout of the city ensures that this mandate is never exercised. The situation is worsened by the absence of an impartial monitoring and enforcement mechanism at the regional or the state level. The Maharashtra Water Resources Regulatory Authority, a regulatory body, that was set up in 2002 to adjudicate disputes and allocate water entitlements, has a provision that subordinates its power to make decisions to state water policy, thus making the act ineffective in dealing with water disputes in a fair and transparent manner (Wagle et al., 2012).

A legal-institutional analysis of local water governance in the T-V water district reveals that the water laws of the Mumbai Municipal Corporation and the State government of Maharashtra rely on a combination of prior appropriation and riparian principles (Beaumont, 1943; BMC Manual, 1976); also see Table 4.3). The implication is that since the Mumbai Municipality was the first to harness water resources in the T-V water district and reserve the watershed for its purposes, Indian water laws confer upon it a status for senior rights over local users and even other cities that share water from T-V reservoirs. However, the riparian influences in state and central water laws only confer usufruct rights to local water users in the T-V water district thus rendering their claims weaker in comparison to those of the city of Mumbai and other towns in the Mumbai metropolitan region (see Table 4.3). Table 4.4 summarizes the attributes of the governance system at play in the T-V water district. The reservation of the T-V water district in the 1950s for Greater Mumbai had a direct impact on both the water and land

rights of the local communities. While the implementation of the Bhatsa Multipurpose irrigation project sought to balance the water needs of the city and irrigation demand in this water district, the governance arrangements around the intersectoral sharing of water ended up turning out to be inadequate. The conferral of senior water rights to Mumbai from the Bhatsa project only reinforced this disparity since national water laws such as the Indian Easements Act only grant customary rights to local communities and no contestation of prior appropriation through the existing legal framework is possible. In 1992, the Indian legal scholar, Chatrapati Singh critiqued the influence of prior appropriation principles in national water laws (like the Indian Easement Act) and local water laws. Singh pointed out that prior appropriation fails to recognize the rights or needs of new users for distribution and does not meet the demands of natural justice. The influence of prior appropriation principles that inform the senior water rights of the city of Mumbai in the T-V water district is primarily a vestige of the colonial period in India. It merely records and recognizes “political fact of acquisition or appropriation.”

Table 4.4: Governance System and Outcome of Action Situations under Central, State and local water laws in northern and coastal Thane District. **Sources:** Following Bombay Municipal Corporation Act (1988), People’s Democracy (2006) and Pathak (2005).

Governance System	Attributes
National Legislation	<ul style="list-style-type: none"> Indian Easements Act, Statute of Limitations
State Legislation	<ul style="list-style-type: none"> Bombay Irrigation Act 1976
City Legislation	<ul style="list-style-type: none"> Bombay Municipal Corporation Act 1988
Rules regarding Landholding and Forests	<ul style="list-style-type: none"> Land Ceilings in place Tenancy rights under Bombay Tenancy Act 1953 Wildlife Protection Act governs Forest land Eksali laws (one year leases to cultivate land in forest area)
Average size of landholding	<ul style="list-style-type: none"> 0.2-0.5 hectares Contestation around land in forest areas

Formal rights to land	<ul style="list-style-type: none"> • Not always assigned formally. • Land in forest areas under control of farmers (see Figure 4.5) • One Year leases for cultivation. • Formal Land Titles needed to access water from canals
Property rights to water	<ul style="list-style-type: none"> • Riparian Principles in areas serviced by canal irrigation • Prior Appropriation principles in Tansa-Vaitarna water district • Rights to water under the Indian Easement Act • Bombay Irrigation Act
Ownership of irrigation and water supply dams	<ul style="list-style-type: none"> • Water in storages owned by different parastatal entities such as state Irrigation Department, public water agencies, state industrial corporations & Municipal Corporations. • Other River use regulated by state
Financing of rural water supply for domestic use	<ul style="list-style-type: none"> • State support; grants provided by the state government
	<ul style="list-style-type: none"> • Water charges paid by village councils
Monitoring of relevant transactions	<ul style="list-style-type: none"> • Public sector irrigation corporation/Bombay Municipal Corporation
Conflict = resolution arenas	<ul style="list-style-type: none"> • Local Courts, High Court, District Council (Zilla Parishad)
Action situations around water	Attributes
Maintenance of rural water supply systems. Water for domestic use in rural areas	<ul style="list-style-type: none"> • Poorly serviced infrastructure • Revenue often not shared by city with rural areas • Multiple agencies with conflicting agendas • Low revenue base of Village Councils due to their location in forest areas
Maintenance of irrigation in major and minor projects	<ul style="list-style-type: none"> • Poorly maintained conveyance systems; lack of co-operation amongst farmers; absence of participation by farmers • Arbitrary diversions of water to urban areas
Social Action and search for institutional alternatives	<ul style="list-style-type: none"> • Demands for rural water quotas • Struggles against displacement

Furthermore, “it also provides no legal grounds for why the new settlers or users cannot appropriate water for their own beneficial use.” Moreover, “instead of providing a legal arena for conflict resolution, prior appropriation leaves the entire matter to political or

coercive methods” (Singh, 1992, p. 69-70). Many countries that share the common law framework with India have reformed their water laws to reduce the influence of riparianism and prior appropriation, South Africa being a case in point.

4.11 Conclusion

From a theoretical perspective, this case study on the Mumbai region has identified some of the potential common ground between the IE and the HG literature(s) on the theme of water sharing between large cities and their source areas. First, the findings could remind environmental geographers that bad rules are as much to blame as political power and the social and cultural hierarchy of different places in the uneven distribution of water. The paper identifies the influence of prior appropriation in the water bylaws as a major constraint in the ability of villages in the T-V water district to meet their basic water needs and their demand for irrigation quotas. Ostrom’s SES framework is a useful tool to identify the influence of rules that are implicit in the application of local water laws and policy. On the other hand, institutional economists could better appreciate the significance of geographical variables in the outcome of action situations. The demands of a large and growing urban centre, the forest ecology and the evolution of land, forest and water institutions are some of the enabling spatial factors that influenced the outcome of the action situation. An understanding of the politics of scale can thus be a helpful addition to the toolkit of institutional economists; they can be useful in telling us how geographical scales are socially produced in the course of action situations (Swyngedouw, 2004). In addition to the rules and the

geographical context of the water district, a third factor that overlaps geography and institutions is the fragmentation of water governance in the so called Mumbai hydrometric area. This is identified as another major impediment to ensuring a fair distribution of water between various regions. Recent research in the Mumbai context has argued that the presence of multiple Government agencies with overlapping functions has actually obstructed the effective implementation of decentralization and governance reform in several development schemes (UNCHS, 1993; Pethe et al., 2011).

Reform of water governance in Mumbai could begin by confronting the archaic legal institutions on water in this growing mega-urban region. Reform also needs to address the fragmentation of metropolitan governance, and establish a more democratic arrangement that is representative of sectoral interests on water. Empirical evidence from Southern India that cites 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 (Vaidyanathan and Jairaj, 2009: p. 7). However, such 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 the hydrometric area is written in rules that were crafted for another time.

Notes

1. My reference here is primarily to developing countries. This lack of attention could be attributed to the focus on small-scale communities in the common pool resource literature. However, a classic in the institutional literature on this subject of the creation

of water districts that predates the common pool resource literature is Vincent Ostrom's book *Water and Politics*, a study of Los Angeles (Ostrom, 1953). There are also several multidisciplinary studies on inter-sectoral water management and water conflict in development studies, political science, geography, but few of these have focused on the institutional and geographical implications of an exclusive water district for a fast growing city at the level of contextual detail as V. Ostrom's 1953 case study of L.A.

2. This debate from the 1940s is presented to further my argument that the Mumbai Municipality and the Metropolitan Planning Authority's present refusal to countenance any claims by rural communities towards water has been shaped considerably by engineers to take for granted that the water within the "hydrometric area" has been allocated to for urban and industrial use. The Mumbai Municipality has refused to take any lessons from its experience because as an organization, its behavioural habit and institutional disposition to serve urban interests are mutually entwined and reinforcing. Its stated commitment to serve urban demand completely ignores rural aspirations. This is despite legitimate rural claims for minimum water entitlements that even the state government has acknowledged. There is no official acknowledgement by the Mumbai Corporation or the State Government of Maharashtra of a water district, though water resources in the hinterland have been reserved for future urban utilization since the early 1960's. Instead, the vague technical term 'hydrometric area' has been constantly referred to in the water plans and the metropolitan planning documents since the 1970s. The first reference to a hydrometric area was first made in Binnie's consultancy report of 1971 for the Government of India on planning water resources in the Mumbai region.

A hydrometric area is generally referred to a grouping of catchments for monitoring and reporting purposes. My interviews with planning officials in Mumbai revealed that water in this entire hydrometric area is reserved for the city, though the reality is that the water rights situation in rural communities is far more complex and variegated with small, medium and large irrigation projects that continue to supply water and meet irrigation demand in some pockets (see Figure 4.3).

3. Data on ownership accessed from Chitale Committee Report (1994); Maharashtra Irrigation Commission Report (1999); and Thane Irrigation Circle website. PA stands for prior appropriation, and R for riparian rights. This classification is based on analyzing water diversion data from various reports, and responses of State Government to legal affidavits challenging such diversions. Dams in T-V water district are reserved for Mumbai, which has senior rights to water. In the case of Bhatsa Dam prior appropriation and riparian rights overlap. The primary objective of Bhatsa Project is to meet demands of Greater Mumbai and other MMR towns, but water is allocated by Ministry of Irrigation based on local water rights, needs and scarcity. While this dam was built in a watershed reserved for Mumbai, farmers in Shahpur and Bhiwandi have rights to water from the reservoirs, and other cities in the metro region downstream of Bhatsa but upstream of Greater Mumbai also have developed rights to Bhatsa water. Tata stands for Tata Power Corporation.

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5 The Paradox of Dispossession Amidst Plenty: Social differentiation and Institutions in Intra-Rural Water Conflict in the Mumbai-Dahanu Region

In his fictional 2011 novel, *Dahanu Road*, the Indo-Canadian author Anosh Irani shares with his readers the story of Dahanu, a fertile and scenic agricultural belt outside Mumbai, famous for its vegetables, fruits and orchard farms. Irani narrates the saga of the intertwined fates of feudal landlords and the agricultural labourers of the indigenous Warli tribe in a gripping account that combines drama with accounts of exploitation of the tribal community over the last century (Irani, 2010). Missing in Irani's dramatic account of violence and dispossession in Dahanu are three social and cultural contradictions that now characterize the landscape of this region outside Mumbai and the wider metropolitan region.

The first and primary contradiction is the one between the city of Mumbai and its agricultural countryside to the north that finds growing expression in the increasing number of anti-dam and anti-urban water diversion movements. The second is between tribal and non-tribal commercial farmers around access to resources, where the former are at the receiving end of water and land grabbing practices of the latter. The third contradiction is the conflict between modern and traditional agriculture within Dahanu. This is a place where large commercial farmers are bringing in new technology for growing horticultural crops, whereas tribal farmers continue to cultivate domestic and traditional paddy varieties. These three contradictions increasingly characterize the

Mumbai- Dahanu region with the contestation around water at the very centre of this cultural landscape.

This paper is an ethnographic account of how all these contradictions play out in the horticultural belt of Dahanu, Thane district in western India. Dahanu is located in northern Thane district in Maharashtra and borders the western Indian state of Gujarat to the north and Palghar to the south. It lies outside the boundaries of the Mumbai Metropolitan Region, but it has witnessed some industrial spill over from both Gujarat and Mumbai over the last three decades. Dahanu is one of the most fertile parts of coastal Maharashtra state and is also home to a diverse population of the local Marathi and Gujarati speaking communities. It is also the site of a new struggle over the construction of a new dam to meet water demand of towns in the Mumbai Metropolitan Region. Using an account of social relations around land and water in an agrarian context that enjoys the benefits from canal irrigation, this paper focuses on experiences of water scarcity in the context of intra-rural conflict on a canal system. It narrates the story of the uneven development of Dahanu's horticultural belt, where the promised benefits to the tribal Warli community from the Surya irrigation project have not been realised. The two central empirical themes of this paper are a study of social differentiation in the geographical context of an agricultural belt irrigated by canals and an examination of the role water technology and local land and water institutions have played in shaping intra-rural conflict over water. As a contribution to the literature on nature-society relations in the Mumbai region, this study of intra-rural conflict on the

canal system in Dahanu will build understanding of the claims of the fast expanding Mumbai Metropolitan Region on water from this particular irrigation project.

Using a hybrid of two institutional approaches from political ecology, the socio-technical and hydro-social, this paper explores the institutional and technological architecture of canal irrigation and the everyday working of irrigation systems in rural India with a focus on the experiences of farmers with water access and scarcity. This paper takes six main steps in investigating social differentiation and local water practices with a focus on the role of water and land institutions. The paper begins by examining the broad interface of local geography and institutions around water, canal systems, urbanization and agricultural land in the Mumbai-Dahanu and Konkan regions. Secondly, it presents an argument from the interdisciplinary environmental politics literature on how ethnography can be an important tool for researching the scalar dimensions of local water management. The paper then presents qualitative evidence on social relations in irrigated agriculture and shows that the practices around water use and grabbing by large commercial farmers during the irrigation season is an act of power meant to serve accumulation objectives. It later situates this evidence in the context of the institutional architecture around water rotations and the functioning and state of the canal system in the Surya command area. It also presents cartographic data on the transformation of the ecological and agricultural landscape, and the functioning and governance of the main canal system in the everyday context of the two villages. Finally, it presents the broader socio-ecological consequences of formal and informal

water practices in Surya project, the varied social response to irrigation and its implications for growing claims on Surya water from outside the project.

5.1 A Hybrid Institutional Framework

From within the discipline of human geography, this paper is closely informed by two theoretical approaches that have been influential in the critical literature on water and irrigation research. These are the socio-technical and the hydro-social frameworks. Both these frameworks have been useful in analyzing the interactions between social relations, technological systems around water and the everyday micro politics of water governance. The main argument of the hydro-social approach is that the “models of the hydrological cycle that dominate water science need to be combined or integrated with conceptualizations of social dynamics” (Mollinga, 2013, p.1-2). Theorizing the hydrological cycle as a hydro-social cycle is also an effort on the part of geographers to avoid the pitfalls of reductionist and depoliticized water resources management analysis (Mollinga, 2014, p. 1). Here, the theoretical contributions of critical geographers such as Jamie Linton, Erik Swyngedouw and Jessica Budds have been important. Working in diverse contexts and exploring the history of water science as in Linton’s case, this geographical scholarship has made compelling arguments about the importance of a critical analysis of state-led hydraulic paradigms and water governance practices that have become hegemonic in the twentieth century. The hydro-social cycle’s key objective is “to capture the ontological complexity of water resource management as being structured, stratified and heterogeneous and in critical

perspectives, contested systems and processes animated by configurations of actors networked in a variety of social relations of power that shape their individual and collective agency” (Mollinga, 2013, p. 2). All three scholars have thus advocated for a process and human centred understanding of the water cycle. The socio-technical approach to water systems research has its origins in an influential argument from science and technology studies about the social construction of technology. Here, “the inter-relationship of technical/physical, organizational/managerial and socio-economic/political control of water” are the central issue (Mollinga, 2013, p. 2). In the Indian context, the canal system can thus be seen as a socio-technical configuration of relationships of communities of irrigators with the outlet structures on canals which in turn are the important sites of contact and contestation between the system’s engineers and irrigators (Mollinga, 2010: p.424). The re-working of these canal systems in the local context and the experiences of farmers with this system and its managers constitute the main focus of this theoretical framework.

Both the hydro-social and the socio-technical frameworks have been used by interdisciplinary scholars studying water conveyance systems such as canals in the rural context. Thus, within this body of critical water literature, the recent research of scholars like Peter Mollinga and Vishal Narain on canal irrigation systems in southern and western India is important (Mollinga, 2003; Narain, 2003). Influenced by this latter scholarship, this paper pays close attention to the institutional and technological architecture of canal irrigation and analyzes their functioning from both the socio-technical and hydro-social perspectives. At the same time, it also tries to develop an

understanding of the working of irrigation systems in the everyday context of rural India keeping in view the cultural specificity of the local context with a focus on the experiences of farmers with water access and scarcity. The main theoretical argument of this paper is that these critical approaches drawn from human geography, when combined with an ethnographic study of the actual movement of water in a conveyance system, can be usefully deployed to distil the materiality of water and the manner in which it shapes and is in turn shaped by social relations. Thus, while I have much in common with recent researchers who have used these critical frameworks to analyze canal irrigation systems in the Indian context, I supplement the hydro-social and socio-technical approaches to utilize a new emerging body of theoretical literature, namely the paracommons approach.

5.2 The Paracommons Approach

Conventional intellectual and policy understanding of the impact of irrigation on rural societies has been deeply influenced by the principle of seeing water in volumetric terms and the language of the hydrological cycle. As a result, most empirical work on water has not focused on the possibilities of water savings (Lankford, 2014). The socio-technical and the hydro-social approaches to water are not devoid of this focus on seeing water in volumetric terms and in terms of water quotas. A potential problem with an exclusive application of these frameworks in the context of this particular case study is that they would be unable to analyze and account for the social and ecological possibilities that are created by water efficiencies at the farm level and the waste

resulting from the underutilization of water. This is because in their application to the Indian context, the socio-technical and hydro-social approaches have been mainly applied to water scarce contexts (Mollinga, 2003; 2013). At the same time, the socio-technical approach retains some of its utility to irrigation in Dahanu. The implementation of canal technology based on the principles of productive irrigation was developed from certain knowledge and experience that came to this region from the interior of Maharashtra (WAPCOS, 1996). However, while useful in analyzing canal technology and its reception by farmers in this area, the socio-technical approach is unable on its own to grapple with the material properties of water and its abundant availability in Dahanu context. A scalar approach that incorporates the possibilities of the creation of surplus and unutilized water is more useful here. The hydro-social and socio-technical approaches are also somewhat constrained by their Marxian lens in analyzing consequences of such efficiencies. Similarly, even the Common Pool Resource (CPR) literature is seriously constrained by lack of attention to efficiency.

In an important revisionist contribution to our understanding of the commons and water in particular, Bruce Lankford has drawn attention to the lack of attention in the Common Pool Resource (CPR) and the political ecology (PE) literatures to the consequences of micro level efficiencies in the use of water resources and the potential future pathways of such efficiencies (see Table 5.8). Where do the savings made in our use of resources end up? The silence of both literatures on this subject has made Lankford coin the concept of the “paracommons.” The paracommons views “social ecological systems as being shaped by efficiencies and the material salvaged losses

from efficiency improvements, giving rise to a wider system of systems than is usually recognized” (Lankford, 2013, p. 17). Thus, according to Lankford “the idea of the ‘paracommons’ is to view water in a different way. As yet-to-be conserved gains within a system, water movement and use can waste or ‘save’ previously wasted water. But where does that ‘saved’ water go? Who has claims to freed up water resources from improved technological or social practices?” (Lankford, 2013, p. 29).

In this paper, I have merged the paracommons framework with its close attention to the assembling, use and diversion of saved (and wasted) water with the socio-technical and hydro-social’s emphasis on the complex, stratified, heterogeneous and political nature of water governance (Mollinga, 2013; Linton & Budds, 2014). The fact that two thirds of the land in the horticultural belt under study is comprised of vegetables irrigated by drip and sprinkler irrigation points to the substantial savings on a canal system where engineers continue to release water at rates intended for more water –consumptive paddy cultivation.

