Water in South Asia
Volume 1

Integrated Water Resources Management

Global Theory, Emerging Practice and Local Needs

Editors
Peter P. Mollinga
Ajaya Dixit
Kusum Athukorala

SAGE

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Series Editor's Note

This volume is the first in the *Water in South Asia* series, which has been published by Sage Publications, New Delhi, in collaboration with SaciWATERs (South Asia Consortium for Interdisciplinary Water Resources Studies (www.saciwaters.org). The series has been envisaged as a string of 10 volumes on topical water resources issues in the South Asian region. These volumes are generated through a project called 'Crossing Boundaries: Regional Capacity Building on IWRM and Gender and Water in South Asia', which seeks to strengthen or establish new Masters education programmes on water resources management that have a broader scope than the conventional technical focus of water resources education, and incorporate concerns like ecological sustainability, equity and poverty, gender relations, and democratic governance into professional water education. This reconfiguring of professional water education is supported by a series of training, research and networking activities, of which the production of a series of readers is an important one.

The 'Crossing Boundaries' project is being implemented with financial support from Government of The Netherlands, which is gratefully acknowledged here. The coordinating South Asian partner is SaciWATERs, Hyderabad. The South Asian university partners are Centre for Water Resources, Anna University; Institute of Rural Management, Anand; Institute of Water and Flood Management, Dhaka; Bangladesh University of Engineering and Technology, Dhaka; Bangladesh Centre for Advanced Studies, Dhaka; and Post-Graduate Institute of Agriculture, Peradeniya University, Sri Lanka. The sixth partner is the Irrigation and Water Engineering group at Wageningen University, The Netherlands. The project began in 2005, and will be carried on for a period of five years.

This series is very much a collective product of the project partners, with each volume being edited by two or three editors, and contributions from several South Asian countries. The editorial board of the series supports the production of the volumes. The focus on comparison at the South Asia level, and addressing of regional South

Asian water issues is the series' hallmark. It seeks to provide high quality collections of 'state of the art' material on different water resources topics, and the policy and research agendas that need to be addressed, accessible to a broad interested audience, and suitable as resource material in education and other forms of capacity building.

The series starts with a volume that critically investigates the notion of integrated water resources management or IWRM. IWRM has become the international label for the 'new approach' to water resources management that our time and age requires. It particularly wants to internalise poverty and environmental concerns into mainstream water resources management. However, there are many meanings of integration, in terms of what is integrated, who integrates, and how this is done, and different groups understand and appropriate the concept in different ways. The volume investigates whether and how this global concept resonates with regional, national and local concerns in South Asia.

Peter P. Mollinga
Voorburg/Hyderabad
July 2006

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List of Abbreviations

ADB	Asian Development Bank
ASAs	Aggregated Simulation Areas
ATV–DVWK	German Association of Water Management, Wastewater and Solid Waste
AVHRR	Advanced Very High Resolution Radiometer
AWP	Area Water Partnerships
BCM	Billion Cubic Metres
BGW	Association of Gas and Water Engineers
BOD	Biological Oxygen Demand
CASAD	Centre for Applied Systems Analysis in Development
CCCIM	Central Coordinating Committee on Irrigation Management
CEB	Ceylon Electricity Board
CETPs	Common Effluent Treatment Plants
CGWB	Central Ground Water Board
CIEDP	Committee Integrating Environment and Development Policy
CEPOM	Committee on Environmental Policy Management
CLS	Constrained Linear System
CMA	Catchment Management Agency
COD	Chemical Oxygen Demand
COTAS	*Consejos Técnicos de Aguas*
CWC	Central Water Commission
DAC	District Agricultural Committee
DCC	District Coordinating Committee
DEM	Digital Elevation Model
DFG	German Research Council
EKC	Environmental Kuznets Curve
EIA	Environmental Impact Assessment
ET	Evapo-Transpiration
FAO	Food and Agriculture Organisation

FAS	Funeral Assistance Society
FO	Farmer Organisation
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GIS	Geographical Information System
GO	Government Order
GODB	Gal Oya Development Board
GWH	Giga Watt Hours
GWP	Global Water Partnership
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ID	Department of Irrigation
IDGEC	Institutional Dimensions of Global Environmental Change
IDRC	International Development Research Centre
IETPs	Individual Effluent Treatment Plants
IFPRI	International Food Policy Research Institute
IMMAS	Integrated Management of Major Agricultural Settlements
IMT	Irrigation Management Transfer
INWRA	Interim National Water Resources Authority
IRBM	Integrated River Basin Management
IRDP	Integrated Rural Development Project
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
IWRAM	Integrated Water Resources Allocation and Management
KWHOE	Knowing about, Wanting, Having, Operating and Effectively Operating
LAI	Leaf Area Index
LAWA	Working Group of the Federal States on Water Problems
LEA	Loss of Ecology Authority
LIWAG	Inter-Ministerial Working Group for the Lausitz
LVS	Lok Vidnyan Sanghatana
MANIS	Management of Irrigation Schemes
MASL	Mahaweli Authority of Sri Lanka
MCM	Million Cubic Meters

MDG	Millennium Development Goals
MKVDC	Maharashtra Krishna Valley Development Corporation
MLB	Downstream System
MRDPSP	Maharashtra Rajya Dharan Grasta Va Prakalpa Grasta Shetakari Parishad
MSC	Mukti Sangharsha Chalval'
MSD	Multi-Stakeholders' Dialogue
MW	Mega Watt
NBA	Narmada Bachao Andolan
NCIWRDP	National Commission for Integrated Water Resource Development Plan
NCP	North Central Province
NWP&SP	North Western Province and Southern Province
NDVI	Normalised Difference Vegetation Indices
NEERI	National Environmental Engineering Research Institute
NOAA	National Oceanic and Atmospheric Administration
NTADCL	New Tirupur Area Development Corporation Limited
NWP	National Water Policy
NWRA	National Water Resources Authority
NWSDB	National Water Supply and Drainage Board
NWSS	National Committee on Water Supply and Sanitation
O&M	Operations and Maintenance
OFCs	Other Field Crops
PGIA	Post Graduate Institute of Agriculture
PMC	Project Management Committee
PRM	Participative Resource Mapping
PWD	Public Works Department
PWP	Peasant and Worker's Party
RBM	River Basin Management
RO	Reverse Osmosis
RS	Remote Sensing
SC	Supreme Court

SCOR	Shared Control of Resources Project
SGVP	Standardised Gross Value of Production
SHE	Système Hydrologique Européen
SKSS	Shetmajoor Kashtakari Shetkari Sanghatana
SLNWP	Sri Lanka National Water Partnership
SLURP	Semi-distributed Land Use-based Run-off Process
SMD	Shramik Mukti Dal
SOP	Seasonal Operation Plan
SOPPECOM	Society for Promoting Participative Eco-system Management
SRB	Upstream System
SWAP	Soil–Water–Atmosphere–Plant
TDS	Total Dissolved Solids
TIMP	Tank Irrigation Modernisation Project
TMC	Thousand Million Cubic
TNAU	Tamil Nadu Agricultural University
TNPCB	Tamil Nadu Pollution Control Board
TOPAZ	Topographic Parameterization
TSK	*Thuruwila Surakeeme Kanirtuwa*
TSS	Total Suspended Solids
TSV	*Thuruwila Surakeeme Vyaparaya* (Movement to Save Thuruwila Tank)
TVA	Tennessee Valley Authority
TWAD Board	Tamil Nadu Water Supply and Drainage Board
UMK	Environment Ministers' Conference
UNCED	United Nations Conference on Environment and Development
UN-ECE	UN's Economic Commission on Europe
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
WCD	World Commission of Dams
WFD	Water Framework Directive
WMS	Water Management Secretariat
WRO	Water Resources Organisation
WTO	World Trade Organisation
WUAs	Water Users' Associations

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PART I
IWRM: THE CONCEPT

1

IWRM in South Asia: A Concept Looking for a Constituency

PETER P. MOLLINGA

THIS FIRST VOLUME of this series of readers on water resources in South Asia is about the concept of IWRM (Integrated Water Resources Management). The Global Water Partnership defines IWRM as follows:

> IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP 2000: 22).

The document also notes that 'an unambiguous definition does not currently exist' (ibid.: 22), and the definition given is thus a working definition, to be made more specific for regional and local contexts. The definition is a call for sustainable water management, an idea that very few would disagree with at this general and abstract level. However, there are indeed many ambiguities in the IWRM/sustainable water management concept as presently discussed and promoted at the global level. This volume critically discusses the meaning and relevance of the IWRM concept for the South Asian context.

Integrated Water Resources Management's foundations as a global approach were laid at and after the 1992 conferences in Dublin (International Conference on Water and the Environment) and Rio de Janeiro (United Nations Conference on Environment and Development, or the Earth Summit). The Global Water Partnership (GWP) was established in 1996 and became the main social carrier of the notion. The GWP 'promotes IWRM by creating fora at global, regional and national levels, designed to support stakeholders in the practical implementation of IWRM.'[1] The concept rose to prominence in global water policy around the time of the second World Water Forum in March 2000. It was on that occasion that the GWP released its Background Paper No. 4 on IWRM, which sets out the 'basics' of the idea.

IWRM may not be as universally supported as is sometimes claimed in the global water debate. It may even be a house that is already in the process of deconstruction before building has been completed. Following its organisation of an Alternative Water Forum in 2003, the Bradford Centre for International Development is organising a series of five seminars (November 2004 to May 2006) that aims to challenge the 'global water consensus' and

> criticises water policy for being narrowly underpinned by neo-liberal principles, dominated by technical and managerial concerns and informed by limited methodologies and empirical data. NGOs and campaigning groups have questioned the pro-privatisation focus of the consensus, the neglect of environmental and ecological concerns and equity issues (http://www.bradford.ac.uk/acad/dppc/seminar/water/).

This is a fundamental criticism, as the proponents of IWRM defend it precisely on the basis that the IWRM approach can effectively address these issues. This thus raises the question how IWRM should be 'read', that is, what is its meaning and significance as a concept, as a policy approach and as a practice?

[1] Quote taken from the inside cover of the GWP background papers. For more information on GWP's mission to promote sustainable water management, see http://www.gwpforum.org/servlet/PSP. The present financial supporters of GWP are the governments of Canada, Denmark, France, Germany, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom, and the European Union and the International American Development Bank. One way to read the emergence of the GWP politically is to see it as a social democratic response to the strongly neo-liberal development thrust of the 1990s.

IWRM and Global Water Politics

Integrated water resources management has undoubtedly gained currency and prominence since the 1992 Dublin and Rio de Janeiro international conferences which covered the issues of water, environment and development. These conferences formulated the so-called Dublin–Rio principles, which are listed in Box 1.

Box 1: The Dublin–Rio Principles

The Dublin principles are:

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
3. Women play a central part in the provision, management and safeguarding of water.
4. Water has an economic value and should be recognised as an economic good.

For discussion of these issues, see GWP's TAC (2000) Background Paper No. 4 on IWRM, pp. 13–21.

These principles strongly shaped the *Agenda 21* recommendations of the Earth Summit (Chapter 18 on freshwater resources). IWRM is the first 'programme area' proposed for the freshwater sector. Section 18.8 speaks of freshwater as 'a natural resource and a social and economic good', thus amending the 'economic good' formulation of the Dublin principles. The document is available at http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm)

It is interesting to note in this context that the first consideration in the European Union Water Framework Directive referred to below reads: '(1) Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.' How to look at water as a resource is thus no straightforward matter.

However, integrated approaches to water management are not an invention of the 1990s and IWRM is a part, not the whole, of the present international water policy 'sanctioned discourse'.

There are several regions of the world where integrated approaches to water resources management have a longer history than from the 1990s, as idea as well as practice. These include Latin America, the European Union, the USA and Australia. According to Dourojeanni (2001), Latin America has a long history of watershed management approaches dating to pre-Inca times, and efforts at river basin management since the 1960–1970s, following the Tennessee Valley Authority model. The latter were, according to the same source, not so successful. The European Union has adopted the EU Water Framework Directive[2] in 2000, which was preceded by a long process of lobbying and negotiation to adapt existing quantity-focused and agriculture-biased water management practices. The Framework focuses on water quality and integrated river basin management. The USA has a history of watershed management approaches, which has, among other things, resulted in elaborate approaches for participatory planning.[3] The Australian experience of the Murray–Darling basin and the Landcare movement for community involvement have been projected as exemplary cases of integrated approaches to land and water management.[4] More examples undoubtedly exist.

Does this mean that IWRM is just old wine in new bottles? In some sense, yes, because new policy ideas are usually reworked with only partial, though sometimes substantial, departures from earlier ideas and practices. But there are new dimensions too. The major one is the emergence of a *global* water policy and politics in a way not seen before.

There is, indeed, a 'global water consensus' in the sense that governments have put their signatures under the outcomes of the Dublin and

[2] The full name is 'Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy'. The document is available at http://europa.eu.int/comm/environment water/water-framework/index_en.html.

[3] See the USBR (United States Bureau of Reclamation) guidebook for decision-making processes, which is available at http://www.usbr.gov/pmts/guide/content.html.

[4] The Murray–Darling website is http://www.mdbc.gov.au/ and the Landcare website is http://www.landcareaustralia.com.au/. The South Australia government has a Watercare initiative, see http://www.watercare.net.

Rio conferences, and are participating in the follow-up process of implementing these agreements. This, as yet, does not seem to be a very forceful process as far as freshwater is concerned—for instance, there are very few binding conventions or agreements as compared to other areas of global environmental policy—but it nevertheless constitutes a move away from looking at freshwater resources management as an exclusively regional and local issue.[5] The globalisation of freshwater management is marked by the emergence of a range of new global water institutions in the 1990s, including the above-mentioned Global Water Partnership and the World Water Council (both established in 1996) and several other organisations. On the activist civil society side, an example of the establishment of global freshwater politics is the proliferation of global NGO activity around the inclusion of water in the GATS (General Agreement on Trade in Services), which is part of the WTO (World Trade Organisation) process of rule-making for global trade.[6]

The term 'consensus' can be misleading. Certainly not all interest groups across the globe were involved in designing the so-called global water consensus, nor did they actively subscribe to it. Though 'inclusiveness' is a key idea in IWRM advocacy, in practice the social carriers of the concept in developing countries are a rather small group of people moving at the levels of international and national policy (advocacy), research and education. In South Asia, IWRM is a concept in search of a constituency and not a concept that has

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[5] On the management of international waters, and the things living in it, there is a longer and more binding history of rule-making that is outside the scope of this volume. The focus in this chapter and volume is on land-based freshwater management. The interface is coastal zone management, for which integrated approaches have been discussed for a considerable time, largely driven by ecological concerns. The most comprehensive attempt at an international agreement on a specific aspect of freshwater resources governance and management is probably the World Commission on Dams process. However, in the implementation of the outcomes of this exercise, progress seems to be less than hoped and desired (see http://www.dams.org/ and http://www.unep.org/dams/ for more information).

[6] Entering 'GATS' and 'water' in an internet search engine gave 138,000 hits when this was written, suggesting the intensity of the debate on this global water issue.

emerged from regional and local practice.[7] The GWP regional and national water partnerships in South Asia, as elsewhere, tend to be inhabited by internationally networked elite policy actors. Not surprisingly, a lot of global IWRM activity in developing countries is focused on promotion/awareness raising, networking, capacity building, and drawing-up of implementation plans. To what extent IWRM as a global concept has been emulated by national water policy networks is one topic discussed in this book.

Further, IWRM is not one single idea, and it is not the only idea circulating in the global water discourse. It has been argued by different people that the so-called global consensus is a collection of several, and not necessarily internally consistent, ideas. Three of the main ones are:[8]

1. Integrated Water Resource Management (IWRM), in association with River Basin Management (RBM);
2. Participation and stakeholder involvement; and
3. Privatisation/liberalisation.

In the call for papers for the third seminar in the 'Water Governance—Challenging the Consensus' series referred to earlier, the global consensus on the necessary shift in water governance is summarised as follows (order changed to match the list above) (available at http://www.brad.ac.uk/acad/dppc/seminar/water/Seminar_3.pdf):

1. From administrative to resource-based management;
2. From centrally administered to user-based management institutions; and
3. From state to market-driven regulation.

[7] In Europe, for instance, there is also no general 'consensus' with active subscription by all interest groups—many citizens are even likely to be unaware of its existence. However, it has emerged from a 'domestic' political and policy process, and can be read as the internalisation into water policy of the environmental concerns as brought on the political agenda by environmental movements since the 1960s and 1970s. How IWRM may articulate with regional and local approaches to water resources management in South Asia is discussed below.

[8] This is taken from the discussion at the 'Water, Politics and Development' roundtable held in Bonn, Germany in April 2005.

The two lists of main components are not identical, but they are very similar. One ambiguity in the 'consensus' can readily be identified on the basis of this. If IWRM is primarily associated with river basin management and river basin organisations, IWRM can easily become a centralising discourse. There is then a tension with the principle of participation/user-based management institutions (governance and management at the lowest appropriate level, or the subsidiarity principle).

These three components are three sets of ideas, each with a different history and supporting coalition. They have been brought under a single roof by writing them into 'consensus' global water policy documents. In addition, none of these components is singular, that is, an accomplished, undisputed orthodoxy. All three are contested ideas in their own right. For privatisation/private-sector participation, for instance, this is evident in the shift in emphasis within the World Bank, from almost unqualified belief in market mechanisms and private sector involvement in the 1990s to much more qualified positions in recent years, as a result of disappointing outcomes of privatisation processes and public resistance to privatisation (see Hall et al. 2004; Hall et al. 2005). Already noted was the intensive debate around water in the GATS process. For the participation component, the contested nature of the concept is evident from recent publications on the 'tyranny' of participation (Cooke and Kothari 2002; Hickey and Mohan 2004). The contested nature of IWRM has already been discussed at the beginning of this chapter.

More than discursive contestation, the different *appropriations* of the concepts are important for understanding how ideas like IWRM travel in the real world, which and whose agendas they serve, and what outcomes and impacts they produce. This means that policy ideas only become 'real' when groups of people 'buy in', and make them part of concrete water resources governance and management practices. In this process different aspects of the IWRM, participation and private-sector participation thrusts are amalgamated into concrete policy frameworks (or lobbies for these). The so-called global water consensus is such an amalgamation of ideas, with its own internal contradictions, and therefore not a true consensus but more of a compromise 'sanctioned discourse' in the making.[9]

One of the most prominent 'buy-ins' is to associate IWRM with the establishment of river basin organisations that are, it is assumed, necessary for 'integrated' management of water resources. Many things can be said about this propensity, but one meaning and significance it may have is that it allows existing, technocratic water resources agencies to continue their dominance in the water sector by re-inventing themselves as basin level organisations (see Mollinga and Bolding [2004], for examples of the ability of irrigation agencies to maintain their engineering and water supply enhancement focus in the context of irrigation and waters sector reform processes). The problems associated with the river basin (organisation) perspective in both Europe and South Asia are discussed in this volume in the chapters by Moss and Shah et al. (Chapters 3 and 4) respectively.

Another 'buy-in' focuses on the dimensions of participation and inclusive governance. It tries to lift participation from a local phenomenon (in the village or the local water users' group), to a higher policy and regional level. The instruments are dialogues and multi-stakeholder platforms/institutions. Though the extension of participatory management to participatory governance can be considered as a step forward, dialogue approaches can easily become naïve when 'consensus' is expected or projected, and dialogues are not seen as inherently political. In South Asia such multi-stakeholder institutions are a rare phenomenon (examples are discussed in Chapters 10 and 12 in this volume), while India presents the paradox of a long-standing democracy with an active civil society but few institutional mechanisms for inclusive water resources governance (see Mollinga 2004).

Yet another 'buy-in' is the ecological focus: the effort to get ecological concerns addressed in mainstream water resources governance

[9] On the term 'sanctioned discourse', see Jagerskög (2002: 1). He defines it as 'the prevailing dominant opinion and views, which have been legitimised by the discursive and political elite'. The GWP systematically works to 'fill in' the IWRM concept through its publications (for IWRM and ecosystems, see Falkenmark 2003; for IWRM and poverty reduction, see GWP 2003; for IWRM and governance, see Rogers and Hall 2003).

and management.[10] Environmental concerns have been the main trigger for rethinking water policies. This is certainly true for Europe and other industrialised countries, where water pollution and negative ecological effects got politically translated through an increasingly aware and vocal urban constituency, which undermined the dominance of agricultural production concerns in regional water management and spatial planning. In developing countries, ecology and poverty are the main social concerns associated with water management: for instance, in the specific case of the dams debate, forest destruction/protection, the effects of changed river hydrology, and the undermining of the livelihoods of to-be-displaced people. Ecology may be the more effective lever for water policy change in developing countries too, as the poverty concern can in principle be accommodated or marginalised more easily in other existing approaches. (This can be done through the reasoning that water resources development leads to economic growth, which leads to poverty reduction, thus skirting the issue of distribution.) In South Asia the ecological concern is just beginning to be addressed in mainstream water resources policy, despite considerable lobbying by environmental groups.

In the academic domain, IWRM and related ideas have served as a great boost to water-related research. The concept posits the need for integrated and interdisciplinary analysis and frameworks for implementation, which has opened up a whole new domain of enquiry and expanded existing ones. The implementation of the EU Water Framework Directive, for instance, is accompanied by a large amount of EU-, national government- and research foundation-funded research. This has partly been an avenue for furthering existing disciplinary research agendas but has also generated a considerable amount of innovative work. Whether such an expansion of water-related research is also happening or is in the offing in South Asia is unclear.[11]

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[10] This is one of the main themes and objectives of the ongoing global Comprehensive Assessment of Water Management in Agriculture (see http://www.iwmi.cgiar.org/Assessment/Index.asp).

[11] The 'Crossing Boundaries. Regional Capacity Building on IWRM and Gender & Water in South Asia' project, started in 2005, with partners in Bangladesh, India, Sri Lanka and the Netherlands, hopes to contribute to the growth of interdisciplinary

What this, by no means exhaustive, list of examples of 'buy-ins' to the IWRM agenda suggests is that different categories of people appropriate the different meanings of 'integration' in different ways and for different purposes. This is only to be expected: the same is true for the participation and privatisation notions, or any other policy concept. What is important is to understand the who, the why and the how of this process, that is, the politics of IWRM and related concepts, and to position oneself (as an individual, group or organisation) in that field as one of the strategic actors.

How to Read IWRM from a South Asia Standpoint?

It is tempting to say that the multiple meanings of 'integration' make IWRM a highly problematic concept as integration is not well-defined. In addition, it can be argued, for instance, that the focus on water alone is unwarranted for a concept that professes to be integrative. At the least one should look at land and water, and probably at natural resources in general. With such criticisms of conceptual clarity and scope, little is left of IWRM as a sharp and precise conceptual tool, which may result in it being discarded as not helpful.

This misunderstands the relevance or role of the IWRM concept. Instead of considering multifarious meaning as a weakness, this could be a strength. IWRM can be understood as a 'boundary concept' that allows different constituencies attaching different meanings or emphases to the concept to interact with each other and negotiate the operationalisation of these different meanings and their combinations.[12] The 'frameworks' that are produced to put IWRM into practice have the same function: they create discursive and policy space for negotiating the meaning of the concept.

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education and research on water resources in the region (see www.saciwaters.org for more information).

[12] 'Boundary concept' and 'boundary object' are ideas developed in the social studies of science and technology literature. See Star and Griesemer (1989) for the basic formulation. 'Boundary objects are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. They may be abstract or

This is not a free, open and unbounded space. Each of the contestants is likely to claim to have the *proper* understanding of the concept, thus creating boundaries and asserting certain problem definitions. The contestation is, thus, also about the characteristics of that policy and discursive space itself, and this is an important part of the politics of the policy process.[13] How such contestation takes place depends on the institutional structure within which it happens. This is where inclusiveness is relevant, as translated into concrete procedures and other institutional arrangements.[14] The case of the European Water Framework Directive merits comparative study because it has created a bounded policy and discursive space with considerable legal and political force, within which a diversity of operationalisation, appropriation and reshaping processes are taking place.

The next question to be asked could be whether IWRM is better suited for this 'boundary work' than other concepts. The other components of the so-called global water consensus seem to be less appropriate to play this role than the IWRM concept.

In South Asia, the concept of participation as it has functioned over the past 20–25 years seems to have achieved very little in terms of reshaping mainstream water policy approaches. What it seems to have mainly done is to legitimise a local-level practice of user involvement or user-driven land and water resources management.

concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable means of translation. The creation and management of boundary objects is key in developing and maintaining coherence across intersecting social worlds.' See Löwy (1992) for a discussion of the importance of 'loose concepts' in interdisciplinary research.

[13] On policy narratives and discourses, see Roe (1994), which has a chapter on irrigation-related salinity/toxicity in the San Joaquin Valley in California, USA; and Apthorpe and Gasper (1996).

[14] Borrini-Feyerabend et al. (2000: 13) describe conditions for successful 'co-management' of natural resources. These include 'full access to information on relevant issues and topics, freedom and capacity to organize, freedom to express needs and concerns, a non-discriminative social environment, the will of partners to negotiate, and confidence in the respect of agreements.' These are also conditions for effective inclusion of policy actors in policy processes. They are rarely, if ever, fulfilled. The creation of better conditions for more inclusive policy processes to be able to happen is thus part of the 'politics of policy', and also that of IWRM policy.

It has thus supported the decentralisation and devolution agenda and acted as a vehicle to bring local-level concerns and voices more prominently into the public discourse. This is important, but the participation discourse has not been able to enrol or force the government water bureaucracy, which is so dominantly present in South Asia, into a process of rethinking some of the basic premises of its approach to water resources. For engineers and economists, 'participation' tends to be an unattractive idea because it is difficult to capture it and make it happen, and it is difficult to relate to the disciplinary repertoires of knowledge, skill and intervention strategies. Participation tends to be an exclusively 'social' idea, not dealing with the resource itself or the incentive structures that shape its use (which are the two main issues of interest for engineers and economists).[15]

Private-sector participation, a mainstay of neo-liberal perspectives on development, has also not been an idea that has brought the different interest groups in water resources management much closer together or managed to substantially question mainstream policy orthodoxy. On the contrary, discussions on privatisation and private-sector involvement have been very heated and divisive. Apart from the merits or demerits of increasing private-sector involvement, it tends to be as singular or reductionist an idea as participation, proposing market mechanisms of some sort as the most suitable mechanism to achieve efficient resource use and (thereby) other development objectives. There is little empirical evidence that it can fulfil this promise, and in South Asia liberalisation and privatisation of the water sector has been rather limited so far, leaving government dominance largely unchallenged.[16]

[15] There is no necessity that this be so. There is a practice of participatory design, technology development and modeling (and also of participatory budgeting practices, for example), which take participation into the core subject matter of the disciplines of engineering and economics. These are not very current approaches anywhere, but are virtually absent in South Asian water resources management practice.

[16] The reference here is to privatisation of the governmental organisations for water management (privatisation of public service delivery), or privatisation of water as an asset in itself. Individual farmers pumping water with their own tubewells, low-lift pumps or other devices is a form of private water control, within which

IWRM seems to be a more promising candidate to function as a boundary concept in water policy formulation and implementation. The very word 'integration' militates against singular and reductionist renderings of the concept. When mainstream water policy agencies feel obliged to discuss the meaning of 'integration', that is one step forward. Engineers can read the concept positively because integrated approaches define many professional challenges for the engineering domain, whereas participation is often read as a threat, displacing the importance of engineering.

Whether the IWRM concept will operate as a boundary concept does not depend on the words themselves, but on whether concrete water resource governance and management issues or conflicts require and force a more 'integrated' perspective, and whether interest groups involved in these processes will actively call upon the idea of an integrated approach. This seems to be the case. Water resources issues in South Asia increasingly seem to proliferate as multi-sector issues: agriculture and aquaculture versus wetland protection; water to be released from agriculture for urban use; industrial pollution affecting drinking water quality; re-use of urban waste water in peri-urban agriculture; etc. The issues also play out at a supra-local and sub-national level, that of the watershed or (sub-) basin, or the district, rather than exclusively at the local or national level. The empirical argument for an 'integrated' perspective is that such issues will be of increasing prevalence and importance, and will require a different, more comprehensive, approach than the dominant paradigm of water supply enhancement for productive agricultural and hydropower use. This process will, of course, not be automatic. It will depend on the strategies adopted to consolidate local and regional struggles into general changes in the policy and institutional framework, and on the ability to change existing balances of power.

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water markets have also emerged, but this is not the type of privatisation meant here. The importance of such private water management (in India the area irrigated with pumped groundwater exceeds the area irrigated by surface water) shows that much water regulation is in the users' domain, outside government purview. The role of government policy in such private forms of water control is more indirect than it (potentially) is in sectors with strong government presence.

I thus postulate that there is a concrete necessity to develop 'integrated' approaches to water resources management. This necessity derives from the type of issues that are occurring in practice. This volume investigates whether the concept of IWRM can play a role in addressing these issues. It is suggested that it may, when it is deployed as a boundary concept that allows different interest groups to interact more constructively than is often the case at present.

In terms of practice there is very little that goes by the name of IWRM in South Asia, and therefore the reasoning presented here is largely speculative. In a recent GWP survey on the current status to move towards IWRM at national-level, two countries are assessed to be at the initial stages (Maldives and Nepal), while in the other countries 'some steps have been taken'. None of the South Asian countries is in the category of 'having made good progress'. The progress is all in terms of incorporation in policy documents. As a result, finding IWRM case studies for this volume was not an easy task. The IWRM concept as promoted in the global water policy arena has entered South Asian water policy vocabulary, but is not yet a very strong force. However, as an idea it resonates with concerns and approaches of domestic origin. Some of these are the need for re-orientation of the main government water resources agencies away from overly technocratic supply enhancement and productivist approaches towards internalising concerns of ecology, poverty and equity; the need and problems in upscaling local-level community resource management initiatives; the emergence of water allocation and water quality issues at regional and (sub-) basin scale; and the need for capacity building of water professionals and decision-makers regarding the complexity and interdisciplinarity of water resources management. What IWRM as a concept can do is to give more legitimacy to such ideas and the constituencies promoting them. It provides the proponents of an 'alternative approach' or a 'new paradigm' with a vocabulary and with international support and ideas to push their agenda.

That the transformation of water governance, management and use is an inherently political process bears repeating. The operationalisation of 'integration' will be played out in an arena structured by the normative concerns of efficiency and growth, equity and welfare, and sustainability and democracy. These define the interest perceptions of the different actors in the fray. How the IWRM discourse will travel in that process remains to be seen, or rather, to be done.

The Structure of this Volume

Part I of this volume discusses several conceptual aspects of IWRM. Following this introductory chapter, IWRM as a concept is discussed at two levels: as a concept in the global water policy discourse, and as an analytical concept for understanding water systems as complex systems in an 'integrated' manner. This requires an enquiry into the notion of integration.

J.A. Allan's paper (Chapter 2) describes the emergence of IWRM as a central notion in water debates, and discusses the political dimensions of it, arguing for emphasis on allocation (IWRAM).

Timothy Moss' paper (Chapter 3) discusses the European experience with IWRM, in the context of the European Water Framework Directive. As this is the most comprehensive attempt at an IWRM-based water governance and management system extant, the problems of 'fit', 'scale' and 'interplay' found there may be of relevance elsewhere.

Tushaar Shah, Ian Makin and R. Sakthivadivel's paper (Chapter 4) investigates the issues related to transplanting the model of river basin organisations, a central thrust within global IWRM concepts, from developed to developing countries, and identifies the limits of such leapfrogging.

Jayanta Bandyopadhyay's paper (Chapter 5) assesses to what extent IWRM has become internalised in India's national water policy, and shows that at this stage there is no question of a paradigm shift in the thinking on water at this level.

In D.J. Bandaragoda's paper (Chapter 6) it is argued that a focus on water alone may be misguided, and that IWRM should be looking intensely at land–water linkages.

In Part II of the volume several dimensions of 'integration' are explored.

The first paper in Part II, by R. Sakthivadivel (Chapter 7) deals with the science involved in IWRM and discusses how conventional approaches to making water balances and doing hydrological modelling have to be adapted from an IWRM perspective.

The next two papers discuss issues of sector integration and collaboration. Lalani Imbulana (Chapter 8) presents a case study of the issues related to the integration of hydropower and agriculture concerns in a project in Sri Lanka. Ranjith Ratnayake (Chapter 9) explores the broader theme of intra- and inter-sector collaboration, again in Sri Lanka.

The last three papers are all case studies of efforts to involve different interest groups in the planning and decision-making on water resources development. S. Janakarajan (Chapter 10) describes the initiative to set up a committee with multiple stakeholders in the Palar river basin in Tamil Nadu, India, to address the tanneries-related pollution problems in that basin. Kusum Athukorala (Chapter 11) describes a local process of conflict resolution around a tank in Sri Lanka. Anant Phadke and Bharat Patankar (Chapter 12) describe the history of the dam oustees' movement in South Maharashtra, India, and the emergence of an alternative approach to water resources development.

Together, these chapters give a first approach to the theory and practice of IWRM in South Asia. The constituency supporting more 'integrated' approaches to water resources management in South Asia is likely to grow—whether it will prefer to use IWRM as a label is an open question.

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IWRM: The New Sanctioned Discourse?

J.A. Allan

Introduction

The purpose of this chapter is to show how water resource allocation and management policies evolve in contentious arenas. It will situate the integrated water management approach in a water policy narrative. The agents who operate in these policy arenas reflect special interests and concerns. Policy debates bring about hegemonic convergence, a concept which is similar to that of sanctioned discourse. Both terms are part of a political ecology approach to water policy-making and help to show how environmental policy-making takes place (Hajer 1996). All policy-making discourse is partial in that it is made by coalitions which reflect those who can best construct and deliver the most persuasive arguments. The most persuasive of these can exclude the voices of those who do not construct their messages sufficiently well to gain access to the discourse. Policy outcomes are the result of elites making deals selectively with groups that cannot be gainsaid. For example, governments rarely confront large farming communities existing on low incomes. Confrontation involving a public policy reallocating water supplies from irrigation is even more rare. In the case of water the dominant and foregrounded coalition in many water-short regions is between the farming (irrigating) community, the water professionals and national political leaderships. Policy arguments are driven by immediate interests, rather than by high-minded notions of long-term collective action based on social equity, economic efficiency or environmental considerations.

Policy is not made on the basis of rational science, although well-observed science can play a role if its messages are as effectively constructed as those of other participants in the policy-making process. Policy is made by agents and policy entrepreneurs operating in complex local discourses, usually at the national level, rather than in generic discourses informed by principles developed in international science.

This chapter will show that local discourses can be impacted by Northern ideas—albeit slowly. A sequence of international water resources management paradigms superseded the hydraulic mission of industrial modernity in the late 1970s in the plural North. Of course, neither the North nor the South are homogeneous in terms of endowments or social capacities, and we are not implying that they are. There are some generic characteristics, though, which distinguish Northern and Southern political economies. In brief, Southern economies have fewer policy options because they are poor. They are less able to ameliorate scarcity by redistributing resources across a political economy.

The water sector in the North adopted principles of sustainable development during a protracted discursive struggle from the late 1950s to the mid-1970s. It will be shown that the three-phase water management paradigm of late modernity was technologically, economically and environmentally inspired. It has had three sub-phases, which are ongoing.

The promotion of the new paradigm of late modernity became a global project in the post-Cold War 1990s. International agencies and Northern bilateral agencies assumed that the model would fit all circumstances. The river basin was a central organising framework despite evidence that global trading processes were just as important as local hydrology in ameliorating serious local water circumstances (Allan 2001). This was especially the case in the most water-challenged regions of the Middle East and southern Africa. It will be argued here that the integrated water resources management (IWRM) approach can only be safely deployed if two conditions are also taken into account. First, IWRM must be seen as primarily a political process in terms of getting policy in place. To this end it should be renamed IWRAM: water resources *allocation* and management. Allocation and reallocation are unavoidable in water policy and management. They are not silent and are always contentious and political. Second, the river basin concept must not limit the scope of IWRAM. Economies, whether they fit hydrological boundaries or not, cope with water resource deficits and challenges with remedies deriving from beyond immediate watershed(s). IWRAM must think beyond the watershed.

Why Review IWRM/IWRAM Now?

The last few years of the 20th century witnessed an unprecedented level of international discourse involving the world's water users, managers and policy-makers. They engaged in intense consultative activities, reviewed the global water predicament and identified ways to secure regional water environments and the societies and economies which depend on them. The preparatory process produced numerous reports for the Second World Water Forum in the Hague in March 2000 (WWC 2000, GWP 2000, World Water Commission 2000). During the consultations for the report-writing, attention was drawn to the fundamental political nature of the pre-Hague process (Allan 1999a). But the authors of the numerous reports were unable to escape their assumptions that water was a hydrological phenomenon rather than a multi-dimensional resource enmeshed in nested political economies. There was talk of civil society, governance and stakeholders, even of political commitment. But the discourse ducked the challenge of recognising that innovative outsider scientific information as well as outsider principles of economy, equity and the environment are subordinate to local political milieus into which they would have to be introduced.

At the Hague the political viewpoint advocating that water is an economic resource rather than a social resource was strongly contested. Water pricing instruments and privatisation were also very loudly opposed from the first moments of the Forum.

The purpose here is to draw attention to the necessity of starting with the political contexts in which water resources are allocated and managed if an approach such as IWRM/IWRAM is proposed. This chapter will include a narrative on the paradigms that have determined the way that water resources have been perceived and managed during the 20th century in the North. For example, the paradigm that nature could be controlled was one of the ideas that dominated both capitalist and socialist versions of industrial modernity during the first 75 years of the 20th century.

Another paradigm, based on the notion that environmental resources such as water were being damaged rather than controlled by the impact of the alliance of science, engineering and national investment gained currency in the North and with Northern donors by the mid-1970s. This paradigm reflecting environmental concern has only achieved very limited purchase on water policy-making in the South. In the 1990s a further set of principles gained currency. That water is an economic resource was very widely adopted by the Northern professional water community. This economically inspired paradigm has been resoundingly rejected in the South. Meanwhile, another paradigm has emerged in the last years of the 1990s—that of integrated water resource management (IWRM). IWRM requires a holistic approach and an unprecedented level of political cooperation.

