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South Asia's Water Resource Systems at the Crossroads

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South Asia, comprising Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, is one of the most densely populated regions of the world. Over 1.5 billion people reside in the region. The South Asian economies still largely depend on agricultural production, though urbanization and industrialisation are on the rise. Water is fundamental to economic growth, poverty reduction and public health in the South Asian economies. Almost half of the population in the region suffers from poor access to clean drinking water and inadequate sanitation facilities. It is estimated that South Asia's renewable freshwater resources are about 1,200 cubic meters per capita. Withdrawals of freshwater are very high, and rapid increase in the use of water in agriculture, industries and urban townships is causing acute water shortage and water pollution across the region. South Asia has witnessed rapid urbanisation in the past decades and the growth of the urban population has led to an increased pressure on basic amenities, particularly those related to water, such as drinking water and sanitation. Increasing contamination and lack of proper sewage and effluent treatment further accentuate the shortage of clean water supply. This has led to deterioration of quality of life particularly for urban and rural poor.

The problem is further compounded by the degradation and deterioration of natural resources like forest, land, biodiversity and water bodies. The Remote Sensing Department of the China's Aero Geophysical Survey, warns that "*the Himalayan glaciers could be reduced by nearly a third by 2050 and up to half by 2090 at the current rate of melting. The glacial melt would further deplete Tibet's water resources, which are the lifeline for the people of southern and southeastern Asia and China*"[1] Thus the water crisis is not only aggravated by climate change but also compounded by manmade environmental degradation in the form of shrinking forests and swamps that foster a cycle of chronic flooding and drought resulting from the depletion of nature's water and absorption cover.

Since the poor depend more critically on the activities based on natural resources, and market and public institutions generally by-pass the poor, they become the victims of environmental degradation. The irony of the current system of agricultural practices is that though being one of the most important strategies for poverty reduction, it is inadvertently contributing significantly to the degradation of environment, particularly to the water bodies of the region.

[1] As reported in an editorial of *The Manila Times* internet edition on 25 September 2008, *http://www.manilatimes.net/national/2008/sep/25/yehey/opinion/20080925opi1.html* (accessed on 15 January 2009)_

The investment in canal irrigation, tube-wells, both public and private, contributed substantially to food production and productivity increase. However, the adverse effects of long-term canal irrigation are now surfacing in the form of water logging, salinity and alkalinity besides financial losses. This brings to the fore the issue of sustainable growth and development and the question of 'who gains and who loses' from the current practices. The current literature is replete with examples confirming the fact that it is the select few who benefit to the exclusion of a large majority; the cost is shared and commonised, whereas, benefits are privatized by the powerful few. South Asia's water problem is no exception to this general observation. It is in this context that the issue of South Asia's water resources is at the crossroads. Water is essential for survival, economic development, maintenance, and conservation of the environment, but it is becoming scarcer in the region and remaining a mute spectator to the present system of water management will only lead to catastrophe. If this catastrophe and crisis is to be averted, we need to change radically the way water resources are being used and managed in the region.

There has been considerable improvement in our thinking and the discourses about water resources management in the region. The discourse begins from the questioning of supply side management to a search for a new paradigm based on everyday realities within which people live and sustain their livelihood. When requirement exceeds supply of the available water, it is often found that the existing supply is diverted to already well off people and in the struggle for capture and control over scarce water, the poor and marginal section of our society are further cornered. Thus bringing more of the finite quantum of water available in nature into the usable category through supply side management, large projects and bureaucratic responses and engineering solutions have been questioned on grounds of effectiveness and equity and sustainability of water bodies.

Another solution to mitigate an impending water crisis is to develop property rights and allow trading of water (rights), and build public-private partnerships in developing water infrastructure. It is argued that if market forces are allowed to work freely and the state changes its role from provider to the facilitator and regulator of the resources, water prices will be right, conflict will be resolved and supply will match the demand through market mechanism. This in turn will help scarce water resources to be allocated efficiently and mitigate the water crisis. Both these paradigms have been challenged by NGOs and social activists, civil rights groups and others. The responses of NGOs and social activists have been critical in identifying alternative technical and institutional solutions. But the capacity of NGOs is limited both in terms of their number and scale of operation.

In more recent times, NGOs and their agenda are being adopted in the mainstream policy agenda, for example, involvement of community in water resources management and project implementing agency, without any substantial progress in space for community involvement. Thus, water resources management in South Asian economies is facing challenges that cannot be addressed in the current policy and analytic framework. For example, if the experience of participatory irrigation is any indication, water bureaucracies in South Asian countries remain firmly in control of the decision making process as well as the water resources. The water services department is not accountable to water users or to their organisations and these departments by and large determine the nature and extent of the people's participation.

SAWAS is conceived as an interdisciplinary journal to address these twin concerns, of the acute problem and crisis encountered in water sector on one hand and the inertia within the water bureaucracy on the other, aspiring to provide space for alternative and critical thinking. The

journal aims to be an independent forum for discussion about water related issues that affect South Asia, issues in particular countries and regions within South Asia, and issues related to the global context in which South Asian water issues are situated. SAWAS aims to share knowledge of successful resolutions of water related problems as well as constructive analyses of deadlocks and failures, and promote an intellectual debate on South Asian water. SAWAS welcomes contributions that discuss any dimension of water resources development; technology, management and use, and their relations with society and the environment.

The aim of the journal will not only be to generate 'knowledge for understanding' but also 'knowledge for doing' particularly in the domain of policy and politics. The team of SAWAS shares the view that water problems have often been framed in very narrow and highly disciplinary ways, despite the apparent emphasis on integrated management. It also reckons that the political dimension of water resource development and management at all levels – local, regional, national and global has been underplayed.

It is with these objectives that the journal has been launched and we invite contributions from research scholars, academicians, practitioners and water bureaucrats for not only enhancing our understanding about what needs to be done, but also on how to reorient policies and strategies to mitigate the water crisis in South Asia. The first issue of the first volume is now in the public domain. It has five papers, two book reviews and a short article reported under perspectives. They together cover varied issues such as water rights, problems associated with valuation of water resources and projects, conflicts and the political economy of water resource access, control and management. These articles reflect the complex nature of problems confronted in water resources management in South Asia. The articles also suggest that a blue print approach is unlikely to mitigate the water crisis in South Asia. We invite comments and contributions from the readers to further expand our knowledge horizon of water resources in South Asia.

Water Rights in Farmer Managed Irrigation Systems in India: Equity, Rule Making, Hydraulic Property and the Ecology

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Abstract

Water rights in farmer managed irrigation systems in India have been studied in different ways, using different concepts and approaches, relating to the different purposes of the studies. The four ways in which water rights have been understood are: 1) as a right to water, focusing on the equity and social justice aspects of water rights; 2) as rules, constituting the 'mechanics' of irrigation management; 3) as 'hydraulic property, that is, materialisation, emphasising the technological dimension of water rights; and 4) in their ecological aspect, by showing that ecological relations are inherent to the definition of land and water rights. The first two readings are typical social science readings, fully focused on the behavioural and institutional dimension of property rights. The third and fourth reading provide a socio-technical and a socio-ecological perspective on rights by specifying their material dimensions. The presentation of these four perspectives constitutes an argument for adopting a multidimensional, interdisciplinary understanding of the concept of water rights.

Keywords

Water rights, farmer managed irrigation, India, equity, rules, hydraulic property

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Introduction

The category 'farmer managed irrigation system' (FMIS) in this paper refers to those irrigation systems of which the management, and to a considerable degree mostly also the governance, is in the hands of the users of those systems. The category refers to relatively small surface irrigation systems, supplied by small reservoirs (called tanks in South India), river diversions, and sometimes pumping-stations lifting water from rivers or lakes. Palanisami (2000:11-13) reports that the three South India States of Tamil Nadu, Karnataka and Andhra Pradesh have about 150,000 tanks.[1] The area irrigated by tanks is a significant, though declining part of total irrigated area. Palanisami (ibid.:17) reports that at all-India level the share of tanks in total irrigation has declined from 18.5% in 1960-61 to 6.8% in 1990-91. Apart from their physical and economic importance, FMIS have been given great developmental importance, as being the potential harbingers of local self-governance and grassroots, bottom-up human development processes.[2] FMIS stand in contrast to government managed irrigation systems, in India meaning canal irrigation systems particularly, in which governance and management are largely in the hands of government agencies (notably irrigation departments). Excluded from the FMIS term are, for the purposes of this paper, private (individual) and collective groundwater-based lift irrigation schemes. The reason for this exclusion is that they have a rather separate set of issues associated with them as regards water rights (Saleth, 1996; Shah, 2008).

Though the term FMIS denotes a reasonably clear type of irrigation systems, all words that compose the notion of farmer managed irrigation systems can be questioned. Even when a system of water infrastructure has irrigation of crops as its main purpose, users of the system are not only farmers. The multipurpose nature of the South Indian tanks is well known and documented for instance (Ludden, 1978, 1985); Palanisami, 2000:119-125). In addition, within the activity of crop irrigation, there are other interested parties than farmers, agricultural labourers for instance, while farmers are differentiated as a category along several lines. Management is not an unproblematic term, particular if understood in relation to governance. User governed/managed irrigations systems have complex and changing relations with the state (cf. Mosse 2003). Whether 'corporate organisations' manage the systems in a 'robust' manner, or a 'syndrome of anarchy' or 'chaotic management' prevails is an open question. Lastly, the notion of system needs to be taken with care. For instance, when the water bodies of tanks are understood in relation to their catchment area, and in their groundwater recharge functions, boundaries of the 'system', as well as who counts as a 'user' become a complex question, particularly because functions (and users) change over time. Furthermore, FMIS can be a component of government managed systems, like tanks that have been incorporated in canal irrigation systems, and tube wells are appearing in the irrigated areas of tanks and other groundwater recharge structures on a large scale. The three categories discerned, FMIS, canal irrigation and groundwater irrigation are thus not always separate management units, and are hydrologically integrated at the level of watersheds or basins even when they are operated as separate management units.

These issues are not the main focus in this paper. The categorical enquiry mainly serves to sketch some of the important features of the types of irrigation systems that the category FMIS refers to

[1] Karnataka 36508; Tamil Nadu 39200; Andhra Pradesh 76663. For Andhra Pradesh government statistics show that between 1955-56 and 1986-89 the number of tanks has increased from 58518 to 76663, while irrigated area has declined from 1076992 ha to 989666. The number of tanks irrigating an area of more than 40 ha has declined from 8817 to 7743. Palanisami (2000) also discusses the methodological problems in counting tanks and tank irrigated area. These basic statistics suggest important dynamics in the function of tanks in the past decades. Also see Palanisami and Easter (2000).

[2] A comprehensive vision statement in this regard is DHAN Foundation (2004).

and that are the subject of this paper.[3] This paper discusses FMIS in terms of the question how researchers have conceived of 'water rights' in such systems. In that discussion some of these categorical complexities play a role, but they are not the subjects of discussion *per se*. The main question this paper addresses is how the concept of 'water rights' has been differentially understood in analyses of the functioning of such systems. The category of water rights plays an important role in the analysis of FMIS, in India as elsewhere, but different dimensions of it have been emphasised by different scholars. Many analyses emphasise one particular understanding of water rights, and thus tend to theoretically exclude other dimensions. This paper is a review of how water rights have been 'read' in different types of research on the functioning of Indian farmer managed irrigation systems. The review constitutes an argument for adopting a multidimensional, interdisciplinary understanding of the concept of water rights.[4]

The paper discerns four ways in which water rights in FMIS in India have been looked at: 1) in relation to the question of equity and social justice; 2) as rules governing management; 3) in their intimate relation with infrastructure; and 4) how the ecology and the landscape can be part of the conception of water rights. In the discussion of each of the four different 'readings' of water rights, I discuss one or two examples, rather than attempting a covering review and assessment of the available literature. The objective is to present a general conceptual argument, rather than an argument engaging with specific substantive findings of the literature on water rights in Indian FMIS.

1. Water rights, equity and social justice

Analysis of water rights often takes the form of arguments about the right to water. The focus on the 'right to water' derives from the existence of inequity in rights and in access to water. Water rights in such accounts are primarily related to the question of social justice.

This reading of water rights very forcefully comes through in a collection of papers published in the South Asian journal *Water Nepal* in 2003 in a special issue called 'Water, Human Rights and Governance'.[5] In the editorial article the authors write that their search is for the "basic human rights associated with water management" (Moench et al., 2003:1). Problems regarding the fulfilment of basic human rights are associated with competition over water, the cost of water, health issues related to substandard drinking water supply and sanitation, displacement of people though the building of water infrastructure, privatisation of rights, and several other factors. The question then becomes "What 'rights' should society retain when, in response to practical management needs or the pragmatic recognition of power relations in society, water rights are allocated to specific users?

[3] Furthermore, renaming the category to for instance user managed irrigation systems, peasant managed irrigation systems, local irrigation systems, traditional irrigation systems, and/or replacing 'irrigation' with 'water', 'water use', 'water control' or 'water management', yields terminology that is uncommon, awkward or unclear, while each alternative category has its own conceptual complexities. I stick to 'farmer managed irrigation systems' as it is a term commonly used in the literature. The reader is kindly requested to keep relevant caveats in mind.

[4] For those familiar with FMIS, the focus on India may be found somewhat of a random delimitation in the South Asian context, and also in the broader Asian context. There is, for instance, a very elaborate literature on FMIS in Nepal, probably richer than that on India as far as water rights are concerned (cf. Pradhan and Pradhan, 1996; Benda-Beckmann et al., 1997). Some of the important insights on water rights in FMIS have been developed in research on East Asian situations, notably Thailand, Indonesia and the Philippines. Outside the Asian context there is a lively and rich debate on water rights in FMIS in Latin America, particularly the Andean region, including a strong focus on gender relations, as there is in the African context. However, this paper is part of a broader interest of the author to explore academic and policy discourses on water resources management in India specifically – hence the delimitation., I do use some literature not referring to Indian cases also.

[5] *WaterNepal. Journal of Water Resources Development* Vol. 9/10, No. 1/2, July 2001-July 2003, 422 pp. URL: http://www.i-s-e-t.org/Water%20Nepal%20(HRG).pdf (accessed 30 January 2008)

Furthermore, if public or individual 'non-right holder' rights remain, how should they be protected and given voice?" (ibid.:2) The question of (access to) water as a human right is thus related to the question who holds water rights, and which privileges and obligations are associated with it. "Rights are meaningless unless practical mechanisms exist to ensure they are recognised." (ibid.:20) These mechanisms are the rights people hold combined with the capacity to voice and defend them. "This is an issue of governance – the processes and structures through which decision-making, implementation, and enforcement occurs in society." (ibid.:2)

In this discursive construct fundamental human rights (and basic needs) are related to specific rights of people over natural resources (notably water) and people's decision-making rights (participation in governance on a level playing field). It is probably no exaggeration to say that this basic needs and human rights perspective has dominated South Asian public debate on water (related) rights. How strong that perspective weighs on the public debate is nicely illustrated in the editorial article just quoted. The authors state "(...) participants [of the conference at which the papers in the collection were discussed, PPM] were selected to ensure that currently dominant and polarised debates over human rights and large dams did not overwhelm or dominate the meeting or its products." (ibid.:3) Though only a few of the papers in the collection discuss Indian situations, the statement on the dominance of a polarised debate around the large dams issue certainly applies to India (cf. Mollinga, 2004).

Menon (1999) is an example of a distributive justice perspective on community based natural resources management. The main target of the paper are 'common property studies', and their, in the author's view, unsatisfactory way of conceptualising (distributive) equity. Menon puts forward a 'rights based approach' that he states could do a better job in addressing distributive concerns. The paper provides an interesting overview and critique of the natural resources (community) management literature, by dividing it into three strands: 1) historical studies that counterpose the pre-colonial and the colonial situation; 2) studies discussing conditions for successful collective action; 3) studies that highlight the importance of common property resources for the livelihood strategies of rural communities (ibid.:52-53). In this review he refers several times to examples of inequity in access to water in farmer managed irrigation systems. My main concern for the present analysis is, however, Menon's conceptualisation of rights in relation to equity. He states as follows.

As Amartya Sen has argued, debates around distributive justice are as much about equality of what as they are about equality per se. For example, utilitarian theories are concerned about equality of utilities, welfare theories about equality of welfares, income theories about equality of incomes and rights theories about equality of rights." (Menon, 1999:64)

Analytically, and politically, the main focus of such a perspective on rights becomes who has the rights (ibid.:66), and subsequently who can get access to the benefit streams associated with these rights.

In the literature on Indian FMIS, explicit case study analysis of water rights and equity as outlined above is, surprisingly, rare[6] Most of the FMIS literature focuses on the institutional performance of FMIS, that is, looks at rights from a rules perspective as discussed in section 3 below. Poverty and livelihoods concerns are present in such analyses, but mostly in quite general terms of rural poverty and overall social stratification. Menon's criticism that in this literature equity and distributive justice are not conceptualised very rigorously, seems to be correct (also see Blair, 1996; Lélé, 1998). The existence of equity and distributive justice problems comes through in several publications, either in

[6] In contrast to, say, the Latin American literature on the subject. See for instance Boelens and Davila (1998) and Boelens and Hoogendam (2002). For India, the 'water rights, equity and social justice' perspective is strongly present in a recent collection of papers on water conflicts (see Prakash and Sama, 2006; Rajagopal and Jayakumar, 2006; Lele and Patil, 2006). Also see Upadhyay (2002).

more broadly cast analyses of rural transformation (see for instance Harriss, 1982; Athreya et al., 1990; Pandian, 1990) or as descriptive inventory of deprivation (see Rajagopal et al., 2002). The most explicit articulation of a rights based perspective as proposed by Menon in the context of water resources management are the dam building and watershed development related struggles in Maharashtra as described in Phadke and Patankar (2006), but that is outside the domain of FMIS as discussed in this paper.[7] Shah's (2003) analysis of tank irrigation in Karnataka, though not employing a rights vocabulary, comes close to this perspective. She states that her central concern is "to understand how democratic the water utilisation practices in tank-irrigated areas are" (ibid.:260) and sketches, among other things, the reproduction and transformation of the social and economic power of rural farming elites engaged in tank irrigation (ibid.:chapters 5-8)

In this first, political and ethical reading, of water rights in FMIS, these rights would thus be analysed from the perspective of how they enhance or hinder the fulfilment of basic human rights. In other words, the central concern and perspective would be whether, how and to what extent FMIS function in an equitable, socially just and human development-enhancing manner. Given the gross inequities in resource access, including access to water, in FMIS as in other domains, emphasis on this distributive justice/equity perspective is more than justified. However, it is one of several ways of looking at (water) rights, and one that does not give much insight in the concrete working of local rights. The equity/distributive justice perspective looks at who owns the rights and who benefits from them, but does not look at the rights themselves very closely. The latter is the core focus of the second perspective on water rights discussed in the next section.

2. Water rights as rules

In the international discussion on natural resources management the 'rights as/and rules' perspective is undoubtedly the most well known. As part of the 'CPR debate' Elinor Ostrom's work on *Governing the Commons* (Ostrom, 1990) and the subsequent work on how to craft self-governing irrigation systems (Ostrom, 1992; Ostrom and Gardner, 1993) have been very influential in academic as well as policy thinking on irrigation management. Equally influential has been the new institutional economics 'rights as rules' perspective, for which the work of Douglas C. North (1990a, b) has become the standard theoretical reference. This perspective looks at irrigation management and governance from a transaction costs perspective. A third cluster of perspective that looks at rights, rules and norms very closely are analyses of collective action (Wade, 1988) and legal pluralism (Benda-Beckmann and Van der Velde, 1992) with a strong sociological and anthropological flavour.

Though these approaches are very different in some respects, they have in common a focus on concrete analysis of the institutional arrangements that 'make rights work'. In an engineering metaphor, they are all interested in the 'mechanics' of management, collective action and decision-making. For FMIS this translates into detailed studies on how, in Ostrom's terminology, use rights and control rights are concretely operationalised in the management and governance activities in irrigation systems. Two examples in the Indian context that combine elements of these different approaches are Palanisami's analysis of tank irrigation in Tamil Nadu (Palanisami, 2000), and Sengupta's analysis of tank (*ahar)* and diversion (*pyne*) irrigation in Bihar (Sengupta, 2000).[8]

[7] For an example in the domain of groundwater irrigation, see Prakash and Ballabh (2005).

[8] Other sources describing and analysing institutional arrangements for management and governance of FMIS, focusing on tank systems, include Shankari (1991), Janakarajan (1993), Sivsubramaniyan (1997), Sharma and Selvaraj (1999), Selvaraj and Vasimalai (1999), Janakarajan (1993), Venkateshwarlu and Srinivas (2001), Sakthivadivel et al. (2004), Jyotishi and Rout (2005), Menon et al., 2005, and many others.

Palanisami's (2000) focus is on understanding collective action in tank systems. He observes problems in tank management, through neglect of the tank technology and other factors, and aims at tank 'revival for prosperity', the subtitle of the book. His analysis maps out the different types of rights over tank water and water based resources (ibid.:117ff). Quoting Singh (1991) he defines property as "a benefit (on income) stream from any tangible or intangible objects and (or) circumstances" and a property right "as a claim to a benefit stream that is recognized and respected by people conventionally, legally or otherwise" (Palanisami, 2000:119). He distinguishes, from a legal perspective, several types of rights: natural rights, customary rights, positive & negative rights, individual & group rights, and riparian rights. Informing his analysis is the perspective that "property rights have a critical bearing on the management and sustainability of tank systems by creating expectations on how people will act; generating incentives for use, protection, and investment in the systems; and conveying the resources and authority to manage the resource." (ibid.:120) Subsequently he analyses the bundle of rights that governs the multiple uses of tank resources in a sample of 80 tanks in Tamil Nadu. Palanisami looks at the complexity of rights, including competing and conflicting claims, by operationalising, following Schlager and Ostrom (1992), the bundle of rights as follows (ibid.:121).[9]

Use rights:

1. *Access rights:* the right to enter a defined property of a tank system and enjoy non-subtractive benefits.
2. *Withdrawal rights:* the right to obtain the benefits from the property of a tank system by taking out or utilising some portion of it.

Control rights

1. *Management rights:* the right to regulate use patterns and transform the resources of a tank system, potentially altering the stream of benefits from that resource.
2. *Exclusion rights:* the right to exclude/keep out the non-right holders from the property of a tank system, and to decide how access rights can be transferred.
3. *Alienation rights:* the right to sell, lease or bequest control rights to the resource of a tank system.

Mapping who holds which rights to the different uses of the tank resource (irrigation, fishing, social forestry, watering livestock, domestic use, and other uses) Palanisami concludes that:

… [a]lthough various state government departments and the Panchayat Unions are formally vested with control rights (...) of most tank assets, in practice they do [not][10] have the local institutional presence to exercise these rights effectively. Such public property degenerates into open access, subject to degradation through overuse, unless local management institutions step in. (Palanisami, 2000:126)

This conclusion supports the perspective that the (colonial and modern) state may have assumed authority (and ownership) over tanks, but in practice the systems remain predominantly user managed and governed. This configuration creates serious problems.

In many cases local tank management institutions are less effective than in the past, eroded by the government claiming some rights on one hand, and by well owners and other critical stakeholders ignoring the local tank authorities as alternative water sources become available. (ibid.:126)

[9] See Schlager (2005) for detailed discussion of this perspective.

[10] The original text does not have the [not], but from the context it is clear this is an omission and that the absence of local presence is the intended statement.

But Palanisami also observes that

[i]n terms of modern principles of water management, a basic criticism against customary law i[s] that they seem to acknowledge no national obligation superior to internal obligations between laws or castes. It becomes possible, hence for one caste to dominate the various productive uses of water and either to exclude others or to admit them only at a price. (ibid.:118)

This sketches the basic dilemma of how state-tank users relations could or should be shaped. Palanisami also maps which rights are well specified and enforced, and which less so. He finds that access, withdrawal and management rights are usually more strongly specified than exclusion and alienation rights. This suggests that tank communities may find it difficult to adapt overall governance arrangements even if they are quite effective in day-to-day management of the system. He also finds that collective action, that is efforts at community level to enjoy and maintain the multiple benefit stream of the tank system through resource mobilisation, joint resource management and conflict resolution (ibid.:130), is at a low level in more than half of the tanks investigated, pointing at the prevalence of conflicts (among farmers, between user groups, between managers and users) in the tank systems (ibid.:136ff).

The purpose here is not to discuss the details of the substantive analysis Palanisami provides, but to outline the type of approach adopted for the analysis of water rights. The emphasis is on the mapping of (multiple and complex) rights. The objective is to formulate conclusions on how the performance of tank systems could be improved in term of higher productivity of the land and water resources for sustainable livelihoods (ibid.:147). The perspective taken is that the state needs to create clear legal and financial frameworks for local organisations (Water Users' Associations) with full autonomy – clear rights generating clear incentives for effective performance. This reflects the institutional economics perspective from which the analysis is undertaken.

The case of tank and diversion irrigation in Bihar analysed by Sengupta (2000)[11], in contrast, takes a more sociological and negotiation oriented perspective than the more economic and instrumentalist perspective of Palanisami's analysis, by concentrating on the *contestation* of (water) rights in tank systems.[12]

Sengupta makes the important observation that "the colonial government left most natural resources with poorly defined property rights" (Sengupta, 2000:138). The post-independence government, though very present in rural areas and in resource management has not done much to change that situation. As a result, processes have ensued in FMIS, as in other forms of local resource management, of spontaneous self-organization through ongoing conflicts and negotiations. A second important observation Sengupta makes is that we have to be very careful with calling the FMIS *traditional* irrigation systems. They no longer exist in their 'traditional' social and physical settings, and have transformed their internal working over time (ibid.:138). Rigid concepts of (customary) rights make no sense in situations of ongoing negotiation of rights, even when some principles may be enduring.[13]

[11] Also see Sengupta (1980).

[12] A recent collection of papers on water property rights issues from a sociological and anthropological perspective focussing on the plurality of rights and the social relations of power that are part of irrigation management is Roth et al. (2005). It has no case studies of FMIS in India.

[13] Sengupta's paper also illustrates the importance of history in studying (water) rights in FMIS, something that also characterises Mosse's work (see for instance Mosse, 2003) One aspect of colonial history is that the tanks (*pyne*) systems of Bihar went unrecorded, in contrast to those in South India, and are therefore relatively unknown to irrigation and other scholars.

In the Bihar systems diversion canals (*pynes*) take water from rivers and convey the diverted water to local storages/tanks (*ahars*). The systems are complex because the canals branch out and interconnect, multiple tanks are fed by the canals, and there have been infrastructural changes through government building weirs, new irrigation systems and other infrastructure that has affected the working of the systems, with the government being largely ignorant of the of the potential of the indigenous systems (ibid.:152). Not surprisingly, the system of water rights in the systems is also complex, and confused – reflecting this situation and history.

The case study describes the negotiations over water rights that take place in detail. One important theme is the mismatch between formal legal decision making in courts on water rights conflicts, and the practicalities of the local situation to which it has reference. For example, in one case an existing record of *pyne* rights was not admitted because it was considered to express a private property right. The position taken by the court was that no one has any right to obstruct the flow of a natural watercourse, effectively making most indigenous irrigation practices illegal (ibid.:153). This leads to strategic presentation of cases to the court so that they become admissible, and a resort to negotiated local arrangement between parties without formal kegal standing. Sengupta observes that "[i]f at present a party seeks adjudication, it is not for mediation but to harass the opponent and to bring them to terms." (ibid.:154) This is a clear example of using law as a resource and of forum shopping, two central themes in the social anthropology of law (Benda Beckmann and Van der Velde, 1992), but they are hardly a constructive contribution to water resources management in this particular case. The law does not help to settle the rights but lends strength to different sides in the negotiations, with access to the law being highly skewed, as the transaction costs of using it are high. "[T]he net effect of law is that conflicts linger in civil courts for decades, with manipulative juggling of explanations and a smattering of criminal cases, ultimately being resolved primarily through self-organization by the users outside the ambit of the legal system." (Sengupta, 2000:155)

The local situation is that:

[d]istinct individual rights to water supply simply do not exist: they are secured only by being a member of a particular corporate group or 'community'. Most members who own land in a particular command area also belong to the same caste and reside in the same hamlet. They have to follow somewhat uniform agricultural and water application practices. These are not demanded explicitly or even consciously. The very functioning of the system is such that one cannot take advantage of the full benefit if one differs in one or the other of the community attributes. (ibid:155).

Local water distribution is more or less 'automatic' – conflicts seem to emerge primarily between communities.[14] Local water management thus requires little explicit decision making. Another aspect is that landholding is fragmented and spread in this region and that as a result most or all would similarly experience the effects of water scarcity in a command area, as there is no clear 'head-tail' pattern in land distribution. The land use pattern is flexible also in the sense that when there is a drought the farmers do not use the gravity irrigated command area, but the tank bed. This flexibility is possible Sengupta report because farmer successfully lobbied against consolidation of land owned by each farmer in this part, that is against the individualisation of land rights in this part of the system (in contrast to the situation in South India as regards tank bed cultivation).

The point in the context of this paper is that in Sengupta's term 'imaginative property rights' exist at the local level. These rights and rules serve to structure local water management practices, often quite effectively, though they should also not be idealised. State agencies have great difficulty to recognise, in both senses of that word – actually observe them, and acknowledge these local rights and rules. According to Sengupta, the "imaginative property rules were beyond the grasp of the

[14] This is not dissimilar to my own finding in canal irrigation that conflicts between tertiary units (outlets) along a canal abound, but conflicts in the distribution within outlet command areas is often not explicit (see Mollinga, 2003).

technocrats" and the bureaucracy "often have a warped sense of rights" (Sengupta, 2000:158). The prerequisite for meaningful negotiation "that both parties are willing learners" is not fulfilled (ibid.:158). This is part of the broader challenge to find "the appropriate balance between government coordination, and incentives for local management." (ibid.:159)

The two examples in this section were chosen to illustrate that the 'mechanics of water rights' in FMIS can be studied using different approaches and from different standpoints. An approach primarily grounded in a new institutional economics frame associated with a state policy standpoint, was discussed next to an approach with a historical, sociological and political angle on FMIS, from a users and contestation standpoint. However, comparison also shows that the developmental concerns that inform the analysis and the direction into which change and transformation is sought are not too different. There is no one-to-one relation between politics and method. On a broader plane, the analysis of 'rights as/and rules' is characterised by increasing intermingling of perspectives, as well as a narrowing gap between research and policy (cf. Bruns et al., 2005; Meinzen-Dick and Di Gregorio, 2004).

What remains to be developed more systematically in the Indian, and possibly the South Asian, context of FMIS analysis is what could perhaps be called a 'political economy of rights as/and rules'. This could take its cue from the observation that in addition to a theory of rights, a theory of access is needed (Ribot and Peluso, 2003). Such an approach would combine the first and the second reading of water rights in FMIS as presented in this paper into a single framework.

3. Technology as water rights: hydraulic property

The two perspectives on water rights discussed so far, the equity/social justice and the rules perspectives, could be labelled as truly *social* perspectives. Their subject matter is the social relations that are part of irrigation management, and the meaning and impacts of these on individuals and groups of human beings. The technical and ecological dimensions of irrigation are little more than the setting and background of the analysis – they can be enabling or constraining, can be positively or negatively impacted, and can provide resources and be instrumental for human social action, but they do not play much of a role by themselves. The first two perspectives are strongly human behaviour and institutions oriented.

In his analysis of FMIS in Thailand, Indonesia and the Indian Himalayas, Coward (1986a, 1986b, 1990) analyses the intimate relations between the social relations of water management and the technical infrastructure (the irrigation facilities). The basic argument he puts forward is that "(...) creation of irrigation facilities establishes among the creators property relations." (Coward, 1986b:227) Naturally, "[n]one of this property can be sustained over time without frequent renewal through the investment of labour and capital." (ibid.:225) Therefore "the basis for [the] social action [of the community irrigation group] is the common relationship they have with regard to property objects which they have created." (ibid.:225)

This means that the creation and upkeep of irrigation infrastructure go hand in hand with the (transformation of the) social relations through which that infrastructure is used: they co-evolve and are each other's expression as 'hydraulic property'. [15]

[15] To my knowledge, Coward first used the 'hydraulic property' category in this meaning. Soils and canals also have 'hydraulic properties' in a material sense as physical or technical characteristics (the hydraulic conductivity of soils and the rugosity of canals for instance). Coward and those who have developed the concept further show that the technical (including the hydraulic) properties of the irrigation facilities do matter for the relations of hydraulic

Coward develops the insight in a paper on property rights arrangements in FMIS in the Kangra valley of Himachal Pradesh (Coward, 1990). The water rights in these diversion schemes were recorded in the colonial 'settlement' of land rights in the second half of the 19th century. Whether that process only consolidated existing rights, or also transformed some of these and created new rights, is not totally clear, but the rights that were recorded structure local irrigation management and governance to the present day.[16] Coward notes that

[i]ncluded in this description of rights is detail regarding the materials that can be used to construct each diversion structure. The right to build a diversion structure with both stone and mud plaster rather than only stones, for example, really is a statement of rights since the former structure will capture a larger volume of water. (ibid.:81)

For one of FMIS cases he discusses he states that "[t]he irrigation rights of the water users in this network were implemented through a complex set of irrigations structures and distribution rules. (ibid.:81)

The division structures involved are devices that are capable of proportionally distributing the water. Water rights are defined as shares of a flow (which may be varying in different parts of the season for different operations, and between seasons). The device thus expresses this definition of the right.[17]

In the Banuri areas there is a permanent division structure that divides the flow in the main canal with half going to Banuri and half to Band Bihar, Either just before or just after the weeding (depending on the water supply), water distribution in the reconstituted Bharul network is switched to a continuous flow delivered in an amount proportional to the area being served. This arrangement is achieved by installing simple proportioning structures (here called thelu) at each (or most) location[s] where a junction occurs in the canal system. (...) The width of the openings created by the thelu is measured in 'fingers' depending upon the area of land to be served by a given turnout. (...) the thelu is a simple but effective device by which the abstract water rights of individuals can be translated into calibrated water flows. (ibid.:83)

The reproduction of water rights happens through the contribution of labour for maintenance of the system.