5.3 Water Surplus and Abundance: Socio-Ecological Transformation and the Commons in the Mumbai-Dahanu Region

5.3.1 The Surya Project: Geography and Political Economy of the Project and Villages

The Surya project is a large multipurpose dam that lies in the western parts of Thane district in Dahanu and Palghar sub-districts (see Figure 5.1). It is one of the few irrigation projects in the country designed to benefit more than 25,000 hectares of small

holder agricultural land in 64 villages, most of which belong to tribal agriculturists in the area of Dahanu and Palghar. Work on building the reservoirs started in the 1970s and work on the storages and the first phase of the canal work was completed in the early 1980s.

The project witnessed several obstacles in its completion: while most of the irrigation potential was created and the dam and appurtenant gates were completed, the spillway gates could not be lowered to impound water due to a non-transfer of designated forest land to the project. Similarly, certain lengths of the canal system remained incomplete due to the non-transfer of forest land (see Figure 5.1 for incomplete parts of the canal system in Palghar). Canal building in this region presented another challenge. Given the narrow terrain between the Western Ghats and the Arabian Sea coast, canals often run close to rivers in the Konkan and they require better foundations. For this reason, canal building is often more expensive for the government to execute. In Figure 5.1, the area in brown indicates a belt in the command area where canal construction has been left incomplete. Given the incomplete canals and the underutilization of water from other parts of the project, surplus water from the reservoir is conveyed to Vasai-Virar and Mira Bhayandar in the MMR.

For years, work on the reservoirs was stopped due to a lack of environmental clearances; then work on the canal system was done in phases. The most difficult phase was in parts of Dahanu, where the system had to be constructed through forests and ravines during the 1980s and early 1990s. This had implications for agricultural development in the entire Dahanu beneficiary area.

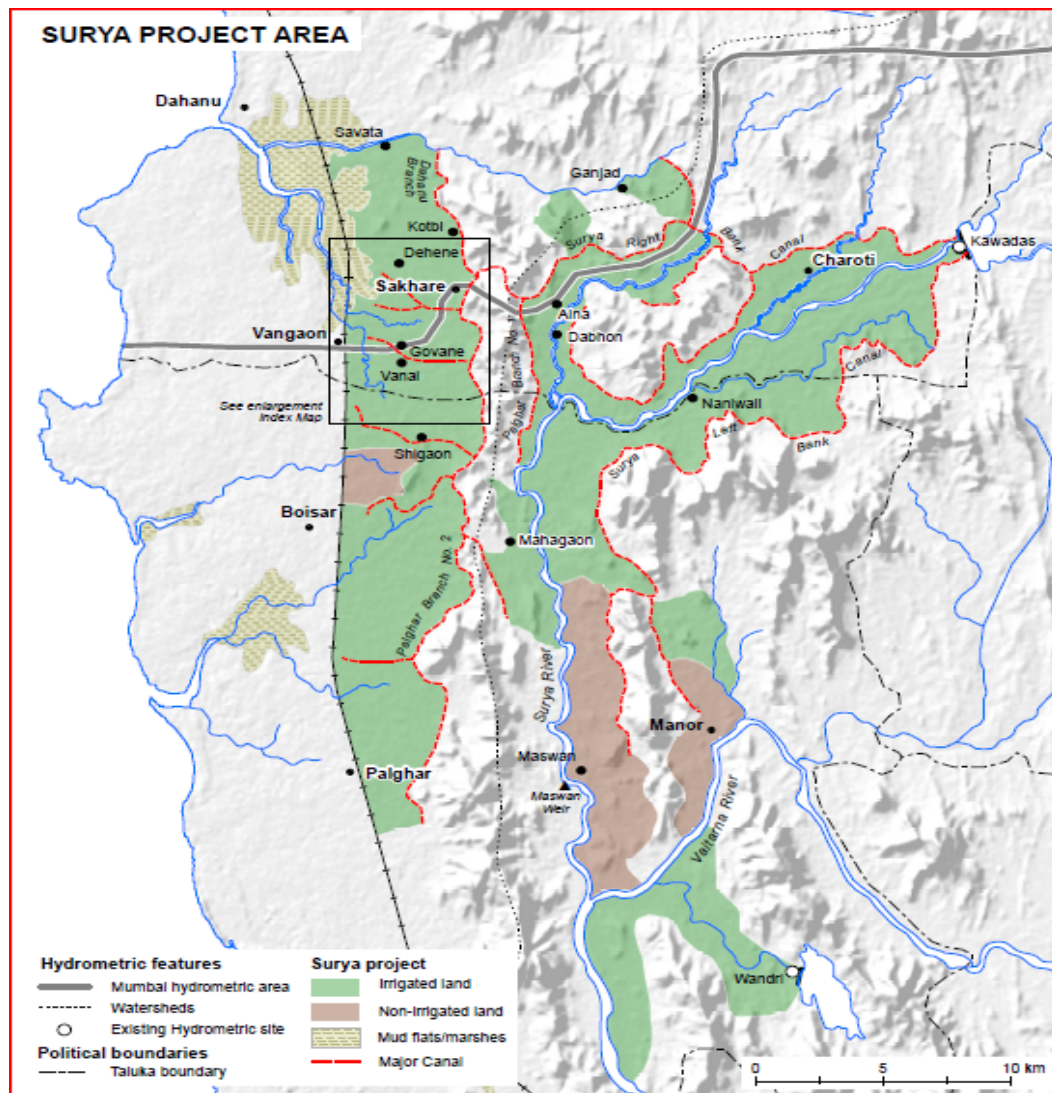


Figure 5.1: Map of the Surya Project's Command Area in Dahanu and Palghar with Sakhare and Vanai villages in focus (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

As this was a productive irrigation project aimed at double cropping, farmers in the horticultural belt benefited from the canal system only from the mid-1990s which led to farmers on the head of the main canal branch starting with an advantage of prior access. The late execution of the canal system did not stop enterprising horticultural farmers from Vadaval and other communities from buying or leasing inland from Brahmin landlords in the area. The land ceiling laws in India had still left Brahmins in

this part of Thane with surplus land. Parts of that surplus were distributed among tribal beneficiaries in 1976; however, a substantial part of the land was distributed by these landlords among their families to escape provisions of land ceiling laws (Ambasta, 1998; Lobo, 2012). Given that laws prevented Vadavals from purchasing tribal land in the newly irrigated belt, a strategy was employed in Dahanu to lease land from Brahmin landlords. Land was purchased and leased strategically on the canal minor systems. The problem, however, lay in the complex system of land tenure that characterized agriculture in Thane. The presence of customary tenures adjoining the land of Surya River and the command area of the canal project was a major obstacle for Vadaval and other farmers who wanted to cultivate a second commercial crop in this area. An excerpt from a 1983 thesis by the University of Mumbai sociologist, Indra Munshi-Saldanha, anticipates this transition from the dominant landholding class (Gujarati Vaniyas, Brahmins and North Indians) to the Vadaval caste:

The Surya project will most definitely lower the land ceiling in this area around Vangaon and that has consequences for our landholdings. Also, once the water comes, the Vadaval caste has able horticulturists and they will be able to take advantage of the irrigation facilities to expand and will surely grow powerful. (Munshi-Saldanha, 1983, Ch 2)

This passage from Munshi's thesis is also a useful pointer to the rise of new classes and castes that occurs frequently within Indian agriculture and the importance of place oriented studies in understanding the local political economy of agrarian change.

It also affirms the recent findings of human geographers who have argued about the centrality of caste in initiating new waves of capitalist accumulation in farming and agro-industrial enterprises in rural and small town India (Chari, 2004; Gidwani, 2008).

In my first fieldwork report after a month of interviews with farmer in February 2008 on the Palghar Branch canal of the main Surya canal, I wrote, “I have seen dispossession of small and marginal farmers from water and common land, but I have also seen precious water resources squandered from the main canal systems into the natural drainage.” This particular canal branch irrigated a wide belt of fifteen villages in the low lying fertile black soil tract of western Dahanu (see Figures 5.1 and 5.2). It was here and in the railway agricultural town of Vangaon that I saw beautiful homes belonging to upper caste orchard owners, SUVs and the Dahanu creek where it meets the Arabian Sea, full of canal water (described as runoff and wastage by local politicians and canal engineers) from the irrigation project.

5.3.2 Water Institutions and the Historical Background of Multipurpose Dam Projects in the Mumbai-Thane Region

To understand the performance of Surya project at the local level in the villages, it is necessary to place it in a broader geographical framework of water policy and practice. The interactions of institutions and the physical geography of watersheds and river basins have received cursory attention in theoretical and empirical literature on irrigation in human geography. However, Indian and South Asian social science literature on irrigation emphasize geography and local institutional evolution in the history of water technology (Bolding, Mollinga, & Van Straaten, 1995; Mosse, 2003).

Contributions from South Asian economic history have also dealt centrally with the co-evolution of institutions and geography in the irrigation context. For instance, a contentious debate between Ian Stone and Elizabeth Whitcombe revolved around the role of institutional variables, colonial water governance and related geographical factors in the performance of canal irrigation systems in the colonial period in North India (Whitcombe, 1972; Ali, 1982; Stone, 1984). The uneasy co-existence of local and modern land institutions, evolution of class structures, and economic objectives of colonial government came into special focus in the historical literature.

I will focus on a definition of institutions for the purposes of this case study and later examine the interface of water policy and laws with the local physical geography of Konkan region, where the Dahanu region and Surya project are located. Rules, laws, customs and every-day practices play an important role in water governance in the developing world within which decisions and policy choices in the water sector are made. As demonstrated by a solid body of empirical work on Indian irrigation, both in economic history and development studies, institutions have been central tools in our understanding of the scenario around water in the country. The significance of an institutional framework for this paper is further enhanced by the fact that India is a formal democracy with a well-defined constitutional division of powers between different levels of government concerning water. Indian rural society also has a somewhat rigid social structure based on caste and kinship, but has witnessed rapid social change in the last six decades. At the same time India also enjoys a vibrant civil society sector, which includes a strong presence at the grassroots and a focus on

environmental governance. From a constitutional angle, water policy is primarily a state subject in India, but the Central Government has a role to play as it often allocates funds to build large water storages and also intercedes in river disputes between different states. The influence of institutions on water policy and politics finds overwhelming expression in the presence of laws and statutes created in the colonial period which continue to influence the country's water laws (Iyer 2009; Cullet, 2013).

In the north Konkan region, the institutional framework on water co-evolved with historical experience of what modern dam systems in the Western Ghats could achieve for agricultural and industrial development purposes. The main physiographic features of Konkan region, shared with Surya command area, include its location in a very high rainfall tract and the availability of untapped small perennial rivers. Amongst other factors, the water policy framework has been primarily influenced by the physical geography of the river basins which constitute the units around which long term water planning was done. The main physiographic features of the Konkan region, which it shares with the Surya command area, includes its location in a very high rainfall tract and the availability of untapped small perennial rivers. Amongst other factors, the water policy framework has been primarily influenced by the physical geography of the river basins which constitute the units around which long term water planning was done.

In the context of canal irrigation, such assumptions of water abundance in resource planning made planners ignore the geographical variation within Konkan region. They also ignored important geographical and institutional differences in land tenure and water rights between this region and the interior of Maharashtra. Other

factors ignored were the potential scarcity of suitable locations for reservoir and canal construction, and the implications of prior rights established by Mumbai's claims on water for power and water supply, thus intensifying competing sectoral demands on watersheds in the region (Government of Maharashtra, 2005).

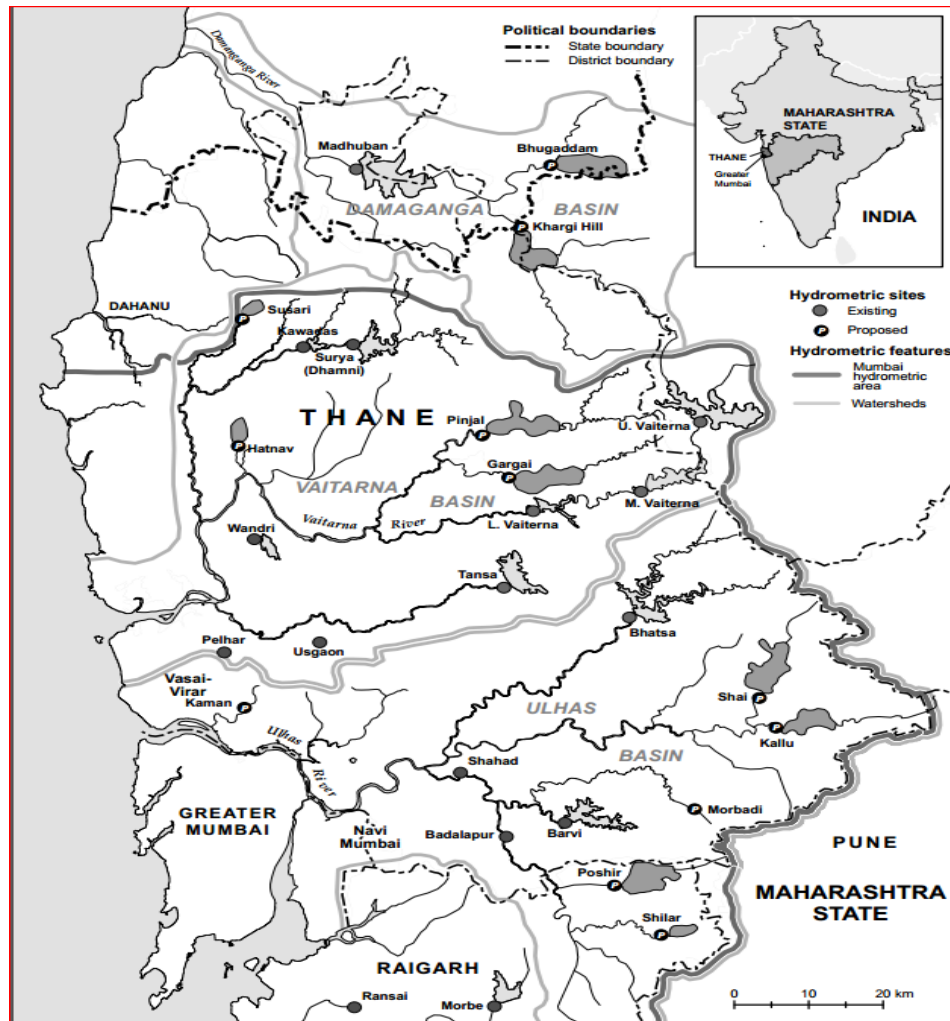


Figure 5.2 - Existing and proposed new dam projects in the Mumbai-Thane region and the Mumbai hydrometric area over the next two decades (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

Emphasis on tapping “open” river basins in this region for both irrigation and urban development continues to be the single most important variable that influences present day water policy and the planning of new dam projects in this region

(Government of Maharashtra, 2005) (see Figure 5.2 on new proposed projects). All the proposed projects in Figure 5.2 (identified by black circles with “P”), including the transfer of water from Damanganga basin to new reservoirs, are being planned to meet urban water demand from the Mumbai Metropolitan region. Given these factors that emerge from the local physical geography, rules around water management and sharing between different sectors have had a complex evolution. They have also been deeply influenced by the local rights around land and water, the physical geography, the agro-ecological setting and the water policy frameworks of Maharashtra state government.

5.3.3 Inter-Sectoral Rules and the Local Context: A Geographical-Institutional Profile

As far as the structure of rules are concerned, while the institutional evolution of water laws in the North Konkan context continues to be largely informed by state water policy and broader national and state laws, the priority given to local water rights within Indian water law has also had its influence on rules around water allocation. The North Konkan has a governance system that is largely characterized by administrative decisions on water allocation and transfers with the absence of any kind of voluntary or market mechanism. Some factors that have become more important over others in the last six decades are the local water rights regimes that were created with the expansion of the city of Mumbai’s access to watersheds in north eastern Thane from the 1950s, and the reservation of entire river basins for metropolitan use in the 1970s (Government of Maharashtra, 1981). Other rights were created largely as a result of local water development for farmers on small irrigation projects in several parts of Thane and

Raigad districts. In addition, the construction of canal projects from the 1970s and the rights conferred to farmers by priority of use in irrigated agriculture, a result of the riparian influence in Indian water law, have also created local rights for these rural populations (Chitale Committee Report, 1993; Government of Maharashtra, 2005; MMRDA, 1996; Mumbai High Court, 2006).

Additional rights were also created by new dam projects and water sharing agreements between towns, cities and villages in and around the Mumbai metropolitan region (Paper Two of this thesis, Sivaramakrishnan, 2014, p. 68; Rao, 2015, p. 166). The continued access of urban areas to rural water storages exists as long as their use complies with the priority accorded in Indian water law to continued beneficial use of water, such as an urban jurisdiction's entitlement to quotas related to domestic water use. Such institutional arrangements are regulated by the state government; however water re-allocation decisions are also closely informed by the state of local rights, water demand and utilization, and the local state's attempts at balancing rural and urban political pressures.

However, there can be some variation within the rules that inform rural-urban transfer of water (an increasingly contentious subject in this region since the early 1990s). Here, the initial project objective of different multipurpose dams adds an important layer to the institutional water governance framework in this region. Large dams, such as the Bhatsa dam in Shahpur in north eastern Thane district, were constructed for both agriculture and urban use, though priority of access in the case of the Bhatsa was accorded to Greater Mumbai, with no known rules of allocation between

that city and other urban and rural settlements during times of scarcity (Government of Maharashtra, 1964). There are other dam projects which were planned purely for urban use, such as the various projects on the Vaitarna river for Greater Mumbai, and some others like the Surya project, which is the focus of this case study, that were planned for growing a second post monsoon crop, but are now a major source of water to the metropolitan region. Smaller reservoirs are mostly devoted to agriculture, the condition being that they continue to be utilized by farmers. Yet, there are a few examples of small reservoirs (Usgaon dam in Bhiwandi) being constructed for the purpose of irrigation and then having their water diverted to urban and industrial use on grounds of underutilization. The water rights structure for the farming population utilizing water from canal systems is largely riparian. While this ensures that the rights of farmers (with clear land titles) who access water from reservoirs for canal irrigation are guaranteed, it does not mean that water quotas for irrigation in the overall system cannot be diverted for urban use. Water re-allocation (or diversion) can occur if the construction of canal systems for projects has not been completed, as Indian water law gives the state government the right to divert surplus water from reservoirs for beneficial urban use (Mumbai High Court 1996).

Another factor that influences the institutional architecture around water in this region is the ownership of reservoirs. This adds another complex layer to water governance. Some dams and storages in this region are owned by the Mumbai Municipal Corporation, giving it priority of access. Others, such as the Bhatsa and Surya, are owned by the Irrigation Department, giving the State Government more

influence in water allocation between different water users. The presence of a city like Mumbai and a fast expanding metropolitan region with senior water appropriation rights further complicates this picture and places urban and industrial water demand in direct competition, sometimes even overt conflict with farming communities in the region (see Paper Two of this dissertation). In such cases, the latter have little recourse for contesting rural-urban water transfers except to challenge such (often arbitrary) diversions in local courts or through social protest. The combined effects of institutional variation and the geography of water storage and use have also meant that in the absence of effective functioning of autonomous regulatory mechanisms, such as the Maharashtra Water Resources Regulation Act (MWRRA), to provide any countervailing influence the State Government plays an important role in adjudicating water disputes between jurisdictions (Wagle, Warghade, & Sathe, 2012; Paper Two).

Canal technology has also played a major role in institutional evolution and directly affects the experiences of rural and urban communities with water for agricultural use. Some empirical work on the Konkan done locally has examined the role canal technology plays in the utilization of water and the shaping of water institutions. This paper will review the arguments from this literature next. In the empirical section following this section, I examine the implications of this technology for water politics and policy in this region.