Water users and policy-makers operate in political systems, which determine or not whether new paradigms, such as integrated water resources management, can be assimilated. The political systems make sense to those who live in them, as they have a political rationale. It follows that new water resource management paradigms, such as IWRM/IWRAM, can be assimilated if the innovation of 'integration' is appreciated as a political process and not just as a technical, investment or information sharing process. As mentioned earlier, it is recommended here that the term IWRM should be expanded to IWRAM. The 'A' is for allocation. Allocation is unavoidably a political process. Water professionals tend to ignore the allocative role of management. With allocation being ignored, management can be projected as a technical matter susceptible to modelling. In practice the political pressures associated with contentious allocation overwhelm the information provided by the technical professionals.

Integration is also a political process, as all those who have attempted to take interdisciplinary approaches know. Innovation is challenging in much less comprehensive fields than faced by those trying to bridge the gaps between the environmental, engineering, social, political, economic and legal professionals of the water sector.

Water policy will be transformed only if it is politically feasible. Influencing political feasibility is an essential element of an effective water management paradigm. The extent to which IWRAM can embrace the notion of political feasibility will determine whether it can play a useful role in water policy-making. Such innovation will be achieved by taking the inclusive approach of what in this chapter is called the fifth paradigm, the inescapably political process of IWRAM.

'New Knowledge' and Approaches to Water and Water Management

This section provides an account of the shifts in direction in water policy-making in the North in the past couple of centuries. These trends in the North are recounted not because they are more important than those in the South, but rather in order to help understand where and when in the North its recently adopted economic and environmental wisdom on water emerged. It will be shown that IWRM/IWRAM is an articulation of a recent convergence of thinking requiring technical, social and political expertise to be integrated to underpin the political process of water policy-making.

The political economies of the industrialised countries have been inspired for a century or more by the belief that nature, including water resources, could be controlled. Since the late 19th century the entrepreneurs and state agencies involved in delivering water for economic and social purposes believed that nature, including water, could, and should, be subject to the mastery of science and industry. This high phase of *industrial modernity* was possible because of the revolutions in science and industry in the early 19th century and the achievements of capitalist organisation in marshalling the resources of labour, the environment and capital.

The unsatisfactory outcomes of this unprecedented synergy had become evident by the mid-19th century. In the 1840s Marx drew attention to the dangerous tendency of this capitalist-inspired system to ignore the interests of the other contributors to the capitalist mission and especially the contribution of labour. In the event, capitalism and the polities in which it was embedded addressed this 'first failure of capitalism'. The message of the philosophers and critics was heard. The extreme risks to political stability of the grotesque and rapidly expanding urban poverty of the second half of the 19th century in industrialising Europe and North America were avoided. Over the next century various forms of redistributive social democracy emerged to reshape the capitalist mode and confound, at least for the moment, the predictions of Marx. Capitalist interests were made aware of the social necessity of addressing the concerns of labour. Post-modernists might see a version of 'reflexiveness' in the way the ideologies—liberal, social democrat and even conservative—adjusted a century ago in the industrialising Northern polities.

The second fundamental problem, some would say the second failure, of capitalism, resulting from the drive for progress, whether in the economies of Europe and North America or of the former Soviet Union, became evident just over a century after the first. The negative pressures on environmental resources, especially on water resources, of progressive industrial modernity with its assumption that nature could be controlled began to be evident by the 1950s. Classic analyses by environmentalists such as Rachel Carson (1965) drew attention to the carelessness of what others (Beck 1992, 1995; Giddens 1990) have identified as a century of industrial modernity, which damaged rather than controlled nature.

Two decades of discourse later, certainties had been replaced by uncertainty and environmentalist principles had entered Washington politics via President Jimmy Carter's presidency (1976–1979) (see Carter 1982; Allan 1999a). Carter became a champion for water and for the environment. He challenged the institutions and political networks put in place by his predecessors to dam and control the wild waters of the United States. He was unsuccessful but he did accelerate widespread recognition that the approaches of supposedly progressive industrial modernity, 'harnessing the forces of nature for the benefit of mankind', were full of risks and no longer viable. He also emphasised that they were not cost-effective. By the mid-1970s, the progressive nature controlling methods 'had ceased to charm' (to use the phrase of J.S. Mill), at least in the North. But note that the mid-1970s was a very short time ago.

The recognition that the past mismanagement of water resources required new attitudes to be adopted by those at the commanding heights of the rich economies of the North is just one of many signals that there has been a significant shift in approach to the use and husbanding of environmental resources. The lesson from the North, however, is that the two or three decades-long environmental discourse, and especially the water discourse, did not start in the corridors of power in Washington. Neither did the initiative come from the multinational corporations or from the Corps of Engineers or the United States Bureau of Reclamation (USBR). Water gained a place on the agenda of those allocating national budgets relating to water only after the argument had been made by individuals and activists, mainly ecologists and scientists (and the hippies of the 1960s who have now come into power). Economists remind us that Ricardo valued the environment at the beginning of the 19th century, but they cannot explain their century and a half of neglect of the subject thereafter. Their recent unconvincing attempts to 'value' the environment were a response to the questioning by the green community of what the latter regards as the environmentally charm-less outcome of industrial modernity. The economist's role was a reflexive one, as has been that of engineers.

Who has sufficient wisdom to decide rationally for society what kind of change is best? Should it be the rationale of the expert, the collective rationale of citizens or the whim of a patrimonial national leadership? The North has experienced a shift from the assumption that the expert knows best, which ruled until the 1970s. The approach has shifted to one which considers environmental, economic and social sustainability expressed in political processes to be a safer basis for policy-making. Delli Priscoli (1978, 1981) has recorded how the world changed for water policy experts and for water policy-makers in the late 1970s in the United States. He captures the dilemma facing those in the water policy community in the United States in the late 1970s succintly: 'Actually, we know little of whether managing the social system or the natural system is more efficient to deliver benefits, to create growth opportunities and to reduce potential social stress' (Delli Priscoli 1978: 15).

By 1992 a suite of environmental issues had become global concerns: global warming, species diversity and water. Each had attracted activists and champions. In the event the environmentalists gained what many had intuitively considered to be impossible. At the 1992 Rio UNCED Environment and Development conference, priority was achieved for the issues of global warming and of biodiversity. Global warming is scientifically controversial, especially when it is used to suggest that it is associated with more general climatic trends, e.g., changes in rainfall levels. Biodiversity is a complex topic, barely comprehensible to non-specialists. Despite the unsteady scientific foundations of the climate change and biodiversity arguments, they were the major issues at Rio. Even the unstable concept of desertification was constructed to more political effect than water at Rio. These unlikely issues squeezed out the predicament of the hydrosphere. Water was given relatively little attention at Rio, but the commendable preparations in Dublin in January 1992 resulted in a detailed chapter (no. 18) on freshwater, the longest in *Agenda 21*. The lessons from the UNCED meeting in Rio appear to be that abstract issues can gain the attention of policy-makers and their influential political leaders if they are cleverly and effectively constructed. Such a tendency fits the risk society theory of Beck (1999) on how individuals and communities in the North respond to risk after such emblematic shocks like Chernobyl, when people stopped trusting progress: 'The discourse of risk begins where the unbroken trust in safety ["progress"] ends and applies so long as the catastrophe has not [yet] occurred. The perception of threatening risks determines thought and action' (Beck 1999: 75).

The disaster of AIDS and then of BSE and other food scares has further broken the trust that communities in the North had in science and the industries that could impact on public health. They became especially fearful that science and industry could neither control nature nor be trusted to understand its potential power. These events accelerated the process of changing perceptions that environmentalists had laboured for three decades to achieve. With an awful lot of help from the globalising media, Northern societies are beginning to force their governments to become more environmentally aware and industry to adopt precautionary principles. The risk theorists call the condition in which the North finds itself 'reflexive modernity'. Responses are being made to more and more risks as they are identified and awareness is quickly and widely diffused by the globalising media. The susceptibility of the risk-aware North to 'new knowledge' about water resource poverty and water resource stress is thus high. However, evidence shows that this awareness alone does not lead to changes in attitude—pressures and incentives are needed.

The World Water Vision process of 1998–2000 was the first major attempt to construct knowledge about global and local water since 1992, and the most serious attempt yet to include all interested stakeholders in a worldwide consultation process. Its goal was to provide the pressure to change attitudes and, most important, the funds for water policy priorities. The heightened awareness achieved at the Hague in 2000 was impressive. Its impact was revealed two years later in 2002 at Johannesburg at the second Environment and Development Conference. Water, and making it available to poor communities, was the prime issue. Other concerns such as climate and biodiversity were argued to be subordinate.

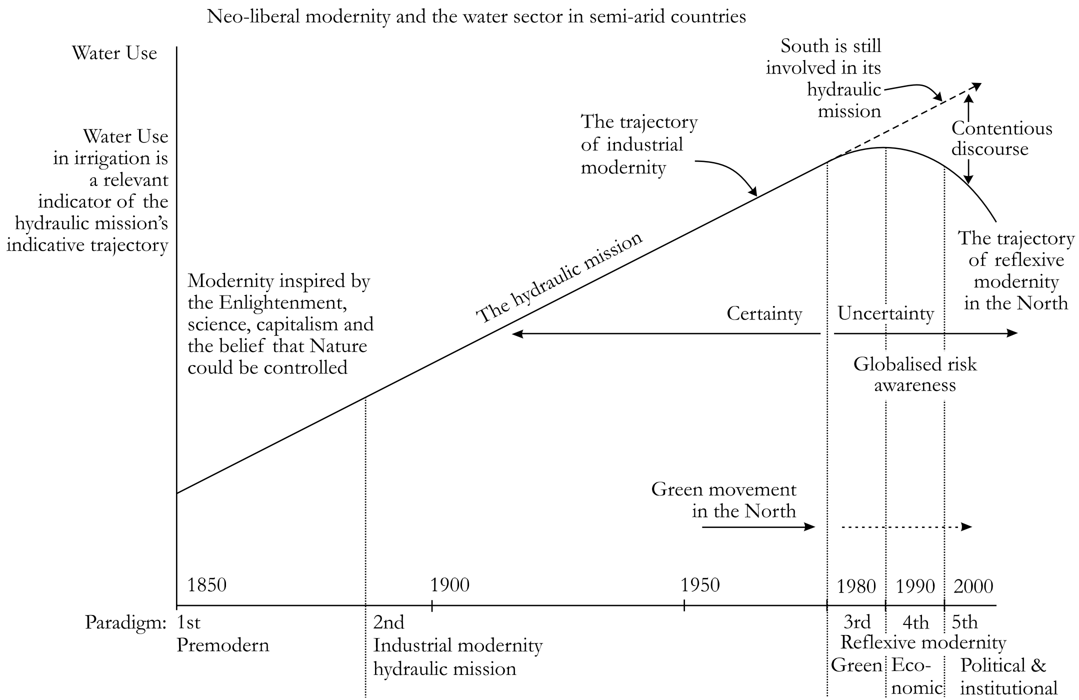
Shifting Water Management Paradigms?

Shifts in perception reflecting awareness of water resource scarcity have influenced the discourse on water management. Awareness of scarcity and declining water quality have tended to increase the prominence and intensity of water policy-making. The assumptions of the professionals and scientists involved in policy-making limit the scope of the debates within which such policy-making is conducted. Here we shall review the shifts in approach that have occurred. The driving ideas on which water policy has converged will be highlighted. It will be suggested that the recent IWRM/IWRAM approach could in its turn be constricted by the limiting assumptions of policy-makers.

As discussed above, it was the Green movement which proved to be the main agent of innovation with respect to paradigmatic shifts in water management policy after 1980. Figure 2.1 uses trends in levels of use of freshwater for agriculture as an indicator of the driving forces, which influenced water management policy since the late 19th century.

Five water management paradigms are identified. The **first paradigm** is associated with *pre-modern communities* with limited technical or organisational capacity. The **second paradigm** is that of *industrial modernity*. In the water sector the ideas of the Enlightenment, engineering capacity, and the science and investment initiatives of the state and the private sector characterised industrial modernity. Industrial modernity was manifest as the hydraulic mission of the mid-20th century.

Figure 2.1: The Five Water Management Paradigms, 1850–2000



This project seized both liberal western economies (especially the United States) as well as the centrally planned economies of the Soviet Union. The hydraulic mission proved to be readily exportable to the South in the second half of the 20th century.

According to social theory, the ideas underpinning industrial modernity were challenged during the 1960s and the 1970s. The questioning led to reflexive responses and a phase which has come to be known as 'reflexive modernity'. In the North in the water sector the reflexive response is evident in three water management paradigms (Beck 1992). This phase witnessed a reduction of water use in agriculture in a number of semi-arid industrialised economies: Australia, California, Arizona and Israel. This reflexive phase can be shown to have three sub-phases (viz., the third, fourth and fifth paradigms). The **third paradigm** is the change of water allocation and management priorities inspired by the *environmental awareness* of the green movement. These activists succeeded in persuading governments and voters in industrialised semi-arid regions to allocate water to the environment and reduce allocations to agriculture. Their campaigns started in the 1960s, but it was not until the 1980s that evidence of the influence on policy became evident in water use figures.

The **fourth paradigm** was inspired by economists who had drawn the attention of water users in the North to the *economic value of water* and its importance as a scarce economic input. These ideas gained currency in the early 1990s. There has been an attempt to export them to the South via agencies such as the World Bank and through the energies of institutions such as UNCED, the World Water Council and the Global Water Partnership, and the associated global water fora in the Hague in March 2000 and in Kyoto in March 2003.

The environmental and economic phases are still in train. It is argued here that they are being supplemented by a new **fifth paradigm**, which is based on the notion that water allocation and management are political processes. This approach is especially relevant to IWRM/IWRAM. Environmental fundamentals such as the hydrological logic of the river basin and economic fundamentals relating to the value of water are central to the paradigm and to the implementation of *integrated water resources management (IWRM)*.

But IWRM/IWRAM demands much more than the mere recognition of the environmental and economic value of water and the planning of engineering and economic interventions. IWRAM is an intensely political process because water users have interests which they do not want diminished by interventions which contradict their immediate security. Prioritising water allocation with an eye on the economy in general and prioritising investment to reduce environmental impacts will conflict with the immediate concerns of current water users. The fifth paradigm has brought forward approaches which include participation, consultation and inclusive political institutions to enable the mediation of the conflicting interests of water users and the agencies which manage water.

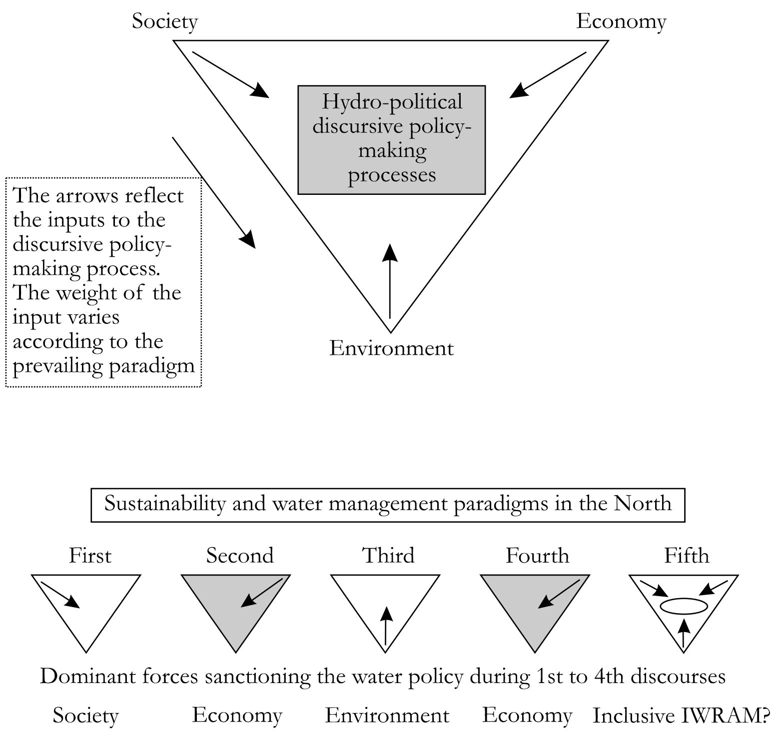
The inclusive political process of the fifth paradigm requires that the interests of civil society, hierarchy (government), social movements (NGOs) and the private sector are included in the policy-making discourse (Thompson et al. 1990).

Evolving Perspectives on Sustainability and Their Special Relevance to Integrated Water Resources Allocation and Management

It has been shown in the previous section that IWRAM can be situated in the most recent, socially inclusive and politically aware phase of the water resource management narrative, i.e., in the fifth paradigm. Another concept, sustainability, has been useful in emphasising the role of water in ensuring the reliable delivery of environmental services. It was one of the notions used by green activists to raise the profile of the importance of the environment. But the notion proved to be impossible to operationalise in a narrow environmental sense. This was because the environment was conceptualised as being a separate focus of policy rather than one that was integral to society's and the economy's use of water in the political economy as a whole.

Figure 2.2 shows the way in which sustainability has been viewed in the second half of the 1990s. Sustainability is shown to have three dimensions rather than just one. Voices reflecting the priorities associated with these three dimensions play a role in the political processes, which mediate the water use and water policy outcomes—i.e., the integrated water resources allocation and management—in a particular political economy. The strengths of the voices change according to the capacity of the different interests to construct and articulate their concerns and priorities. It will be shown later how cultural theory throws light on the reasons why the paradigms have been sequenced as they have.

Figure 2.2: The Concept of Sustainability and the Water Sector; Water Management as a Political Process and Determining Perceptions of the Diverse Values of Water in the North



For water to be managed so as to sustain the environment and environmental services, water management policies have to prioritise interventions and resource allocation so that, along with the environment, society and the economy are also sustainable. Ideally, this ‘balance’ is achieved (or not) via political processes of integrated water resources allocation and management.

It is possible to map the five water management paradigms on to the conceptualised space of the sustainability triangle and its hydro-political core. The purpose of this mapping is to show where the arguments were coming from in the North during the past two centuries.

Referring to the sequence of five paradigms shown in Figure 2.1, it can be shown on the sustainability triangle (Figure 2.2) that the first pre-modern paradigm can be mapped on to the social corner which addresses social sustainability. The second paradigm of industrial modernity can be mapped on to the economic corner. The hydraulic management initiatives of the 1930s in the United States and the former Soviet Union were inspired by the expectation of improved economic outcomes in the areas of energy production and agricultural productivity. The departure from certainty, which occurred in late modernity in the late 1970s allowed an environmental voice into the core hydro-political discourse. The third paradigm was in the environment. The fourth went back to economic inspirations. The fifth approach, inclusive and integrated, is located in the central political discourse. Arguably the mediating process should always have been recognised to have been central.

The fifth paradigm, and ideally the IWRAM approach, make it explicit that the interests of society, the economy and the environment should be simultaneously considered. There are many places in the South, however, where the priorities of society are still understandably preferred over arguments that water should be commodified or that the environment be considered. If the message of this chapter is persuasive, it will enable us to understand the nature and relevance of political processes and the reason why such new knowledge is rejected. The importance of such awareness is captured in the following prayer:

> Help us to know the things that should be changed,
> As well as the things that can be changed,
> And give us the wisdom to know the difference
> (Adapted from the serenity prayer by Reinhold Niebuhr, c. 1940)

Contrasting Water Policy Paradigms in the North and the South

The semi-arid plural North can be shown to have partially adopted all five water management paradigms. The professional community associated with the water sector can easily recognise the first four paradigms. The fifth paradigm is gaining currency, albeit slowly and sometimes partially, as a result of the sanctioning which will be elaborated in the conclusion of this chapter. Water users and politicians in the North, on the other hand, have been slow to change their ways of perceiving water, probably because irrigation interests are impacted by economic and environmental principles.

In the plural South, by contrast, the professional community generally, and all water users and politicians, have successfully resisted the adoption of the last three reflexive paradigms. Exceptions exist in the South at the local level where small communities manage their water via transparent institutions tested, both socially and technically, over time.

The South, where about five sixths of the world's population lives, is still very much involved in its hydraulic mission—the second paradigm. It has much ground to make up in terms of economic development. Socio-economic development priorities are urgent. Environmental priorities are recognised, but for the moment the voices articulating environmental priorities are less powerful in the policy discourse than those of society and the economy. The different water allocating and managing trajectories of the North and the South are conceptualised in Figure 2.1. The distance between the two trajectories in the top right of the diagram reflects the distance between the discursive processes in place in the North and the South.

The water policy discourses in the North and the South are different. Those 'outsiders' from the North who insist on preaching about the environmental and economic values of water have little impact on the 'insider' Southern water management discourses.

Some Important Exceptions

The social theory used in the preceding sections to underpin the notion of water management paradigms cannot be used beyond the semi-arid realm. The experience of France in managing its water sector shows that as early as the mid-1960s it was possible to install an inclusive, decentralised and democratic political arrangement as well as a regional management structure (Roche 1999; Seine-Normandy Water Agency 1999). In 1966 France legislated into existence regional water parliaments based on the geographical river basins of the country. These parliaments enabled the diverse interests to be taken into account, through representation in the regional water parliaments. These structures reflect all the virtues of the fifth paradigm. The concerns of water users in agriculture and industry/services as well as those of municipal authorities responsible for providing water services and related engineering, social and public health services are all represented. More recently the concerns of those responsible for environmental services have also been incorporated into the policy-making system.

These institutional developments anticipated those in the rest of the world by over 40 years. That the utility of the institutions was being questioned at the turn of the millennium by the central government of France, anxious to bring back to the centre the control of the expanding budgets of France's decentralised water agencies, is a predictable reflection of the constant tension between the political centre and decentralised political institutions (Water Academy 1999).

Who Are the Stakeholders in IWRM/IWRAM Processes?

In the high-profile contention, and sometimes conflict, which occurred worldwide and prominently in some Southern political economies in the late 1990s, the contending parties could easily recognise each other, but had no basis for understanding where the other contending parties were coming from. The purpose of this next section is to provide a widely respected framework from cultural theory to identify the parties and their motives. This framework has been shown to be very relevant in helping those participating in fundamental social and political processes to identify the driving principles and expectations in play. It has also been shown to be very useful for those attempting to analyse immensely complex socio-political processes such as IWRM/IWRAM (Allan 2001: 317–27).

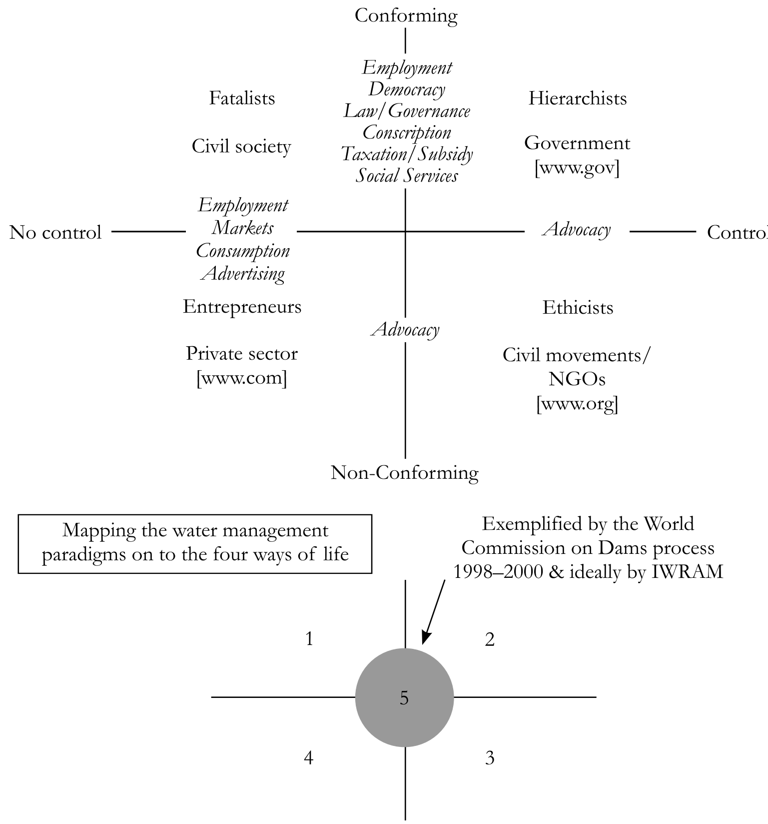
Mary Douglas (1970) has shown that members of society identify with four 'ways of life'. The inclination to control (or not) and to conform (or not) determine where these four ways of life are located on a diagram conceptualising cultural theory. Avoiding or seeking control *and* conforming or not conforming are the underlying tendencies.

Figure 2.3 locates the four ways of life. The diagram also shows some of the processes which enable the individuals and groups in the four ways of life to relate to each other. In an industrialised economy one of the most important relationships is via employment. In addition law, governance, taxation, conscription and subsidies enable civil society to relate to government. Civil society relates to the private sector via employment, consumption and advertising. Civil movements relate to and impact government, the private sector and civil society through advocacy.

The significance of the four ways of life analysis to such activities as IWRM/IWRAM is that it provides a form of checklist of who should be involved in a fifth-paradigm IWRAM activity. Just as the five water management paradigms could be mapped on to the sustainability triangle, they can also be mapped roughly on to the four ways of life. The first pre-modern paradigm can be mapped in the civil society quadrant. The second paradigm of industrial modernity can be mapped on to government. The hydraulic missions pursued in the United States as well as in the former Soviet Union in the 1930–1980 period were government-inspired and -financed projects in both cases. The paradigms of late modernity were promoted in other ways of life. The third (environmental) paradigm was successfully advocated by the late 1970s in the United States and other industrialised economies by green civil society organisations and NGOs. The fourth water management paradigm was the result of an alliance between governments and the private sector. This alignment is common. Similar alliances are found in other economic areas, e.g., the military-industrial alliance. In agriculture similar alliances exist between governments and plant breeders and farm-input manufacturers.

It is the location of the fifth paradigm that is most interesting. The fifth paradigm requires that all the stakeholders participate in the integrated monitoring, allocation and management of water resources.

Figure 2.3: The Four Ways of Life of the Mary Douglas Cultural Theory (Douglas 1970; Thompson et al. 1990)



The upper diagram shows some of the socio-economic processes through which the ways of life interact, and the uncanny prediction of the internet-server structure. (Email numbers mainly fall into the categories .gov, .com and .org. The cultural theory structure predicted this categorisation of users.) The lower diagram shows, how the sequence of water management paradigms can be mapped on to the ways of life categories.

The ways of life analysis identifies the stakeholders. Figure 2.3 shows how they all ideally come together, enabling *integration* and effective *political discourse* through the participation of all the interested parties. This coming together for integration can be conceptualised by placing the fifth-paradigm IWRAM activity at the centre of the ways of life diagram where they all intersect.

In the late 1990s the international initiative of the World Commission on Dams (World Commission on Dams 2001) was a classic example of the fifth-paradigm process. The WCD process also adopted many of the principles of social, economic and environmental wisdom outlined at the beginning of this chapter, which we have shown to be integral to the deployment of IWRM/IWRAM.

Why Innovate, Why Reform? IWRM/IWRAM and Transaction Cost Reduction

Recent analysis of water policy reform by economists (e.g., Saleth and Dinar 2000) has rediscovered the powerful idea of Coase (1960) that institutions are transaction-cost-reducing entities. New institutional economists have been developing this idea for over a decade with reference to both the North and the South.

Although policy reform may reduce transaction costs, it may not be perceived in this way by either the policy-makers or by those whom a policy reform might impact. This is unfortunate for the innovator because it takes little observation and analysis to detect the transaction cost savings in legally defined water management systems. For example the domestic water reticulation systems in cities across the world massively reduce the transaction costs of accessing safe water. The distribution of water to agriculture throughout the world in irrigation systems is also very successful in reducing transaction costs, although there may be substantial costs if the systems are inefficient. Would-be reformers now want to extend policy innovation by means of institutional innovation. They advocate legally defined water allocation and management instruments at local, national and international/river basin levels. They aim to reduce even further the transactional costs of making water available to users. All this may be intellectually worthy but is usually not politically feasible.

Understanding the notion of reducing transaction costs is best achieved by considering the role of the familiar instrument of money (Coase 1960). The adoption of money to reflect mutually agreed values for diverse commodities and services required unprecedented levels of trust. Trust was particularly essential in the socio-political domain.

The progressive formal legitimisation of the instrument was also essential via legal frameworks with regulatory capacities in the socio-economic domain. Money is a spectacular example of how legally contextualised instruments can reduce transaction costs. Imagine gaining access to commodities and services as diverse as food, transport services and information without trusted and legal monetary instruments.

In the water sector *new instruments* based on principles of water-use efficiency through the commodification of water are an element in innovative IWRM/IWRAM. Furthermore, protecting the water resource will also be transaction-cost-reducing. But the nature and scale of the benefits of cost reduction and environmental protection are impossible to define and quantify at the level of the community and the nation. This inability to define and quantify future benefits is one of the most serious impediments to identifying water policy reform and to the implementation of such reform. Unfortunately it is not enough to claim the impressive actual and potential benefits of the current water systems and institutions because the benefits are often intangible and difficult to value in quantitative terms. In addition, potential beneficiaries will resist any attempt to argue that the current systems should be reformed to reflect economic and environmental values. This is especially the case where such reforms to protect environmental services would reduce the quantity of water used by them, or lead to an increase in price of water paid by them to accord with underlying economic fundamentals, even though the collective good would be advanced both environmentally and economically. The resistance is explained by the politics of the contention of existing interests and non-awareness of the benefits of potential innovation.

Water Policy Reform: A Classic Case of the Political Challenge of Innovation

Water policy reforms are shaped by the discourses that precede their formulation. The outcomes of such discourses reflect the interests of the participants and the absence of the interests of any that might have been excluded. Some participants in the discourse might introduce new knowledge; others might challenge old beliefs. Current politically correct procedures urge that no stakeholder be excluded if the consultative process is to be socially and politically safe. An ideal consultation process is one in which there is a potential for local approaches to be understood by those wanting to introduce innovations based on newly constructed knowledge.

Water policy reform is, like all innovation, a political process. It has certain recognised phases. Those attempting to understand and intervene in innovative processes must be aware of the cycle if they are to make any analytical progress to understand the nature of a particular policy innovation or have a substantive impact on such innovation. The frustration of those recommending radical water policy reforms, such as IWRM/IWRAM, can be reduced. Policy innovators must recognise that the benefits of the adoption of new socio-political approaches and new economic instruments are always retrospective rather than prospective for those stakeholders who have to adapt to an externally inspired innovation.

The Unavoidable Phases of Innovation: KWHOE

If water policy reform innovators, such as those who advocate IWRM/IWRAM, are to have any impact on water-using stakeholders, they have to recognise that such stakeholders have to *know about* the proposed innovation and then have to *want* the proposed innovation. When the innovation is wanted, it will be possible for them to *have* the new system or institution. With the innovation in place it will then be possible to *operate* it, or to *comply* with it if it is a regulatory instrument. Operation of the new system may not at first be effective. The final stage therefore is to achieve *effective operation of* the system (or to achieve *effective compliance*). Knowing about, wanting, having, operating and effectively operating (KWHOE) water reforming policy and practice can be conceptualised in a sentence but the actual process can take decades (Allan 1999b).

The KWHOE process is relevant to the professionals involved in water policy reform in both the North and the South. It is particularly relevant to the knowledge construction, information dissemination and general innovation central to developing the vision and framework for action for global water.

- *Knowing* about the benefits of new (water reform) instruments, which will reflect the environmental and economic values of water.
- *Wanting* the new instruments, which will reflect the environmental and economic values of water.
- *Having* the new instruments, which will reflect the environmental and economic values of water.
- *Operating/complying with* the new instruments, which will reflect the environmental and economic values of water.
- *Effectively operating/complying with* the new instruments, which will reflect the environmental and economic values of water.

IWRAM: A New Sanctioned Discourse?

The history of water management over the past two centuries has been shown to have been subject to a sequence of sanctioned discourses. A discourse is sanctioned or not by the extent to which the policy is the result of what social theorists call a hegemonic convergence. When coalitions come together they are partial in their selection of assumptions and information to feed into the policy-making discourse. Self-serving assumptions and information get on to agendas, are discussed and influence policy outcomes. Unwelcome information is relegated to appendices or ignored. The five water management paradigms were sanctioned, or limited, in the scope of their consideration of relevant ideas through ignoring underlying fundamentals. The process is summarised as seen in Table 2.1:

Table 2.1: The Characteristics of the Five Water Management Paradigms

Water Management Paradigm	*Inspiration*	*Sanctioned Assumptions and Sanctioned Evidence/ Information/Approaches for Water Policy and Reform*
Pre-modern		
Paradigm 1	Local secure provision	• Domestic & livelihood water inviolable social resources
Industrial modernity (late 19th century)		
Paradigm 2	Hydraulic mission	• **Nature can be controlled** • **'Certainty' that the interests of the state, its development agencies, the**

(*Table 2.1 continued*)

(*Table 2.1 continued*)

Water Management Paradigm	*Inspiration*	*Sanctioned Assumptions and Sanctioned Evidence/ Information/Approaches for Water Policy and Reform*
		irrigators, the power generators, etc., were engaged in essential and appropriate activities
Late modernity (the late 1970s and 1980s)		
Paradigm 3	Environmental security	• Nature cannot be controlled · • 'Uncertainty' • Water in the environment was essential in underpinning environmental services • Water should be returned from irrigation to the environment • **Environmental considerations are primary**
Significant from about 1990		
Paradigm 4	Economic efficiency	• Water is an economic resource • Water has an economic value • Water should be used according to principles of allocative efficiency • **Economic principles are primary**
Significant from the late 1990s		
Paradigm 5	Participatory, inclusive, integrated approach	• Integration of professional discourse is a political process • Water allocation and management is a political process • The river basin is a fundamental hydrological unit • But global economic systems are more likely to bring amelioration in regions facing extreme water shortages • **There is a danger of the sanctioning of the IWRAM approach if ANY of the above are NOT included in the approach**

Note on the tabulation: The detail in bold identifies the nature of the partiality and the resulting sanctioning for the particular paradigm. In the case of the fifth paradigm the situation is evolving. It is not yet clear to what extent the assumptions necessary to successfully implement the IWRAM approach are being adopted.

Table 2.1 provides a summary of the shifts in approach to water resource allocation and management over the past two centuries. The sanctioning assumptions and ideas are shown in bold in the boxes.

Each of the approaches has been subject to only a partial consideration by policy-makers of the conditions which should ideally have been addressed if social, economic and environmental security were to be achieved in relation to water use. The first four approaches were sanctioned to the extent that they were non-comprehensive and especially because they de-emphasised the political nature of water allocation and management. The fifth can be subject to sanction if it does not recognise certain realities: first, that integration of professional discourse is a political process; second, that water allocation and management are political processes; and, third, that the river basin is a useful fundamental hydrological unit but global economic systems are more likely to bring amelioration in regions facing extreme water shortages.

Water management has been shown to be a political process inspired by constantly changing social priorities. Approaches to water management in semi-arid economies differ in the plural North from those in the plural South. Cultural, social, political and economic circumstances determine such differences. Hydro-political processes mediate the interests of the social and economic users of water and the interests of the environment given voice by environmental activists. Ideally, sustainability is the outcome.

A major purpose of this chapter is to show that political contention associated with water policy-making is dynamic and that in industrialised political economies in the semi-arid North five water management paradigms can be identified from pre-modernity to the present.

The plural South is very much engaged in its industrialising mode, which involves the control of water resources to increase agricultural output and to generate power. The contention between newly informed Northern outsiders arguing for the inclusion of environmental and economic priorities into water policy anticipates by some decades the politically feasible circumstances which will facilitate the new approaches.

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3

Solving Problems of 'Fit' at the Expense of Problems of 'Interplay'? The Spatial Reorganisation of Water Management following the EU Water Framework Directive

Timothy Moss

> *The realization that institutional problems in water resources development and management are more prominent, persistent, and perplexing than technical, physical, or even economic problems has fostered as much frustration as insight among analysts and planners in water resource agencies* (Ingram et al. 1984: 323).

1. Introduction

This chapter deals with a particular type of institutional change: the policy-driven reform of supranational environmental legislation and its anticipated impact on existing national, regional and local institutions of resource management.[1] It takes as an example the EU Water Framework Directive (WFD), which came into force in December 2000, and investigates how the future introduction of river basin management across the EU is likely to affect the spatial organisation of water management within member states. For students of

[1] This paper presents results from a project funded by the German Research Council (DFG) within the priority programme 'Global Environmental Change—Social and Behavioural Dimensions'. The author would like to thank the DFG for its generous support. Thanks are due also to Vera Tekken, Jochen Monstadt and Thomas Weith, who helped research part of this paper. The paper was published earlier in Heiko Breit, Anita Engels, Timothy Moss and Markus Troja (eds) 2003. *How Institutions Change—Perspectives on Social Learning in Global and Local Environmental Contexts*, pp. 85–121. Opladen: Leske + Budrich. The author would like to thank the publisher for permission to republish.

institutional and environmental change the WFD is intriguing and illuminating for two reasons. First, by institutionalising at a supra-national level the concept of river basin management, the Directive raises important issues of compatibility with well-established national and sub-national institutions of water management, particularly those not organised around river basins. Second, by establishing the river basin as the spatial unit for future water management, the Directive follows a powerful ecosystem logic of managing water according to biophysical, rather than political-administrative, boundaries.

This chapter investigates these two key issues by applying and testing an analytical framework provided by the Science Plan of the international project 'Institutional Dimensions of Global Environmental Change' (IDGEC) of the Human Dimensions Programme (Young 1999). It examines how the institutionalisation of river basin management by the WFD represents a classic case of trying to solve problems of spatial 'fit' arising from managing a biophysical system along political-administrative territories. It then queries whether, in overcoming this dilemma, problems of 'interplay' between water and other relevant institutions—such as for spatial planning, agriculture or nature conservation—may be exacerbated by creating a different territorial unit for water management.

On the surface it is a study of the quest for the right scale at which to manage a natural resource, namely, water. This may appear a straightforward and, indeed, superfluous task, given the wealth of literature from environmental sciences advocating the river basin or catchment as the natural territorial unit for water management. Our objective, however, is not to question the validity of the river basin management concept but to investigate the implications of introducing or strengthening river basin management for existing institutional configurations (Göhler 1997). This is because, despite unequivocal calls for river basin management from environmental policy-makers and researchers, the practice of reforming institutions of water management towards a more catchment-based approach has—as examples from around the globe illustrate—proven very difficult. The statement in the introductory quotation of this paper still holds true today.