The maintenance tasks (...) are not equally distributed among the water users in the network. In Bharul kuhl the principle used to organize labor for maintenance reflects a general rule recorded in Palampur's Riwaj-i-abpashi [the record of irrigation customs, PPM] – the 'last' village is responsible for maintenance and repair. (...) In theory, the labor needed for performing these tasks is provided by water users in relation to the size of their irrigated area; those with larger areas are to provide more labor than those with small units. However, there was no evidence in Bharul that this rule is closely followed or that records are kept regarding participation in maintenance functions. (...) The lower zone people (...) reproduce their water rights in the Bharul network even though the costs to them are considerably higher than those incurred by the upper groups. (ibid.:84)

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property, and vice versa. Such phrasing easily causes confusion when the two senses of 'hydraulic property' are not clearly understood and distinguished. That both are observed and recognised is not self evident – neither for engineers nor for social scientists. As Coward notes, "[t]he untrained observer can easily fail to extract from the rude weirs and rough canal structures the sometimes intricate property relations which (...) prior investments have created." (Coward, 1986b:226)

[16] Coward's case study in the Indian Himalayas provides a case study where water rights were meticulously recorded in the colonial 'settlement' process (and perhaps new rights were created), while in Sengupta's Bihar case these rights, and even the systems themselves went unrecorded because of the way the 'settlement' was done. To my knowledge there is no systematic analysis available of such diversities in FMIS history and practice in India. Agarwal and Narain (1997) is an impressive descriptive inventory of traditional water harvesting system in India. However, the approach to water rights remains confined to the 'equity' perspective (ibid.:325, 330-331).

[17] Time shares are also used in the systems discussed.

Several additional points can be derived from this extract. Firstly, the observed reproduction of rights through investment of labour does not necessarily happen in an equitable manner. Secondly, the 'precision' with which rights are realised and rules are implemented differs from case to case. This reinforces the point made in the previous section that apart from analysis of rights, the analysis of access mechanisms is important.

The hydraulic property perspective on irrigation management and technology is a nice example of effective conceptual capture of the hybrid, sociotechnical nature of irrigation.[18] Though developed independently from social construction/shaping of technology and actor-network approaches (see for instance Bijker and Law, 1992; Hughes, 1987), the hydraulic property insight fits within such frameworks very well and can be further developed by means of it. Shah (2003) is a constructivist approach to the analysis of tank irrigation in Karnataka. Shah starts her book with a quotation from Bruno Latour that very adequately expresses the overall theoretical point about the co-evolution of technology and institutions.

The great import of technology studies to the social science is to have shown, for instance, how many features of the former society, durability, expansion, scale, mobility were actually tied to the capacity of artefacts to construct, literally and not metaphorically, social order (...) They are not 'reflecting' it, as if the 'reflected' society exists somewhere else and was made of some other stuff. They are in large part the stuff out of which the socialness is made." (Latour, 2000:109, quoted in Shah, 2003:1)

Shah investigates resource utilisation patterns in tank irrigation in Karnataka from this perspective. She suggests, "the design principle of a labour intensive construction method of embankments carries the imprint of the historical era that rested on a rigidly built, hierarchical social order which exerted a considerable degree of control over labour." (Shah, 2003:261) This is supported by the observation that in the present situation, with expanded market relations, decentralisation policies and a general loosening of social rigidities, rural elites find it increasingly difficult to mobilise labour for tasks like canal cleaning, sluice operation and field-to-field irrigation from lower caste labourers. They turn to the state for investment in maintenance and management. (Ibid.:262-263) "This push and pull – the push that rural elites are increasingly less inclined to invest in tank resources and the pull that traditional social arrangements to mobilise lower caste labour cannot be reproduced in their entirety – has created a crisis in terms of management of tank resources." (ibid.:263) An example of field level irrigation practices she gives is how the field-to-field irrigation method favours head-end farmers by materialising a certain order of irrigation (ibid.:269-270). Shah casts here analysis in the language of 'social relations of power' rather than in that of 'property rights', but the evidence she is able to provides on the technology-social relations linkage strongly suggests that the 'hydraulic property' concept could be further developed by incorporating a constructivist analysis of technology into it.

Apart from, or maybe because of, being an analytically powerful concept, the hydraulic property concept has significant policy implications. The intimate relationship between the social relations of management and governance and its technical infrastructure means that both external infrastructural intervention and external institutional intervention may unbalance an irrigation system and lead to ineffective management. For example, a government programme replacing temporary diversion weirs made of brushwood and stones by permanent, concrete weirs may undermine the water rights of tail-enders in the system when these reproduce their water rights by providing labour for the seasonal weir reconstruction. When a government programme assumes ownership rights of an FMIS and establishes a water users association to implement state policies, the user investment in system maintenance may reduce or stop and the infrastructure deteriorates.

[18] On the sociotechnical approach to irrigation, see for instance Bolding, Mollinga and van Straaten, (1995); Vincent (1997); Mollinga (2003); Bolding (2004).

Coward (1990:86-87) discusses examples of such interventions for one of the FMIS he studied in the Himalayan region. He gives both successful and unsuccessful examples of infrastructural intervention by government agencies. The success or lack of it depended on the maintenance of a 'matching' relationship between the institutional arrangements and the infrastructure. He also observes that external intervention often overlooks this relationship and thereby easily unbalances the functioning of the systems.[19] Studies in many parts of the world have supported and elaborated this argument, but detailed discussion of these examples is outside the scope of this paper.[20]

To conclude this section, that water rights take on a material form in the characteristics of the infrastructure of the systems in and for which they exist, and that the activity of infrastructure creation and upkeep is a process of property rights creation and upkeep, are the two theoretical ideas captured in the concept of hydraulic property. This is the third 'reading' of water rights in FMIS, and the first of two interdisciplinary readings. The second interdisciplinary reading is a similar insight as regards the ecology, which is discussed in the next section.

4. Ecological relations as water rights[21]

The fourth reading of water rights in FMIS can be regarded as an elaboration of the previous discussion of the 'hydraulic property' concept. It broadens the scope from water rights and technology (infrastructure) to water rights and the ecology (landscape). In her study of the interaction of pond (tank) and canal water management in a watershed in the Palakkad region of Kerala, Krishnan (2008) links the ecological characteristics of the landscape to the (land and) water rights that govern its use.[22] She documents how ecological relations were historically part of the definition of land and water rights in a way that achieved ecological sustainability. When land and water rights were changed without being cognisant of their ecological meaning, an, again, uninformed bureaucracy wreaked havoc rather than achieved its stated objectives of equitable development. The case is that of post-independence land reform and irrigation development in a landscape where ponds (small tanks) captured runoff and groundwater from forested uplands, to irrigate paddy in the lowlands. The land used to be owned by landlords (*janmis*) who rented them out to tenants through intermediaries (managers). Those cultivating land in the command area of a pond (tank) had a water right attached to it, involving access rights to the pond (tank) water, access to the upland forested area for forest products for their own use, while there were also arrangements for pond (tank) maintenance. The *janmi* undertook regular desilting of the pond (tank), through the supervisor appointed by him. Day to day activities like cleaning run off channels in the catchment (necessary to

[19] This conclusion is very similar to that of Sengupta discussed above. However, Coward observes positive 'matching' also, where Sengupta hardly found this.

[20] For example from Nepal, see for instance Ostrom (1992); on Bali, Indonesia, see Lansing (1991) and Horst (1996); on the Andean region, see Boelens and Hoogendam (2002). The literature on South Indian tank irrigation rehabilitation also provides evidence for this point (Shah, 2003).

[21] I thank Jyothi Krishnan for commenting on and correcting this section.

[22] I have searched for other papers (on Indian farmer managed irrigation systems) presenting a similar argument about ecological relations internalised into property rights arrangements. I haven't found them, though I would not want to claim my search has been exhaustive. Wade (1988) is an exploration of the role of ecology in societal organisation, and Mosse (2003) wants to develop a social ecology of water with South Indian tank irrigation as the main case (Mosse, 2003: 3 ff.). I can only speculate about the reasons for the absence of an explicit ecological perspective on water rights as discussed in this section. A clue may lie in statements by Mosse like the following: "Ultimately, ecology and history will be shown to be inseparable (Mosse, 2003:6) and "...it is impossible to separate out the facts of property – land and water – from political or kinship structures through which they are represented." (ibid.:21) It seems to me that the analysis of Krishnan, while acknowledging, like in Mosse's perspective, that ecology and history, ecology and social relations, have heavily intertwined development trajectories, constituting each other, shows that analytical separation has its merits.

fill the tank), and other regular tasks, were undertaken by permanent labourers who worked for the concerned tenant(s).

The Kerala government decided to implement a land reform and distribute the landlord owned land to the tillers, to achieve equitable access to land. Around the same time the vesting of privately owned forests with the government was implemented. The time lag between the promulgation of the forest act and its final implementation enabled landlords to dispose of the valuable trees, resulting in deforestation of the uplands. Landlords also made sure that they maintained access to the valuable valley lands by strategic registration of plots. When the uplands and lowlands were redistributed under the land reform process, only land rights were consciously redistributed. The government overlooked the water rights linked to land rights. Some land kept the water rights attached to it, other land did not. Many former tenants who obtained small plots of land remained without water rights.

In parallel a government irrigation system was constructed and implanted on the landscape without taking cognisance of the pond/tank systems already extant. The water supplied through the government canals to a significant extent ended up filling ponds/tanks, whose original function changed from capturing runoff and groundwater to capturing canal water. The public water provided by the government system was privatised the moment it entered the ponds/tanks, and became accessible only to those with water rights to the tank. Krishnan (2008) documents graphic examples where among adjacent plots one gets ample water for paddy irrigation from a tank (originally being canal water) because the owner has part of the original water rights attached to his land right, while the next plot is drying up because the owner has no water rights to the tank connected to his land right, and can only acquire water at great cost (by investing in pumping for instance) or by depending on the mercy of his neighbour.

The point in the context of this paper is that land and water rights were originally connected, and, most importantly, consolidated the demarcation of paddy cultivated lowlands and forested upland that allowed the tanks to be refilled, regulated the access to and extraction of forest products from the uplands, and included labour arrangements for the reproduction of the water management system. In the process of land redistribution land and water rights got disconnected, leading to the undermining of the ecological integrity of the landscape. The area is now a region suffering from water scarcity, while having a yearly rainfall averaging around 1500 mm. The irony is, of course, that ecologically sustainability was achieved under a system with feudal characteristics, while ecological degradation ensued when land reform was implemented on welfarist principles driven by a communist party political agenda. Put in a more nuanced manner, had the need for water (rights) reform in addition to land reform been realised and taken up, and would the ecological importance of the forested uplands have been recognised, there would have possibly been other (ecological) landscape management options. The process that did happen has produced new forms of social inequality combined with ecological degradation. The recently started decentralised planning seems to be able to do little so far to remedy the situation.

Apart from the depressing outcome of this rights reform and development process, the conceptually interesting point for this paper is that ecological relations were part of the definition of the land and water rights. How rights are defined shapes the landscape, and the reproduction of certain landscapes requires specific property rights arrangements. The parallel with the 'hydraulic property' concept seems evident, even when an appropriate phrase is still lacking – 'ecological property' or 'landscape property' sound awkward (as yet).

The inherence of ecological relations in land and water rights concepts, for better or for worse, that is, enhancing either ecological integrity or degradation, is the fourth and last reading of water rights in FMIS, and the second interdisciplinary one.

Conclusion

This paper has presented four ways in which water rights have been understood in analyses of Indian farmer managed irrigation systems: first as a right to water, emphasising the equity and social justice aspects of water rights; second as rules, constituting the 'mechanics' of water distribution and other aspects of irrigation management; third as materialisation, emphasising the technological dimension of water rights; and fourth in their ecological aspect, by showing that ecological relations are inherent to the definition of land and water rights. The first two readings are typical social science readings, fully focused on the behavioural and institutional dimension of property rights. The third and fourth reading provide an interdisciplinary perspective on rights by specifying their material dimensions.

The argument following from this is that these different perspectives do not exclude each other, but rather should be seen as identifying different and complementary dimensions of a single phenomenon. That is, water rights (and property rights in natural resources more generally) are a multidimensional concept. In the literature on Indian FMIS the first two readings have, by far, received most attention; the third and fourth play a small, if not marginal, role in the debate on water rights. This is not a problem so much because it implies the dominance of social reductionist analysis of water rights[23], but it is primarily a problem because of the very substantial developmental and policy implications of ignoring the technological and ecological dimensions of property rights – as the disaster stories referred to above have hopefully illustrated. There, thus, is a case for attempting to develop a comprehensive, interdisciplinary framework for the analysis of water rights, in FMIS as in other situations. The first step is to recognise and acknowledge the different dimensions of water rights, the second to understand their interrelationship. This paper has attempted to provide a convincing account for the first step. The second step involves developing further a 'landscape approach' to irrigation and water rights (Coward, 2005; Mosse, 2003: chapter 1). This is a project that remains to be completed, both at the analytical and at the practical level.

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[23] This is not meant to be a statement on the contributions discussed in the paper; these are among the most multidimensional analyses of water rights in FMIS, even when for the purposes of this paper they are discussed under one heading only.

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Methods of Valuation of Water Resources: A Review

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Abstract

The valuation of water resources is extremely important from a policy perspective. Water valuation helps in efficient allocation, which often has been the prime point of contention in water resource management. Existing literature has a large number of papers on the significant attempts at valuing water. However, a number of publications only consider certain specific aspects of water pricing, rarely attempting a comprehensive review. However, such an issue cannot remain confined to disciplinary bounds. This paper presents a survey that attempts to resolve this gap by summarizing accumulated knowledge on valuation of water resources and dealing separately with valuation of water in the economic and the ecosystem sectors. Under each component, a host of studies on valuation done by various economists have been mentioned. Finally, the policy implications of water pricing have also been discussed in light of the scarcity value theory.

Keywords

Valuation, Economic Services, Ecosystem Services, Scarcity Value, Water.

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1. Introduction

Water scarcity is on the rise in various parts of the world. Traditional modes of freshwater management are becoming defunct and obsolete. This situation calls for a paradigmatic breakthrough in the ways water has been managed so far. Over the last two decades, water valuation has emerged as an important feature for such a new paradigm and will influence policymaking in the coming years. This paper reviews the diverse approaches to the valuation of economic and ecosystem services provided by water to offer a broad platform for evaluation and policy implications to the reader. Over the centuries it has been stated that the prime problem of water systems management is with allocation. This brings in economics whose scope was delineated in its canonical definition, "… allocation of scarce resources among competing ends". A number of economists working on water have analyzed the problem of water allocation with institutional economic theories (e.g. Richards and Singh, 2001; Brown, 1997; Holden and Thobani, 1996; etc.), which, by their very nature, call for diminishing transaction costs over time. Institutionalists have talked of the economics of property rights and the legal frameworks that have been instrumental in formulating a number of international statutes on water. Analysis of the existing legal framework has been motivated by institutional thinking (Barrett, 1994). At the same time, economics of property rights has also been operational in delineating property rights explanations of water disputes (Richards and Singh, 2001; Berck and Lipow, 1994). Thus, institutional thinking has buttressed the framework for sustainable water systems management.

However, being broad and qualitative, institutional thought processes only provide some guidelines set by international and national statutes. As a result, the laws have often been too rigid to provide an easy operational solutions and, sometimes, so flexible that they could be interpreted by strong stakeholders according to their conveniences (Chauhan, 1981; Tarasofsky, 1993). Institutional economics has always talked of broad policy decisions and has only provided theoretical explanations of these decisions. At the same time, while institutionalists have been talking of the diminution of transaction costs, there has been no quantification (or monetization) of the transaction costs due to their improper delineation. This leaves the policymaker with no benchmark to ascertain the goal. Hence, institutional thinking has, so far, not proposed any tangible, neutral, and quantified instrument for water management. The above holds true for international water law, as well as for water laws for interstate rivers within national boundaries. The institutional frameworks are often without objective economic instruments despite their extensive underlying importance. The obvious question is whether it is possible to develop an instrument that can complement this broad subjective configuration provided by statutes. On the other hand, attempts have often been made to resolve interstate water disputes in a nation within the framework of the water law of the land. Even then, there is yet no domestic legal framework that makes any provision for objective evaluation of disputes. Thus, the states abide by the awards of the courts or by orders passed by the concerned bodies vested with the judicial power to take decisions on water-related issues.

1.1 Valuation as a tool

Under circumstances where institutional economics have not been able to provide an objective tool for resolution of disputes, there is the need to examine whether a more objective instrument can be developed with the help of the emerging tools for valuation. Such tools are indeed in a very early stage of development and needs to be used as an approximation. The value of a resource simply reflects the level of its usefulness to the user, whether an individual or a community, a corporate body or even a national economy. This value varies with the user. The use of valuation in water management and dispute resolution needs to be rationalised. The reasons are:

- Valuation offers a somewhat objective instrument for decision making: There often arise situations in which valuation can provide a more objective basis for decision ranking (Singh, 1994; OECD, 1995).

- Valuation aids efficient as well as equitable allocation, helps the process of proper distribution, and offers means of achieving better optimality in social consumption and production: Equity and efficiency in the allocation of natural resources have always been viewed as complementary ideas. The inherent conflicts in policy making emerge from the dichotomy between efficiency and equity. In making a policy, the value yielded by adhering to either equity or efficiency or a combination of both should be considered. Similarly with distribution. Social planners need to take into account the value of the net social welfare to decide upon the distribution scheme. At the same time, either consumption or production should be considered to optimise the net economic welfare of a system, subject to some constraints. These may exist as resource availability, infrastructural bottlenecks, economic identities, etc. Optimisation exercises yield shadow values (which reflect upon the increase in welfare with a unit release of a particular constraint). Moreover, these are extremely relevant for future decision making on economic variables (Bouhia, 2001; Mahendrarajah, 1999). Again, the valuation of eco-systemic degradations helps to devise economic instruments like pollution taxes or quantity taxes that can help in reaching social optimality in consumption or production (Acutt and Mason, 1998).

- Valuation of natural processes or resources can raise awareness of the market and the policy makers on the importance of the ecosystem or natural resource under consideration: A high value of a natural resource reflects its importance to the user(s) under consideration. Under situations where valuation mechanisms are absent, this importance remains unregistered. For example, the importance of biodiversity conservation or carbon sequestration by wetlands can be better understood if expressed in relatively quantified monetary terms. This would make a case for the public significance of wetlands when communities often fail to recognise the same (Bann, 2002; OECD, 2002).

- Valuation can help legal proceedings determine damages where a party is held liable for causing harm to another party: In legal proceedings, where one party has caused harm to another, the loss is evaluated (usually in monetary terms) and the affecter (once proved guilty) is made to compensate the affected with the value of the damage. This can also be the case for ecosystem services. Pollution from upstream areas affects the downstream ecosystems negatively. To deal with compensation policies properly, the economic value of the harm so caused needs to be assessed to obtain the extent of the negative externalities (Bann, 2002; OECD, 2002).

- Valuation helps in the designing of efficient management mechanisms (economic instruments, controls, etc.): Economic instruments like a tax or a subsidy can help in the attainment of the optimality in consumption. However, when damages due to pollution, for example, are valued, valuation opens up a range of management options (Acutt and Mason, 1998). Apart from taxes, internalisation of the externalities and governmental controls – on laying a ceiling or a floor in the associated economic activity that creates the pollution – can also help the process. Tradable permits are another option (Hanley, 1998).

- Valuation of natural processes and resources helps revise investment decisions, like in infrastructure development, that might otherwise ignore the related harm expected to be caused to the natural environment: Investment decisions on public goods and utilities (for example, roads) in many countries largely ignore the possible environmental damages, thereby causing those damages, albeit in the long run. These have adverse impacts on the natural

environment and related human livelihoods. While taking investment decisions on projects, valuation of these ecological costs must be considered. It might happen that the ecological cost might be large enough to exceed the projected economic benefits from an investment, needing a revision of the investment proposal (Bann, 2002).

- Valuation reduces the scope for market failures and enhances its creation: Sometimes, there are goods for which markets do not exist. Examples are certain environmental resources, which are apparently abundant in nature, e.g. air, water, and so on. Because of non-existent markets, there is no market-clearing price. When such a resource becomes scarce, better resource management may call for the creation of markets. Valuation of the resource helps in this process of market creation (Acutt and Melinda, 1998; Fisher, 1995). This is also true for certain public goods and services. It is thus apparent that in all the major economic activities of allocation, production, distribution, and consumption, valuation can play an important role in decision-making and prioritisation. Valuation thus can offer a mechanism for extending justice and equity while setting conservation priorities within a limited budget.

1.2 Valuation in the resolution of water disputes

However, for environmental resources like water, the most important function is perhaps the correction of the market failures, which has great implications for its sustainable management. Given such a background, valuation has been proposed in this exercise as an instrument for mediating transboundary water conflicts. As a tool, valuation seems to be a more tractable one than the others. And if properly applied in the transboundary context, it can offer a more objective basis for resolving disputes. It should also be remembered that of the types of applications that have been extended from the framework of economics, valuation is the most fundamental. In game-theoretic frameworks, pay-offs to agents depend on the values they put on water. Institutional approaches subsume valuation, thereby either enabling or preventing institutions from emerging.

Water pricing, whether by government mandate or by market forces, is an important way to improve water allocations and to encourage conservation (Tsur et al., 2004) if the basic water needs of all are satisfied a priori. Interestingly, despite the realizations, there have been very few attempts at establishing an objective economic analysis of policies through this process of valuation.
For water, valuation studies have remained as isolated interests of some economists. Such studies have rarely been involved or applied effectively in the policy framework as an objective instrument for analysing and understanding water disputes. If realised properly, valuation can be an effective approach for reducing conflicts among various stakeholders by using common water resource. (Ghosh and Bandyopadhyay, 2002 and 2003; Ghosh, 2002).

A number of publications only consider certain specific aspects of water pricing with comprehensive reviews being rare. Such an issue cannot remain confined within disciplinary bounds. This survey attempts to deal with this gap by summarizing accumulated knowledge on valuation of water resources. The review finds inspiration from ecological, environmental, resource, and agricultural economics. The initiating point of the paper lies in the notion that valuation of water resources involves the valuation of the services that water provides. The paper looks at two broad aspects of valuation of water. These involve the valuation of the economic and the ecosystem services from water. The paper has been divided into four sections. Section 2 summarizes the database of the literature on economic services of water. These broadly involve the valuation of the services that water provides in the economic sectors. The studies have been broadly categorized according to the methodology and, at the next level, sectoral classifications have also been made. Section 3 discusses the valuation of the ecosystem services of water.

Finally, in section 4, an attempt is made to relate to the notion of *scarcity value* as it exists in the literature. The section also argues how the various valuation modes followed so far in academic literature has actually been valuing "scarcity".

2. Valuation of economic services of water

Depending on the way different studies treat water; these can be divided into two broad categories, namely:

- Water as an input to the production process
- Water as a good in the consumer's utility bundle

2.1. Valuation with water as an input to the production process

Contribution of water as an input to the total output occurs primarily in the agricultural and the industrial sectors. The agricultural sector is where most of the water gets used for irrigation. A large number of studies have been conducted on valuing irrigation waters with the production-function approach. The valuation of water has been reviewed keeping in mind the separate use of water in agriculture and industry.

2.1.1. Pricing of agricultural waters

While discussing the pricing of agricultural water, one must remember that the criteria for and practice of water pricing might be different. With pricing playing a fundamental role in allocation, a variety of methods for pricing water is available in the literature which can be categorized as:

- Pricing in practice
- Pricing criteria
- Valuation of agricultural water

2.1.1.1. Pricing in practice

The prevailing pricing methods include volumetric, non-volumetric, and market-based pricing methods. Under volumetric pricing mechanisms, the charge for irrigation water is based on consumption of actual amounts of water. Non-volumetric measures are based on output, input, area, and land values. The recently developed market-based mechanisms deal with the existing inefficiencies in the institutional mechanisms of allocation (Tsur et al., 2004).

- Volumetric methods: The requirement for valuing water under this method is a measure of the volume of water consumed from an irrigation system. This information is collected by an authority or water users' association, who sets the prices, monitors use and collects fees. Easter and Welsch (1986a), Small and Carruthers (1991), and Bandaragoda (1998) refer to the information requirements and costs, and the priorities to be considered. Easter and Welsch (1986b) mention the operational and institutional problems of implementing irrigational projects. Easter et al. (1997) have described temporal block-pricing methods that are followed in the varying surface irrigation charges in the state of Maharashtra in India where the water charge varies by crop and season. This implies that if the volume of water delivered per unit time by the water source diminishes throughout the cropping season, the effective price per unit of water should rise proportionally. In developed countries, with sophisticated methods for monitoring

and accessing of information, multi-tiered volumetric pricing methods are in vogue. Studies by Rao (1988) on California and by Yaron (1997) in Israel reveal such examples. Boland and Whittington (2000) have traced the recent movement toward increasing block tariffs in developing countries.

- Non-volumetric methods: Non-volumetric pricing methods are used in situations where volumetric pricing is either unfeasible or undesirable. Several such pricing methods are common for irrigation service: output pricing, input pricing, area pricing, and betterment levy pricing (Johansson, 2000; Tsur et al., 2004). Area pricing is the most common mode of pricing irrigation water (Bos and Walters, 1990; Bosworth et al., 2002). Under area pricing, users are charged for water use per unit irrigated area, often depending on crop choice, extent of crop irrigation, methods of irrigation, and season. Easter and Welsch (1986a) and Easter and Tsur (1995) explain its widespread prevalence for its ease of implementation and administration, and its suitability in continuous flow irrigation. Due to the high costs of a meter system, it is often more efficient to use per unit area pricing than volumetric pricing when allocating water. However, it suffers from the practical difficulty that the area of land is assumed to be an adequate proxy for the proportion of water received. However, this may not be the case because of logistical, physical, and political reasons (Rhodes and Sampath, 1988). Under the output pricing system, farmers pay a water fee for each unit of output produced. Whereas, under input pricing, they pay for irrigation water through higher prices for inputs purchased from the government or water agency. Both input and output pricing are easy to implement since inputs and outputs are readily observable and the measurement of water used is not needed (Johansson, 2000). However, neither measure is favoured by economists because of distortions inherent in taxation (Rhodes and Sampath, 1988).

- Market-based methods: It has often been stated that market-based mechanisms can be used to reduce the inefficiencies in water allocation (Easter et al., 1999). Rosegrant and Binswanger (1994) suggest that water markets provide a flexible and efficient way to allocate water, while, at the same time, providing incentives that are beneficial for water users. When the water saved can be traded, it provides extra income to farmers, while pricing leads to a reduction in income. They also suggest that markets lead to the highest value use of water. As shown by Holland and Moore (2003) for the Central Arizona Project, a restrictive market mechanism on groundwater resources could result in ineffective solutions. According to Hearne and Easter (1995), markets should be recognized as a means to allocate water according to its real value thereby leading to efficiency gains and conservation. Gardner and Fullerton (1968), Hartman and Seastone (1970), Marino and Kemper (1999), and Holland and Moore (2003) suggest that markets can be a means to allocate water according to its opportunity cost resulting in efficiency gains. Nature of the markets can range from formal to informal. Informal water markets are found in India (Saleth, 1997), Pakistan (Bandaragoda, 1998; Meinzen-Dick, 1997), Chile (Hearne and Easter, 1997), and Mexico (Thobani, 1997). Transactions are typically small-scale and local, selling surplus water to neighbouring farmers or towns (Johansson, 2000; Bosworth et al., 2002). Formal markets involve buyable and sellable water rights, permanent and seasonal transfers or transactions between sectors and jurisdictions. Examples exist for the western U.S. (Colby, 1998) California (Howitt, 1998), Texas (Griffin, 1998), and Spain (Garrido, 1998). The most advanced form of tradable water rights are reported to exist in the Murray-Darling basin in Australia with seasonal and permanent states of diversion entitlements (Bosworth et al., 2002).

2.1.1.2. Pricing criteria

There are two broad criteria for charging a price for water. One criterion involves equity and the other involves efficiency. An efficient allocation of water resources maximizes the total net benefit that can be generated by using existing technologies and with the volumes available (Easter et al., 1997). In other words, efficiency incorporates the equalisation of marginal benefits from the use of the resource across sectors to maximize social welfare (Dinar et al., 1997; Ghosh and Bandyopadhyay, 2002 and 2003; Ghosh, 2002). Sampath (1992) describes four situations under which efficiency can be defined within the relevant time horizon. Johansson et al. (2002) adopted a similar definition of efficiency. As put by Dinar et al. (1997), in the short run, an efficient allocation maximizes net benefits over variable costs. This results in the equalisation of marginal benefits from the use of the resource across sectors to maximize social welfare. In the absence of taxes or other distortionary constraints, an allocation that maximizes net benefits is called *first-best efficient* or *Pareto efficient* (Tsur et al., 2004; Johansson et al., 2002). With the incorporation of long-run fixed costs in the short-run maximisation problem, Pareto efficient allocations are possible. However, when maximization occurs under distortionary constraints, the allocation is termed *second-best efficient* (Mascollel et al., 1995; Tsur and Dinar, 1997; Johansson, 2000).

Equity of water allocation is concerned with "fairness" of allocation across economically disparate groups in society, and often, this turns out to be incompatible with efficiency objectives (Seagraves and Easter, 1983; Dinar et al., 1997; Dinar and Subramanian, 1997). As suggested by Sen (1973), the concept of "fairness in allocation" is vague and amorphous, and hence, subjective in nature. Therefore, it is essential to obtain a yardstick to measure fairness. Sampath (1990) uses a *Rawlsian* concept of fairness to investigate equity in India's irrigation systems. The concept seeks to maximize the welfare of the society's least well-off individuals and allows evaluation of reform strategies in these terms. According to Tsur and Dinar (1995), water pricing mechanisms are not very effective in redistributing income. However, it always remains in the government's national interest to increase water available for certain sectors and citizens. Hence, certain sectors of the economy (e.g. agriculture) are offered water at subsidised rates. This is where inefficiency often creeps in. To analyze such issues, Seckler et al. (1988) differentiates between the evaluation of an irrigation system – considering efficiency as a managerial issue – and the other, a policy.

Pricing can be an effective tool for both equity and efficiency under certain conditions. Differential pricing based on volume, as stated in *volumetric methods,* is based on the notion of vertical equity. On the other hand, market-based pricing is more likely to produce efficiency. When left to market forces, water tends to find a value of its own. The market price of the resource bears the signal of the level of its availability and scarcity. A higher market price of water would reflect on a higher effective demand for water. With water finding its value in the market, a trend toward greater efficiency is seen.

For the variants from equity and efficiency, non-volumetric prices might apply. This is particularly true for output pricing. Under output pricing, it is assumed that a higher output entails a higher use of water. It thus loses its visions thoroughly from the efficiency notions of resource-use efficiency and factor productivity. Output pricing can result in an individual getting unnecessarily penalised despite lower exploitation of the resource.

2.1.1.3. Valuation of agricultural waters

Attempts by environmental and agricultural economists to obtain the value of water exist in reasonable numbers. In a majority of cases, agricultural water has been valued with a production-function approach. This involves assuming a production function where water is an input in the production process. Theoretical details of the economic principles based on which such pricing, and hence, the demand and supply curves for water can be derived, have been provided by Tsur et al. (2004: 64-85). Similar to economic valuations in various contexts over time and space, assigning a monetary value to water

through improved agricultural output, resulting from improved availability of resources, involves what has popularly been termed a with-versus-without comparison (Gittinger, 1982).

Bouhia (2001) provides a value of water from a constrained maximization exercise on Morocco. This study stands as one of the most comprehensive ones in structure and content. The analysis talks of the sectoral shadow values of water by considering the three sectors, namely industrial, urban, and agricultural. Ghosh and Bandyopadhyay (2002), in a theoretical yet simplistic mode, propound static and dynamic frameworks to set the rules for optimal payment that the beneficiaries should pay the affected for obtaining benefits from a marginal increase in water usage. They (Ghosh and Bandyopadhyay, 2003) suggest similar exercises in the upstream-downstream framework. All these exercises talk of the shadow value of water that emerges from the value of the multiplier associated with the optimization exercise.