5.3.4 Institutions, Technological Constraints and Canal Water Management in the Konkan

In the case of the operation and functioning of the rural canal systems in the North Konkan, this paper argues that the availability of water “on demand” on canal systems in irrigation projects in the region makes it imperative to examine the actual experiences of farming communities with water access from a perspective that is qualitatively different from the one that has been used in the canal irrigation literature in India. The projected availability of water to grow a second paddy crop in irrigation systems in the Konkan itself means that there is sufficient water available on demand (WAPCOS, 1996). The design and construction of the canal system has also factored in the abundant availability of water (WAPCOS, 1996). The resulting canal technology which includes the design of irrigation outlets and the local rules of water management on the canal system are closely influenced by the planned cropping pattern during the execution of the project, viz. paddy. Experiences with irrigating paddy have produced mixed results. In this regard, research done by local geographers and economists on water technology and practices in the north Konkan provides some useful insight. A survey by geographers on the canal system of the Vandri medium reservoir, a project next to the Surya in Thane district, points to the conveyance systems and outlet structures. Here, canals designed to irrigate paddy influence rules around water rotations on the main canal level and through the canal minors to agricultural fields. These rules which involve providing water for a second paddy crop with a weekly

rotation and flow type of irrigation are hard to change once the canal systems have been constructed (Gore & Phadke, 1996).

The heavy flow of water through the canals that were originally designed to irrigate paddy became a disincentive in growing less water intensive crops in the Vandri project. So, while farmers continue to have notional rights over the water of the project, lower water utilization as a result of the design of the conveyance system and the non-implementation of crop zoning rules resulted in massive wastage and underutilization of water. This technological-institutional constraint will be explored in the empirical section of the paper.

Thus, in addition to the ownership and other organizational dimensions of water management, the technical design of irrigation systems and the tailoring of water rotation rules based on canal designs have created a challenging institutional obstacle for reform in water governance in this region. The findings affirm the claims of local irrigation engineers in the Konkan that the geography of the region, the difficult adaptation of canal projects to the local environment and the social relations within rural communities also make co-operation around water on village canal systems a formidable challenge (Sinchan, 2000). This does not mean that such claims by the bureaucracy should not be critically analyzed, as relations between social classes in agriculture are being constantly re-produced in the context of an unequal agrarian structure in villages that are still dominated by large rentier land holding classes and farming entrepreneurs (Ramachandran & Swaminathan, 2014).

5.4 Method and Scale: Justifying an Ethnography of the Commons

The best methods for understanding the social, cultural and collective implications of the commons might also be elastic and diverse. First, as landscapes change through state intervention, urbanization and globalization, the units of analysis to study the commons also change. We cannot decide on how to study the commons without understanding what led to the definition of commons in our analysis. (Rao & Appadurai, 2008:p.165-166)

When I started my field research on the access of farmers to water on the canal system in Sakhare village in Surya project area, the field research quickly turned towards a parallel investigation of dispossession from land being primarily experienced by small and marginal tribal farmers. The scale of analysis also shifted given that water from this project was claimed by a new group of farmers outside the official beneficiary area of the project in coastal Dahanu. Another claimant to the irrigation water in Surya project that emerged during the course of my field research was the fast urbanizing Vasai-Virar sub-region outside Greater Mumbai. Both new agricultural and urban claimants to the water of Surya project cited water wastage by tribal farmers. Thus, the flows of water became salient in a context that had already come to be increasingly characterized by the conversion of resources from sustaining agriculture to increasingly enabling the spatial expansion of suburban and peri-urban areas of Mumbai.

In focusing ethnographically on relationships between water, society, land tenure and geographical scale on resource access, this paper takes on a methodological challenge posed by social anthropologists who argue that the commons should be treated as an analytical and political construct rather than as a mere physical category (Rao & Appadurai, 2008, pp. 165-166; Linton & Budds, 2014).

First, in terms of the physical space of the canal systems in villages in the horticultural belt, I argue that a study of the commons in rural areas should be part of a larger relational analysis examining impacts of regional processes on a local unit (Rao & Appadurai, 2008, p. 166).

A second justification for a study of the commons that incorporates a scalar perspective is the multidimensional relationship between state territorialities and local resource rights in rural India (Agrawal & Sivaramkrishnan, 2000). The variety of institutions and the specific nature of local ecologies and land tenures in Dahanu and Thane make study of the impact of canal irrigation on a local unit such as a village an interesting methodological challenge for social scientists. Ethnography helps us appreciate the nature of relationships and histories around resources between state and communities in such contexts. It also helps emphasize the penetration of markets and the geographical interactions of industrial-urban forces with agriculture in rural areas in the context of rapid social and environmental change in Asia (McGee, 1995; Li, 2007).

Therefore, the choice of ethnography is not simply another attempt to make claims about the importance of researching complexity in resource management, but is more of an attempt at a real engagement with the scalar dimension of a resource like

water. The allocation of water across crops to different sectors of the local economy, and the contrary experiences of abundance and scarcity of water in this region, make the observations that follow from an ethnographic route even more valuable. From the point of view of producing an ethnography of the commons in contemporary rural India, the importance of a holistic investigation is also reinforced by a scenario where agricultural livelihoods remain tethered to access to local commons in rural India (Gidwani, 2008). Moreover, unequal land distribution and uneven access of tribals and lower caste poor to agricultural land continue to be central policy issues for agrarian researchers in the country (Menon & Vadivelu, 2006; Ramachandran & Swaminathan, 2014). So, rather than dismissing the village as a unit of study, I have attended to social and ecological flows between villages and the external world while also furthering an analysis of micro water politics by undertaking agrarian research in two villages (Gupta, 2005).

5.5 The Politics of Unequal Water Distribution and Accumulation in Horticulture: Anarchy, Location, Water Grabbing and Dispossession

The water literature in political ecology does not take into account the centrality of land in the actual working of the socio-technicality in water systems (Mollinga, 2003). A polarized discourse between Marxist scholars who work on agrarian change and critical political ecologists who research the politics and political economy of canal management is responsible for this disjuncture (Mollinga, 2010). The focus on flows of water and the multi scalar implications of water management in a local context in this study of canal irrigation make it imperative that this paper focuses on the consequences

of uneven agricultural development in the Surya project. Thus, the theoretical frames of socio-technicality and the hydro-social cycle (outlined above) become useful here. At the same time, a power centred view of technology and social relations that characterize both these approaches do not produce sufficiently insightful analysis on how the instruments of power in water systems actually work in practice in the Indian context. Besides being selective in their conceptualization of power, socio-technicality and hydro-sociality paradigms can produce an over-socialized explanation of ecological problems on water systems and do not incorporate the technological dynamism of farmers and water users. Here, my disagreement with the literature on water in geography stems from an overemphasis in that literature on a Marxian and Foucauldian definition of power to the exclusion of studying institutions at the level of organizations. Practices, habits and attitudes (Hodgson, 2006) that often remain deeply entrenched at the level of very centralized Irrigation Departments reinforce and exacerbate social differentiation and social inequities in a hierarchical context like India. Both frameworks also do not throw sufficient light on the movement of water across scale.

Hence, in this paper, the socio-technical and hydro-social frameworks are in effect combined with the paracommons approach so as to “follow the water” (Lankford, 2013). The central findings discussed in this section are the inability of the Irrigation Department to adapt to local needs for water, the obstacles posed by social relations and

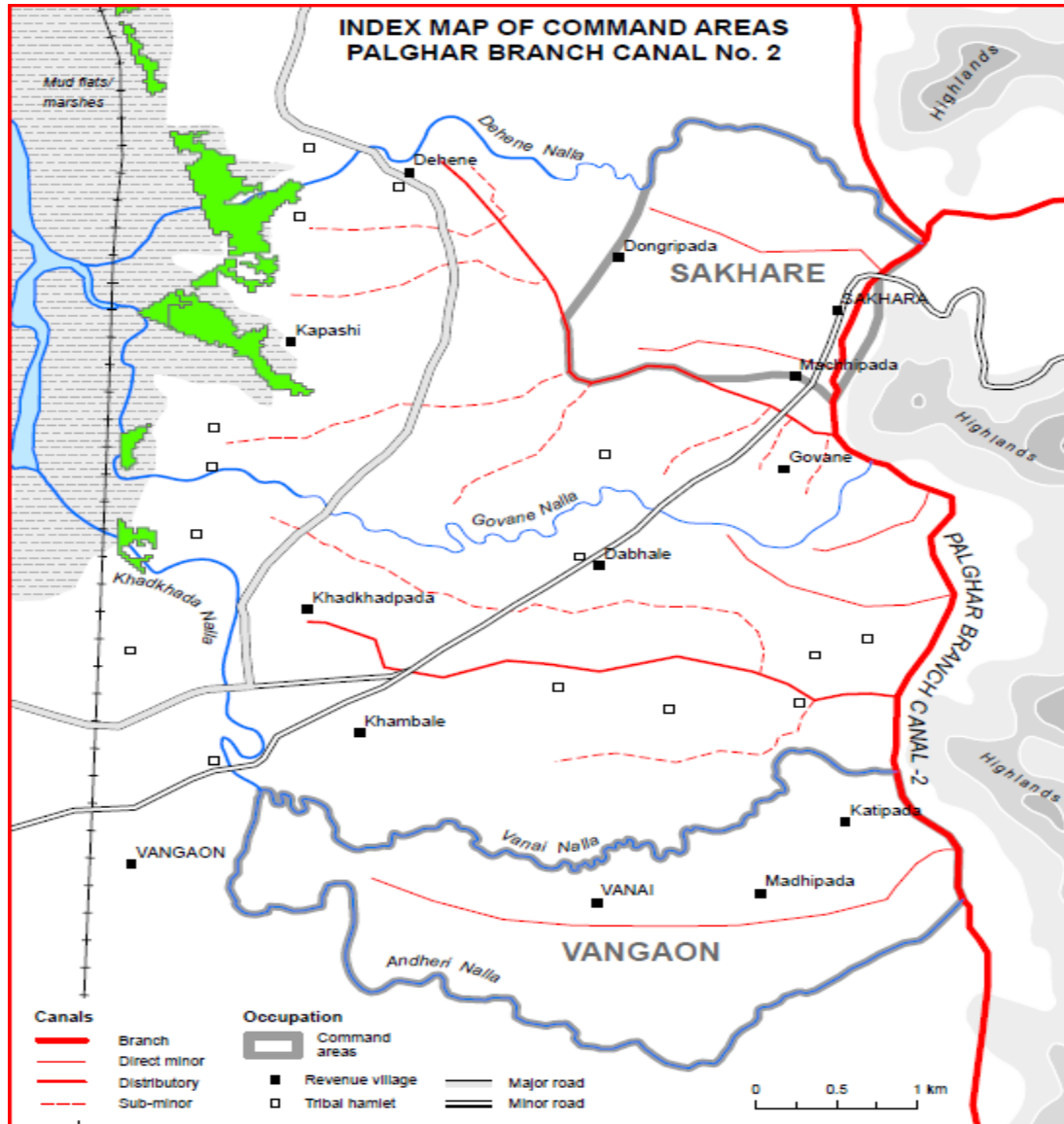


Figure 5.3 - Map of the Horticultural belt that includes Sakhare, Vanai and other villages. The area in green indicates water logging as a result of water runoff and is taken from the Indian Government's WRIS data source (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

local geography to efficient utilization and the scalar dimensions of water wastage and underutilization. Thus, the local politics of water becomes central, but in keeping with the ethnographic thrust of this paper, the political and social frame of the study extends far beyond the unit of analysis in Dahanu as it tries to follow the 'wasted' water.

My findings that follow here are from the two villages of Sakhare and Vanai of Surya 5.3 project located on Palghar branch canal (see Figure 5.3). The data is highly

Table 5.1 - Gross Command, Culturable and Irrigable Area in Dahanu's Horticultural Belt (in hectares)

No.	Village	Gross Command	Culturable Command	Irrigable Area
1	Sakhare	260	130	130
2	Govane	408	204	204
3	Kapashi	200	100	100
4	Dehane	300	150	150
5	Vanai	800	400	400
6	Dabhale	478	239	239
7	Khambala	120	60	60
Total		2566	1283	1283

Source: Draft Project Report, Surya Project (2005)

Table 5.2: Total Area (in hectares) under command in various administrative sub-divisions of Surya project

Name of sub-division	Gross Command area	Culturable Command area	Irrigable Area
Jawhar	60	30	30
Dahanu	12730	6111	6111
Palghar	17757	8555	8555
Total	30547	14696	14696

Source: Draft Project Report, Surya Project (2005)

specific to the agro-ecological context of this part of the command area of the Surya project (see Table 5.1 on the extent of cultivable irrigable area in the horticultural belt). I state this at the very outset because there were other parts of the command area where I witnessed lesser social differentiation and inequality in access to water. Parts of Palghar in the Surya Command area (see Figure 5.1), for instance, had water user associations comprised largely of tribal farmers using water from the project. While my findings are highly specific to the horticultural belt of Dahanu, research findings on social differentiation, the functioning of water institutions, and the problem of

underutilization of canal water (first pointed out to me by the engineers interviewed in 2006 and 2008) resonate throughout the command area. However, the causes of such underutilization of water vary between different areas of the project.

5.5.1 Planned Anarchy

There is enough water wasted into the Arabian Sea from the release in the Surya irrigation project in Dahanu during the canal rotations that could last suburban Mumbai's demand for six months. This is a project as large as the Bhatsa. The local Irrigation Department is as incompetent as it is corrupt, no one knows what is going on with this project and the maintenance of canals is very poor. It irrigates far less agricultural land and its performance is a symbol of waste and bureaucratic sloth - Large Commercial Farmer. (Interview with Mr. Mistry, June 2008)

It is not unusual to see chaos in Indian canal irrigation systems, as the presence of democracy and populism in rural India often leads to the Irrigation Department adapting to the wishes of local elected politicians. The release of water into the canals in Dahanu followed a prescribed pattern of paddy cultivation that catered to its predominantly tribal population. However, the paradox was that a significant portion of the land under this specific canal was also under vegetables, which required less water. The horticultural farmers from the Vadaval caste had adapted to these cultivation conditions by using wells, but the Irrigation Department continued to release water for

paddy. When Mistry, a large commercial farmer in Dahanu shared his frustration about the volume of wasted water in April 2008, I was into my fourth month of research in the command area of the Surya irrigation project. I had also been a firsthand witness of the waste of water and corruption around the irrigation project (see Paper One). However, the kind of graft around this important irrigation project outside Mumbai was one in which the upper caste Hindu-Vadaval and Parsi commercial farmers (both of whom represent the dominant faction of agrarian capital in this region) were complicit. Some of these early interviews and close interactions with the richer sections of the farming communities and engineers in the spring and summer of 2008 set the stage for my survey research in both the first and second villages. This was also a time when the canal rotations on the Surya Right Bank Canal system were close to an end in May 2008 and farmers in the region had started preparing their fields for the monsoon (My field research had started in December 2007 and continued until September 2008). Some of the preliminary observations of the movement of water in the canal system in the villages yielded findings of a paradoxical nature. I had witnessed tribal farmers accessing water from wide streams at the tail end of the canal minors complaining of water scarcity and water grabbing by the large farmers on the middle reaches of the canal minor system. However, what was consistent about the picture was the quantity of water drained into rivulets and streams in the region and the haphazard organization of water rotations and constant violations of rules on the main canal system. Canal rotations were typically organized according to a weekly schedule between November 2007 and May 2008. Water rotations would start on Sunday and would stop on Friday,

to begin a week later. On the main canal level, water would first be released to the tail of the main canal system in Palghar and a day later the gates in Dahanu would be opened (tail-head rotation). This was done to ensure fairness on the main canal system.

A prescribed schedule of water rotation was advertised in local newspapers prior to the beginning of the rotations in November. Yet this schedule was violated in April and May of 2008 when the canal system broke down due to poor maintenance, and political pressure came from local large farmers wanting to harvest their produce in May and water to stop flowing through the canals. While, on paper, farmers had to submit applications to the local Irrigation Department for water, in practice no applications were made. Moreover, while tail-head rotations were implemented at the main canals level, no such rotation was practiced at the canal minors level. When I asked engineers in Vangaon why there was no policy of rotation on canal minors they said “this was an Adivasi area and there was no need for rotations on the canal minors.”

The reasons for non-implementation of rules below the outlet were attributed to the dysfunction of local society and termination of the command area development programme funded projects that were focused on re-engineering the canal minors. However, closer observation of the canal system yielded interesting sociological clues. While it was true that water drained very quickly due to the design of the system and the Konkan topography, it was also true that both the rules and conditions on the canals below the outlet and on the main canal level were dictated by the large Vadaval horticultural farmers. Thus, while the quantity of water released into the main canal system was clearly meant to cultivate paddy, keeping in mind local tribal interest in that

crop, there was no effort by engineers to regulate water usage or even mediate water disputes between farmers. When I started my interviews in Sakhare, the rotations and water discharge had clearly not taken account of new cropping patterns that had evolved in the horticultural belt since 2000. This was in keeping with early productive irrigation objectives of the Surya irrigation project where the entire project design was developed and implemented to cultivate a second paddy crop and boost agricultural production.

A report of the Surya Irrigation project published by the project two years before my fieldwork states:

As actual water utilization is comparatively less and storage available in the reservoir is more, the rules of canal operations are not strictly followed and water for irrigation is released mainly as per demand of farmers. (Draft Project Report. Restructured Command Area Development Programme, 2007)

A twenty year old report prepared by Water and Power Consultancy Services (WAPCOS) involving a technical survey and socioeconomic study of Surya Command area warned about possible loss of control over water use soon after the canal system was in place in Dahanu, and two years after rotations began on the main canal system:

The water resources stored and available in the reservoirs are much more than needed in the field. The water is supplied as desired by the cultivator. Though the system is being operated on a demand basis and the numbers of rotations are fixed in advance and water is being supplied to the sanctioned area, there is no rotation or control at the

outlet level. The irrigation is mostly “field to field.” (WAPCOS, 1996, pp. 6-11)

The design and construction of a canal system that was designed to irrigate a second crop of paddy, the absence of any institutional intervention below the level of the main canal, the poor management of water at the main level, the failure to account for the dynamism of farming entrepreneurs in the horticultural belt and their success at changing cropping patterns, all remained unincorporated into local water policy and practices in the project. The unanswered question here is: What were the reasons for such mismanagement of water? And was water the only object of politics here?

The concept of ‘water control’ in the canal irrigation literature has now posited that technical/physical, organizational/managerial and socio-economic/political control of water are internally related (Mollinga, 2013). In the Surya project, engineers I spoke to told me about political pressure applied on them by the tribal MLA of Dahanu to make the main canals appear full of water. While they were aware that the consequence of releasing water into the main canal system for paddy was clearly not working, they wanted to ensure the MLA was kept satisfied. “The real problem here is not the availability of water, but that of social relations between the Vadavals and non-tribal farmers in the villages,” explained a junior engineer in a candid moment. “We cannot manage that turf because it is not our responsibility.” This deliberate separation of technical and social realms of irrigation by engineers speaks to the very heart of the socio-technical critiques of centralized modern canal systems (Mollinga, 2010: p. 424). By consigning the social and technical into separate realms of water management, the

engineers failed to acknowledge the political embeddedness of large irrigation systems and their management.