This chapter therefore goes beyond the immediate issue of the functional suitability of organising water management around river basins to explore a set of challenges relevant to research on environmental institutions which emanate from the implementation of the WFD. These challenges all relate to spatial dimensions of institutional change. The first is the need to re-order responsibilities and distribute new tasks among water management bodies at national, regional and local levels. Here we examine what experiences with river basin management and the plans for implementing the WFD can tell us about multi-level governance of an environmental resource in the EU. The second challenge addressed is the effectiveness of institutional reform 'from above'. The issue at stake here is whether the WFD can stimulate institutional innovation within the member states whilst being sensitive to existing national styles of water management. The third challenge relates to the adaptability of existing institutions to pressures for change: in our case the ability of institutions of water management at regional and local levels to meet the WFD's requirements for river basin management. Finally, we aim to draw lessons from the changes envisaged by the WFD on the nature and value of interplay between distinct but functionally related institutions at local and regional levels. Given the importance of integrating land use and water resource management to river basin management in general, and the WFD in particular, we focus on the interrelationship between institutions of land-use and water management planning. By addressing these issues we hope, in sum, to create greater sensitivity among researchers of institutional change with regard to its spatial dimensions at sub-national levels.

The chapter begins with a review of the international literature on river basin management in order to establish whether and how problems of institutional 'fit' and 'interplay' are addressed in the scientific community of water specialists. The next section explores how far the WFD and recent EU water policy reflect and build on this knowledge, in terms of recognising the advantages of an ecosystem approach to water management and showing sensitivity towards the potential negative effects of the institutional changes demanded. The potential impact of the WFD on the spatial organisation of water management is explored in a case study of Germany, selected as a member state where water has traditionally been managed around political-administrative units rather than river basins. The adaptability of existing institutions to the required changes is assessed with a comparison between past and future institutional arrangements in Germany and an analysis of the views and implementation plans of relevant organised actors at different spatial levels. The chapter concludes with lessons drawn from the case study, relating in particular to the need for an integrated approach to solving problems of spatial fit and institutional interplay.

2. River Basin Management as an Instrument for Overcoming Problems of Fit

Boundary Problems and Environmental Governance

The problem of fit has been identified by the IDGEC project as one of three clusters of factors which strongly shape the performance of institutions that govern human/environment relations (Young 1999: 45; 2002). The basic idea is that the effectiveness of an institution is diminished where its characteristics do not match the characteristics of the biophysical systems it addresses. One obvious dimension concerns spatial fit: i.e., the degree to which a resource regime covers the same geographical area as the natural resource it is designed to influence. Examples are fishery conservation regimes which cover the entire migratory range of fish and the need for global institutions to deal with emissions of climate gases. There are many other dimensions, though, besides the spatial, at which fit can be sought. Identifying and responding to problems of fit requires a systems approach, looking beyond the immediate problem of resource over-use or point-source pollution to the wider causal effects and seeking linkages between these and characteristics of human systems. Systems linkages of this kind can extend in many directions—i.e., not just spatially—making it difficult to determine appropriate system boundaries for institutions. Bearing this in mind, creating better fit involves 'structuring institutions in ways that maximise compatibility between institutional attributes and biogeophysical properties' (Young 1999: 48).

Problems of spatial fit are familiar to political scientists, economists and geographers interested in determining optimal units of governance for various policy fields, in particular relating to the distribution of public goods. Mancur Olson's principle of fiscal equivalence has long held that the responsible level of government should coincide with the range and scope of the public good's effects on welfare (Olson 1969). The related theory of fiscal federalism also argues for a link between the spatial extent of a problem and the spatial remit of political decision-making bodies and jurisdictions (Kirsch 1984). The central argument is that lack of fit causes spatial externalities, benefiting free-riders and harming others beyond the spatial reach of the responsible institution. Recent research on regionalisation and decentralisation processes within the EU takes a similar line in identifying growing incongruence between the spaces of problems and political boundaries as a major source of institutional ineffectiveness (Holzinger 2000). In such cases, 'disparities between functional space and political territory can arise which can only be removed by the reorganisation of political territories or by functional cooperation between the responsible jurisdictions' (Holzinger 2000: 12, translation).

Environmental problems present a particular challenge since the spatial context of natural resources cannot in most cases be altered. The onus of problem-solving lies, therefore, on changes to institutional arrangements. This is reflected in the rich literature on the management of common pool resources, where boundary problems between biophysical and human systems play an important role (Ostrom 1990; Ostrom et al. 1994). The issue of spatial fit has, indeed, been central to attempts to redesign institutions to follow the characteristics of specific ecosystems. Here, the spatial mismatch between institution and ecosystem—at local, regional and national as well as international levels—is not just an obstacle but the heart of the problem. As Lipschutz argues:

> We take it for granted that ecosystemic boundaries have little correspondence to political, economic and social institutions at the international level … But the same poor fit is true at the national and even the local levels: For historical and economic reasons, the jurisdiction of virtually all governments matches poorly to nature. This suggests environmental governance is problematic where one looks. (Lipschutz 1999: 102–3).

Perhaps the most radical expression of this spatial approach to environmental governance is the bioregionalism movement. Conceived in the United States in the 1970s, bioregionalism seeks to use the 'distinctive boundaries' of natural systems as a reference for human agency and—on a philosophical plane—as a means of rediscovering connections between the natural world and the human mind (cf. Aberley 1999; Pepper 1996). Strongly rooted in notions of communal self-reliance, the bioregionalist movement spawned bioregionalist groups around the country, often around river basins or 'watersheds'.[2] The river basin, with its clearly delineated boundaries of a river system, offered bioregionalist groups an ideal spatial framework for organising and managing relations between humans and the environment. 'Watershed consciousness' became a catchphrase to express cultural identity with a natural place (Parsons 1985). Since the 1990s the language of bioregionalism has, interestingly, been appropriated internationally by environmental policy-makers and resource managers 'to assist in conceptualising experiments in institutional and organisational form' (Aberley 1999: 34). The most common examples relate to the restructuring of regional governance units to match river basin boundaries.

River Basin Management: A Classic Case of Responding to Problems of Spatial Fit

If the river basin is one of the most clearly defined territorial units of an ecosystem, how far does the literature on river basin management reflect the above debates on the need to overcome problems of spatial fit? The attraction to water managers of using the river basin as the territorial unit for managing water resources has, indeed, always been to address what Mitchell and Pigram have called 'the political boundary problems that plague integrated resource management' (cited in Downs et al. 1991: 300). Effective protection of

[2] It should be noted that the term 'watershed' is used in American English to mean the whole river basin or catchment, whereas in British English it refers to the dividing line between two adjacent river systems. In this paper, where the term is used without inverted commas it is in the British English sense.

water resources, in terms of both quality and quantity, depends on a management concept which reflects the complexity of water-based ecosystems, the multiple anthropogenic uses of water and the interaction between biophysical and human systems (Voigt 1997). Policies or strategies which address only a part of the water system—such as a stretch of a river or a point source of pollution, without considering the broader context—run the serious risk of ignoring, or even creating, negative external effects. By managing water resources for a whole river basin—i.e., from the source to the mouth of a river as well as laterally from the river bed to the watershed—it is hoped to address the interdependencies between, in particular, upstream and downstream effects, water quality and water quantity, and water and adjacent land-use resources (OECD 1989).

Although there are various interpretations of what comprises integrated river basin management (see later), it is generally held to include elements of the following list: water management (quality, hydrological regulation); river channel management (channel control); land management (land degradation control, land-use regulation); ecological management (preservation, diversity); management of human activities (socio-economic benefits) (Downs et al. 1991: 304). A more detailed explanation of the concept of river basin management is given by Marchand and Toornstra (1986).

The argument that river basin management is the best way of protecting water resources in an integrated way is reflected in virtually all the major international policy documents on water management, from Agenda 21 of the Rio Conference on Environment and Development to statements from the World Bank (Quarrie 1992; World Bank 1993). For example, Chapter 18.9 of the *Agenda 21* document states that 'integrated water resources management, including the integration of land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin.' The European Water Charter calls for 'the management of water resources … based on their natural basins rather than on political and administrative boundaries' (cited in Newson 1997: 283). The UN's Economic Commission on Europe recommends: 'The whole catchment should be considered as the natural unit for integrated, ecosystems-based water management' (UN–ECE 1995: 13). Interest in an integrated, ecosystem approach to water management—and thus in river basin management—has recently been strengthened by debates on sustainable development following the 1992 Rio Conference.

Support for river basin management is, moreover, not restricted to policy-making communities. As Newson (1996: 12) points out: 'It is axiomatic to almost all water managers that the river basin is the appropriate scale.' The ecosystem logic underpinning river basin management is today accepted by most hydrologists, water biologists and ecologists, as well as by an increasing number of water engineers. In the language of institution theory the growing international support for river basin management amongst water managers represents the institutionalisation of a scientific concept (Lepsius 1997). The river basin approach to water management has in recent years matured into an informal or fundamental institution, in the sense of becoming a guiding principle for the water management community in many countries.

The institutionalisation of river basin management has not, of course, been restricted to the informal sphere. For decades river basin management has been applied across the globe as a formal institution, i.e., as an operational regime. In 1935 the Tennessee Valley Authority became the first major organisation to coordinate the management of water resources within a single drainage basin and became a model imitated worldwide (Downs et al. 1991; Mitchell 1990). Today, applications of river basin management can be found in many—particularly in industrialised—countries, such as the watershed conservancy districts in the USA, the basin agencies in France and river catchment planning in England and Wales (Newson 1997).

Problematising the Quest for Perfect Fit

Experiences with the many practical applications of river basin management demonstrate, however, serious limitations to the logic of overcoming problems of spatial fit by reorganising water management around natural boundaries. The Tennessee Valley Authority, in the past a model for water managers in industrialised and developing countries, is today more commonly held up as a lesson on the negative effects of knowledge transfer insensitive to national or local contexts (Downs et al. 1991; Newson 1996; 1997). Since the late 1980s the literature on river basin management has, on the basis of extensive empirical evidence, begun to challenge the notion of creating perfect spatial fit which underlies a purist interpretation of river basin management. The principal criticisms broadly relate to physical, political-administrative and socio-economic problems.

Even in hydrological terms, river basin management does not solve all boundary problems. The river catchment or basin follows surface water, not groundwater, boundaries. Its geographical range may well not correspond at all to that of groundwater aquifers, resulting in spatial misfit which can negatively affect the integrated management of surface water and groundwater resources (OECD 1989). Physical boundary problems can also occur where water supply networks or artificial waterways, such as canals, cross from one river basin to another.

The most intractable problems emanate from creating a spatial unit for water management at odds with existing political-administrative territories. In overcoming problems of spatial fit within the water sector, river basin management creates new spatial misfits with other institutions. This can limit the effectiveness of institutions of river basin management in several ways. First, it challenges their political legitimisation and accountability. River basin authorities are territorially distinct from democratically elected bodies of local and regional government and are therefore not accountable to them. In some countries, such as France, steps have been taken to compensate for this 'democracy deficit' with elected representatives on river basin committees, but the essential problem of political independence from local and regional government remains. What is advantageous for the spatially integrated management of water resources can prove damaging when, in a crisis such as a major flooding incident, the accountability of river basin authorities becomes a political issue. Second, solving boundary problems within the immediate institutions of water management creates new boundary problems with other policy fields which have a major impact on water use, such as urban development, agriculture, forestry, transportation and energy. This spatial mismatch with other institutions—discussed in more detail below under problems of institutional interplay—can act as a barrier to effective cooperation between different institutions. In England and Wales, for instance, the different spatial remits of water management and land-use planning are held partially responsible for the low level of policy linkage on water issues (Slater 1997; Slater et al. 1994).

On a more fundamental level, structuring water management along an ecosystem boundary has often encouraged water managers to focus on biophysical, rather than socio-economic, problems of water management. As Pepper (1996) has observed, regions defined by natural features alone have only limited social and economic meaning. The quest for perfect biophysical fit can result in important social and economic factors being overlooked, such as water consumption patterns, pricing disincentives to save water or the supply logic of water provision. A lack of sensitivity towards these forces has contributed to the criticism that river basin management is in practice often too technocentric and heavily reliant on regulatory tools, allowing little scope for market-based incentives or instruments of persuasion (Downs et al. 1991; Newson 1997; Pepper 1996).

To conclude, the perfect spatial fit does not exist. The replacement of existing institutional units by institutions oriented around biophysical systems will inevitably create new boundary problems and fresh mismatches. Rather than try to identify the ideal river basin management institution we need to consider the territorial unit of the river basin in a broader context of overlapping social, economic, political and physical spaces (Lipschutz 1999). Reflecting on spatial misfits produced by river basin management, a comparative study of about 100 cases of river basin management worldwide cautioned: 'The key is to determine the rationale for the choice of spatial management unit, and to consider the relative merits of adopting the catchment area as the management unit' (OECD 1989: 15).

3. The Impact of River Basin Management on Institutional Interplay

Problems of Interplay as a Factor of Institutional Effectiveness

A second cluster of factors identified by the IDGEC Science Plan as central to the performance of institutions has been termed the problem of interplay (Young 1999, 2002). The basic idea is that 'the effectiveness of specific institutions often depends not only on their own features but also on their interactions with other institutions'

(Young 1999: 49). Interest in interplay has arisen in response to cases where institutional reform has failed to produce the expected results owing to incompatibility with existing institutional arrangements. The history of environmental policy is rich in examples of deliberate institutional change where inadequate consideration has been given either to how the intervention affects other institutions or to how its own effectiveness is influenced by the wider institutional framework. Recent efforts to introduce carbon emission taxes, for instance, reveal strong institutional dependence on transport policy and rural development strategies.

Young (1999: 50) identifies two dimensions to the problem of interplay: functional linkages involving the unavoidable interdependencies of two or more institutions (e.g., between agricultural production and land-use regimes) and political linkages where actors seek better integration between two or more institutional arrangements (e.g., those for public health and organic farming in the wake of the recent BSE crisis in Europe). A further distinction is drawn between vertical linkages cutting across different levels of social organisation (e.g., local, regional, national) and horizontal linkages of a cross-sectoral nature on the same level of social organisation.

These are boundary problems of a different kind. The boundaries at stake here relate not to physical territories but to political responsibilities and social spheres of influence. It is along these boundaries, where the jurisdictions and interests of organised actors overlap, that conflicts between formal institutions most commonly arise (Mitchell 1990). It is important to appreciate that problems of interplay are, of course, not restricted to formal institutions. Social activities are shaped by different—sometimes even competing—institutional logics, just as organisations can be infused with values from various informal institutions (Friedland and Alford 1991, cited in Hanf and Jansen 1998). This chapter is, however, concerned primarily with interplay between political or formal institutions, referring to informal institutions only where they help explain incompatibilities between formal institutions.

Fit versus Interplay? The Dilemma of River Basin Management

How suitable is river basin management for solving problems of institutional interplay arising from the protection of water resources?

Is there not a real danger that river basin management may, in the pursuit of better spatial fit, exacerbate existing problems of interplay with other water-relevant institutions? As we have already noted, reorganising water management around the river catchment or basin gives rise to spatial mismatches between the new river basin bodies and other organisations which are structured around political-administrative territories. The literature on organisational aspects of river basin management has identified such differences in spatial remit as a significant hindrance to trans-sectoral cooperation over water-related issues. For Newson, one of the principal problems of river basin management is the 'policy gap' between land-use planning and water management planning resulting from the different spatial scopes of the two planning regimes (1997: 343). The underlying argument in this literature is that the effective protection of water resources cannot be achieved by institutions of water management alone. The quality and quantity of water resources are affected by a wide range of human activities—from agriculture to electricity generation, from recreation to industrial production—each framed by its own institutional arrangements. For this reason good institutional interplay is essential for effective water protection.

Intriguingly, an integrated approach to water resource issues is a key feature of river basin management. Besides its geographically comprehensive perspective of managing water within a whole basin, the concept of river basin management is holistic in its approach to interactions between human and natural systems. It draws on a rich body of knowledge, loosely termed as integrated water management and developed in response to the ineffectiveness of one-dimensional and isolated solutions to water resource problems. Mitchell (1990), based on a review of the literature, identifies three possible interpretations of integrated water management. The most straightforward form involves the systematic consideration of the various dimensions of water and their interdependence (e.g., quality and quantity; surface water and groundwater). The task here is to ensure adequate linkages between various water management functions, such as water supply, wastewater disposal or flood protection. A second, more comprehensive interpretation of integrated water management addresses the interactions between water, land and the environment. In this case the management tasks cross sectoral boundaries between land and water use, for example with floodplain management, the reduction of diffuse-source pollution or the preservation of water-dependent habitats. The third, most far-reaching form of integration looks beyond physical impacts to the interaction between water and economic and social development. This approach is rooted in the debate on sustainable development and addresses, in addition to the above issues, the role of water in various other matters, for instance, electricity generation, transportation or recreation.

The concept of river basin management is open to all three approaches; in practice there exist examples of each and of combinations of them. What is significant in terms of our interest in spatial organisation is that the management of water resources around the biophysical territory of a river basin is founded on the first approach with its emphasis on integration within the water sector. Broader interpretations of integrated water management, which include interactions between water and other sectors and their institutional arrangements, are therefore, as a result of the kinds of spatial misfits described earlier, likely to encounter difficulties.

Coping with the Dilemma: Lessons from Past Experience

How then are water managers to overcome the dilemma of pursuing more advanced forms of integrated water management in cooperation with other water-relevant institutions in a spatial framework which may well, by creating new spatial misfits, make institutional interplay more difficult? Empirical studies of experiences with river basin management indicate that a flexible and contextually sensitive approach can help to overcome this dilemma. Many of the difficulties experienced in the past emanated from the attempt to introduce a blueprint of river basin management—based for instance on the Tennessee Valley Authority—in a very different context. They revealed how important it is for institutions of river basin management to respect the political traditions and culture of the host country or region (Newson 1996: 15; OECD 1989). Furthermore, river basin management can be suggestive of an organisational 'fix' which, it has been claimed, appeals to water managers who are keen to avoid more fundamental changes in attitudes, work patterns or lifestyles (Kinnersley 1988: 93–94).

Past experience argues that the processes and mechanisms involved in implementing river basin management are of greater importance than the availability of an ideal organisational model. This is the conclusion drawn by Mitchell:

> … there is never a perfect 'fit' among legitimisation instruments, functions and structures. As a result, use is made of various processes and mechanisms to overcome the problems which occur because of imperfect matches. It is often these processes and mechanisms, informal and formal, which facilitate co-ordination and integration (1990: 214).

River basin management, to be effective, depends on coordinating mechanisms capable of bridging the gaps between the relevant institutions and organisations (OECD 1989). The task of winning broad support for a more integrated, holistic approach to water management demands extensive consultation with a wide range of parties. For most water managers, consultation exercises with professional groups beyond the immediate water sectors is unfamiliar territory. River basin management demands more than merely disseminating information and collecting opinions in the context of a formal planning procedure. It requires complex negotiation and bargaining processes with other parties relevant to water resource management and the creation of new partnerships to solve basin-specific problems (Newson 1997). Beyond professional groups it is important to engage the wider public in debates on the future of the river basin, not only to ease acceptance of river basin strategies but also to tap relevant local knowledge. The central message is that river basin management, to be effective, requires a more open and interactive form of regional environmental governance, involving a wider range of stakeholders.

A second point raised in the literature is the need to consider the appropriate scale for particular institutional arrangements (OECD 1989). Many cases of river basin management have encountered serious problems when taking either too detailed an approach at the level of the whole river basin or too broad an approach at the local level. Mitchell recommends, for instance, distinguishing between the strategic level of a whole basin, where the need is for a comprehensive perspective covering all water-relevant issues and institutions in general terms, and the operational level, where tasks should focus on those water functions (including human impacts) of particular relevance to that locality (1990: 4).

Finally, the dominance of the ecosystem logic underpinning the river basin management concept should not blind us to a wide range of other motives influencing the way river basin management is applied in practice. River basin management is not only a biophysical construct; it is also a social construct in the sense that it is seen by its proponents as an optimal way of achieving specific policy objectives or of promoting certain power interests. The policy objectives underpinning river basin management have varied widely over time and space. In the USA river basin management was originally a response to drought and limitations to urban development (Mitchell 1990), in Spain in the 1920s and 1930s it was an important tool for modernising agriculture (Swyngedouw 1999), whilst in England the central motives shifted from land drainage via flood protection to securing adequate water supply (Newson 1997). The introduction of river basin management had the—often deliberate—effect of strengthening the hand of certain political, economic or professional groups at the expense of others. In Spain, for example, it was used by a new generation of wealthy farmers as a tool to undermine the traditional water regimes of the landed aristocracy (Swyngedouw 1999). When implementing river basin management it is, therefore, essential to be aware of the hidden agendas behind the rhetoric, and the potential winners and losers of institutional change.

4. The Water Framework Directive and the Institutionalisation of River Basin Management across the EU

Institutional Change from Above: Introducing the Water Framework Directive

How far is existing knowledge on the difficulties of institutionalising river basin management, as outlined above, reflected in the WFD? In the following section we are particularly interested to discover whether the lessons on how to solve problems of fit and interplay with river basin management have influenced both content and style of the WFD. The WFD (2000/60/EC) came into force on 22 December 2000 (EC 2000). This Directive is designed to provide 'a transparent, effective and coherent legislative framework' for community water policy (Preamble, para. 18). The overall aim is to establish a legal framework within which to protect surface waters and groundwater in the EU using a common management approach and following common objectives, principles and basic measures (EC 2000). The core environmental objective is to prevent the deterioration of aquatic ecosystems and to restore polluted surface waters and groundwater to a 'good' status in terms of ecological and chemical as well as water quantity-related parameters within a specified time frame (Art. 1). Additional objectives are to promote the sustainable use of water resources and to alleviate the effects of floods and droughts.

The WFD marks a departure from past EU water policy in a number of ways. On the one hand it harmonises existing EU legislation on water management, removing many of the inconsistencies and gaps which had emerged over the years between the 30 or so directives relating to water protection. It provides for the first time a coherent framework for EU water policy. On the other hand the WFD sets EU water policy on a new footing in terms of the environmental objectives, regulatory style and spatial organisation of water management in the EU. The WFD establishes the river basin as the unit for water management planning across the EU, strengthens the combined approach to pollution prevention, introduces economic analyses of water use, provides the general public with rights of participation in planning processes and establishes a detailed system of monitoring and reporting. These innovative elements relate, therefore, not simply to standards of water protection but above all to organisational aspects of water management.

In the language of institution theory the WFD represents a deliberate reform to a formal institution (the EU's water policy regime) designed to induce change to formal institutions of water management at lower levels of spatial hierarchy (i.e., within the member states). The implementation of top-down changes from a 'peak regime' on to multiple smaller regimes is fraught with difficulties, as is documented in the literature (Lipschutz 1999; Ostrom 1990). Referring to resource regimes in general Lipschutz delivers a warning which could well be applicable to the WFD:

> Legislation originating 'from above' is rarely able to take into account the valid concerns of all stakeholders in a resource because of a lack of information about the institutional history and path dependency of a resource management system, which are of critical importance to its revision (Lipschutz 1999: 106).

Our interest lies in explaining how the WFD is likely to affect institutions of water management at national and sub-national levels in terms of the changes that will be required and the ability of existing institutions to adapt to these changes. This relates to a number of distinct but interrelated strands of research into institutional change. The WFD presents, first, an interesting case of multi-level governance involving institutions at supranational, national and sub-national levels (Mayntz and Scharpf 1995: 44, 50). It is illuminating, for example, to explore how far Elinor Ostrom's (1990) critique of centralised institutional solutions to environmental problems can be applied to the WFD, or whether the WFD does leave scope for distinctive sub-national styles of integrated water management. More specifically, the WFD contributes to the ongoing debates on whether processes of European harmonisation are eroding national policy styles and how far national forms of environmental governance compete for influence over EU legislation (Börzel 1999; Héritier 1996; Héritier et al. 1996; Jordan and O'Riordan 1995). Finally, the WFD offers insight into the relationship between formal and informal institutions (on the distinction between the two, see Göhler 1997; Dietl 1993; Jordan and O'Riordan 1997). Being itself an expression of a recent shift in perceptions and assumptions within the EU over how water should be managed, the WFD is an example of change to a formal institution precipitated by change to an informal institution. This development reflects a deeper understanding of institutional change as a reconfiguration of formal and informal institutions over time (Eisen 1996; Göhler 1997; Häder and Niebaum 1997).

Resolving Problems of Spatial Fit with the Water Framework Directive

One of the principal changes initiated by the WFD is the establishment of the river basin as the territorial unit for managing water resources across the EU. The main tool of the WFD is, indeed, the river basin management plan (Art. 13). The EU's new water policy, substantiated in the WFD, builds unequivocally on the ecosystem rationale underpinning the concept of river basin management. As early as 1996 a key communication on EU water policy by the European Commission stated that new demands on water management 'would require integrated water management planning on a river basin basis' (CEC 1996: 18). The Commission's Directorate General for the Environment is today even more explicit on the need to overcome problems of spatial fit: 'The best model for a single system of water management is management by river basin—the natural geographical and hydrological unit—instead of according to administrative or political boundaries' (Homepage of DG Environment, http://ec.europa.eu/environment/water/water-framework/overview.html, accessed 18 August 2006).

The concept of river basin management is institutionalised principally in Article 3 of the WFD. This requires Member States to identify river basins within their territory and assign them to River Basin Districts. These River Basin Districts form the spatial unit for all environmental objectives and specified measures under the WFD, primarily comprising obligatory river basin management plans, programmes of measures, river basin and economic analyses, public information, monitoring programmes and reports. River basins covering more than one member state are to be assigned to an international River Basin District. All these requirements must be implemented at the same time in all River Basin Districts according to a strict and detailed timetable. For the first time river basin management will be institutionalised throughout the EU. Yet the WFD deliberately falls short of specifying how each member state should organise this complex process internally. Member states are not obliged to set up new river basin authorities but only to ensure 'appropriate administrative arrangements, including the identification of the appropriate competent authority' for each River Basin District (Art. 3). Following heated opposition—in particular from Germany—to an earlier draft which made river basin authorities obligatory, the current formulation was chosen out of respect for national (and sub-national) styles of water policy and management (for the criticisms, see Breuer 1997). In this way, it is hoped that the WFD will stimulate institutional and organisational change within member states by providing a common framework for action and detailed specifications for individual measures (e.g., river basin management plans) without actually prescribing to member states how these measures should be put into practice.

The introduction of River Basin Districts and river basin management plans is, interestingly, not the only way in which the WFD will affect the spatial organisation of water management in the member states. A second institutional innovation concerns greater sensitivity to regional circumstances. In response to past criticism that EU-wide emission limit values or environmental quality standards made no allowance for the very different conditions and needs of water management across the member states, the WFD calls for programmes of measures to respect this diversity and for 'decisions to be taken as close as possible to the locations where water is affected or used' (Preamble, para. 13). This appeal is substantiated by allowing the reference parameter for the 'very good status' of surface water bodies to vary according to different river types. There are 20 reference types for Germany alone, permitting a degree of regional differentiation and context sensitivity new to EU water policy.

The WFD can, indeed, be said to herald the regionalisation of water management in the EU. Besides river basin management and regionally differentiated reference standards, a stronger emphasis on environmental quality standards within the combined approach to pollution prevention will have a far-reaching impact on land-use patterns (Art. 10). By setting objectives for the ecological and chemical quality of surface water bodies and the chemical quality and availability of groundwater resources, the WFD directs interest towards the multiple sources of pollution and over-exploitation within a whole river basin and its sub-basins. Point sources of pollution, such as sewage treatment plants or industrial emitters, will remain important in future but attention will need to focus more on diffuse sources, emanating primarily from agriculture, urban development and other forms of land use. The combined approach for point and diffuse sources introduces, in other words, a new, spatial dimension to pollution prevention, which covers all water-relevant activities within a river basin. This raises the issue of institutional interplay and the degree to which it is addressed in the WFD.

Considering Problems of Interplay and Implementation

Institutional interplay is not referred to explicitly in the WFD, being a matter of operational responsibility of the individual member states. It is, though, strongly implicit in the combined approach to pollution prevention and in the stipulations on river basin management planning. If water managers are to adopt a more integrated approach to water protection, taking a wide range of human impacts into account, they will need to cooperate to a far greater extent than in the past with organisations outside the sphere of water management, in particular in the fields of land-use planning, nature conservation and agriculture.

Indicative of the recognition of the need for greater interaction between stakeholder groups is the emergence of new instruments of water management within the WFD. Past EU legislation sought to protect water resources in the main by establishing uniform technical standards for emission levels or environmental quality across the EU. The WFD retains this focus in part—e.g., emission and quality standards relating to specified priority substances in Article 16 and Annexure X—but draws on a wider range of instruments to pursue its objectives. Supplementing the more conventional regulatory instruments are several novel market-oriented and participatory tools.

The economic analysis of water use, for instance, forms a part of the ex-ante evaluation of the characteristics of a River Basin District (Art. 5 and Annex. III). On the basis of this knowledge, member states are to apply the principle of full-cost recovery for water services, including 'environmental and resource costs', at the same time ensuring 'adequate incentives' for efficient water use and the 'adequate contribution' to water costs by each category of water user—generally households, industry and agriculture (Art. 9 and Annex. III). How these requirements are to be interpreted is a question addressed at the European level by a Working Group of Water Directors within the Common Implementation Strategy (CEC 2001) and at the national level with a pilot project on the Main river (Kessler 2001). Depending on which costs are included and how they are calculated and allocated, the principle of full-cost recovery and the new transparency over cost calculations could seriously reshape the economic relationships between different stakeholder groups.

To take a second example, the WFD institutionalises forms of public consultation and information in water management in the EU (Jekel 2002). Article 14 establishes public information and consultation as a component of future river basin management planning. Member states are to 'encourage the active involvement of all interested parties' in implementing the WFD. Specifically, they will have to publish a timetable and work programme for the production of river basin management plans, an interim overview of significant water management issues identified in the River Basin District, and draft copies of the plan. In addition the public is to be granted access to relevant background documents and information. Here, again, the specifications in the WFD are vague, reflecting the differences of opinion between member states over what public participation should involve. There is no definition of who the 'public' of a River Basin District are: for instance, whether it refers to any interested party or just to those resident in the district. It is also unclear whether participation is limited to providing information to the public and considering their comments or should be more interactive, involving consultation meetings and even a stake in the decision-making process. There is a strong argument for saying that, regardless of the text of Article 14, the need to gain support for water protection measures required by the WFD will make some form of active consultation unavoidable (Hagenguth 2001: 19; LAWA 2002: 48-49, 72, 75).

The New Style of Governance Underpinning the Water Framework Directive

The WFD is often criticised—in particular by environmental groups—for possessing inadequate powers of enforcement. There are indeed many loopholes in the WFD, notably the options for exemptions and/or delays in achieving 'good' status for water bodies. The danger of inadequate and ineffective implementation needs to be taken seriously. Ultimately, much will depend now on how the WFD is implemented and interpreted in each of the member states.

What is often overlooked, though, is that the WFD does not rely wholly on the EU's (limited) powers of regulation over water management but on other kinds of sanctions and incentives which have the potential to stimulate institutional change within and between individual member states. The WFD encourages a new style of decision-making in and beyond the water community, a style which is more open, more consultative and more participatory. Within River Basin Districts we can expect the emergence of complex—and often controversial—negotiations over future river basin management plans and programmes of measures conducted by a wide range of policy-makers and planners and drawing on the inputs from interest groups and individual citizens. Moreover, the EU will in future possess the power to sanction member states not only for non-enforcement of technical standards or non-fulfilment of environmental objectives, but also for failing to meet organisational requirements such as the production of river basin management plans, programmes of measures or reports to the European Commission. The power of the European Commission to monitor progress has been strengthened by the use of uniform and detailed reporting procedures for all member states under Article 15.

This style of governance envisaged by the WFD mirrors, it should be noted, a wider shift in EU environmental policy since the early 1990s, away from a command and control approach towards the use of more market-based instruments backed up by incentives for greater self-regulation and public involvement (Héritier 1996; Héritier et al. 1996; Philip 1998). This trend is in part a pragmatic response to low implementation levels using regulatory instruments and in part a consequence of the dominant logic of liberalising or privatising public services (Héritier 1996). Against this background the Commission is keen to consolidate existing legislation while attempting to raise environmental standards as economic development and new technologies permit (Philip 1998). Pressure in this direction is also coming from individual member states (notably the UK) which are themselves less reliant on regulatory instruments. Indeed, the history of the WFD is an interesting case of conflict between two national logics of environmental policy-making in the UK and Germany. While the UK prefers the use of environmental quality standards and 'least-cost' technologies, Germany traditionally relies more on emission controls using best available techniques. These differences were further accentuated over the WFD because river basin management is standard practice in the UK but not in Germany. The final version of the WFD can therefore be classified, to use Héritier's terminology, as a 'British home-run with concessions', in the sense that key features of the British model of water management, such as river basin management, environmental quality standards and cost-efficient water use, were adopted, but are complemented by elements characteristic of the German approach, notably emission values for priority substances (Héritier 1996: 479–83). It is the purpose of the following case study to ascertain how the German model of water management will need to adapt to accommodate the changes required by the WFD.

5. Reshaping Existing Institutions: A Case Study of Implementation Plans in Germany

The Spatial Organisation of Water Management Prior to the Water Framework Directive

The changes to the spatial organisation of water management resulting from the WFD will be greatest in those member states where river basin management is least developed. Germany is a prime example of a country where water management is traditionally organised around political-administrative units, making it well suited to a case study of institutional change towards better spatial fit.

Responsibility for water management in Germany is divided between public authorities at different spatial levels, in accordance with the federal structure of government (see Kraemer and Jäger 1998). There are essentially three tiers in the German institutional model of water management: federal, state and municipal. Legislative authority over water issues rests primarily with the 16 states (*Länder*). The federal Water Management Act merely provides a legal framework, which allows considerable scope for substantiation in the water legislation of each state. Federal legislative functions have increased in recent years, though, to meet the need for uniform emission standards and compliance with EU directives (Kahlenborn and Kraemer 1999). Executive authority is similarly concentrated at the state, rather than the federal, level. The state water authorities, with up to three territorial sub-units, possess the principal policy-making, planning and regulatory powers. Several federal ministries exercise advisory or supervisory functions in ensuring standards are met on individual aspects of water management. The Federal Waterways Directorate is unusual in possessing substantial executive powers over navigable waterways, which it exercises via its regional offices (Kahlenborn and Kraemer 1999). Operational functions—in particular, the provision of water supply and sewage disposal services, but also the maintenance of smaller watercourses and flood protection measures—are primarily the responsibility of local authorities, many of which operate their own water utilities.

The principal advantage of this multi-level system of governance is that it ensures a high degree of formal political legitimacy to institutions of water management in Germany. Each water authority—whether at federal, state or municipal level—is politically accountable to a democratically elected parliament or council. The main drawbacks—besides the lack of spatial fit with river basins—lie in institutional diversity between the 16 states and problems of vertical institutional interplay, in particular between federal and state levels. Indicative of the need for improved coordination and harmonisation of German water policy is the growing importance of the Working Group of the Federal States on Water Problems (LAWA), an inter-state consultative body with close links to the relevant federal ministries and to the European Commission (Kraemer and Jäger 1998: 208–9, 271).

Elements of river basin management have existed in Germany but they are supplementary, not central, to the above water management institutions and their impact is often limited by spatial misfit to political-administrative territories (Interview 6). The principal instruments of water management planning are at least partially oriented around river catchments or reaches (Betlem 1998; Umweltbundesamt 1998). Water management framework plans, required by Clause 36 of the pre-WFD Water Management Act, covered river basins, urban areas or parts of these, whilst water management plans were for short reaches of heavily polluted watercourses. However, these plans stopped at state borders, the only exception being the framework plan for the Berlin metropolitan area produced jointly by the states of Berlin and Brandenburg. Furthermore, the framework plans—although required by law—were not legally binding for either authorities or users, whilst the management plans, which were legally binding, were voluntary. As a result the framework plans generally proved fairly ineffective and only a very limited number of management plans were produced, mostly for the heavily polluted watercourses in Northrhine–Westphalia (Hoffmeister 1994; Umweltbundesamt 1998). Being highly detailed, these plans took as many as 13 years to be introduced, rendering many out of date before they were even complete (Umweltbundesamt 1998).

Several organisations for water management have been created to improve management coordination across the administrative boundaries of a watercourse or river basin. At the international level, river commissions for the protection of the Rhine, Elbe, Danube and Oder rivers represent voluntary, contractual forms of cooperation between national or sub-national authorities. These international river commissions vary greatly in their technical and spatial responsibilities (there exist four distinct commissions for different reaches of the Rhine and its tributaries) and are concerned primarily with the river itself rather than with the whole basin. Their principal influence is via action programmes focused on improving water quality and flood protection (Umweltbundesamt 1998).

Within Germany inter-state cooperation is partially institutionalised in the form of working groups of state water authorities for each of the major river systems, such as the Elbe, the Rhine and the Weser. As with the international river commissions, these working groups produce action plans and programmes which are not legally binding but are designed to give guidance to water authorities. The Action Programme for the Rhine, for instance, sets emission limit values for pollutants. The Integrated Ecological Plan for the Weser is distinctive for addressing the impact of a wide range of human activities along the whole river system and its floodplains (Henneberg and Schilling 1998). On a smaller spatial scale there exist various forms of inter-ministerial cooperation between states, often to tackle a localised water management problem. These can be relatively formalised, as is the case with the Inter-Ministerial Working Group for the Lausitz (LIWAG) to manage water resource problems resulting from long-term lignite mining on the Saxony-Brandenburg border, or regular meetings of departmental heads, as between the water authorities of Berlin and Brandenburg (Interviews 2, 4 and 5).

Inter-municipal cooperation along river reaches or catchments is institutionalised in several forms, albeit limited to specific territories or tasks. The nine statutory river associations (*sondergesetzliche Wasserverbände*) of the state of Northrhine–Westphalia are the closest Germany has to operational organisations of river basin management. Created in the early 20th century to cope with extreme demands on water resources in the Ruhr industrial region these associations operate facilities of wastewater treatment, water supply and reservoirs and maintain watercourses for a whole catchment of a tributary of the Rhine. Membership is compulsory for local authorities, municipal water utilities and private companies that abstract or discharge significant amounts of water in the catchment. Recently, these associations have shown a growing interest in a more integrated approach to water quality and quantity issues as well as in better consultation with local stakeholders (Interview 8; Kolisch et al. 2000). The inter-municipal water management associations (*Wasser- und Bodenverbände*) also have a long historical pedigree, developing unevenly across the country and differing greatly in their operational priorities. Funded by landowners with property adjacent to watercourses, their principal task is to maintain ditches and smaller watercourses in the interest of flood protection and drainage. Although required by law to respect natural and landscape functions, water management associations are often criticised for serving the water needs of the farming community at the expense of ecological quality (von Alvensleben 2000; Interview 11). A more integrated approach to the management of small watercourses has recently been promoted by the principal professional association of water specialists, the ATV–DVWK, which has set up voluntary working groups, called *Gewässernachbarschaften*, in several states to raise awareness of ecological management practices by means of educational courses, meetings and field trips (Interview 8).