Barring a few (some of which have been mentioned above), most of the studies have been confined to the sectoral allocation of water. Of the publications on the agricultural shadow values, those by Acharya (1998) and Kumar et al. (2003), are recent. Young (1996) suggests applied approaches that incorporate change in net income – the most commonly used method of determining the shadow price of irrigation water. Omezzine et al. (1998) have taken the average returns to water from agriculture and set the path to the approach to valuation. Among the examples of economic analysis of irrigation, issues using a mathematical programming approach are a study by Bernardo et al. (1987) in which a programming model was developed and applied to assess irrigation management decisions in the north western United States. The researchers identified various responses to growing water scarcity and rising energy costs, including more careful irrigation scheduling, crop substitution, the adoption of irrigation labour practices, and the idling of land. Mahendrarajah (1999) uses the latest optimization tools and simulation models in his study on small-scale water resource systems in Sri Lanka. Gomez-Limon and Riesgo (2004) have developed Multi-Attribute Utility Theory (MAUT) mathematical programming models that reveal the usefulness of differential analysis in evaluating the impact of a water-pricing policy. This was applied in the case of Duero Valley in Spain. This allows one to observe significant differences in the evolution of agricultural incomes, the recovery of costs by the state, demand for agricultural employment, and the consumption of agrochemicals resulting from rising prices of irrigation water in various groups of farmers within a given irrigated area.

Lindgren (1999) used field-based primary data with residual valuation method for the evaluation of Stampriet aquifer of Namibia. Existing literature points out that residual imputation is valid if two conditions are satisfied (Young, 1996, Southgate, 2000). First, all inputs and outputs must be exchanged in markets that are both competitive and unregulated. On the factor side, this means that the price of each and every input is equal to its marginal value product (i.e. output price multiplied by the additional output associated with a marginal increase in employment of the factor). Second, the production function should be so that an X-fold increase in each and every input leads exactly to an X-fold increase in output (Southgate, 2000). However, Lindgren (1999) hardly makes such assumptions explicitly, and generates the value with a small sample of 17 farmers from the questionnaire method, which also raises questions on the data and the estimates.

In India, quite a few economists have, however, worked extensively on detailed analysis of economic contributions from irrigation and related agricultural production. An impressive amount of literature is available on this subject and Vaidyanathan (1999) has given a realistic picture of economics of irrigation in India. The water sector suffers from economic ills of under utilization, inequitable distribution, heavy loss of stored water, and so on, but their quantification and subsequent use in policy have not happened. Interestingly, research on more advanced topics, for instance, pricing of water, and allocation under conditions of physical scarcity, has not entered the decision-support arena.

That has not deterred scholars though. There have been quite a few studies that have unanimously indicated that the prevailing irrigation water rate for different crops in India neither promotes use efficiency nor cost recovery (e.g. Vaidyanathan, 1994; Sangal, 1991; MoWR, 2002; Nagaraj et al., 2003; Ghosh, 2005. Vaidyanathan (1994) classified three major heads of cost of irrigation water, namely operations and maintenance, depreciation, and interest on capital invested. Nagaraj et al. by considering the same three heads, revealed the yawning gap between revenue collected and expenditure incurred for various crops. The gap persists, and the problem related to cost recovery has mostly been attributed to the political economy of the water sector in India (Vaidyanathan, 1999). In a recent essay, Vaidyanathan (2004) discusses the issue of water charges and suggests a two-pronged strategy: involving the media to highlight the current mismanagement of irrigation, and utilising farmers' awareness of the improved water management to mobilize their support for better maintenance by operation and maintenance (O & M) cost recovery. While this is a good beginning, there is no doubt that the political economy of water pricing is complex and made even more complicated by the vote-bank politics (Mollinga, 2003; Gulati et al., 2005). Somanathan and Ravindranath (2006) argue that raising the marginal price of electricity toward its actual cost could substantially mitigate the problem of over-extraction of groundwater. They have arrived at this conclusion with the help of a survey estimating the value of water, and arriving at a structure for demand functions. Ghosh and Bandyopadhyay (forthcoming) have also discussed the political economy of conflicts in the Cauvery basin, and have attributed conflicts to non-diminishing scarcity value of water from paddy cultivation in the basin, resulting in an "insatiable demand".

2.1.2. Pricing of water as an input in the industrial sector

The value of water in the industrial sector emerges from its role as an intermediate public good that plays an active part in production processes thereby reducing the unit cost of production. Despite the ubiquity of water use among manufacturing firms, studies concerned with the structure of industrial water demand are few. A majority of the water-use studies for industry were performed by estimating water demand models where the ratios of total expenditures to total quantity purchased were used as proxies for prices. The initial studies of water use in the industry were conducted by estimating single-equation water-demand models where the ratio of total expenditures to total quantity purchased was used as a proxy for price (Turnoskvsky, 1969; Rees, 1969; DeRooy, 1974). Grebenstein (1979) and Babin et al. (1982) extended these analyses to incorporate trans-log cost functions where water was being included and treated like any other input as labour, capital, and materials, and the average cost of water is used to determine the price. Most of these studies used average cost of water as an indicator of price. Thompson and Singleton (1986), Renzetti (1992) and a few others on recent counts (e.g. Dupont and Renzetti, 2001; Reynaud, 2003) have used either econometric or programming methods to examine the structure of industrial water demands. Renzetti (1988) assumed a Cobb-Douglas production function to derive a water-demand function in estimating industrial water-use elasticity. He used firm level data on water use and expenditures for British Columbia manufacturing firms in 1981. In another paper, Renzetti (1992) reports the general findings, suggesting that water demand was inelastic.

In most jurisdictions, self-supplied firms typically obtain their raw water intakes at little or no external cost (Renzetti and Dupont, 2003). In these cases, analysts typically have access to information on the quantity of water withdrawn, and perhaps, the firms' characteristics. A number of methods have been employed for inferring the value of industrial water use in these circumstances. One straightforward method involves calculating the ratio of the value of output to the quantity of intake water (Giuliano and Spaziani, 1985; Mody, 1997). This approach is problematic as it fails to account for the contributions to production of non-water inputs and for differences in revenue across firms that are not related to water use, such as the structure of output markets.

A variation on the above approach is adopted by Wang and Lall (1999). They developed a marginal-productivity approach for valuing industrial use of water and applied it by using data from 2,000 industrial firms in China, where water as well as capital, labour, energy and raw materials is treated as an input to a production function. The authors have regressed total revenue against input quantities and a set of regional and scale dummies by using data from a cross-section of Chinese manufacturing plants. On more recent accounts, Goldar (2003) has worked on water use and its value in the Indian industry with econometric fittings. Prior to that, Goldar and Pandey (2001) have studied the distilleries in India and have worked out their pricing and abatement cost of pollution. The paper also exhibits how in countries like India, where concentration-based environmental standards are adopted for water pollutants and financial-extraction costs of water are too low, firms have incentives to dilute the effluent stream with the excessive use of water. Kumar (2006) has used input distance function to estimate industrial water demand in India with a linear programming approach on a sample of 92 firms over three years. The results show that the average shadow price of water is Rs 7.21 per kiloliter and the price elasticity of derived demand for water is high – 1.11 on average – a value similar to what has been found by other researchers working on developing countries (for example, China and Brazil). This indicates that water charges can be an effective instrument for water conservation. Holmes (1988) and Renzetti (2001) estimate econometric models which demonstrate that water treatment plant costs rise with decreases in water quality.

Gibbons (1986) reports on the use of linear programming models to base valuation measures on the marginal cost of recirculation and concludes that the values are typically quite low: $6–10/acre-foot (1980 US$) for cooling water and $16 to $75/acre-foot for process water applications. According to Renzetti and Dupont (2003), such methods are useful when data on water prices and quantities are not available. Under conditions of regulatory restrictions that restrict the firms' freedom to alter intake water quantities, estimation of a restricted cost or profit function in which water is treated as a quasi-fixed input, as conducted by Halvorsen and Smith, (1984 and 1986) is suggested. The estimated cost or profit function coefficients can then be used to calculate the shadow values for water.

2.2. Valuation of water as a good in the utility bundle if the consumers

Valuation of water as a good in the consumers' utility bundle has followed three approaches. These can be classified under two broad heads: the stated preference approach and revealed preference approach. Stated preference approach has only one component, which is popularly known as Contingent Valuation Method (CVM). This method involves the creation of a hypothetical market and by asking respondents about their willingness to pay for a change in their ambient environment, qualitative or quantitative (Mitchell and Carson, 1989; Kolstad, 1999). Under revealed preference approach, there are two categories, namely Travel Cost Method and Hedonic Pricing Method. Travel Cost Method estimates the value of an environmental resource through the amount spent by a consumer in visiting that resource. On the other hand, Hedonic Pricing estimates the value of a resource through the differentials in the property prices resulting from variations in ambient environments through location changes (Kolstad, 1999). Applications of such methods can be found in limited numbers for irrigation waters, in greater abundance for urban waters and in various non-use values of water.

2.2.1. Pricing of irrigation water as a good in the utility bundle of the consumers

Irrigation water has rarely been priced as a good in the consumer's utility bundle. Contingent valuation has not been used very frequently in the study of water for irrigation. The same can be said about Travel Cost Methods. The seemingly apparent inapplicability of such methods in valuing irrigation water (where

water is always to be seen as the input in the production process) has perhaps restrained research with these methods.

However, Hedonic Pricing perhaps seems to be one that can be applied in this case, though in a restricted manner. This has been used in *ex post* evaluations of irrigation projects and usually involves analysis of agricultural real estate values. An econometric model relating these values to all relevant variables is estimated. Of particular interest are the price differentials between irrigated and non-irrigated land with allowance for other factors influencing the market value of real estate like location and soil quality (Southgate, 2000). In the late 1980s, for example, Whitaker and Alzamora (1990) conducted a survey of real estate values to determine the premium offered for irrigated land in Ecuador. Their sample included parcels lying inside systems that account for three-fifths of the irrigable area of the country's government-run projects. Price data for similar parcels, close to but outside those same systems, were also collected. Per-hectare premiums were found to range from $367 to $3,897. The weighted average for 25 projects was $1,091 per hectare, which was a little less than half the average cost of irrigating that same land. That is, *ex post* evaluation revealed that irrigation investment in Ecuador had turned out to be quite inefficient.

2.2.2. Pricing of water supply to urban areas

The Contingent Valuation Method can be used to estimate the consumers' willingness-to-pay (WTP) for just about any environmental good or service, including clean water. Whittington (1991) and Whittington et al. (1993) have carried out contingent valuation studies of the WTP of households for improved sanitation services. The same approach can be used in potable water valuation. Whittington et al. (1990) have estimated the WTP of the consumers for water services in a case study in southern Haiti. Jordan and Elnagheeb (1993) have examined the WTP for improvements in drinking water quality. Ragan et al. (1993) provide estimates of the damages from residential use of mineralized water. Dasgupta (2003) uses contingent valuation methods for evaluating safe water supplies for urban households in Delhi. Esrey et al. (1991) have talked of the effects of improved water supply and sanitation on various diseases like ascariasis, diarrhoea, etc.

Musser et al. (2003) discuss contingent valuation methods as providing useful information for resolving disputes related to drinking water. Altaf and Hughes (1994) also conducted another Contingent Valuation Study for measuring the demand for improved urban sanitation services in Ouagadougou, Burkina Faso. Stewart's (1996) study on the valuation of Sierra Nevada is one of the most comprehensive ones, and deserves mention in discussions on urban water valuation. Harris and Tate (2002) present a detailed analysis of the economic aspects of municipal-water servicing. The report initially reviews some of the economic theories related to water management, and then describes water quantity and quality issues in Ontario, closing with selected estimates of pollution related costs to water utilities. Billings and Day (1989) and Billings and Jones (1996) have long been talking of the factors affecting urban water demand, and eventually, of frameworks for forecasting urban water demand. Pricing of urban water often involved block rates in several places of the world (Harris and Tate, 2002). Billings and Agthe (1980a, 1980b) have shown the methodologies and discussed the issues involved with price elasticities of water under increasing block rates.

3. Valuation of ecosystem services of water

In recent years, the services provided by the natural ecosystems have interested economists, independent of their values in traditional economics. While the ecologists and professionals working in

the area have been identifying the list of services provided by the ecosystem over time (e.g. Holdren and Ehrlich, 1974; Ehrlich and Ehrlich, 1981), there remains a lot to be done. Despite the extensive interests generated worldwide, the contributions of water as an input in the sustenance of diverse natural ecosystems have not been properly appreciated. As a result, the identification and recognition of ecosystem services by water still remains an emerging area of research. In this context, what is often missing is the understanding that provision of environmental water allocation or environment flow requirements means striking a balance between allocating water for direct human use (e.g. for agriculture, power generation, domestic supplies, industry, etc.) and indirect human use (maintenance of ecosystem goods and services) (Acreman, 1998; Smakhtin et al., 2004). With increasing diversion of water from the natural aquatic systems, striking a balance between the needs of the aquatic environment and the needs for diversion of water is becoming critical in many river basins of the world (Postel et al., 1996; Vörösmarty et al., 2000; Naiman et al., 2002). The Millennium Ecosystems Assessment has further stressed the need for the valuation of ecosystem services for water (Aylward et al., 2005). While, in general, the ecosystem services provided by water hardly gets recognized in the reductionist visions of policy making, policymakers in the developed world have slowly realized the extensive value that ecosystem services can provide.

One of the initial attempts discussing economic valuation of ecosystem services was *Proposed Practices for Economic Analysis of River Basin Projects* by the Committee on Water Resources in 1958 (Bingham et al., 1995). Valuation of ecosystem continued throughout the next decades (de Groot et al., 2002), but the focus of research has expanded greatly since two publications helped the subject gain popularity. The first is a book, edited by Daily (1997), which discusses ecosystem services, their valuation, and provides several case studies. The second is a paper by Costanza et al. (1997), which came up with a value of $33 trillion for ecosystem services across the globe by extrapolating with previous and new data. Though their methods and result were criticized, the papers served their purpose by drawing attention to and provoking discussion on ecosystem service valuation.

3.1. Ecosystem services provided by water

Ecosystem services provided by water involve the aquatic ecosystems, such as rivers, wetlands, estuaries, and near-coast marine ecosystems, from which people receive a great variety of benefits. These benefits are provided for both goods and services. Under ‘goods’, Dyson et al. (2003) include clean drinking water, fish and fibre, while under ‘services’, the components are water purification, flood mitigation, and recreational opportunities. Rivers and other aquatic ecosystems need water and other inputs like debris and sediment to stay healthy and provide benefits to people. Environmental flows are vital for the health of these ecosystems (Dyson et al., 2003). Unavailability of these flows injures the entire aquatic ecosystem, and thus, deprives the people and communities who depend on it. What stands as a danger in the long run is that the long-term absence of environmental flows puts at risk the very existence of dependent ecosystems, and therefore, the lives, livelihood, and security of dependent communities and industries.

Existing literature clearly reveals that quantitative knowledge of changes in ecosystem functions does not exist in as much detail as required. Without knowledge getting ubiquitous over time and without the development of user-friendly procedures to quantify ecosystem services, the interdisciplinary knowledge on water systems and practice of integrated water resources management will remain inhibited. One important process on which attempts for quantified modelling have been made is that of the self-purification potential of the river flows. The load of agricultural nutrients on aquatic ecosystems has increased considerably during the last few decades. This puts an extra load on the potential for self

purification available in river flows (Mitsch and Gosselink, 2000). Thus, in studies on ecosystem services, the self-purification potential is frequently evaluated (Bystrom, 2000 and 1998; Gren et al., 1997).

Dyson et al. (2003) discuss various methods for defining water requirements needed to maintain the ecological processes. The same has previously been set by Dunbar et al. (1998). Tharme (1996) and Arthington et al. (1998) provide reviews of these methods. Smakhtin et al. (2004), in a seminal attempt, summarizes the results of the pilot study on global assessment of the total volumes of water required for such purposes in the river basins of the world. These volumes are referred to as *Environmental Flows Requirements* (EFR).

Previous studies on environmental water requirements have used purely hydrological methods, which derive environmentally acceptable flows from the traditional hydrological point of view and use limited ecological information or the eco-hydrological knowledge base (e.g. Richter et al., 1997; Hughes and Münster, 2000) to multidisciplinary, comprehensive methods like functional analysis, involving expert panel discussions and collection of significant amounts of geo-morphological and ecological data (e.g. Arthington et al., 1998; King and Louw, 1998).

3.2. **Economic valuation of ecosystem services of water**

One of the most comprehensive reviews of literature on economic valuation of the ecosystem services of water has been done by Dalton and Cobourn (2003). The existing body of literature on such issues needs to be seen under three heads: the theory behind ecosystem service valuation, application of ecosystem service valuation, and multifunctional attributes of agriculture and ecosystems valuation. This classification continues in the work of Dalton and Cobourn (2003). The theoretical approach for the valuation of ecosystem services is, by far, the largest section of the review because the bulk of the work on ecosystem valuation has been theoretical or analytical. However, attempts to empirically value ecosystems services have been limited in number. On the other hand, studies on ecosystem service valuation in areas such as the measurement of the multifunctional attributes of agriculture provide a contrasting view of how to expand the value of agricultural production into food and functional values.

3.2.1. Theory of valuation of ecosystem services

Despite movements toward collaborative research at the interface of environmental sciences and economic sciences, the differences in delineations of structures and contents of the two disciplines of environment and economics often act as impediments in transcending disciplinary boundaries. However, the value of ecosystem services can be a useful guide when distinguishing and measuring trade-offs between society and the rest of nature are possible and where they can be made to enhance human welfare in a sustainable manner. While win-win opportunities for human activities within the environment may exist, they also appear to be increasingly scarce in a 'full' global ecological-economic system. This makes valuation all the more essential for guiding future human activity. Farber et al. (2002), while talking of economic valuation versus ecological valuation, feel that while economics talks of values in various terms like use, exchange, labour, utility, scarcity, etc., ecology relies on energy theory of value. The paper discusses critical zones or threshold conditions for ecosystems-nonlinear relationship. This leads to the idea that there is an insurance premium that society could pay to avoid a natural catastrophe. In another paper, Limburg et al. (2002), distinguishing between the ecological modes of valuation and economic valuation, suggest that as an ecosystem approaches a state of rapid bifurcation (non-marginality), ecological methods of valuation are more appropriate than economic valuation. This suggests a combined system based on both forms of valuation, depending on where the system is for its marginality.

Bockstael et al. (2000) state that value must be stated in comparative terms – the answer to a question should involve two clearly defined alternatives. "Compensation measures cannot be defined in isolation. They are entirely dependent on the context and may change as there is change in one or more elements of that context" (Bockstael et al., 2000: 1385)]. Therefore, the need to be specific about both the default and changed situation arises.

Hannon (2001) attempts to model the ecological and economic systems into an "input-output" framework. He assumes that the system is static, linear, and requires a system-equilibrium assumption. However, he does not discuss computation of biological costs. The three core competencies of this paper are delineation of metabolism as net input of the ecosystem, use of economic techniques to evaluate metabolic costs, and addition of lost capital to the net output definition to determine the system efficiency.

Alexander et al. (1998) assume "weak complementarity" that implies that ecological services are absolutely essential in production and consumption – their value can be as much as the surplus generated in all production and consumption processes. In an interesting discussion, Wilson and Howarth (2002) proposes that valuation of ecosystem services should be elicited through free and open public debate to enhance the social equity of the final decision, in contrast to other methods that rely on individual estimates of WTP or WTA. Farber and Griner (2000), in a critical attempt to value ecosystem change using conjoint analysis, feel that the methodology is more appropriate for ecosystem valuation than any other because it allows the valuation of "complex multi-attribute values to people" (Farber and Griner, 2000: 1408). Eventually, they have shown its application in a watershed quality study. However, later on, there have hardly been attempts to evaluate environmental change with this methodology, maybe because of the difficulty of administration and understanding.

Kaiser and Roumasset (2002) estimate the value of indirect ecosystem services that do not contribute to the production of a well-valued final good (e.g. public goods) in their study on valuing tropical wetlands by using shadow prices, calculated from an optimizing model to estimate the discounted net present value of water resources with a conservation policy and without the conservation policy, respectively. Their economic model involves consumer surplus formulation.

Some other notable attempts on the theoretical approach to valuation of the ecosystem services have been those by Antle and Capalbo (2002), Ando et al. (1998), Hawkins (2003), Simpson (2001), and many others. Antle and Capalbo (2002) demonstrate the limitations of using economic-decision models that are not integrated with biophysical processes by using an example from Ecuador.

Simpson (2001), while delineating a conceptual framework, expresses that the data with which to implement them empirically is generally not available. Conceptual frameworks in these lines have also been developed by Ghosh and Bandyopadhyay (2003). Ghosh and Shylajan (2005) posed a theoretical model of stream-flow depletion and pollution affecting the mangroves and fisheries negatively, and they, eventually, propounded a principle based on which "compensation" can be paid to the fishermen. There is no doubt that theoretical models have their own novelties, but what constrains their real-life applications is the understanding of the complex ecological processes, which further acts as an impediment for data availability. Resultantly, the theoretical models have often been incomplete, and could have been improved even in theoretical terms to incorporate greater ecological functions.

3.2.2. Application of ecosystem service valuation

Research on the application of ecosystem service valuation has, indeed, been limited for the obvious reasons stated above. At the same time, the few that has happened have been criticized on various

methodological grounds. Klauer (2000), based on an analogy between the ecological and economic systems, uses mathematical economic price theory and applies it to ecosystems to derive values based on gross ecosystem outputs. It has been inferred from this study that estimated prices are not comparable to economic prices because neither are there any relation to individual evaluations nor are they comparable over time (and structural changes). Flessa (2004) estimates that ecosystem service value of the Colorado water is $208 per acre-foot ($0.17 per cubic metre). He thus concludes that the ecosystem cost of $208 per acre-foot ($0.17 per m3) is a hidden subsidy currently paid through the loss of nature's services to society. Lazo (2002) presents a comprehensive delineation of the valuation of ecosystems and provides an overview of methods for the valuation of ecosystem services. The study uses methods from non-market valuation to scale potential restoration projects.

However, the paper that has been the most referred as well as the most criticized in this purview is that by Costanza et al. (1997). They have compiled more than 100 studies that estimate the ecosystem services of various biomes. Then, they have obtained the values of these services using one of three methods: the sum of consumer and producer surplus, producer surplus, and product of price and quantity. They multiply these values by the surface area of each respective biome to generate an estimate of the total value of all ecosystem services. They estimate the total value to be in the range of $16–$54 trillion. Pearce (1998), in a critique of Costanza et al.'s paper, expresses that the latter have violated all principles of economic valuation. The results are inconsistent with WTP as the estimates ($33 trillion) exceed world income. They focus only on benefits of protecting environment, not costs. They do not conduct a marginal analysis, and "find the value of everything", but WTP is for relatively small changes, not the extensive changes that Costanza and his co-authors assume. The paper has also been criticized on methodological grounds, especially with the assumption that there are no irreversible environmental thresholds, and there is no interaction between services (Dalton and Cobourn, 2003).

One of the comprehensive publications by Chopra et al. (2003) has devoted a substantial portion to ecosystems services valuation in the Indian context. Moreover, in policy response options on the linkages between ecosystem and human well-being, Chopra et al. (2005) have emphasised the urgent need for valuation of the development environment linkages.

The other notable studies are summarized in table 1.

Table 1: Some notable studies on the valuation of ecosystem services of water

Author	Methodology Classification	Summary
Kaplowitz (2000)	Contingent valuatic methods	Empirical test of the use of focus groups versus individu interviews to identify and value ecosystem goods. Examir hypothesis that focus groups and individual interviews, all el being equal, "reveal similar sets of information about a share mangrove ecosystem" (171).
Kerr (2002)	Informal person interview	Looks at watershed development projects initiated in India und various types of organizations and qualitatively analyzes th impact of those projects on the poorest sector of societ Women and the poorest in the villages were hurt the mos where public lands are closed to use for revegetation.

Chomitz et al. (1998)	Analysis of financing Environmental services	Details particulars of Costa Rican federal programme for fo forest benefits: biodiversity, carbon sequestration, watersh protection, ecotourism, and scenic values.
Kumar et al. (2003)	Production function approaches	Evaluates groundwater recharge through the agricultur production in the floodplains of the Yamuna river in t corridors of Delhi.
Pan et (2002)	Ecological functic analysis and indire valuation methods	Attempted to estimate the Baoan lake ecosystem services (C fixation, O_2 release, nutrient recycling, water conservancy a water supply and SO_2 degradation) and its indirect econom values on the basis of ecological function analysis and econom methods.
Sekar (2003)	Contingent valuatic methods and hedon pricing methods	Conducted for Kargambathur village of Vellore district in t state of Tamil Nadu in India to assess the effects of deteriorati of the Palar river due to pollution from the leather industry.

3.2.3. Multifunctional attributes of agriculture and ecosystems valuation

It is often difficult to distinguish between the studies mentioned in the previous section discussing the application of ecosystem service valuation and the category delineating the multifunctional attributes of agriculture and ecosystems valuation, because both are mere applications. However, this sub-section takes into its fold the various attributes of agriculture to value the ecosystem services of water. Although agriculture's primary function is the production of food and other commodities, it is also the source of many non-commodity outputs. Most agricultural commodities are traded on well-organized markets. In contrast, most non-commodity outputs, such as food safety, contributions to the environment, landscape amenities, and cultural heritage are not traded on such markets. Despite this, non-commodity outputs are clearly valued by the inhabitants of rich countries, and that valuation appears to increase as their incomes and wealth rise (Blandford and Boisvert, 2004).

Chopra and Adhikari (2004) have attempted to model the development-environment linkage in a simulation framework. They have formally brought out that supply of ecological resources are determined by technological, physical, and ecological factors, while a series of behavioural and institutional variables have an impact on the demand for such services. The methodological problems in such attempts might be numerous. However, both the interests of ecologists and economists have been reconciled in this paper by investigating the nature of linkage between the economic value and the ecological value in Kaoladeo National Park.

The existing strands of literature reveals the prevalence of interesting methods of obtaining value of the watersheds ecosystems under this head. Some of the more popular methods include producer surplus approaches, dynamic programming models, and contingent valuation methods. A few studies under this head have been summarized in table 2.

Table 2: Studies on the multifunctional attributes of agriculture and ecosystems valuation

Author	Methodology Classification	Summary
Pattanayak and Kramer (2001)	Producer Surplus Approach	They have generated estimates of the value of forested watersheds in terms of drought mitigation by estimating the impact of a change in base-flow on agricultural profit through increased production of coffee and rice.
Portela and Rademacher (2001)	Dynamic Programming and Simulation	Examine four ecosystem services in Brazilian Amazonia's river drainage basin, including climate regulation, erosion control, nutrient cycling, and species diversity. Use estimates from Costanza, et al. to value the four services.
Smith et al. (1998)	Contingent Valuation Method	Look at the possibility that small-scale farmers in Peruvian Amazon could provide carbon sequestration services. Taxation is considered an undesirable alternative because of equity considerations and enforcement difficulties.
Peterson et al. (2002)	Commentary on the Policy Perspective	For an open economy, output subsidy is only efficient if all multi-goods have positive social values, and production of non-commodity outputs is fixed in proportion to production of commodity outputs. Decoupled policies only work if every input can be allocated separately in the production of either public or private goods.
Babcock et al. (1997)	Commentary on Valuation Tools	Examines implications of using alternative decision rules that do not maximize total environmental benefits (cost, benefits, and C/B ratio targeting). Infer that Benefit Ranking is superior to Cost Ranking, in most cases.
Horan et al. (1999)	Commentary on the effects of Valuation	Literature deals with economic efficiency and gives no weight to farm income objectives that are important in designing a green payments programme.
Helfand and House (1995)	Production Function Approach	Estimates the losses due to the use of second-best regulatory instruments when pollution sources vary in characteristics, as applied to lettuce production in California's Salinas Valley.
Randall (2002)	On Valuation Methodologies	A commentary stressing the need for right valuation to remove inefficiency.

4. On the notion of "scarcity value" of services

"Scarcity Value" of services as an environmental resource has remained a neglected concept, with its implicit and infrequent mention in the literature. Values arise due to the shortages of the resource under consideration and act as a monetised scarcity signal (Batabyal et al., 2003). Though Batabyal et al. (2003) are the initial ones to explicitly realise that there are differences between total value and the value of

scarcity, the concept of the implicit allusions of scarcity value can be found in the concept of Ricardian rent (see Ricardo, 1817) where rent increases because inferior quality of land is

being brought into the fold of the production process, resulting in diminishing productivity of the marginal land. However, existing literature has hardly recognised this phenomenon.

Despite that, ever since the time of Ricardo and Malthus, economists have explicitly discussed the concept of the scarcity of economic resources. The basic economic resources turned out to be natural endowments (e.g. land, water, forest, etc.). Such environmental resources are becoming scarce over time with the swiftness of human consumption, and the typical irreversibility thereof on a time scale of interest to humanity warrants substantial prudence in human predatory behaviour (Daily, 1997; Daily et al., 2000). While the concept of scarcity implicitly remained in the analysis of the classicists and neo-classicists and never came to the forefront, it was finally formalised by Hotelling (1931). Hotelling showed the mechanism by which a market price serves as a signal of scarcity. Interestingly, though it was not explicitly present in the works of other market economists, it remained dormant in their analysis. Barnett and Morse (1963) extended this work by demonstrating the way in which the increasing price associated with increased scarcity actually mitigates the scarcity problem.

However, in all these works on scarcity, the focus has primarily been on the scarcity of the exhaustible resources for which well-functioning markets exist. Environmental resources are non-market goods; hence, the market system has no say in their price determination. Therefore, there is no readily available price or non-price signal that can serve as an indicator of scarcity. Costanza and Folke (1997) and Goulder and Kennedy (1997) point out that important ecological phenomena that affect the scarcity of ecosystem services are often not incorporated into prices. Batabyal et al. (2003) point out that although ecologists are aware of the complex dynamics of the environmental system, they rarely consider the behavioural forces that influence individual decision making. By focussing on scarcity of the provision of ecosystem services, both ecologists and economists will be able to find a common ground that can be the basis for meaningful future research toward the formulation of environmental policy.

While economics is the study of efficient allocation of scarce resources, one of the necessary steps toward achieving the same is to understand the scarcity value of these resources. Unlike a few exhaustible resources like fossil fuel and minerals, many other natural resources are often found to be independent of the market system with their scarcity values not incorporated in the market prices. To incorporate these scarcity values in the valuation, environmental economic approaches have been suggested lately. Though these valuation techniques can do an adequate job of measuring the scarcity of environmental resources in the manner in which they contribute to the production of economic goods, except the efforts by Batabyal et al. (2003), there hardly exists any other worthwhile effort to explicitly measure the value of scarcity rather than the total use value of the resource.

Saleth (2001), while talking of the problems of water pricing, refers to the difference between scarcity value and the total market value (as given by cost) of water. The total cost signals the scarcity value and opportunity cost of water and guides allocation decisions within and across water sub-sectors. Hence, he advocates that the financial function requires water rates to cover the cost of supplying water to users. As in practice, the supply cost is obtained by adding the operation and maintenance costs and the capital costs of constructing the system. However, full cost recovery also requires water rates to reflect the long-term marginal cost (the cost of supplying an additional unit of water including the social cost of externalities). Thus, Saleth (2001) implicitly refers to the scarcity value of the ecosystem services provided by water along with the scarcity value of the economic services. While talking of water pricing policies, Saleth (2001) highlights the role of scarcity value in the following words,

"...The economic and allocative role of water pricing requires water rates to capture the scarcity value (or the marginal productivity/ utility) and to equalize the opportunity costs (the value of water in its next best use) of the resource across uses. As water moves from [the] least productive to [the] most productive uses, places, and time points for efficient allocation, there will be a convergence of the scarcity value, opportunity cost, and long-term marginal cost of the resource. Unfortunately, such a convergence is rarely seen in practice. …Water rates are still subsidized even in countries with a relatively mature water economy such as Australia, Israel, and the United States. This is rooted in the political economy of water as powerful state and user interests often oppose charging the full cost of water. As a result, the gap is vast between the observed water rates and the ideal economic prices of water, as reflected by its scarcity value and opportunity cost".

The notion of "scarcity value" of water emerges more explicitly in a document published by CIE (2004). It clearly states that for water to acquire a "scarcity value", the supply of water must be a limiting constraint to economic activity. In such circumstances, a marginal reduction in access to water will reduce the profitability, wealth, or other measure of economic welfare of the entitlement holder.

Scarcity values have often been referred to as resource rent or scarcity rent. These terms are used to refer to the returns or imputed values of natural resources – that remain after all user costs – have been accounted for. For renewable resources such as water, scarcity rent equates to the above-normal returns to using water in a production process (CIE, 2004). Normal returns are defined as the earnings needed to cover long-term costs, including labour and other variable operating costs (including water charges); overheads, including depreciation and the cost of capital; a 'normal' rate of return on capital that is the minimum rate of return required to hold capital in the activity (sometimes referred to as normal profit); and a margin to cover risk (CIE, 2004). Above-normal returns are defined as the returns in excess of all the costs listed above. They are the surplus above returns that are necessary to retain the use of inputs in the production process. Scarcity rent to the use of water in a particular activity is only available where there is a surplus after all other costs, including water service charges, have been accounted for. The entitlement to take and use water will have value as an asset if these surpluses are expected to be positive, either in their current use or when traded to another (CIE, 2004).

According to Ghosh (2005), the notion of the scarcity value of water should be interpreted as the "unmet demand" for water. Ghosh (2005) has shown how a non-responsive scarcity value to water use in the Cauvery and the Colorado basins has resulted in conflicts over water resources in the basin. Hence, Ghosh and Bandyopadhyay (forthcoming) recommend that in a situation of "non-satiable" water demand, supply augmentation plans can only aggravate the hydropolitical condition in a basin, resulting in enhanced conflicts.