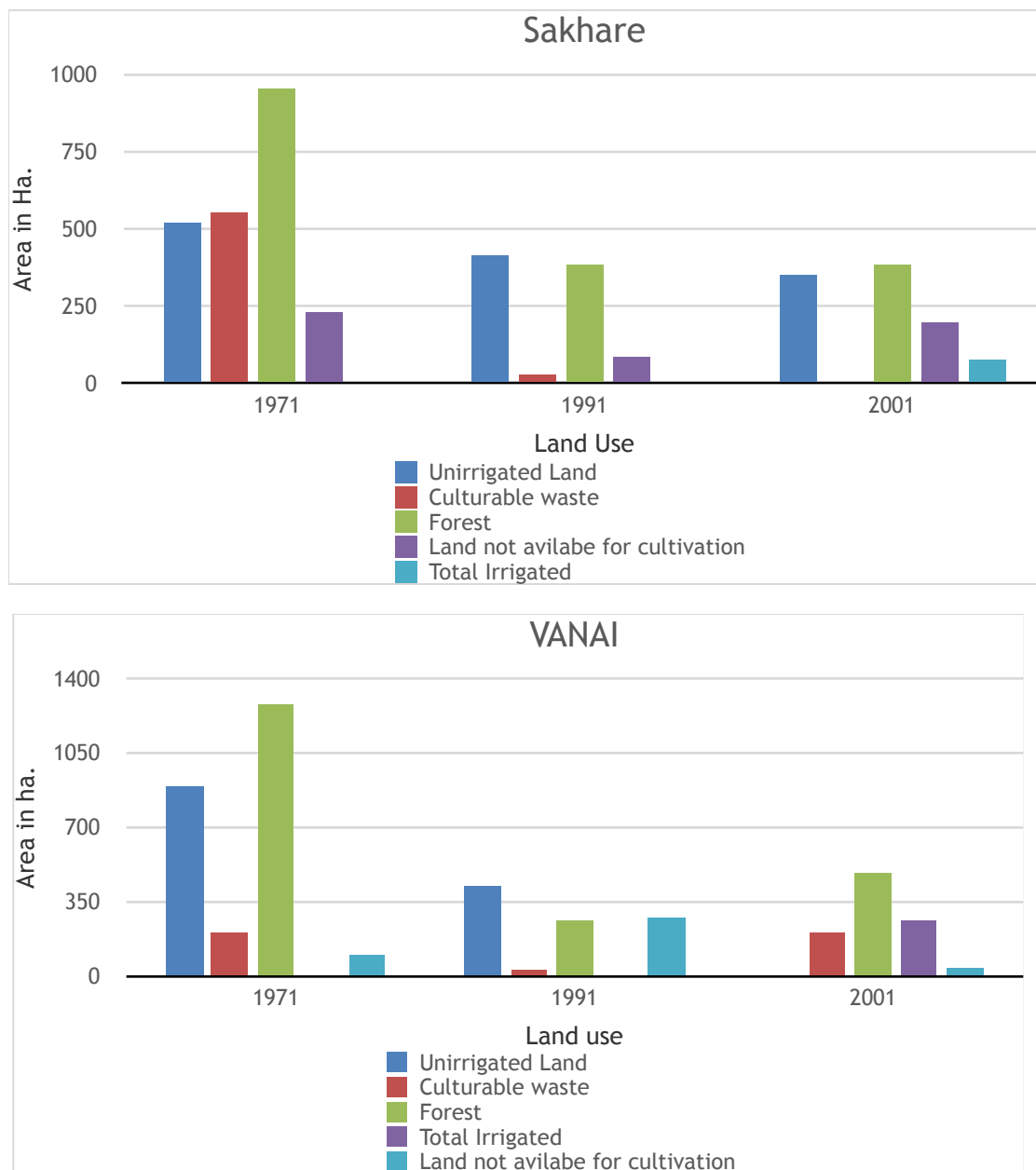
5.5.2 Phase 2000-2008: Settler Farmers Increase their Grip on Land and Water on the Canal Minors

A broad literature on canal irrigation has focused on the main canal level and less on the experiences of farmers who enjoy the benefits of surface irrigation within villages on canal minor systems (for notable exceptions, see Mollinga, 2003; and Narain, 2003). Most analyses of canal irrigation have also neglected to analyze and understand the interface of water conveyance technology, the behaviour of users, and the institutional organization of irrigation. More recently, a critical lens has been extended to canal technology and the degree of social and technical organization needed for the successful working of such water conveyance systems at local levels (Mollinga, 2003). However, even this literature is not without blind spots. The relationship of land and water institutions is not well understood; moreover, the geographical and scalar dimensions of local water management are also poorly researched. The findings in this section point to the centrality of the land-water nexus in villages under study. From both theoretical and empirical standpoints, that nexus is emphasized in this study because it reminds water researchers studying other contexts that land titles/ownership and actual access and control over land also play a key role in ensuring fair and equitable entitlement to water in rural contexts. Also, in the micro context of conflict on a rural water conveyance system, water may not be the only resource of interest; other resources may also be up for grabs. For example, appropriating water may serve a

particular class interest in re-ordering of agricultural accumulation strategies. Appropriation of water could also help richer sections of the farming community re-work land ownership and access to their own advantage and the disadvantage of the rural poor on a canal system (Mehta, 2012, p. 203). By focusing mainly on access to water within political ecology and neglecting the interactions of land and water institutions in the agricultural landscape, one might be missing a vital part of the puzzle in the local politics of water in rural areas of developing countries.

Sakhare village's location at the junction of two large main canals and the presence of two distributary canals and three minors with a weekly rotation system of water makes it seem like a village that should be well endowed with water and in principle should enjoy benefits of surface irrigation evenly (see Figures 5.3 & 5.4). However, the presence of three distinct caste groups in one village, the leasing of land by settler farmers, and presumptions lying at the heart of engineering large dam projects and conveyance systems qualify the anticipation of an even distribution of benefits from irrigation. The population of Sakhare is 2,700 people and more than ninety percent of its inhabitants are from the tribal Warli community, while the rest are from Macchi caste. There are about 600 households in the village. Vanai village is of equal geographical size, with 2,600 people, mostly tribals, and also has about 600 households (see Table 5.3 below for data on land use for both villages before surface irrigation).

Figure 5.4 - Land use in Sakhare and Vanai Villages 1971-2001.
Source: Census of India, 1971; 1981; 1991; and 2001



In Figure 5.5, the canal layout of the village command for Sakhare is further divided into sub-commands named “chaks” (see Chambers, 1990, pp. 54-59 for the origins of irrigation planning under chaks in India). The chaks are organized on the basis of the location of outlets and gates that are used to apportion the water equally

amongst users. Most of these sub-commands and the organization of irrigation within villages in the Surya Command area were developed during the period of the Command Area Development Authority (CADA, 1995-2001) where the objective was to implement a rule based rotation of water below the outlets. Under this principle, the

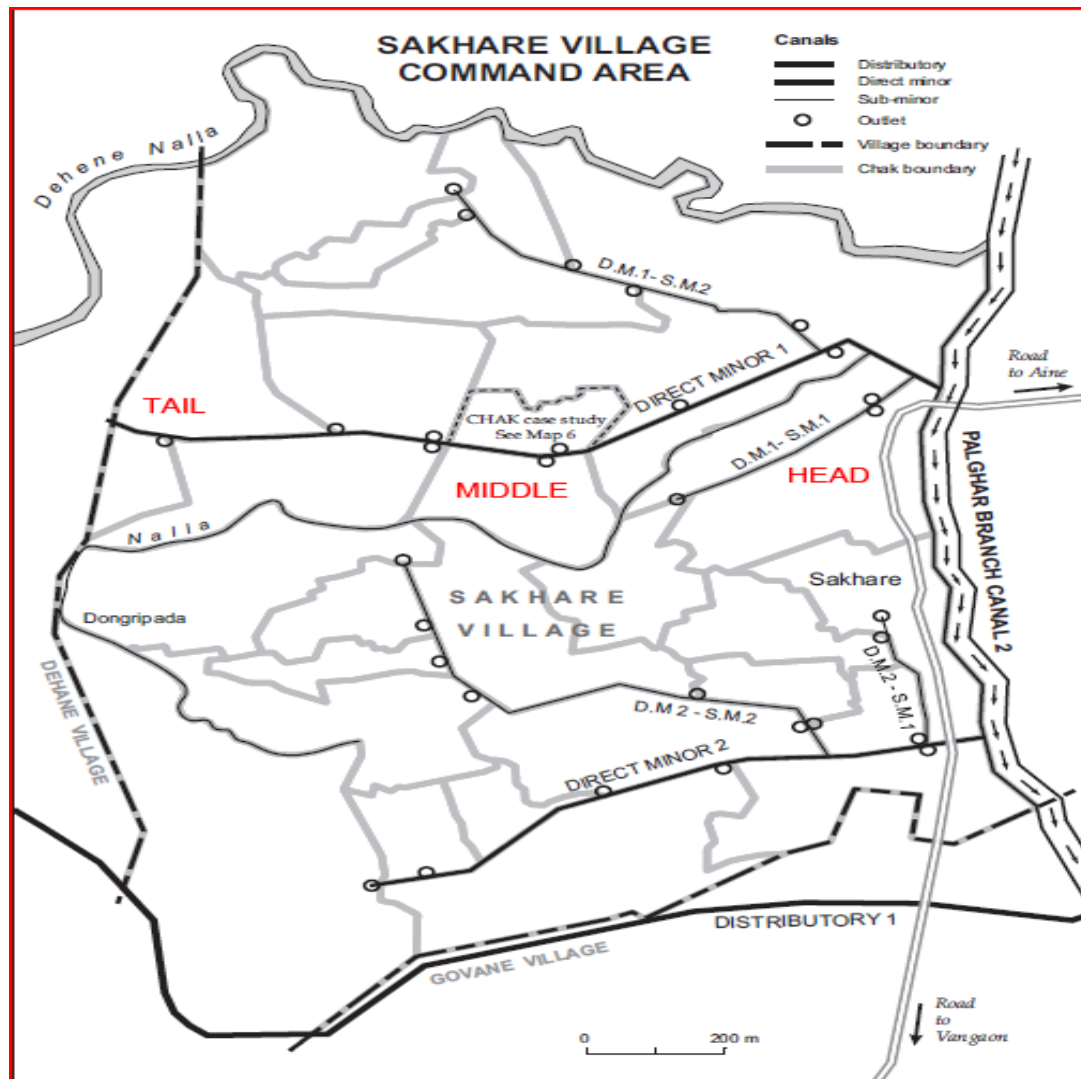


Figure 5.5 - Map of the Distributory, Canal Minor and Sub-Minor Network and the chaks (village sub-commands) in Sakhare Village (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

tails of the sub commands in the village get water first and it is later released at the head. This rules based rotation of water was also intended to closely co-ordinate with water requirements of the farmers and the cropping patterns within every village.

The lack of community experience with irrigation in this part of Maharashtra with canal irrigation made it imperative for the Government to implement the CADA programme here. However, when I started fieldwork in 2007, CADA had been withdrawn from the Surya Irrigation project amidst allegations of serious impropriety and misuse of development funds. During my fieldwork, I noticed that of the outlets and the gates regulating the flow between fields had fallen into a state of disrepair and water measurement devices on the system were missing. With the dissolution of CADA, a state of anarchy had gripped water management in Sakhare village.

5.5.3 Canal Location and Land Grabbing: The Centrality of Social Relations

Conventional analysis of irrigation systems have focused on access to water along the various reaches of the canal system. However, in contrast to protective irrigation systems in Southern India (Mollinga 2003), the experiences of water scarcity in the canal system of the Surya project were marked at the middle and tail reaches of the system. At the same time, water access followed the acquisition and subsequent fencing of land by Vadaval farmers at all reaches of the canal minor system. Consequently, water grabbing followed the grabbing of land in some instances. In a few cases Vadaval farmers had also acquired agricultural land at the head reaches of canals (see Figures 5.4 and 5.8). However, given the heavy flow of water, tribal farms

adjoining Vadaval farms at the head of the canal minor system (unlike those on the middle and tail sections) did not face any serious disadvantage regarding water access.

At the head of the canal minors, changes in land use that were a result of a second irrigated paddy crop produced expectations amongst some tribal farmers about the possibilities of cultivating other crops. “There was great joy in the village when the canal water came” said Gehla, my first contact in the village. On other sections of the head of the canal system, during my interviews, most tribal farmers shared with me their interest in growing mostly traditional varieties of paddy. “It is our staple,” said one farmer. “I don’t care what others want from irrigation, I want to continue to grow paddy. A second crop of paddy helps us in providing subsistence for our households. We have to survive and cannot invest in horticulture like the Vadavals, it is risky. Besides, they have more experience in growing vegetables and fruits, we don’t.” A second tribal farmer on the head of the canal system pointed to the heavy water discharge from the minor branches of the gravity canals and said “We cannot grow anything but paddy here, because of the flow of water. Moreover, our land plots are small.” The average size of a tribal family plot is 0.5 ha in this area.

Both tribals and Macchis (a local caste in Sakhare village) who were numerically dominant at the head of the canal system consistently pointed out the heavy flow of the water that compelled them to grow paddy. “I did not take a canal irrigated crop this year, as we have to leave the land fallow this year,” said another farmer. Another tribal farmer pointed out to the fact that most members of his household were not interested in farming and he was himself employed on industrial estates in Palghar.

Farming families at the head of the canal system, being close to the road to the railway station in Vangaon, were more likely to have diversified outside agriculture.

Tribal and Macchi farmers in Sakhare at the head of the canal minors pointed out how they had tried to get the Irrigation Department to do something about the heavy flow of water to their fields. “This is how it will stay, we cannot re-design the canals for you was the answer we got from the engineers,” pointed out another farmer. Several tribal farmers in Sakhare at the head of the canal minor also narrated to me how they had signed a joint written petition to the Irrigation Department to stop the canal rotations for a year in 2005 so that they could do some maintenance work on the field channels and also nurture the soil so that it could regain its nutrients. However, the Irrigation Department did not relent. “It is the demands of the Vadaval horticultural farmers in this belt that always prevail, we don’t matter, though it was the tribal community that made a sacrifice for the Surya project and lost land in the process.”

Due to the undulating terrain, small land holdings, high intensity of rainfall, and terraced fields, the traditional pattern of canal irrigation below the outlet in the Konkan is “field to field” irrigation (WAPCOS, 1996). The conventional open channel distribution network that is present in the interior parts of Maharashtra does not work well in the Konkan and maintaining field channels has proved to be a costly and repetitive operation for local farmers. This mode of irrigation is a cause for the area irrigated per unit of water to be far lesser in the Konkan region. It was one of the reasons why farmers could not grow crops other than rice which was also a cause for underutilization of water (as rice had a limited market and not all farmers were

interested in growing a second paddy crop). Moreover, this also means that co-operation between farmers growing different kinds of crops becomes a challenge.

Shiva and Ganpat, two tribal farmers at the head of the canal minor system who also had land plots on middle reaches of the canal system, noted an absence of co-operation between farmers around water throughout the canal system in the villages. “I tried bringing farmers together, but it did not work. Some farmers have lost land to the Vadaval farmers; some others don’t trust each other because there is a lot of contestation and conflict around land. Some don’t even know where their land is located,” pointed out Shiva.

Ganpat who also had agricultural land on the middle reaches of Direct Minor 2 spoke of how the field to field irrigation (a system where water courses have to be developed between fields and channeled by farmers) needed more cooperation between farmers. “Given that water courses had to be developed by farmers due to the nature of the soil and the quick run-off of water, the importance of building relationships cannot be underestimated,” said Ganpat. “However, while we developed such mechanisms of co-operation by starting groups to manage water, things would fall apart during night time when some individual farmers would destroy the channels and grab water at the expense of others. Things fell apart further after the Vadavals started irrigating their fields,” added Ganpat. Gehla, a farmer who has a forest plot on the outskirts of the village and cannot irrigate that particular plot, though it is close to the distributary at the northern end of the village, narrated an account of how he had tried to initiate a co-operative arrangement around sharing irrigation water with Ganpat and two other

farmers in another plot he had clear title to near Direct Minor 1 (on the middle reaches) that went through the middle of the village (see Figure 5.6, the large farm is in yellow).

Ganpat, Gehla and a third tribal farmer had constructed a field channel from the outlet in 2002 and were overjoyed at the prospect of cultivating an irrigated crop. Yet that very irrigation season, Raut, a Vadaval horticultural farmer, enclosed his farm (and by default the canal outlet and field channels) on a pretext that stray cattle were entering his farm and destroying the bell pepper crop. In a short time, Gehla and Ganpat started facing problems on their small plots of land as water started running short. When they approached Raut he claimed that he owned the land around the outlet and had no choice but to fence the farm because of the threat of stray cattle to his crop. Ganpat added:

That was the end of the story for us, we never could take a second crop again as we did not know how to coordinate with Raut. When we complained to the irrigation engineers, they said that they had no jurisdiction over disputes over water that broke out between farmers and asked us to manage such differences on our own. The engineers also remained evasive when we questioned them about the canal being enclosed by the Vadaval farmers.

The regulation of canal minors and dispute resolutions between farmers on field channels falls under the purview of the Maharashtra Irrigation Act (Government of Maharashtra, 1976, pp. 9637-9638). While co-operation between farmers on field channels is voluntary, enclosure of entire canal minors and manipulation of field

channels and water courses by Vadaval farmers constituted clear and flagrant violations of the Irrigation Act.

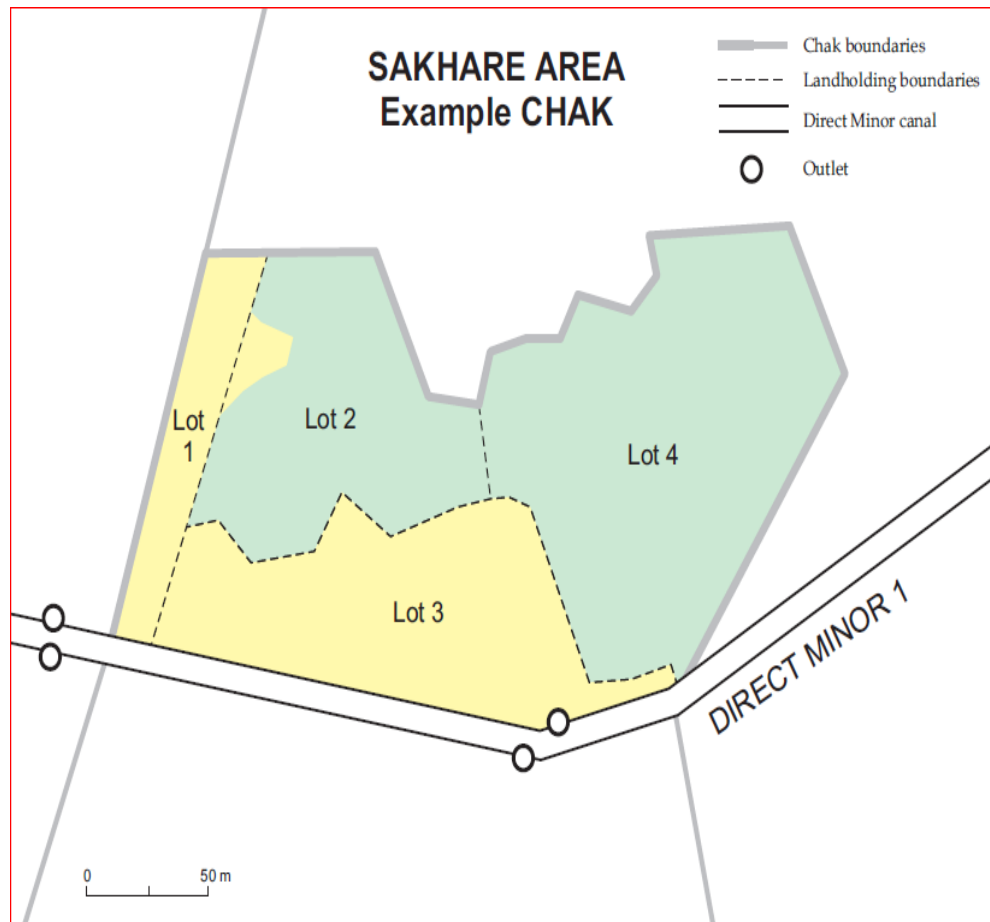


Figure 5.6 - Map of land holdings on a Canal Minor in Sakhare Village. Plots of land under this outlet were cultivated by tribal farmers, but access to water was lost as Lot 3 under the control of a large horticultural farmer sealed off the canal with a fence (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

There were also agricultural plots at the head that were left unsown; farmers blamed the cattle problem for their choice not to plant. Thus, another reason for underutilization at the head of the canal minor system was the cattle problem. Forest hamlets in the village witnessed seasonal migration. Inhabitants in these hamlets and others with non-agricultural employment would let their cattle loose in the village and

they would destroy the standing crop. The enclosure of large Vadaval farms, common land, and entire paths exacerbated this problem after irrigation: “We don’t have fences like the Vadavals,” said Ghoda a farmer at the head of the canal. On one occasion when Ghoda’s farm was being rampaged by cattle, I personally ran and brought his attention to it, but a lot of damage was done by the time we reached his plot (see Figure 5.7).