Finally, it is worth noting that till 1990 a form of river basin management was standard practice in East Germany. From the 1950s onwards both the organisational structure and the instruments of water management planning of the GDR were designed around seven (later five) river basins rather than political-administrative boundaries. This early orientation towards river basin management was only partly driven by concern for integrated water management. More important was the state planning logic of centralising control of water resources at the expense of municipal influence, in order to secure strategically important water supplies for industrial and household use (Umweltbundesamt 1998; van der Wal and Kraemer 1991). Nevertheless, several features of river basin management under the GDR—notably the spatial organisation and uniform methods of reporting—can be regarded as valuable contributions to implementing the WFD (Umweltbundesamt 1998: 36). Some river basin structures indeed survived the territorial reorganisation of water management following unification in 1990: the regional water authorities of Brandenburg's state environment agency, for instance, largely follow river basin boundaries (Interview 5). The irony of having to reinstate river basin management little more than 10 years after it was dismantled in the interest of strengthening renascent municipal and state authorities is not lost on those who witnessed this earlier phase of institutional change.

Given the generally limited and isolated forms of river basin management in Germany it is not surprising that spatial misfit between river basins and the territories of water management institutions has given rise to the kind of boundary problems described earlier. On the other hand, one might expect that the spatial fit between water and land-use planning authorities has aided institutional interplay in a given territory. On paper the relationship between the two planning regimes has a sound legal basis, with clauses on spatial planning in the Water Management Act, a requirement for water management planning to respect spatial planning objectives and detailed procedures for consulting water authorities over spatial planning set down in federal and state legislation (Jacobitz 1994). In practice, however, it is commonplace for local authorities to build roads, houses or commercial estates on flood plains, along river banks or in water protection areas, contrary to water protection policies (Kahlenborn and Kraemer 1999).

Several factors have in the past contributed to ineffective institutional interplay between water management and land-use planning. The inadequacies of water management planning instruments as outlined above have limited the forcefulness of water protection policies. Local authorities, equipped with considerable (spatial) planning authority, often resent and resist what they regard as an intrusion by state water planning authorities. The objectives of spatial planning at the state and regional level are often too unspecific to lend weight to state water policy. Furthermore, interaction between water management and land-use planners is typically limited to formal consultation procedures during planning processes (Interview 8). The norm is for planning authorities, as representatives of the public interest, to submit written comments to a draft plan by another body rather than engage in discussion. It is quite common for the wording and zoning of a regional plan relating to water protection, for instance, to be suspiciously similar to that of an existing water management plan, indicating that no real weighing-up of the different planning perspectives has taken place at all (Hoffmeister 1994; Jacobitz 1994; Interview 11). More generally, institutional interplay is hampered by strong functional division of responsibility in German administration. From the federal to the municipal level, issues of water management, spatial planning, nature conservation and agriculture are commonly the responsibility of separate organisational units (Kahlenborn and Kraemer 1999). Even where these fields are under one administrative roof, as is the case in the state environment ministries of Brandenburg or Northrhine–Westphalia, sectoral thinking remains entrenched (Interview 3). To summarise, spatial fit between different institutions at any one level of the administrative hierarchy is clearly in itself no guarantee of effective cooperation between them.

Institutionalising River Basin Management: Initial Steps towards Better Spatial Fit

Given the importance of political-administrative territories to water management in Germany and its limited, if varied, experience with river basin management, the WFD will necessitate major changes to the way water protection is spatially organised in the future

(Holzwarth and Bosenius 2002; Stratenwerth 2002: 324). The challenge currently facing water managers in Germany is to reform existing institutions in such a way that they are compatible with both the WFD and the country's federal system of government. Having successfully opposed an early draft which would have required the creation of new river basin authorities, Germany's water authorities now need to demonstrate how they can improve spatial fit with the river systems they manage within a federally structured framework.

The debate on implementing the WFD is being conducted primarily by the state water authorities in conjunction with the Federal Environment Ministry under the auspices of the inter-state working group LAWA (Irmer 2000). The LAWA has produced guidelines for water authorities covering technical, legal and organisational issues as a way of ensuring the speedy and—if possible—uniform implementation of the WFD in all 16 states. The initial focus was on legal implementation—i.e., changes to existing legislation explicitly required by the WFD—to be completed by December 2003. In terms of spatial organisation, the principal changes to the federal Water Management Act, amended in 2002, identify River Basin Districts on German territory, make obligatory the coordination of water management planning across state boundaries, establish the river basin management plan and programme of measures as the principal instruments of water management planning, set quality standards for surface and ground water and establish a framework for public participation in the planning process (Deutscher Bundestag 2002).

On the basis of these changes, state water laws and ordnances have been reformed, specifying in detail how the WFD is to be implemented organisationally. This applies in particular to allocating the river catchments within a state to a River Basin District, determining the procedure for drawing up river basin management plans, including public participation, and institutionalising forms of cooperation and exchange with states of the same River Basin Districts. One of the main changes will be to instruments of water management planning. Although some methods and data from existing water framework and management plans will prove useful in future (Umweltbundesamt 1998: 67–69), experts are in no doubt that the new river basin management plan and the programme of measures drawn from it will need to cover a much wider range of issues (Leymann 2000). In particular, they will need to address the interrelationship of upstream and downstream water use, the reduction of diffuse sources of pollution within the whole river basin, the efficient use of resources and public participation (Umweltbundesamt 1998: 68–72).

One of the toughest challenges, central to resolving the dilemma of following two different spatial logics of governance, is how to adapt existing organisational structures, responsibilities and procedures to satisfy both. The problem for Germany is exacerbated by its geographical characteristics. Germany's natural river basins vary enormously in size, from the Rhine basin with an area of 100,000 sq km and a population of 34 million in Germany alone to the German part of the Oder basin of just 5,600 sq km and 0.4 million inhabitants. All but one of its major river basins are transnational, covering nine neighbouring countries in and outside the EU. The Elbe basin covers 10 of Germany's 16 states, and the Rhine basin covers eight states. The future task of cross-border and inter-state coordination is, therefore, huge.

In accordance with the WFD, 10 River Basin Districts have been identified in Germany. It was then necessary to identify a 'competent authority' for each full or partial River Basin District on German territory. The key question was which existing body was to be entrusted with responsibility for each River Basin District and what coordinating and planning authority it would be allowed to exercise (Hagenguth 2000). From the outset it was clear that there should be no new river basin authority created for the parts of a River Basin District in Germany (see the reservations above). The issue at stake was whether state water authorities should transfer some planning sovereignty by inter-state contract to a new coordinating body for a River Basin District or whether they should retain their full powers and rely on looser co-ordination in the form of a river basin secretariat for day-to-day management and regular meetings of representatives of the state water authorities (Hagenguth 2000). At a meeting of the Environment Ministers' Conference (UMK) in 2001 it was resolved to avoid any transfer of sovereignty and pursue the latter model.

The activities of the coordinating bodies for German River Basin Districts are to be limited to collecting data, drafting the river basin management plan and communicating, where necessary, with the international coordinating body. Enforcement will be the responsibility of the individual state water authorities. With this decision the state water authorities circumvented jurisdictional problems of spatial fit between River Basin Districts and the federal structure of administration, and ensured no loss of formal power to an independent body. The model of loose coordination has the additional advantage of being able to build on existing organisations of trans-boundary cooperation: the inter-state working groups for the major rivers (e.g., ARGE Rhein, ARGE Weser). However, it has the considerable drawback of relying heavily on the ability of participating state water authorities to reach unanimous agreement on most issues and to sell the agreements made to their respective governments. Given the potential conflicts of interest with ministers responsible for finance, agriculture and spatial planning, the loose model of coordination may yet prove a major weakness when it comes to drawing up the river basin management plans and implementing the programmes of measures.

A second organisational dilemma is whether to sub-divide the larger River Basin Districts into smaller sub-basins, each with its own management plan and even organisational structure. Article 3 of the WFD allows for this, leaving the decision to individual member states. In Germany it is widely felt that a single plan for, say, the whole Rhine or Elbe basin cannot adequately reflect the diverse characteristics and needs of their main tributaries (Irmer 1999; Interview 6; Umweltbundesamt 1998). In these cases it makes sense, for hydromorphological as well as institutional reasons, to introduce river basin management at the sub-basin level and aggregate these plans into a common plan for the whole basin. This allows for more context-sensitive planning, facilitates public participation, eases the task of coordination within the whole basin and permits the use of existing forms of cooperation. Agreements have been reached, for instance, to sub-divide the Rhine basin into 11 and the Elbe basin into five sub-units according to river catchment boundaries. Within the largest River Basin Districts a further sub-division into smaller catchments has been made. Interestingly, these smallest planning units do not follow the catchment boundaries precisely but are adapted to accommodate political-administrative jurisdictions. This is justified by proponents as a way of avoiding the impracticalities of water planning boundaries running through the middle of towns and cities, minimising administrative upheaval and bridging the gap between the two systems of spatial organisation (Interviews 5 and 6). Critics warn that, by focusing activities on the sub-basin level within each state, the state water authorities may be less interested in a coordinated approach across the whole basin.

Actor Viewpoints on the Institutional Changes

So far we have analysed institutional change in Germany in terms of reforming laws, instruments and organisational structures, i.e., the formal institutions of water management. What the analysis reveals is how far the alternatives under discussion are being shaped by what the leading actors regard as the right way of doing things, i.e., by informal institutions. It is worthwhile at this point, therefore, to reflect on the degree to which the spatial reorganisation of water management initiated by the WFD meets with the approval of the main actor groups.

It might be assumed, given Germany's tradition of managing water along political-administrative boundaries, that water managers there would resist the imposition of river basin management from Brussels. In fact, rather surprisingly, all the principal water policy-making, regulatory, planning and service bodies in Germany welcome the strengthening of river basin management by the WFD. Whether the Federal Environment Ministry, the LAWA, state water authorities, the Association of Gas and Water Engineers (BGW) or the German Association of Water Management, Wastewater and Solid Waste (ATV–DVWK), all agree with the principle of managing water resources across political boundaries for a whole river basin (Fuhrmann 2000; Interviews 2, 5, 6, 7 and 8; Schmitz 1998). More than this, they generally welcome the form of river basin management established by the WFD, with its emphasis on monitoring water quality standards, uniform planning methods and sensitivity towards regional differences (Interview 6). While acknowledging a number of potential problems of adapting existing institutions and emphasising the premature status of debate on implementation, water managers in Germany (as elsewhere) largely follow the ecosystem logic underlying the WFD. They approve of its holistic approach, the greater attention to diffuse sources of pollution, the pressure for improved trans-boundary cooperation and the requirement for better data. Interestingly, the spatial planners interviewed also welcome the strengthening of river basin management. For them the WFD represents an important step towards a more integrated approach to water management which relates to their own professional task of considering competing claims on land use.

A further reason for water managers in Germany to welcome the WFD is essentially political. Recently, water protection has lost some of its political urgency, as the quality of many rivers and lakes has improved markedly. Water protection strategies and economic restructuring have succeeded in raising water quality and reducing demand but have in so doing weakened the willingness of politicians to fund additional protection measures. 'And it is at this point,' the LAWA chairman points out, 'that the WFD with its ecological, holistic approach was sent to us as a gift. Whoever takes water protection seriously must be delighted. The WFD has come right on cue' (Leymann 2000: 8, translation). In addition, water managers widely anticipate that a more integrated approach to water management, which considers the wide range of human impacts, will strengthen their hand in policy-making and planning processes vis-à-vis other policy fields. In particular, they hope to gain greater influence via the WFD over forms of land use damaging to water resources (e.g., Interview 2). While some water managers view this in terms of a power shift at the expense of other policy fields, others prefer the notion of sharing responsibility for water management across a wide institutional spectrum.

The broad welcome from water managers to river basin management should not blind us, however, to some important differences of opinion over implementing the WFD. The state water authorities are fearful of losing influence to the federal level in the course of harmonising water policy and to any coordinating body for a River Basin District which seeks to assert its independence from state authorities. They are similarly wary of delegating any planning authority to the statutory river associations or enforcement tasks to municipal water management associations. The influential ATV–DVWK has, by contrast, long criticised state particularism over water management, calling for a stronger role for the federal government. It favours coordinating bodies with real powers and the active involvement of existing river basin organisations, such as the river associations in Northrhine–Westphalia and its own *Gewässernachbarschaften* in an implementation strategy (Interviews 7 and 8). The BGW, representing water and sewage utilities, is similarly critical of past state influence and had hoped the WFD might simplify water management structures in Germany but is now sceptical, fearing additional bureaucracy and costs resulting from the co-existence of state and river basin structures (Interview 9; Schmitz 1998). Water utilities are particularly attracted by the prospects of using the polluter-pays principle to improve water quality before it reaches water treatment plant, thus saving them considerable investment costs.

Institutional Interplay: The Open Questions

The optimistic attitude of most water managers in Germany towards the institutionalisation of river basin management in principle is tempered by a fair degree of uncertainty—even among the well-informed and influential—over how the WFD is likely to alter existing processes and structures of water management in Germany in practice. The impact on the water authorities at federal and state level is, if still not finalised, at least the subject of intensive debate among those responsible. Far less consideration has been given as yet to the wider implications of the WFD to institutional arrangements beyond the legislative framework. Largely uncharted are, for instance, the potential impact on local authorities and their water/sewage utilities, modes of allocating costs of implementation across state boundaries, forms of engaging the public, the future role of existing forms of river basin management (such as the municipal water associations) and the willingness of actors from other policy fields to cooperate in pursuing the objectives of the WFD. These unresolved issues all relate to institutional interplay, whether between different water organisations, with other water-relevant institutions or between water managers and the general public.

As we have noted earlier, river basin management, to be effective, needs to ensure good interplay as well as fit.

Leading water managers in Germany do recognise that there is much more to implementing the WFD than adjusting the legal and organisational framework: 'The WFD will demand considerable changes to our past ways of thinking and working in the water sector if we are to take a spatial and context-sensitive approach to water protection' (Leymann 2000: 25, translation).

Water management under the WFD will require greater co-operation and coordination within and beyond the water sector. There is talk of the emergence of new environmental partnerships as more effective means of water protection than traditional regulatory instruments (Fuhrmann 1999: 122; Interview 13). However, if those responsible for implementation focus their efforts on following the letter, rather than the spirit, of the WFD, the danger is that the resolution of important issues of interplay not specified in the text of the Directive will be sidelined or seriously delayed: 'The prospect of water authorities spending the next nine years exclusively on developing water management plans and ignoring their wider impact is very real indeed' (Leymann 2000: 7, translation).

Looking at vertical institutional interplay within the water sector, we can observe how the solutions are focused on the future tasks of the state water authorities. The coordinating bodies established for each of the 10 River Basin Districts in Germany are composed solely of state officers, with no representatives from federal or municipal authorities, let alone from other relevant stakeholder groups. This raises questions as to the effectiveness of such bodies if, for instance, they do not include a representative from the influential Federal Waterways Directorate. Local authorities and their water/sewage utilities have criticised state and federal bodies for not engaging them in discussions on the WFD in the past on the grounds that their involvement is only necessary when legal implementation is complete (Lattmann 2000; Interview 8). By then, they argue, it will be too late to affect real change: 'We have always said this is a great opportunity to reshape water management together. Truly together and not with the authorities on one side handing out instructions and the addressees on the other having to pay up' (Interview 8, translation).

A further example of unresolved interplay is over the river associations in Northrhine–Westphalia. Although these organisations have long been responsible for collecting data, compiling water management plans and negotiating with stakeholders for whole river catchments, the state water authorities are keen to ensure that they control river basin management functions, taking on some tasks previously performed by the inter-municipal river associations (Knitsch 2000; Interview 8).

While it is quite likely that water managers from different organisations, with their common interest in water protection, may be able to reach agreement on a plan or programme of measures, enforcement will require the support of others outside the water sector. The effectiveness of the WFD will depend much on horizontal institutional interplay, in particular with land-use planning, agriculture and nature conservation. It is recognised amongst state water authorities that the WFD's goal of 'good status' for water bodies cannot be achieved by water managers alone (Leymann 2000; Interviews 1 and 2). Interestingly, most water managers do not see any major problems of communication emerging from having different territorial units for water management planning and land-use planning (Interviews 3, 5 and 6). This view reflects partly their confidence in the continued influence of state authorities over water management but partly also from the expectation that river basin management will create greater pressure for cross-sectoral cooperation in practice. A more integrated approach to water management will, it is felt, require others to cooperate over water protection issues.

Some state water authorities, as in Bavaria, Hesse and Saxony, are actively engaging with government agencies, local authorities, interest groups, NGOs and business organisations directly affected by the WFD. In the state of Baden-Württemberg an advisory group on the WFD has been established, including representatives from municipal associations, state ministries for rural development and economics and local business. In addition the water authorities there are conducting an intensive publicity campaign on the WFD. In many other states, however, water managers appear reluctant to consult other interest groups over their implementation procedure or to inform them of the WFD's implications.

The need to cultivate better relations within and beyond the water sector will be particularly apparent when it comes to allocating the costs of implementing the WFD within a River Basin District. As yet, very little consideration has been given to suitable mechanisms for funding the WFD. It is widely expected that the WFD will give rise to substantial additional costs necessary to cover both new administrative tasks (e.g., monitoring) and the water protection measures themselves (Interview 6). If water managers are to acquire these additional funds they will need to persuade politicians and water users of the benefits of improved water protection. They will also need to co-opt funds earmarked for nature conservation, river management and sustainable agriculture if they are to meet some of the new environmental objectives in target areas.

Equally problematic will be establishing a modus for distributing costs between different localities and states of a single River Basin District. If, to take one topical example, it is ascertained that the most cost-effective way of improving the water quality of the rivers and lakes of the Berlin metropolitan region is to reduce the use of nutrients in agriculture upstream rather than upgrade the city's sewage treatment plants, who will have to pay (Interviews 1, 2, 3 and 5)? According to the territorial principle currently practiced, each state is responsible for arranging the funding of measures on its own territory. In our example, the cost burden currently falls on the water utility of Berlin rather than the farmers of Brandenburg. Clearly, new mechanisms for allocating costs across state boundaries will need to be found, which offer adequate incentives for the most cost-effective measures for the whole river basin. The redistribution of costs affects not just state authorities. If, in our example, the decision were made to limit nutrient inputs upstream, the costs would fall initially on farmers in Brandenburg and the savings would benefit primarily the Berlin water utility. Finding an acceptable mechanism for cost allocation is likely to take considerable time and effort, particularly in view of the difficulties of identifying the cause of diffuse source pollution. If the timetable for implementation is not to be endangered, this issue must be addressed soon.

Finally, consulting and informing the public is a further dimension of interplay where discussions on implementation are as yet only partially developed. Water managers in Germany have little experience of engaging with the general public: past water management plans have not required public involvement (Umweltbundesamt 1998). Moreover, limited experiences with formal public participation procedures, as in the context of environmental impact assessments, often discourage further contact. Article 14 of the WFD, requiring consultation with the public in drawing up river basin management plans, poses a major challenge to German water managers. In its implementation guidelines the LAWA distinguishes between measures to engage the general public and those directed at organised groups affected by the WFD (LAWA 2002, Part 3: 48–49, 72, 75). It also points to the need for different forms of engagement at different spatial levels and at different stages of the implementation process. The Federal Environment Ministry has also produced ideas on how to meet the requirements of Article 14 (Jekel 2002).

At the level of the states, however, there are substantial differences in the degree of importance attached to engaging the public and the activities conducted or planned. Some state water authorities prefer a minimalist interpretation of the legal requirements and are not intending to engage with the public until the first drafts of the river basin management plans are complete. They only plan then to make information on the relevant issues and the draft plan publicly available by means of official journals, newspapers and the Internet. Public participation is regarded there as a legal obligation rather than a means of developing a wider understanding of the issues and gaining support for the plans and measures. Other states, by contrast, are contemplating or already enacting more proactive forms of public participation. Public opinion there is actively sought in preliminary consultation processes as a way of creating awareness of the WFD's objectives and minimising the risk of conflict over the selection and enforcement of particular measures. It is these same states which also look beyond Article 14 to engage voluntarily with those interest groups directly implicated in the WFD, either as polluters or as organisations responsible for enhancing the environment. They see important advantages in informal, flexible approaches to cooperation with bodies outside the water management sector on whose support they will have to rely in order to deliver many of the environmental objectives set out in the WFD.

6. Conclusion

The process of implementing the WFD has begun only recently, but the contours of the future organisation of river basin management in Germany are already becoming apparent. From this it has been possible to identify the extent to which the lessons from past experiences of river basin management have been learnt and to highlight areas where further reflection is needed.

This chapter has used a conceptual framework for analysing the effectiveness of institutions in terms of their ability to solve problems of fit and interplay, in order to identify some of the chief strengths and weaknesses associated with reorganising water management around river basins rather than political-administrative territories. The principal message emerging from past empirical analyses of river basin management is that the quest for the perfect spatial fit is fundamentally flawed. Addressing problems of spatial fit via river basin management is an important way of conceptualising and managing the complex interactions between human and water systems. However, creating new water management institutions around biophysical systems inevitably creates new boundary problems and fresh mismatches with existing water regimes and other institutions. Rather than try to identify universal river basin management institutions we need a more flexible approach, adapting the model to the physical, socio-economic and institutional characteristics of a specific river basin. This means addressing problems of interplay between institutions, both within and beyond the water sector, alongside problems of fit. The objectives of integrated river basin management cannot be achieved by water managers alone.

Our analysis of the WFD and early plans to implement it in Germany show that whilst the problem of spatial fit is widely recognised by water managers, even where river basin management is not standard practice, the importance of institutional interplay to the success of river basin management is not yet fully reflected in the debate. The WFD is not explicit on mechanisms of interplay, although it does create some openings relating to public participation, diffuse sources of pollution and cost recovery. Much will depend on how each member state interprets the Directive and recognises the need for cooperation with other stakeholder groups in practice. Initial steps towards implementing the WFD in Germany suggest that issues of institutional interplay may well get sidelined, or at least postponed, as a result of the water authorities' prime concern with meeting their most immediate obligations and protecting their own position in the new structures and procedures of river basin management. This tendency, if not corrected, could exacerbate conflicts of interest with other stakeholder groups at a later date when it comes to defining policy objectives, prioritising water protection measures and allocating costs within a River Basin District. The WFD presents an opportunity for a more transparent, consultative and participatory form of regional governance for water protection. Whether this opportunity will be seized is, as yet, unclear.

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4

Limits to Leapfrogging: Issues in Transposing Successful River Basin Management Institutions in the Developing World

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1. BACKDROP

MANAGEMENT BECOMES IMPORTANT as a productive resource becomes scarce; and there is hardly a situation in which this is truer than in case of water. For a long time now, the water policies of many emerging nations have been focused on developing the resource, and optimisation was directed at the efficiency of water infrastructure rather than water itself. As water has become increasingly scarce, optimising is now being increasingly directed towards improving the productivity of water itself. Increasingly, the river basin is emerging as the unit of management of land, water and other natural resources in an integrated fashion. Many developed countries such as the US, France and Australia have evolved highly advanced and resilient institutional regimes for Integrated River Basin Management (IRBM),

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but this has taken decades—centuries, in the case of Europe and the US—of gradual change to evolve. An issue which has held great appeal for policy makers and social researchers is whether it is necessary that developing countries in Asia and Africa should take all that long in crafting such institutional regimes? Or might it be possible for them to do an 'institutional leapfrog', as it were, to a stage at which developed country basin institutions are today. A textbook case of institutional reform for IRBM in recent times has been the Murray–Darling basin where sweeping changes have been made and enforced since 1990. And transferring the lessons of success in IRBM—from Murray–Darling to Mahaveli, and Mississippi to Mekong—has emerged as a growth industry.

This chapter attempts a broad-brush approach to understanding the material differences in the contexts of the developed country river basins from where idealised institutional models emerge and the developing country river basin context in which these are sought to be applied. The idea is not to undermine the significance of the lessons from success but to emphasise the need for sagacity and critical analysis in assessing what will work and what will not, given the differences in the context. The phrase 'institutional change' is used to describe how communities, government and society change recurrent patterns of behaviour and interactions in coping with water scarcity and its socio-ecological ill-effects. It involves understanding laws and rule making, roles, policies and institutional arrangements at different levels. The overarching premise is that the effectiveness of a pattern of institutional development is determined by at least four realities of a river basin viewed in conjunction with each other: hydro-geological reality, demographic reality, socio-economic reality, and the organisation of the water sector. By implication, institutional arrangements that have proved effective with one set of these realities may require major adaptation before they become appropriate to the needs of a river basin context defined by an alternative set of these realities.

Integrated River Basin Management is a powerful idiom, and will increasingly dominate natural resource management discussion in the developed as well as developing world. In its broadest sense, a basin or catchment is visualised 'as an inter-connected machine or system which transforms natural inputs of solar energy, atmospheric precipitation, nutrients and other environmental factors, along with man-made inputs of labour, capital, materials and energy, in to output products such as food, fibre, timber, building materials, fuels, minerals, natural vegetation and wildlife, recreational and aesthetic amenities, buildings and development sites, as well as water in desirable quality and quantity' (Burton 1986, cited in Hu 1999: 324). River basin management as a notion goes far beyond traditional land and water management and 'includes significant parts of land-use planning, agricultural policy and erosion control, environment management and other policy areas. It covers all human activities that use or affect fresh water systems. Briefly put, RBM (river basin management) is the management of water systems as part of the broader natural environment and in relation to their socio-economic environment' (Mostert et al. 1999: 3).

Institutional discussions on IRBM have invariably—and probably erroneously—tended to gravitate around three models of strategic organisations for managing river basins: the *hydrological model,* in which a river basin organisation/authority cutting across administrative boundaries takes over all charge of water resource management; the *administrative model*, prevailing in many developing countries, in which water management is the responsibility of territorial organisations unrelated to hydrological boundaries; and *coordinating mechanisms* superimposed on the administrative organisations to achieve basin management goals. Each has advantages and disadvantages: the hydrological model effectively deals with upstream-downstream issues that the administrative organisation is generally unable to deal with; however, hydrological organisations typically tend to focus on water and overlook land management issues. River basin commissions, as a hybrid, might combine the advantages of both, but they often command little authority, at least in the developing country context, and are therefore confined to lowest-common-denominator solutions (Mostert et al. 1999). In many developing countries today, institutional reform for RBM is confined almost wholly to the creation of the basin level organisation, the implicit assumption being that mere formation of the appropriate organisation will result in IRBM, an assumption whose validity has been repeatedly refuted.

In the developed world, the discussion has been much broader and has veered around initiatives in four aspects of natural resource governance: (*a*) some mechanism for basin-level negotiation and coordination fortified with adequate authority and resources, and a broad mandate considered appropriate to the basin's context; (*b*) legal and regulatory reform; (*c*) redesigning economic instruments of policy (transfer prices, taxes, subsidies) in sync with national policy goals; and (*d*) redesign of economic institutions (including utilities, service providers, property rights, water markets and irrigation management transfer to user organisations). Above all, developed country approaches that have succeeded have been *adaptive, gradual* and *problem-focused.* The Rhine Commission, for instance, has laboured for over 200 years to get its nine member countries to agree to a set of rules for managing the river as a shared resource. Countries like the US have achieved, over long periods, high levels of integration even without a central basin organisation (see, for example, Svendsen 2000).

2. Applying the Lessons of Murray–Darling to the Developing World

The Murray Darling River system, as a recent case of accelerated institutional reform, has appropriately emerged as a model of institutional structure for IRBM. The basin encompasses all of the Australian Capital Territory, over 75 per cent of New South Wales, 56 per cent of the state of Victoria, and small parts of Queensland and South Australia, altogether comprising a vast region of south-eastern parts of the continent. Already, several case studies of Murray–Darling are available; and it is not our intention to review these. In brief, the innovations of the Murray–Darling basin management regime include: (*a*) at the institutional level, the Murray–Darling Ministerial Council as the top-level policy making and coordinating mechanism, the Murray–Darling Basin Commission as the operating organisation, and several Catchment Management Agencies that are responsible for the day-to-day management of water; (*b*) a system of 'permits' for diversions that encompasses all uses except water needed for domestic use, livestock production, and irrigation of up to 2 ha., which are recognised as prior rights, and exempted from legal as well as permit systems; (*c*) an effective cap on water diversions at 1993–94 levels of development to ensure adequate environmental supplies, accompanied by a system of volumetric licensing to users that raises the scope for large-scale water trade across states and sectors; (*d*) consumption-based, full-cost recovery pricing (Macdonald and Young 2000: 14); (*e*) a system of 'salinity credits' that permits trade in salinity; (*f*) explicit mechanisms for water allocation for environmental needs; (*g*) a legal regime that separates water rights from land rights; (*h*) privatisation of service providers such as Murray Irrigation Ltd and Victoria's Rural Water Corporation (Malano et al. 1999).

The Murray–Darling RBM regime clearly represents a highly evolved form of institutional arrangement and effectively addresses all major problems that a mature river basin would face. As alluded to earlier, exploring whether developed country basin institutions—particularly the Murray–Darling experience—can be replicated in developing country context has fascinated many researchers (including these writers) in recent years. An entire issue of *Water International* (Vol. 24, No. 4, 1999) was devoted to this subject in 1999. The results of these investigations have not been very encouraging. For example, Hu (1999: 323) explored the applicability of Murray–Darling experience in the Chinese context and came to negative conclusions regarding its replicability, because of: (1) difficulty of coordinating authorities at different levels; (2) unclear ownership of resources; (3) small farming scales; and (4) 'poor education of resource users'.

In a similar vein, Malano et al. (1999: 313) ask: 'Can Australian experiences be transferred to Vietnam?' Their conclusion is less emphatic than Hu's, but all their evidence suggests that it will be a long time before Vietnam becomes really ready for the Murray–Darling prescription; and that 'context, hydrological and socio-economic, defines the detail and balance that is required.' The new water law of Vietnam contains provisions to adopt an integrated river basin approach. The World Bank as well as the Asian Development Bank (ADB) have apparently held up funding to Vietnam until it forms a national water council to implement it. The Ministry of Agriculture and Rural Development, which is at present in charge of water, does not relish the responsibility of IRBM. The progress in stakeholder participation, another Murray–Darling prescription, has been slow to say the least. Farmers view irrigation provision as government responsibility; even so, irrigation charges in Vietnam are high by Asian standards. Yet, presumably under donor pressure, the government tried to eliminate irrigation subsidies, but this was followed by massive popular unrest in 1998, whereupon the government had to restore the subsidies.

Can the Australian success in enforcing the user-pays principle be transferred to the Solomon Islands? Hunt (1999) explored this issue in a recent study and concluded that such transfer 'is not sustainably viable' on account of huge differences in political structures, national priorities, living standards, cultural traits, technological development, literacy levels, financial and infrastructure growth, and change management competency. All these differences result in the absence of what Hunt (1999: 302) calls a 'contextual fit between the policy development and the respective policy application environment'.

'If there is any conclusion that springs from a comparative study of river systems, it is that no two are the same' (Gilbert White, cited in Jacobs 1999). Each river basin may differ from another in a thousand respects, but that does not mean that lessons of success in one are of no value to another. It does mean though that uncritical 'copycat' replication of successful institutional model—either by enthusiastic national governments or at behest of enthusiastic donors—is a sure formula for failure.

The history of institutional reform in developing country water sectors is dotted with failures of such copycat reform. Integrated river basin management is not a new idea even in developing countries. India tried to transpose the TVA (Tennessee Valley Authority) model tried in the US by constituting the Damodar Valley Authority, which was a resounding failure. Catchment management committees were established in China way back in the 1950s in some of the major river basins such as the Yangtse and Yellow rivers to plan and exploit water resources, generate electricity, mitigate flood damage, and to provide facilities for navigation (Hu 1999: 327). But all these institutions shed their broad agenda and ended up focusing on irrigation, the purpose that was most central to their domains at those times. In Sri Lanka, a Water Resources Board was established as early as in 1964 to promote integrated water resources planning, river basin and trans-basin development and to tackle water pollution; however, the Board never worked on its broad mandate and instead took to hydrological investigations and drilling tubewells.[2] Such examples can easily be multiplied; the point is that in learning useful lessons from success cases for making meaningful reform in developing countries, it is important to understand critical differences between the two worlds that have material significance for what will work and what will not. We pose the hypothesis that, in understanding the applicability of institutional innovations, it is critical to take into account four types of *material* differences between the developed country reality and developing country reality: (*a*) hydrology and climate; (*b*) demographics; (*c*) socio-economics; and (*d*) organisation of the water sector. We briefly outline these material differences in the following sections.

3. Hydrology of the Developing World

Historically, agriculture advanced early in arid climates such as in Egypt and Iraq, but industrial development began early in the temperate and humid climates of Europe, North America and Japan. Some arid areas where significant wealth creation and accumulation has occurred—as in West Asia—are typically rich in mineral and oil resources. As of today, however, the bulk of the developing world, where rainfall tends to be low and water scarcity is a major emerging constraint to progress, is in the arid or semi-arid[3] parts of the world. Developing countries also happen to be concentrated in parts of the world with more extreme climates compared to the regions occupied by today's developed countries (see Fig. 4.1) (Sutcliffe 1995).

India, for example, receives all its annual rainfall in less than 100 hours of torrential downpour in the period June–October; and its challenge is to save enough of it from evapo-transpiration (ET)

[2] Another round of reform has just begun in Sri Lanka. In 1990, a draft law made provision for bulk water allocation and included the establishment of a National Water Resources Council to deal with issues that the Water Resources Board could not. But the law could be submitted to the Parliament only in 1995 on account of the lack of consensus in the cabinet as well as amongst the myriad agencies dealing with water (Birch and Taylor 1999: 331)

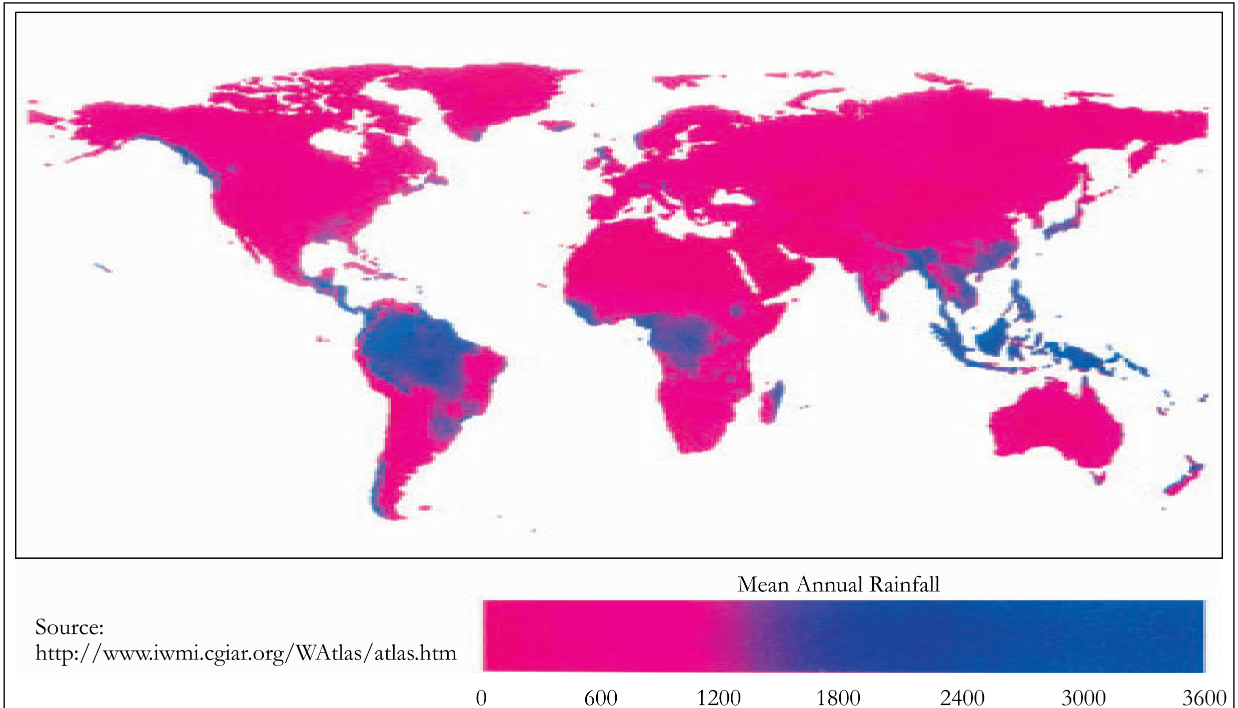
[3] Referring to regions like India and West Africa, which are humid for a small part of the year but arid during the rest of the year.

to last from October until the months of April and May that mark the period of highest water stress. Botswana receives all of its 350–500 mm rain fall in the period November–March, which coincides with period of highest evaporation, leaving little or no run off (Sutcliffe 1995: 69). Humid areas also typically have higher stream density compared to arid and semi-arid areas—which means that, *ceteris paribus,* a great deal more of the precipitation in the arid and semi-arid areas runs off as a sheet before it forms into streams, and is thus subject to higher ET losses. And other things are not quite the same: the developing world, especially South Asia and much of Africa, around the tropics has higher mean temperatures for a longer part of the year compared to the developed world. And, for the same level of precipitation, run-off as well as need for irrigation tends to be greater in arid and semi-arid areas than in humid areas (see Fig. 4.2) (Sutcliffe 1995: 64).

In sum, a river basin's hydrology shapes its challenge. In Figure 4.4, in the Rhine basin in Europe and Omono Gawa in Japan, rainfall always exceeds ET. As a result, the compulsion to manipulate its water supply to irrigate crops is virtually eliminated and the focus on water management here is primarily on non-agricultural requirements. In stark contrast, in Murray–Darling in Australia, precipitation never exceeds ET, and all its farming demands artificial water application. In Chad, Fuyang and Sabarmati—representing river basins in many third-world countries—precipitation exceeds ET but only for a few months. But unhelpful hydrology is only one reason why agricultural water use in these basins shapes the water management regime; the other is their demographics.