In the previous two sections of this chapter, we have discussed the valuation of economic and ecosystem services of water. It should readily be realised that like total value of water, *scarcity value* of the services can arise from both the economic services of the resources and the ecosystem services of the resources. Due to scarcity of water, losses occur in both economic and ecological services. *Scarcity value* can capture the loss of value in each of these services.

5. From "scarcity" to "scarcity value"

It is clear that the changing water paradigm with its shift away from sole or even primary reliance on finding new sources of supply to deal with perceived new demands, emphasizes incorporation of ecological values into water policy, re-emphasizes the meeting of basic human needs for water services, and consciously breaks off the ties between economic growth and water use (Gleick, 2000). The vision

of the need and demand for water as an input in production and social life implies a partial view that fails to consider the implications of the status of water after use (Falkenmark et al., 2004).

A very large proportion of humankind lives downstream of other communities and entire human race stays downstream of precipitation. Indiscriminate upstream activities have often caused problems to the downstream communities, not only because of quantitative loss but also due to losses in qualities. "Reuse of water could be possible in a quantitative sense, but if quality is affected through previous uses, reuse is associated with various costs and hazards" (Falkenmark et al., 2004).

The consideration of the term "scarcity" confines the analysis to the quantitative physical availability of water, without giving much consideration to its qualitative aspects. "Scarcity" mitigation exercises were conducted through supply augmentation plans. This vision dominated the old reductionist vision that existed in the form of what has been called "arithmetical hydrology" (Bandyopadhyay and Perveen, 2004). This is what was being followed in the two basins analyzed in this thesis. This thesis exhibited that the social cost imposed by addressing "scarcity" defined in terms of physical availability of water is a conflict between stakeholders.

Under the new holistic paradigm of "eco-hydrology", the importance of supply augmentation is slowly but steadily getting reduced, and demand management has started taking its place. Notionally, as well as in practice, demand management occurring under scarcity (either through virtual water imports or through other measures), does not mitigate scarcity, but allows for a process of "adaptation" to the scarce conditions. It allows for "playing on the will of nature", rather than "playing against the will of nature". For example, as argued in this thesis, regions under chronic water scarcity, like the Cauvery basin, would be under further stress if it produces high water-consuming crops like rice. Similarly, the Colorado basin produces a high water-consuming fodder crop like alfalfa. These regions should grow low water-consuming crops that are more suited for water availability. By raising less water-consuming crops in the region, scarcity is not mitigated, but scarcity value of the concerned high water-consuming crop is lowered because the unmet or excess demand of water for producing the water-consuming crop goes down.

Israel is the ideal case where one can always explain the attempts to reduce economic "scarcity value" of water, rather than scarcity mitigation. If one looks at scarcity in the region for low physical availability of the resource, one would be horrified to note the state of affairs. Yet, "scarcity value" mitigation through appropriate strategies has totally changed the profile of Israel, thereby calming down the hydropolitical tensions with Jordan and Palestine. Agricultural (virtual water) imports have played a crucial role in this context.

It needs to be understood that "scarcity value" is a holistic measure of not only the state of the resource, but of every type of intervention that can occur on the resource, which rarely gets captured by the notion of "scarcity". The part of the world, where policies are fundamentally based on "arithmetical hydrology", there remains the utmost need to understand the "scarcity value" of the services that water creates. What is intended to be presented in this discussion is that the shift from the old paradigm to the new paradigm should be understood as the shift from dealing with "scarcity" to understanding "scarcity value".

5.1. Development of derivatives markets

One of the important implications for scarcity value framework will be the development of a derivatives market for water resources. This can be thought of in the framework of a futures market for water

resources where standardised contracts can be traded. This can have considerable significance for dispute resolution and scarcity mitigation. An efficient futures market for water can help in discovering the price of water. With proper information dissemination, this price will reflect upon the scarcity value of the resource. On the other hand, on the expiry of the contract, rather than physical delivery of the resource (unless a hedge has been rolled over), the settlement can take place at the scarcity value, which will be reflected by the estimated loss due to water scarcity (Ghosh, 2008). This will ensure both liquidity of the contract, and can also help to resolve water-related conflicts.

6. CONCLUSIONS

There, however, remains no doubt about the fact that despite the growth of conceptual literature on valuation of ecosystem services, empirical applications have taken place in restrictive numbers. When applications have adopted production-function approaches, the valuations of the ecosystem services have been arrived at by considering a marketed product (in most cases, agricultural). This involves the framing of an agricultural damage function, which is taking place due to effluent emissions (e.g. Kumar et al., 2003; Sekar, 2003). This leaves out an entire range of ecosystem functions that are provided by resource for the sustenance of the planet. Due to the lack of the "optimal" integration of economic sciences and the biological sciences, such an application has not been possible.

At around the same time, the problem with the creation of the best types of models to delineate a framework of the working of interrelationships of the various ecological systems has restricted growth of literature on such applications. The uses of Contingent Valuation Methods, however, are prone to yield hypothetical results because they are based on hypothetical markets. It has also proved highly vulnerable to response biases and individual whims. One must remember that revealed preference methods like Travel Cost and Hedonic Pricing cannot reflect the value of ecosystem services, as market awareness of the ecosystem services has been traditionally low.

On the other hand, all these methods that attempt to evaluate the various functions of water through the utility approach are actually valuing "scarcity", and not the absolute values of water. For non-market methods like contingent valuation methods, the question asked to participants is about their WTP for qualitative or quantitative improvements in the ambient environment. Such a question is being asked to reveal something that does not exist, or to reflect upon the scarcity of the improved quality of the environment. For revealed preference approaches, like travel cost, there is an implicit attempt to put a value on the environment that does not exist in the proximity of the agent. Even for hedonic pricing, somehow it is "scarcity" of the resource that is being valued.

Finally, let us conclude our discussion on valuation by focusing on valuation of Integrated Water Resources Management (IWRM). Valuation of water resources is an important instrument for IWRM As argued in various contexts, valuation can help comprehensive assessment of water development project by keeping the integrity of the full hydrological cycle through a holistic evaluation of economic and ecological systems. On the other hand, it is also argued that that prioritisation of water needs can also be done through valuation. For the new economics of water, valuation provides a new basis of water use and a means to understand and evaluate the emergence of institutions. Hence, to offer the right type of basis for an interdisciplinary knowledge base, it becomes essential to emerge with the right type of valuation methods where one can compare the economic and ecological services of water to offer a benchmark for comparison. Our survey in this paper reveals that such attempts have so far been rare, but are emerging.

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Urbanization and peri-urbanization: Aggressive competition and unresolved conflicts - The case of Chennai city in India

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Abstract

The peri-urban areas have now become a highly contested terrain due to rapid urban expansion, demographic pressure, industrialization and the increasing natural resources crisis. The institutional vacuum prevailing in these areas further aggravates the intensity of problems in democratic countries such as India. This paper ventures to highlight the issue in the contest of urban and per-urban conflicts emerging in Chennai city. Following the introduction, Section 2 provides back ground information to the city such as urbanization process and delivery of urban services in Chennai city; Section 3 introduces the NEGOWAT project with objectives and methodology adopted; Section -4 discusses the overall nature and intensity of water conflicts in Chennai and peri-urban areas; Section 5 discusses the methodology, outcomes and difficulties encountered in developing multi-stakeholders' platforms and dialogues; Section 6 analyses water resources audits carried out in the context of Chennai and peri-urban areas. The last Section summarizes key lessons learnt and policy options available to move forward and to have more positive impact

Key Words

Peri-urban areas, NEGOWAT, water conflicts in Chennai, policy options

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Section 1 Introduction: Underpinning issues

According to the Registrar General and Census Commissioner of India, large areas of the country would become more urban by 2026 (Times of India, 8 August 2006). The urbanization rate is likely to go up from 27.8% in 2001 to 38.2% in 2026. What is worthy of note is that three-fourths of the population in the Tamilnadu State will turn urban in another two decades – much more rapid than the country's average. The urban and peri-urban conflict gains enormous significance in this context.

What is Peri-urban area? The peri-urban area is neither rural nor urban. This terminology is derived from the word `peripheral'. The expression peri-urban could be defined as fringe; edge city; urban stretch/sprawl; bordering villages. Effectively, these words also convey meanings of being *less important, incidental to main activities, outer edge, fringe to the main, spillover or over flown*. Nevertheless, the term peri-urban is not fully explicable because of complexities and ambiguities involved in it. Thus the Organization for Economic Co-operation and Development (OECD) in its report on peri-urban agriculture (OECD, 1979: 10) states as follows: *"The term peri-urban area, cannot be easily defined or delimited through unambiguous criteria. It is a name given to the grey area which is neither entirely urban nor purely rural in the traditional sense; it is at most the partly urbanized rural area. Whatever definition may be given to it, it cannot eliminate some degree of arbitrariness."* [1]

Of late, peri-urban areas have become a highly contested terrain due to rapid urban expansion, demographic pressure and industrialization. The institutional vacuum prevailing in these areas aggravates the intensity of problems in democratic countries such as India. Unplanned expansion of mega-cities and increasing scarcity of natural resources such as land and water for urban expansion have contributed to more intense conflicts and serious livelihood problems. The conventional notion that *cities are engines of growth* is not proving to be entirely true. On the contrary, growth of cities results in serious negative implications such as using rural and peri-urban areas as dumping yards for the wastes generated (solids, liquids and bio-medical), transportation of water, encroaching rural lands for urban expansion, transferring pollution loads etc.

As a consequence of all these, rural unemployment and poverty increases and livelihood options get shrunk. The direct outcome is the rural-urban and peri-urban – urban migration, which again intensifies pressure on urban infrastructure in cities such as housing, drinking water and sanitation, solid waste management etc. And, the vicious cycle continues. The need of the hour is to break this cycle: But how to break? What are the existing policy options? The present paper situates itself in the particular context of Chennai city in India. Motivation of the present

[1] "THERE IS AN INCREASING PERCEPTION THAT RURAL, PERI-URBAN AND URBAN ENVIRONMENTS OPERATE AS A SYSTEM RATHER THAN INDEPENDENTLY. MANY DEVELOPMENT SPECIALISTS CONCLUDE THAT RURAL DEVELOPMENT AND URBAN PLANNING ARE NECESSARILY LINKED ACTIVITIES. ACTIVITIES OR INTERVENTIONS IN ONE ARENA HAVE CONSEQUENCES, WHICH ARE OFTEN NEGATIVE, IN THE OTHER. AT THE SAME TIME, CREATIVE POLICIES CAN TURN LIABILITIES INTO RESOURCES AND BRIDGE THE RURAL-URBAN DIVIDE". D.L. IAQUINTA AND A.W. DRESCHER (HTTP://WWW.FAO.ORG)

exercise is to document and analyse water scarcity conditions in Chennai and nature and intensity of conflicts between Chennai and its peri-urban areas; the paper also explores to what extent multi-stakeholders' driven approach can provide long-term - sustainable solutions to growing problems of mega-cities such as Chennai.

The road map of the paper is as follows: Section 2 following introduction, provides back ground information to the city such as urbanization process and delivery of urban services in Chennai city; Section 3 introduces the NEGOWAT with objectives and methodology adopted; Section -4 discusses the overall nature and intensity of water conflicts in Chennai and peri-urban areas; Section 5 discusses the methodology, outcomes and difficulties encountered in developing multi-stakeholders' platforms and dialogues; Section 6 analyses water resources audits carried out in the context of Chennai and peri-urban areas. The last Section summarizes key lessons learnt and policy options available to move forward and to have more positive impact.

Section 2 Background information to the Chennai city

The Chennai basin is located between latitudes 12 °40'N and 13 °40'N and longitudes 79 °10'E and 80 °25'E in the Tamilnadu State of India. The Chennai basin consists of group of small rivers such as Araniyar, Kusathalayar, Cooum river, and Adyarriver. The total area of the Chennai basin is 7282 sq.km of which 5542 sq km lie in Tamilnadu and the rest in the adjacent Andhra Pradesh State. All the four rivers once brought fresh water in to the city. For instance, the Araniar, which runs to a total length of 132 km, drains an area of 1470 sq km of which roughly 50% falls within the state of Tamilnadu – finally joining the Bay of Bengal near Pazhaverkadu village. The Kusathalayar forms with the surplus from the Kaveripakkam tank (which is a part of the Palar Anicut system), across which Poondi reservoir has been constructed in 1945 with a view supplying drinking water to the Chennai city in the year 1945. The capacity of this reservoir is 77.91 Mm^3 or 2753 mcft below the Poondi reservoirs, two regulators were constructed (namely, Thamaraipakkam anicut in the year 1879, and Valur anicur in 1872) basically with a view to regulating water during flood seasons. While Cooum river takes from Kesavaram Anicut (constructed across Kosathalayar river in the upstream), the Adayar river carried the surplus water the Chembarambakkam tank. There was another water course – a man-made canal called Buckingham canal constructed in the year 1806 linking up various lagoons all along the east coast to a total length of 618 km of which 161 km lie within the State of Tamilnadu. During the past, it served as useful navigational purpose.

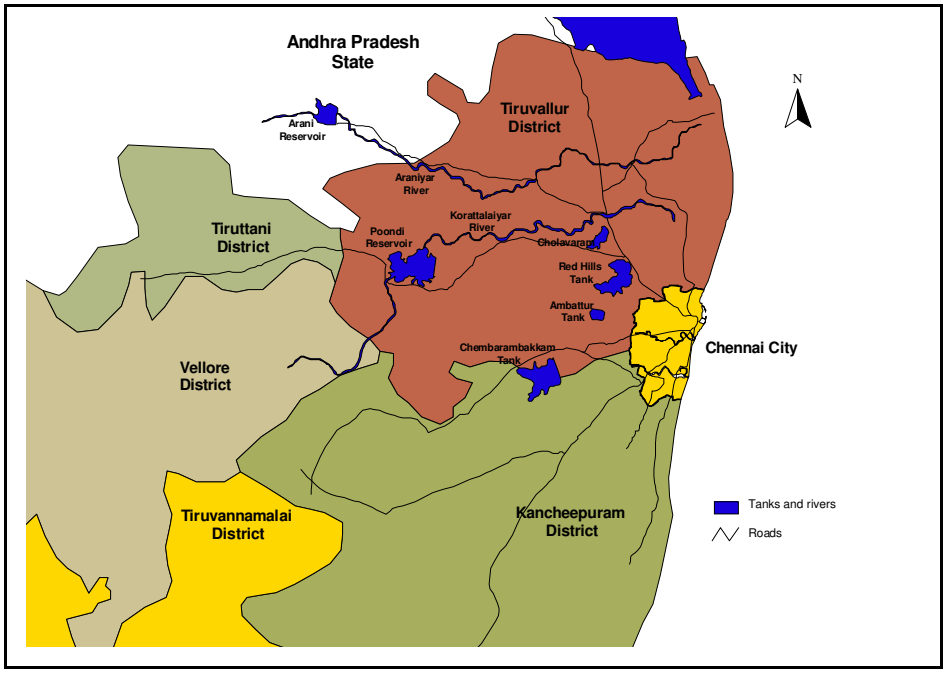
Major surface supply sources to the Chennai city are the following:

- Poondi reservoir – capacity: 77.91 Mm^3 or 2753 mcft
- Red Hills – a lake (formerly an irrigation tank) – has been one of the most important sources since 1870. Capacity: 80.65 Mm^3 or 2850 mcft
- Cholavaram – an irrigation tank until 1969 – contributes to the city's water supply- Capacity: 25.13 Mm^3 or 888 mcft
- Chembarampakkam – formerly an irrigation tank – currently contributes to the city's water supply. Capacity: 103.03 Mm^3 or 3645 mcft

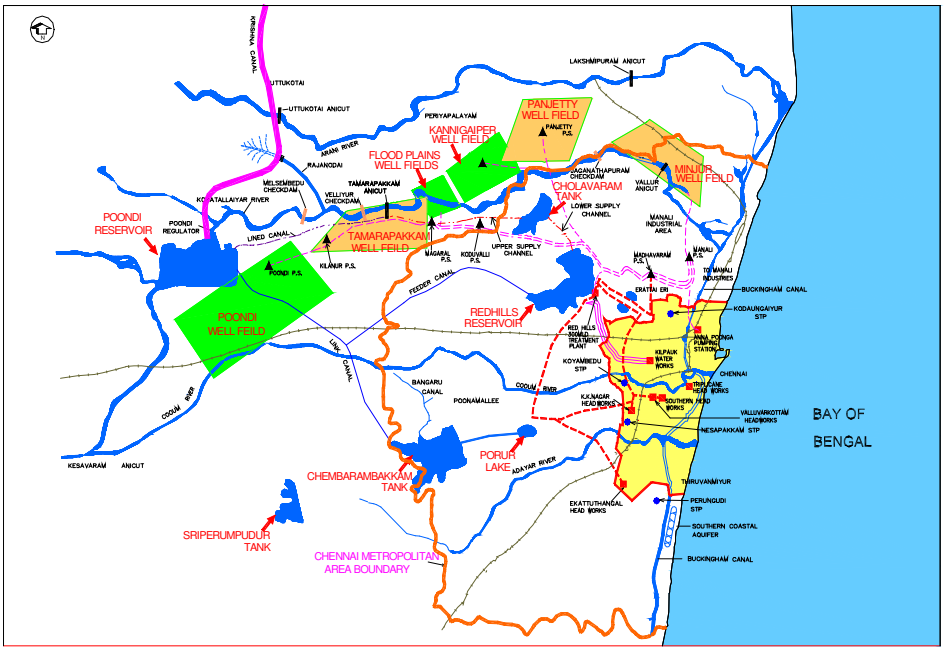
In recent times a few water supply augmentation measures have been implemented: They are Telugu Ganga project (to get water from Krishna basin from Andhra Pradesh state from a distance of about 400 km) and New Veeranam project to get water from the Veeranam tank

from a distance of over 250 km. In addition, a large number of well fields have been identified from the two adjacent districts of Tiruvallur and Kancheepuram which have been a big source of conflict between Metro-water Board and peri-urban villages. The latest attempt by the government (still in early stage) is desalination plants to generate 100 MLD (million litres a day) of water at a cost of 500 crores and another 150 to 200 MLD at a cost of Rs.1000 crores.

Map of city river basins and reservoirs



Map showing well fields around Chennai city's peri-urban areas



Water scarcity for the Chennai city is not new**.** The city has been historically water deficit due to lack of perennial river. Successive governments in the state of Tamilnadu have spent over Rs.40 billion on various drinking water supply augmentation measures to the city. The problem of water scarcity however continues to persist. The water supply in Chennai is hardly 76 lpcd (Litres per capita a day) which is the lowest compared to what is supplied in the major cities in India (Joel Ruet, Saravanan and Marie-Helene Zerah, 2002). But even this much supply is irregular. Only in exceptionally good years, 76 lpcd is supplied in an uninterrupted manner. In bad years (which are not infrequent for Chennai) water hardly flows through pipes but distributed through tanker-trucks in a haphazard fashion. In the month of July 2000, for example, piped water supply was only 59 lpcd. In response, the Metro Water Authority installed 4525 tanks and hired 400 trucks of 9000-12000 liter capacity to make water deliveries to under served areas.[2]

Acute water scarcity coupled with the inefficiency of the government has made those involved in water business rich in a short span of time. Needless to say, purified water companies are increasing in number in India. According to the Bureau of Indian Standards, 1200 bottling water companies are located across India of which 400 are in Tamilnadu and over 200 are in and around Chennai city. These companied make huge profits since they pay nothing towards license for groundwater extraction.[3] Furthermore, tanker-transport industry which directly involves in transport of raw water from peri-urban villages makes huge profits by selling water.

"A Rs. 600-crore tanker industry is capitalising on Chennai's acute water scarcity. Over 13,000 tankers are mining the surrounding farmlands for water".[4]

Chennai city does not have access to a perennial river and has to depend primarily on three major erstwhile irrigation tanks and one small reservoir across a river that brings floods only for a few days during the monsoon. All these sources together supply about 300 MLD in a good year. For the past two decades, during the dry seasons, these sources have had to be supplemented by groundwater pumped from agricultural wells located in peri-urban villages, contributing around 125 MLD. The current water needs of the city and its urban agglomeration are almost double, of the order of 750 MLD and, it is estimated that by 2011, at 100 lpcd, the city would require about 660 MLD for an estimated population of 6.6 million. For the rest of the Madras Urban Agglomeration, an estimated 300 MLD would be required for its 3 million populations. If the estimated industrial requirement in 2011 is also added (would be another 250 MLD) then the total requirement of the city and its extended urban areas would be of the order of 1210 MLD. This is only a conservative estimate. But the current supply from the surface sources is nowhere near what is needed.

[2] *The Hindu*, July 7th, 2000. see also Moench and Janakarajan (2004)

[3] http://www.digantik.com/IPs/Digantik/aishwarya/bottle-business.htm

[4] http://www.infochangeindia.org/agenda3_08.jsp

Chennai water balance

As per MMWSSB's (Madras Metropolitan Water Supply and Sewerage Board) website**:**

- Chennai gets an average rainfall of 129 cm, which is much more than the national average
- Only about 5% of this rainfall actually gets into the ground
- 80% of Chennai's groundwater has been depleted and any further exploration could lead to further salt water ingression
- north-east monsoon and surface run-off from the Araniyar and the Kortalaiyar rivers replenishes:
- Poondi (2.2 mts deep) - yield in normal year 76.7 Mm^3/day
- Sholavaram (3.4 m) - yield in normal year 22.5 Mm^3/day
- Red Hills (3.8 m) yield in normal year 71 Mm^3/day
- Total yield - 200 million litres a day (MLD)
- These reservoirs are shallow, spread over a total catchment area of 3,513 sq km.
- The water supply during years of normal rainfall is around 313 MLD (78 litres per capita a day, or lpcd) and during the drought years availability has been as low as 127 MLD (32 lpcd).
- Thus even during normal years there is shortage to the tune of 113 MLD for city water supply and this doubles during drought years.
- Industries in North Chennai and in particular in Manali industrial area are supplied about 125 MLD of water per day, which is roughly the shortage in normal years for city water supply
- To augment this shortage, (as per Metro Water website) Chennai City currently draws about 100 MLD of ground water from Arniar-Kortalaiar basin (AK Basin). The estimated sustainable yield from this basin is 100 Mm^3 per year but the current total extraction is 300 Mm^3 per year, three times the sustainable yield.
- It can thus be seen that the shortage for the city is the quantity supplied to the industries and this shortage is managed by overdrawal from the A.K. Basin, leading to sea water intrusion into the aquifer and shortage for local water users.
- The other side of the story is more depressing: The water transported from peri-urban villages to Chennai has created serious livelihood problems for them (Janakarajan, 2006):
- Continuous water transport, in order to supplement the city's drinking water needs; have drained water resources in peri-urban villages. Groundwater table has dropped to

a significant low and in many parts, groundwater is completely dried or reached a dead-end with hard-rocks. The existing surface water bodies are completely neglected or encroached. Many farmers have become heavily indebted due to heavy investment that has gone into the well irrigation without adequate returns

- This has affected seriously agricultural activities in the peri-urban villages resulting in shrunk in agricultural income. Employment opportunities have also reduced quite considerably. In turn, unemployment has emerged as a major problem in the villages. Landless agricultural labourers and marginal farmers started migrating to other villages and towns for want of employment; many have become a sort of foot-loose population migrating to cities and towns, creating pressure on the already stressed urban infrastructure

- While a small section is obviously gained in the last two or three decades – like those of water sellers, those employed in urban areas, traders, sand miners, brick manufacturers etc – a majority have been suffering due to lack of assured and gainful employment – whether farm or non-farm; Even water sellers who benefited a lot by selling water to the Metro Water Board started feeling the pinch of the crisis after drying up of their bore-wells. Quite a number of water sellers started constructing their houses when their business was good. At present these houses remain incomplete because of drying up of aquifers and cessation of contract between water sellers and Metro Water Board. Many of them have also purchased tractors on loan but at present remain in disuse because of lack of agricultural activities.

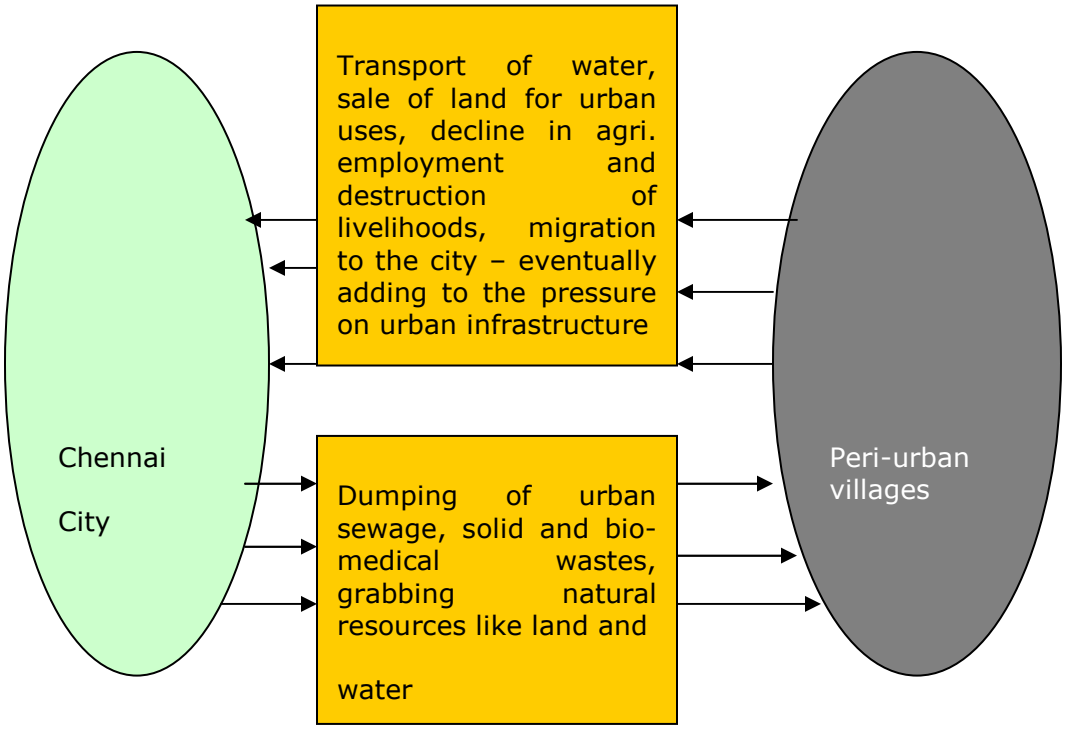
- Whatever non-farm job opportunities that have emerged in the peri-urban villages are only incidental and unplanned. Indeed, if at all anything such activities (like a sugar factory in PS village, many bottling water companies, brick manufacture, sand mining, chemical units etc. The most important question is therefore, what kind of abilities or the enabling environment that the peri-urban population (who are more vulnerable) possesses to diversify their livelihood strategies? An ability to adapt depends upon several factors such as education, transport net work, skill acquisition and so on. What concrete efforts are taken by the government to create this enabling environment?

Nevertheless, the urbanization process is quite rapid in Chennai: Many new housing colonies and settlement spring up in metropolitan areas without adhering to any plan or rules and regulation governing the Chennai metropolitan area. The haphazard development and growth or urban expansion has resulted in severe problems of management of civic amenities such as drinking water supply, sanitation, solid and sewage management etc. There are hundreds of civic associations in these areas, which struggle with local administrations (local Panchayats and municipal towns) to get the basic amenities. But the facilities provided are quite far from what is needed. Therefore not only the city but also the newly developing towns around metropolitan areas also choose peri-urban location for dumping their solid and liquid wastes.

On the whole what one encounters is a vicious cycle in which people migrate to the city for want of employment due to reasons such as drying up of groundwater resource, decline in agricultural employment and overall degradation in ecology and environment; On the other hand, the city experiences pressure due to increasing demographic pressure which in turn puts enormous pressure on urban infrastructure such as land, housing, drinking water, sanitation, solid, liquid and bio-medical waste management etc. Again in order to ease this pressure, the city keeps extending and thus the vicious cycle continues

(See Diagram 1)

Diagram 1: Pressure building between urban and peri-urban areas: The vicious cycle



Section -3 The NEGOWAT project –objectives and methodology adopted

Main Objectives

- The present project aims to document and analyze impacts of unregulated and unchecked horizontal urban expansion on natural resources, in particular water; its impact on poverty and livelihoods, ecology, environment, and on health conditions of people living in peri-urban areas.

- This project will also develop and test tools and institutional structures that support and enable effective stakeholder led water resources management for negotiating emerging conflicts and water rights. It aims to draw upon developments in Integrated Water Resources Management (IWRM), and decision support methodologies that can be readily understood and adapted to meet the needs of multi-stakeholder groups.

Methodology and tools of analysis

The methodology of the study has got different components:

- Broadly two segments of the Chennai peri-urban area have been identified: They are, A-K basin and Palar basin (for details of Palar and A-K basins, see Appendix 1 and 2)

- Besides official sources of data, a meso-level survey in these adjoining basins of the city (covering 23 villages and 41 villages respectively from Palar and A-K river basins) and a detailed survey in two villages (PS in the Palar and Magarel in the A-K basin) were conducted in 2004-05 with a view to collecting information on various aspects such as poverty and livelihoods, current and past water use pattern, nature, extent and history of rural-urban water market, impact of water sales on agriculture, employment, income, ecology and environment and so on.

- A water resource audit was conducted in Magarel village block and the Chennai city

- GIS was used for mapping over 2000 surface water bodies (tanks) in the two adjoining districts of Chennai city

- Agent-based Bayesian models or Bayesian networks, stakeholder analysis and conflict analysis were carried out to understand and characterize multi-stakeholder groups and their conflicting interests

- Development of stakeholder platforms and user groups for shared learning and for a sustained dialogue to promote stakeholder led IWRM

Section 4 Conflict analysis in Chennai and peri-urban areas

4.1 Background to Chennai peri-urban conflicts

The basic premise of the study is that water transport from peri-urban villages to the city has affected livelihoods in these villages due to declining agricultural activities and declining income. As a consequence, conflicts have occurred between urban and peri-urban interests. The key issues are, to what extent decline in agricultural employment is compensated by non-farm job creations in peri-urban villages? To what extent the conventional notion that *cities are engines of growth* is true?

Water transport from Chennai's peri-urban villages has a history of nearly four decades. The Metro Water Board started pumping groundwater from peri-urban villages in order to supplement the city's water requirement as early as in 1965. It identified rich aquifers (well fields) in the A-K basin as well as the Palar basin. The earliest well field identified was in Minjur (1965) in the A-K basin about 40 km north of Chennai. Not less than 100 MLD was pumped from the A-K basin well fields until recent times. Another 40 MLD was pumped from the Palar basin. Giant bore wells in these well fields were installed for round the clock pumping. The continuous pumping from these well fields has not only affected agriculture but also due to seawater intrusion entire aquifer has become saline. During peak seasons, the Metro Water transported at least 6000 tanker loads of water to the city from these well fields. Besides, numerous private operators also transported water from various peri-urban villages to supply many commercial establishments, hotels, construction sites and hospitals.

However, since the year 2000 the Chennai and its peri-urban villages were facing continuous drought as a result of which water table and water yields have started declining. Therefore, with a view compensating reduced yield of water, the Metro Water Board has started purchasing water from private agricultural wells. Over 180 private agricultural wells were identified from whom water was purchased at a price of Rs.25 to Rs.40 per tanker-load (depending upon season and quality of groundwater). From each well at least 10 to 18 loads of water was pumped (0.1 to 0.2 MLD). Many of these wells connected to the existing Metro Water

transmission system (include some pictures). The total estimated cost of hiring these agricultural wells is Rs.85 million per year including the cost of civil works, hiring charges and current consumption charges.[5]

In addition to the state agencies, the private operators and water companies also pump groundwater either to sell raw water or to sell bottled water after purification process. Everyday, at least 3000 tanker loads of water go into the city to meet the needs of multi-storied apartments, hotels, hospitals, other commercial establishments, construction activities etc. During peak summer months this number shoots up steeply. Furthermore, there are over 400 bottling water companies around the city, which suck a good deal of groundwater for commercial purposes.

The main reasons for conflicts in the peri-urban areas of Chennai are:

- Urban stress is transferred to peri-urban areas as a result of which there is a drain in natural resources such as land and water
- Mushrooming of urban settlements and housing colonies in PU villages results in escalation of drinking water demand and poses a much big threat in disposing of solid wastes and wastewater[6].
- This problem gets aggravated due to institutional vacuum in peri-urban villages; urban infrastructure such as good roads, drainage facility and sanitation, solid waste management and so forth are a far cry in these areas. The existing democratically elected bodies such as Panchayat suffer from lack resources and support from government
- Industries relocate to peri-urban regions due to better land and water availability
- Land in the peri-urban areas is bought for urban use resulting in dramatic changes in land use pattern
- Increasing urban activities in the peri-urban areas leading to pollution and degradation of natural resources
- Changing land use leads to fall in agricultural employment in peri-urban areas, weakens agriculture and causes serious livelihood problems
- The village commons — land and traditional water bodies such as tanks— are either encroached upon or suffer from total neglect
- While need for infrastructure grows in peri-urban villages, the prevailing institutional vacuum leads to overall frustration which reflects in widespread conflicts and unrest

[5] Nevertheless, there was a huge gap between demand and supply. While what is supplied in a normal year is to the extent of 400 mld, the total demand for the city, the rest of Chennai urban agglomeration and for industrial use is of the order of 1300 mld @ 100 liters per capita. The projected demand in 2021 is going to be around 1763 mld (Metro Water Board, Chennai, 2006).