Figure 5.7 - Cattle straying into tribal farms in Sakhare

There were few instances of tribal farmers or Macchis grabbing each other’s land (detailed below), but many cases of Vadaval farmers having grabbed land of tribal and Macchi farmers on the head, middle and tail reaches of the canal minor system. My initial Sakhare interviews revealed cases of land grabbing in at least 25% of the 50 marginal tribal farmers I interviewed in my first round; the grabbing of land was rampant throughout the head, middle and the tail ends of the canal, but more severe at the middle and the tail (for survey data from Sakhare, see table 5.4).

Table 5.3 - Reasons for non-irrigation or factors influencing lack of access to water on canal sub- minor one in Vanai village. N=23

Reasons for non-irrigation	Head	Middle	Tail
Unlined sub-minors/Poor Canal Maintenance			
Too much water	1		
Absence of field channels/Water courses washed away		1	
Lack of co-operation between Farmers			
Canal minors and field channels enclosed and blocked within large farms			2
Agriculture is un-remunerative	4	1	
Cattle Problem	1		
Picks up drainage water (no need for Canal)			3
Accesses well			1
Unleveled Land	2	2	5

Source: Survey in Vanai Village (2008)

Table 5.4 - Reasons for non-irrigation on two canal sub- minors systems. Sample survey of all classes of farmers: Sakhare Village (N= 31). Sub Minor 1= 15 Sub Minor 2 =16. Survey conducted in April-May 2008

Reasons for non-irrigation	Head	Middle	Tail
Unlined sub-minors/Poor Canal Maintenance	1		3
Too much water	9		
Absence of field channels/Water courses washed away	1		
Lack of cooperation between Farmers	1		
Canal minors and field channels enclosed and blocked within large farms			10
Agriculture is un-remunerative	2		
Cattle problem	1	2	
Picks up drainage water (no feed for Canal)			1

On public canal systems in rural India, the land-water nexus has become even more crucial as contestation over resources intensifies. Given the state of social relations in Dahanu before the 1980s and difficulties involved in gaining access to tribal land, Vadaval farmers went towards a strategy of leasing in land from another dominant community who had lost interest in agriculture. Land was leased strategically on the

canal minor system and then enclosed. “Theirs is a strategy of consolidation,” said Shiva, adding “they leased inland from the Brahmins in Vangaon, but many land holdings were scattered throughout the village. Given that the canal runs through the villages, they had to bring everything together. This strategy has come at our expense. After they grabbed land, they fenced off their farms” (see Figure 5.8). “Then we lost access to water because the canals were enclosed too! Unless you work as agricultural labourer inside, no one knows what happens inside the farms of the Vadavals!” A third of farmers surveyed in Sakhare village revealed that they had lost land in various ways to the Vadavals in the aftermath of canal irrigation in the village (see Figure 5.8). A common complaint was of the loss of *Varkas* land. *Varkas* was a form of customary tenure that was mostly not entered in the official land records. It was used to make “rab,” a natural input that goes into local agriculture (Munshi, 1989). Tribal farmers reported losing *varkas* land to the Vadaval horticultural farmers throughout the canal minor system. Data from Vanai village on loss of land is unavailable but the numbers are fewer than in Sakhare given the resistance put up by the local social movement, the Kashtakari Sanghatana. The Sanghatana shared ten cases of Vadaval farmers grabbing land belonging to tribal farmers, some involving *varkas* land, others being unrecorded tenants while yet others involving open theft of tribal agricultural land and even village paths. For instance, there was a case of a large orchard owner grabbing land belonging to the tribal community’s village deity in Vanai. The Sanghtana fought back in court



Figure 5.8 - Fencing of a large Vadaval farm at the tail end of Direct Minor 2 in Sakhare village. The canal is not visible in the picture and the large fence prevents access to the farm.

and won the case on behalf of the tribal inhabitants of Vanai and the owner was forced to return the land. The strategy in Vanai was to grab land belonging to tribals that had turned valuable and potentially remunerative after the onset of canal irrigation.

This account of the canal minors being enclosed by Vadavals is represented well by the map in Fig. 5.6 and the picture in Fig.5.8. Throughout the upper, middle and lower reaches of this map, one can see that the outlets are enclosed within the large farms (in yellow) belonging to the Vadavals. Vadaval farms are surrounded by patches of tribal land (in brown), especially at the middle and tail reaches of the canal system.

Vadaval farms were then fenced off by Vadavals who used domesticated dogs to keep out trespassers from the tribal village. The strategy of land consolidation is thus affirmed by the map, but whether Vadaval farmers needed the water remained a question. After all, they cultivated vegetables, flowers and fruits which require less water than paddy. The largest Vadaval farm in Sakhare was about 30 hectares while

there were at least nineteen other large farmers who owned farms ranging from 30 to 60 hectares in other parts of the horticultural belt. These farmers dominated other villages in the belt where Sakhare was located, but came mostly from coastal Dahanu, having anticipated the opportunities of irrigated agriculture as a result of the Surya project.

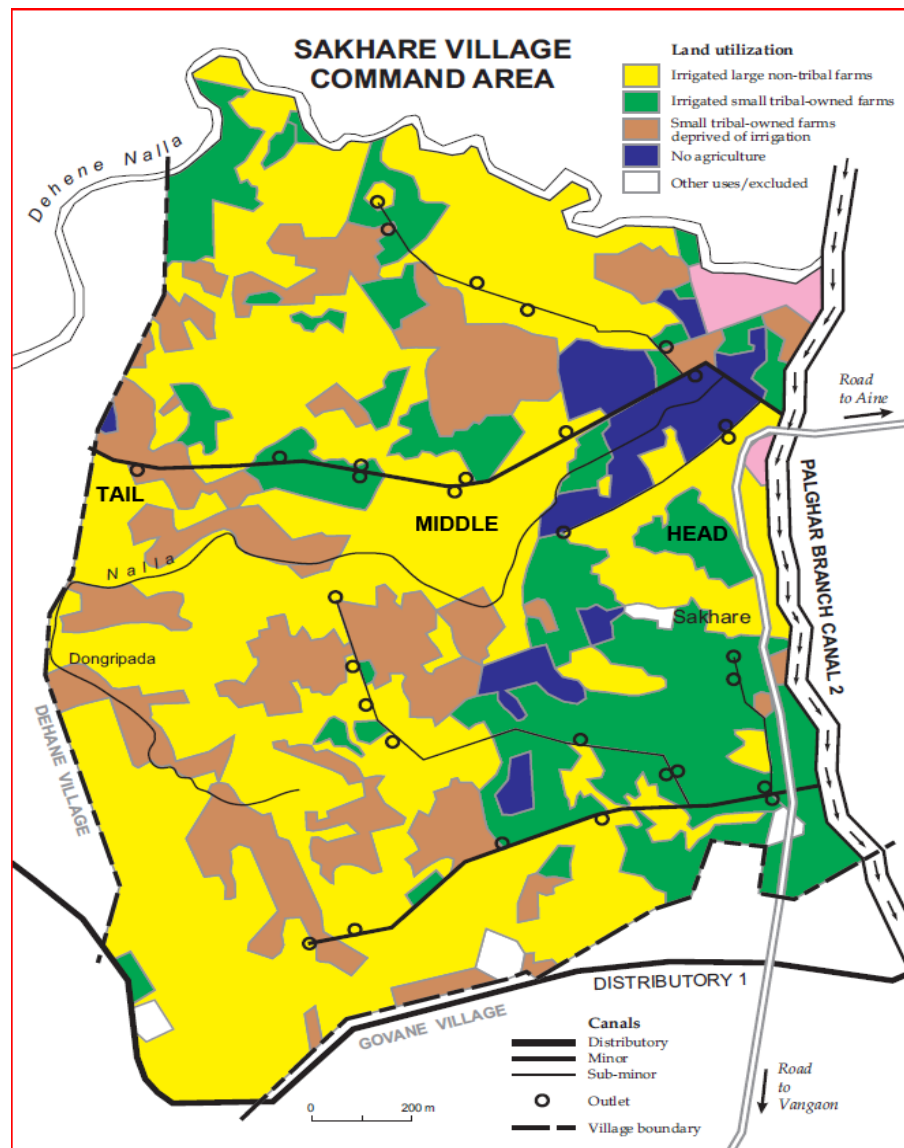


Figure 5.9 - Map of Sakhare Village's command area highlighting social and economic differentiation between small irrigated tribal and non-tribal large farms on the canal minor system. The area in yellow was under grass cultivated and sold in Mumbai and Gujarat. In the 1990s these particular land tracts came to be irrigated and brought under horticultural crops. The area in brown shows land plots belonging to tribal farmers and were unirrigated in the agricultural season year 2008. Green indicates tribal farms that were irrigated (Base Map courtesy of the Irrigation Department, Government of Maharashtra).

“There is no money in agriculture” lamented Churi, the first large Vadaval farmer I spoke to. “Have you seen my farm? I grow bell peppers, flowers and fruits, where is the money in there?” Churi was reckoned in Dahanu as the most successful horticultural farmer who came from a family of small agriculturists and worked hard after leasing land from a Brahmin landlord from Vangaon. Churi explained, “we use tubewells, drip and sprinkler irrigation so our benefit from the Surya project is indirect. The Government still wants us to pay water charges and we won’t.” (see Table 5.6 for well ownership). While the onset of canal irrigation in this area had imparted a change in the hydrological cycle in the area, the rhythms of water rotations on the canal system had been further altered in Sakhare and other villages where horticultural farmers had managed to regulate water use on their farms through the use of tubewells while accessing canals at the same time. The distribution of wells between Vadaval and tribal farmers also points to a disparity. While most Vadaval farmers had tube wells, none of the tribal farmers in Sakhare had access to such wells because it required a heavy financial investment. The wells were used by Vadavals to regulate and optimize water use on the farms where the water discharge through the canals often exceeded 4-6 times than what the vegetable crops needed (Government of Maharashtra, Water Audit, 2011).

Churi’s claim of not using the canal system wasn’t true because a sub minor of the canal system ran through Churi’s farm and, as the tribal farmers had told me, he was one of the biggest farmers in the area and employed a large number of agricultural labourers from tribal families in Sakhare and other villages in the interior of Dahanu. A very significant section of this farm labour came from the small farms that surrounded

Churi's huge landholding that encompassed an entire section of Sub-minor 1. "We have to compete for this labour with industry. None of the new generation wants to work in agriculture; it is a challenge to find labour. We, Vadavals, have worked hard to survive the vagaries of the farming business here as entrepreneurs."

Table 5.5 - Well Ownership in villages in the Horticultural Belt under Palghar Canal Branch 2.

Village Name	Number of Tribal Farmers	Number of non-Tribal Horticultural Farmers	Total Hectares under Vegetables	Area cultivated by tribal farmers	Area cultivated by Horticultural Farmers
Sakhare		18	85.80		85.80
Govane		16	64.70		64.70
Kapashi		34	130.65		130.65
Dehne		26	89.30		89.30
Vanai	1	20	87.08	0.41	86.67
Dabhale		29	148.61		148.61
Khambale		18	80.91		80.91
Chandranagar	7	2	32.05	1.99	30.06

Sources: Calculated from Revenue Tables 2007-08, Surya Irrigation Project & Fieldwork Notes.

A month after I left Churi's farm, my research assistant showed me how Churi had enclosed an entire sub-minor and flattened it and had diverted water to his tube well. While there was direct evidence of such siphoning away of water, other tribal farmers told me that competition for water in the past really became intense in March when the weather started turning hot and everyone (whether it was tribal or non-tribal) wanted water for their crops. While there were no fights on this issue, the Vadavals decided to fence their farms along with the sub-minors. The Vadavals move to grab water from the canal minors was also part of a strategy to deny water to neighbouring farms, so that agricultural labour from the adjoining smaller farms would continue to be

employed on Vadaval farms. It was also a strategy to ensure that they would not have interruptions in their access to water. “Who will work on their farms, but the tribals” said an Irrigation Department employee on the condition of anonymity.” It is all an encompassing strategy, involving land, labour and water,” he chuckled and said.

Table 5.6 - Reasons for dispossession from land in Sakhare Village. N=31. Almost a third of the surveyed farmers reported losing land to commercial farmers in the village since the late 1990s after irrigation (June 2008).

Reasons for Dispossession from Land	Head	Middle	Tail
Loss of Land to Canal Building	3		
Land Grabbing	1	2	3
Loss of Varkas Land/Unknown where land is lost	2	1	2
No loss of land	5	6	6

Source: Survey of Sakhare Village (2008)

In terms of the distribution of farmers who reported no access or issues with water from the canal minors, almost 80% of the tribal and Macchi farmers at the head of the canal in Sakhare were able to access water from the canals. However, this number declined as one entered the middle and the tail ends of the canal in Sakhare village (see Table 5.4 and Fig 5.9). In Vanai village, the picture was not different. In 2002, the Kashtakari Sanghatana lodged a court case against Tarporewala, a Parsi farmer who had grabbed land from a tribal agriculturist and was siphoning water away from the canal minor in Vanai. The Sanghatana records revealed that the Taraporewala lost the case as the canal was ruled by the judge to be a common resource to be shared by everyone. Still, the sharp inequity in land holdings and social power between tribal and large non-tribal farmers makes this a tough struggle for the former in other villages where the Sanghatana is not powerful.

The problems of farmers in Vanai village were of a different sort (see Table 5.4). While siphoning away of water was prevalent there too, the problems of tribal farmers with water access could be categorized into four types:

- 1) Agricultural land plots were often above the canals and the farmers could not access the water for their fields.
- 2) An intensive round of land disputes between large farmers, mostly Vadavals from the coast and the tribals, had also led to underutilization since the early 2000s.
- 3) A large part of the tribal community that was settled in Vanai after the construction of the Surya reservoirs were unable to cultivate land in the village as the formal process of transfers of land certificates was not done properly.
- 4) Several Parsi farmers (former landlords) sealed off canals inside their farms and this led to disputes between the tribal community and these farmers.

In both villages, tribal farmers were often surrounded by large farms that fenced the canals inside (see Figure 5.7). Water drawn from canals was stored under-ground and ensured successful crops for the large farmers, while tribal farmers surrounding large farms either withdrew from agriculture into other occupations or were forced to look for wage work on the large farms. It was clear that Vadaval horticultural farmers flourished on the labour from families that came from the same village. The large farms in this belt have also relied on labour from the hilly interior of Dahanu, but it was easier for the large farmers to access labour from the same village (Mehta, 1999).

A visit to the farm of another Vadaval farmer, Raut, in Sakhare yielded more insight, as he was transparent about reasons behind the success of the Vadaval community:

It is the canal system, we were like the tribals, my own father was an agricultural labourer on a farm on the Dahanu coast, but the surface irrigation in this area changed the entire picture. We wouldn't be here if it was not for the canals. However, we don't need the water from the canals as we grow vegetables with drip and sprinkler, so though we use the canal water, most of the benefits are indirect as we use the recharged ground water. The flow of water through the canal system is unsuitable for our vegetable and fruit crops, we don't need it. We understood the importance of the use of optimizing the use water from Israel where we undertook trips to learn the use of drip and sprinkler irrigation. When it comes to vegetables, fruits and flowers, they need the right amount of water at the right time; sprinkler irrigation ensures that we are able to water the plants adequately at the right time.

A Gujarati landlord in neighbouring Vangaon who had diversified outside agriculture then told me how *Syngenta*, the agro seeds corporation, had sent these farmers to Oakland, California and Israel to learn the new agricultural technology, which included drip and sprinkler irrigation. Still, a question that continued to bother me was what happened to the water that went into Vadaval farms? The canal water discharge in Sakhare was meant for paddy, while vegetables consumed less than a third

of the water needed for paddy (Command Area Development and Water Management Programme, undated). “This isn’t just about water, it is about control of all three elements that are central to horticulture in the village,” I wrote in my fieldwork diary.

Water was an important object of politics in this micro context, but not the only resource up for grabs. Moreover, water that was not needed was expelled by Vadaval farmers into neighbouring farms using pumps. After disputes over land, this was also a contentious issue between tribal and Vadaval farmers and caused more disputes on how village water should be managed. However, the power of local Vadaval horticultural farmers was quite overwhelming for tribal farmers in places like Sakhare. Closer observation of canal minors was supplemented by similar observation of the canal system at the main level. There, the water was often conveyed into the natural drainage system and rivulets by canal engineers (see Paper One). Perplexed, I checked with several tribal farmers whether they had always seen the main canal gates at Sakhare (Palghar branch) open to the drainage and they nodded their heads affirming my worst doubts about deliberate mismanagement at the main canal level. “Some of this is because they want the Vadavals to be able to pick up water from the drainage too at the tail end of the village; the canal system here is rigged to benefit them,” the tribal farmers added. This last comment exposed both the lack of knowledge of tribal farmers about local machinations around water, but also exposed their ignorance about the rules around rotations on the main canal. According to the Irrigation Act, 1976 for the state of Maharashtra, sluice gates leading to the natural drainage system have to be always kept closed unless there is an overflow in the reservoir or a flood (Government of

Maharashtra, 1976, Section 16, p. 9634). At the level of the canal minors, water that was not required was periodically expelled using pumps into surrounding tribal farms and waste land (see Figure 5.10). A lot of this water ended up in rivulets that led into the Khadkhada River and later into the Dahanu creek.

Water waste was thus an important social-ecological consequence of introducing canal irrigation to the area. However, complicity of the local irrigation bureaucracy and Vadaval farmers in creating wastage was beyond any doubt from my nine month field research in Dahanu. Social relations in the area after the onset of canal irrigation had also completely transformed the agrarian landscape, while also facilitating urban claims on Surya water.



Figure 5.10 - Water expelled out of the large farms in Sakhare

5.5.4 The Significance of the Paracommons: The Social and Political Discourse of Water Underutilization and Diversions

The Surya project has not been able to meet most of its objectives around irrigation, but what has saved it is water demand from the city and industrial areas which keeps this project financially viable. The only projects that work for irrigation in the land constrained Konkan region are small irrigation projects. Large irrigation projects veer off their objectives and end up supplying their water to cities and industrial areas. (Executive Engineer Interview, Feb 2008)

The unique ecological context of the Surya project, which irrigates an agricultural belt between the Western Ghats and the northern Konkan coastal belt with a canal system (with all its institutional underpinning and cultural assumptions of farmer response) imported from interior Maharashtra, clearly narrates a story about the unsuitability of canal technology for the tribal agriculturalists of this water rich, but land constrained region. Given these constraints, state attempts to shape the agrarian context with the help of various programmes to remodel the canal system for tribal farmers have also failed and social relations played a major role here (Sinchan, 2000).

Given the overwhelming challenges posed by terrain as well as social relations and unfeasibility of canal technology, the socio-technical and hydrosocial frameworks help us understand the adaptation by Vadaval farmers to the canal system to grow a commercially viable but less water intensive crop. The sociotechnicality of Vadavals' response is best embodied in the (illegal and subversive) re-working of the canal system

through drip and sprinkler irrigation which reflect Vadaval ingenuity and enterprise in horticulture. Thus, at the same time the cycle of water rotations through the canal system (in itself constituting a new hydro-social cycle) is also further re-engineered on Vadaval farms through the construction of tube wells and class relations transformed simultaneously to the detriment of small and marginal tribal farmers who don't have similar access to capital and knowledge to utilize drip and sprinkler irrigation.