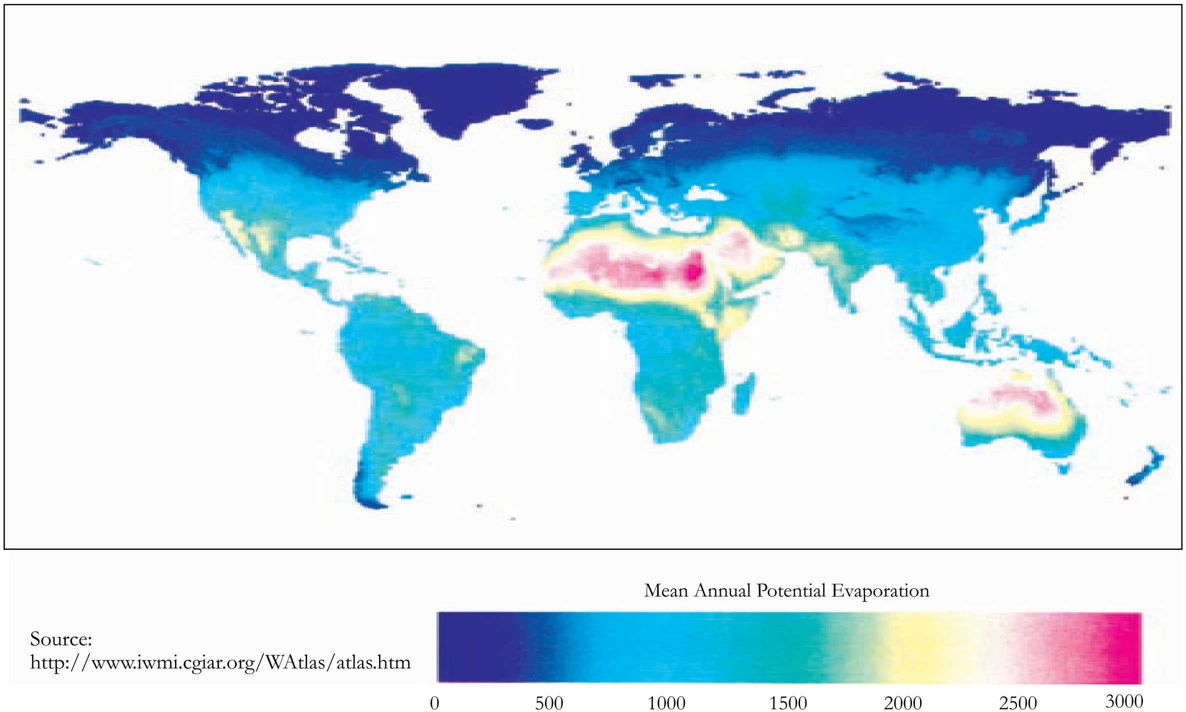
The climate and hydrology conditions—combined with the demography (discussed in the following section)—explain why decentralised institutions for water management have historically evolved in many parts of the developing world. The profusion of small tanks in India's southern peninsula and Sri Lanka can be viewed as the response of communities in the catchment areas to stake their claim on their rainfall. Even today, one maintenance task that many south Indian tank communities carry out collectively before the start of the monsoon is to clean and deepen the supply channels that feed rainwater run-off to their tanks. Village people here recognise that if they do not capture run-off in artificial streams, most of it will be lost before it reaches their tanks.

Figure 4.1: Global Distribution of Mean Annual Rainfall



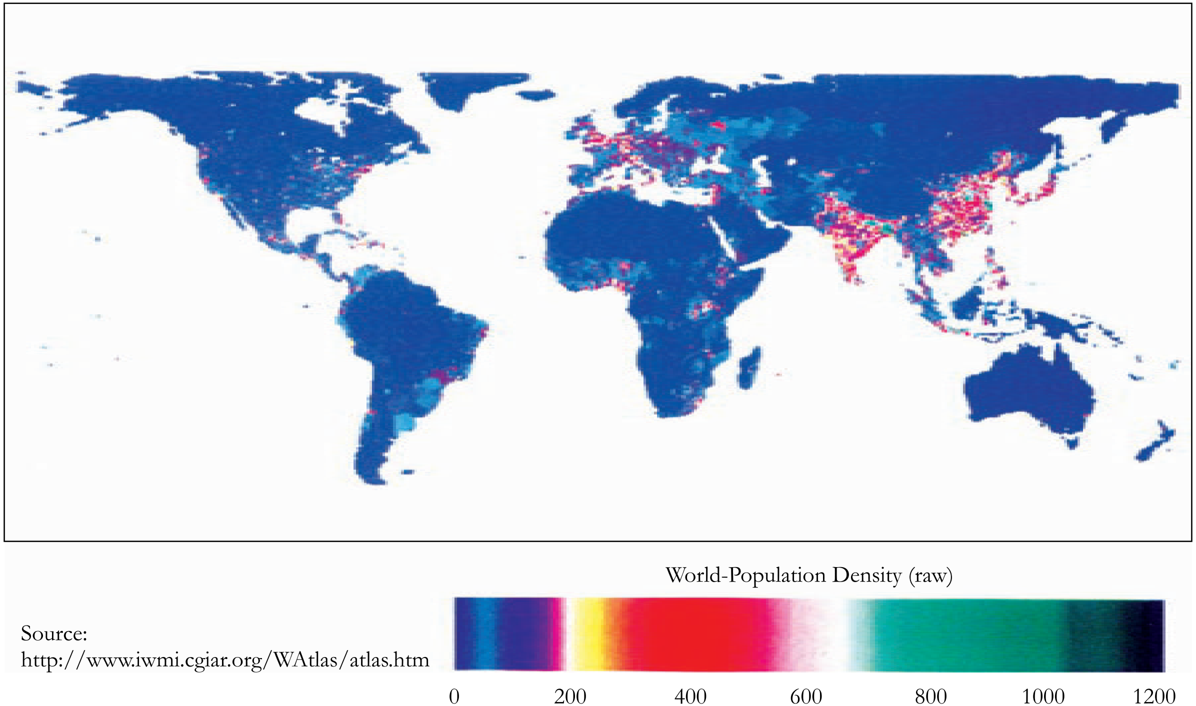
Source:
http://www.iwmi.cgiar.org/WAtlas/atlas.htm

Figure 4.2: Global Distribution of Mean Annual Potential Evapo-transpiration



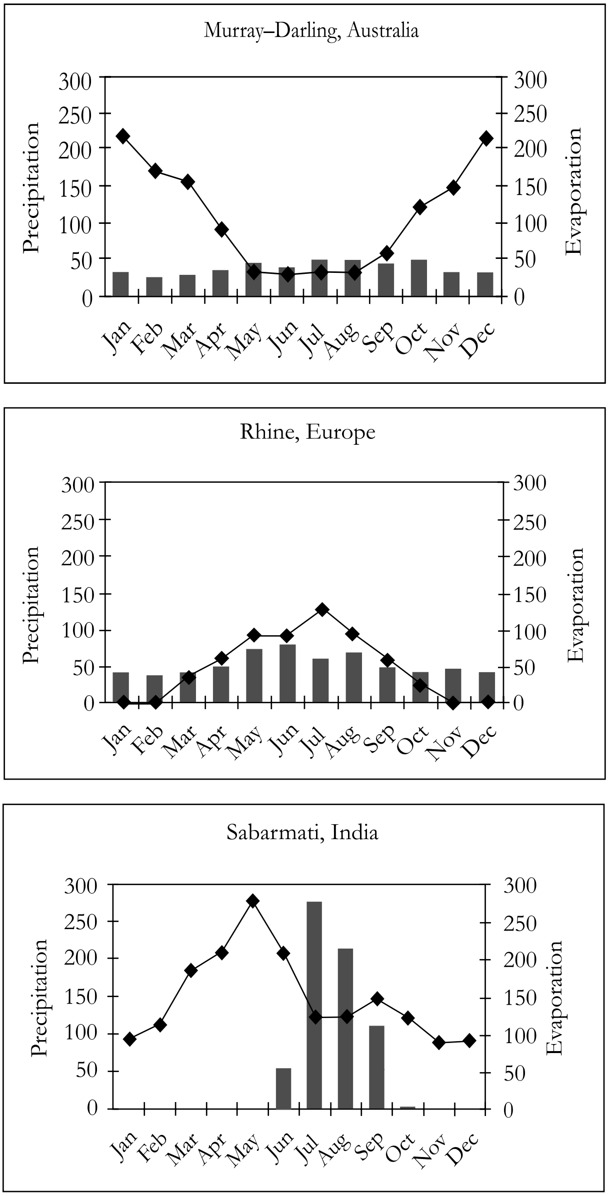
Source:
http://www.iwmi.cgiar.org/WAtlas/atlas.htm

Figure 4.3: Global Distribution of Population Density



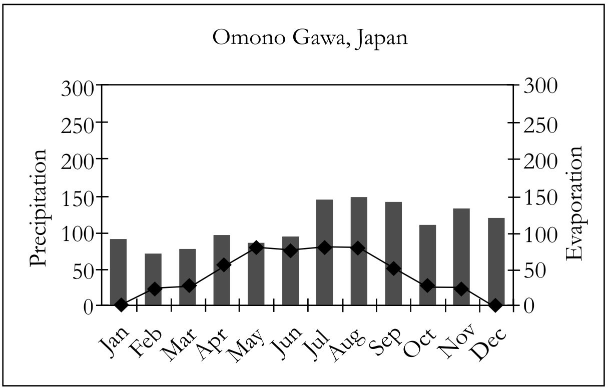
Source:
http://www.iwmi.cgiar.org/WAtlas/atlas.htm

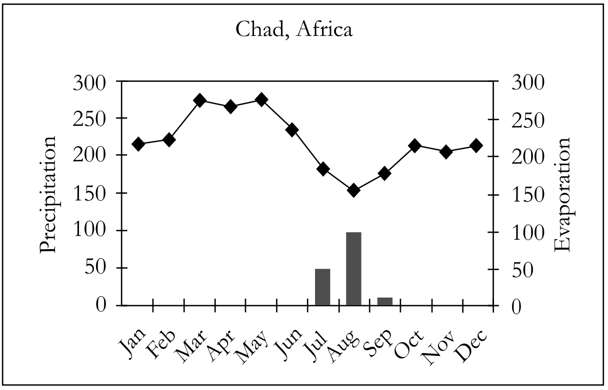
Figure 4.4: Hydrology of a River Basin and its Water Management Challenge

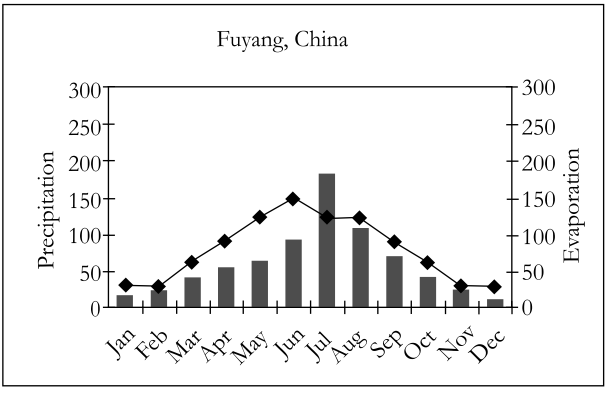


(*Figure 4.4 continued*)

(*Figure 4.4 continued*)







Source: http//www.iwmi.cgiar.org/WAtlas/atlas.htm

4. Demographics

Many parts of the developed world are arid too; however, over time, population and urbanisation in these parts have tended to get concentrated in wet areas or near the coastal areas where the rivers end up, or which can be supplied through large-scale diversion structures. As Figure 4.3 shows, leaving out Europe, most of the developed countries have low population densities throughout, with urban agglomerations near the coasts and rural population along rivers or irrigation systems. Here, the competition is for large accumulated bodies of 'diverted water'. Since catchment areas have sparse population density, downstream water harvesting structures command large catchment areas that are virtually free. This is not the case in some of the most densely populated regions of the world. In India, for instance, population density is high, approaching 600 persons per sq km in the water-rich Ganga basin, but seldom less than 350–400 even in semi-arid Western India and hard-rock peninsular India. This is true about upstream as well as downstream areas of dams. The same is true about China: North China plains have much less water than South China, but its population density is around the same. One might argue that intensive groundwater development in South Asia and China is due to the fact that most people here can not be downstream of large dams; and, by sinking tubewells, people upstream in a sense challenge the basic inequity inherent in the pattern of large irrigation projects that usurp the rainfall precipitation of populous upstream catchment areas to bequeath it to a small number of canal irrigators.

All these factors have had implications for the kind of water institutions that have evolved historically in the developed and developing world. For example, the system of rights based on riparian doctrine and on the doctrine of prior appropriation is alien to the cultures of many developing countries, because by far the majority depends upon rainfall and their local water harvesting and storage structures. Riparian rights or prior allocation becomes operative only along the streams and rivers where the bulk of the irrigators and water users tend to get concentrated in countries like the US or Australia. But these make no sense to, for example, some 20 million groundwater-pumpers in South Asia or the communities that use over 300,000 tanks in South India or 7 million ponds in China.

Because large proportions of the population in the developing world depend upon rain and on local storage, the notion of ownership and rights relates more easily to precipitation than large-scale public diversions. Egypt gets less than 10 per cent of its water from rainfall; yet, Egyptians consider the rainwater to be truly there own. In Asia, where population density is commonly as high in the catchment areas of the river basin as along the streams and the rivers, the implicit primacy of the right of communities over precipitation rather than over diversions is widely accepted. Indeed, in recent years, a popular slogan in Western India is 'rain on your roof stays in your house; rain on your field stays in your field; and rain in your village stays in your village'. In the Western countries, upstream/downstream conflicts are important because most water users think of users upstream as their rivals. In the World Water Forum that met at The Hague in March 2000, the slogan that Delhi-based Centre for Science and Environment popularised was 'Everyone Lives Downstream', which is eminently sensible if all or a majority of people in a basin depend for their water needs directly on rainfall precipitation.

The IRBM discussion talks very little about the enormous amount of work on farming in the semi-arid tropics done by national and international centres such as ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). As GWP (2000: 25) notes: 'Most water management, including the literature on IWRM, tends to focus on the "blue water", thus neglecting rains and soils water management. Management of "green water" flows holds significant potential for water savings.' This is because there is little real 'dry land farming' of the Indian and West African variety in the developed world, but making the best use of soil moisture is a critical issue in many African and Asian countries.[4] Europe, Canada, New Zealand and the US do have rainfed farming, but this is not quite the same as dry farming in

[4] Rockstrom asserts that the current debate on global water scarcity '… relate[s] to "blue" water management—i.e., the use of our monitored perennial water resources in rivers, lakes and accessible groundwater … 1,500 m^3/cap/year is required to produce an adequate diet … [but] the bulk [2/3rd] of the world's foods do not originate from "blue" water at all but are produced with direct "green" water return flow of vapour in rainfed agriculture … ' (Rockstrom 2000).

Western Rajasthan or Sub-saharan Africa. In many of the former group of countries, favourable rainfall and climate conditions result in a favourable soil-moisture regime that makes irrigation unnecessary in growing good crops. The conventional notion of irrigation is one of controlled supply of water to meet the full scientific requirements of plants precisely when needed. But irrigation that is most widely practiced in South Asia and amongst smallholder farmers in Africa, for example, is supplemental irrigation designed to increase the productivity of 'green water'—which is the part of the precipitation used directly for crop production and 'lost' in evaporation. 'Blue water' pumped out from wells is as important in South Asia and North China as the part that flows into rivers and canal systems.[5] This is quite unlike the situation in many developed country river basins where the bulk of the economic water demand has for long been met by 'blue' surface water; with the closing of basins here, the focus of basin management is on raising the productivity of 'blue surface water' without much regard to the green water.

Uniformly high population density combined with unhelpful climate and hydrology has profound impact on the objectives of water management in developing country river basins. In recent years, IWMI's (International Water Management Institute) water accounting work (Molden and Sakthivadivel 1999: 58-60) has made much contribution to understanding water productivity in the basin context.[6] Although IWMI's focus has been productivity of water in agriculture, the framework can be easily generalised to develop a notion of basin-level water productivity in terms of a social welfare function for all

[5] This distinction between 'green' and 'blue' water is extremely important for developing countries in the semi-arid tropics. Terrestrial ecosystems are 'green water'-dependent; aquatic ecosystems are blue water-dependent (GWP 2000: 24).

[6] Standard definitions used in IWMI water accounting work (Molden and Sakthivadivel 1999) are:

- *Gross inflow*: Total amount of water flowing into a domain from precipitation, surface and sub-surface sources;
- *Net inflow*: Gross inflow plus change in storage;
- *Depletion*: Use or removal of water from a domain that renders it unavailable for or unsuitable for further use;
- *Beneficial depletion*: Depletion that generates welfare;

stakeholders in a river basin constituting a basin community. Under this broad conception,

$$\text{Basin Welfare Productivity of Water} = \text{Basin Welfare/Available Water}$$

Water productivity understood thus could be enhanced by (*a*) enhancing productivity in each use; and (*b*) constantly reallocating water amongst alternative uses—irrigation, domestic, industrial, and environmental—so that the marginal contribution to overall welfare by water allocated to all uses remains equal. Using the IWMI water accounting framework, this welfare productivity measure can be written in several alternative ways to highlight the importance of different water use strategies.[7] But for highlighting the difference between developed and developing world, a useful way to write the welfare productivity ratio is:

$$\text{Basin Welfare/Available Water} = [\text{Basin Welfare/Diversions}]^* [\text{Diversions/Available water}]$$

In water-abundant, humid regions with low population density in the catchment areas and dense human settlements near the coasts and along rivers, river basin management seeks to maximise basin welfare productivity by increasing 'Basin Welfare/Diversions'; allocation of diverted water amongst alternative uses is a crucial function in basin

- *Process depletion*: Depletion in private economic uses;
- *Non-process depletion*: Depletion in non-private, socially valued uses;
- *Non-beneficial depletion*: Depletion that generates no economic or non-economic private or social benefit;
- *Committed water*: Outflow committed to other or downstream uses;
- *Uncommitted outflow*: Outflows by default which are not used to create any value, private or social;
- *Available water*: Net inflow less committed outflow less non-utilisable uncommitted outflow.
- *Non-depletive uses:* Uses that create value without resulting in depletion.

[7] For example, by writing Basin welfare/available water = (Basin welfare/total depletion) * (total depletion/total diversion) * (total diversion/water available), we can signify alternative routes to water productivity.

level water management in such conditions. Here, reservoirs have large free catchments and ET in catchment areas is often not high; therefore, the need for active human intervention to maximise 'Diversions/Available Water' is not great. In water-scarce tropical countries with high population density everywhere, as in South Asia and China, maximising basin welfare involves working on both the components; increasing the productivity of diverted water is certainly important, but equally important is the need to maximise the proportion of precipitation and inflows into a basin that get diverted before they are lost to non-beneficial depletion.

It is against this backdrop that we need to consider the growing mass movement for rainwater harvesting and groundwater recharge in Western India (Shah 2000). The region has amongst the highest wind-speeds encountered anywhere in the world; it has high mean temperatures for nine months; rainfall varies between 300–800 mm; and population density is 300–500/sq km in the catchment areas as well as in the downstream areas. The greatest challenge for rural communities is surviving the annual pre-monsoon drought in April and May, which is made infinitely more daunting by regular failure of monsoon rains. During the pre-monsoon months, leave alone growing crops; ensuring drinking water for humans and cattle is a great challenge, especially in the catchment areas of river basins. While the government investment programme concentrated on building large reservoirs downstream to support irrigation and municipal water supplies to towns, the problems of the people living in the catchment areas remained unaddressed. Disenchanted with government and public systems, NGOs and communities began to find their own solutions. The past decade has witnessed a massive popular awakening as the result of the efforts of NGOs like Tarun Bharat Sangh and Pradan, and of religious organisations such as the Swadhyaya Pariwar. This has taken the form of rainwater conservation and groundwater recharge work on a scale that governments or public agencies would not be able to manage. The basic motivation that has been driving the movement is to ensure availability of domestic water supply for two months before the monsoon and for one or two crop-saving waterings from wells; and there are indications that the movement may well meet this challenge.

Government agencies and scientists (hydrologists in particular) have been dubious about this mass movement, their argument being that rainwater harvesting structures upstream merely transfer water: they reduce the input into the reservoirs downstream, thereby reducing their productivity. But this argument does not resonate with the communities, especially in the upstream areas, which fail to see why they cannot meet their basic water domestic needs instead of feeding reservoirs which irrigate a relatively small area of paddy or cotton.

In defence of this popular movement, the Delhi-based Centre for Science and Environment has asked what India needs more: irrigation or drought-proofing? In reply, it has suggested that by doing a total rethink on 'appropriate' river basin management, India can trade drought-proofing over vast areas by sacrificing irrigation of small areas. It has also adduced evidence to show that diverting rain water in a large number of small water harvesting structures in a catchment captures and stores more of the scarce precipitation closer to the communities in these parts of the world than having a large reservoir downstream (Agarwal 2000).[8] This is because water collected over larger watersheds will have to run over a larger area before it is collected and a large part will get lost in small puddles and depressions, as soil moisture and evaporation. Much before irrigated crop production, semi-arid India needs drinking water for its dispersed rural population during the nine non-rainy months. Many Indian observers think that the answer is not piped-water supply schemes but decentralised rainwater harvesting. Agarwal's Centre for Science and Environment estimated the average area needed per village to capture enough

[8] For instance, Agarwal (2000: 9) cites evidence from the Negev desert in Israel to show that 3,000 micro-catchments of 0.1 ha capture 5 times more water than a single catchment of 300 ha, and this multiple increases in a drought period. He also cites results by Micheal Evanari, an Israeli scientist, which show that 'While a 1 ha watershed in the Negev yielded as much as 95 cubic metres of water per ha per year, a 345 ha watershed yielded only 24 cubic metres/year. In other words, as much as 75 per cent of the water that could be collected was lost. This loss was even higher in a drought year.' Agarwal cites Evenari: '… during drought years with less than 50 mm of rain fall, watersheds larger than 50 ha will not produce any appreciable water yield while small natural watersheds will yield 20–40 cubic metres per hectare and micro-catchments (smaller than 0.1 ha) as much as 80–100 cubic metres per hectare.'

water to meet every household's drinking and cooking water requirement in various regions with varying climate, precipitation and demographic conditions: the average for India as a whole was all of 1.14 ha/village in a normal year and 2.28 ha/village in a drought year!

5. Organisation of the Water Sector

Developed country water sectors which have evolved over decades of public intervention tend to be highly organised and formalised with the bulk of the water delivered—and most of the users served—by 'service providers' in the organised sector. In low-income countries, a vast majority of water users—the poorest ones—get their water directly from rain and from local private or community storage without any significant mediation from public agencies or organised service providers. The notion of water service providers is alien to a majority of rural South Asians and Africans. As a society evolves and its economy as well as water sector mature, the bulk of the water delivered to ultimate users is produced, developed, planned, allocated—in general, managed—by formal organisations, business or utilities. In Israel, for example, 70 per cent of the water supply in the country is managed by Mekorot, a state-owned water company that operates the National Water Carrier, the pipeline system that moves water from Lake Galilee to the Negev desert, and is in the urban water retail, desalination and sewerage treatment businesses (Saleth and Dinar 2000: 185). When the bulk of the users and uses are served through the formal sector, resource governance becomes feasible, even simple. If a basin management regime wants to up the water price to domestic users by 5 per cent, or make a law intended to change the way business is done, it can do so with the confidence that it will stick. But this is not true when the bulk of the water users and uses are served by an informal sector where 'service providers' are not even registered.

In comparing the Australian success with containing agricultural pollution of water with the Chinese situation, Hu (1999: 327) laments that the small number of large Australian farmers are served by a range of local organisations—such as sugar, rice and cattle associations—which serve as vehicles not only for new knowledge and technical advice but also for implementing new rules and laws; but in China, 'given the small scale of farming units and the large number of farmers, it is difficult to control chemical and pesticide application, removal of vegetation, erosion and water resource exploitation.'

In South Africa, over 90 per cent of water is 'managed' by formal organisations including the Water Boards, but 90 per cent of rural people—the black irrigators in former homelands—are almost wholly in the informal sector, far out of the reach of the public systems. Ignoring the scale and complexity of dealing with the informal water sectors in the developing world can lead to misleading analysis. According to Saleth and Dinar (2000: 186), for example, the institutional reform challenge in South Africa 'lies in translating the provision of its water law and water policy without creating much uncertainty among private investors.' In our view, these are easily done; but the real challenge that the government of South Africa is struggling with is of reaching the reform to the black communities in the former homelands, who operate in the informal water sector. And hard as the government is trying, this is not proving to be easy.

About the process of Catchment Management Agency (CMA) Formation in Olifants, South Africa, Merrey (2000: 9) writes: 'Rural communities were unaware of the provisions of the new water law and the CMA process, despite the efforts to inform people and offer them opportunities to express their views. Small-scale farmers had not heard about the CMA … [But] the Irrigation Boards providing water to large commercial farmers were participating actively in the process.' A small number of large stakeholders is easy to work with; the ballgame changes fundamentally once we have to deal with a huge number of tiny stakeholders.

One way the informal sector can be 'formalised' is through grassroots user organisations. The global Irrigation Management Transfer (IMT) initiatives to organise irrigators into water user associations is partly motivated by the need to bring them into the formal sector. But in this too, small number of large users in the developed world have an advantage over large numbers of small users in developing world. All manner of user associations form spontaneously in countries like the US and Australia. These institutional models are constantly being tried out in developing countries but these generally break down when faced with large number of small stakeholders who face such diverse constraints in their livelihood systems that they are at best apathetic towards each of them. Thus, for example, irrigation management transfer to Water User Organisations have unambiguously succeeded in the US, New Zealand, Columbia, Turkey and Mexico—all situations of medium to large commercial or export farmers who run their farms as wealth-creating enterprises. In contrast, nowhere in low-income Asia (barring a few 'islands of excellence'), including the much-researched Philippines, has IMT held out the promise of long-term sustainability. White commercial farmers in South Africa took to Irrigation Boards like duck to water; but in African smallholder black irrigation schemes there seems little chance that IMT will take off at all unless it is preceded by a wide-ranging intervention to make smallholder farming itself viable (see, for example, Shah et al. 2000).

One standard refrain of institutional discussions in the water sector is to get a water law and get it 'right'. It is often the case, however, that the problem is not in passing a law but in enforcing it in a society with a large number of tiny stakeholders operating in the informal sector with little or no linkage with meso- and macro-level resource governance structures. This is why many governments in Asia readily pass laws but spend years before gazetting them so that they begin getting enforced. There are also cases of countries which have passed laws, and these have come totally unstuck. Sri Lanka has been debating a water law—which has 'all the right ingredients' (Saleth and Dinar 2000)—since the early 1980s but is yet to enact it. This is presumably because it is difficult to figure how to make all the 'right ingredients'—water permit systems, full cost pricing, water courts, an explicit water policy statement—actually work in ways that make significant difference to the management of water resources in a country where 50–70 per cent of the rural people acquire their water not through water supply service utilities/companies but straight from nature or from local storage in small community tanks.

India adopted a water policy in 1987, but nothing changed as a consequence and it is now working on new one. Many Indian states have likewise been debating groundwater laws for 30 years; a dozen or so drafts are in circulation. The legislative assembly of Gujarat—the state with the most severe groundwater overdraft problems—

passed a bill as far back as 1974, but the chief minister refused to make it into a law. And his reasons were convincing: first, he was unable to see how the law could be effectively enforced over a million small private pumpers scattered throughout a huge countryside; second, he was certain that it would become one more instrument of rent seeking for the local bureaucracy (Shah 1993).

'Get the price right' is another old prescription to make water an economic good. Now that water scarcity in many parts of the world is real, it would be naïve to question the value of pricing, not so much for revenue collection but to signal the scarcity value of water to users. There can be no serious debate on whether 'water as a scarce but free' resource is tenable in today's context. The real issue is making the price of water stick in a situation where a majority of users are in the informal sector and do not go to anyone except the rain gods for getting their water. Even in canal irrigation systems in South Asia, which are in the formal sector, many political leaders and senior administrators would become open to volumetric pricing of water to promote efficient use if only the logistics of doing so were simpler and cost-effective, what with the large number of small irrigators in the command areas of Asian systems. After all, paying high prices for high-quality irrigation service is common for millions of resource-poor buyers of pump irrigation in India, Pakistan, Bangladesh and Nepal; but most people would avoid paying the full-cost price if not paying were an option, as is the case in many developing country water sectors. That high transaction cost of monitoring water use and collecting water charge is the central issue in water pricing rather than the politicians' propensity towards giving away largesse will soon be evident in South Africa, where the new pricing policy will be easy to enforce on large commercial farmers—for whom the transaction cost of monitoring and collection will be low—rather than areas of black irrigation, which represent the developing country picture in general, dominated as these are by large number of small users.

Developed country institutions have not solved the problem of serving or regulating large numbers of small users particularly well; indeed, they have not yet found satisfactory way of dealing with moderate number of large users. In New South Wales, Queensland and Victoria, the existing law confers on every occupier of land the right to take and use water for domestic consumption purposes, watering stock, irrigating home gardens and non-commercial crops on a maximum of 2 ha (Macdonald and Young 2000: 24). If this exemption is applied to India, it would cover over 80 per cent of all land and over 90 per cent of all people; and in South Africa, it would cover 90 per cent of all users, though only 10 per cent of land and water. In South Asia, South-East Asia and North China, groundwater is the most valuable and threatened resource and protecting groundwater from over-development is probably among the top three priorities in this region; yet, doing so is proving to be a challenge precisely because groundwater is in the informal sector.

In understanding how best to deal with South Asia's 20 million tubewell owners in the informal sector, the experience of Murray–Darling or Mississippi does not have many practical lessons to offer. Even in 'highly evolved' river basins, sustainable management of groundwater is at best problematic, and at worst, as hopeless as in India and Pakistan. Murray–Darling has tried groundwater regulation but it is not certain if it has worked. Access to groundwater in New South Wales is regulated by licenses under the Water Administration Act of 1986; however, 'over much of New South Wales, undeveloped licenses were not cancelled. In retrospect, this has proved an administrative disaster as in a number of areas, the total volume of licenses issued is well in excess of estimated sustained yield' (Macdonald and Young 2000: 23). In California's Central Valley, groundwater over-exploitation is a 60-year-old problem; yet in his case study of basin management, Svendsen (2000) concludes, 'Groundwater is the most lightly planned and regulated segment of the state's water resources. There is little control over abstractions and, on average, the state is in a serious overdraft situation.'

Even in middle-income countries where major institutional reforms have been initiated in recent years, groundwater over-exploitation has defied solution. Spain, one of the European countries that suffers agricultural over-exploitation of groundwater, has instituted sweeping reforms that will affect surface water but have little to do with groundwater (Saleth and Dinar 2000). Mexico's aquifers too are amongst the most over-developed; IWMI researchers based in Guanajuato state, one of Mexico's agriculturally dynamic regions, found the water tables in 10 aquifers they studied declining at average annual rates of 1.79–3.3 m/year during recent years (Wester et al. 1999: 9). An institutional solution is being tried here; the establishment of Aquifer Management Councils called COTAS (*Consejos Técnicos de Aguas*) in Mexico as part of its water reforms and under the new Mexican water law are a notable development. IWMI researchers in Guanjuato are, however, sceptical: '… several factors bode ill for their [COTAS'] future effectiveness in arresting groundwater depletion.'

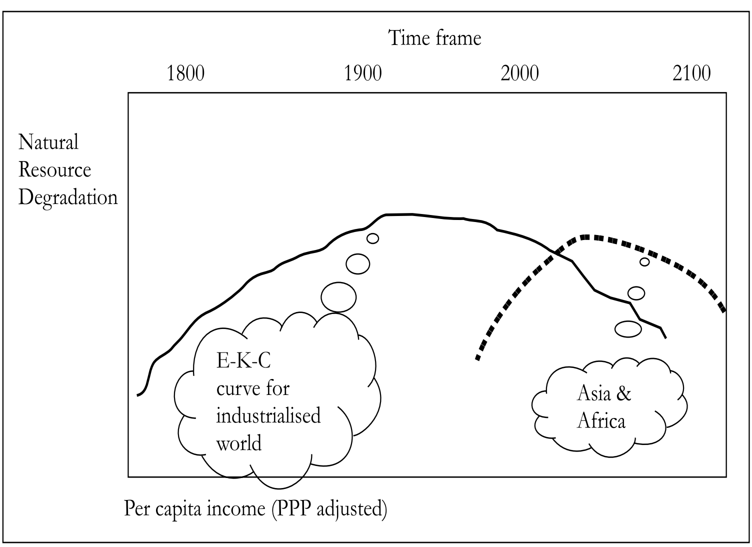
Finally, for the top echelons of national decision-makers, it is always easy to take hard decisions which do not affect large proportions of a nation's population in a seriously adverse manner. Political leaders and water sector leaders in emerging economies constantly face pressures to be myopic and adopt postures that are at odds with the ideal of integrated RBM. The most powerful and compelling pressures emerge from their own internal social realities. In low-income agrarian societies like in South Asia and much of Africa, food security and poverty alleviation will continue to remain prime concerns for decades to come. When several poor states are involved in a basin—such as India, Nepal and Bangladesh in the Ganga-Meghana-Brahmaputra basin, or the Central Asian states in the Aral sea—coordinating mechanisms tend to operate at sub-optimal levels because national leaders are under pressure to maximise their national interests. It has been argued that the Aral sea crisis is the outcome of the compelling need of the political leaders in the Central Asian states to ensure food security as well as water-intensive cotton cultivation for export, both at once. In this context, a major move to reverse the desiccation of the Aral sea—the Amu Darya and the Syr Darya—will have to wait until something changes the dominant perception of the political leadership in Turkmenistan and Uzbekistan that cessation of cotton monoculture will have politically and socially destabilising consequences.

6. Stage of Socio-economic Development

What factors might influence the pace of institutional change in developing country water sectors? Saleth and Dinar (2000) suggest that as water scarcity intensifies, opportunity costs imposed by missing or malfunctioning institutions will increase and transaction costs of institutional change will decline, which together will determine the pace of institutional change in developing countries. A competing hypothesis is offered by the application of the Kuznets curve to natural resource management by societies. Recently, there have been attempts to fit an environmental Kuznets curve to deforestation using cross-country data (Bhattarai and Hammig 2001).

The environmental Kuznets curve (EKC) poses an inverted 'U' relationship between economic growth and environmental degradation (see Fig. 4.5): the core hypothesis is that as economies grow, they use natural resources as a factor of wealth creation; but as per capita real income grows, demand for environmental amenities grows and there is greater demand and support for environmental protection. Although the empirical results of some of this econometric work are far from conclusive, it seems intuitively compelling to suppose that the income elasticity of demand for environmental amenity is lower at low per capita income levels (as in Bangladesh and Burkina Faso) than at high per capita income levels. From this it would follow that highly evolved economies of the western world would therefore

Figure 4.5: Relationship between Level of Economic Growth and Natural Resource Degradation



have greater demand, capacity and collective will to fix the environmental problems from natural resource malmanagement than low-income emerging economies. In many Western countries—where per capita income growth to present levels took 200 years or more—the EKC-effect too took centuries to work out. Historical evidence suggests that deforestation in Europe was at its peak at the time of the Industrial Revolution, and the area under forests began to increase long after economic prosperity ensued (Bhattarai and Hammig 2001).

Much the same relationship seems to hold in the case of water resource management. Countries with highly developed water institutions are also those which have evolved industrially. In contrast, it is difficult to find a low-income agrarian society which has highly developed water institutions. Interestingly, some sketchy evidence suggests that the period of decline followed by an upswing gets telescoped in economies like Japan and Taiwan that have increased their industrial output and employment rapidly over a relatively short period.

In Table 4.1, we present the data set for 57 countries organised around their per capita water and arable land availability. The figures alongside the country names are their respective per capita CO_2 emissions, which is one of the best correlates of GDP per capita as well as Human Development Index. Mean per capita availability of water and arable land along with CO_2 emission is used to divide the countries into eight categories. B1, C1 and D1 category countries are poor in water and/or arable land resources; but these are rapidly becoming post-agrarian societies where pressure on water and land from irrigated farming will rapidly ease. The social and economic costs of fixing water malmanagement in these countries are already, or will soon be, within acceptable limits. It is notable that A1 represents the category of countries from which most models of effective water institutions emerge and these are offered to countries in D2 category which have the least water, land and CO_2 emissions. A1 countries are amongst the best-endowed in terms of both water and land; as a result, despite being highly industrialised (as indicated by their high CO_2 emissions), they still have large, wealth-creating agriculture and agro-industries sectors that absorbs a very small proportion of their populations. In D2 category, poor land and water resource endowments combine with high population pressure; but,

Table 4.1: Natural Resource Availability and Economic Growth

	Per Capita Water > Mean (10460 cu m); Countries with High and Low CO_2 Emissions/Capita				*Per Capita Water < Mean (10460 cu m); Countries with High and Low CO_2 Emissions/Capita*			
	A1 (High CO_2)		**A2** (Low CO_2)		**B1** (High CO_2)		***B2*** (Low CO_2)	
Per capita	4.61	Australia	1.01	Argentina	2.95	Denmark	0.1	Sudan
arable land	3.73	Canada	0.46	Brazil	2.09	Greece	0.83	Syria
> mean	5.37	USA			2.89	Kazakhastan	0.08	Zambia
(0.37 ha)	2.18	New Zealand			2.18	Libya	0.78	Turkey
Per capita	1.59	Hungary			1.6	Spain	0.02	Afghanistan
arable land								
	C1 (High CO_2)		**C2** (Low CO_2)		**D1** (High CO_2)		**D2** (Low CO_2)	
< mean	1.58	Malaysia	0.01	Cambodia	1.68	Switzerland	0.45	Zimbabwe
(0.37 ha)	1.67	Sweden	0.92	Chile	2.1	South Africa	0.02	Tanzania
	1.77	Vietnam	0.33	Indonesia	5.32	Singapore	0.11	Sri Lanka

(*Table 4.1 continued*)

(Table 4.1 continued)

Per Capita Water > Mean (10460 cu m); Countries with High and Low CO_2 Emissions/Capita				*Per Capita Water < Mean (10460 cu m); Countries with High and Low CO_2 Emissions/Capita*			
		0.02	Laos	3.88	Saudi Arabia	0.11	Senegal
		1.02	Mexico	1.85	Oman	0.25	Philippines
				2.53	Japan	0.3	Peru
				1.92	Italy	0.18	Pakistan
				2.46	N. Korea	0.02	Nepal
				3.07	S. Korea	0.07	Kenya
				2.5	Israel	0.29	India
				2.86	Belgium	0.02	Ethiopia
				1.69	France	0.42	Egypt
						0.74	China
						0.37	Botswana
						0.05	Bangladesh
						1.21	Iraq
						1.15	Iran
						0.83	Syria

Source: Engelman et al. (2000)

ironically, their most critical problem is their low CO_2 emission. Industrial growth, urbanisation and transfer of people from agricultural to off-farm livelihoods seems the only way pressure on land and water will ease. Many of these countries will, over the coming decades, more likely take the Kuznets curve route that Japan and Taiwan took than the one that the Australia and US took.