[6] For more details on solid and bio-medical wastes and wastewater management in Chennai, see Geeta Lakshmi and Janakarajan (2005a), Geeta Lakshmi and Janakarajan (2005b)

- Women who lose agricultural employment are the worst hit among the peri-urban population

- More specifically while some among the farming community benefit, a majority lose

- Farmers whose lands are demanded most for urban activities –such as those which are located along roadside plus those plots which have good groundwater potential; these farmers are real gainers who became rich through windfall profit; but these are handful farmers

- On the other extreme, landless agricultural labourers a majority of whom migrate either temporarily or permanently looking for jobs; A handful of them are better-off due to better wage; but for a majority opportunities are scarcely available for a decent living (Janakarajan, 2005)

- The worst affected are women and aged who are confined to villages and undertake all kinds of odd jobs for a meager wage

- In between these two extremes are those farmers whose lands are neither demanded (or suitable) for urban activities not could undertake successful cultivation due to lack of labour force and water; since traditional irrigation institutions such as tanks and springs are defunct, water sources for agriculture is ceased; this class of farmers remain in a dilemma whether to stay in villages / agriculture or seek different employment and leave the village; prospects of opportunities for a decent living for this class of farmers is not easily available

However, responses to all these impacts in peri-urban villagers are not uniform. While some villages have reacted violently, some others have meekly surrendered to the urban pressure. Following are only examples of two case studies, one each from the A-K basin and the Palar basin. There are many villages under these two categories.

Case study 1: The Velliyur village in the A-K basin:

In Velliyur village (located at a distance of 50 km from Chennai in the A-K basin), conflict broke out and took violent turns due to continuous pumping of groundwater for over 30 years. Total population of this village is 4379 (as per 2003 survey); Total wet land 834 acres; Total dry land: 966 acres; Total government land : 200 acres. Although the village has one large tank (with a command area of 804 acres), groundwater remains as the primary source of irrigation. In 1980, there were 280 agricultural wells in the range of 50-80 ft. Now there are 220 wells and the depth is in the range of 130-160 ft. Quality of water is deteriorated compared to 10 years ago. Since 1990 at least 60 dug wells were abandoned due to falling water table. Main crops were paddy and groundnut. In the year 2000 drinking water was supplied round the clock from 4 bore wells. In 2004 only 2 hrs per day is supplied from a total of 12 bore wells (of which 4 have already stopped supplying water).

Backdrop to conflicts Velliyur village:

In 1969, 11 bore wells were installed to pump water from the common land of the village in order to supplement water supply to Chennai city and to supply to nearby industries. The estimated water supplied from this village was 16 MLD in 1969. In 2000, out of 11 bore wells, 9 had failed; since then water is purchased from farmers. Total number of water selling farmers /

wells in the village is 75 from whom 40 MLD is collected; but this is reduced to 16.84 MLD in 2004. Of the 75 bore wells, which originally supplied water, only 55 were working in the year 2004. Furthermore, the TWAD Board was planning to install 7 bore wells in the common lands of Velliyur in order to supply water to Thiruvallur town; but due to the resistance from farmers only 4 were actually commissioned. Sand mining activity is quite extensive in the Kosathalaiyar riverbed, which has drastically reduced water yields in the riverbed aquifer.

The people of Velliyur village were quite passive who did not oppose water pumped from the common lands of the village for more than 3 decades. However, when groundwater table decreased progressively, farmers had to spend quite substantially on deepening activities. Agriculture as an occupation was very badly hit resulting in reduced farm income and employment. The livelihoods of small farmers and landless agricultural labourers were affected. Therefore, self help groups (SHG) have been opposing transport of water from this village since 1995. SHGs insisted that the Panchayat should pass a resolution banning water sales from Velliyur village; But the Panchayat did not do so since groundwater is pumped only from Government land. But since 2000, water is purchased from farmers, village population have revolted against water transport. Again the village Panchayat (elected body) refused to pass a resolution against water sales on the grounds that it is individual farmers who sell water from their own land. Since the property rights on groundwater are undefined nothing much could be done. Some of the village residents filed a case in the court to ban water sales from the village. They were successful in getting the stay but soon it was vacated through an appeal petition filed by a water-seller who was supported by the Metro Water Board. Under such duress, in the year 2003, almost all the agricultural land was left uncultivated and the landless population was either engaged by sand miners from the river or they migrated in search of employment.

Meanwhile, as a consequence of extensive sand mining water yields from wells were reduced considerably. When water-selling farmers protested against it, Metro water Board took up the issue with the government and stopped the sand mining activity. This has affected livelihoods landless agricultural labourers who were working with sand miners. This is a vicious cycle in which agricultural labourers were pushed into sand mining occupation due to distress in agriculture. But when the sand mining activity was banned, they also joined the protesting mass of the village. Thus the violent conflict broke out it broke out on 15th August, 2004. More than 400 strong village population gathered near the Metro Water Board pumping station The Metro water officials and higher officers of the revenue department arrived at the scene and tried to resolve the issue. Since the entire villagers were against water sales a peace committee was formed consisting of water-sellers, non-sellers, SHG's and officials.

During the peace committee meeting it was decided to stop the water sales from farmers to MW Board after 15 September 2004. Everyone including the MW officials, sellers, non-sellers and all other villagers agreed to abide by this decision. After the peace committee decision entire issue was put into cold storage until 14 September 2004. On the 15th of September, MW officials reported that water purchase will not be stopped since the higher authorities MW officials did not agree for the agreement arrived at the Peace Committee meeting; water-sellers were also willing to sell water. In the mean time water sellers tried to move the court and tried to obtain stay from the court against the decision taken during the peace committee meeting. Since the non-sellers had a doubt that the sellers might seek legal protection, they also moved the court to get a stay on water sales; It was an unsuccessful move for both sellers and non-sellers. Since water pumping was not stopped even on 16 September 2004 till 11.00 am the entire village gathered near the Metro Water Board's giant water storage sump from where

water was pumped. The road was blocked. Though the higher revenue department officials arrived, they did not agree for stopping water purchase from private wells.

At this point of time, some people from the agitating group broke the entire pipeline structures, which belonged to the MW Board; After this violent protest from people, police arrested 44 people belonging to Velliyur village and filed a First Information Report. They were arrested under Public Property Damaging Act and remanded for 15 days judicial custody. The MW Board demanded through the court of law a compensation of Rs.30,000 from the agitating mass for breaking structures belonged to them. The court also instructed the arrested farmers to pay the compensation but the case was never withdrawn till date. Present status: Water selling was started again. MW officials are asking more farmers to come forward to sell water. MW Board has pasted a notice and even circulated it among the farmers stating that whoever is willing to sell water can approach the MW to have an agreement for one year.

Case Study 2 : Palayaseevaram village in the Palar basin:

This village is located at a distance of 50 km distance from Chennai city closed to the national highway. Total population of the village is 5285 (as per 2001 census). Total wet land 1191 acres; dry (rain-fed) land: 1446 acres; Government land: 1068 acre. This village is located right on the Palar river and benefited a great deal from the river water for irrigation. This used to be an agriculturally prosperous village that has (had) access to 8 surface sources for irrigation with a total command area of 1191 acres. Groundwater served the purpose of only a supplementary irrigation. In 1980, there were 71 wells (24 wells in wet lands and 47 in dry lands) and depths were in the range of 24 to 27 feet. Now there are 150 wells and the depth is in the range of 60 to 100 feet. Out of these, 50 are bore wells and the rest are open wells. At the time of the survey in 2004, only 20 wells were in use. Quality of water as well as water table has declined drastically. Main crops in 1980 were paddy and sugarcane. Agricultural land was fully cultivated until 1985. In 1990 the area under paddy and sugarcane was already reduced to 200 and 100 acres respectively. In 2004, the area under paddy was only 15 acres and area under sugarcane was 10 acres. Weeds and wild vegetation are seen at present in most of the wetlands. In 1990 drinking water was supplied for 5 hours / day. In 2002 it is reduced to only one hour per day.

Backdrop to conflicts:

Originally, it was planned to pump water from the Palar riverbed to supply to the adjoining areas of the city such as Alandur, Pallavaram. Chrompet, Tambaram, Anakaputhur, Pammal, Chithilapakkam, Vandalur Zoo etc. The estimated demand for this region has been at least 45 MLD in 2004. It used to be 22 MLD in 1972 when it was originally decided to pump water from this village in order to supply water to these adjoining areas of the city. The people of Palayaseevaram village opposed this move on the grounds that it would affect the groundwater availability in the region. A memorandum was also submitted to the District Collector and issue was also taken up for discussion at the Chief Minister level. However, finally the government took a decision in favour of the city and against the interests of the village population. And, the work was executed. Accordingly, in 1972, the Tamilnadu Water Supply and Drainage Board (TWAD Board)[7] dug 5 wells and subsequently six more wells in the Palar riverbed.

[7] While Metro Water Board is responsible for supplying water to the city, the TWAD Board is responsible for supplying water to all other parts of the state.

For the past 5 years, supply of water in these wells is reduced drastically. Six more wells have been dug in the year 2004 on the other side of the river bank, which is part of the village called Pullambakkam / Thirumukkodal. The main reasons for the reduction of water supply in these wells are round the clock pumping for over three decades and substantial and illegal sand mining in the riverbed much beyond permissible limits. All these have adversely affected the agriculture in the village. Groundwater has become scarce even for drinking. Not only Palayaseevarm but also all villages in this stretch (such as Thimmavaram, Athur and Palur etc) was badly hit due to round the clock pumping either by the Metro Water Board or by the TWAD Board. Wherever these agencies were not pumping, private tanker trucks pumped water for selling in the city. In fact, there is a virtual competition between these two state agencies in pumping water to supply to their respective constituent population. The Sugar mill, which was constructed in the year 1987 in Palayaseevaram village, was severely opposed by the people. At present, the sugar mill generates good deal of effluent and discharges them into a village tank, which is supposed to provide irrigation to 423 acres in this village. Furthermore, the sugar factory has blocked the water flow in one of the main canals which eventually was supplying water to the big tank of th4 village. Therefore, in addition to groundwater pumping by the State agencies, the sugar factory has also been instrumental in destroying livelihoods of the village population.

How the conflict was represented?

Several petitions / memorandums have been sent to the government; a group of NGO organizations organized a series of demonstrations and has organized a public hearing meeting. The jurists of the public hearing committee (one of them was a retired Supreme Court Judge) severely condemned the illegal sand mining and competitive water pumping and suggested to the Government to appoint a Committee to go into the details of damage done to the river. But all these efforts never helped since both activities continued.

Present status of conflict in the village:

Struggle against the damage by the people of this village was weak and passive. People are absorbing the shock created due to water depletion or leaving the village for urban employment. Many have sold their lands and many more are planning to sell lands. If there are no severe conflicts despite severe damage to the ecology and livelihoods of this village, it is because of the reasons such as (a) location of the village on the main corridor linked to Chennai, (b) sand mining as a lucrative activity for the small farmers and landless agricultural population, (c) growing absentee landlords, (d) very powerful sugar mill lobby having highest political connections and threatening local people, (e) growth of non-farm employment such as in construction industry in urban areas, railway contract work, employment in the local sugar mill, vegetable and fruit selling in urban areas, other petty business etc. and (f) non-availability of farm labourers who find more gainful employment in non-farm activities such as sand mining, construction etc.

4.2 Conflict analysis

An in-depth conflict analysis between urban and peri-urban areas throws interesting light on clashing viewpoints of various stakeholders. This is summarized in the following tabular format.

Sl. No	Type of stakeholder	Reasons for conflict	Fighting against whom?
I	Farmers cum well	Reduction in profit due to	Those who protest against

	owners cum water-sellers	not selling water to MW Board	water sales to Metro Water and TWAD Board
2	Farmers (non-water selling well owners and all others in the village)	Destruction of livelihoods in villages due to declining water table and agriculture	Water sellers, Metro Water Board and TWAD Board
3	Landless agricultural labourers	Loss of income and livelihoods	Metro Water Board, TWAD Board, water- sellers who protested against sand mining since their wells do not receive recharge due to sand mining resulting in emptying of RBA
4	Metro Water Board	Compulsion to supplement the city's water needs	Protesting village population against water sales and competing with TWAD Board
5	TWAD Board	Compulsion to supply water to the city's adjoining areas	Protesting village population against water sales and competing with Metro Water Board
6	Private tanker operators	Reduction in profit	Those who protest against water sales to Metro Water and TWAD Board
7	Water companies	Reduction in profit	Those who protest against water sales and civil society organizations
8	City dwellers and residents' welfare associations	Reduction in drinking water supply	Protesting against Metro Water and TWAD Board
9	Civil society organizations	Destruction of livelihood and falling water table	Water sellers, illegal sand miners, Metro Water and TWAD Board

Section 5 Building multi-stakeholders' platform

5.1 Identification of stakeholders in the context of Chennai peri-urban water markets

Basically two sets of stakeholders could be identified who have diagonally opposite interests: (1) State and (2) Peri-urban village population.

State is represented by,

- Metro-Water Supply and Drainage Board
- Tamilnadu Water Supply and Drainage Board
- Chennai Metropolitan Development Authority
- Village Administrative Officer (VAO)
- Block Development Officer (BDO)
- Thasildar (the Revenue Department taluk-level head)
- District Collector
- Public Works Department (water resources)
- State and Central Groundwater Boards
- Chennai city Municipal Corporation
- Departments of Agriculture, Revenue, Forest and a few others who are concerned with water
- Tamilnadu Pollution Control Board
- Member of Legislative Assembly (MLA) and Member of Parliament (MP)

Peri-urban population is represented by

- Farmers (as a broad category) who live in peri-urban villages
- Village Panchayat
- Village level informal institutions

The broad category of farmers could be further differentiated into several sub-groups such as,

- Land and well owners,
- water sellers,
- non-water sellers,
- Land owners but non-well owners,
- Tenant cultivators,
- Landless agricultural labourers,
- Women self-help groups.

In addition to the broad category of farmers, a substantial section of non-agricultural population also live in the peri-urban villages including traders, employed in the other non-agricultural sector.

In addition to the above two sets of stakeholders, there are others who have either or indirect interests in the urban and peri-urban water supply and conflicts. They are represented by,

- Tanker-truck operators and their Association
- A large number of water companies who sell purified drinking water who are located in and around Chennai city
- A large number of high profile hospitals which are located in and around Chennai city
- A large number of high profile hotels located in and around Chennai city
- A large number of educational institutions located in and around Chennai city
- A large number of commercial enterprises, industries, major educational institutions and government offices located in and around Chennai city
- Flat promoters, Residents' Welfare Associations and other urban water users

The last batch of stakeholders represents the civil society. They include,

- Non-Governmental Organizations (NGOs)
- Activists
- Researchers
- Media

Strengths and weaknesses of stakeholders

Four sets of stakeholders have been identified: They are,

(i) State (all official agencies and political leaders),

(ii) Other urban stakeholders,

(iii) Civil Society,

(iv) Peri-urban agricultural and non- agricultural population.

It is not very difficult to judge strengths and weaknesses and exigency, legitimacy and power of these stakeholders. The state for instance is all powerful enjoying enormous power, control and authority. Other urban stakeholders go *hand in hand* or have *hand over hand* with the State in so far as exploiting resources from peri-urban villages. This set of stakeholders also demonstrate exigency and claim legitimacy in transporting water from peri-urban areas. In other words, 'the State' and 'other urban stakeholders' strengthen each other and eventually their strength and power becomes formidable. It is a real threatening alliance. In other words, other urban stakeholders constitute market which is more profit driven than anything else. The third set of stakeholders, namely, civil society organizations, activists, researchers and media indulges in investigating, writing and campaigning against depletion and pollution of resources in peri-urban and rural areas although play a critical role, this set of stakeholders, neither can they claim any legitimacy nor are they powerful.

Peri-urban population, unlike other stakeholders, does not constitute one single homogeneous group. A part of them, namely, water selling farmers, align with first and second set of stakeholders described above and make a short-term profit. But, it is very difficult to say whether they sell water voluntarily. Available evidence suggests that water-sellers are either compelled or encouraged to sell water to Metro Water Board. In the case of farmers selling water to private truck operators or private companies, the advances made by the latter trap them. Nevertheless, this class of farmers are viewed as enemies of farmers; but soon they realize their mistake since their wells go dry due to round the clock pumping.

All others sections of the peri-urban population are at the receiving end. They have to suffer the brunt of water transport and other damages to the local ecology and environment; this is a voiceless and powerless community. Even the democratically elected village Panchayat Board becomes powerless. What one finds in such a situation is virtual *institutional vacuum* and a sort of *neither here nor there* state of affairs. They are left with two options: One, stay and suffer and two, flee. The second option is generally exercised by a few who are educated and resource-rich.

Building multi-stake holders platform for a dialogue

The prevailing conditions in Chennai city is such that one cannot take extreme positions: An ideal situation is one in which both the Chennai city and peri-urban villages co-exist in a conflict-free state, cooperating with each other for each other's benefit; while cities can act as engines of development of both city and peri-urban areas, the latter can contribute to its development; a state where one can anticipate a win-win situation – from conflicts to cooperation.

Nevertheless, the critical question is how to reach this point from conflict to cooperation? It is neither easy to define this path nor can one define the time frame to travel through the path of conflict to cooperation. After all, conflicts occur primarily for reasons of prevalence of free riders that are also politically and economically powerful; this group will lose if cooperation among all stakeholders is attained. Whereas, the condition of the majority of peri-urban population, whom I would call *fatalists*, are losers any way. Therefore, this group will only be more than happy to participate in dialogue and reach the level of cooperation. Precisely for these reasons, it is not going to be easy to involve these diverse groups in a meaningful dialogue.

My theory is that until one reaches a *threshold level of crisis* the hitherto gainers may not be interested in dialogues because of operation of markets and the support that they enjoy from the State; but it does not mean that one should not start the dialogue process before. This is precisely where multi-stakeholders platform (MSP) and multi-stakeholders' dialogue (MSD) play a key role. In the case of Chennai city and peri-urban villages, it must be said that conflicts have reached an intense level but the threshold level of crisis is not yet reached unlike the cases of Palar and Cauvery basins[8].

Multi-stakeholders' dialogue (MSD) experience in the context of negotiating Chennai and peri-urban water conflicts

The MSD has been initiated in the context of Chennai peri-urban area. A series of multi-stakeholder meetings have been held since July 2004 and the process continues till date. A committee of stakeholders with 64 members drawn from all sections has been formed. Several meetings have been held so far and many key issues were brain stormed.

Lessons from the MSD experience

- A sound research is a necessary condition for undertaking and carrying forward MSD
- Degree of success or failure of dialogue initiatives depends upon active and sustained state support
- Need for an untiring facilitator who can carry on with the job of facilitating and arranging a platform for the dialogue to continue

[8] The present author has initiated MSD initiatives in conflict-ridden river basins of Palar and Cauvery in South India. In these river basins, conflicts have reached a threshold level of crisis in which even the highest judicial authority of the country could not travel too far. When *everything has failed* the MSD among all stakeholders is the only option for arriving at some kind of consensus and cooperation.

- Dialogues are never smooth; there will be lots of ups and downs; this should be expected

- Final outcome is uncertain; difficult to judge; But in the absence of a viable alternative there is a case for pushing the dialogue initiative as far as possible until one reaches anywhere near a viable solution

Solutions as emerged from MSD meetings

The stakeholders Committee discussed at length not only threats to livelihoods in peri-urban villages but also solutions to drinking water problems of the Chennai city. Several issues and solutions were discussed.

First, there was an unanimity in emphasizing the need for revamping water bodies such as tanks in peri-urban villages and suggest ways and means to the government for modernizing and strengthening them. Through this measure, not only that with improved groundwater level agriculture could be protected but also excess or unclaimed water could be diverted to the city's needs. This was taken up on a priority basis.

What have we done so far?

- All hydraulic particulars pertaining to 2600 tanks in two adjoining districts have been collected from the government records

- Gathered all relevant topo sheets (relating to year 1971) and digitized them in GIS

- All hydraulic particulars as recoded in original tank memoirs are being fed into the digitized maps

- What are we planning to do further?

- Next step is to get the latest satellite imageries and super impose them on the 1971 maps

- Finally the actual survey data of all 2600 tanks will be fed. Survey in 30 tanks have already been conducted with the help of stakeholders

- Three-time period picture of tanks will help us to identify those tanks, which are in retrievable shape. For such tanks we will work out the costs of rehabilitation and submit it to the government through the stakeholders' committee

Second, the Committee felt that solutions to Chennai water crisis needs to be approached carefully and such measures cannot be and should not be ad hoc as have been the practice in the past. In fact, before launching on mega projects like bringing water from other basins (such as Telugu Ganga) or Veeranam, many stakeholders expressed the opinion it is absolutely necessary to examine what is locally available. This point might appear irrelevant to many. But this is an extremely relevant question: Let us take the case of Chennai city. It is true that the city is neither located on the banks of any perennial river nor has any big perennial reservoirs from which water can be drawn. But consider the following option:

- There are at least 70 temple tanks and ponds located in different parts of the city, which used to get filled during monsoon months. Now most of them are silted up and supply channels have disappeared because of civil constructions all over. Need of the hour is to restore all these tanks to their original condition and restore flow of rain / flood water during monsoon months. Simplest way would be to link storm water drains with these tanks; otherwise, huge amount of floodwater wastefully flows into sewage drains or into the city's polluted rivers.

This particular measure would not cost much compared what is spent on big projects. The potential benefits that it may produce are remarkable. This will not only improve groundwater levels in the city (which is at present declining at the rate of 3 meters per year) but also improve the quality substantially. This will help mitigate the city's water problems to a large extent because, at present 60% of the city's water needs are met from groundwater.

Third, the city generates about 680 MLD of sewage water, which is at present not properly utilized. Except around 100 to 150 MLD, which is supplied to Chennai Petroleum and MFL after the primary treatment for industrial uses, the rest is unutilized. The sewage water is let into the city's rivers either untreated or after primary treatment. There is huge scope for recycling this water even for domestic uses. At least 80% of the sewage water (or 500 MLD) can be recovered and recycled. Environmental engineering experts point out that the cost of sewage water treatment is cheaper than seawater desalination.

Fourth, construct a series of check dams in Araniar and Kosathaliar to save rain water and augment groundwater recharge.

MSD in the final analysis

On the whole, a threshold level of crisis will make dialogue initiative more sustainable and will ensure active participation of all contending stakeholders; otherwise, only one set of stakeholders will participate. In the case of Chennai peri-urban villages, stakeholders' participation is less than expected level and many villages are getting swamped in the urbanization process

Section 6 Water Resource Audit[9]

This section seeks to address the issue of capacity of the Chennai city to manage with available water resource within its command for the present population and for the projected population. The results of an extensive assessment of access to and demand for water in Chennai are discussed in a separate paper on this theme.[10] The main motivation behind this exercise is to (a) Identify and evaluate potentially viable options for tackling Chennai's water problems; (b) Develop a water-related vision for what might be achieved by 2015; (c) Develop a range of demand scenarios that take account of some of the most important factors that influence demand; and (d) Develop and evaluate a number of strategies for achieving the vision taking account of the demand scenarios and negative impacts on peri-urban areas.

[9] The section on water resource audit was initiated by Patrick Moriarty and developed by Charles Bachelor. The present author is indebted to both of them for their generous help.

[10] For a detailed discussion on water resource audit for Chennai and its metropolitan area, see Janakarajan, S, Charles Bachelor, Patrick Moriarty, Jothi G and Prabhakar G – draft (2005)

Main conclusions of the water resource audit are the following:

- Best estimates of Chennai's water supply and water demand indicate that current water supply is *at best* approximately half the demand based on a domestic demand of 150 lpcd. If the figures used are approximately correct, this suggests that the current average access to and use of domestic water is of the order of 75 lpcd in good years. Demand is increasing rapidly in line with factors such as rising population, increasing rural – urban migration and industrialization. Taken as a whole, the available evidence suggests that the Chennai's water supply situation is at a crisis point, particularly for poorer social groups.

- As households in relatively wealthier areas of the city are reported to be using well above this daily volume of water, households in poorer areas are using much less. There are severe - major problems with sanitation, sewage treatments and there is also plenty of evidence that indicates that Chennai's ever-increasing water footprint is causing real hardship for many water users in per-urban villages. It is noticeable that most estimates of demand do not include delivery or conveyance losses. Quite obviously the lower the conveyance losses, the lower the infrastructural capacity required and the lower the pressure on water resources. Estimates of demand calculated by us include 25% allowances for conveyance losses.

- A major recommendation of this exercise is that the starting point for better management of Chennai's water services must be a long-term vision that also takes into account water resources development in the districts from which water will be supplied to the metropolitan area. It is recommended also that this vision be SMART (Specific, Measurable, Achievable, Realistic and Timebound) and an output of a consultative process that has the active involvement of all primary stakeholders.

- Four water demand scenarios are presented in this section. These are based on the assumption that issues linked to changing demand and population growth will continue to be the major drivers of water demand. Many other factors will also have a major bearing on demand for "blue" water (i.e. surface water or groundwater) as opposed to recycled water, treated wastewater or desalinated seawater.

- Supply and demand strategies: Twenty-two options for tackling Chennai's water problems are listed in the report. None of these are entirely new as they have all been identified by individuals and organisations with a long history of working in and around Chennai. Using the demand scenarios, which themselves include options for managing demand, the report identifies different water supply strategies and then evaluates these against the vision.

- It is estimated that, if Chennai's demand continues to increase at current rates and if the major source of "blue" water supply is rainfall in the metropolitan area and adjacent districts of Kancheepuram and Tiruvallur, then domestic and urban demand in the metro area and these two districts will be equivalent to 50% of all the renewable "blue" water in an average rainfall year

Section 7 Summary, key lessons learnt and policy options available to move forward

The most fundamental questions that we tried to answer in this study were;

- Since the urbanization is an inevitable process, should we let the peri-urban population / areas suffer? Or

- Is there a way in which the spread of urbanization could be used for the best use and advantage of both the populations?

- Why all hitherto policy options have failed in this regard? What are the suggested policy measures that would not only contribute to resolving urban and peri-urban conflicts but also would contribute to improving livelihood and environmental conditions in peri-urban villages?

- For a long time social science or hydrology related research were focusing more either on urban or rural issues. Peri-urban problems have become a subject matter for discussion only during the last couple decades. That urban and Peri-urban conflicts have surfaced as a major issue, which policy makers no longer can ignore, is clear from the fact many urban expansion plans have been stalled due to stiff resistance shown by peri-urban farmers[11]. Hitherto all approaches to solve urban problems and stress have failed because rural, peri-urban or urban issues were treated isolation. Instead, there is an urgent need to view urban, peri-urban and rural segments of a region as a part of the single but integrated livelihood and eco-system. In other words, all three segments are very much a part of an integrated socio-economic developmental process of an economy. D.L. Iaquinta and A.W. Drescher have expressed similar views: *Rural, peri-urban and urban form a linked system (R-PU-U), which constitutes an uneven multidimensional continuum.*[12] A fragmented approach would only bring about rural-urban and peri-urban – urban divide, besides contributing to destruction of ecology, environment and livelihood options in the rural and peri-urban areas.

- Following are some of the lessons learnt that need urgent policy interventions;

- Horizontal urban expansion encroaches upon natural resources, in particular land and water, enjoyed hitherto by rural and peri-urban communities. As a consequence, severe competition and conflicts spur up between urban and peri-urban areas. While Municipal corporations, Housing Boards and State Metro water agencies collectively negotiate claims over land and water rights on behalf urban areas, the peri-urban areas are represented individually and often are subject to threats. These kinds of negotiations are often one-sided because of unequal bargaining power enjoyed by these agencies. This is precisely the context in which a collective - multi-stakeholders' dialogue approach and a participatory planning process would be useful for a better negotiated democratic settlement.

- Though urban interests are deeply committed to make the most of the available land and water resources of rural and peri-urban areas hardly are these state agencies pay attention to document or analyze patterns and intensities of vulnerabilities and its long-term implications

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[11] Two important projects of the Government of Tamilnadu could be sited as examples in this regard: First was the project which entailed shifting of the entire State secretariat to peri-urban villages at a distance of 40 KM in about 2000 acres. The second, was the construction of a satellite town at a distance of 50 KM from Chennai in an area of over 4000 acres. Both projects although were announced in the State Legislative Assembly had to be given up due to stiff opposition from peri-urban population.

[12] D.L. Iaquinta and A.W. Drescher, ` Defining the peri-urban: rural-urban linkages and institutional connections' (by) (http://www.fao.org)

- Peri-urban population depends upon land for livelihood, commons for fuel wood and water for agriculture, animals rearing and for drinking; Therefore, entire livelihood options are affected due to transport of water to urban areas. These areas are in a state of decay, in particular for those, who depend upon agriculture for their livelihoods. This section is the majority. On the other hand, for those who benefit due to `spillover effects of urban development' (e.g., enhanced land value due to locational advantage or due to water selling) is a minority. However, what is important is to examine, how the majority, whose livelihoods are affected cope with spillover effects. How sustainable the continuing and round the clock groundwater transport from peri-urban areas of Chennai? Are there any institutional mechanisms existing to cope with peri-urban issues relating to natural resource management? Role and functions of Panchayat bodies – Are they aware and what concrete actions have they taken so far to deal with the urban entry?

- The State institutions do not take any coordinated actions to preserve the local natural resources; instead they pull in different and opposite directions – due to `fractured institutional set up'. There are no legal mechanism to protect livelihoods and ecology of peri-urban areas.

- This was the context in which the multi-stakeholders' dialogue in the peri-urban areas of Chennai was organized.

- In the MSD Committee meetings several measures were discussed with a view to providing solutions to Chennai city as well as to the peri-urban areas.

- Further, the MSD meetings have created a stir in Chennai with media reporting about the MSD processes extensively.

- Most importantly, the MSD initiative has an agenda of social learning as well as negotiation process for win-win settlement. This is opposed to centralized decision-making, which often fails. But the key question is how far can a researcher sustain the MSD process? NGOs need to be trained in conflict resolution. Stakeholder participation and ensuring their participation in MSD is a gradual process through research and stakeholder analysis.

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Box 1 Water market in the Chennai city

Tamil Nadu accounts for 50 per cent of the total mineral water business in India. And there are more than 400 registered units in this state out of which over 220 are located in and around Chennai. The water selling figures quoted by the South India packaged Drinking Water manufacturers Association is quite stunning:

Type of packaging	Price per unit	No of units sold per day	Total amount transacted (Rs)
250 ml polythene sachet	Rs.1	5 million	5.0 million
One liter bottle	Rs10 to 12	75,000	0.75 to 0.9 million
12 liter cans	Rs 20 to Rs. 30	100,000	2.0 to 3.0 million
25 liter bubble top containers	Rs.25 to Rs.40	25,000	0.625 to 1.0 million
Water tankers* carrying 10,000 to 12,000 liters	Rs.600 to Rs.1000	10,000	Rs 6.0 to 10.0 million

*The price variation is due to factors such as water quality, distance from where transported and the season (summer or monsoon months).

How does it translate into money transaction per day?

- Rs.14.3 million to 19.9 million / day (US $ 0.3 to 0.4 million)
- Rs.429 million to 597 million / month (US$ 9.5 to 13.3 million)
- Rs.5.15 billion to 7.16 billion / year (110.4 to 159.1 million)
- 5,15,000 to 7,16,000 tons of rice per year

With this money 2.82 million to 3.92 million people can have rice at the rate of 500 grams per capita per day for the whole year - at the rate of Rs.10 per kilogram of rice

Box 2 Chennai groundwater laws

There have been serious legal attempts to regulate Chennai water supply and wastewater management. The first prominent act to exclusively attend to the needs of the Chennai city's water problems was called Chennai Metropolitan Water Supply and Sewerage Act, 1978. The three main objectives of this Act were,

- Promoting and securing the planned development of water supply and sewerage service,
- Efficient operation, maintenance and regulation of the water supply and sewerage systems in Chennai Metropolitan Area and
- Preparing the immediate and long term measures to meet the future demands of water supply and sewerage services in the Chennai Metropolitan Area.

Unfortunately, even after 25 years of promulgation of this Act, the Chennai's water problems seemingly have reached serious proportions. In order to fill the growing gap between supply and demand, the Board resorted to taping groundwater that is available from the peri-urban villages of the Chennai city. So greedy that the Chennai Metro Water Board was that with a view to protecting water supply to the Chennai city, an Act called Chennai Metropolitan Area Ground Water (Regulation) Act was enacted in 1987, prohibiting groundwater extraction in 229 notified villages around the Chennai city for any purpose other than domestic. Since then, the Act was amended twice to increase the notified villages to 243 and then to 302. Even though the main purpose of this Act was to control groundwater extraction and illegal transportation of water from these areas into the city, the main purpose of this Act is apparently grossly violated not only private individuals but by the government itself. Metro Water Board is very much a party to the over exploitation of ground water in these notified villages contributing to serious threat to livelihoods. Furthermore, in many villages groundwater quality has turned brackish or even saline due to seawater intrusion. Thousands of truck operators are still involved in commercial transaction in water in these villages. Worst of all, in some of these notified villages water companied have been established: Example: Mathur, a notified village in the Act, there are at least two water companies – Polo and Acqua – which pump raw water, purify and sell. Another Act called The Tamil Nadu Groundwater (Development and Management) Act, 2003, which has received the assent of the President, has been enacted with a view to protecting groundwater from hazards of over exploitation and to ensure its planned development and proper Management. But would all these Acts make any difference to the water problems of the

Chennai city and its peri-urban villages? Would these Acts be an answer or add fuel to the growing conflicts between urban and peri-urban areas?