However, since water was still released into canals for paddy, what happens to the wasted water? On their own, the socio-technical and hydro-social approaches only partially help to understand social consequences and material properties of "wasted" and underutilized water in this context. The concept of the paracommons focuses in a novel way on competition over water resources freed up as a result of efficiency in utilization or wastage. It is used to bring together the narrative above and explain how water claims are made on wasted water of the Surya (Lankford, 2013, p. 9). Thus, while the hydro-social cycle and socio-technical perspectives remain crucial to our understanding of the social context of canal irrigation in Dahanu, they are supplemented by the paracommons approach in order to understand dynamics of water use in a productive irrigation project (see Paper One) where canal water is distributed on principles other than strict crop zoning and based on meeting water demand from farmers.

The canal engineers in Dahanu termed water runoff from the Surya canal system as wastage. Run-off from canal systems is not an uncommon phenomenon in rural India. Yet the scale of run-off from the Dahanu canal system created an interesting local

cultural discourse about tribal utilization of water in the area. In 2008, a separate, powerful lobby of Vadaval farmers in coastal parts of Dahanu outside the command area (where fellow farmers from that caste had benefitted) blamed the Government for poorly implementing the Surya project and wanted the Irrigation Department to construct a canal for Vadaval farmers in western coastal Dahanu to access “wastage.”

The flow of wasted water into the natural drainage of the area created expectations for other users, especially farmers outside the dam’s official command area. Thus, within the paracommons perspective is a spatial dimension that explains this politics of water claims, “the loss portion of a unit withdrawn by one user is available for other users including the original, proprietor/withdrawer through different pathways” (Lankford, 2013, p. 179). Therefore, the paracommons features modified subtractibility (subtractibility and non-rivalry in the consumption of common pool resource is assumed in the CPR literature, see Table 5.7), whereas, in Lankford’s new conceptualization, a loss of water in a system like the Surya could become available for other users outside the official beneficiary area. Raul, a Vadaval farmer specializing in organic agriculture and local leader on water issues for the west coast of Dahanu noted:

If you take a look at the Khadkhada, you can see the volume of water being wasted during the irrigation season. We, Vadavals have proven ourselves and can put this water into better use and have formally approached the state government on many occasions for building a canal that takes this “surplus water” and wastage into irrigating our

Table 5.7 - How do the two theoretical frameworks explain underutilization of canal water in their separate domains? The political ecology/production relations, common pool resource and paracommons approaches. Sources: After K. Bharadwaj (1990) and Lankford (2013: p 172)

Dimension	Production Relations/ Political Ecology approach	The (principal) Commons approach	The Liminal Paracommons approach
Behavioural approaches	Access to water depends on class or caste status of farmers	Rational actor approach	Not worked out
Factors behind water losses and wastage	Socio economic environment and including conditions of production that users face that affect utilization. Geography of canal system and role of state acknowledged.	Brief incomplete and summary treatment	Defining feature of the paracommons. Complex nested and scalar.
Property rights question	Not important, but this could change in a complex agro ecological context that involves customary tenure land, but property rights in water not central	Who owns the commons? How could rights be transferred?	Who owns the wasted and underutilized water?
Subtractibility	No attention	Water consumed in one place cannot be consumed elsewhere	Modified subtractibility
Regulatory Questions	State seen as representing dominant class interests	How to manage common pool resources and regulate demand? What common pool resource modes?	How to govern the commons with a significant proportion of salvageable wastage?
Design and Technology	It is more important in political ecology, but socio-economic context more central	Canal technology related to harvest and water storage	Technology related to raising efficiency-though often unpredictably so and requiring 'systems thinking'
Spatiality Conferred Ownership claims and Competition	Not central. If geographical scale considered, class relations and sectoral priorities of the capitalist state become important. Within rural areas, some attention to spatial aspects	In parallel (all users acting simultaneously); or in geographical sequence with users in longitudinal, vertical or lateral sequence	Extrinsic-appropriation sequence; likely to be a complex intricate and unique set of resource and wastage flows in different contexts.
Non-Excludability or Rivalry	Not considered.	Defining feature of the principal commons. Difficult to exclude others accounting for geographical and spatial factors.	Excluding others from waste fraction is one option; or not if recycling/reuse by others deemed normal

fields, west of the railway line. But we are told that the tribal community has prior rights to the water.

Seconding Raul's argument was an engineer from the Surya project, whom I met separately. The engineer stated:

There is indeed underutilization in the project, but what can we engineers do? The tribal community is utterly incompetent and underserving of the benefits of modern canal irrigation, this is a social problem. All this water I can tell you will end up in the city, it pays for the water. This could and might happen to more of the Surya water; it will end up in the city.

The underutilization and wastage of water became grounds for the proposal of a new canal project to irrigate western parts of Dahanu where the Vadaval community originates. However, this project never fructified because the diversion was proposed from the existing horticultural belt where communities had now developed clear rights to waters of the Surya project. At the same time, the state government citing essential use and overall underutilization in the irrigation project has successively diverted water to the northern suburbs of Mumbai and to Vasai Virar, one of the fastest growing townships in the MMR. The diversion to Vasai Virar began in 1998 and has been renewed by the state government three times in the last 15 years citing underutilization in canal irrigation (see Figure 5.11 and Table 5.8). Another diversion of Surya water was

made to Mira-Bhayandar, a suburb in Greater Mumbai in 2009. Almost 25% of the project's water has now been transferred to urban-industrial use (see Table 5.8).

Table 5.8 - Water utilized for non-irrigation purposes, including diversions to Vasai Virar. **Source: Various Reports, Surya Command Area Development Authority (2002-2010)**

Water Supply to Maharashtra Industrial Development Corporation, Tarapur (MIDC), Tarapur	19.20 mm ³ (6.17% of total water utilization)
Water Supply to various towns (10 No.) and villages (27 No.)	24.56 MM ³ (8.58%)
Water Supply to Industries like Bombay State Electricity Supply company, mills, industries etc.	21.93 mm ³ (7.76%)
Water Supply to following important Central Government Schemes Tarapur Atomic Power Station (Stages I, II, III, IV, V & VI) and Bhabha Atomic Research Centre, Tarapur	6.70 mm ³ (2.34%)
Total	72.39 mm³ (25.28% of total water utilization)

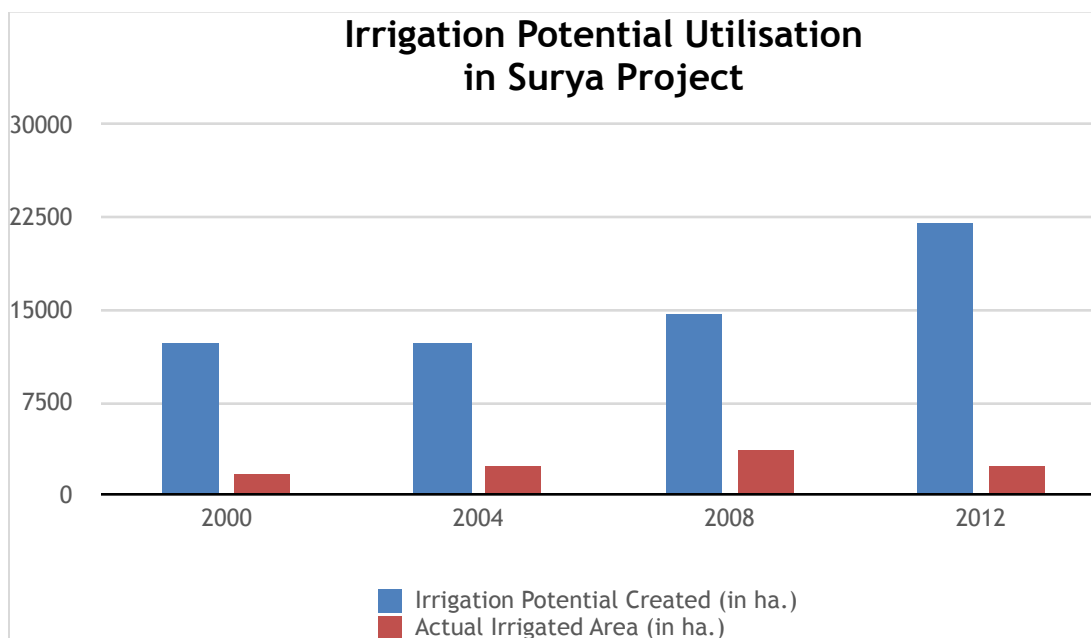


Figure 5.11 - Irrigation potential utilisation in Surya Project. Sources: Directorate of Economics and Statistics, Thane District, 2000-2012; Report on Benchmarking of Irrigation Projects in Maharashtra, (Various Years). This data has been calculated after using all these sources.

“The water of the Surya is coveted by property developers in Vasai Virar because without water, there cannot be any urban expansion at the fringes of Mumbai,” said Navneetbhai Shah, a former MLA and litigant on the Surya dam water diversion to

Vasai Virar in the Bombay High Court. On the one hand, the Government says it wants to give a fair deal to economically depressed tribal areas; on the other, they take water away from poor tribal agriculturists to help with the contentious expansion of Mumbai into Vasai Virar. Now, the government has decided to construct a new dam called Susari in Dahanu to supply water to Vasai Virar (see Figure 5.2). Shah added,

Where is the underutilization? On the one hand, the Government has not constructed the canals and maintains the existing system poorly. On the other hand, it wants to divert water from the tribal areas and now build a new dam displacing 10,000 people in an area that has already sacrificed land for this massive Surya project with negative results for tribal agriculture. There is no logic in the Government's policy.

The politics of surplus and wasted water created by such "underutilization" in the neighbourhood of the horticultural belt points to the weaknesses of both the Marxian and political ecology approaches to irrigation in analyzing this phenomenon of water wastage. A classic Marxian political economy response would be to blame the condition of class relations for the underutilization of irrigation potential (see Bharadwaj, 1990 for an excellent Marxian analysis of underutilization in irrigation and Table 5.7 on political economy analysis of underutilization) While the Marxian political economy argument is validated by the above account, it neglects the assumptions that go into the technical design of large irrigation projects, the material properties of water, and the role of the

bureaucracy in water management (also see Table 4 above on the differences in approaches to underutilization of irrigation water).

5.6 Conclusion

The empirical findings of the paper that focus on the underutilization of irrigation water in the Surya project help us justify the theoretical framework that has been brought together in this paper. The introduction of a new irrigation project fundamentally altered the hydrological cycle in this region and transformed social relations and the ecology of the area. However, on their own, the hydro-social and the socio-technical approaches cannot explain the claims made on the unutilized water of the Surya project as a result of underutilization. The scalar politics which the urban claims to that water create justifies a synthesis of the paracommons approach with the hydro-social and socio- technical approaches.

From both theoretical and empirical perspectives, this paper forwards a new lens of understanding and analyzing the intra-rural water dimension in rural-urban water transfers in India, especially in areas that enjoy an abundant availability of water, but are characterized by significant social-geographical constraints. While this paper has dealt mainly with the experiences of farmers on the canal system in a rural area, it has shown that we need a combined grasp of the interface of local canal technology and water institutions at broader geographical scales to understand how intra-rural dynamics over water could facilitate rural-urban water transfers. This needs to be considered in a context where the utilization of water by agriculture is influenced by the social

geography as well as water institutions, such as rules of water management and the role of the Irrigation Department.

In this paper, the various theoretical frameworks that exist in political ecology and the general literature on water were utilized to examine the interface of social relations, technology and institutions. An empirical attention to the micro politics of water utilization at the canal level constitutes part of that focus and highlights both the underutilization of water and the implications of underutilization for water management at a broader geographical scale. It is quite clear from the evidence that the dispossession of the tribal community from both land and water lies at the centre of the politics of resources in the horticultural belt in Dahanu. Any explanation of water diversion to Mumbai is thus incomplete without examining the contestation of resources between the tribal and the non-tribal communities on the canal system in this part of the Surya project. The analysis of water wastage due to the non-implementation of rotation rules at the level of the canal minors, the lack of incentives to farmers to optimize their water use, the excess conveyance of water in the canal system, and the state of social relations are some of the highlights of the empirical findings. They highlight the broader regional implications of the uneven nature of agricultural development in the Dahanu area for subsequent water transfers to Mumbai.

While each of the theoretical frameworks from within political ecology (the hydro-social and socio-technical) remains useful in analyzing the empirical data presented in this paper, these theories present strengths, but also some key limitations. Therefore, approaches from outside political ecology are assembled together with the

hydro-social and socio-technical frameworks. In terms of strengths, while the socio-technical parses the working and the adaptation of canal technology in the social-geographical context (Section 5.6) by the large Vadaval horticultural farmers, the hydro-social approach helps us to keep the political construction of geographical scale (Sections 5.6.4) and social consequences of the hydrological re-formatting of the entire landscape in focus. The paper uses some key features from both these frameworks to analyze the evidence from the experiences of farmers on the canal system.

It also becomes clearer that a treatment and analysis of empirical data on water utilization in this context by developing a hybrid framework is necessitated by some of the unique contextual factors at play. A significant one is the presence of underutilized and “wasted” water. In this context, the paracommons approach is critical for dealing with the material properties of water. The social and institutional mechanisms behind the creation of water wastage and underutilization at the canal level and local politics around wasted water necessitate theoretical hybridization in analysis. Key features and characteristics of the geography of the canal systems are thus also identified as playing a major role. Thus, the social and geographical context in which canal technology works, the political construction of geographical scale, and the politics of underutilized water all inform this hybrid framework. The scalar focus of the paracommons approach has some characteristics in common with the hydro-social framework

While this paper does not claim to contribute to theory, it does emphasize the value of studying the movement and politics of water at different scales by using theoretical tools from both political ecology and water policy. By attempting to provide

an explanation that is both sensitive to social and geographical context, this paper has tried to understand how the politics of water and utilization at one geographical scale influences claims and water transfers to other scalar levels. Through a scalar approach, this paper also highlights the importance of more contextual studies on the social, institutional and geographical implications of rural water use, regional water institutions, and geography for rural-urban water transfers in India.

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6. Conclusion

6.1 Intent and Questions

This dissertation set out to address the politics of water transfers and appropriation in the context of the Mumbai-Thane region, India. In the process, it has posed questions on the institutional, social, geographical and political context of the management and governance of watersheds and water districts (including irrigation Command Areas) that are shared between large urban centres and agricultural/rural water users. Given the growing contestation over water between cities and agricultural areas in India and other parts of Asia (Meinzen-Dick and Pradhan, 2005), this dissertation should be seen as an empirical and conceptual contribution to the subject of *inter-sectoral* water transfers. It should also be seen as a contribution to the literature on water politics in human geography, political ecology and environmental politics. In this concluding chapter, I present and reflect on the dissertation's theoretical, empirical and policy contributions, and make recommendations for future study. This chapter also summarizes the core findings of each of the component manuscripts of my dissertation, drawing them together to answer questions that guided my overall research project. To repeat them here:

- 1) What aspects of farmers' social and economic locations (within overarching relations of production) influence their access to water? (For instance, is access to water influenced by size of landholdings? By proximity to canals? By a

farmer's class- or caste-position? And *how* is water scarcity *experienced* by farmers in Surya Command Area?).

2) What are the rules, institutions and governance structures underpinning water transfers from rural to urban areas (and water management more broadly) in Mumbai-Thane region? (For instance, what factors might lead to water being [paradoxically] underutilized for agriculture in locations such as Surya Command Area? And, how do broader structures and practices of water governance interact with social/class divisions in such rural areas?).

6.2 Empirical Findings

This dissertation also sets out to research questions around water governance, institutions and social relations in the Mumbai-Thane region of western India, at two primary geographical scales: *rural*, and *urban-regional*. This section of the conclusion summarizes the answers to those questions which I identified as a result of my field and archival research. The latter was carried out in four locations: India; United Kingdom; Canada; and the United States. Such archival research in various locales helped me to situate my field and empirical data within proper historical and policy perspectives.

All three of the manuscript components of this dissertation have pointed to the excessive centralization of decision making powers in both the Maharashtra Ministry of Irrigation, and the District Irrigation Department, in one of the most important economic regions of Maharashtra State. This is true not only in the context of how water is managed at the regional level in the Mumbai-Thane region, where

fragmentation of water governance has led the Ministry of Irrigation to make decisions about administrative re-allocations of water. It is also true in the context of the broader failure of governance and collective action at local levels. By focusing on three case studies - two from dam projects, and one from a water district catering exclusively to Greater Mumbai and adjoining towns - this dissertation also brings into sharp focus the institutional variation that exists within Mumbai-Thane region surrounding water appropriation and transfers.

For example, Paper One explains how excessive centralization of power and decision making at the Irrigation Department is characterized by a lack of participation and transparency - which has in turn created opportunities for graft among engineers. That centralization has also created an environment in which the needs of small-scale farmers (who depend on the rural canal network for subsistence) have been completely neglected by Irrigation Department staff. In Paper Two, I closely analyze the political and institutional dimensions of relations between an ever-expanding Greater Mumbai, and the water district located outside its official boundaries (yet reserved for exclusive use of Mumbai and other nearby towns). There the dissertation also situates the interface of geography and institutions - as well as long term consequences of past policy decisions to reserve the entire Tansa-Vaitarna watershed for the eventual use of Greater Mumbai - within their proper institutional, geographical and historical perspectives. And in Paper Three, farming communities' experiences with the canal technology prevalent in the Surya irrigation system are critically analyzed, along with political claims about how water is wasted and underutilized there. Studying how intra-

rural water conflict results from (or is exacerbated by) the pressures of geographically distant urbanization also raises important contextual questions about the major actors facilitating changes to the 'waterscape' of Mumbai-Thane region.

PAPER ONE focused on the governance of the canal system in Surya Project. That chapter was brought together using qualitative data gathered from interviews with engineers after the 2008 canal irrigation season was over. Conventional understandings of the political-bureaucratic *corruption nexus* surrounding irrigation projects in India has already been firmly represented in Indian social science scholarship by Robert Wade's classic papers (Wade, 1982 & 1985). While acknowledging the strengths of Wade's arguments, this chapter points to weaknesses in his use of the *rational choice framework* to explain the behaviour of junior bureaucrats who are unwilling or uninterested in job transfers to other locations. The chapter identifies possible reasons for them to avoid seeking promotions or transfers, such as the potential for them to skim off developmental subsidies in economically backward areas.

Paper One also presents findings that challenge official narratives behind the underutilization of irrigation water - which are used to justify the transfer of water from Surya project to the Vasai-Virar sub-region (VVSR). The paper presents evidence that underutilization of irrigation water is explicitly the result of informal norms that project engineers have cultivated and followed, in which they deliberately under-maintain the rural canal network. The system of kickbacks that results from such poor maintenance work responds to a logic of self-interest among engineers (first identified by Wade in the context of Andhra Pradesh). It also reflects an institutional incentive for the

Irrigation Department to earn official water revenues from urban areas (amid political pressure not to collect water charges from the prosperous new class of commercial Vadaval farmers who have benefitted from the irrigation system). Thus, in the context of a poorly maintained rural canal system that does not respond to the needs of the small-scale, marginal, tribal farmers, the extent of agricultural land that is actually irrigated (versus potentially irrigated) remained small and stagnant.