In Taiwan where rapid industrial growth and urbanisation have resulted in a 40 per cent decline in irrigated areas over the recent decades, popular outlook towards water management issues has undergone fundamental transformation. Over 90 per cent of Taiwan's irrigators have become part-time farmers, and income from industrial employment far outweighs agricultural incomes; there have been major increases in demand for environmental amenities and in the touristic value of former irrigation structures. All these have resulted in substantial private initiatives and investments in improving water quality and aquatic ecology (Sakthivadivel, personal communication). Taiwan has amongst the highest population densities we find anywhere in the world; yet, its water institutions will soon approach those in high-income western countries, rather than those in low-income Asian countries, which share high population density with Taiwan.

The Kuznets curve hypothesis looks at the relationship only from the angle of demand for environmental amenity. But there is also the supply side: much larger volumes and quality of resources are applied to natural resource management in high-income countries compared to low-income countries. Consider the budget of the water departments: the California State Department of Water Resources has 2,000 employees, mostly professionals, who operate an annual budget of US$ 1 billion (Svendsen 2000); the Gujarat Department of Water Resources probably employs as many engineers but operates a budget of less than US$ 10 million. The upshot of this discussion is that, over a decadal timeframe, economic growth is probably both the cause as well as a response to the problem of natural resource malmanagement; and that, if the experience of Japan and Taiwan is any guide, the period over which the interaction between the two plays out need not run into centuries as it did in the case of Europe, but can be telescoped from centuries to decades.

7. Conclusion

In this chapter, we have made an attempt to explore why efforts to transfer the institutional models of river basin management from developed countries to developing ones have not met with the desired success. The contexts in which reforms are tried in developing countries are vastly different—in their hydrologic and climatic conditions, in their demographics, in their socio-economic conditions as well as in the way their water sectors are currently organised—from the context of the countries in which 'models' first succeeded. Successful institutional reforms in the water sector worldwide have tended to have common overarching patterns: they have focused largely on management of surface water bodies; they have aimed at improving the productivity of publicly diverted large water bodies; they have largely ignored groundwater and have not had to contend with dominant informal water sectors; and they have centrally been about 'blue water' productivity and have largely ignored 'green water'. The problems that successful institutional models have resolved—water quality, wet lands, sediment build-up in the upper parts of the river, maintaining navigation use, dealing with occasional floods—are often not of paramount interest in developing country contexts. The problems that developing countries find critical and insurmountable have, on the other hand, either remained unresolved in developed country river basins (such as groundwater over-exploitation) or are rendered irrelevant by their evolutionary process (as in using irrigation as a means to providing poor people livelihoods and food security). This does not by any means imply that developed country experience has no lessons to offer to the developing world; drawing such a conclusion would be naïve in the extreme. What it does mean, however, is that imposing institutional models uncritically in vastly different socio-ecological contexts can be dysfunctional and even counter-productive.

What it also means is that we need to take a broader view of institutional change. An extraordinary aspect of the institutional discussions in the global water sector is how very narrowly it has focused on things that governments can do—make laws, set up regulatory organisations, turn over irrigation systems, specify property rights. A recent review of institutional changes in the global water sector in 11 countries by Saleth and Dinar (2000), for example, treats water law, water policy and water administration as the three pillars of institutional analysis. This makes water purely the government's business, quite contrary to the slogan popularised by the World Water Council to make 'Water Everyone's Business'!

If institutional change is about how societies adapt to new demands, its study has to deal with more than what just the governments do: people, businesses, exchange institutions, civil society institutions, religions and movements—all these must be covered in the ambit of institutional analysis (see, for example, Mestre 1997, cited in Merrey 2000: 5). Which elements of the Murray–Darling experience can be sensibly applied in which developing country context is certainly an important and interesting analytical enterprise; but equally—or, even more—important is the need to listen to voices from the grassroots. If people living in the Deduru Oya basin in Sri Lanka, for example, are facing water scarcity, they are certainly going to begin to do something about it; likewise, if the government of South Africa withdraws from the management of smallholder irrigation schemes in the Olifants, the smallholders will soon respond in some way. What institutional reform makes best sense in Deduru Oya or Olifants or Sabarmati should best emerge from understanding the respective realities of these basins, while a broad understanding of what has worked elsewhere including in the developed world might offer a good backdrop to the design of institutional interventions. But it might be unrealistic to expect much more, and copycat institutional reform would be outright disastrous.

Consider Table 4.2, which sets out what problems water institutions in industrialised countries have been effective in resolving in comparison with critical water sector challenges facing countries like India. One task that river basin organisations have performed well is of water allocation across sectors and administrative regions; another is securing agreements amongst contesting parties on strategies for containing harmful externalities, such as pollution, wetland dessication and water quality deterioration. These are indeed emerging as major problems in emerging economies like India and China. However, no matter how much lip service is paid to these, key priorities underlying day-to-day decision making here continue to lie elsewhere, and some of these are no longer problems in the industrialised world. In India, for instance, making water services—irrigation as well as municipal water services—pay for themselves is proving to be a Herculean task. Equally critical are the challenges for resource generation for new infrastructure, of using water as an aid to achieving food security and livelihoods for the poor, and of improving water service provision to large dispersed rural populations. As we outlined earlier, in much of developing Asia the water institutions that really matter are in the 'informal sector', which is beyond the reach of any public decision-makers. There is a crying need to formalise this sector and bring it within the ambit of public policy and institutions. Unless this is done, critical challenges—such as groundwater over-exploitation by 20 million unregistered private pumpers—cannot begin to be met.

Table 4.2 The Question of Contextual Fit

		Developing Country Current Priority	
		Low	*High*
	Problems effectively addressed	Wetland preservation; Water pollution; Water quality; Inter-sectoral allocation of water	Financial viability of water sector; Urban water supply; Water allocation across sectors and administrative units
River Basin Institutions	*Problems that still remain substantially unresolved*		Groundwater regulation; Secondary salinisation
	Problems rendered irrelevant by evolutionary process of industrialised societies		Resource mobilisation; Making water services work; Water and poverty; Water and food security; Water supply to dispersed poor rural populations; Institutional arrangements at the user-end

In conclusion, in many developing countries IRBM in practice has in its most degenerate form come to mean converting irrigation departments into river basin organisations. In our analysis, this is unlikely to help these countries resolve critical problems facing their water sectors. Institutional and policy reform that is likely to help will steer clear of such quick fixes; instead, it will work with the complex of four classes of interventions that have helped today's industrialised world to put their water sectors into order: (*a*) *functional* (as distinct from dormant and/or defunct) mechanism negotiation and coordination at various levels including the river basin; (*b*) *effective* legal and regulatory reform; (*c*) redesign of economic *instruments of policy*; and (*d*) redesign of *economic institutions*.

Compared to taking the easy way out of creating river basin organisations, such work is bound to be arduous and difficult because it will confront us with the harsh *operational* reality of populous developing countries. How to *actually* create new property rights that affect users' behaviour is more important than exhortations to create such clear property rights. Understanding how to meaningfully enforce a groundwater law on 20 million private pumpers scattered throughout the South Asian countryside is more helpful than pushing a groundwater law as a panacea. How to monitor water use and collect canal irrigation charges cost-effectively is more in order than discussing whether or not irrigation subsidies should be eliminated. Numerous small steps need to be taken first to build the foundation on which the edifice of IRBM can stand. These steps include establishing a system of licensing and registering groundwater structures; instituting the principle of 'user pays, polluter pays' at the operational level; integrating numerous departments dealing with water at the local and meso levels into a unified structure; shifting the focus from just resource management to resource *and* service management; and effective reform of irrigation institutions and of urban and rural water supply and sanitation institutions.

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5

Criteria for a Holistic Framework for Water Systems Management in India

JAYANTA BANDYOPADHYAY

1. GLOBAL RECOGNITION OF THE NEED FOR CHANGING THE PRESENT APPROACH TO WATER MANAGEMENT

THE FACT THAT the way humans have approached the matter of water management in the past centuries has become destructive and that there is an urgent need for changing our ways of how we envision the water systems and make use of them is now widely accepted. It is also increasingly being accepted at the highest international professional platforms that the 'business as usual' way of understanding and managing this crucial natural resource would lead to conditions of severe stress, and probably conflicts (Anon. 1992: 27; Cosgrove and Rijsberman 2000: xxi). The situation calls for urgent action.

Though in India the governmental officials holding the charge of water resources have generally been silent on this matter, independent professionals have written extensively on the need for a fundamental change in our ways of managing water systems (Bandyopadhyay 2004; Iyer 2003). Over the past several years, important opinions have been expressed in diverse contexts at various points of time on what should be the nature of this new paradigm for the management of water systems in future (Biswas 1976; Falkenmark 1986; Gleick 1998; Wolff and Gleick 2002: 1–32).

In the existing approach to water, guided by a reductionist perspective of traditional engineering, water has been viewed as a stock of resource, to be withdrawn and utilised as desired. The shortcomings of the present management strategy and the need for a change in our perceptions about water have been described very well in the literature.

Uncritical faith of water resource officials on this approach has, over time, created a global crisis.

> The water crisis is real, but we cannot underestimate its complexity and linkages to poverty, food and environmental insecurity, and hopelessness. The problem is not just lack of water. It is also the degradation and depletion of water ecosystems—the lakes, rivers and wetlands that are the life support system for citizens and economies of developing countries (El Ashry 2001).

However, a conceptual framework, that could provide a clear operational alternative to the present one, is yet to emerge and receive wide acceptance.

The emerging thought is that it is only a fundamental shift away from the present reductionist engineering paradigm to a holistic and interdisciplinary one that will be able to provide sustainable solutions to the complex challenges facing water management today. In the words of Wolff and Gleick (2002: 1), 'The world is in the midst of a major transition in the way we think about-and manage-our vital and limited freshwater resources.' Such statements exemplify fundamental changes that are being introduced in the subject of development and management of water systems by an increasingly growing number of professionals (Postel 1997; Reddy 2002; Seckler 1996). This recognition is the product of a long-drawn intellectual struggle raised both from outside and within the formal structures of education on development of water systems. The growth and wider acceptance of a new conceptual framework for their management in future is going to take time because this long-drawn process is based on the struggle between the threatened and the emerging paradigms. The various elements characterising a new way of looking at water have been commonly identified with the broad description known as Integrated Water Resources Management (IWRM), a term that has been much popularised by the Global Water Partnership (2000).

There are still many, especially in the water resource technocracy in the countries of the South, who continue to believe that there is no reason for panic, and that the present paradigm is able to address these problems, by incorporating some adjustments and modifications in its practices.

1.1 The Debate over the Definition of IWRM

The new paradigm has received the name of IWRM much before it got its description. The new name indicates only that the existing paradigm is reductionist and that, as it evolves as an alternative, it needs to integrate many other aspects of water systems. Several recent publications have made useful attempts to identify the elements that need to be integrated in the new approach to water management (Falkenmark and Rockstrom 2005; Hunt 2004). In a critical comment on the very concept of IWRM, Biswas (2004: 249) takes the view that

> a comprehensive and objective assessment of the recent writings of the individuals and institutions that are vigorously promoting integrated water resource management indicates that not only no one has a clear idea as to what exactly this concept means in operational terms, but also their views of it in terms of what it actually means and involves vary very widely.

In response to these comments, Mitchell (2004: 398) points out that there is a need for a gradual development of IWRM. Disagreeing with Biswas on his evaluating IWRM only against operational considerations, he stresses that 'the value of IWRM may be greater at the normative and strategic levels, to provide context or a framework for different types of approaches at an operational level'. In his comments on the criticism made by Biswas (2004) on the definition of IWRM presented by the GWP, Lamoree (2004: 400) wrote:

> … the IWRM concept has led to various developments that were very desirable: a wave of awareness raising at both the political and the grassroots level about the importance of water to life; a move away from single-sector institutional responsibilities and decision making towards more integrated and multisector decision making processes at the government level; the renewed focus on stakeholder participation, the broadening of the water profession to increasingly include non-technical disciplines and multidisciplinary research …

It is in this background of the intellectual dynamism on the strategy for the sustainable management of the planet's water systems that the present policy for water systems management in India will be analysed. The description of a 'paradigm' in this paper is the same as used by Kuhn (1969) while explaining the changes in the structure of science. In order to identify more clearly the changes that could be internalised in the conceptual framework for IWRM, some of the characteristic elements of the conceptual changes towards a holistic paradigm for water management will be identified in this paper. In the background of these indicators, the National Water Policy (Anon. 2002) that was recently adopted in India will be assessed to examine how much this new policy document has been informed of or responded to the global recognition for a move towards a new and holistic paradigm. In this way, the paper makes an assessment of the new policy document from the point of how much it bases itself on the intellectual structure of the older paradigm that is facing a challenge to its survival, and how much it is informed of the need for transformation through integration to make way for an approach to IWRM in India.

1.2 Water Requirements of the Large Population and the New Paradigm

The challenge to water systems management in India is surely dominated by the challenge of providing water for a very large population. The history of human civilisations is in many ways also an account of how the constantly growing requirements of water for human societies have been met by making increasingly larger interventions in the natural movement of this resource. There are several ways in which natural processes conserve and store on the continents the water precipitated from the sky. However, as human requirements grew rapidly, the capacity of these natural processes started to prove inadequate for meeting those requirements. The growing water requirements of human societies pushed them towards human-induced interventions that could enhance their ability to harvest, store and transfer ever increasing volumes of water. As a result, the early human settlements started and grew along the fertile plains by the side of the rivers. Among the rivers, more well-known as the cradle of early human civilisations, are the Nile in Egypt, the Tigris-Euphrates in Mesopotamia, the Hwang He in China, the Indus in Pakistan, etc.

As human settlements started to spread all over from the shores of lakes or rivers, this ability to intervene in the natural movement of water gave them a greater protection against droughts and seasonal water shortages. In this way, humans started to overcome spatial inequities in water availability as the irrigation canals made it possible for humans to grow food in newer and newer areas, as much as it extended the seasons for growing crops.

India occupies about 2.45 per cent of the terrestrial surface of the Earth and receives about 4 per cent of the global precipitation. Thus, on a spatial scale, the precipitation it receives is larger than the global average. In a year, the Indian landmass receives a total precipitation of about 4,000 billion cubic metres (BCM), which provides the country with an estimated total available water resource of 1953 BCM (NCIWRDP 1999: 12). With this amount, the country is expected to be in a comfortable position as far as the macro picture is concerned. However, the population is a factor that makes the scenario dim. In the 50-year growth period since independence, the annual per capita availability of water in India has steadily dwindled from 6,008 cu m in 1947 to 2,266 cu m in 1997 and the declining trend is expected to continue in the foreseeable future. The situation is further compounded by the fact that about 71 per cent of the available water resources of the country are concentrated in 36 per cent of area in the Ganges-Brahmaputra-Meghna basin and the west-flowing rivers from the Western Ghats. The remaining 64 per cent of the geographical area of the country is left with only 29 per cent of the available water to satisfy their needs. Such drastic spatial inequity in the availability of water is also observed within the individual river basins.

Recent rapid economic advancement of human societies in all parts of the world has been possible by the human ability to access larger and larger supplies of water for the satisfaction of human needs and demands for economic activities. This process of human interventions in the natural hydrological cycle has been most rapid in India in the last 100 years. Numerous dams have been used for storing river flows and generating hydro-electricity on a very large scale. The availability of stronger and stronger pumping technologies to take water out from the deeper levels of aquifers enhanced human control below the ground.

While the achievements in water resource development taken up from within the present paradigm have been most impressive, serious concerns started to be expressed about the long-term justifications of following such a strategy. The supply-side solutions that were offered through ever increasing engineering interventions into the natural hydrological cycle were responsible for rapid growth in the utilisation of water by the irrigation sector, industry and large human settlements. The result of this has also been an additional but de facto reduction in the amount of utilisable water caused by decline in water quality by pollution from agriculture, industry and human settlements. These have emerged as another critical problem in need of urgent solution.

In the last one or two decades it has increasingly been realised all over the world that addressing the new and emerging challenges in water management is no more possible with such engineering interventions alone. Fundamental changes were felt to be needed in the way human societies look at water systems and intervene to make it a resource. In simple words, the continued usefulness of the existing paradigm that offers solutions from the 'business as usual' approach is in question. What is worse, it is now feared that the continuation of policies made from the old paradigm will be counter-productive due to the clear possibilities of their causing irreversible ecological damages to the water systems.

Indeed, the need for introducing fundamental changes in the ways water systems are perceived and managed—i.e., the adoption of a new holistic and interdisciplinary paradigm—has been constantly gaining ground over the years (Bandyopadhyay and Mallik 2003: 55–96). In spite of being a relatively water endowed country as far as average annual precipitation is concerned, water in various areas of India frequently becomes scarce. When calculations are made on a per capita basis, the availability figures dwindle further. The physical scarcity that emerges becomes politicised, creating conditions for conflicts at all levels. This ranges from a fight between two small girls in queue for drinking water in an urban slum to two chief ministers at loggerheads in upstream–downstream states in a river basin.

Water has always been a sensitive political issue in India, as much as in South Asia. In the last few decades, water conflicts and subsequent promises have remained central to politics in the country. From the provinces of Punjab and Haryana to Karnataka and Tamil Nadu, ever-growing demands of water for irrigation have been chasing the limited water resources of the country. With all the farmers dreaming of irrigation, irrespective of the level of precipitation, and their political leaders willing to make promises, realistic or otherwise, trans-boundary water conflicts invariably emerge. These have started to threaten the federal structure of India. Unless the management of water systems in future is guided by a wise and holistic policy, the country will face the emergence of a great number of more intense water conflicts.

In the background of this emerging seriousness of the water resource situation in India and as a response to the demands of the challenges that lie ahead, fundamental changes are required in the management of water systems of the country. Without these fundamental changes being introduced, continuing in the path of undertaking major construction projects, like the proposed interlinking of rivers, will be a sure prescription for inviting widespread political conflicts of the highest intensity.

On 1 April 2002 the National Water Resource Council adopted the National Water Policy 2002. In the background presented above, this paper examines this new policy document and tries to find how much it has internalised the tremendous challenges facing the water sector and how much it is informed of the new concepts of and approaches to managing water systems that are being accepted worldwide. In order to do this, this new policy document has been analysed in the context of a number of new concepts and ideas that are identified as integral to the emerging new paradigm.

2. The National Water Policy 2002: Recognition of the Inevitable Change?

Depending on the type of intellectual dynamism or lethargy associated with the structure of governance of a country, the reaction to this need for evolving a more comprehensive and integrated paradigm for the management of water systems would vary. They may span from early recognition to uninformed ridicule. In some small countries like Australia or South Africa, great improvements have already taken place in the way water systems are being managed. In the case of India, the National Water Resource Council at its Fifth Meeting on 1 April 2002 did recognise this need for change as it observed: 'During the last 14 years, many new challenges have emerged in the water resources sector which has necessitated the review of the existing National Water Policy.'

Thus, India's National Water Policy 2002, which is the most recent official policy for the management of water systems in India, accepts the need for a policy review. The question that emerges is from what perspective this review would be undertaken. It is important to note that the Ministry of Water Resources had embarked on finalising a detailed Action Plan for the implementation of the policy, almost immediately after announcing it, making it apparent that in its opinion the new policy document needed no further refinement.

As already suggested above, the question posed in this chapter is to what extent the new policy document indicates an acceptance of fundamental changes to a new holistic paradigm and to what extent it is the product of the desperate attempt of the existing reductionist paradigm to respond to the challenges without fundamental conceptual reformation. This question becomes more significant in the background of three things. The first is the growing disagreement expressed from the non-governmental sector on the making of the Action Plan. As an important stakeholder which needs to be integrated, the NGOs are asking for a review of the new policy itself (see *The Times of India*, 2002a). Similar views have also been expressed by water experts (Iyer 2002). Second, the questions raised on the scientific justifications of the proposal for the large project of interlinking of the rivers in India (Bandyopadhyay and Perveen 2004), which is the most important output of the existing paradigm in the case of India, have not been openly and convincingly answered by the water resource officials. As of now, this proposal is being carried out without any open professional assessment at the level of the technical and economic feasibility of the projects. This indicates a mindset exactly opposite to what is known as integrated water resources management. Third, as observed by the National Commission for Integrated Water Resource Development Plan (NCIWRDP 1999: 370), there is widespread data secrecy practiced in India, and data has not even been shared with the NCIWRDP, which has noted that, 'the secrecy maintained about water resources data for some of the basins is not only highly detrimental but is also counterproductive. Hydrological data of all the basins need to be made available to the public on demand.' Such confidentiality associated with the detailed hydrological data of river systems has remained a great obstacle to the growth of open professional knowledge on several important rivers in India. A paradigm shift is essentially generated by mismatch between theory and practice. When data is kept confidential, it provides a big barrier to the growth of science and protects the existing paradigm and its supporters from examination on the basis of scientific validity.

Based on the review of the published literature on the debate on IWRM or what could constitute a new holistic paradigm for managing water systems, in this chapter a few distinctive features of the new and integrated paradigm have been identified and described. The list of these indicators should at present be seen as a tentative one and not exhaustive. The indicators are listed below and will be taken up for detailed analysis and discussion in the following sections.

1. All water systems are viewed as integral parts of the hydrological cycle, not as a stock of a material resource to be allocated for satisfying diverse social and economic requirements. Accordingly, water development projects are to be assessed in the background of their impacts on the full hydrological cycle.
2. Continued economic growth does not require ever-increasing supplies of water. Thus, ad hoc proposals for supply enhancement should be examined with respect to prospects of solutions from demand-side management.
3. Diverse needs and demands for water are clearly prioritised with the requirements for respective qualities clearly identified. Consideration of recycling and re-use of water is made mandatory under scarcity conditions.
4. Management of water systems is made transparent and participatory. The social, cultural, ecological and economic roles played by water systems and related projects are made part of knowledge in the public domain.
5. An ecological view of water-related extreme events, like droughts and floods, is taken. These are not to be described as unexpected disasters but understood in the context of the

wide variability in the meteorological and eco-hydrological conditions prevailing in the country.

6. The institutional frameworks for the management of water systems and related property rights are restructured at local, state, river basin and national levels for making them equitable, sustainable and participatory.
7. A new approach to valuation and pricing of water is supported by new social and economic instruments for promoting equitable and efficient allocation of water resources among diverse social and ecological needs and economic demands. Thus, ecosystem services and ecological flows are given full recognition.

2.1 All Water Systems Are Viewed as Integrally Linked with the Hydrological Cycle

Water is circulated and purified as it moves non-stop along the global hydrological cycle. The availability of water for the satisfaction of all human requirements is made possible by the functioning of the hydrological cycle. This is probably the greatest ecosystem service humanity receives free of cost. In the holistic interdisciplinary perspective, all water quantities, whether a small piece of cloud or the oceans themselves, need to be viewed in the context of their links with the global hydrological cycle. However, in the reductionist engineering perspective that has been guiding water resource management so far, water has been treated as a stock of natural resource waiting to be extracted, transported and used. This limited viewpoint of reductionist engineering is the reason behind the emergence of many of the critical problems faced today by traditional water management projects. The reductionism limits the understanding of the engineers only to the perceived tangible economic gains from any project, without being able to recognise or understand the economic costs of the related damages to society or the losses to the ecosystem that may not be so tangible or immediate. This provides, in the traditional paradigm, the space for the absolute glorification of engineering interventions. In the new paradigm based on a holistic understanding of water systems, the economic gains or losses, tangible or otherwise, are recognised and considered in relation to the whole of the hydrological cycle. In a more practical context, such considerations would be extended over the concerned ecosystem, e.g., a river basin.

On an examination of the text of the National Water Policy 2002, one finds that, in the opening sentence (para 1.1) of the document, water is described as 'a prime natural resource, a basic human need, and a precious national asset'. The need gets recognised, and hence the resource is looked for, and hence transformed into an asset. This is clearly an example of the traditional reductionist viewpoint. However, in paragraph 1.3 of the policy document, water is given its broader ecological identity when it is described as a 'part of a larger ecological system'. While, the importance of water in sustaining all life forms gets clearly recognised in this paragraph, further elaboration or articulation of the 'larger ecological system' is not available. In this way, while the ecological links of water systems do get mentioned in the policy, there is little indication that in practice there will be a departure from the traditional reductionist paradigm.

In paragraph 3.3, the policy mentions the need to work within ecological units when it states: 'Water resource development and management will have to be planned for a hydrological unit such as drainage basin as whole or for a sub-basin …' Unfortunately, this recognition of hydrological units is not congruent with the actual practice of project appraisals. For example, in the official project documents there is hardly any recognition and reference to published works on the downstream ecological impacts of water development projects (Sinha 2000; Smith et al. 2000). The engineering solutions that are prescribed for all water related problems are ad hoc and reductionist. This difference in policy statements and actual practice indicates the deep inroads made by the traditional paradigm in India's water technocracy. In the background of the above, it appears that though the new policy document does definitely try to provide itself with a more advanced and ecologically informed posture, it is still not in a position to unhesitatingly introduce in practice a fundamentally new way of looking at water systems. This analytical position will become clearer in the next few sub-sections.

2.2 Continued Economic Growth Does Not Require Ever-Increasing Supplies of Water

In the traditional paradigm for water management, availability of ever-increasing volumes of water is accepted as a pre-condition for continued economic growth of a region or a country. This view identifies the availability of increased supplies of water as an essential national objective. Suggestions for reduced consumption based on ecological limits of water withdrawal are instantly interpreted by water resource officials as an obstacle to economic growth. In contrast, the conceptual detachment of continued economic growth and continued availability of ever-increasing water supplies is a vital element of the new and holistic paradigm for water management. This delinking of economic growth with the availability of larger water supplies helps in shifting the conceptual focus away from being preoccupied with supply-side solutions and to give demand-side management its overdue importance. From this viewpoint, the new policy document is seen as guided by the traditional concepts, when it reiterates in paragraph 1.7 the belief that the 'growth process and the expansion of the economic activities inevitably lead to increasing demands for water for diverse purposes: domestic, industrial, agricultural, hydro-power, thermal-power, navigation, recreation, etc.

It will indeed be very useful if policy-making for water resources in India can liberate itself from the older assumptions and become able to conceptually delink continued economic growth and increasing water availability. This will indicate a major step towards a new paradigm of integrated water management in India. That is because, through such traditional concepts, the future economic advancement of the country incorrectly gets conceptually identified with plans for the construction of storages for ensuring greater water supply. This new way of thinking would reduce the desperate stress that is now given on ensuring larger and larger supplies of water or transporting bigger and bigger volumes of water over greater and greater spatial distances, as epitomised in the questionable proposal for interlinking of rivers.

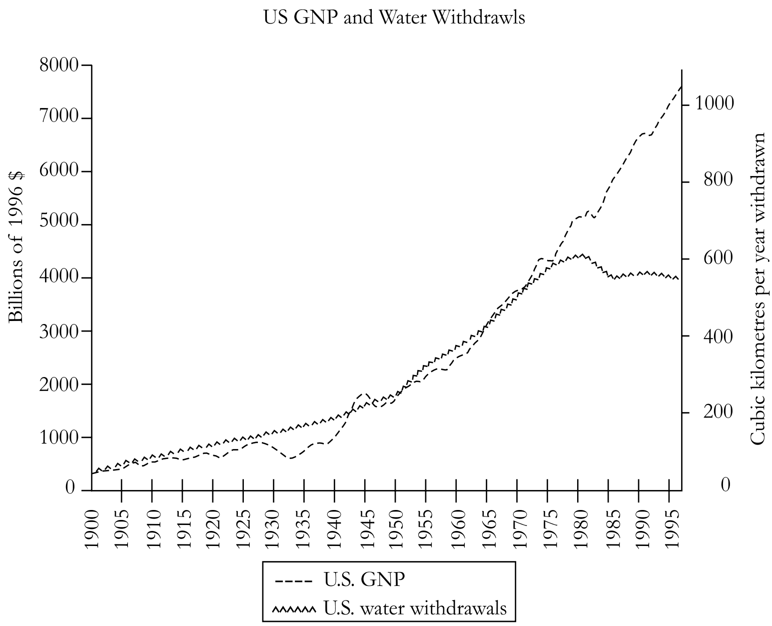
While economic development was at one stage of history accompanied by increasing availability of water, this link may not be applicable in all periods of history. Today, all the industrialised countries provide examples of co-existence of declining water requirements and rapid economic growth. For example, Wolff and Gleick (2002: 24–25) have shown that the GNP of the United States does not show any linear dependence on the water withdrawals in that country. While until the early 1970s the linear relation between economic growth and water withdrawals was observed to exist, by the mid-1970s the relation changed. The total water withdrawals started to level off and then decline, even while the GNP of the USA continued to grow. Withdrawals of water in the US are now 10 per cent lower than the level in 1980. The requirement of water for the industries in the US has dropped by about 40 per cent since 1970, while the industrial output has continued to rise steadily. Between 1980 and 1995 per capita freshwater withdrawals in the US declined by 20 per cent. This case is indicative of most major industrialised countries. A very similar picture also emerges in the case of Hong Kong.

Such examples go to show that there is no basic reason to invariably link economic growth with the availability of greater water supplies. The physical limits of water resource availability will, any way, impose the limits on the availability. In paragraph 1.8, the new policy document underscores 'the need for the utmost efficiency in water utilisation and a public awareness of the importance of its conservation'. Here, the policy document does encourage solutions based on demand-side management.

The delinking of the linear relation between the growth in the economy and growth in water supply is seen as an important element of a new paradigm for integrated water management. It opens up important avenues for the diversification of approaches to the management of water systems in India. One important feature of the present and the past assessment of water resources is the constant and uncritical comparison of the total annual utilisable water resources and the total annual requirements in the country. Such an arithmetical view presupposes an unhindered mobility of and uniform access to water within the geographical limits of the country. The very unequal spatial distribution of supplies of and demands for water makes the comparison of these gross annual figures either irrelevant or misleading. This is because, in real spatial terms, water is not as liquid as cash. Such comparisons can, at best be made in the case of small sub-basins, where a semblance of equitable access could be expected.

The proposal for the interlinking of rivers in India is based on such presuppositions. The ideas guiding the proposed interlinking of rivers (TFILR 2003) exemplify the deep-rooted influence exerted by the existing paradigm on the thinking of senior policy makers in India. However, the serious implications of the spatial non-compatibility of the distribution and that of the demands has not received any serious attention. It appears that the increasing mobility of water resources to all parts of the country through large engineering interventions has been accepted more as a political agenda, however much these interventions may be ecologically unsustainable and economically unviable.

Figure 5.1: The GNP and Water Withdrawals for the USA in the 20th Century



Source: Wolff and Gleick 2002: 24–25.

Furthermore, while the requirements are based on the real-life needs of the various sectors, the availability figure is based on topographic factors and subject to a number of storage structures being constructed and operational (NCIWRDP 1999: 34). From paragraph 1.2 of the new policy document it is apparent that the policy-makers have a presupposition that the storage sites required should and would get developed in the near future. In this way, a comfortable water future of the country is seen to be inexplicably linked with the construction of major storage projects.

Notwithstanding the recognised need for more comprehensive assessment of the economical feasibility or ecological sustainability of such large water projects, these dream projects have found big support from politicians in the drier states of the country (see for example, *Deccan Chronicle* 2002). In these areas the scarcity of water is an important and sensitive political capital that runs the risk of being misused, especially when the conceptual base for professional water resource management is traditional and weak. If water resource policy is prepared merely by politicians and technocrats, ignoring the open and independent community of water professionals, it will inevitably constitute a prescription for political conflicts and ecological unsustainability. One needs to remember that the conflict over the Cauvery waters or between the states of Punjab or Haryana are serious ones that have the potential of threatening the federal structure of India.

There is a reference to a 'paradigm shift' in the policy document, to which some attention must be given. The idea of this 'paradigm' appears to be quite different from what is understood vis-à-vis Kuhn (1969). In paragraph 22, there is recognition of the need for a paradigm shift 'in the emphasis in the management of water resources sector'. Recognition is given to the shift as follows: 'From the present emphasis on the management of water resources infrastructure for diverse uses, there is now a need to give greater emphasis on the improvement of the performance of the existing water resource facilities.'

Here, the need for a paradigm change has been used in connection with the improvement in the performance of the projects, so that the supplies could further improve. This is an example of a limited concept of a shift that has been presented in the policy document under the heading of 'Performance Improvement'. This shift is in no way related to the paradigm change discussed above, which is related to a fundamental shift to a holistic and interdisciplinary knowledge base on water systems.

2.3 Diverse Needs and Demands for Water Are Prioritised with the Requirements for Respective Qualities

A policy based on a new paradigm for integrated management of water systems is to assign clear priorities to the various competing requirements of water. This prioritisation is among various types of needs. First, it is between the needs of the natural ecosystems and the needs of the human societies. At another level, the prioritisation is among the diverse needs of the human societies themselves: e.g., of domestic supplies, irrigation, industry, etc. The policy document is sensitive to the prioritisation of the second type and is rather silent on the first one.

In paragraph 5 of the policy document, a clear allocation priority for the diverse requirements of water is given. The highest priority accorded to the satisfaction of drinking and domestic water needs is fully justified. This is quickly becoming an integral part of basic human rights. However, the priority given to irrigation and hydropower is higher than that to ecology. This would invariably be inconsistent with the priorities of the emerging paradigm for integrated management. While the importance of maintaining the ecosystems is accepted in principle, a clear methodology for making appropriate quantitative allocations to ecosystems is not available in the policy.

There exists quite a bit of confusion of priority on this point. In an earlier exercise, the NCIWRDP has limited its assessment of the environmental requirements in rivers only to the needs of afforestation and tree planting, and maintaining water quality in the streams and rivers. The question of water requirements for the stability of ecosystems and the continuity of ecosystem services has not been addressed with due importance. The NCIWRDP (1999: 69) made some ad hoc and very marginal allocation of water under the category of 'Environment (Ecology)', which does not address the emerging challenges of the need of the ecosystems. For example, the ad hoc allocation recommended for 'Environment (Ecology)' is a mere 1 per cent, while that of 'Evaporation Losses' from reservoirs is estimated to be six times that. Such a limited and ad hoc consideration of ecology and environment is a clear indicator of the continued rule of the reductionist paradigm over water management in India. This does not recognise the water requirements for the conservation of diverse water systems and continuation of their services along the various parts of the hydrological cycle. On the basis of a more complete knowledge base, there may be a need for assigning 'Ecology' a much higher priority above irrigation and hydropower, so that food production or power generation may themselves not become unsustainable.

2.4 Management of Water Systems Is Made Transparent and Participatory

A crucial element of a new and holistic paradigm is the creation of an interdisciplinary knowledge base that would be able to offer non-partisan and comprehensive assessments of the justifications for decisions for water systems management. In the policy document under review, there is indeed recognition of the need for new knowledge. Expressions of the need for 'frontiers of knowledge' that need 'to be pushed forward in several directions' (para. 25) are seen. This is followed by the presentation of a long list of topics on which the new knowledge could be generated. It ranges from hydro-meteorology to regional equity. This is a very good starting point in the policy. The problem however, remains that the policy does not go beyond this and describe a methodology for the synthesisation of the advances made in such diverse and individual topics and for the generation of a transdisciplinary knowledge system for decision support. Thus, it appears that, while the new policy recognises the importance of new knowledge in the various disciplines, it is still thinking in terms of traditional discipline-based knowledge. The process of generating a transdisciplinary knowledge system, which is an essential element for a new paradigm, is not clearly identified.

For example, in paragraph 6.3 of the policy it is stated that 'in the planning, implementation and operation of a project, the preservation of the quality of environment and the ecological balance should be a primary consideration.' The wide and interdisciplinary conceptual base needed for achieving the above cannot be generated by a disciplinary approach. It is only through interaction of diverse disciplines and interest groups that an appropriate methodology for such a decision-making process can be developed. This situation does not get reflected either in the present initiatives of the Ministry of Water Resources for a dialogue taken up to follow the publication of the new policy document. The NGOs find that the dialogue is 'dominated by retired officials of the Central Water Commission (CWC), Central Ground Water Board (CGWB), the water resources ministry and those who have worked in various capacities with the state governments' (see *The Times of India*, 2002b). In a new paradigm, there has to be a full participation of all the stakeholders, not merely as unwelcome members whose participation is a mere formality. The government officials are still not able to recognise the basic need for multistakeholder discussions, as exemplified in the comments of the TFILR (2003: 24), which says: 'Environmental concerns must be appreciated and project planning, designs reviewed in harmony with nature. But such concerns should not become instruments to block development of the water resources for greater good of the largest number.'

Thus, there are indications that what is development and what project may be undertaken will be decided first by the reductionist paradigm; and there may be some discussions with environmentalists on the margin as to how the negative environmental impacts can be 'reduced'. This means that water management in India is very much retrograde in recognising the contributions of the ecosystems and their services. The process of change towards a new paradigm for integrated water management is surely going to be slow and often full of frictions. This difficulty is further enlarged by the general detachment of the official water management institutions from the knowledge front. A review of the citation pattern in government policy documents or project proposals will be enough to assess this vital gap.

Transparency of one's own database and respect for diverse viewpoints are essential for the generation of the ability to raise new scientific questions and challenging the old paradigm. The agenda for research in the new policy document can be used as a good indicator of whether it is going to generate open and transdisciplinary knowledge. Unfortunately the issue of transparency of databases has not been stressed in the new policy document to the extent needed. New transdisciplinary knowledge can be generated only in open professional platforms. Without free availability of data that is respected by the open professional platforms, decisions taken stand the clear danger of being partisan, inefficient and uneconomic.