Building an Advocacy Coalition for River Sand Mining Affected Stakeholders in Sri Lanka

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Abstract

This paper records an ongoing initiative carried out mainly by volunteers. Illicit and unregulated river sand mining has created a number of social and environmental issues in Sri Lanka. Damage to riverine ecosystems causes biodiversity, livelihood and water security losses. Illicit mining is controlled by a powerful sand mafia linked to political patronage. Localized efforts for combating this trend through community action met with limited success. Ultimately a networking initiative by CSO with local community organizations was able to raise profile nationally for this issue through successful use of media. Interaction between affected river communities was supported and linkages enabled with national level agencies for building a stakeholder platform and a collective voice.

Key words

River sand mining, community action, ecosystem damage, advocacy, sand mining mafia

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"Anyone who has loved a river can tell you that the loss of a river is terrible, aching thing" - Arundathi Roy, "The Greater Common Good"[1]

1. Introduction

River sand mining is fast appearing as an issue for concern for environmental security in South Asian countries facing rapid urbanization. Especially in Sri Lanka, a post-tsunami construction boom and the consequent demand for sand has been a contributory factor to the rapid increase of river sand mining. Escalation of river sand mining in Sri Lanka is seen as damaging and leading to conflicts. It is usually location specific, often leads to high levels of stress and violence for affected communities and is sometimes countered by advocacy and collective action.

Sri Lanka has an extensive practice of civil society led campaigns related to collective action in environmental governance issues. Impacts of collective action and effective NGO/CBO interventions has been recorded in the cases of the Thuruwila water transfer, Eppawela phosphate mining issue, Upper Kotmale hydropower project, Muthurajawela wetland encroachments, the Kotte wetlands and the Southern Express Highway. In many cases the issues that triggered these interventions and the resultant community/collective action were localized. Sometimes protests were conducted at regional and national level as well, with the activists sometimes (like in the Chilaw Water supply case) seeking the Supreme Court for recourse, citing loss of human rights. Basing their appeals on the National Environment Act No.47 of 1980 as amended by Act No.56 of 1988 and the Regulations made there under, NGO and CSO activists have had an impressive record of successful judicial activism.

The activity described in the paper is essentially a process documentation of an advocacy and awareness building activity carried out by a volunteer organization with river sand mining (RSM) affected stakeholders in the river basins of Deduru Oya, Nilwala Ganga and Maha Oya .Though localized at the onset, this advocacy effort has resulted in some national level actions and therefore has implications for all other water bodies currently experiencing the same set of problems generated by illicit or unregulated RSM. The issue is much wider spread than the three rivers referred to earlier. It affects many rivers, tanks and water bodies throughout the country. Media scans of newspaper reportage carried out in 2006-2008 reveal that at least 25% of Sri Lanka's 103 rivers report some level of incidence of illicit RSM (Annexure 1).

As this paper documents an ongoing activity, it is largely descriptive but highlights developmental issues related to environmental governance to be studied and raised for future research and further discussion in relevant forums.

NetWwater (Network of Women Water Professionals), a volunteer group of women with water interests in Sri Lanka, has been engaged since 2004 in carrying out a series of district-wise gender and water dialogues involving substantial interaction with community groups. The river sand mining activity was first identified as the result of a gender and water dialogue carried out in 2005 in Kurunegala district, North Western Province where women complained of the damage to drinking water sources due to destructive river sand mining. Further interaction with communities revealed the extent of environmental, structural and social damage caused by RSM. This led to an initiative to work with RSM affected communities in raising awareness as well as build linkages with other CSOs and activist groups.

[1] "The Greater Common Good" by Arundhati Roy is about the Sardar Sarovar dam: http://www.narmada.org/gcg/gcg.html

2. Sand for Construction needs in Sri Lanka

Sand is a mineral as defined in the Mines and Minerals Act No. 33 of (1992). In Sri Lanka sand is the property of the state, the mining of which requires a permit. Sri Lanka's construction industry contributes over 8% to GDP and requires over 7 million cubic meters of sand annually. This volume has expanded in the recent past due to additional demands of post tsunami construction, during which there was an annual increase in demand by 10%. The sand is usually obtained from the country's river beds, river sides or mined from previous riverbeds and sand dunes. In one instance deep sea mining was carried out to fulfill the sand requirements of an expressway project; the project did not come through but there is little demand for this substantial stockpile due to aversion of the construction industry towards use of sea sand.

Artisanal sand mining generally was the norm in Sri Lanka until the current law Mines and Minerals Act No.33 of 1992 replaced former Mines and Minerals Law No.4 of 1973. Artisanal mining did minimal damage to ecosystems and rivers and in fact is necessary in some cases to clear river blockages. The new Act established the Geological Survey and Mines Bureau (GSMB) as the sole authority for sand mining. The GSMB regulates the exploration for, and mining of minerals, which includes sand. The GSMB defines mining sites, calls for deposits while mining tenders are called by the Divisional Secretary (DS) who is part of the Administrative structure. Two government agencies from two different Ministries thus need to collaborate on this activity. The sand mining licenses are required by the Act to contain a number of conditions, including a requirement that the licensee comply with all written laws relating to the environment and rehabilitate the land to which the mining license relates. However, it has been found that the license form issued to applicants does not contain all the conditions required by the Act, or contains them in a diluted form. Furthermore, there was limited enforcement of such applications mainly due to lack of personnel. The monitoring capacity of GSMB is very weak with sometimes only two technical officers in an entire Province and is wholly inadequate to contain the current spate of illicit sand mining.

With the post 1992 decision of the Geological Survey and Mines Bureau (GSMB) to expand sand mining sites, large scale negative impacts, affecting the local farmers and domestic water users both qualitatively and quantitatively, have been recorded. Increasing use of unregulated mechanized harvesting in the late 1990s has resulted in heavy localized river water turbidity, lowering of water tables, bank erosion, land degradation and salinity intrusion, resulting in hardship both to the population and damage to riverine ecosystems. The river sand bed acts as a natural reservoir for retaining water in the under laying soil and for maintenance of the groundwater level in the catchment areas. The base flow of the river depends on this retention. Due to excessive sand mining, the river beds become deepened and the river flow velocity increased. During the monsoons the natural retention of water is hampered by the absence of a sand bed .Water drains out quickly due to the high velocity river water flow, which damages the river bed and increases sedimentation.

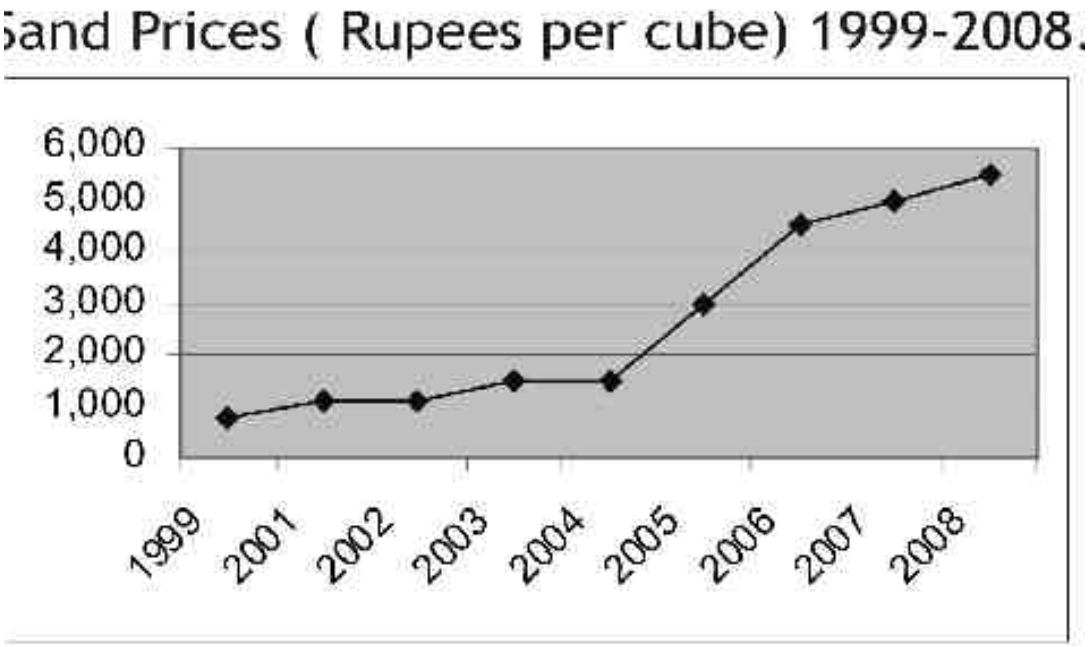
Unfilled excavations and abandoned sand pits provide the breeding grounds for mosquitoes spreading vector-borne diseases. Sand excavations in the river beds create dangerous spots for bathers. In particular, community concerns are raised as regards the increasing damage to drinking water sources, damage to irrigation systems, related health and hygiene issues, which have a further detrimental impact increasing the current burden of women as primary domestic water users and family caregivers.

Sri Lanka is saddled with a plethora of laws and regulations regarding natural resource use, functioning within a poor enforcement environment, further complicated by the complex and often violent political context. Little benefit is derived from comprehensive laws and policies unless there is ability within the system to satisfy demand of both users and the environment as well as regulate effectively through a proper monitoring mechanism. Illicit mining is often carried out by a politically powerful sand mafia, in the face of whom affected communities are helpless. This has led to a

situation where the Sri Lankan rivers are gravely endangered and the well being and livelihoods of riverine communities badly affected.

The post tsunami construction needs have tremendously increased the demand for sand in Sri Lanka and correspondingly increased the damage to rivers. The acute problem of supply is driving construction costs to uneconomic levels and high prices encourage suppliers to secure sand at any cost. The price increase of the commodity by 250% over the last decade is seen below in Table 1.

Table 1 Price of sand



It is further increasing at an alarming rate as the high sand demand has driven the problem from the normal mining sites of wet zone rivers such as Kelani, Deduru Oya and Ma Oya even to fragile dry zone areas such as Mahiyangana and Amparai. River sand mining has escalated even in remote rural areas such as Kaltota and areas in North Central Province adjacent to Malwathu Oya and Mee Oya which had hitherto been free of commercial mining. This has resulted in widespread damage to ecosystems, agriculture and rural infrastructure. The quality and the quantity of available freshwater have reduced, causing a serious problem especially in the North Western Province, with dropping groundwater tables and salinity intrusion. Many lucrative permanent crops – mainly coconut trees – are thus destroyed. River bank collapse adds to crop losses, endangering the subsistence livelihoods of agricultural labourers.

On the other hand the poorly paid agricultural male wage laborers can earn high wages through illegal RSM as nobody- especially not the police – would want to upset the status quo; there is no such advantage for female wage labourers. In many RSM affected villages substantial school drop-out levels by boys has been reported they prefer to earn money in RSM instead of continuing their education. Social problems such as alcohol abuse and drugs have increased amongst such youth due to the fact that they have money to spend, sometimes more than their own fathers.

It would have been useful and important to assess what would be the costs to the country due to damage to infrastructure due to river sand mining. There have been cases of state agencies shoring up shaky bridges and repairing damaged roads but there is no clear record of such expenditure. Nevertheless a conservative estimate of replacing an endangered bridge would be a minimum of Rs 400 million (Euro 1 = Sri Lankan Rs. 157 in December 2008). Replacement of a water supply intake will cost a minimum of Rs 10 - 20 million. The water intake on Nilwala river in Southern province has already been shifted upstream twice due to salinity intrusion. Prompt action needs to be taken to decrease such damage in a situation already exacerbated by falling foreign exchange earnings and global recession.

Offshore sand mining requires major investment both in terms of machinery and infrastructure. Holding of sand inventories in quantity before release of offshore sand of usable quality requires major capital. Neither is within the capacity of current suppliers of mechanized mining (mostly small contractors and machine owners). Nor was it possible for the relevant local authorities to invest or regulate in such magnitude given the "float" time between harvesting and release of sand from offshore sources. Thus it requires the state to take the initiative in this regard. Otherwise the current policy declarations remain mere platitudes that are unenforceable for practical purposes. Some efforts are being made to seek offshore mining as a solution but there is resistance from the builder's lobby.

Given the extent of damage caused by illicit and unregulated RSM, it would not be incorrect to call it a second tsunami for Sri Lanka. Often environmentalists and advocacy campaigns react to events rather than anticipate and mobilize civil society and communities to take precautionary measures. In the case of sand mining, it was seen by the activists that this process now needed to be rapidly reversed by proactive measures.

3. Policy and legal initiatives

The environmental impacts of the escalation of river sand mining and the introduction of mechanized mining (especially on Ma Oya) has been raised by the affected communities at various forums for at least 5 years. Several localized initiatives were taken to curb excessive mining which damaged the environment, citing sand mining related corruption. Temporary bans of sand mining have been periodically sought from the Courts. RSM has led to several high profile instances of legal activism. In 2004 a sand miner in Ma Oya petitioned the Supreme Courts for the right to exercise his livelihood. The Supreme Court taking judicial notice of the social and environmental problems caused by the then largely unregulated mining of sand from riverbeds and river banks, suspended all sand mining licenses on Ma Oya pending a study of the impacts, and called upon a well known environmental organization (Environmental Foundation Ltd) to assist the Court. The case is still going on, with periodic hearings taking the form of an accounting by the relevant sectors (GSMB, Police, North-Western Provincial Authority, and Environmental Foundation Ltd) as to how the issues of enforcement of controls and the rehabilitation of the river are being dealt with.

A new draft National Policy on sand for construction needs was prepared by the Ministry of Environment and Natural Resources in March 2005 articulating the proposed state policy principles and institutional arrangements that will be the basis of control and regulation and published for public comment. It is not made clear how the issue of supply and demand will be satisfied through this policy. Moreover the draft policy is limited in that it only refers to sand for construction purposes and does not emphasize preservation of ecosystems, water security, biodiversity needs, and livelihoods.

4. Organizational Background

The RSM activists' coalition was first initiated through requests made by contacts made at community level IWRM awareness programs, including children's water awareness programs (Sisu Jala Hamuwa). It was slowly built up into a loosely connected alliance of community groups in RSM affected areas and CSO activists. Almost all the RSM affected communities had attempted controlling RSM through interventions of religious and community leaders and through appeals to politicians. Where there was a strong community leadership there had been higher levels of activism. The highest level of community activism prior of the formulation of the CSO alliance has been seen in Deduru Oya in the North Western Province. The sand mining groups here as elsewhere are seen to have political patrons that sponsor local "strongmen". Local communities along Deduru Oya (DO) had mobilized under the aegis of an umbrella organization termed as "Movement to Save Deduru Oya", a movement led by the Chief Incumbent of a historic temple (Devagiri Raja Maha Viharaya) in Bingiriya.

Their campaign too had at first been one of peaceful demonstrations, appealing to various political and administrative authorities and demonstrations. After some time, the DO campaign took a new turn for a period with the activists physically blocking the sand miners for three months. Windscreens were broken and nail boards used to puncture tires, but no physical violence is recorded. Sand mining came to a halt in DO and livelihoods of sand miners were temporarily lost. The temple, in pursuance of its religious beliefs, supported both the sustenance of the blockage and its religious principles during this time by feeding the families of sand miners who had lost their source of income.

In these early days of the DO agitation, women played an active role in demonstrations and roadblocks, effectively acting as human shields. As has been observed earlier in similar community protests such as the Thuruwila campaign (Athukorala 2006), women are seen as front runners in protest marches, signature campaigns etc. This is partly due to the fact that activism opponents and the police are generally seen as wary of physically attacking women demonstrators. It could also be that women are recognized as raising a legitimate voice regarding loss of water security since they are the most severely affected by RSM related loss of drinking water supplies. However, in subsequent consultations and negotiations with legislators and administrators as part of judicial activism, women are seen to play a less dominant role. This is an interesting issue for further in depth observation and study.

In early 2006, with increasing levels of aggression from the sand mafia, the DO movement and the temple felt that a change of strategy was required. Efforts were made by local DO community to seek, with external CSO support, contacts to launch a national awareness program. Their reasoning was that RSM hitherto seen as a local problem, now needed to be profiled at the national level, as a national and not merely a provincial problem, if a solution was ever to be reached.

The building up of an advocacy coalition per se was not a target at the first point of intervention. The objectives of the DO activists were to simply identify a partner organization which would support their efforts in:

- Highlighting damage caused by river sand mining especially in North Western Province to water security , rural livelihoods and ecosystems
- Raising awareness on resultant loss of national investments and impact on national debt due to RSM
- Raising national consciousness on RSM leading to a change of policy
- Emphasizing the need for development of alternate sources of sands and modes of construction

The chosen method of the CSOs thus involved to be linked with the DO activists, was the organization of a media blitz highlighting the issue of Deduru Oya. Dedura Oya had by then suffered major damage due to erosion and salinity intrusion. A media tour involving members of the print and visual media was carried out on the 28th February 2006 to cover the most damaged hotspots in Deduru Oya. The involvement of all prestigious national media organizations and the extent of ensuing print and visual coverage made this an unprecedented advocacy event even in the eyes of the participant media personnel. NetWwaters and its partner the Centre for Environmental Justice (CEJ) coordinated this activity.

This activity was planned to take place before the dry season started, to move away from the hitherto reactive response of the media and the authorities into a proactive response. The media tour and resultant publicity was intended to red-flag the issue and serve as an early warning for all decision makers before the onset of the dry season. This advocacy effort proved to be extremely successful, with a spate of media reports eliciting positive responses from political decision makers including the Minister of Environment and the President himself. It also sensitized the media, who continue thereafter to highlight RSM issues. The level of reportage has increased substantially and it was even possible to conduct a two day water issues sensitization program for the media. This effort successfully opened out the RSM dialogue from being solely a provincial issue into the national arena.

Another CSO, Sri Lanka Water Partnership, conducted a National Sand and Clay Mining Dialogue presenting the damage due to RSM as well as the need for promotion of alternate sands. This was coordinated by NetWwater with the assistance of Capnet Lanka on 24 April 2006. Several presentations on manufacture of alternate sands highlighted the fact that efforts were needed to draw the attention of actors outside the traditional water sector in order to find solutions. Quartz sand and offshore mining were seen as two possible solutions. The need to sensitize engineers and the construction industry to develop new construction methods too was highlighted. As a result the Minister of Science and Technology agreed to set up a Ministerial Task Force for technological alternatives. But there has been no follow up on this due to prevailing political problems and the escalation of the conflict taking precedence over environmental issues.

As a result of the National Dialogue, the Deduru Oya local action group also gained sufficient public profile to be invited to present their views to the Minister of Environment and the Chairman Geological Survey and Mines Bureau (GSMB) who promised redress especially on the issue of forged mining permits in Deduru Oya. But again little action is seen to have been taken to curb this issue, though certain corrective measures (such as printing permits on water marked security paper) were proposed.

NetWwater received requests from other affected areas to facilitate a similar supportive action. With the support of Lanka Jalani and Capnet Lanka, a linkage was formed with the University of Ruhuna to form a Southern Province RSM Action Committee. An initial meeting was called in December 2006 for a high profile meeting. It had attendance of the Governor, members of the media as well as police. A Southern Province Action Committee was formed with representation from all sectors, including a representative of sand miners. It was anchored in the University of Ruhuna in the Southern province. A reputed university academic became the chair. This group has access to resources of the university and had wide social acceptance. They have therefore been able to continue with awareness building activities, including the production of a video documentary. A positive outcome of the awareness building of the SP Action Committee was that a request was received from the Southern Province Police Department to conduct an awareness program on the impacts of river sand mining for police station heads in the entire province. In all local communities the relative inaction or alleged corruption of the police has highlighted as a major cause for the proliferation of RSM. The police program, however, highlighted political interference as the major issue.

Several local community groups came to the conclusion that localized initiatives alone were insufficient to create an impact on national policy makers. The CSOs thus involved, NetWwater and Sri Lanka Water Partnership with the support of Capnet Lanka were requested to bring together the different local river based initiatives to engage in a broad national campaign. During a meeting of the DO and Nilwala river groups held in January 2007 it was collectively agreed to join forces to form a national network of RSM affected people.

The activist group supporting the coalition building tried to build interlinkages. The Deduru Oya Activist group called meetings bringing together affected communities of mid and lower Deduru Oya region (Chilaw to Nikeweratiya). There were cross visits with the Southern Province Action Group and other observers visiting Maha oya and Deduru Oya further strengthening the linkage of affected communities. These cross visits were intended to bring together communities mobilized around the issue thereby building critical mass. Maha Oya and Attanagalu Oya groups were eventually added on and since then have become very active. Since some of these groups had access to the web and an internet based newspaper they were able to communicate RSM issues in general.

The following suggestions for joint action leading to a People Sand Charter were made at the Bingiriya Joint Rivers meeting in February 2007.

- To form an Environmental Protection Force (EPF) to take prevention measures for river bank erosion such as establishment of trees to strengthen the river banks.
- To take measures to define and protect river reservation areas.
- Support coordination between national organizations which prepare acts & laws related to water resources in Sri Lanka.
- To present observations leading to a Peoples' Sand Mining Charter and hold a conference on revisions needed for the draft National Sand Policy.
- Promote greater awareness and usage of alternative sands.
- Request definition of quality standards for sea sand and revisions in quality standards for the construction industry.
- Start awareness programs for school children (Sisu Jala Hamuwa) in RSM affected areas.

This activity took the form of a meeting facilitated by the Central Environment Authority (CEA) in Colombo. One positive aspect of the joint action was the increasing ability of community groups to dialogue with decision makers. One stated objective of this meeting was to present a Peoples' Charter for Sand Mining and elicit comments on the draft Sand National Policy on Sand as a Resource for the Construction Industry (presented by the Ministry of Environment and Natural Resources in 2005 and as yet in draft form). The DO group has taken the lead in this issue as it noted in particular that that the current draft policy confines itself to construction needs and does not mention sand as a necessary resource for sustenance of ecosystems.

The different river based groups carried out various activities, based on localized needs using the limited resources available. The DO Oya group decided to conduct a workshop for further strengthening the lower and mid Deduru Oya activists to formalize a Deduru Oya Area Water Partnership affiliated to the Sri Lanka Water Partnership. The Maha Oya group requested assistance to build awareness and mobilize communities through a community leaders meeting and a Sisu Jala Hamuwa on World Water Day 2007. This activity has been carried on in conjunction with fishing societies and village disaster management societies in Maha Oya. Community legal rights awareness programs were also conducted in Deduru Oya and Maha Oya. Video documentaries and leaflets regarding corruption and river sand mining have been produced and disseminated. Activities have continued slowly but steadily since, and action is taking place at various levels though the minimal funding and the current tensions caused by the escalation of hostilities in the North continue to pose barriers.

5. Judicial activism related to river sand mining

Public interest litigation, the favoured weapon of Sri Lankan environmental activists, was also undertaken by two environmental groups: the Green Movement of Sri Lanka (GMSL) and the Centre for Environmental Justice (CEJ). Undertaken together with stakeholders of the lower Deduru Oya this served to raise the issue. They collaborated with local level organizations such as Navodya and Mihisara Foundation in North Western Province.

The ongoing Deduru Oya case (S.C.F.R. No.226/06) as it is popularly known was filed by leaders of three community based organizations in 2006. It concerned the issue of virtually unregulated sand mining from a river bed in the North-Western part of the country that had not only destabilized the river banks, but had also caused the level of the water to drop to such an extent that the water supply scheme for Chilaw, the main town of the area was threatened. The allegation of the petitioners was that there was a widespread flouting of the law in which the miscreants were backed by local politicians and the police were therefore turning a blind eye. The Court, having granted an injunction against any further sand mining from the river in question, has assumed the role of monitor, whereby the police and officers of the mining regulatory authority are required to report to the Court every two to three months. This had a salutary effect on police vigilance, increasing the number of arrests for illegal mining and transportation of sand for a short while. The petitioners were allowed to mention any shortcomings and the respondents are required to state what remedial action they have taken. As a result the petitioners have now been able to raise funds and embark on a project to rehabilitate the river banks. Amongst the project's workforce are several poor persons of the area who previously had to make a living doing the illegal mining for the "sand mafia".

This Deduru Oya case highlights two interesting developments:

(i) The willingness of local communities and local organisations, under a capable community leadership, to work together towards protection of water resources.

(ii) The willingness of the Supreme Court to play a monitoring role where other agencies of the State are seen to have failed.

The input of external CSO activists raised awareness of local communities on issues related to the court case. The local communities were not aware of court procedure and how to access the Supreme Court. The CSOs and judicial activists educated the affected communities on the issues related to the court case. The CSOs also absorbed the legal costs of the case. Though the administrative cost of filing a fundamental rights case in the Supreme Court is relatively small, the cost of lawyers' fees, preparation of court briefs and obtaining copies of each day's proceedings

substantially add to the costs. This capacity building and information sharing support given by external CSOs had a positive impact on the local level activism.

However, unlawful sand mining activities continued, together with a high level of sporadic intimidation against the petitioners and other groups who were trying to rehabilitate the river banks. As a result the Supreme Court adopted a policy of calling the case in open court at regular intervals to monitor the situation and in particular monitor the conduct of the police officers of the area.

6. Role of media as a tool for RSM advocacy

Media interventions were seen by the advocacy coalition activists as a key weapon for promoting their cause following the success of the DO media tour in 2006. As such NetWWater with support of the Sri Lanka Water Partnership carried out a media scan of all river sand mining issues reported in five leading Sinhala language newspapers (Lanka Deepa, Divaina, Dinamina, Silumina and Lakbima) and presented at its National Partner Forum 2007 to raise awareness regarding the extent of the damage. Though very limited in its scope, the media scan was revealing, as the news reports from these five newspapers alone referred to ongoing river sand mining activities on 35 of the103 Sri Lankan rivers.

Though Deduru Oya, Ma Oya, Nilwala Ganga and Kelani Ganga were the focus of attention of the advocacy coalition, it is seen through the media that there is hardly any river or water body which is not affected by RSM at some point of its extent. Throughout the country there were scattered and muted protests of groups whose water security and livelihoods was being threatened by uncontrolled RSM. There were very few instances where a strong collective community voice was raised even intermittently as it was in Deduru Oya and Ma Oya. The placement of the news items is indicative of the importance given to the issue. Usually the RSM news items are found tucked away in the Provincial news section or middle pages. The RSM issue rarely made the front page or even the high profile third page.

The rivers mentioned in the reportage listed in the media scan for 2006 are 23 in number. They are Maha Oya, Deduru Oya, Kala Oya, Mahaweli Ganga, Mee Oya, Gin Oya, Ma Oya, Mawath Oya, Maguru Ganga, Galmal Oya, Kalu Ganga, Malawe Oya, Nilwala Ganga, Kimbulwana Oya, Kirindi Oya, Minipe Yodaela, Galewela Rakshita Ela, Talawe Ela , Gin Ganga, Kirindiwella Ganga, Polathu Ganga, Halwatta Oya and Sengal Oya. In an area where formal studies and research are minimal, the media scan was very useful for the advocacy coalition as it further enabled the RSM issue to be profiled as a national (and not a mere provincial) issue by highlighting the extent of the problem.

7. Bottlenecks, pitfalls and possible solutions

As is seen from the above, the damage to rivers and river centred livelihoods by RSM was not without reaction from local communities. The opponents of organized illicit mining usually focused on legal means, advocacy and awareness raising and judicial activism whereas the RSM proponents take the path of intimidation and violence. In the current scenario of political instability, their methods are seen to be more effective and in 2008 high levels of RSM activism has become very difficult to sustain due to escalating threats.

The aim of the advocacy coalition was to create a critical mass and a public voice needed to speed up various processes and receive commitment from the government agencies and the construction sector to invest in research for alternatives that will decrease the use of river sand in construction. There is some success in that there is widespread recognition of RSM as a critical issue. The use of alternatives has been less successful. However, the escalation of the conflict situation in the North,

steep increases in the cost of living, the constant threat of LTTE suicide bombers in the South and the resultant erosion of civil life have been a hindrance to organizing the planned levels of activism in 2007.

With the pressure of the activists minimized and the police more concerned with national security issues, all rivers, and especially Deduru Oya, have seen a recent escalation of illicit RSM which the authorities have done very little to curb. With it levels of hostility towards the media too have risen in 2007-2008 (Annexure 2). Village level RSM activists also experienced severe setbacks due to high levels of intimidation. Continuing violence against civil society resonates in the ongoing threats against media and reflects the current weakness of civil society in Sri Lanka.

Against the backdrop of the ongoing defiant rejection of communities agitating against the Special Economic Zones (SEZ) in neighbouring India, the preferred modes of collective action in Sri Lanka are as yet supporting dialogue, peaceful protests and leaning towards judicial activism. Sri Lanka has not yet seen a Nandigram where activists actually suffer in confrontations. But the sand mafia is successfully sidelining the activists through selective violence and threat in an ever politicized context.

The advocacy coalition followed a well known pattern of ground level activities which built confidence of local persons and communities, followed by networking among CSOs. Nevertheless suspicions among CSOs and perhaps fears of competition for funding too proved to be barriers for strengthening the network. Another constraining factor was the weakness of volunteerism which often found difficulties in identifying human and financial resources for sustaining programs. Ideological divides too were a divisive factor in limiting the power of the advocacy coalition. Against this backdrop, the politically savvy sand monopolies and their powerful linkages with the sand mafia further enhances community powerlessness by their single-minded strength.

Development of alternate construction technology and manufacture of alternate sands for construction is critically needed to reduce the negative impacts on the rivers. Though such technology now exists there is little state or professional support for such alternative technology. Benefits of improving efficiency in use of traditional natural resources such as mud bricks need be recognized and researched and recognized if RSM is to be curbed. Though there have been a few initiatives (such as use of quartzite and quarry dust for a sand substitute) the need to vigorously seek alternatives for sand in the construction industry has not been followed through at a policy or practical level; certain substitutes and aggregates may be cost effective and less damaging to the environment than the current degradation of rivers and waterways. The supply gap can only be met by a clear strategy and involvement of the state and investment of private sector resources in order to satisfy short and long term demand for sand.

Long term related impacts of RSM such as out-migration from the rural sector and reduced agricultural efficiency need to be studied from a national perspective. Control of illicit RSM needs to go in tandem with provision of alternate livelihoods of the affected poverty groups currently engaged in RSM, and with resuscitation of the degraded lands.

RSM in Sri Lanka has not yet been viewed from a serious researcher or development perspective. At the time this paper was in its first draft there were no serious writing on the non-technical issues associated with river sand mining. For long the developmental needs of the construction industry have over-shadowed the damage to ecosystems and livelihoods. RSM creates damage to rivers that are ecologically irreversible in the long run and an urgent and sustainable solution is now needed for the affected rivers and communities in Sri Lanka. The worst affected rivers need a complete moratorium on RSM in order to be allowed to regenerate even briefly. Until then the problems of lost water security and vanished livelihoods due to illicit RSM will remain in the affected communities.