Paper One thus brings together an analysis of how social relations, institutions and incentive structures can influence water policy at the local and regional level. It demonstrates how the uneven development of Dahanu's agricultural landscape facilitates underutilization and water transfers to the Vasai-Virar sub-region and parts of Greater Mumbai. By taking a broad view of institutions and seeking to inform a more grounded understanding of the politics of water transfer, this paper also departs from a more narrow economic-legalistic view of the institutional underpinnings of inter-sectoral transfers that some important policy studies in the Indian water literature have taken on this subject (World Bank, 1999). My focus on the informal dimension of the politics of water transfers and the role of the bureaucracy in that presents new information about the social and cultural dynamics of water transfers from Thane district's reservoirs to Mumbai.

PAPER TWO is situated within the theoretical framework of the environmental politics and common pool resource (CPR) literatures. It takes a slightly different route because of its reliance on multiple sources of information: archival material; dam project reports from the 1960s; newspaper reports; government reports on water

utilization; interviews with planners and municipal bureaucrats; and maps from conservation departments. This chapter uses the CPR literature and applies it to analyze geographical, social and economic data with a focus on an action situation around water entitlements in the Tansa-Vaitarna water district. It uses that case study to examine associated problems of water appropriation, as well as the long term environmental and human consequences of reserving entire watersheds for a metropolitan city based on the *prior appropriation* principle. It later juxtaposes the institutional analysis with an argument about the fragmentation of metropolitan water governance, while advocating for the establishment of a *metropolitan regional water council* to manage water conflict and specific contestations on a broader, regional scale.

Information was not forthcoming from the Maharashtra Government about rules of allocation from T-V reservoirs, among towns, cities, irrigation Command Areas and other villages. Thus, data for writing this section had to be compiled from primary and secondary sources, including newspaper reports on water diversions and interviews with local leaders, which were crucial. At the same time, archival material and a closer reading of dam Project Reports from the 1960s proved useful in piecing together a picture of the institutional architecture of water governance, and the historical legacy of water planning in Tansa-Vaitarna water district since the 1940s. Interview data with government officials was also valuable. Some individual planners in the *Mumbai Metropolitan Regional Development Authority* (MMRDA) spoke clearly about the legal rights of Greater Mumbai and the MMRDA to exploit the untapped water potential of the Hydrometric Area. But officially, Mumbai Municipal Corporation authorities were

reticent to speak about the status of rural communities' claims concerning water rights and access in the T-V water district. They were equally reticent about the rights of other towns in the MMR that lie on the water pipeline route to Mumbai. Given the resistance to share such information, greater transparency on the part of Mumbai municipal authorities would have helped immensely.

The fragmentation of water management policies and procedures between the District Irrigation Department and the Mumbai Municipality also did not help matters while investigating these issues. After my persistent petitioning of both planning authorities and municipal officials, a brief, cryptic description of the City's senior water rights was finally released to me; it simply stated: '*the water in this area has been allotted to us.*' Clearly, further research is needed on this question of water rights in Tansa-Vaitarna water district; for geographers, an empirical route to investigating this problem might be through the use of more archival sources, surveys, and Freedom of Information requests.

PAPER THREE brings out the ecological salience of the urban–rural resource relationship between large Indian metropolitan centres and areas where water sources for smallholder farmers are located (such as Dahanu in Thane District). The experiences of small-scale, marginal farmers - as well as interviews with commercial, Vadaval farmers - revealed that smallholder agriculture in Thane District faces not only the brunt of intensive water demands from large cities, but also the challenge of the emerging class-interest of commercial farmers. This chapter shows how both land and water have acquired a new economic and cultural significance for the poor in the context of this

dual threat of dispossession. An enclosure-like situation in which smallholder farmers have lost access to land and water is another finding that sums up the experience of tribal small and marginal farmers. Institutional inertia on the part of the bureaucracy, partly a result of technological choices that accompanied the construction of large dams and canal systems in this region, hasn't helped. Manifestations of this institutional inertia include the declaration of "*underutilized irrigation potential*" without adequate scrutiny of the functioning of the canal system at various levels; brazen neglect of the needs of smallholder farming; and a callous waste of water by the bureaucracy and large farmers. The paper presents new findings on the transformation of social relations in agriculture in Dahanu and how these get mapped onto institutional practices and ultimately water policies in the Surya Command Area and at the regional level.

Given my focus on how water institutions impact rural livelihoods in Dahanu, this chapter was not able to investigate the influence of either seasonal migration or economic diversification upon small-scale, marginal, tribal farmers in the Mumbai-Thane belt who are now slowly moving away from irrigated agriculture, as they do not find it sufficiently remunerative. The dominance of the non-farm sector has been demonstrated in other empirical work on Thane District (Ambasta, 1998; Mehta, 1999), as has been the finding that small and marginal farmers also remain tied to the land. Some of these issues around diversification remained uninvestigated as they were beyond the scope and organization of my planned field research on water, institutions and social relations, but they warrant further academic and policy attention.

Papers one and two bring out the central importance of developing a more transparent and autonomous water governance apparatus that monitors water use by different sectors. The findings from both these papers emerged only after careful conceptual analysis of the water problem in two locations drawing primarily on the *rational choice* and *institutional* frameworks. Paper three uses the *political ecological* framework explicitly, but also relies on *institutional theory* to analyze the problem of water underutilization in the Surya Project. All three frameworks are detailed in the following section, which outlines this dissertation's theoretical underpinnings and conceptual contributions.

6.3 Theoretical Framework: Merging Political Ecology and Institutionalism

This dissertation furthers understanding of the social and political processes that underlie water transfers and contestation between rural and urban areas. While there is a significant policy literature on this subject in the Indian and international context (World Bank, 1999; Molle and Berkoff, 2006), case studies that integrate the institutional dimensions of water transfers with the social, cultural and geographical context of irrigated agriculture are made are quite rare. Thus, in the three papers presented, I have sought to focus on the multi-scalar politics and geographies of water transfers, and how those interface with the formal and informal institutional rules and practices at the village level in the SMIP, the water districts and the hydrometric boundary of the Mumbai-Thane region.

Drawing on a wide literature about water and irrigation in political ecology, this dissertation asserts that claimed scarcity of water is a limiting perspective for analyzing water problems. Physical availability is only one dimension of water insecurity, as issues around access to water also hinge around local socio-geographical contexts and land and water institutions. Therefore, besides focusing on the dynamics of water allocation between cities and rural areas, this dissertation also investigates how water is managed and distributed for agricultural irrigation between different social groups, by actors such as the local water bureaucracy and the state Irrigation Department. It has further examined the implications of intra-rural management for water policy and politics in the entire Mumbai-Thane region (Paper three). The politics and political economy of local water management and regional water institutions also find a presence in all three case studies.

To understand the experiences of farmers and rural communities in water districts, the policies of the local water bureaucracy and the evolution of policy frameworks of the State of Maharashtra, this dissertation brings together theories from political ecology and the common pool resource literatures. By utilizing the CPR literature to examine the rules that inform distribution and allocation of water, the dissertation tries to compensate for the policy gap in the political ecology literature (Walker, 2005). It does so by focusing on the evolutionary and institutional aspects of regional water governance. However, at the same time, it does not rely on merely analyzing the working of rules and rights in water transfers, but places these in the context of social relations, the agro-ecology of the water districts and the fast

transforming geography of water use in the Mumbai-Thane region. A disconnect between the political ecology and common pool resource literatures on water prevails primarily due to the exclusive reliance on rules and governance in the latter and a dependence on examining social relations and power in the former. By focusing on how social relations, geography and governance interact and are transformed after the execution of dams and modern canal systems, this dissertation draws attention to links between all three themes. The Indian context - with the presence of a populist democracy; a large water management bureaucracy; poor rural populations; social ferment; rapid urbanization; and a fast changing ecological landscape - necessitates such a pragmatic blending of theoretical frameworks. The politics of the regional water commons is thus situated in the overall context of the constant re-scaling of water governance, and the production of space and nature in the Mumbai-Thane region (Smith, 1984; Swyngedouw, 2004).

The presence of a large and growing metropolitan city like Mumbai places an extraordinary ecological footprint on its rural hinterland. At the same time, the mapping of water resource availability and the rules that govern re-allocation of water from rural to urban use necessitate a closer analysis of local water practices and how scarcity of water on the canal systems in this context are experienced by rural communities. A mere focus on urban versus rural to explain water diversions would have been insufficient as agriculture is the dominant user of water in the Surya sub-basin. This political ecological dimension of the analysis is also informed by literature on the political economy of development and agrarian change in India. The findings presented in Paper

three emphasize the social and economic impact of the wasteful water practices of the rich horticultural Vadaval caste farmers on the small-scale, marginal, tribal farmers, whose villages are located on the middle and tail reaches of the canal system. The transformation of social relations in the aftermath of canal irrigation is thus identified as one of the major factors in the underutilization of irrigation water in the Surya Project.

Land grabbing, and the concomitant transformation of caste and class relations *in the rural areas* (and its effects) in the aftermath of canal irrigation become equally important in explaining practices and access to water. In this context, the paradoxes of water wastage and underutilization are confronted and analyzed in the context of a productive irrigation system by developing a merger of the socio-technical, hydro-social and the paracommons frameworks. The choice of the paracommons framework builds on and adds to the present theoretical tools that have been deployed to research canal networks in India within the political ecology literature (Mollinga, 2013; Lankford, 2013). Furthermore, by using the paracommons framework to analyze the consequences of waste and efficiency on the canal system in the villages, the limits of the political economy and institutionalist frameworks for explaining *underutilization of water* in this context are highlighted and explained.

While Papers one and two have relied on methods and theory from the rational choice and CPR literatures respectively, both papers develop a more hybrid theoretical framework that draws from rational choice and human geography. Thus, a pure dependence on rational choice is eschewed in Paper one, while retaining some of its features to explain corrupt practices in the Irrigation Department (such as a lack of

bureaucratic turnover amongst some sections of the staff, as well as the rent seeking activities of engineers). In this same paper, keeping with a critical geographical focus, attention is also paid to the local context, the state of social relations and other features of the bureaucratic system that manage water, thus merging attention to the politics of place and space with an equal emphasis on why corrupt practices flourish on the canal system. In Paper two, the rational choice framework typically applied in CPR theory to development problems (Forsyth and Johnson, 2014) gives way to a more evolutionary framework. A historical evolution of rules in the Tansa-Vaitarna water district provide a useful context and background to the failure of local collective action in solving the water problem. Given cultural and legal variations in the nature of water institutions and geographical context in Thane district, this dissertation thus tries to develop an *institutional-geographical* framework for researching the problems of water distribution and management in Mumbai-Thane region.

Due to the emphasis in political ecology on developing a critical focus upon neo-liberal policies in the water sector, it is often forgotten that the water sector is still a state monopoly in countries like India. And that corrupt practices and lack of access to water can flourish under the aegis of the public sector too. This dissertation is thus informed by Karen Bakker's advocacy within human geography of applying an ethical lens on urban and regional water governance in the developing world (Bakker, 2010). A common thread between all three papers is an ethical perspective that draws our attention to the relationships that exist between geographical place, social relations and water institutions.

The three papers in the dissertation share a focus on the actual experiences of communities with water scarcity in the water districts outside Mumbai. They also jointly contribute to developing an institutional and spatial understanding of the geographical relationship of a significant and growing metropolitan city-region like Mumbai to a socio-economically poor, agricultural hinterland in Thane district.

6.4 Policy Implications

Through its focus on developing a combined institutional and political-ecological understanding of water transfers, this dissertation also seeks to contribute to the policy literature on water in the Mumbai-Thane region and in the State of Maharashtra. All three papers contribute to the contemporary debate around water policy in the Konkan region and in the State of Maharashtra as a whole. The academic nature of the inquiry in this dissertation does not preclude such a focus on policy. The existing research literature on water in the city of Greater Mumbai and the surrounding region, including in human geography, does not engage with the policy dimensions of the problem (see Gandy, 2008). Alternatively, those who have done field research in Greater Mumbai on urban water problems have not paid sufficient attention to water policy and have neglected crucial legal-institutional aspects of the urban and regional dimensions of the water question (Anand, 2011). A synthesis of fieldwork, historical research and analysis of State Government policy around rural-urban water transfers has allowed me to throw light on the policy dimensions of the water question in the Mumbai-Thane region. It has also helped me to avoid the pitfalls that might have

resulted from an exclusive reliance on a political-ecological analysis of the regional water question.

The chief policy contribution of this dissertation lies in the analysis of the legal-institutional framework of water transfers, and the conflict between urban and rural water entitlements, as presented in Paper Two. Greater Mumbai's water rights in the MMR are critically scrutinized, and this is the first time that the role of *prior appropriation* has been highlighted in the water literature on Mumbai and urban India. The legal underpinnings of Greater Mumbai's claims to the water were unearthed by an analysis of water by-laws and legal frameworks at various scales (urban, rural, and regional), as well as analysis of historical material that provided details about the 1950s decision to reserve an entire watershed for the purposes of the city (Modak, 1948). The policy implications of such institutional rules for sustainability and environmental justice are then made evident through the case study. This contribution also adds to the already voluminous case study literature on water law in the Indian context. It also fills a major gap in the urban water research on Mumbai and contrasts with the mainly cultural and ethnographic orientation in the literature (Gandy, 2008; Anand, 2011).

A further policy contribution is made in Paper Three, where causes behind the underutilization of water for irrigation are researched at the level of the canal minors. There, the disinterest of engineers in maintaining the canal system points to the political dynamics of water contestation, and to their own complicity with rich farmers in constructing an official discourse of underutilization. The water rights of the city and the countryside are further outlined and highlighted in the paper, even as the regional

water governance structures that inform rural-urban water transfers are examined through an analysis of government and planning reports, as well as of High Court affidavits contesting water transfers. The administrative nature of water transfers meant that close attention was paid to the Irrigation Department as a main actor in the water politics of the region. Researchers have been unwilling to bring state actors in India who manage water under critical scrutiny. However, the wide coverage by local media in Thane district of corrupt practices within the Irrigation Department, and the various encounters this researcher had with the near breakdown of relations between senior level engineers and their junior counterparts, point to a serious dysfunction in the water bureaucracy in the region and the State of Maharashtra.

In Paper One, the sensitive nature of my research on water governance precludes me from identifying the main political actors in the corruption nexus, but it is clear that closer attention should be paid to the welfare of poor agricultural communities in the tribal areas especially in the context of a modern irrigation project that has been implemented to further their economic well-being. If more attention were paid to developing better governance frameworks that ensure the accountability of public officials, and furthermore, if more efficiency in water use were to be ensured at the rural and urban levels, an outcome like the dispossession of the tribal community of its access to water is not necessarily inevitable.

This research has demonstrated and also validated a long tradition in the political ecology literature which argues that water scarcity and shortages are socially and politically produced, and that solutions lie in social, political and ethical domains,

rather than the purely technological. The findings of this dissertation tell us that the water governance picture in the Mumbai-Thane region can be transformed only by a fundamental reform of water practices, local laws and policies inherited from the past. The present exclusive reliance on increasing water supply through new dam projects will not serve the needs of the varied sectoral demands within this region, especially in the context of very fast paced spatial transformation. Regulating water in a manner that balances sectoral (urban, industrial, agricultural, rural) interests is not impossible, if policy makers realize that successful collective action around water would necessitate the creation of water districts and decentralizing water management to democratically elected water district councils. An example of such co-operation around joint rural and urban water provision already exists in a formal governance setup within the MMR. For instance, a good example of such co-operation is the creation of the Shahad Temghar Water Authority by cities of the MMR (such as Thane, Mira-Bhayandar and Bhiwandi), who have partnered with villages in Thane District to set up their own water services system (Sivaramakrishnan, 2014, p. 68; Rao, 2015, p. 166).

Further experiments to create such independent water authorities encompassing urban and rural water users should be extended outside the boundaries of the MMR in Thane District. This is vital given that rural populations living outside the metropolitan boundaries of Mumbai (but inside the hydrometric area) do not have adequate legal leverage to have their basic water entitlements met under existing local water laws. Consequently, a reform of such laws (i.e. the Maharashtra Irrigation Act of 1976, and the Bombay Municipal Corporation Act of 1988) also acquires significance. The latter,

while exclusively protecting Greater Mumbai's water demand and senior water appropriation rights, is a great obstacle to potential water governance reform at the regional level. The riparian underpinnings of the Maharashtra Irrigation Act (Government of Maharashtra, 1976) serve to exclude landless populations from access to water. Legal reform thus has to go hand in hand with reform of water policy at the regional level in Mumbai-Thane region.

6.5 Recommendations for Future Research

This dissertation raises a number of questions that warrant further research. The difficulty of researching water governance in India has been highlighted in other places of this chapter and in other parts of the dissertation. The non-transparent nature of how the Irrigation Department functions; the lack of communication between various Government entities that manage water; and the absence of an umbrella organization with regional water data on Mumbai were particularly challenging. This research project helped me to better understand such informational gaps and also prepared me to continue with an urban component of this research in the near future. Secondly, this research highlights the theoretical limitations of political ecology as a framework for examining water problems. The absence of attention to policy within South Asian political ecology led me towards institutionalism in order to examine regional water governance in the Mumbai-Thane region. I plan to engage more closely with the broad corpus of work in institutionalism and the common pool resource literatures to research the regional water question in the Mumbai-Thane region.

This dissertation could not examine the political-economic structures that underlie uneven agricultural development in the Dahanu area. However, in the near future I will be analyzing census data from the past two decades in order to examine migration patterns of the tribal community related to water scarcity, as well as the creation of exclusive water districts for Mumbai. Furthermore, I was not yet able to utilize archival sources of Maharashtra State Government; Mumbai Municipal Corporation; or the World Bank, regarding the development of the water supply system for Greater Mumbai and other towns in the MMR. Thus, I plan to conduct the following thematic research in future:

- Develop an understanding of the historical context of urban water supply and hydroelectric dam projects outside Mumbai, from 1892 to 1990;
- Investigate and classify various litigation concerning water and land in the Tansa-Vaitarna water district and the Surya Command Area, in order to better understand legal- institutional frameworks;
- Analyze the role of the World Bank in funding and developing multipurpose dam systems, canal systems, and long distance aqueducts (from the 1960s through the 1980s), that extend into northern Thane District from the City of Mumbai;
- Comparatively study water governance practices of other large Indian metropolitan regions, such as Delhi, Chennai, Kolkata, Bangalore and Hyderabad against those of Mumbai.

6.6 Conclusion

Through closer empirical work on institutions and the rules that inform water policy, as well as further field research on users' experiences with water scarcity on the canal system in the water districts, this dissertation renders a critical but nuanced picture of the nature and impact of water transfers upon rural communities within the Mumbai-Thane region. Using an interdisciplinary analysis of the experiences of such small-scale, marginal, tribal farmers, this dissertation also narrates a story about the continued dispossession of India's tribal communities from their access to resources. It is quite clear that tribal farmers on the canal system in Dahanu lose out in their access to water due to the brazen nature of the nexus between engineers and upper-caste, Vadaval commercial farmers. While this dissertation originally set out to investigate the role of formal water institutions, my findings also highlight the importance of both formal governance mechanisms and informal politics that revolve around such water transfers. Economic growth and development mean higher water demand and, consequently, more dam building in areas such as the Mumbai-Thane region (Joy et al., 2008). Thus, growing water demands of both the urban and rural sectors of the Indian economy mean that challenges of governance in the water sector will remain important in future.

A singular focus on class and social differentiation in this dissertation could not by itself have revealed the working of the internal structures and institutions that play a role in the underutilization of water in the Surya Multipurpose Irrigation Project. That is also true of my analysis of the Tansa-Vaitarna water district, where prevailing institutions are also identified as important factors enabling Greater Mumbai to

exclusively access the watershed at the expense of rural communities. With an equal emphasis on the functioning of formal and informal institutions and other place-related factors such as caste and class, this dissertation thus makes an important interdisciplinary contribution to understanding the causes behind underutilization of water from Surya Project. The theoretical literature within institutional economics (Hodgson, 2006), as well as empirical and theoretical research within human geography and development studies, have identified caste and its metamorphoses as a modern, social and economic institution (Harriss White, 2003; Chari, 2004; Gidwani, 2000 & 2008). The rise of the Vadaval caste-cluster, along with social change on the canal system in the agricultural belt of Dahanu and northern fringes of Mumbai Metropolitan Region, also confirm empirical research that points to the role of rising caste groups as vanguards of capital accumulation in urban and rural India. Thus, water conflict between small-scale farmers of the tribal community, Vadaval commercial farmers, and urban Mumbai is situated in its proper institutional and social-geographical context.