In many other countries, open availability of data has made it possible to exercise timely changes in unwise policies on water systems. For example, the erstwhile prescription for water resource development based on storage dams is increasingly being reversed in the USA, the country which has shown the way in large dams to the rest of the world. From the 1930s onwards, the United States pioneered the building of large dams, and between 1900 and 1930 about 50 large dams were built. In the 50 years from 1930, about a thousand more large dams got built. The first truly massive dam was the Hoover dam that was built in 1930 on the river Colorado. By 1945, the US completed the largest dams on the Earth, initiating a wave of similar construction activities all over the country (Gleick 2002). The Indian dam-building activity took a great amount of inspiration from the USA. Today however, 'there is a new trend to take out or decommission dams that either no longer serve a useful purpose or have caused such egregious ecological impacts as to warrant removal. Nearly 500 dams in the USA and elsewhere have already been removed and the movement towards river restoration is accelerating' (Gleick 2000: 130). No serious analysis of the crucial policy changes in other parts of the world is visible in the new policy document of India. There is a trend, often heard from engineers, to refer to China's construction of the massive Three Gorges Dam. Very soon China may change its policy towards a more holistic direction (Wang 2002), leaving its followers behind. Such fundamental changes in policy are possible only when there is a transparent and interdisciplinary approach to the creation, testing and use of the knowledge base at the national level. This crucial aspect of the knowledge base is not addressed with adequate stress in the policy document.

2.5 An Ecological View of Floods and Droughts Is Taken

In the context of the meteorological conditions prevailing in India, which is dominated by the monsoon and characterised by variability, periods of water stress or periods of regular annual inundations are normally expected. In the reductionist paradigm of traditional engineering, such situations of stress and inundations, resulting from natural variabilities, are unhesitatingly categorised as natural disasters, of droughts and floods. Once the disaster image is successfully fixed in the public mind, official steps get limited to providing relief. Attention to the issues of mitigation and adaptation to such hydrological extremes is not given any priority in the traditional paradigm. The new paradigm takes a different look at such events and offers top priority to the ecological understanding of extreme events and preparedness of the people.

In paragraph 19.1, the policy document correctly lays stress on making the drier areas less vulnerable to such extreme events. However, unless the ecological processes leading to water stress are properly understood, water stress conditions of all types may conveniently be described as natural disasters. That all situations of water stress are not rooted in meteorological factors and that there are many human-induced processes leading to water scarcity has been systematically described by Bandyopadhyay (1989). In paragraph 3.4 of the policy, the stress given on 'watershed management through extensive soil conservation, catchment area treatment, preservation of forests and increasing the forest cover and construction of check dams' for addressing the conditions of water stress indicates that the policy is aware of the need for ecologically informed steps being taken for the mitigation of drought. Indeed, this can be identified as an indicator of the ideas and concepts of a new paradigm for integrated management of water systems.

This sensitivity towards ecological processes is, however, not so clearly noticed in the prescriptions made for 'flood control and management'. In paragraphs 17.1–17.5, it appears that floods are visualised as pure disasters, and hence unwanted. This is a straightforward engineering view. The positive aspects of regular annual inundations offered through ecosystem services, like recharge of the groundwater, rejuvenation of the soils, transportation of silt, biodiversity, etc., are not really recognised. The positive contributions of floods have recently been analysed by Acreman (2003). The absence of such a viewpoint leads to prescriptions for control of floods by structural measures. From such a reductionist viewpoint emerges the idea in the policy document that 'physical flood protection works like embankments and dykes will continue to be necessary', without any importance being given to the questions of prevention and adaptation. The policy document does not appear to be informed of either the grave ecological impacts of many of the existing embankments nor the prospects of the management of floods by improving the process of drainage.

In sharp contrast, the international professional community is looking up to innovative prevention, adaptation and mitigation approaches for sustainable flood management as well as a highly developed policy articulation on the associated socio-economic and environmental impacts (Huang 2005). It is of interest that in China, another country facing big challenges from floods, new ideas are emerging with respect to managing floods. Referring to traditional engineering, Wang (2002: 81) commented that 'under such practices, Man blocks the passage of water … we should change to a new philosophy with regards to flood control.' He recommends that 'to provide floods with a route of retreat, is to give man a way out … it is very important that man should abide by natural rules when struggling with nature.'

Regular annual inundations of the flood plains, not floods that result from unwise human interventions in the hydrologic systems, are expected, especially in the eastern and north-eastern parts of the country. In the new paradigms for water systems management, structural measures that have been taken in India, or are being planned for flood control, need to be re-examined comprehensively from the ecological perspective. Similarly, an ecological-economic assessment is needed of whether there are economic justifications for controlling all floods with massive investments in engineering projects. Otherwise, official policy will keep thinking of 'solving' the problems of drought in states like Rajasthan and Gujarat, by linking these areas with the rivers of the 'flood prone' Ganga sub-basin, while floods in Rajasthan and Gujarat will continue to damage the economy of these states with a predictable regularity, and no serious efforts will be mounted to solve the problem of water scarcity in Gujarat and Rajasthan with flood water in these very same states.

2.6 Restructuring the Institutional Frameworks for Transparent, Sustainable and Participatory Water Resource Development

One of the clearest features of the paradigm shift occurring in water resource development is the recognition of the need for a fundamental change in the institutional framework which is used for the development and management of water systems. In the emerging paradigm, this framework is essentially transparent, participatory and informed by a holistic knowledge base. 'Participatory Approach to Water Resource Management' is addressed in paragraph 12 of the policy document.

India has witnessed great success in people-based water conservation and watershed management projects, undertaken especially in the drier areas by rural communities outside the governmental framework (Agarwal et al. 2001). This success makes a strong case for using local wisdom and community initiatives in solving water problems and giving people the required place in the related institutions. However, inclusion of words like 'participatory' has often been motivated by objectives other than participation. One has to guard against this. As the *The Times of India* (2002b) has reported on the formal dialogue organised by the Ministry of Water Resources to discuss the Action Plan for the Policy Document, 'though hardly any NGOs had been invited to participate in the dialogue (for the Action Plan), their role in the water sector came up for frequent mention. One participant noted that while there should be greater involvement of NGOs in executing the water policy, the action plan had allocated most of the tasks to the ministry itself.' The recent controversy on this subject raised in the national dialogue on the Action Plan (*The Times of India*, 2002b) is a natural outcome of such gaps in the policy. In line with this, and in paragraph 13, there is encouragement for 'private sector participation'. Thus, both the communities and the private sector are declared in the policy document as important stakeholders in water development and management. There are great positive expectations from both, if adequate checks against misuse of opportunities are also introduced. A clearer description of the scope for these stakeholders in the policy document is urgently needed.

The institutional framework for an activity is very closely linked with the knowledge base behind the related activity. A fundamental change in the knowledge base for water systems development depends on important transformations in the institutional framework. The issue of institutional mechanism has been addressed in paragraph 4.1 of the policy document, but it does not go beyond mentioning the obvious. There are important gaps in thought, for example, on the institutional mechanism necessary for the generation and use of new research outputs in better working of the water sector. Similarly, in paragraph 4.2, where the critical issue of river basin organisations is mentioned, no clear description has been suggested for them. In the context of the water conflict between the states of Karnataka and

Tamil Nadu, frequent references are made of the need for changing the status of water from a subject in the state list to one in the concurrent list. Talks about linking the rivers of the so-called 'water surplus' basins to those in the so called 'deficit' basins have also found mention in important policy statements at the highest level (see, for example, the first Independence Day-eve address to the Nation by President A.P.J. Abdul Kalam on 14 August 2002). Assessment and subsequent realisation of such large objectives requires very important changes in the institutional framework based on the study of the past achievements and mistakes. However, no clear indication of the way forward to institutional changes is observed in the policy document.

2.7 Towards a New Economics of Water

The several points raised above indicate that in addition to looking at water with an ecological perspective, there is an immediate need to widen the social and economic perspective of human understanding of water systems. The policy document under review does not focus much attention on issues like need for rethinking the existing property rights or ecological economic valuation of water systems or the idea of virtual water transfer. These are surely the subjects that the next water policy document for India will have to address. The question of pricing of water, the desirability or otherwise of the growing trends of privatisation of water resources as the final solution, and the ecological economic valuation of the ecosystem services provided by water systems are all part of a rapidly emerging knowledge base of water economics. Reinterpretation of critical water conflicts in India, like the Cauvery conflicts (Ghosh and Bandyopadhyay 2003), by using emerging concepts in economics, constitutes an essential input to a new policy. Integrated management of water systems is rapidly learning from such new economic analyses of water systems. Countries like Australia, China and South Africa are well ahead in this process. It will be very important for the official policy-makers in India to accept the inevitability of the change and open the official sector up for closer informal interaction with the larger world of professionals outside the government, so that the old paradigm of water management can rapidly give way to a new holistic one.

3. Conclusions

The National Water Policy 2002 is the revised and updated version of the earlier policy adopted in 1987. This review and updating has been undertaken at a point of time when fundamental changes are taking place all over the world in the paradigm for the management of water systems. Old ideas, which have failed to deliver, are getting thrown out and new interdisciplinary and revolutionary ideas are taking their places. Radical changes have already taken place in many parts of the world on vital issues of water resource development, like decommissioning of dams in countries that have led the world's dam building activities only a few decades ago. The new policy document has been examined in two contexts: first, what is new in this policy, and, second, whether the new Policy is the product of a new paradigm for water systems management.

For this, based on the study of recent literature, several indicators of a new paradigm have been identified. It is observed that the National Water Policy 2002 surely shows good knowledge of the existing problems and the inability of the present paradigm to address them effectively. At the same time, the policy document does not reflect any serious recognition of the urgent need for accepting fundamental changes in the traditional reductionist paradigm. Thus, there is little indication of the much-needed emergence of a new holistic paradigm of water systems management in India. The resilience of the present paradigm in the official water resource institutions in India appears to be very high.

The non-availability of water-related data in general, and on several river systems in particular, has added to this resilience by reducing the scope of professional assessments and critical inputs for the growth of knowledge on water systems. It is only the increasing challenges to its existence from the mismatch between predictions and actual results, and professional criticisms thereof from all segments of the stakeholder community, that scientific knowledge can grow and a new paradigm can emerge. The position of confidentiality taken by official water resource administration in India regarding open provision of hydrological and scientific information on projects, and the near absence of open professional debates with the community of independent water professionals, has clearly protected the old and outgoing paradigm to retain its position in official policy and obstruct the emergence of integrated management. The seven criteria identified in this paper with a new paradigm for water systems management deserve serious professional attention of policy-makers in India for ushering a new and comprehensive paradigm for integrated management, so that the water systems of the country can be used in the best public interest.

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6

Water–Land Linkages: A Relatively Neglected Issue in IWRM

D.J. Bandaragoda

If there is an ailing river, a sick landscape may be the cause (Falkenmark et al. 1999: 33).

1. Introduction

Water is no doubt the *sine qua non* for human existence. Water is essential for drinking, food production and food processing to ensure the very survival of human life; it is also an essential commodity for industries, power generation, operation of urban utilities and to maintain a hospitable environment. Land is the plane on which all these actions take place. In an undisturbed natural system, at any given time, and in any given location, the prevailing climate provides water and energy to the land surface, and helps to maintain the life that exists on it. In an essentially systemic manner, climatological, geological and biological dynamics co-exist to determine the quantity and quality of water in the land surface (Falkenmark et al. 1999). Axiomatic in the process of 'development' are the human actions that continue to modify the landscape and interfere with these inter-related dynamics in nature.

Of the various uses of water, water for agriculture accounts for the highest proportion of all water available for human use. Globally, agriculture accounts for 66 per cent of freshwater withdrawals and 85 per cent of freshwater consumption; agriculture also accounts for 38 per cent of land use (FAOSTAT Database 2001; Shiklomanov 2000). In agriculture, water is inalienable from land as they are closely interlinked in usage. Also, water and land are the most critical natural resource inputs for crop production. Irrespective of the criticality of either of these resources for agriculture, the concern on water seems to have superseded that on land resources. While it is very important to be concerned about the increasing water scarcity, declining water quality and other related issues of water resource management for food production, it is equally important to realise that most solutions that may address these issues are invariably linked with the management of land resources.

During the last two decades, the world has come to recognise the importance of an integrated approach to water resource management. The year 1992 saw two major global initiatives on water and the environment, and since then there has been a wide appreciation of the need to consider water as a critical resource. Increased knowledge on the limitations, finiteness and vulnerability of water as a resource gave rise to an accentuated concern on water. The famous *Agenda 21* of the Earth Summit in Rio de Janeiro (Savenije and van der Zaag 1998; UNCED 1992) and the Dublin Conference on Water and the Environment (ICWE 1992) concluded on a set of eight principles and concepts.

One of these eight items referred to 'integrated water resources management, implying an inter-sectoral approach, representation of all stakeholders, all physical aspects of water resources, and sustainability and environmental considerations'.

Despite the reference to 'all physical aspects of water resources' and 'environmental considerations', the principles as enunciated above tended to emphasise the water resources, and paid little attention to the importance of considering some intrinsic linkages water has with other aspects of environmental resources, and also the biochemical and ecological processes associated with water. When the 'Dublin principles' referred to the term 'integrated water resources management', the main consideration was probably on an approach to integrate the management of all different water uses and the representation of all stakeholders. While this part of the definition attracted the attention of water enthusiasts, the reference to 'sustainability and environmental considerations' did not influence much serious thought or action beyond their water resource perspective.

A broader coverage in water resource management was meant by 'integrated water resource systems' (Keller et al. 1996), a concept that came to be known as the 'IWMI paradigm', but the emphasis was once again only on water. The main feature of this river basin-wide concept is that it explicitly includes water reuse, in which the water that is diverted but not fully utilised by any water use sector upstream could be captured by any water use sector downstream. Although a water resource system may involve water, land and other related resources, the integration appears to cover only the water aspects only. So are the analyses and practices that have followed this concept.

The Global Water Partnership's definition of IWRM (GWP/TAC 2000) is perhaps one instance where IWRM has been given a fairly comprehensive scope, and where the water link with land resources has been given specific mention. Unpacking this definition, the content of integration embodied in the concept of IWRM is seen as basically between the natural and human systems (Jonch Clausen 2000). Within the natural system, integration is sought between 'freshwater and coastal zone, land and water, "green water" and "blue water", surface water and groundwater, water quantity and quality, and upstream and downstream'. Similarly, in the human system, integration is required between demand and supply across various water use sectors, among various stakeholders and in numerous socio-economic considerations. Still lacking was the reference to water-related biological and ecological processes within a river basin context, and their interactions with the sociological processes.

Following these international initiatives, the planners and professionals started to focus on water as if it could be harnessed, preserved and managed in isolation from other linked resources, and without reference to the implications of biological and ecological implications of its use. Many countries proceeded to embark on complex reform measures in the so-called 'water sector'. Policies and laws to promote these reforms were deeply embedded in the water sector, and the resultant institutional framework for integrated water resources management artificially created a screening effect to isolate the water sector from other resource use sectors. Ministries, departments and professional institutes, and even some NGOs that emerged to carry on the crusade on IWRM, developed a separate identity with water and tended to jealously guard its exclusivity. A classic segregation in this developing scenario is the separation of water management from land management. Emphasis on water seems to have polarised a similar emphasis on land, or on the environment, through a departmentalised bureaucratic approach to natural resources management. However, this artificial barrier does not seem to operate in the action arena, as the actual use of water has to take account of the overall resource context in which water is used. More importantly, the political economy of water management recognises the inevitable linkage with the socio-political issues related to land tenure and land economy. The purpose of this chapter is to highlight the importance of appreciating the close linkages that exist between IWRM and land management.

2. Current Sectoral Thinking: The Main Problem

Some parts of Australia currently experience the adverse effects of single-resource thinking. Arising from mass-scale clearing of land for cattle or growing irrigated crops during the early settlement period, problems such as rising water tables, waterlogging and salinisation are now leading to evacuation of areas where soils are too saline. Emphasis on land use without reference to its water implications was mostly based on practices in the temperate climates from where the settlers and their leaders came.

In Sri Lanka, the Mahaweli Development Project was implemented based on a water emphasis. The reservoirs were built mainly on water-related criteria and an environmental impact assessment, which also basically emphasised water. Later, some of the ecological implications started to emerge, including landslides in the catchment of the Kotamale reservoir, low biomass production downstream of the Pologolla barrage and the adverse effects on the fauna and flora of the riverine and deltaic areas. Even for irrigation, water diversion was decided mainly based on maximum command area rather than on soil conditions. Later, adjustments had to be made for diversified crops to replace the failing monoculture of rice on irrigated red soils.

Our current understanding of water and land management is to effectively manage each of these resources as independent resources. For example, management of a river basin from a water perspective would view it as primarily for water supply and water-based resources, control of floods and, perhaps, aesthetic values. Similarly, land management is often limited to land distribution, title registration, crop-based subsidies, and some agricultural extension work. This approach could be viewed as overly simplistic, discipline-based and, in several instances as outlined below, sectoral or piecemeal. When one considers that these resource systems are complex and therefore conform to non-linear dynamics and are chaotic by their very nature, it could be argued that our current approach is inappropriate.

The multi-functional aspects of water and land resources would help us to understand that each water and land resource management strategy is very complex, and not as simplistic as is currently practiced. The current approaches to water and land management in most developing countries are based on practices introduced by colonial administrations, and inherited from earlier generations who handled them at a time when the population was small and human interventions were on a relatively small scale. Some of these methods were derived from practices in temperate climates. In either case, these strategies need to be adjusted to suit the current situations in the contexts where they are applied.

3. Availability of Water and Land Resources for Food Production

Recent publications on the subject of water resources have emphasised water scarcity. Some referred to 'severe water shortages' and others to 'the essential resource under threat'. The Hague World Water Forum in March 2000 saw the World Water Commission launching their report on 'A Water Secure World'. Just as much as the countries followed this lead by focusing on the need to secure water, the analysts of IWRM also often focused on water scarcity. Their analyses ranged from very general overviews of water resource scarcity to scarcity of water in terms of its specific use, such as in food production.

Falkenmark et al. (1989) ranked countries on the basis of water supply. A similar supply-oriented approach was taken by the UN Commission on Sustainable Development (Raskin et al. 1997) in identifying countries with water scarcity.

An IWMI (International Water Management Institute) study integrating overall water supply and demand data projected a year-2025 scenario and estimated that countries with 'absolute water scarcity' will by then be having about 1.4 billion people (Seckler et al. 1998). Countries having water scarcity due to economic disabilities or sectoral imbalances will be having another 1.3 billion people, and these countries have to pursue tremendous efforts to develop the needed water resources or to divert water from low-value water uses to high-value uses.

In a more recent study, Rosegrant et al. (2002) discuss world water availability and its effects on food production by the year 2025. They are basically dealing with scarcity, and the analysis includes water availability and demand for food, the effect of scarcity on environmental purposes, future food production through rainfed and irrigated areas, and the impact of water policies and investments on water supply and food production. According to this analysis, about 80 per cent of global and 86 per cent of developing country water consumption is in agriculture. By 2025, global population would increase to 7.9 billions, and more than 80 per cent of this population will live in the present developing countries. Projected increase in demand for cereals between 1995 and 2025 would be 46 per cent globally, and 65 per cent for developing countries.

All the above analyses and interpretations are valid and important, but at times they tend to understate the criticality of the availability of other essential resources. In almost all of these scarcity and food security scenarios, only the availability of water has been highlighted as the constraint for food production in the future. It is likely that an integrated approach to consider constraints from other essential resources like land would give a different picture. In some instances, the modelling exercises would have considered inputs from land resource constraints, but the literature does not seem to provide the extent to which land scarcity and land degradation would impact on the scenarios presented.

The most compelling reason to integrate land issues in IWRM is the declining availability of cultivable land. Since agriculture requires water and land as the most critical inputs, any serious consideration of water in agriculture has to go hand in hand with an equally serious consideration on land resources, particularly when the availability of land for crop production in many parts of the world is declining. As will be presented in the following paragraphs, further improvements in food production levels could be best achieved through increasing irrigation intensity. In this scenario, the availability of land becomes a crucial issue.

An important finding that surfaced in a recent publication is the large difference in global trends for agricultural water and land use (Goklany 2002). As shown in Figure 6.1, both water withdrawals[1] and water consumption[2] at the global level have increased much more than cropland during the past century. Water diverted for agricultural purposes increased by 388 per cent between 1900 and 1995, whereas water consumption by agriculture increased by a still higher proportion of 446 per cent during the same period.[3] Concurrently, irrigated land area increased by a similar margin of 435 per cent. However, during this same period, the extent of cropland increased only by 95 per cent. Since around 1990, the extent of cropland seems to have been levelling off. The increase in population by 251 per cent during this period finds its significance in the information given in Figure 6.2.

Figure 6.2 gives the information on a per capita basis. Agriculture water withdrawals and consumption per capita have both been increasing during the period to reach a peak in 1960. They have declined since then, but their 1995 levels, along with per capita irrigated area, have persistently been very much higher than their 1900 levels.

The most noteworthy feature is the per capita cropland extent, which has been declining since around the 1930s, while irrigated land per capita and agricultural water use and consumption per capita have all been increasing. Since around 1945, per capita cropland has plummeted down to an overall 44 per cent decrease for the period 1900 to 1995.

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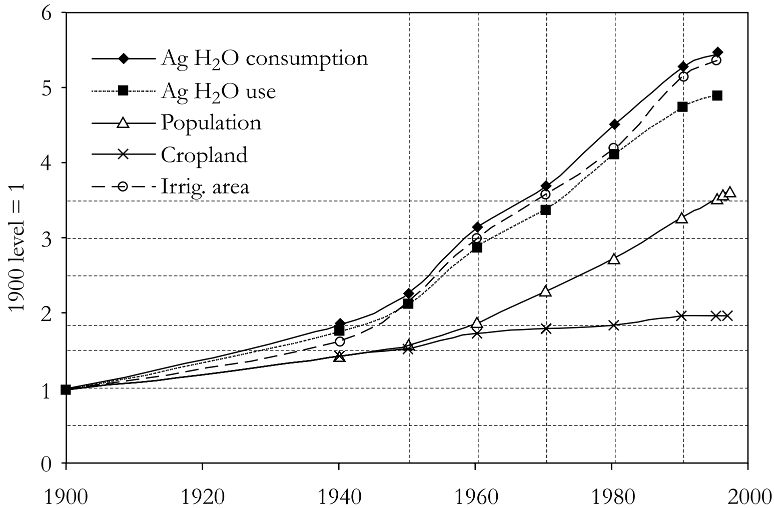
[1] Water withdrawals means water diverted from a source for human use, some of which may be returned to the source for reuse downstream.

[2] Water consumption is water withdrawn from a source and actually consumed or made unusable downstream due to irrecoverable losses.

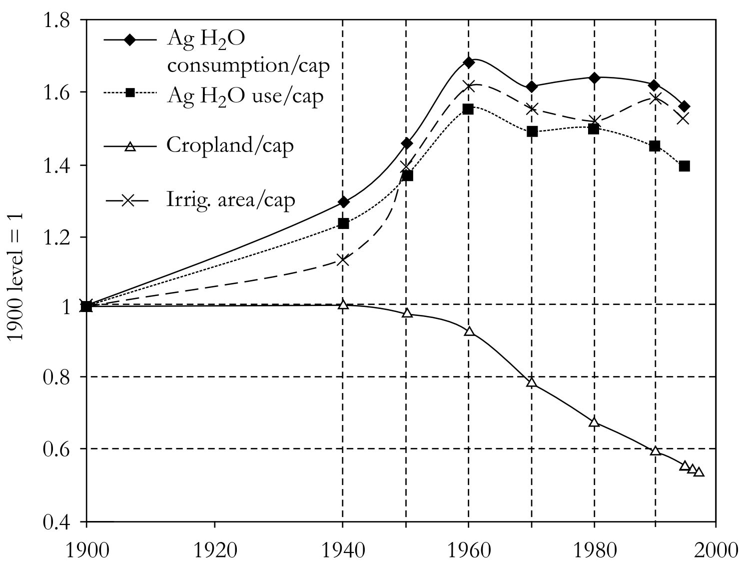
[3] Rosegrant et al. (2002) estimated that during the 20th century, irrigated area increased five times over its extent at the beginning of the century to reach its present level of 250 million hectares.

Figure 6.1: Global Agricultural Land and Water Use (1900–1997)



Source: Goklany (2002: 322)

Figure 6.2: Global Agricultural Land and Water Use Per Capita (1900–1997)



Source: Goklany (2002: 323)

Interestingly, Figures 6.1 and 6.2 together show that between 1900 and 1980, global agricultural water withdrawals and consumption increased on average at a faster rate than irrigated land. Since 1980, this trend has been reversed, and irrigated area increased more rapidly than agricultural water use during the period 1980 to 1990. Since 1995, they all show a downward trend of a similar scale.

What do these global trends mean? While an increasing population has created a growing demand for food and brought about increased pressure on global biological resources, since 1960 the trend in cropland expansion has slowed down and levelled off. This can happen only when productivity of agricultural land substantially increases. This in fact happened during the 'green revolution' period. At the same time, expansion of irrigated area, water withdrawals and consumption have kept increasing, indicating a persistently slack level of water productivity. Goklany (2002: 327) attributes this divergence between cropland and agriculture water use to a possible substitution of water for land in order to boost production. During the last few years of this period, however, the expansion of irrigated land and water withdrawals has been halted, probably due to increasing pressure from the environmentalists.

This global picture is further compounded by the fact that almost 90 per cent of the population growth occurs in developing countries, where the availability of arable land is fast diminishing. From a land management perspective, to achieve a 3 per cent increase in food production over the next decade it would be necessary to have a 30 per cent increase in terms of cultivating new land and up to 17 per cent on intensification of cropping patterns (Falkenmark et al. 1999: 26). This includes continuous cultivation and intercropping. The questions that arise are: is there land available, and are the strategies sustainable?

In some countries, the extent of available productive agricultural land has already reached its upper limits. While the total farmland area in Thailand has steadily declined during the period 1991 to 1997, the conversion of this land to other purposes is also shown in the increase of land for housing. While paddy land has steadily decreased in extent, the area under vegetables shows a substantial increase.

This pattern of land conversion to uses other than agriculture (or other than rice cultivation) is common to other Southeast Asian countries such as Malaysia, the Philippines and Indonesia. Following global trends, Thailand's irrigated area has also increased over the past few years. Total water availability for agriculture and per capita water availability also seem to be still increasing.

4. Imperatives of Water and Land Linkages in IWRM

A coordinated approach to research and management that considers the various biophysical components, institutional arrangements, levels of management, stakeholders and use sectors is the most plausible strategy to consider all the linkages in a truly cohesive IWRM. Integrated water resources management, as the GWP definition implies, is the coordinated use and management of land, water and other natural resources and activities within a river basin, to optimise the use of resources and ensure its stability and productivity now and in the future. The health of the river and adjacent land are closely associated.

In seeking to understand the concept of IWRM in this broader connotation, it is essential to clearly understand the land–water linkage, and how water movement through the landscape is linked to the quality of water (Falkenmark et al. 1999: 13). In general, rivers tend to accumulate run-off from land in addition to a smaller proportion of water reaching the river as direct precipitation. Since water is a unique solvent, it tends to dissolve everything soluble as it passes above and below the soil surface. In so doing it carries soluble components along pathways towards the river. In this way pollutants from sources based on land are carried into the water system draining the land area. In addition, water has a large erosive capacity, allowing it to carry fine suspended materials from easily eroded land into the river. There, soil particles are deposited as silt when the water velocity decreases in lakes and coastal waters. What is clearly evident is that the mismanagement of our land resources manifest themselves in water (in terms of reduced flows, poor quality, lack of institutional structures and policies to protect the environment, etc.), clearly demonstrating the intricate linkage between land, vegetation and water. Consequently, land and water are interdependent.

Managing water and land linkages in IWRM is more than simply lumping two sets of resource management strategies together under a single umbrella. Recognition of the system gives explicit acknowledgement of the many complexities involved in management. This implies the necessity for adopting a multidisciplinary as well as interdisciplinary approach to solving land and water issues. The curious lack of demand for holistic knowledge of land use systems may be because our present institutions, based on disciplinary lines, would largely be unable to make use of it even if it existed. As such, it is probably contrary to the academic environment that we were trained in, which promotes disciplinary specialisation. Real incentives will be required to encourage policy makers, scientists and managers to work together across disciplines, to learn the 'culture' and 'language' of the different disciplines, and to foster real collaboration.

One way of motivating the concerned actors is to provide them with scientific information and practical experience in the form of field visits to study sites. Upper catchments are a good starting point to understand the water–land linkages. A study conducted by IWMI in a number of Asian countries on 'Management of Soil Erosion' provided some important insights into water–land linkages in catchment management:

- A figure as high as 54 tons per hectare of soil loss annually has been recorded in the Philippine study site. This rate of erosion is way above the tolerable soil loss of 2 tons/ha/year. Replacing the amount of nutrients lost by soil erosion with external fertiliser inputs would cost as much as US$ 68 per ha per year. With the very low income of the farmers in some study sites (only US$ 296 per annum in Laos), the purchase of external inputs could be difficult.
- Land management practices greatly influence hydrological behaviour and soil erosion, with the proportion of the area cultivated to annual crops presenting the best predictor of sediment yield. Soil loss decreases with increasing catchment size but this can often be overridden by the effect of land use. Suspended sediments appear to be more significant than the bed load and could significantly impact on activities downstream.

- The model developed to simulate and predict soil erosion showed a fourfold increase in soil erosion with an increase of the proportion of the cultivated area from 9 per cent to 60 per cent. The model also supports the observation that land use greatly affects soil erosion and more than the effect of climate. The use of this model will greatly help planners in deciding development options for better catchment management.

In this instance, through constant dialogue with the farmers and opinion leaders, the best-bet land management options were identified and introduced for evaluation. These were essentially variants of the hedgerow cropping technology combined with other options considered to more quickly generate additional income. Similar information packages on combined water–land management issues are necessary to ensure that the essential linkages are understood and appropriate strategies are promoted.

Growing global populations and changing consumption patterns for food and livestock feeds will have to be met by increased agricultural production. The projected increases in cereal production in the developed countries (by 45 per cent between the period 1997 and 2020) will not keep pace with demand. Therefore, future challenges will have to be met by more innovative measures of natural resource management, involving rainfed cultivation, use of lower-quality degraded lands and, therefore, substantial investments in land improvements and water utilisation and changes in institutional and legal frameworks, in order to sustain higher productivity and maintain healthy agricultural ecosystems.

Land is the plane on which all water-related functions are performed. For instance, considering the key functions of water and land mentioned in Table 6.1, a fair conclusion is that each one of water functions cannot be performed without its base being found in one or more of the key functions of land—they are intrinsically interlinked.

In sum, two important areas for rethinking on IWRM can be identified. First, there should be a wide awareness of the water–land linkages and related physical, chemical, biological and ecological processes under different hydro-climates, so that more realistic assessments and strategies can be developed. Second, there is a need to

Table 6.1: Key Parallel Functions of Water and Land

Water	*Land*
• *Health function*: Safe water is crucial for protecting the survival of a healthy population.	• *Living space function*: As a physical and spatial entity, land provides living space for human settlements, industries, and social activities.
• *Habitat function*: Aquatic flora and fauna are critically dependent on the characteristics of the water in the water body in which they dwell.	• *Connective space function*: Provides space for transport of people and goods, and for movements of plants and animals.
• *Carrier functions*: Of dissolved material, and of eroded material.	• *Production function*: Life support systems provide biomass.
• *Production functions*: Plant production in agriculture and forestry; socio-economic production in industry and urban societies is feeding on water passing through aquifers and rivers.	• *Environmental function*: The basis for terrestrial biodiversity.
• *Religious and psychological function*: Water plays a crucial role in most religions. Since ancient times fountains have been seen as desirable components of city architecture, creating a feeling of quality of life and well-being; and water bodies play a crucial role in recreation, both in and on the water.	• *Religious and psychological functions*: Land is associated with many religious beliefs and related practices, and in many developing countries, people attach religious significance to certain land plots.

Source: Falkenmark et al. (1999)

find solutions to existing administrative and legal impediments to a comprehensive application of the concept of IWRM, as intended by its original proponents. As water, land and other related resources are all involved in a river basin, the concept of sustainable river basin management would be an appropriate strategy to give effect to IWRM.

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PART II
DIFFERENT DIMENSIONS OF INTEGRATION

7

Water Balance Studies and Hydrological Modelling for IWRM

R. Sakthivadivel

1. Context

Developing and managing water resources of a basin is complex, in view of competition and pressure on water among different uses and users as well as due to high-intensity rainfall, causing flooding, drainage congestion, soil erosion, waterlogging, etc. The potential of a basin's water supply is dependent mainly on the quantum of precipitation it receives, in addition to importation from other basins; however, its availability for use on a sustained basis (supply side) depends mainly on the river flow caused by variation of rainfall distribution, both spatially and temporally, and the year-to-year variations due to climatic changes and storage created within the basin to capture rainfall run-off for later use. In recent years, pollution of watercourses has also diminished the available water supply. The demand side of the basin water supply is also increasing day by day due to population growth, higher living standards and increased multiple use of water for agricultural, domestic, industrial and environmental uses, causing recycling and pollution of water resources. Both supply and demand management are becoming increasingly complex at the basin level.

Managing the basin water resources needs adequate and reliable hydrologic data; an inadequate and unreliable hydrologic database is one of the major constraints for efficient planning and effective utilisation of the basin's water resources in the case of many river basins. With remote sensing data now available in the public domain and with the use of Geographical Information System (GIS) tools, hydrological modelling has become a handy tool for integrated water resources management.

This chapter focuses on four aspects of a basin's water resources: water accounting; water storage and development; hydronomic zoning; and hydrological modelling. These are important inter-related concepts and activities, which are essential to develop integrated hydrologic modelling in a basin context and to utilise the model for efficient use of a basin's water resources to increase the productivity of water.

This chapter starts with the concept of basin water accounting, which is based on a water balance approach. A water accounting exercise allows us to understand the present basin's water use and classify the basin into open, closing and closed. In open and closing basins, there is a great potential to store water and use it productively. The next section deals with storage and development and shows how integrated planning of storages could lead to conservation of a basin's water supplies. Because of the complexity of managing water resources in a basin context, the concept of hydronomic zones is introduced to take care of the interaction of different uses of water and the multiplier effect of a basin's water resources. Then integrated hydrological modelling is introduced to make use of a basin's water resources in an efficient way to increase the productivity of water. Last, a few typical results of using integrated modelling for building management scenarios of a basin are presented and discussed.

2. Introduction

There is increasing competition for water between agricultural, industrial, domestic, environmental and ecological uses. Because water in South Asia is often in limited supply, there is a need to use water more productively. As there is a high interdependency among uses and users, considerable effort is being placed on improving the integrated management of water resources.

As a large consumer of water, developments in irrigation have profound impacts on basin-wide water use and availability. Higher demand from other sectors means reduced supplies to irrigation.

Irrigated agriculture needs to produce more with less water. Yet, planning and execution of interventions in irrigation often takes place without consideration of other uses. Similarly, actions related to other uses of water resources do not sufficiently consider the effects of irrigation.

Although irrigation water use needs to be considered within the broader context of basin-wide water resources, there are inadequate methods to describe how irrigation water is being used in relation to other uses. Irrigation efficiency is the most commonly used term to describe how well water is being used. But increases in irrigation efficiency do not always coincide with reduced competition for water, nor do they necessarily coincide with increases in overall productivity of water in a basin.

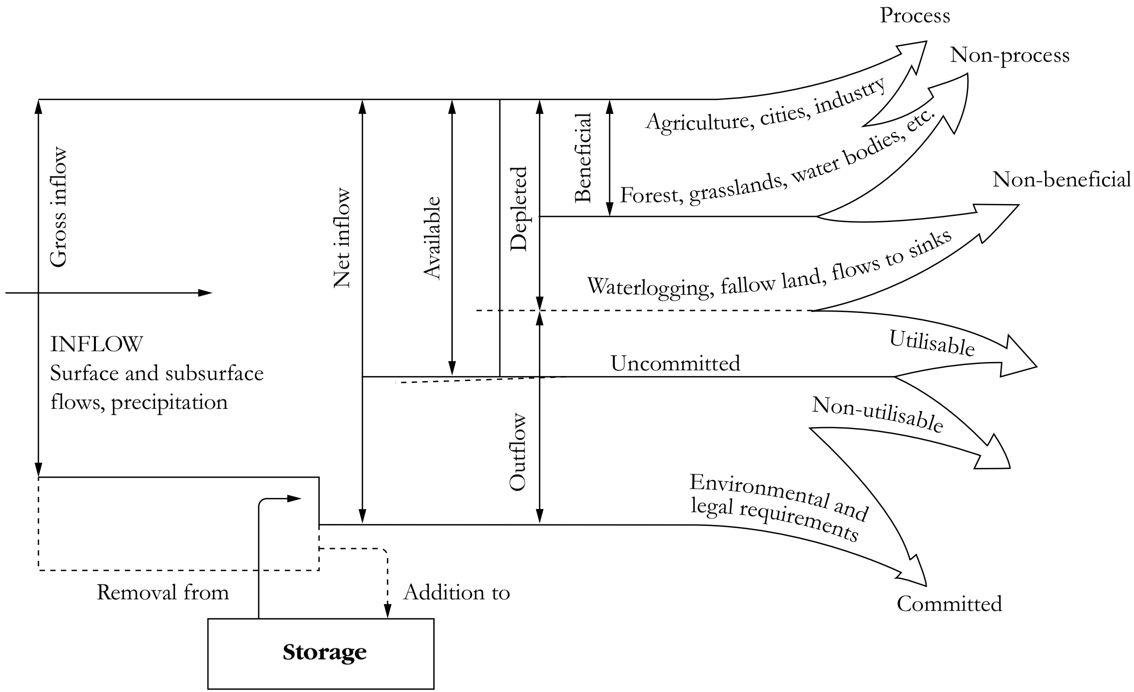
Agricultural researchers often focus on a field or plot level dealing with crop varieties and farm management practices. Irrigation specialists focus on a set of fields tied together by a common water source. Water resources specialists are concerned with other uses of water beyond agriculture, including municipal, industrial and environmental uses. To understand the impacts of action at any level, an analysis of the interactions among the levels (field, system, basin) is essential.

Many water basins worldwide are facing perceived water shortages due to increasing demands on water from all sectors. It is vital that key information about water use and availability is presented in a way that can benefit policy-makers. Choices, tradeoffs and evaluation must be described as clearly as possible. A water accounting approach does this admirably.