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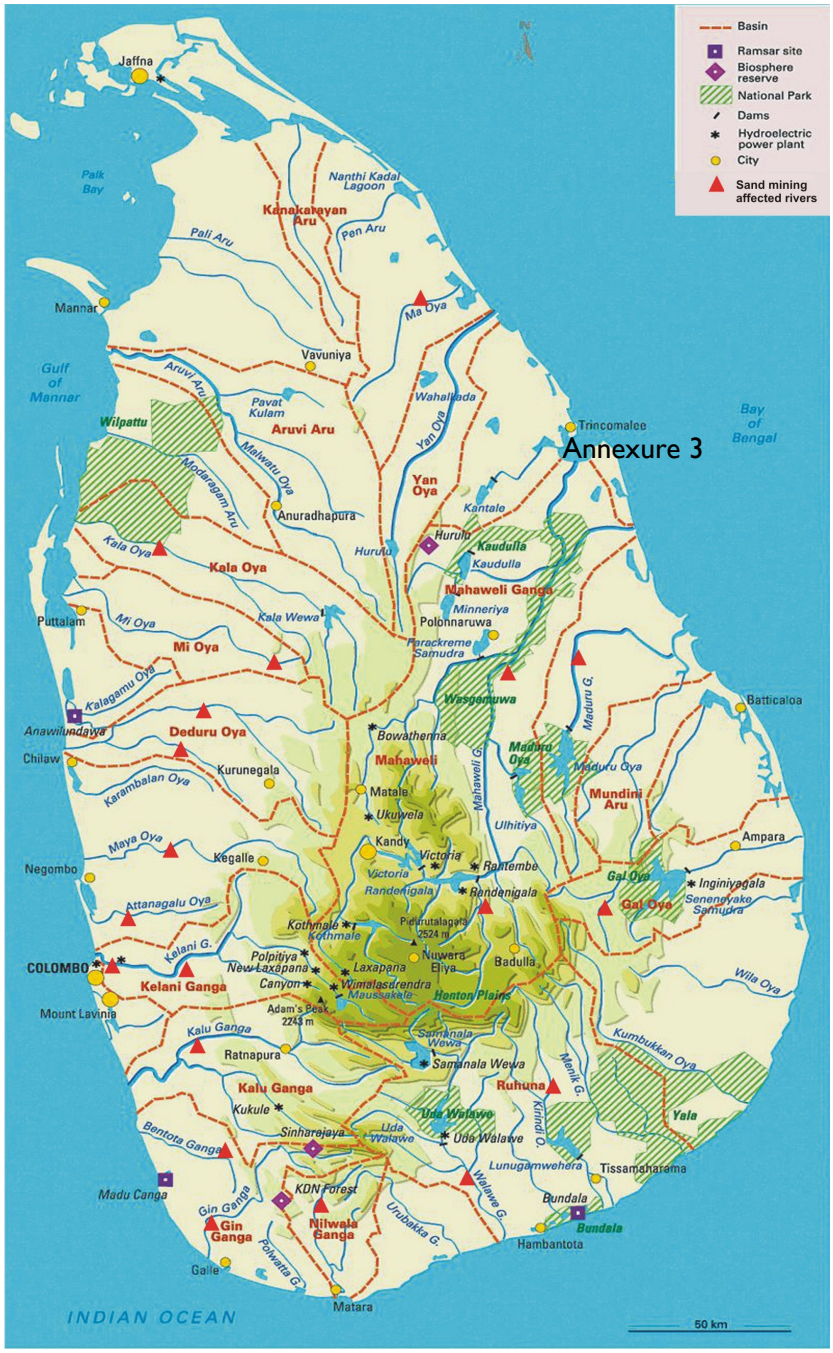
Annexure 1. Map of RSM affected rivers



Annexure 2. Newspaper Clipping

Unauthorized sand miners assault journalist

Jan 2008 DM

BY S SUBASINGHE - BINGIRIYA

Bingiriya

Bingiriya provincial correspondent of the Lankadeepa newspaper Victor Somaweera was seriously assaulted by the unauthorized sand miners in Deduruoya and was admitted to Bingiriya District hospital.

At present, the illegal sand mining is going on unchecked in Deduruoya and Kolamunuoya rivers causing extensive environmental damage. An environmentalist and the Lankadeepa correspondent who visited the area recently were waylaid and assaulted at Urapotta. Somaweera said the gang assaulted him when he photographed a lorry transporting sand. He said the gang armed with clubs and knives destroyed his camera equipment during the assault. OIC Bingiriya police said he initiated inquiries to arrest the suspects. However, the journalist was discharged from hospital after treatment.

Hydropower Development in Nepal: Pluralistic Policy Terrain or Mono-centric Path?

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Abstract

After multi-party democracy was restored in 1990, Nepal's hydropower policy terrain began to grow more pluralistic, involving not just government, but also private and community initiatives. The presence of a diversity of voices has brought numerous societal benefits, in contrast to the earlier government-dominated approach, which often lead to an impasse. This paper takes a brief look at state-guided unitary hydropower development in Nepal between 1911 and 1990 and argues that democratic change in 1990 enabled multiple voices in the policy terrain to be heard and resulted in positive outcomes. Recognising multiple perspectives is a necessary precondition to foster common values and a shared commitment for being able to respond to water and energy issues in Nepal's increasingly complex and uncertain socio-political context.

Keywords

Hydropower policy terrain, government-dominated approach, democratic change, multiple perspectives.

Competing worldviews and contested political space(s)

Recent studies in social science, particularly concerning technological choices, indicate that the response to scarcities of water and energy varies according to people's perception of risk and view of nature which define the problem and preferred solutions. These studies identify four basic orientations or cultural biases in institutions: hierarchical, individualistic, egalitarian, and fatalist.[1] The first three are characteristic bureaucracy, the market and the egalitarian activist group respectively. Each is an active and strategizing grouping which uses a different institutional filter to perceive and assess risks.[2] Based on Cultural Theory (Douglas and Wildavsky, 1982) each orientation elaborates on views of nature that people have. For example, hierarchists assume that nature is tolerant within limits and their management style is to exercise control by keeping the system within its limits. Hierarchists have a risk-limiting attitude. Egalitarian worldview sees nature as ephemeral pursuing a

[1] For a discussion on four fold orientation see Douglas (1999)
[2] See Douglas (1985)

cautionary style. For individualists, nature is benign and people are self-seeking. They are characterized as risk takers, whose strategy is to focus on the short-term. According to Cultural Theory, fatalists believe that nature is capricious.[3]

This four-fold orientation also has salience in the world of dam building. Dam construction began under the aegis of the state which defined the problem as lack of water or energy supply. The solution it proposed was to bring more supply using an expertise-led organization such as a hydrocracy. Such an organisation prefers a structural engineering approach that believes in mastering and controlling natural flows. In the past, dam builders were not concerned with questions of benefits or their distribution. In recent times however, this structural engineering approach has been beset with criticism of social movements that define the problem and solution differently.[4] According to this egalitarian view the problem of poor water and energy services is that there is too much waste. The individualistic market has a third view: it seeks to form networks for maximizing profit. The bureaucracy, the market and the egalitarian groups often jostle and attempt to define the policy terrain on their own terms. Each seeks what Robert Dahl characterizes as closed hegemony in which one voice drowns out all the rest. [5]

The current policy terrain of Nepal's hydropower development fits Dahl's description, the state, its minions and business leaders argue for the benefits of exporting hydropower to become rich. They refuse to consider the merit of "clumsy institutions", a term coined by law Professor Michael Shapiro, as a way of escaping from the idea that when we are faced with contradictory definitions of a problem and its solution, we must chose one and reject the others.[6] In a clumsy institution no voice is excluded, instead contestation is harnessed through constructive, if noisy, argumentation among different worldviews. At the conceptual level, hierarchies call for 'wise guidance and careful stewardship', individualists emphasise 'promoting entrepreneurship and technological progress', egalitarians insist on developing 'a whole new relation with nature' and fatalists ask 'why bother?'[7] On a practical level, considering Nepal's hydropower development terrain, we find these specific responses:

- Hierarchies advocate building large dams to export hydropower to India because the revenue generated will increase the average national per capita income.

- Individualists support continuing with vigour the power purchase arrangement that has fostered the generation of hydroelectricity which they believe will avert a national energy crisis and provide more Nepalese with cheaper electricity services. As long as they can benefit from export through some contract or share in the pie they have no problem with construction of hydropower dams and export of hydropower.

- Egalitarian activist groups argue against exporting hydropower to a single buyer because revenue will be uncertain and because per capita income is an inappropriate indicator of progress. They argue that the poor, socially excluded and nature must be protected and local capital utilized.

- Fatalists simply cope with the ongoing power shortage with a typical Nepali response "*Ke garne!*" (What to do?).

[3] *Ibid.*

[4] Based on Schwartz and Thompson (1990).

[5] This section is based on Verweij *et al.* (2006).

[6] *Ibid.*

[7] *Ibid.*

International stakeholders in water resource planning, development, use, and management have been arguing about the need for and the utility of dams, particularly large ones, since the 1980s. One view is that large dams are needed to fulfil water and energy needs; the other is that the social and environmental costs associated with large dam construction are too high and that the performance of large dams is poorer than promised. The debate has an ideological element to it, casting local approaches to development against centralized ones, supply-side policies against demand-side policies and state-based regulatory approaches against market approaches.[8] Though it has not constructed many dams, Nepal found a position in the global debate when local groups and their trans-national allies questioned the economic viability of the World Bank-funded Arun III hydropower project and forced the Bank to withdraw its support to the project in 1995.

As it is for every country, meeting the demands of a growing population for water, food and energy is a major challenge for Nepal. As life-sustaining resource water is not only vital for the health of the ecosystem but is also a key determinant of national development, especially in the form of hydro energy that will be necessary for sustaining and diversifying livelihoods. For this reason it is also considered to be an important geopolitical resource. Though government, the market and egalitarian activists groups agree on the importance of water to maintain a good standard of living, their views on how the various needs for water should be met differ markedly.

The power of water: from water mills to export commodity

Historical factors, geopolitics and internal socio-political dynamics largely isolated Nepal from the global social, economic and political changes which occurred across the world in the 19th century. The peoples' needs for drinking water, irrigation and motive power were met using locally developed technologies: farmers built and managed systems for irrigation; people exploited springs and stone spouts for drinking water and ran water mills to generate motive power. In the beginning of the 19th century, the expanding Gorkha kingdom of Nepal collided with the British, the colonial power in South Asia, and was defeated militarily. As a result the territorial expansion of the Nepali state came to a halt, the military apparatus lost its purpose, began colonizing internally through rent seeking. In addition, the ruling elite became aware of the utility of modern water use technologies and built the first piped drinking water system, hydroelectric power plant and engineered irrigation system in 1891, 1911 and 1928 respectively.

Unlike in the West where such technologies were developed as a means of production, they were introduced in Nepal as elements of luxury by the ruling elite and the nobility. In the West, the rise of capitalism, science and technology resulted in the emergence of a competitive market; the establishment of universities as sites of knowledge production, problem-solving and capacity-building; a representative polity; accountable governance and functioning institutions of capitalism such as banking, insurance and property rights; and the primacy of the rule of law. In Nepal, in contrast, institutional and structural constraints worked against such developments and kept the country backward. Indeed, even today, there are still traces of Nepal's colonial economic past, when able-bodied men were hired by the British Army and raw natural resources such as timber were exported to the Raj.

Towards the end of the British Raj in India, the potential for exporting electric power from Nepal was recognised. A memorandum by the Secretary of British India suggested:

"There is one particular sphere of progress which seemed to hold out some hope and that it is in the development of hydropower in Nepal. Indeed, it may perhaps be said that Nepal has two important exports, one realised, namely soldiers, and the second perspective, namely electric power."

[8] See Moench, Dixit *et al.* (2003).

The departure of the British from India did not significantly alter its political economy *vis-à-vis* Nepal. Unsurprisingly, the new Indian state emulated the structure put in place by the Colonial Raj. As Gail Kelly and Philip Albach argue,

"*Once established, it is very difficult for the governments of the Third World nations to break with pre-independence. Inertia is a strong force in that functioning institutions, even if they are not ideal, are often seen as sufficient. There are often no readily available models to take place of the colonial structures*".[9]

To cite a particular example, after Indian independence, India and Nepal began discussing ways to control the Kosi river in East Nepal, an effort that had been started by British engineers who had sought to regulate the river using embankments and barrage as early as the 1820s. The two neighbours later have negotiated and signed three water sharing treaties. The 1954 treaty concerning the Kosi river paved the way for building embankments to control flooding and the Kosi Barrage to provide irrigation to Bihar. The Gandak Treaty signed in 1966 was intended to provide supplemental irrigation to north Bihar, Uttar Pradesh and sections of the Nepal Tarai. Both treaties included provisions for building hydropower plants. The two governments signed the third Treaty on the Integrated Development of Mahakali river in 1996.

The idea that Nepal was very rich in water resource emerged after Swiss geographer Tony Hagen submitted a report to Nepal's first democratically elected government. His finding was based on his 1959 study of Nepal's geology which included 14,000 km of travel right across the nation. A few years later, Nepal's Hari Man Shrestha, in a doctoral dissertation written in the former Soviet Union, estimated that Nepali rivers could theoretically generate about 83,000 MW of electricity. The enormity of this number seemed to fuel the popular imagination about the likelihood that hydropower held the key to the nation's development. Surprisingly, what caught people's imagination was not the primary function of the produced energy as an input to the production process but its secondary function as a commodity for export. The logic was that since so much hydropower could be generated and that hardly any would be consumed within Nepal itself, the surplus should be exported to earn revenue for the government. This notion was reinforced by the hydropower discourse in India, which suggested that hydropower generated in Nepal should be used to run groundwater pumps and to promote industrial development in the Indian plains. Referring to the proposed Karnali-Chisapani Dam at Chisapani in the Karnali river, Indian journalist B.G. Verghese wrote in 1970,[10]

"Nepal could not use more than a fraction of the power generated, which by virtue of the impossible mountains to the north, must be exported to India and could be used for lifting groundwater in Uttar Pradesh and for other industrial use…. Nepal would have no other outlets and its revenue from sale of power, would, like the oil royalties earned by West Asian principalities, be the mainstay of it budget."[11]

Hydropower generation and irrigation development in Nepal began in earnest in the 1960s under the aegis of foreign aid institutions. Three early hydropower projects were built in the Trisuli, the Rosi Khola and the Sunkosi rivers with financial and technical assistance from India, the former Soviet Union and China respectively. Nepal also sought foreign technical and financial aid to study the feasibility of constructing large-scale hydropower projects which could export energy to the Indian grid. Most of these projects were conceived as multi-purpose projects: besides generating energy they would facilitate irrigation, flood moderation, navigation and inland fishery. Because the Indian

[9] Gail Kelly and Philip Albach as quoted by Ahmed (2002).

[10] A classic influence of the discourse is reflected in a 1978 speech by the then Nepalese Prime Minister Kirti Nidhi Bista while on an official visit to India. He said that "the completion of Pancheswar project would infuse new life to the slow pace of industrialisation of Uttar Pradesh caused by lack of electricity". Mr. Bista was addressing the welcome meeting organised by Nepal-India friendship association at Lucknow. See *Gorakhapatra* 19 April 1978.

[11] See Verghese (1970).

and Nepali governments had different views on how to allocate costs and benefits, no agreements were reached. In 1996 the two governments signed an integrated treaty on the sharing of the Mahakali river. Nepal's parliament ratified the treaty with the two-thirds majority required by the country's 1990 constitution. Though the treaty proposes a modality for sharing benefits and costs, no progress has been made as officials disagree on the interpretation of certain clauses. [12]

Nepal's continued dependence on foreign expertise for planning, designing and constructing water development projects, including hydropower projects, has been debilitating. The basic tenets of hydropower development, such as local capacity building, using energy to enhance forward linkages in the economy and expanding the pace of providing electricity services to the country's population have taken a back seat as Nepal has continued to witness high energy costs because of its state-guided approach to hydropower development. Despite its theoretical potential of 83,000 MW, in 1995, when the World Bank pulled out of Arun III hydropower project, Nepal generated about 300 MW of hydroelectricity in the national grid and served less than 20 percent of its population. Like many developing countries, Nepal also lagged behind in meeting the goals set during the International Decade for Drinking Water and Sanitation.

Global debates about dams are complicated by the persistently low coverage of drinking water and sanitation services and the increasing pollution and degradation of resource. It is clear that the benefits of large dams are not shared equitably and that dams have many unmitigated negative social and environmental impacts. The bulk of their benefits go to a limited number of people in a limited number of places, to the detriment of the poor, the marginalised, the uneducated and the unorganised. The conventional developmental philosophy, which considers water from a sectoral perspective without considering its broader role in maintaining lives, livelihoods, culture and ecosystems, has been deemed inadequate.

A political space for re-defining Nepal's need for hydropower through societal negotiation occurred in 1990, when the centrist socialist Nepali Congress Party and the leftist United Marxist Leninist (UML), initially Marxist Leninist, came to occupy mainstream politics when the 1990 people's movement overthrew the partyless *panchayat* system. The development ideology of these two major parties seemed to internalise the historical legacy that viewed hydro energy as an export commodity rather than a tool to enhance production, a view which has set in motion the socio-political process defining the contours of the current hydro development paradigm.

Gyawali (2003) has defined this approach which entails adding a hydropower plant only when increased demand has to be met as a classic 'flood-drought' syndrome. Characteristically, Nepal built its second hydropower plant only a full 25 years after the first was built in Pharping. It was another 20 years before it built the third. The power of each plant was supplied largely to the capital and to those regions close to the gradually expanding national grid. Only when the existing supply was exceeded by the growing demand, was another plant added. These projects were initially built with bilateral assistance but after the 1970s they received both bilateral as well as multi-lateral financing. The spectre of planned power outages reached a new height in 2008 when Nepal's power management utility, the Nepal Electricity Authority (NEA), announced that the country's grid would face a power outage of up to 12 hours a day in a dry season and that the condition would last for five years.[13]

[12] For an elaborate discussion on the Mahakali Treaty see Gyawali and Dixit (1999); Dixit, Adhikary and Thapa (2004); Dixit and Basnet (2006).

[13] Faced with a never ending reality of load-shedding the average consumers show fatalistic behaviour and ask '*ke garne*' (what to do?). It is a typical fatalistic Nepali expression which accepts that one can do nothing about anything and hence the best response would be to ask, with a shrug of both shoulders what to do?" In response to the endemic power outage some have switched to solar panels, electric scooter while sale of electric inverter has increased. Petroleum generator sets are other method used to avert power crises.

Nepal's approach to hydropower development was unlike that of Norway, Switzerland and China, all of which began developing small-scale, geographically scattered hydropower plants from the outset. Each plant supplied power to one industry or electrified one community. These countries used their plants as a way to increase their in-country capability to build the larger hydro schemes which would be needed later to expand their national grids (Pandey, 1994). Broadly speaking, the policies of these governments were based on decentralisation, self-construction, self-management, and self-consumption.

A different trajectory can be seen in the United States of the early ninetieth century, when large dams were built to bring human settlement to the West and rivers were used to foster market growth. This development received a considerable boost during the Great Depression of the 1930s, when President Roosevelt's New Deal used construction of large-scale hydropower projects to create jobs for the unemployed and to stimulate economic recovery. Projects provided employment, regulated water for irrigation, and generated electricity for industrial and domestic purpose. This approach became known as the Western United States model. The completion of projects like the Tennessee Valley Authority (TVA) helped transform the Tennessee Valley from one of the poorest regions in the United States in 1933 into a region with a strong, diversified economy and a healthy environmental base.[14] In the aftermath of the Second World War and at the beginning of an era of foreign aid, the water development model of the Western United States was incorporated as a key element of foreign aid. The then U.S. President Harry Truman's four-point programme suggested that technology was the means to solve the problems of development. Large-scale hydropower fitted the model.[15]

Nepal's hydropower development trajectory followed neither of the above paths. It did not construct small-scale, scattered and decentralised hydropower plants as Norway, Switzerland or China had, nor did it pursue the Western United States model of fueling the national economy by enhancing the forward and backward linkages of its investment. Instead, the idea of exporting hydro-energy became the order of the day.[16] Because this approach was adopted, the country continues to face the following major constraints to hydropower development[17]:

- Nepal's energy needs are still met by traditional sources and the share of hydro-energy is less 2 percent of the total energy use. And bulk of hydropower generated is used for domestic purpose.[18] In 2007, NEA sold 40.7% of its electricity to domestic users, 38% to industries, 6.6 % to commercial and rest to non commercial including the agricultural sector. NEA, 2008);

[14] Worster (1985) *ibid.*

[15] President Truman's speech on 20 January, 1949 mentioned four points that would guide American policies towards developing countries: the first related to the interest of the U.S.; the second to the functioning of liberal market economies; the third to resistance against communism and the fourth to the use of modern scientific and technical knowledge to increase production and thus to ensure peace and prosperity in developing countries. See Escobar (1995) for a discussion. The Damodar Valley Corporation (DVC) project in West Bengal was an effort to emulate the TVA model. Its performance has been not up to mark.

[16] Nepal's national past time with export has not materialised in a situation of monopsony buyer. Two examples are the West Seti and the Pancheswor Project, which have been planned for more than ten years but face technical, social and political hurdles.

[17] This section is adapted from Dixit and Basnet (2006).

[18] In 2001 hydropower accounted for about 1.78 percent of the total energy used in Nepal. See http:\www.rrcap.unep.org\male\baseline\nepal\NEPCH.htm and http:\www.bspnepa.org.np\pdfs\cse_61.pdf accessed on 24th Dec 2008. The major share was of forest, followed by agriculture residue. Even in 2008, the pattern is not much different.

- At 79 kWh (Koirala, 2008) Nepal's per capita consumption of electricity is one of the lowest in the world. In advanced countries such as Singapore the per capita consumption is about 6,500 kWh;

- The average electricity tariff of Rs 7.80 per unit is high compared to Nepal's low economic and human development. Per capita income was US $ 289 in 2005 and Nepal ranked 140 of 177 in the Human Development Index;

- The ploughing back of investments into local economies is limited though some small projects do perform well on this count. In the case of the 20-MW Chilime Project developed under the auspices of the market, Bhattarai (2006) found that about 40 per cent of the investment was ploughed back into within the Nepali economy;

- Reconciling competing demands and avoiding disputes over water rights are serious tasks. Studies suggest there is considerable local dispute between different irrigation systems and between irrigation and drinking water systems.[19] The nature of the relationship between power production on the one hand and uses on the other has not yet been documented in many plants though such studies could help identify mechanisms to minimise disputes.

- The hydropower sector is afflicted by the flood and drought syndrome: a period in which surplus power is available is followed by three to four years of deficient supply. In December 2005, the government announced regular load shedding of about three and half hours a week. By February 2008, the timing had increased to eight hours a day (46 hours a week). December 2008 also saw a long period of outage.

The above outcomes fly in the face of the expectation that national development could be achieved by exporting hydroelectricity to India from large-scale projects in Nepal. The policy of exporting electricity was favoured during the monarchy and has continued to be favoured under the republican order constituted in April 2008 when the monarchy was voted out. The Maoists party secured the most votes in the Constituent Assembly and few months after the election became head of a coalition government comprising the United Marxist Leninist (UML) party, other small leftist parties and several parties of the Tarai. During the interim government headed by Girija Prasad Koirala, two major hydropower projects were awarded to Indian companies.[20] Reneging on his Party's earlier promise to nullify the "*rastraghati*" (anti-national) 1996 Integrated Mahakali Treaty, Maoist Prime Minister Puspa Kamal Dahal during his September 2008 visit to New Delhi agreed to pursue the Pancheswor dam project by establishing the Pancheswor Development Authority. In a 40-point rejoinder submitted to the then Prime Minister Sher Bahadur Deuba in February 1996, the Maoist party had demanded that this treaty, which sets the stage for building the 335-m high Pancheswor dam, be abrogated.

Despite the national fascination for power export to the Indian grid, not one project dedicated to that aim has been built. Instead, Nepal imports electrical energy from India. In 2007, it received 3.3 $x10^8$ kWh or 10.8 percent of the energy it consumed that year. It is no wonder that the export

[19] Dixit (1997) discusses dispute between the operations of a hydropower plant in Kathmandu and local irrigation. Dispute among hydropower generation, irrigation and local interests is also seen in the case of the Jhimruk Hydropower Project in Pyuthan District. When Jhimruk Khola was diverted to generate hydropower, the paddy fields downstream were deprived of irrigation water. Local farmers staged a protest demanding that the dam release sufficient water for irrigation. The farmers claimed compensation for the land acquired by the project, demanded employment for local people and the distribution of electricity to the locality. The conflicts over water are discussed in *Water Rights, Conflict and Policy* published by IIMI, 1997.

[20] License of the Upper Karnali Project was awarded to GMR Group while the government owned Sutluj Bidhyut Nigam has received license for the Arun III hydroelectric project.

guided approach began to be questioned, critiqued and challenged by those who espoused self-reliant approach to hydropower development.

Post 1990 era

The self-reliant discourse on hydropower began in Nepal in the aftermath of the political change in 1990 when multi-party democracy was re-established as the partyless *panchayat* system was abolished. The year 1990 was remarkable for many reasons. First, it changed the architecture of the global socio-political context: the breaking of the Berlin wall and the collapse of the Soviet Union were heralded as the victory of liberal democracy. Other events including Margaret Thatcher's privatization of drinking water companies in the UK and the development of the World Wide Web as one of the engines of globalization consolidated the notion of neo-liberalism. This ideology became the new global *mantra* for economic pursuits. Nepal's nascent democracy began its foray along the neo-liberalist path with little recognition for the need to protect the majority, who remained in the informal sector. The country's still immature political institutions stopped questioning the neo-liberal philosophy of development (or lack of it). They adopted an outlook that the forces at work are so powerful that there is no chance of engaging with the course of events and believed that some unseen hand in a faraway place would somehow ensure things work in their favour.[21] Six years after Nepal began its second attempt at liberal multi-party democracy in 1990, a violent insurgency erupted and the Maoists' People's War engulfed the nation for almost a decade, from 1996 to 2006.[22]

There was a positive side to the change as well. Nepal's new attempt at a multi-party system heralded in an era of competitive politics. In this liberalised political environment, citizens demanded rights as well as access to benefits and information. Many questions regarding the path to development in general and to hydropower development in particular began to be articulated in public. Civil society groups began to challenge the conventional approach to hydropower development as debates emerged over the Arun III hydropower project, the memorandum of understanding with India on the Tanakpur Barrage and the Integrated Treaty on the Mahakali river. Other debates over the issuing of a license for the development of the West Seti Hydropower Project to the Snowy Mountain Engineering Corporation (SMEC) of Australia, the proposed awarding of the license for the Karnali-Chisapani multipurpose project[23] to the now bankrupt Enron, the energy giant of Texas, also surfaced.

At the same time, South Asia as a whole saw many other dam-related debates--the sharing of the Cauvery river, the allocation of Ganga river at Farakka Barrage between India and Bangladesh, and the partition of the Indus river system by the Indus treaty between India and Pakistan are only a few of the striking ones. Most of these debates initially involved only two governments. The debate over the Cauvery river, for example, is between the governments of the Indian states of Karnataka and Tamil Nadu and involves the apportioning of benefits as defined by state agencies. In Nepal, too, decision-making terrain about water development and management was dominated by state agencies, which receive support from multi-lateral lending agencies and bilateral donors.

This approach to obtaining benefits is based on the assumption that state agencies are the repositories of citizens' trust and that they can therefore decide for them. Reality is far from such an

[21] See Gyawali (2003).

[22] The contours of the debate began to change around mid 2005s. The Maoist and the government led by Nepal Seven Party Alliance signed a peace accord. The Parliament was reinstated. King Gyanendra lost power and Nepal's monarchy is in the state of animated suspension with the Interim Parliament declaring that the country will be organized as a federal democratic republic. This decision was to be endorsed by the first meeting of the Constituent Assembly whose election is to be held on 10th April 2008. The meeting voted to abolish Monarchy.

[23] This project has been designed with an installed capacity of 10,800 MW

assumption: large sections of the population lack access to basic water-based services and environmental degradation further exacerbates the injustice. As environmental movements in South Asia emerged in the 1970s activist groups began contesting the state-centric approach. In particular, they were at loggerheads with state agencies and the multilateral agency of the World Bank over three projects, the Sardar Sarovar project, the Flood Action Plan (FAP) in Bangladesh and the Arun III hydropower project in Nepal.[24] In each case, egalitarian groups contested the formulation of a project designed to provide drinking water, irrigation, security from flooding and energy by presenting their own sets of arguments. Each espoused its own values and biases, which were defined against those of others and sustained by aggressive self-definition. Each group showed a preference for a particular set of institutional form as well as the kind of knowledge and technological choice that went with it.[25] Since each had a blind spot and provided only a partial worldview, together they would present a more complete picture.

In response to their challenges, the World Bank withdrew its support to all three projects. The Bank's withdrawal was significant for four reasons. First, it indicated that the conventional water development paradigm had reached a state of impasse and that local aspirations would not be met unless there was a fundamental shift in approach. Second, it demonstrated that local wisdom was able to provide countervailing intellectual arguments and suggest alternatives.[26] Third, it became clear that a global initiative of some kind would be necessary to transcend the polarised debate over approaches to dam building. Fourth, even within the Bank views about how a dam should be build was polarised and it became clear that the prevailing model did not work.[27]

The debates in Nepal over the 'trajectory of hydro-development' occurred largely within the global discourse and the debates in South Asia. These debates reflected the desire of Nepali society to adopt practical approaches to developing the country's water resources that would meet the needs of Nepal and the Nepali people. Indeed, the debates spurred the formulation of new polices about generating cheaper electricity, using indigenous financial resources to develop hydro projects, involving the communities as major actors in electricity distribution, institutionalising mechanisms for sharing royalties from hydropower projects with district-level governments, and adopting measures for assessing the environmental impacts of a proposed project as well as for identifying alternatives to it.

Diverse voices bring societal benefits

After 1990, as globalisation brought together not just market actors and government agencies but also helped forge transnational alliances among activist groups, debates of the nature described above began to find salience in Nepal. Gradually Nepal's hydropower terrain began to shift from a mode in which development was defined and implemented by the government alone to a situation in which market and community initiatives also had space. According to Dixit and Basnet (2006), the features of the changes included the following:

[24] Khagaram (2004) discusses the formation of transnational alliance around dam issues. See Dixit (2001) for a discussion on the debate around the three projects, also Bissell (2003)

[25] This discussion is based on Douglas (1999). *Ibid* Dixit (2001) for an application of the concept to the water debates that led to the formation of the World Commission on Dams (WCD, 2000).

[26] Michael Thompson has defined the withdrawal of the World Bank as an indication of local wisdom asserting itself, see Thompson (1995).

[27] David Grey Senior Advisor to the World Bank made this observation in a consultative program on hydropower development in Nepal, on February 1, 2008

- First, the private sector got involved in hydropower development. The promulgation of the Electricity Act of 1992 paved the way for this development in its preamble: "It is utmost necessary to extend proper distribution system in the rural areas where electrification has not been done and also to develop hydropower of the country by motivating national and foreign private investor." The two critical objectives of the Act were (1) to enhance the development of hydropower so it would meet the energy needs of industrial development in the country and (2) to promote national and foreign private sector investment in the development of hydropower. The government's new hydropower policy (2001) adopted the spirit of the 1992 Act with respect to private investment.

- A second characteristic of the shift was the introduction of private (foreign direct) investment, such as exist in the Bhote Kosi and Khimti hydropower projects, both of whose power purchase agreements have raised concerns. A debate about installed capacity of the Bhote Kosi plant has arisen. Another example of private sector investment is the 20-MW Chilime hydropower project in the Chilime river, which was built in 2003 by a local subsidiary company established by the state owned NEA in 1995.

- A third element was the announcement of buy back rates by the NEA Board, an issue of public debate since the 1990. In 1998, the then Deputy Prime Minister Shailaja Acharya, who was also responsible for Nepal's water resources portfolio, announced through the NEA Board the rates at which Nepali entrepreneurs developing hydropower plants in the range of 1 to 10 MW could sell electricity to the grid.[28] According to this proposal NEA was to buy electricity for NRs 4.03 per kWh in the dry seasons (at 90 per cent capacity factor) and at NRs 2.76 per kWh in the wet season. Since this offer did not inspire the confidence of investors, the rates were revised in November of the same year. The capacity factor was reduced to 65 per cent and new rates were set: NRs 4.25 per kWh in the dry season and Rs 3.00 per kWh in the wet. The plants were to begin generation in 2003 and NEA was to buy a total of 50 MW. The purpose of announcing the buyback rate was to encourage Nepali entrepreneurs to invest in and sell electricity to the national grid.

- The partial unbundling of NEA in 2004 was the fourth feature of the shift. NEA is an amalgamation of the then Nepal Electricity Corporation (NEC) and the Electricity Department (ED) in 1985. After two decades of operation, NEA's generation, transmission and system operation, engineering services and distribution as well as consumer services were broken up into core business groups. Twenty distribution centres (DCs), each with some independence, authority and accountability in its operations were created (NEA, 2004). This process reflected the post-1990 move towards the neo-liberal agenda of reforming public sector utilities.[29]

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[28] This decision was taken on 28 June 1998.

[29] Partially unbundling NEA emanated from the push for public sector reform typically seen in post 1990 as the policy pendulum swung from state-led approach to reliance on the private sector. Two decades ago the pendulum was at the other end when private sector institution was nationalised. In 1985 Nepal's Department of Electricity was merged with the governmental owned parastatal Nepal Electricity Corporation (NEC) to form the NEA. The merger was a precondition of the multilateral lending agencies for the approval of a loan to construct the 69 MW Marshyangdi Hydropower Project. Earlier in the 1970s the Word Bank was engaged in putting together a loan for the Kulekhani Hydroelectric Project for the Nepal government. Its staff appraisal reports mentioned private electricity outfits such as the Bageswari Electric Company, Eastern Electricity Corporation and Butwal Power Company (BPC) and tacitly approved their nationalization by bringing them within the fold of the newly created NEA. This decision was guided by the onus to create a monolith state controlled utility to push loans rather than helping companies acquire technical and managerial skill to improve performance and hence the services (Gyawali and Dixit, 1999). With re-emergence of neo-liberal agenda in 1990s, unbundling gained currency and in 2003 government of Nepal sold the shares of the BPC to the private sector. The proposed new electricity act to facilitate the transition was however, stalled due to opposition from trade unions within NEA. How will the financial meltdown of 2008 and government bailing out private banks in US and Europe influence public policy on these processes remains to be seen.