The empirical findings of this dissertation also present a qualification on the urban political ecology literature, which tends to rely on a more structural critique of the state, of markets and of the modern water technology that enable cities to expand their water frontiers. The commodification of water resulting from urbanization and commercial agriculture is also an implicit part of the transformation of the water landscape of Mumbai-Thane region. Mumbai's growing access to water from Thane District is not merely predicated on its political power and economic clout. It is also based on historic decisions taken in the 1950s that entailed reserving entire water

districts for the eventual use of Mumbai, as well as the creation of the Mumbai Hydrometric Area in the early 1970s. Moreover, the decision to implement canal technology in Thane District in the 1970s, along with the social, ecological and economic consequences of those technological choices, constitute an important part of the empirical puzzle about water management in this region.

This focus of this dissertation on the geographical relationship of fast growing metro Mumbai and MMR to its rural hinterland in Thane District has hopefully demonstrated the value of more such studies on urban-regional water governance and urban-rural contestation over water, in the context of rapidly urbanizing regions of India and other parts of Asia. As contestation around water resources emerge with simultaneous ecological and political challenges in a number of urban-regional locations around the world, this dissertation makes a contribution to the theory and empirics of that particular problem. By applying a historical and institutional lens to the resource dilemmas faced by thousands of agriculturists in the Mumbai-Thane region, and placing some of the analysis in a framework that embraces a kind of theoretical and methodological pluralism, I have also affirmed my faith in the theoretical and methodological pragmatism that Elinor Ostrom and other institutional scholars have advocated in their research. I believe that by drawing from disparate streams of analysis - in disciplines such as environmental politics and political ecology - an interdisciplinary methodology in scholarly and applied research will continue to give us new answers regarding questions about the commons, such as we have just examined in the Mumbai-Thane context.

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Appendices

Questionnaire

CAD Project Name _____

Command

Project Command (1); Outside Command (2)

Canal System –

Sub Minor 2/DM 1(1); Sub minor 2/ DM 2(2)

Distributory/Minor Canal Reaches -

Upper (1); Middle (2); Tail (3)

Respondent Marginal Small Medium Large

Category (up to 1Ha) (1-2) (2-4) (above 4)

Code (1) (2) (3) (4)

1. IDENTIFICATION

1.1 Distt. _____

1.4 Head of Household name _____

1.2 Block _____

1.5 Caste SC/ST/BC/UP _____

1.3 Village _____

2. SOCIO-ECONOMIC CHARACTERISTICS

<u>2.0 Socio-economic Characteristics</u>	Illiterate	Literate	Primary	Secondary & above
2.1 Male Adult (Nos)				
Between(14-18)				
Above 18				
2.2 Female Adult (Nos)				
Between (14-18)				
Above 18				
2.3 Children (below 14 yrs Nos)				
Male				
Female				

<u>2.4 Main occupation of Adults of household</u>	<u>No. of Adults</u>		Total
	<u>Male</u>	<u>Female</u>	
1. Mainly Cultivation			
2. Farm. Wage laborer			
a)Farm servant			
b)Non-Farm wage laborer			
3. Type of Job			
a)Urban salaried services			
b)Rural salaried services			
4. Self Employed/Artisan			
5. Non-worker			
Total			

Reason of being non-worker: e.g. age, disability, disease, etc

Type of Job

a) Urban salaried services: _____

b) Rural salaried services : _____

2.5 Family		Employment during the year 2007-2008			
Sr. No	Male Female	No. of months worked			Unemployed
		Own farm	Outside		
			Farm	Non farm	
1.					
2.					
3.					
4.					
5.					

3. LAND INVENTORY

3.1 Owned Total _____ (a+b)

(a) Cultivated _____

(b) Uncultivated (Varkas) _____

3.2 Leased in (+) _____

3.3 Leased out (-) _____

Details of lease terms; duration, cost, output share, labour tying inter linkages

3.4 Net area cultivated _____

3.5 Net area irrigated _____ (a+b+c)

(a) By Canal _____ ha

(b) Well/tube well _____ ha

(c) Nalla

(d) Others _____ ha

3.6 Annual cost incurred towards water charges last year

3.7 Area unirrigated (ha) _____

3.8 Reasons for non irrigation _____

(a) Unleveled land or elevated

(b) Absence of field channels/ Choked outlets

(c) Scarcity of water

(d) Cattle problem

(e) other reason specify

4. ON FARM DEVELOPMENT WORKS

4.1 Whether field channels exist for fields

Yes (1); No (2)

4.2 Whether these channels are well maintained

Yes (1); No (2)

4.3 Who maintains these channels?

Govt (1); Irrigation (2); Panchayat (3); Farmers (4)

4.4 Do you get water in time?

Yes (1); No (2)

4.7 Whether you are told about the availability of irrigation
 Water in advance
 Yes (1); No(2)

4.8 How do you get advance information of canal water?
 Availability
 Notice board (1); Slips (2); Verbal (3); Newspaper (4)

4.9 Reasons for dissatisfaction with CAD/ Surya project works/any suggestion for correction in present activities _____

4.10 Farmers assessment about status of different CAD/ Surya project activities

Activities	Whether implemented on your farm Yes/No	Which of the following activities you consider useful (tick all that apply)	Activities you still require (tick all that apply)
1.Construction of channels			
2. Maintenance of channels			
3. Fields drains			
4.Land leveling			
5.Warabandi			
6.Lining of channels			
7.Land consolidation			
8.other Specific			

5. CROPS GROWN/ CROP PRODUCTION

Season/Crop variety NYV or Local	Irrigated			Rainfed			Total quantity of produce sold (qty)	
	Area in ha	Main qtl	By product qtl	Area in ha	Main qtl	By product qtl	Main product	By product
Kharif								
Rabi								
Summer								

Convert all the figures in qtls & acres

Main produce -- rice, vegetables

By product -- grass etc

6. CROP PRODUCTION INPUTS AND COST OF CULTIVATION PER ACRE

Season & crop	Type IR* or UIR*	Seed Kg	Human Labor days*	Bullock pair days	Tractor hrs	Thresher hrs	Org Fer Kg	Fertilizers in kg					Cost of pesticides	Irrigation charges
								1	2	3	4	5		
Kharif														
Rabi														
Summer														

*All the information to be converted into per hectare basis.

*labor required for all the agricultural operation of the crop, such as land preparation sowing, manure/fertilizer application, inter culture, harvesting, threshing will be taken into account including family, hired and contract labor. Use open-ended questions in interview guide

* IR – Irrigated UIR—Unirrigated

* Fertilizer –Give quantities of fertilizer applied in kg. urea in column 1, Dap in column 2, Murate of potash in column 3, Ammonium sulphate in Column 4 Super Phosphate in column 5.

*Type of seed: HYV or local

7.1 DURABLE HOUSEHOLD ASSETS

Name	Number	Present value (Rs.)
(a) Bicycle		
(b) Motor cycle		
(c) Radio/Tape/VCR		
(d) Watch/Clock		
(e) Sewing Machines		
(f) Others specify		
Sub Total		

7.2 TYPE OF HOUSE

Type of house	Area	Value
Kuccha		
Pucca		
Mixed		

7.3 AGRICULTURAL ASSESTS

Sr. No	Name of assets	No.	Value (Rs)	Sr. No	Name of assets	No.	Value(Rs)
1	Cows			9	Tractor		
2	Buffalo			10	Seed drill		
3	He-Buffalo			11	Thresher		
4	Goats			12	Sprayer/Duster		
5	Sheep			13	Chaff cutter		
6	Pig			14	Diesel pump/ pump set		
7	Poultry			15	Electric pump		
8	Others specify			16	Bullocks		
				17	Improved bullocks drawn implement		

8. CREDIT/LOAN TAKEN

8.1 Loan outstanding at the beginning of this year (in January 2007) Rs. _____

8.2 Loan taken during 2007-08

Purpose for which taken	Amount Borrowed Rs	Source of loan. Whether employer/ money lender/bank	Rate of Interest
1. Agriculture			
(a) Crop loan/input			
(b) Purchase of Machine/Tractor			
(c) Capital improvements (construction of well, diesel motor, PVC pipe, land leveling)			
(d) Livestock purchase			
2. Consumption Loan			
(a) Marriage			
(b) Religious functions			
Total			

What if we receive water for 12 months will u still go out to work? _____

What will u produce through the year? _____

Interview Guide: Questions for Semi-Structured Interviews

The Location of Study: Charoti village, Dahanu Block, Thane District, Maharashtra

Questions for this village are as follows:

1. How much land do you own (if any)? Does your land lie within the revenue boundaries of Charoti village? Did you inherit, purchase, or acquire the land by other means? How much of this land do you cultivate yourself? How much land do you rent out? To whom do you rent it and on what basis? Do you rent in any land in addition to the land you own? From whom and on what basis?

If you are not a landowner, do you rent land? How much land do you rent? Does this land lie within the revenue boundaries of Charoti village? From whom do you rent the land and on what basis? Are the owners resident in the village?

2. What is the land distribution in the village like? Is there is a preponderance of small and marginal farmers (1-2 hectares? Or does the village have several farmers with medium and large land holdings (five hectares and more)?

3. Is your main occupation agriculture? What crops do you cultivate? Does your production from agriculture meet the immediate needs of your family? Do you sell any agricultural produce? Where? Is agriculture carried out on your farm in both the monsoon and the *Konkan hangam* (post monsoon) season?

4. How do you meet your needs for agricultural inputs e.g. credit, fertilizers, pesticides and water?

5. Do you employ labour to help in your farm activities? Do you employ labour during the peak agricultural season (July-November)? How many labourers? Do you employ labour at other times of the year? What are the main areas from where the labour utilized on your farm is drawn?
6. Do you or members of your family ever work as agricultural labourers on other people's fields in this village? Do you or other members of your household have to engage in non-farm work to take care of the needs of the family or enhance household income? Is the non-farm work within this village or outside the area?
7. If you or members of your household migrate for work, do you look for work in coastal Dahanu or in Mumbai city? How many months in a year do you (or they) spend outside your village, either working or looking for work? What are the kinds of labour contract in these areas? Is the work predominantly in agriculture or is it non-farm work? Do you (or they) get paid daily? What are the work conditions like?
8. How many (or what proportion) of the villagers from Charoti work in Vangaon or other agricultural areas in the coastal belt? How many work in Mumbai (or other urban areas)?
9. What are your impressions of the role of water in your daily life? What importance does it have in the agricultural practices you follow?
10. Is there any access to groundwater in this village (e.g. tubewell) irrigation in this village?

11. How do you perceive the Surya dam project? Has it brought any changes to the well-being of farmers in your village? Has it brought any improvement to your own farming situation? If it has, in what ways? If it has not, then why not?

12. What do you have to say about the functioning of the Mahalakshmi irrigation water society in the village? Have you been involved in the society, and in what capacity?

13. What are your views on the maintenance of the canal system by dam/project authorities? Are the canals maintained well and is the delivery of water on schedule?

14. How do you cope with the unavailability of irrigation water? How do you see the larger farmers in the village coping with the unavailability of irrigation water? How do the small and marginal farmers cope, especially those without any access to irrigation water at all?

15. What are your opinions about water from the Surya project being distributed to Mumbai city and non-tribal areas in Dahanu and Palghar (such as Vangaon and Saphale)? Are you aware of this happening already? If it were to happen, what would be your reaction?

16. Are land transactions in the village and other parts of the Surya command area increasing? Do you have any concerns about this? How are these land transactions affecting your overall welfare and the well being of the tribal community in the village?

17. What have the political representatives of the tribal community done if anything to ensure better utilization of water from the Surya project? What have they done? Has any other organization been active in trying to improve access to irrigation water in the village?

18. To whom does the water of the Surya project belong in your opinion? The city of Mumbai, farmers from western Dahanu or the tribal farmers from the interior?

Location of study: Vangaon Dahanu taluka, Thane district

1. How much land do you own (if any)? Does your land lie within the revenue boundaries of Vangaon? Did you inherit, purchase, or acquire the land by other means? How much of this land do you cultivate yourself? How much land do you rent out? To whom do you rent it and on what basis? Do you rent in any land in addition to the land you own? From whom and on what basis?

If you are not a landowner, do you rent land? How much land do you rent? Does this land lie within the revenue boundaries of Vangaon village? From whom do you rent the land and on what basis? Are the owners resident in the village?

2. What is the land distribution in the village like? Is there is a preponderance of small and marginal farmers (1-2 hectares), or does the village have several farmers with medium and large land holdings (five hectares and more)?

3. Is your main occupation agriculture? What crops do you cultivate? Does your production from agriculture meet the immediate needs of your family? Do you sell any agricultural produce? Where? Is agriculture carried out on your farm in both the monsoon and the *Konkan hangam* (post monsoon) season?

4. How do you meet your needs for agricultural inputs e.g. credit, fertilizers, pesticides and water?

5. Do you employ labour to help in your farm activities? Do you employ labour during the peak agricultural season (July-November?) How many labourers? Do you employ

labour at other times of the year? What are the main areas from where the labour utilized on your farm is drawn?

6. Do you or members of your family ever work as agricultural labourers on other people's fields in this village? Do you or other members of your household have to engage in non-farm work to take care of the needs of the family or enhance household income? Is the non-farm work within this village or outside the area?

7. If you or members of your household migrate for work, do you look for work in coastal Dahanu or in Mumbai city? How many months in a year do you (or they spend outside your village, either working or looking for work)? What are the kinds of labour contract in these areas? Is the work predominantly in agriculture or is it non-farm work? Do you(or they) get paid daily? What are the work conditions like?

8. How many (or what proportion) of the villagers from Vangaon work outside the village in other agricultural areas in the coastal belt? How many work in Mumbai (or other urban areas)?

9. Do you have any business contacts in urban areas, especially with respect to marketing of produce in Mumbai and Gujarat states? Does the location of the village on the railway line benefit your farm?

10. What are your impressions of the role of water in your daily life? What importance does it have in the agricultural practices you follow?

11. Do you have access to irrigation water? From what source? How do you cope with the unavailability of irrigation water? How do you see the larger farmers in the village

coping with the unavailability of irrigation water? How do the small and marginal farmers cope, especially those without any access to irrigation water at all?

12. What percentage of the village's farmers access groundwater for irrigation? What are the other sources of irrigation? (E.g. small projects such as Minor tanks which are maintained by the Zilla parishad District Council of Thane)?

13. How was the groundwater situation ten years back? Has there been serious depletion of aquifers? Has there been any salinization or any other decline in the quality of the groundwater? Has the Surya irrigation project improved the ground water levels on your farm or in other parts of the village?

14. What is your opinion on the contention of the Surya command project authorities that farmers in Vangaon village should pay water charges for the improved groundwater levels, as some aquifers in the village have been recharged by the canals which bypass the village?

15. Should the canal system be extended to Vangaon and western parts of Dahanu? Would you like to have the water from the Surya dam for your farm? If yes, why? If not, why not? Would the benefits of irrigation lower the land ceiling in the area and lead to redistribution of land? What would be the consequences?

16. What are your opinions about water from the Surya project being distributed to Mumbai city? Are you aware of this happening already? If it were to happen, what would be your reaction?

17. Are land transactions in this village increasing? Do you have any concerns about this? How are these land transactions affecting your family's welfare and the well being of the village overall?
18. Have the political representatives of Vangaon done anything to gain access to water from the Surya project? What have they done? Has any other organization been active in trying to access Surya water from Vangaon?
19. To whom does the Surya water belong in your opinion? The city of Mumbai, farmers from western Dahanu, or the tribal farmers from the interior?
20. Is the grass trade still active in the area (last reported in 1984 and 1998)? How important is that to Vangaon's economy?

Semi-structured Interviews with the Chief Engineers and Section Engineers.

1. What area of land was the Surya project designed to irrigate? Was there an over projection in the initial area of agricultural land to be irrigated by the Surya project? If so, why was this the case?
2. How are farmers in the tribal beneficiary villages such as Charoti benefiting from the project? What are visible indicators of improvement in welfare in these communities?
3. Is there underutilization of water from the Surya project? Does the fragmented nature of land holdings in the Surya command area affect the viability of tribal farms and their ability to use canal water? What other factors affect the ability of tribal farmers to utilize water from the project?

4. Why is the Mahalakshmi water society in Charoti not functioning? What steps have the Irrigation Department taken to improve the functioning of such farmer's organizations/committees to ensure better utilization of the water?
5. Does Vangaon come in the command area of the Surya project? If yes, what are the steps the Irrigation Department is taking to make the farmers of Vangaon pay irrigation charges for the water? If no, does Vangaon benefit in other ways from the project?
6. Under what rationale (legal and commercial) has the Surya project been supplying water to the western parts of Dahanu and to Saphale village in Palghar? Are commercial reasons a paramount consideration as in the case of supply of water to the Mumbai metropolitan region?

Is work on the project complete? If not, how long will it take to complete work on the canals and convey the water to the beneficiaries? Which interests (or certain communities) are blocking the completion of the Surya project? One view is that the farmers of Vangaon and western Dahanu have used their political clout to block the completion of the project so as to benefit themselves of water? Do you believe this to be the case?
7. How is the growing influence of urbanization and pressure on land impacting the functioning of the Surya irrigation project?
8. Has there been an increase in land transactions, land leasing activity and distress selling of land in the command area?
9. How would improved access to water halt or reverse downward socio-economic mobility in the command area and its vicinity?

10. In addition to irrigation water, what are the other inputs needed to improve agricultural development indicators in the Surya command area communities?
11. How would you outline the various phases of water resources development in this part of Thane over the past few decades? How have water resource development practices evolved over time? Do you think the Surya project was some sort of a “watershed” in Thane?

Ethics Clearance



Office of Research Ethics

The University of Western Ontario
 Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
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Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. J.W. Baxter

Review Number: 12223S

Review Date: December 18, 2007

Revision Number: 1

Review Level: Expedited

Protocol Title: The Politics of Uneven Development: Water and the Urban and Agrarian Questions In the Mumbai Metropolitan Region, India

Department and Institution: Geography, University of Western Ontario

Sponsor: INTERNAL RESEARCH FUND-UWO

Ethics Approval Date: December 18, 2007

Expiry Date: June 30, 2008

Documents Reviewed and Approved: Revised study instruments, study end date and number of participants. Interview Guide.

Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the study or consent form may be initiated without prior written approval from the NMREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the NMREB:

- changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
- all adverse and unexpected experiences or events that are both serious and unexpected;
- new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the NMREB.

Chair of NMREB: Dr. Jerry Paquette

Ethics Officer to Contact for Further Information

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This is an official document. Please retain the original in your files.

cc: ORE File

7 Curriculum Vitae

Name:

Bharat K. Punjabi

Post-Secondary Education and Degree:

University of Mumbai
Mumbai, Maharashtra, India
1991-1995, B. A.
University of Mumbai

Mumbai, Maharashtra, India
1995-1997, M. A. (Part I) (Economics)

Tata institute of Social Sciences
1998-2000, M. A., Social Work

York University
2002-2005, M. A., Social Anthropology

Related Work Experience:

Teaching Assistant
Western University
2005-2009

Lecturer
Western University
2010-2012

Lecturer
Huron University College
2012-2014

Post- Doctoral Fellow
Munk School of Global Affairs
University of Toronto
2014- Present