- The fifth element was the government's engagement in dialogue about dams and development with civil society groups and market institutions. The process began in January 2003. In its first phase, the dialogue helped carry out a scoping study that compared Nepal's legal provisions with those recommended by the World Commission on Dams (WCD). The study showed that in theory Nepal's legal provisions reflect the spirit of WCD recommendations and that in some case; the country's provisions are more developed than what the WCD recommends. A second round of dialogue further analysed gaining public acceptance, conducting a comprehensive option assessment, recognising entitlement and sharing benefit and ensuring compliance.[30]

- The sixth and final characteristic of this shift is the providing of a share of royalties from hydroelectric plant to district development committees (DDC). In 2001, HMG began disbursing the royalties it obtained from hydropower projects to the DDC that housed the project. (Initially it handed over 10 per cent; later the amount was increased to 50 per cent by ministerial decision.) The 2001 policy on hydropower also suggests that "one per cent of the royalty obtained by government from a hydropower project shall be provided to the village development committees (VDCs) that are directly affected by the hydropower infrastructure with the sole purpose of expanding electrification in the VDCs."[31]

The liberalised political environment established after the 1990 democratic movement opened space for contestation and for the presentation of alternative ideas. As debates over dams emerged, alternatives were sought and a pluralistic approach to the generation, management and distribution of electricity was charted out. The outcomes were new policies that fostered community electricity distribution as well as the participation of the local private sector with the state serving as facilitator. As a result of these changes, in less than a decade about 300 MW additional of hydropower was generated. In addition, royalties from hydropower generation began to flow from the centre to districts and in some cases, from districts to VDCs.

At that point in time, the terrain of hydropower policy-making incorporated sufficient diversity to be able to persist in the face of change, to spread risk and to address the complex issues of social-political changes. This terrain is an example of clumsy institution in which none of voices were silenced and captured the idea that "hydropower development would aim to provide its people with cheap and reliable source of hydro energy, fast with projects spread across different regions of the country. Such an approach would enable a strong domestic energy base to emerge."[32]

Unitary vs. pluralistic institution

From 1911 when Nepal's first hydropower plant was built in Pharping, till the early 1990s, Nepal's approach to hydropower development has been led by the government, dependent on foreign-aid, and managed by state agencies. This approach was seriously flawed: it was slow, pushed Nepal onto a high-cost energy path, did not build local capacity, and was poorly linked to local economies. The movement onto the clumsier or more pluralistic path began to be charted when liberal democracy was introduced in 1990. Different perspectives about technological choices found space in the

[30] Within its framework the World Commission on Dams had proposed seven strategic priorities that aimed to provide a principled way forward towards negotiated decision-making about selection, construction and management of a dam and its alternative. The other three strategic priorities are a) addressing existing dams, b) sustaining rivers and livelihoods, and c) sharing rivers for peace, development and security. For a summary see Dixit (2007).

[31] This provision relates to the 1% revenue for rural electrification and was mentioned in the Finance minister's budget speech of 1993/1994 and 1994/1995 Upadhaya (2005). The policy further proposes that, "A Rural Electrification Fund shall be established for the development of micro hydropower and rural electrification by pooling in a certain percentage of the amount received as royalty." This provision, however, remains unimplemented.

[32] Gyawali (2003) has proposed that hydropower development in Nepal must be cheap, fast, reliable, regionally balanced and with a strong domestic base.

political sphere and a shift in policy emerged. This shift produced social benefits: generating capacity was increased and a procedure for sharing benefits with locals incorporated.

In the post 2006 political milieu, however, Nepal faces a contradiction: although there is a serious deficit in internal power supply, the government is pursuing a strategy of power export. This shift is a result of Nepal's power-export political economy and the policy vacuum, which arose after 2001 when the country's politics took a nasty swing downwards from the bloody palace massacre to the peaking of Maoist violence followed by a constitutional crisis and King Gyanendra's taking over power in February 1, 2005. The convoluted political trajectory took another swing with the initiation of the people's movement of 2006, the restoration of the parliament, the Maoist's signing the peace accord with the then government led by Girija Prasad Koirala, and the election to the Constituent Assembly and finally to the abolition of Nepal's monarchy, the formation of a new government and the political violence in Nepal's Tarai. The new Nepali government led by the former rebels announced that in a ten year period Nepal would generate 10,000 MW.

The announcement marked a reversal: the policy terrain has once again started its mono centric assertion that hydropower export should be order of the day.[33] In other words, Nepal's hydropower terrain is sliding towards a closed hegemony as opposed to pluralistic democracy. Once again one idea dominates and all other voices are being ignored.

Inconclusive conclusion

For a brief period from 1996 to 2002, a pluralistic policy terrain did provide social benefits from hydropower development though politically Nepal did not do well. These social benefits can be attributed to the presence of differing definitions of the problem and its solutions. Mixing alternative institutional forms and policies kept the policy process dynamic. It was a tremendous improvement in the previously government-dominated approach. Yet subsequently there has been a policy hiatus in the form of massive power outage and hegemonic pursuit of an export paradigm. It is beyond the scope of this paper to lay out the actual reasons for the current impasse in hydropower sector, which is manifested most conspicuously by the ongoing electricity supply outage.

The belief that exporting power is the best strategy for achieving prosperity though contested by a small group of academics and social activists nonetheless continues to dominate. The government, Nepal's educated elite and political leaders need to pay attention to the basic principle that energy input is fundamental to production processes and that only when it is used prudently will the country move on a self-reliant development path. Exporting hydroelectricity will only perpetuate the status quo, marginalise the broad role of water in maintaining the health of ecosystems and social welfare, while reinforcing its semi-colonial political economy.

Without access to reliable sources of cheap energy from hydropower projects with low social and environmental costs including renewable energy sources such as solar, wind and biogas, the much needed social and economic progress will remain elusive. Any financial gains to the government from the export of hydroelectricity will hardly count as economic development despite current political claims to the contrary. What is needed is a paradigm shift, from unitary hegemonic state-market centrism to a pluralistic terrain, not only of hydropower generation but for water development and management. This shift will be possible and can produce desirable outcome only when Nepal's political space allows room for the competitive market, the state and the activist groups to be constructively engaged in the policy process.

[33] Ney (2006) provides a tool to evaluate if the policy space is closed hegemonic or reflects the creativity if clumsy institution where all voices are head and engage in dialogue.

Post Script

The saga of hydropower export from Nepal will not be complete without the inclusion of a few recent events that veer towards the comical rather than appropriate conduct of statecraft. On 14th December, 2008 Nepal's Prime Minister Puspa Kamal Dahal inaugurated the 70-MW Middle Marshyangdi hydropower project. Four days after this event the daily supply outage duration increased to 63 hours a week from the 42 hours. This increase reflects a profound crisis in the country's energy planning as the outage should have decreased.

On the 13th of December, one day before the inauguration, the government had announced plans to construct 200 MW decentralized thermal power plants close to load centres to overcome the shortage. The very next day, officials of NEA, which is chaired by Nepal's Minister of Water Resources, termed the decision of installing thermal plants a 'disaster', and charged the government of not doing its home work. According to these officials, "[T]he thermal plant, is not viable both financially and physically". On the same day, while speaking in a programme organised by Confederate of Nepalese Industries the Prime Minister hinted that the outage would reach 18 hours a day in March/April (or 126 hours a week). He went on to say that even if 200 MW of thermal generations were installed, daily outage of 5 to 6 hours would continue. Without electricity, he admitted that it would not be possible to draft the new constitution.

Next day on 14 December 2008 the head line of *The Himalayan Times* said, "Tehri-like project likely for Nepal". A photograph of Nepali Prime Minister being received by the chief of India's Tehri Hydro Development Corporation accompanied the article. The Prime Minister had visited the Tehri Project after his official trip to New Delhi during 11-12 November, 2008. A few days later *Nepali Samachar Patra* revealed that the government was all set to take immediate decisions on large projects such as Pancheswor, Karnali Chisapani, West Seti, the Kosi high dam and the Naumure hydropower project.[34] Because hydroelectricity from these large-scale dams, except that from Naumure, is designed to supply power to the Indian grid, not a single energy unit will be available to Nepal.

The advent of Nepal's democracy in 1990 saw some creative policy changes in the water and hydropower sector that brought societal benefits. This window has not lasted, however. As the world's newest republic moves to institutionalize itself, the narrative of the illusive electricity-export led prosperity and policy ad-hocism, rather than the very real needs of its citizens, has begun to guide the conduct of the State. This narrative flies in the face of current Nepali reality where even reliable electricity supply to those Nepali fortunate enough to be connected to National grid, remains elusive. That the majority of the country's citizens still remain without access to basic electricity services suggests much deeper contradictions.

[34] *Nepal Samacharpatra* quoting the Prime Minister's office revealed that the government will declare national electricity emergency shortly, and that the cabinet will approve the work plan submitted by the water resources minister. The work plan included, government providing subsidy to establish thermal plant, revoking of permission from Department of Forest to build a hydropower plant, immediately take up projects like Burhi Gandaki, Upper Seti Reservoir including Pancheswor, Kosi High Dam and Naumure. See Babu Ram Khadga (2008) *Nepal Samacharpatra*, December 23, 2008. Pancheswor, Karnali Chisapani, Kosi High Dam are large scale water projects included in the communiqué issued after the visit of the Prime Minister Girija Prasad Koirala to New Delhi in 1991. Snowy Mountain Energy Corporation (SMEC) holds the license of the proposed West Seti Project since 1994 but faces major social, environmental and political challenges. Conceived as a multipurpose project, Naumure has been defined as a hydropower project during Prime Minister Dahal's visit to New Delhi in September 2008.

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Governance of Water: Institutional Alternatives and Political Economy[1]

Ed. Vishwa Ballabh. New Delhi, Sage Pub., 2008, xiv, 386 p., figs., tables, ISBN 81-7829-770-5.

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In the current discussion on water sector reforms one can discern wide and growing consensus on key issues. It is generally agreed that water is a finite commodity; it has to be looked at in a holistic manner; it has characteristics of social as well as economic good; need to conserve water is as important as the desirability of containing demand yet, at the ground level these principles are hardly respected. In this context one would like to identify the reasons for this gap between what is professed and what is implemented. One of the important reasons, obviously, is the failure of governance at various levels. The book under review discusses different facets of governance in the water sector. The contributors to this volume are well known scholars in this area and many of them, additionally, have rich administrative and field experience. The book is organised in four parts, sections dealing respectively with (i) governance, (ii) pricing and subsidies in surface water, (iii) ground water governance, and the concluding section, (iv) the way forward. As should be expected in a book, which is a collection of papers contributed by different writers, there is large degree of overlap of themes and presentations.

The issues in governance are examined from three perspectives: legal, public administration and institutional. The definition of governance used in many of the papers is very broad. In his insightful paper Ramaswami Iyer warns against too much preoccupation with definition of 'governance' and lists serious issues in the water sector. e.g. rural water supply, canal water irrigation, ground water management, issue of large projects, etc., and makes a plea to discuss these and other relevant issues from financial, economic and management points of view, from users' as much as from the point of view of the delivering agencies. Equally important is his discussion on whether water should be treated as a tradable commodity or it should be considered a natural good. His conclusion, endorsed by may other contributors, is that access to minimum necessary supply of water to each household should be treated in the 'right mode', and only when water is used as an input in economic activities it acquires an economic value.

Two neglected aspects of water management, viz., risk reduction and survival needs of water are discussed in two insightful papers. It is pointed out that risk reduction and coping with drought cannot be discussed meaningfully without taking into account the access to and control of scarce water resources. On similar ground, need to look into water management from women's perspective is emphasized in another paper. Water scarcity and access to water affect women in a critical manner. If one takes into account women's perspective, approach to water allocation cannot be based purely on market-oriented policy (Kulkarni).

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Other important messages on governance issues coming out of the papers are: the present system is overly concerned with supply-side management, it is dominated by bureaucracy and is largely indifferent to social reality, unequal distribution of assets tilts the access to water in favour of the more powerful sections of society, and at each societal level there are dominant groups who influence the political economy of water in their favour. It is recognised by the authors that without taking a stand on normative grounds challenges in water sector cannot be appreciated, much less resolved.

In the second section papers on Pricing and Subsidies, bring out clearly the inadequacy of the water charges to meet even Operation and Maintenance costs. The case for raising water charges is further strengthened when it is pointed out that water charges constitute an insignificant part of the total cost of production while irrigation substantially enhances the yield of the crop. These facts are known but needed some concrete numbers to bring home the lessons, and that is provided in the presentation of the authors (Raju and Gulati).

A difficult question is how to increase the water charges? According to the authors in the volume following steps will be helpful: greater autonomy to irrigation authority; involvement of farmers in the management; establishment of independent regulatory body; making the system more transparent. The authors emphasize the need for decentralization and for proper accountability to be built into the system. Other measures suggested include organization of Water Users Associations (WUA), public private partnership and, in special cases, privatisation. It is repeatedly emphasised that any such raise should be accompanied with distinct improvement in the quality of services. The authors are sceptical about the efficacy of bringing about social change through formal associations. Such change occurs through negotiations that take place at informal and legally undefined space. (Esha Shah)

In one of the papers (Thomas and Ballabh) a neglected aspect of raising revenue from irrigation is highlighted. It is contended that importance of the positive and the negative incentives for the cost collecting agencies cannot be ignored. The question of collection of irrigation charges becomes more complicated, as Parthsarathi has shown in his paper, when there is a possibility of access to ground water (from tube well operators) for supplementing surface water. It should be recognized that such inter dependencies between various sources of water for irrigation will be more common in future.

Another important issue discussed by several authors of the volume is the paradigm of Participatory Irrigation Management (PIM) particularly the organization and functioning of Water Users Associations. PIM has come to be seen as *mantra* for removing all the ills of irrigation system. As it is, WUAs are being created simply as an aid to bureaucracy and not as mechanism for securing a fundamental change in control relations. The other set of problems vis-*à*-vis WUA are because of multiplicity of institutions at the local level, and possibilities of conflicts among them. Such difficulties are exacerbated, as the hydrological boundaries do not coincide with administrative boundaries.

Ground water management and regulation are the most ticklish issues in the water sector. The discussion on these issues in the third section of the book is mostly conducted in the context of water scarce regions where the problems of groundwater regulation are most acute. There are, however, some regions especially in the eastern India, where ground water is abundant and its systematic exploitations can help cultivators including the small holders. A study of groundwater expansion in few 'surplus' states' suggests that several factors contribute to ensure success in this regard. The most important among these being positive approach of the Government, availability of institutional finance to support the program, competitive market for pump sets, and the helpful role of Panchayats (Vishwa Ballabh et al).

However, major difficulties in the regulation and management of groundwater resources are faced in the water scarce regions where exploitations of ground water is confronted with serious problems including, mining of under ground water, iniquitous control over the water, "bagger the neighbour"

approach of the resourceful tube wells owners, and inconsistent policies of the government particularly in subsidising energy for water lifting in water scarce regions. Clearly the present approach of ground water development is not only iniquitous but also unsustainable. However, to regulate groundwater extraction is not an easy task. Tushar Shah in his paper sheds lights on some of the aspects of regulation of groundwater in a comparative study of South Asia, China and Mexico, the regions where agriculture is heavily dependent on ground water.

Major findings of the study are that success of regulatory regime largely depends on the number of people dependent on ground water; smaller the number easier it is to regulate. With innumerable well owners it is difficult to enumerate wells and register groundwater exploitation much less to regulate it. The countries, which have attempted such tasks, e.g. Mexico, have achieved only limited success. The implicit conclusion is that the private sector transactions in water through water markets would be a better approach to enable access to water by small landowners who do not own wells. The discussion on water mining linked with the key issue of the common ownership of the land and water is largely absent in this otherwise interesting paper. Similarly, the role, which decentralised institutions can play, as illustrated in the case of China and also in West Bengal, has not been sufficiently highlighted.

The concluding section is titled "Way Forward" which gives rise to the expectations that some implementable recommendations will be emerging from the earlier discussions. This expectation is only partially fulfilled. Some of the authors have emphasised what is the called "multi-stakeholders process" (MSP) for resolving water related disputes by bringing together the contending parties and initiating a dialogue. However, they are aware of the fact that negotiations based on this approach can also be captured by the elite, who may dominate the process, although it is called a participatory process. It is suggested that for MSP to succeed certain prior conditions have to be met; heterogeneity of the stakeholders should be recognized; there should be knowledge about prior rights; an innovative approach to resolve the problem should be introduced; reliable data should be available, and; a committed resource agency should be present. The key is to turn situation of conflict and distrust into opportunity for mutual aid and cooperation'.

Contributors in this section find that the route of water markets is not the right one to ensure equitable access to water. In fact, water markets could turn out to be very exploitative, mainly, because the initial ownership of ground water is unequal. Yet one of the authors, Tushar Shah, emphasises the market-induced solutions introduced by what he calls *Swayambhu* institutions, i.e., institutions created by people themselves. On the other hand the institutional arrangements for regulation and management of water introduced by the government agencies in our country have resulted into high transaction costs and low pay off. He concludes that induced institutional change can succeed, when participants clearly benefit; when there is a rule enforcement mechanism in place, and; overall institutional environment is helpful for the change. It is suggested that no institutional mechanism can be copied from one environment to other.

The concluding paper by Peter Mollinga gives clear guidance on the agenda for further research. As he rightly says, "we should generate knowledge for understanding but also knowledge for doing". As far as agenda for research is concerned he has classified policy research in (a) research for policy; (b) research on policy processes and; (c) research in policies. Three major areas for research suggested by him are, the rationale, resilience and dynamism of water sector bureaucracy; inclusive water resource governance at intermediate level and; policies and processes due to which intervention are captured and transformed at the local level by interest groups.

From the above discussion it would be clear that the authors have raised pertinent questions, shed light on alterative approaches and recognised decisive importance of the context and the environment prevailing in different regions. On many water-related issues they have enriched our understanding. However, they are certain key areas on which the discussion is either incomplete or totally absent. One of the most important areas is that of the organisational arrangements and

incentive structure of bureaucracy managing and regulating water in the states. Similarly, though there is a mention about a regulatory authority for water on the lines of power regulatory authority, in a few papers, its role has not been spelled out, nor the reasons why it has not been constituted in majority of the states despite the insistence of the aid giving agencies elaborated. Another unresolved issue in the governance of water sector is the management of water at the meso level. There is good deal of discussion on ground level water management, i.e., on Water Users' Associations. It is recognised in one or two contributions that WUA will not be effective unless at a higher level i.e., at the meso level, there are supportive organisations. However, none has provided a convincing explanation for the failure of this idea to catch up. The most ticklish problem of proprietary rights in the ground water has gone largely unnoticed. With several acts on ground water regulation and management proposed in a number of state assemblies, this aspect should have drawn attention of the contributors and some discussion ought to have been there to resolve this issue.

The approach to the organisations of surface water users, i.e. Water Users Association, has been discussed with all its ramifications. But there is no such discussion as far as groundwater users are concerned. Admittedly, organization of ground water users is more difficult as the number of beneficiaries from an acquafer is not easily discernable. But now with the help of technology, i.e. with GIS, it is not only possible to map out the acquafer, but also to bring out the quantum of extraction of water at different levels. Neglect of the role of technology is very glaring in this impressive array of discussion by highly knowledgeable persons. Despite very commendable efforts by the authors of this volume there are areas that still require deeper understanding and more realistic solutions to manage water sector in sustainable and equitable ways.

Towards Water Wisdom: Limits, Justice and Harmony

Ramaswamy R. Iyer. New Delhi, Sage Pub., 2007, 272 p., ISBN: 9780761935858

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Holding Alternate Vision

The catastrophe and crisis of water management has been a known fact in India reflected in persistent water scarcity and droughts in many rural and urban locations. Apart from the issue of resource management, the predicament lies in having lack of ideas on how exactly water should be managed. *Towards Water Wisdom* is a contribution towards this discourse taking into account, the inherent limit of the resource and from the lens of justice for individuals and in harmony with nature.

The book is divided into six sections. The first section deals with the water scene in India through the lens of looming water crisis and presents the alternative view. The author critiques the mainstream view of water management as the crisis of water availability looking at the increasing demand due to urbanization and industrialization. The answer of the mainstream view lies in supply side management to create water infrastructure. Iyer redefines the 'crisis' as gross mismanagement and rapacity. The interrelated threads for Iyer are water governance which is constituted by water policy and management principles. The mainstream views of water governance, according to the author, have led to 'high-handed, violent and cruel aspects to those who face displacement /loss of livelihood and delayed and badly flawed rehabilitation' (pp 29). An alternative view is to use a mix of supply and demand side management with emphasis on community led and controlled augmentation as first resort while big dams, long distance water transfers projects as last resort to solve water crisis.

The second and third section maps water conflicts including river water disputes. These disputes ranges from inter-country rivers Treaties such as Indus and Baglihar (between India and Pakistan) to inter-state treaties such as Cauvery (between Karnataka and Tamil Nadu), The Punjab Water Imbroglio (between Punjab and Haryana) and 'other' kind of conflict between developmental plans of the state and the livelihood and rights of the people in the Narmada valley. The larger question that Iyer asks is the gross mismanagement of water resources of the rivers and issues of inequity in resource distribution that are subservient to the politics of nations and states. On the conflicts of 'other' kind, Iyer challenges the notion of 'development' on the basis of sustainability, justice and equity and calls for adopting more humane and enlightened policies on displacement and rehabilitation.

The fourth section observes the inadequacies of water laws and policies of India and maps the perplexities of ownership of water between the State and the community. The argument is that 'the economic rights of some must not be allowed to endanger the fundamental rights of others' (pp 161).

The fifth section presents national water concerns in other South Asian countries. At the international/global level, it deconstructs several notions and prescriptions currently in vogue, and takes note of significant new thinking. Finally, the author widens the perspective beyond water to the total water management. The facets of water wisdom, according to the author, is responsible use of the scarce water resources, reasonableness towards other users and understanding the effect of actions especially towards the poor and marginalized. This responsibility encompasses restraint, sense of justice and moral obligation and comes close to the concept of *dharma*.

Written in a lucid language, the book is interesting and simple to read and comprehend. The arguments are straightforward and sharp. Coming from a person who served as Secretary of Water Resources for the Government of India and within his tenure worked on shifting the Ministry's attention from big projects to resource-policy issues, the book is an account of his wisdom on water and related issues generated over time. The only critique goes to the editor of the book for not having suggested longer chapters (some chapters end in just two pages) and the sections may have had more sharp opening and concluding paragraphs that summarizes what is going to come in the section and the main conclusions, for the readers. In a rare combination of a person who worked as career bureaucrat and academician later, the book is an exceptional combination of his experience and is refreshing for its alternative perspective and wisdom.

Putting Cultural Politics into Water Policy[1]

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The struggle in the Narmada valley brought home to me how questions of knowledge and power permeate every aspect of our work. How do we decide what the important research questions are? To whom do we address our answers? What forms of knowledge do we value? How do institutional power and academic discourse, notions of audience and expertise, act as filters, selectively shaping the production of knowledge and its relation to practices in the world?

That these are very critical questions is evident when we look around us. We live in a world where conflicts over natural resources are writ large upon the landscape. Be it the struggles between farmers and corporate firms for land for dams, mines, SEZs, or the debates around climate change or genetically modified crops – the big dramatic crises as well as the small, everyday battles for water, shelter or land – all testify to the salience of ecological conflicts in our times. The centrality of these conflicts, and even the instances when they are seemingly absent because they are managed by stable regimes of extraction, requires that we closely examine the relations between nature, culture and power as they shape our lives and the biophysical world we inhabit.

In this talk, I'm going to argue that the questions of nature, knowledge and power that have so far been addressed through the lens of political ecology would benefit from being studied through the lens of cultural politics. Political ecology, like its progenitor political economy, has tended to trap us into forms of economic determinism (the notion that everything is reducible in the last instance to pre-existing, usually economic interests). What political ecology tends to give us is 'stakeholder analysis': a matrix of actors with pre-formed interests, who do not change even though they relate to each other in dynamic situations, actors who have no identity or being apart from their instrumental orientation to the resource in question. We know that real life and real people are not like that, yet political ecology persists in creating abstractions that ultimately founder on the rocks of reality. What we need is a mode of analysis that focuses on the full range of material and symbolic values in how water comes to be imagined, appropriated and contested. Such an understanding, I believe, is also more likely to enrich political practice and public policy on issues of social justice and ecological sustainability.

To look at how we might understand cultural politics, let me offer an example not of water but oil. The ongoing war in Iraq is now in its fourth year. Numberless Iraqi men, women and children have died – there is no official record of civilian deaths, a once-prosperous country is in ruins, its economy gutted and its territory divided up between warring factions. One can analyse the US

[1] The keynote address titled "Putting Cultural Politics into Water Policy" by Dr.Amita Baviskar at the opening ceremony of the International Conference on Water Resources Policy in South Asia in Colombo (17-20 December 2008) has been included in the first edition of SAWAS e-journal with the kind permission of Dr.Baviskar. This address is extracted from a longer essay which appeared as the Introduction to Baviskar, Amita. 2008. (ed.) *Contested Grounds: Essays on Nature, Culture and Power*. Oxford University Press: Delhi.

invasion of Iraq in terms of empire and capitalist control over a critical resource like oil, a resource without which the entire military-industrial complex (and large parts of the agricultural economy) would grind to a halt. Yet this explanation will not exhaust either what is at stake or the form that conflicts around natural resources take. The politics of oil has other meanings that are as constitutive of its meaning and power. To understand the extraction of this resource, we need to focus not only on the regime of rule of which it is part, a regime of rule involving technologies, rationalities and institutions, we also need to focus on how this regime of rule is made intelligible by a regime of truth that tries to organise understanding and experience.

The technologies of rule that develop around natural resources have most often been studied in terms of the imperial quest for stable regimes of extraction for profit. Wars of conquest and 'pacification' are followed by occupation and the coerced re-arrangement of relations of rule, production and exchange. In contemporary times, David Harvey describes this process as 'accumulation by dispossession'. Yet, profit – the economic calculus of private benefit (to US corporations like Bechtel and Haliburton who have contracts to rebuild Iraq) – cannot be separated from passionate attachment to more lofty ideals. In the Iraqi case, as in other colonial schemes, the violence of extraction is tied to ideas of Improvement. As John Stuart Mill declared 'despotism is the legitimate mode of government in dealing with barbarians, provided the end be their improvement'. Echoes of this view can be found in the Indian debate on displacement and dams. So U.S. military occupation is presented as a way to further the welfare of ordinary Iraqis through improved management of their polity and economy: occupation is good for you, for minorities and women. This conceit is underwritten by a key imperial ideology: the notion of stewardship, the idea that the 'more civilized' know best how to run the lives of subordinate peoples and manage the landscapes they inhabit.

Ideas of Improvement, based on constructions of cultural difference – discourses of race and nature, gender and nature (the savage adivasi who needs to be civilized, the village woman who needs to be saved from patriarchal tradition), are at work in creating the White Man's burden, a cultural orientation that continues to inform contemporary discourses of development. These ideas are implicit in the logic of economic planning and the goal of efficient resource use as best directed by technocratic experts, who lead the less-educated towards an enlightened, prosperous future. Democracy, of course, throws a spanner in these works: there is resistance from the material that makes up the machine as well as those it intends to use as cannon fodder. Regimes of rule and truth (like the Iraq war), must struggle to hold their own against unruly subjects and circumstances.

Constructing stable regimes of extraction thus requires not just brute force but also the mobilization of 'consensus' such that others be willing participants. Official narratives frame the 'problem' in ways that legitimize particular forms of action. The U.S. government called its project 'Operation Iraqi Freedom', a classic Orwellian instance of doublespeak. These are powerful representations. If the war in Iraq was about oil, as it indeed was, it was also about freedom and the war on terror, Arab nationalism and evangelical Christian fervour. One is no less real than the other. All have consequential effects. Just as, in the Narmada case, the notion of 'national interest', the idea of adivasis as ecologically noble savages, the belief in the sacredness of a river, or the belief that water should not run 'waste' to the sea, were all powerful concepts that organised different people's understanding of what was at stake – as much as the data on water flows, irrigation potential, submergence and displacement. How one interprets the facts, or even decides what is relevant data and what isn't, is shaped by ideology. Appreciating the inseparability of the material and the symbolic dimensions of the conflict helps us to understand that the political economy of a natural resource is meaningful only through the wider networks of cultural politics in which it is embedded.

Political ecology and cultural politics

The *cultural politics* approach to natural resources attempts to undo some of the assumptions that govern *political ecology*. Political ecology's great strength has been its consistent focus on issues of social equality and justice at stake in conflicts over natural resources. This rich literature has examined social movements large and small that bring together diverse social groups, often address transnational audiences and use international and national regulatory and judicial institutions to defend threatened livelihoods against the incursions of state-led extractive development. However, while political ecology's analysis clearly identifies asymmetries of power, they tend to be viewed as the binary of civil society versus state, or to use Henry Bernstein's phrase, 'virtuous peasants' fighting against 'vicious states'. It is often assumed that the 'state' and 'communities' are separate, autonomous entities with self-evident interests that are clearly opposed. Now these assumptions have been shown to be flawed time and again and need to be replaced by more complex representations, which are indeed now emerging. But it is still overwhelmingly the case that political ecology takes at face value the simplified political representations that social movements must generate in order to mobilise. Yet this uncritical reproduction of claims, often intended as a gesture of solidarity, ignores the difficult, creative work of constructing political identities and alliances and transcending differences. In doing so, political ecology may not only miss the bus in terms of analytical purchase, it may also be complicit in the continued political marginalization of those excluded by dominant narratives of environmental movements (the plight of landless Dalits in the Narmada valley remains invisible if one sticks too closely to the narratives offered by social movements).

Identities and interests are not pre-given; 'stakeholders' don't simply exist to be fitted into a matrix of resource management. Identities and interests are mutually formed through the contingent, lived experience of historically-situated cultural practices. The adivasi fighting against displacement who, ten years ago was a farmer, a collector of forest produce, a mother, a worker on state drought-relief projects, and an anti-dam activist, might today be a panchayat leader, a migrant worker, a devout member of the Gayatri Parivar sect, a consumer of manufactured goods like fertilizers and saris, a voter in state and national elections, and so much more. These multiple and changing facets of her life, its criss-crossing affiliations, are not only intrinsic to how people live their everyday lives, they are hugely important for shaping collective action. However, political ecology tends to assume that cultural identities are pre-formed, derived directly from an objective set of interests based on shared locations in terms of class, gender or ethnicity that challenge nationalism and/or capitalism. (For instance, Bina Agarwal's enormously important work on gender and land assumes that women will always want rights to agricultural land; if they don't, it's either because of patriarchal dominance and repression or false consciousness. This assumes that a person is first of all an individual, with objective interests true for all times. But as Cecile Jackson shows, a woman may feel that her interests and her identity are best served by being *part* of a family or village and that her welfare is better gained by working *through* rather than against family and kin networks.)

Political ecology has also assumed that the primary significance of natural resources resides in their material use value. A forest becomes the locus of contention because its trees represent timber, fodder or fuel, material values desired by different social groups. Cultural politics suggests that natural resources have value within a larger economy of signification which crucially shapes their modes of appropriation. They are also resources for collective representations that exceed the concern with immediate material use. One only has to think of the deep spiritual meanings with which mountains and rivers in the Indian subcontinent are endowed – the connections between cosmologies and communities, the concern with the natural and social order that transcends the mundane – to realize the limits of a political ecology perspective. This 'social life of things' is well illustrated in David Mosse's study of village water tanks in Tamil Nadu where dalits mobilized to be included in the tank management committee. For dalits, many of whom were landless, it wasn't the material gains from controlling water that mattered as much as the symbolic capital of being part of an association that managed the village temple and tank, an institution from which dalits had

traditionally been excluded. The Water Users' Association mattered not so much because of the material resource it controlled, but because it was an arena where dalit aspirations for upward mobility and power could be pursued. As much as the material practices of cultivation, concerns about honour and respect, crystallized through a region-wide dalit movement, became central to water management.

Cultural politics thus embeds resource struggles within a larger symbolic economy where the 'roles' that resources perform are several. Thus Iraq's invasion, while securing oil, also serves as an object lesson to impress the rest of the world with U.S. willingness to act unilaterally. Nationalism and 'the greater public good' or, in the case of Delhi where tens of thousands of poor people were displaced from the Yamuna riverbed in order to make way for the Commonwealth Games Village, shopping malls and commercial developments – the idea of a 'world-class city', are some of the wider structures of meaning at stake in resource politics. Yet, political ecology often tends to unitary analyses that distil meanings down to the economic 'last instance', rendering resources only as sources of profit and subsistence, and not social life. And it is to social life, with all its complexities and contradictions, that we must attend to if we are to understand and challenge the inequalities and exclusions around water.

Finally, a cultural politics analysis would be incomplete if it did not also turn the lens around to look closely at ourselves – as academics, researchers, practitioners – and how our embeddedness in relations of power shapes our concern and knowledge about water. How do operations of power within the academy affect intellectual production? I am struck by the large amounts of scholarly literature produced in the last two decades on community-based natural resource management: joint forest management, ecodevelopment in protected areas, participator irrigation management. These are important areas of analysis, but the overwhelming attention paid to them stands in stark contrast to the neglect of other, equally important areas: for instance, the widespread privatization of water (Priya Sangameswaran's work) or the continued threat of large dams (hundreds of large dams are being built in north-east India -- one, the Upper Siang alone is designed for generating 11,000 MW, with huge submergence areas, and which will totally transform the entire Brahmaputra basin), but how many of us are working on this? Why do we focus more on fine-tuning the micro-practices of a village water-users' association than on the big transformations that are undercutting the conditions of possibility for such associations – the rapid extraction of groundwater by state-sanctioned players, corporate and non-corporate, or the increasing diversion of water to distant urban populations? I began by saying that the question of knowledge and power was central to cultural politics. I will end by saying that we must bring this self-awareness to constantly question what we do in the field of water policy, so that social justice and ecological sustainability become not just mantras to be chanted mechanically, but retain their power as talismans for our work.