3. Water Accounting

The water accounting methodology could be used for irrigation, municipal, industrial, environmental, or other purposes. It defines three different levels of water use and develops water accounting procedures at each level. This methodology is based on a water balance approach, considering inflows and outflows from basins, sub-basins, service and use levels such as irrigation system or fields (Molden 1997) (see Figure 7.1).

Figure 7.1: Water Accounting Integrates Water Balance Information with Use of Water to the River Basin Level



The initial step in performing a water balance is to identify a domain of interest by specifying spatial and temporal boundaries of the domain. For example, a domain could be an irrigation system bounded by its headworks and command area, and bounded in time for a particular growing season. Water accounting considers various components of the water balance and classifies according to uses and the productivity of these uses.

Conceptually, the water balance approach is straightforward. Often, though, many of the components of the water balance are difficult to estimate or are not available. For example, groundwater inflows and outflows to and from an area of interest are difficult to measure. Estimates of actual crop consumptive use at a regional scale are questionable. And, often, drainage outflows are not measured as more emphasis is placed on knowledge of inflows. In spite of these limitations, experience has shown that even a gross estimate of water accounting would be useful for water and irrigation managers, farmers and researchers.

The art of water accounting is to classify water balance components into water use categories that reflect the consequences of human interventions in the hydrological cycle. Water accounting integrates water balance information with uses of water at the river basin level (see Box 7.1).

Box 7.1: Water Balance Information

- *Gross inflow* is the total amount of water flowing into the domain from precipitation, and surface and sub-surface sources.
- *Net inflow* is the gross inflow plus any changes in storage.
- *Water depletion* is a use or removal of water from a water basin that renders it unavailable for further use. Water depletion is a key concept for water accounting, as interest focused mostly on the productivity and the derived benefits per unit of water depleted. It is extremely important to distinguish water depletion from water diverted to a service or use, as not all water diverted to a use is depleted. Water is depleted by four generic processes:

(*Box 7.1 continued*)

(*Box 7.1 continued*)

- *Evaporation*: Water is vaporised from surfaces or transpired by plants.
- *Flows to sinks*: Water flows into a sea, saline groundwater, or other location where it is not readily or economically recovered for use.
- *Pollution*: Water quality gets degraded to an extent that it is unfit for certain uses.
- *Incorporation into a product*: By a process such as incorporation of irrigation water into plant tissues.

- *Process consumption* is that amount of water diverted and depleted to produce an intended product.
- *Non-process depletion* occurs when diverted water is depleted, but not by the process for which it was intended.
- *Committed water* is that part of outflow that is committed to other uses.
- *Uncommitted outflow* is water that is neither depleted nor committed, and is therefore available for a use but flows out of the basin due to lack of storage or operational measures. With better management, or additional storage, this uncommitted outflow can be transferred to a process use such as irrigation or urban uses. Uncommitted outflow can be classified as utilisable or non-utilisable. Outflow is utilisable if the water could be consumptively used by improved management of existing facilities. Non-utilisable uncommitted outflow exists when there are insufficient facilities to capture the outflow.
- A *closed basin* is one where there are no utilisable outflows in the dry season. An *open basin* is one where uncommitted utilisable outflows exist.
- In a *fully committed basin,* there are no uncommitted outflows. All inflowing water is consumed in various uses. In this case, major options for future development are reallocation among uses; decreasing non-process, non-beneficial depletion of water; or importing water into the basin.
- *Available water* is the net inflow less the amount of water set aside for committed uses and less non-utilisable uncommitted outflow. It represents the amount of water available for use at the basin, service or use levels. Available water includes process and non-process depletion, plus uncommitted utilisable water.

The performance indicators for water accounting are presented in the form of fractions and in terms of productivity of water. The productivity of water can be defined in terms of gross inflow, net inflow, available water or depleted water. In a river basin, it makes sense to track gross productivity of water over time to see how well the overall water resources are being used. For an irrigation service area, these are external (output) indicators that relate output of irrigated agriculture to its main input, water.

Application of Water Accounting

The water accounting procedure was applied to the following four sub-basins in South Asia where there are perceived problems of water scarcity: Bhakra in India, Chistian in Pakistan, Huruluwewa in northern Sri Lanka, and Krindi Oya in southern Sri Lanka (Molden and Sakthivadivel 1999). The accounting procedure estimates the quantities and productivity of various water uses within a basin. This information is used to identify the water-saving potential and the means for improving the productivity of the managed supplies.

Table 7.1: Water Accounting and Water Productivity Indicators

Indicator	*Definition*	*Bhakra*	*Chistian*	*Hurulu-wewa*	*Krindi Oya*
Water accounting					
Depleted fraction (available)	Depleted/ available	0.88	1.00	0.84	1.00
Process fraction (available)	Process depletion/ available water	0.86	0.86	0.31	0.22
Beneficial utilisation	Beneficial depletion/ available water	0.86	0.89	0.52	0.65
Productivity of water					
Per available supply	SGVP(US$)/available water for irrigation	0.15	0.06	0.04	0.06
Per unit evaporation	SGVP(US$)/crop evapo-transpiration	0.17	0.07	0.10	0.15

Note: SGVP = Standardised Gross Value of Production.

Table 7.1 summarises important results derived from water accounting. In all cases, the depleted fraction of available water is above 0.84, indicating that nearly all water available for use within the study domain was depleted for various uses. The process fraction was highest at Bhakra and Chistian, indicating that most available water was depleted by process uses or those uses intended by humans. In contrast, at Huruluwewa and Krindi Oya, values for the process fraction were much lower, indicating that most available water did not reach intended uses. The beneficial fraction of available water depleted for beneficial purposes was over 0.5 at these two sites, meaning that over half the water entering these two areas reached a beneficial use. This was due to other non-intended uses: namely, trees within the irrigated area that produced benefit when depleting water. Beneficial depletion at Bhakra and Chistian was quite high, indicating very little scope for saving water at these two sites.

To understand how productively water was used in agriculture, water productivity measures were used. The water available for irrigation was calculated by subtracting out committed downstream uses and other beneficial uses within the domain. Productivity of crops was estimated using a standardised gross value of production (SGVP), which allows comparison between various crops across different countries. The productivity of water available for irrigation varied greatly between US$ 0.04 and US$ 0.15 per cubic metre. The variation of productivity of water per unit evaporation (ET) also varied highly: between US$ 0.07 and US$ 0.17. Worldwide this variation is between US$ 0.05 and US$ 0.62 (Molden and Sakthivadivel 1999). At Huruluwewa and Krindi Oya, productivity of available water was much lower than productivity per unit ET. If more available water could be redirected to crop ET by water-saving measures, these values would increase. The productivity of water at Chistian is much lower compared to Bhakra. Water management efforts at Chistian need to focus on increasing the productivity of water per every drop consumed by crop evapotranspiration.

The following conclusions were arrived at from this analysis:

- The choices available for water savings in closed basins with high beneficial utilisation, such as in the Bhakra and Chistian sub-basins, are limited. In these cases, efforts should focus on gaining more productivity from water that is being depleted.

- A high rate of beneficial depletion does not necessarily lead to increased water productivity as demonstrated by the analysis of the Chistian sub-basin. Even though existing practices lead to apparently high efficiency there remains considerable scope for increasing water productivity.
- Within the open sub-basins of Huruluwewa and Krindi Oya, many more opportunities for saving water and increasing the productivity of available supplies exist than in the closed and closing sub-basins of Bhakra and Chistian, as indicated by the process fractions and beneficial utilisation indicators. But to increase productivity of available supplies, the water saved must be directed to beneficial and productive uses.
- At all the case-study sites there seemed to be a general lack of knowledge of drainage outflows from sub-basins and environmental requirements both within and downstream of the sites. There was little knowledge on both how much water could or should be depleted within the sub-basins and how much water should be committed to downstream uses. This indicates a need for more action on overall water resource management, especially when basins become closed, and a need for more research on how to define rights to and commitments for water.

4. The Role of Storage in Basin Development

As water scarcity and the uncertainty of supply increase in many river basins, water storage is a practical, and in some cases the only, solution to water crises. This is especially so in monsoon Asia and the developing countries in the tropics and semi-arid tropics. As an intermediate step, it is necessary to carry out water accounting inventories on all the river basins of a country and to assess whether they are open, closed or semi-closed (Keller et al. 2000) The productivity of water as presently used must also be assessed to determine the extent to which increased demands for irrigated agricultural production can be met by increasing water productivity, and the extent to which increased demands will require increased consumption of water. The uncommitted discharges from those basins that are open or semi-closed must be determined and plans made to effectively capture and put this water to use. Combinations of small and large storage of surface water and groundwater recharge are generally the best systems where they are feasible. In monsoon Asia, research and development are needed on how to manage water under monsoon conditions. Increasing fresh water storage through a combination of groundwater recharge and large and small surface water facilities is critical to meeting the water needs of the 21st century.

It is important to consider complementary opportunities among different types of storage systems to improve conservation and productivity of water. Water conservation per se may not improve water productivity because of inefficient operation and mismatches with crop water requirements. Table 7.2 presents the characteristics of storage types for providing the needed conservation and operational efficiencies.

Table 7.2: Characteristics of Storage Structures

Storage Type	*Conservation Potential*	*Operational Flexibility*	*Adequacy*	*Reliability*
Large reservoir	H	L	H	L
Small reservoir	L	H	L	L
Groundwater storage	H	H	L	H
Large and small reservoirs combined	H	H	H	L
Large and small reservoir combined with groundwater recharge	H	H	H	H

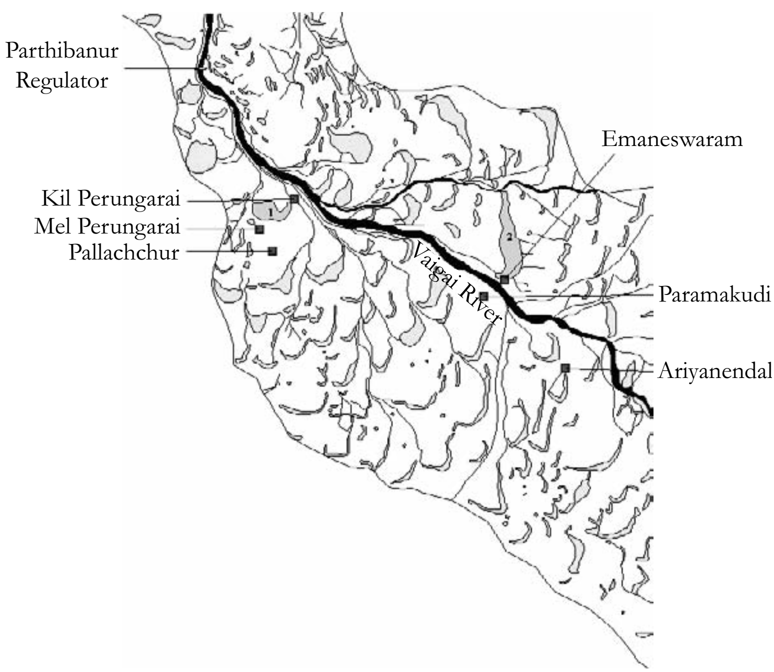
Notes: H = high; L = low; Adequacy = sufficiency of yield to meet needs of command area; Reliability = Assuredness of water deliveries.

Among the alternatives available, combinations of storage types depend on a number of factors including topography, hydrology, and the existence of suitable aquifers.

A number of combinations already exist and work satisfactorily. The combination of small and large reservoirs is nicely demonstrated by the 'melons on a vine' irrigation schemes in China, Sri Lanka and other countries. An example of cascading of tanks, getting their water supply from a storage reservoir from India, is presented in Figure 7.2. Here, a few large storage facilities supply water to numerous small tanks within a river basin. In this manner, small reservoirs act to dampen supply and demand mismatches from large reservoirs. In southern Sri Lanka, construction and linking of a large storage reservoir at Lunugamvehera with five small existing cascading reservoirs resulted in a 400 per cent increase in crop production. In fact, cascading small reservoirs can significantly increase crop water use by capturing drainage, return flow, and surpluses from upstream reservoirs.

Complementarities also occur where surface storage, particularly in the form of micro-reservoirs, retards run off and enhances ground water recharge. With improved tubewell technology now available

Figure 7.2: Cascading of Tanks from Vaigai Reservoir, Tamil Nadu



and within reach of small farmers, many storage reservoirs, which were previously used as irrigation tanks in the arid and semi-arid tracts of India, have now been converted to recharge ponds, and tubewells have taken the place of irrigation canals (see Box 7.2).

Box 7.2: Conjunctive Use of Groundwater and Small Reservoir Water

Oosambadi Peria Eri is situated 10 km from Thiruvannamalai in Tamil Nadu, India. This small reservoir has an 80-hectare command area, 53 farmer beneficiaries, and 60 wells, mostly dug. Prior to 1986, only one crop was grown. Even this crop could not be successfully irrigated without supplemental well water, because reservoir water, when directly used for irrigation, was sufficient only for about 70 days when the reservoir was full.

In 1986, only four farmers in the command area did not own wells. It was decided by the Water Users' Association that these four farmers would be provided with water at the common cost and that the reservoir water would be used only for recharging the aquifer. In 1986, the sluices of the reservoir were permanently closed. From then on, farmers have grown two crops, paddy and another crop. Conjunctive use of surface water and groundwater has been practiced for the last 14 years. Similar switching over to conjunctive use has taken place in more than 16 minor irrigation reservoirs in the dry district of Coimbatore, Tamil Nadu.

These successful experiments indicate that combinations of big and small reservoirs along with effective aquifer management can provide efficient solutions for conserving water and increasing productivity. Hitherto, this concept has not been effectively put into practice from the planning stage, although it has been in practice in many parts of the world. With water becoming scarce, use of such integrated planning for conserving water could lead to higher water productivity while maintaining environmental and ecological balance.

Complexity of Water Supply in the Basin Context

Water supply is an especially tricky concept in the basin context. The first thing to realise is that water is ultimately a renewable resource at the basin level. One uses all of one year's supply of water and then, on the average, the same amount of water is available for use the next year. There are no resources other than water (except perhaps solar energy and atmospheric air) that are not subject to depletion over time.

Second, the fact of water recycling complicates the concept of water supply. The primary water supply is provided by precipitation. The secondary water supply is provided by recycling the primary supply. An example of this is a series of hydroelectric dams on a river. The primary water supply to the first dam flows out of the turbines into the river bed where it becomes a secondary source of supply to the second dam; then the outflow from this dam becomes tertiary supply to the third dam and so on. The total supply to all these dams—the sum of the primary and secondary supplies—is a multiple of the primary water supply. This water multiplier effect (Seckler 1996) is extremely important in managing the basin's water resources. A major consequence of the water multiplier is that the effective supply of water in a system—the sum of all the deliveries—is much larger, perhaps several times more, than the primary supply. This fact can lead to major mistakes in estimating water scarcity.

Because of these multiplier effects, development and management of basin-wide water resources is inherently complex. Two examples are given to demonstrate how return flow, a secondary source of water supply, can affect the design and operation of an irrigation system (see Box 7.3).

Box 7.3: Effect of Irrigation Return Flow on the Design and Operation of Irrigation Systems

Kedar is a rainfed tank in Villupuram District of Tamil Nadu. When this tank was taken up for rehabilitation, the main channel leading from the deepest sluice of the tank was designed by the Public Works Department (PWD) for design discharge of primary water coming out of the sluice. No return flow was taken into account. According to their design, the channel cross-section got reduced because water from the main channel got diverted as water moved from the head to tail end of the channel.

(*Box 7.3 continued*)

(*Box 7.3 continued*)

When this design was discussed with the user community, the community objected to this design because of their experience of return flow from the paddy fields entering into the channel, especially during the time of flooding due to rainfall. They argued and suggested that the cross-section of the channel has to increase from head to tail instead of reduction in cross-section. In spite of the community objection, the PWD went ahead and built the channel as per their own design. In the first flooding of the paddy field itself, the main channel overflowed and inundated the adjacent paddy fields, which forced the farmers to destroy the lined cross-section of the channel to remove the drainage congestion.

The second example comes from Uda Walawe irrigation Project of Sri Lanka. Emplipitya block of Uda Walawe Project has steeply sloping paddy fields, with soil being very porous near the head of the filed channel and clayey at the tail end. In this block, the filed channels were designed for a discharge of 30 litres per second to irrigate an area of 16 to 18 ha on a weekly rotational basis. The inlet to the fields was fitted with 3-inch concrete pipe outlet. During the design, the difference in soil condition and the return flow from head reach to the tail end of filed channel were not taken into consideration and a schedule of operation was prepared without these factors and put into operation, but the farmers could not follow the schedule prepared by the officials. This was because the 3-inch pipe diameter provided at the head of the field channel was not sufficient to make the water advance rapidly into the field because of the high porosity. The tail-end paddy farmers did not water their paddy fields because of the return flow from the upstream fields; instead they drained their fields at intervals to provide aeration. On the other hand, the head-reach farmers watered their fields at least twice a week to keep standing water in their fields. In both the situations farmers did not use the concrete pipe inlet to their fields and removed it, and the whole schedule of operation got modified to meet the local conditions.

These two examples illustrate the need for clear accounting of the return flow for better design and operation of irrigation systems.

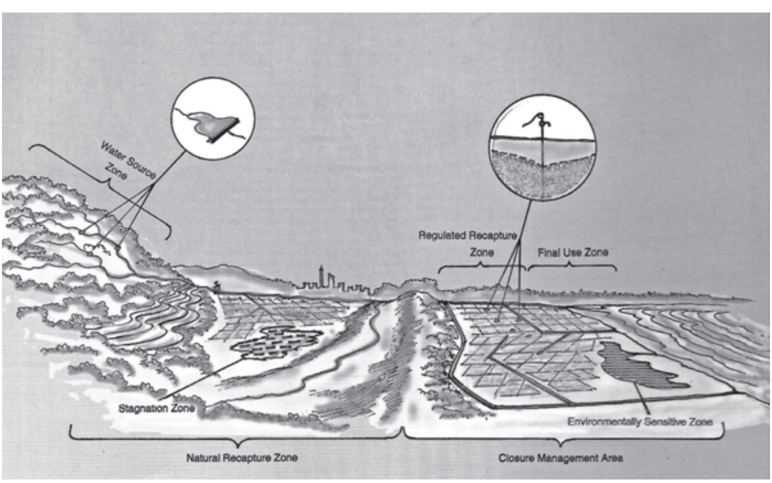
Often, the interactions between primary and secondary water are ignored when making development and management decisions, and the consequences are dealt with after the damage is done. Because of increasing pressure on water resources, we have no choice but to deal with complexities. Under these conditions, we need to characterise basins that will help managers, researchers, and stakeholders think about how water is used, and to develop strategies to consider the interaction between uses of water.

5. Hydronomic Zones

Hydronomic zones were developed to help untangle some of the complexities of basin-wide water resource use (Molden et al. 2000). The zones were developed based on recognition that there are certain key similarities between various hydrological, topographical, and hydro-geological conditions within basins. The second key consideration for zoning is the fate of water flowing out of well-defined reaches within basins. Recognition of the physical conditions, plus consideration of water outflow, allows us to define a unique set of hydronomic (hydro = water + nomous = management) zones.

River basins can be broadly divided in to six hydronomic zones (see Figure 7.3): a Natural Recapture Zone, a Regulated Recapture Zone, a Final Use Zone, a Stagnation Zone, a Water Source Zone, and an Environmentally Sensitive Zone. Across these zones, some key

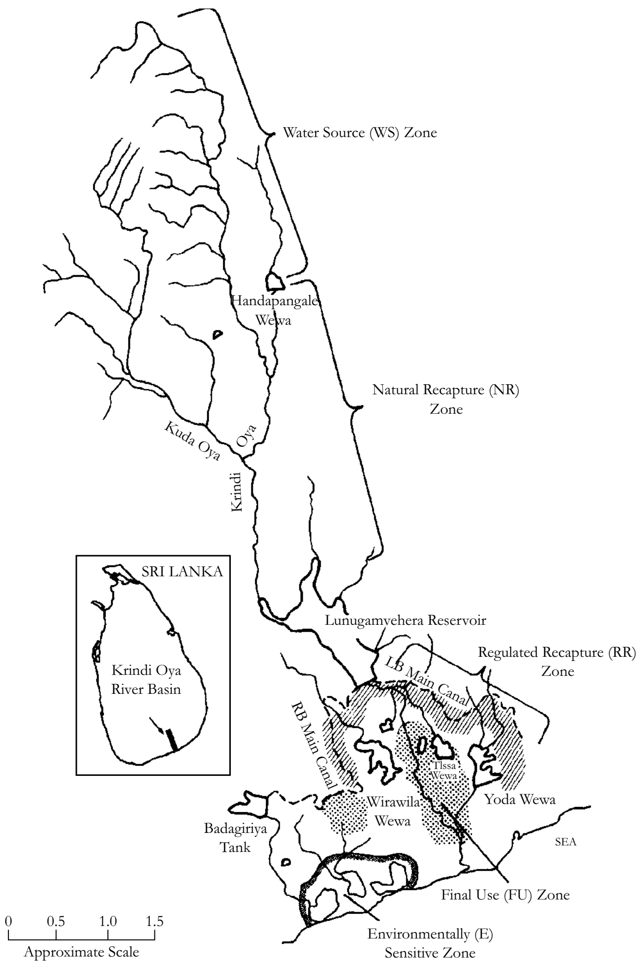
Figure 7.3: Hydronomic Zones in a River Basin



conditions are identified, such as whether or not groundwater can be used for storage or utilisation and whether or not there is appreciable pollution or salinity loading (see Box 7.4).

An example of hydronomic zoning of Krindi Oya basin in Sri Lanka is presented in Figure 7.4.

Figure 7.4: An Example of Hydronomic Zoning of Krindi Oya Basin in Sri Lanka



Box 7.4: Hydronomic Zones

- **Natural Recapture (NR) Zone:** A reach or area of the basin where surface and sub-surface drainage water is naturally recaptured by river systems or channel networks, and is available for reuse.
- **Regulated Recapture (RR) Zone:** A reach or area of the basin where the reuse of surface run-off, spills, drainage, seepage or deep percolation water can be regulated. Groundwater or a drainage network that is physically separate from the distribution network captures drainage flows and is a source of reuse of water.
- **Final Use (FW) Zone:** A reach or area of the basin where there is no further opportunity for downstream water reuse for productive activities.
- **Stagnation (S) Zone:** Any isolated area where the drainage capacity is insufficient for the removal of leached salts and excess water.
- **Water Source (W) Zone:** Any area where there is excess precipitation that provides run-off or ground water recharge that is later used for other downstream process uses. It is the area of the basin where most of the run-off or water supply originates.
- **Environmentally Sensitive (E) Zone:** An area where there is a requirement of water for ecological or other environmentally sensitive purposes.

Conditions Within Zones

- **Pollution or Salinity Loading:** An area where appreciable pollution or salinity is added to the basin.
- **Ground Water Storage/Utilisation:** An area where fresh water aquifers are used for recapturing and distributing and/or storing water.

Hydronomic zones provide a quick characterisation of river basins and an overview of areas with special considerations. They also provide an indication of water flow paths, and how changes in use may affect other uses. For example, a Stagnation Zone is one where there is difficulty in draining water, and problems and solutions may initially be quite localised. In Regulated Recapture Zones where groundwater is significant, we consider recharge as a means of recapture, and pumping as a way to distribute the recaptured water. In these zones, changes in pumping and recharge will affect other uses.

With hydronomic zones, we can isolate problems and solutions, without having to give detailed consideration to the rest of the basin. For example, reducing outflow from final use zones up to an environmental limit requires considerations much different than in natural recapture zone where drainage flows are readily recaptured in a river system. This is helpful to people working at, say, an irrigation system scale, who may otherwise get overwhelmed by thinking how their water use will affect someone else at the far end of the system.

Scale issues are complex in river basins primarily due to water reuse and pollution loading. For example, solutions to saving water at the scale of domestic water supply or an irrigation field may not scale up to water savings at the basin level. The zones are particularly useful in identifying areas where water saving techniques at a small scale will lead to basin-wide water savings. For example, reducing deliveries and outflows from fields in the natural recapture zone may not lead to real basin-wide water savings, rather, it only provides a means to re-route water through the system. Reducing deliveries and outflows within the Final Use Zone, taking into consideration environmental requirements, can lead to real water savings. This simple observation is important, because a common mistake is the desire to apply field-water-saving techniques everywhere within a basin.

Hydronomic zones provide an important means to communicate how water is used within a basin. Hydronomic zones, combined with other information techniques, have a potential to aid in communication between various stakeholders within a basin, and lead to better decisions about how basin water resources are used.

6. Hydrological Modelling

Hydrological modelling simulates the conversion of precipitation to run-off through all of the natural processes involved such as evaporation, infiltration, transpiration, surface flow, interflow and groundwater flow. At the same time, hydrological models simulate those anthropogenic activities which affect the flow of water from source to sink, such as dams, reservoirs, diversion and irrigation schemes.

Using models gives two important advantages over relying solely on collected data. First, models can be used to understand processes that are difficult to measure because of complexity or temporal and/or spatial scale. Second, models can be used to study the effects of changes in land cover, water management or climate, and the impacts of alternative scenarios. Hydrological models can be applied at many different scales, from farm field to basin to continent. Using more than one scale can give increased insight into the processes involved and can help clarify the effects of different management options.

Types of Models

A hydrologic model, like any other model, is intended to be a realistic representation of a physical system, and the details of its design will depend on the purpose of the modelling. The simplest form of hydrological model is probably a regression-type relationship between precipitation and run-off and, for many purposes such as supply forecasting, this type of model works well (Kite 1997). More advanced block-box models such as Constrained Linear System (CLS) have also proved useful, having few parameters and being easy to calibrate. However, stochastic or black-box models are only mathematical propositions and have no physical basis. They may only be applicable to the period and conditions of original data. If the only modelling requirement is to simulate or forecast the stream flow hydrograph, then one of the many lumped parametric watershed models may suffice. For example, the early lumped Stanford Watershed Model was applied successfully to many basins worldwide and spawned many modified and adapted versions.

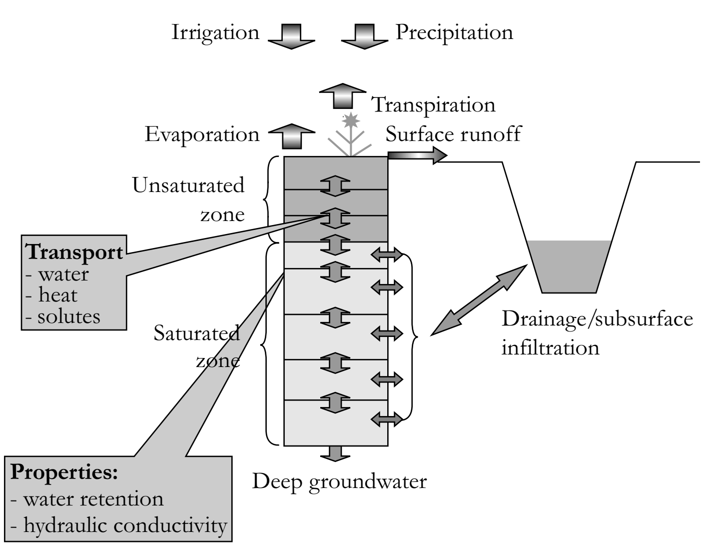
The lumped basin models were often developed into semi-distributed models, which divide the watershed into sub-elements based either on elevation or on land use area. However for accurate modelling of soil moisture and run-off at many points in a watershed, it will be necessary to use a more physically realistic distributed model such as the *Système Hydrologique Européen* (SHE) (Abbot et al. 1986).

In the river basin context, hydrological modelling has been applied to evaluate the water management practices to specific context such as an irrigation project. Such isolated application, while yielding reliable results to manage the specific project, may not yield any result to look at the interaction between other uses within a basin context. Changes in management infrastructure, crops and crop patterns, and fertiliser and pesticide use in irrigation schemes may affect other uses in the basin. And changes in other water uses—industrial, power production, and urban water supplies—can affect the quality, quantity and timing of water available for irrigated agriculture. As demand and competition for water increase, these links become more and more important, and real increases in the productivity of water will become essential if the requirements of all users are to be met.

At the smallest scale (the field), a vertical water balance model such as Soil–Water–Atmosphere–Plant (SWAP) model can be used to show the relationship between water quantity and quality and crop yields (VanDam et al. 1997) (see Figure 7.5).

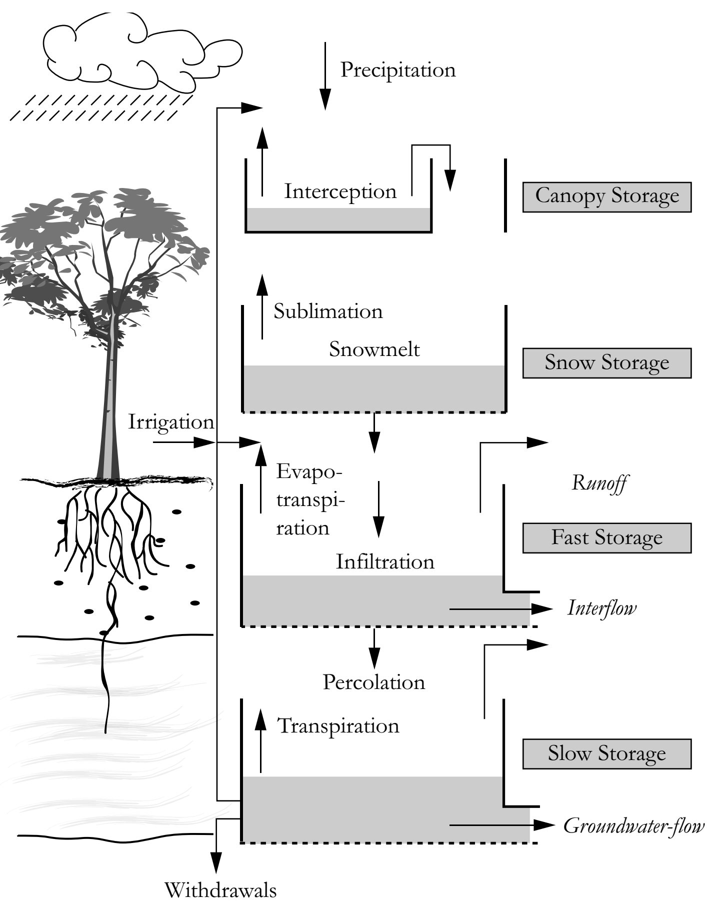
At the irrigation project level, an integrated one-dimensional model such as SWAP can be used to represent types of crop, soil type, and

Figure 7.5: Overview of the Agro-hydrological Model SWAP



types of irrigation (Droogers et al. 1999). This type of model provides information on the effects of management changes in water distribution and allocation, and of these changes on the productivity of irrigation schemes. At the basin scale, models such as Semi-distributed Land Use-based Run-off Process (SLURP) hydrological model can be applied (Kite 1997) (see Figure 7.6). The major advantage of process models such as SLURP is that they can incorporate necessary physics while retaining comparative simplicity of operation.

Figure 7.6: Outline of the Vertical Water Balance of the SLURP Model



The SLURP model divides the water basin into many sub-basins, known as Aggregated Simulation Areas (ASAs). Within each ASA, the model simulates each different land use separately. The detailed information derived from each land use within each ASA is integrated and routed down through the basin, including the effects of regulation and diversions. This enables an evaluation of each irrigation scheme against the prevailing basin-wide water management practice; climate variability is also taken into account in the model, and the hydrologic impacts of climate change can be evaluated.

Transferring data and information between the three modelling scales allows us to see the performance of individual crops within an irrigation scheme, within the context of the overall water resource of the basin. The use of hydrological models at different scales in an integrated manner constitutes 'Integrated Basin Modelling'.

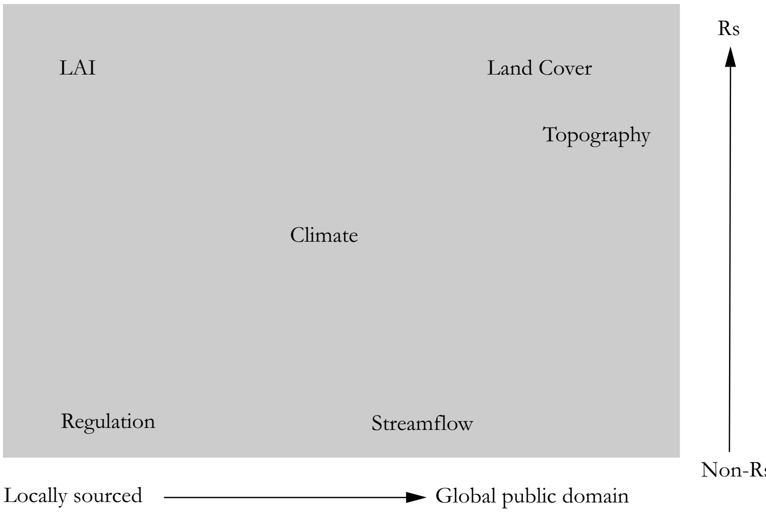
Data for Modelling

Data needed for integrated basin modelling can be divided into two categories: areal data and point data. Areal data include topography, land cover, Leaf Area Index (LAI) and soil characteristics. Point data include climate, stream flow, and operational rules for reservoirs, dams and regulators. Obviously climate data are needed across the whole basin but are available only as point data. Currently, two changes in methods of data access and data collection can be observed. First, data are increasingly available from global data sets, often obviating the need for both time-consuming measurement campaign and sometime tedious process of collecting data from local agencies. Second, more and more data are collected by remote sensing (RS) instead of conventional techniques. Figure 7.7 shows the position of commonly used types of data within this categorisation by data source and data type (Kite and Droogers 2000).

Topographic analysis

Topographic data are more and more available as global data sets and are increasingly measured by remote sensing techniques such as laser altimeters. In terms of availability at basin scale, global public domain availability is high. A Digital Elevation Model (DEM) from a USGS

Figure 7.7: Data Required for Integrated Basin Hydrological Modelling as a Function of Availability and Method of Observation



(United States Geological Survey) GTOPO30 data set available on the World Wide Web (USGS 1998) can be downloaded from the Internet. These data can be used to define basin boundaries and river networks, to sub-divide the basin into sub-basins and to calculate distances traversed by water from one pixel to the nearest stream and down the stream network to sub-basin outlet. These products can be derived by applying the TOPAZ (Topographic Parameterization) program to the USGS data set (Garbrecht and Campbell 1997).

Land cover classification

Land cover classification has received considerable attention during the recent past as a result of widespread concern about environmental effects. Developments in RS and Geographical Information Systems (GIS) have inspired many people to produce land cover maps. The base data for the land cover map are normalised difference vegetation indices (NDVI). NDVI from US National Oceanic and Atmospheric Administration (NOAA) images of Advanced Very High Resolution Radiometer (AVHRR) satellite data at 1-km resolution have been demonstrated to be very suitable for identifying ecologically homogenous land units. The great advantage of this data set is that radiometric calibration, atmospheric correction and geometric registration for all the images are already performed. These data sets can very well be used in the South Asian context too. NOAA images can be freely downloaded from the Internet (http://edcwww.cr.usgs.gov/landdaac/glcc/glcc.html).

Leaf area index
Leaf area indices (LAI) are generally local and are obtained by transforming public domain RS data. LAI values are necessary to estimate the amount of precipitation intercepted and to distinguish soil evaporation from crop transpiration on the basis of relative land cover. LAI data can be derived from NDVI, obtained from an analysis of NOAA–AVHRR satellite images by using a linear relationship between NDVI and LAI.

Soils
Soil characteristics such as infiltration rate, water-holding capacity, wilting point, field capacity, groundwater levels and layering of soils are important in terms of hydrological processes. Remote sensing techniques to obtain soil characteristics are still limited, as most of these techniques are able to detect earth surface properties, while the required soil characteristics should also reflect the sub-soils. A locally available soil map with an appropriate resolution (1:200,000) for basin-scale analysis is preferred. Pedo-transfer functions can be used to derive hydraulic soil functions such as water retention and hydraulic conductivity properties from soil texture and bulk density (Tietje and Tapkenhinrichs 1993).

Meteorological data
Meteorological data may be obtained from local climate stations or from global databases. The simulation models generally require daily data for temperature, precipitation, relative humidity, wind speed and sunshine hours. For the basin scale model, average data for each sub-basin were derived using Thiessen polygons and adjusting for differences between the elevation of the climate stations and the average

elevation of the sub-basin. Lapse rates for temperature and relative humidity were 0.75C/100m and 0.15C/100m, respectively and a change of 2 per cent/100m of precipitation with elevation can be used. For the irrigation project and field-scale models, the nearest climate station data can be used.

Modelling Application

The basic descriptions of SWAP and SLRUP models are given elsewhere (Kite 1997; Kite and Droogers 2000) and will not be detailed here. These models have been applied to a number of basins in countries such as Turkey, Iran, Vietnam and Thailand, where flow measurement data are available at salient points in the basin. Herein, some results of their application to Gediz basin in Turkey by Kite et al. (2001), will be briefly described; it is one basin where these models have been extensively applied and discussed. The study adopted a three-stage approach in deciding what to model and how to model it. This involved in identifying possible scenarios, discussing the perceived importance and relevance of the scenarios with concerned individuals and organisations, and developing a generic set of probable scenarios from these responses. The authors used the three-level modelling described earlier.

Table 7.3 shows the results from seven selected scenarios in quantitative form for the key parameters at three spatial scales. For each scenario, results are given for a dry and a wet year. At basin level, mean discharge and minimum discharge have been used to compare different scenarios. At irrigation system level, relative water supply (total crop transpiration/irrigation releases) and productivity of water are the indicators used. The productivity indicators look at gross returns per cubic metre of irrigation water supplied both in terms of yield (kg/m^3 of irrigation water) and value (US$/$m^3$ of irrigation water). The data have been calculated for an upstream system (SRB) and a downstream system (MLB) to determine if there are differences in the impacts of the various scenarios within the basin. At field scale the analysis compares predicted cotton and grape yields, potential transpiration and actual transpiration and actual evaporation. Box 7.5 gives the impacts of different scenarios for three scales considered.

Table 7.3: Model Results of Different Scenarios

	Baseline Scenario		*Scenario 1*		*Scenario 2*		*Scenario 3*		*Scenario 4a*		*Scenario 4b*		*Scenario 5*	
	Dry	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*
Basin level														
Mean Q ($m^3\ s^{-1}$)	6.10	18.20	3.30	11.80	7.20	19.30	5.90	17.80	6.20	17.50	N/A	N/A	N/A	N/A
Min Q ($m^3\ s^{-1}$)	0.04	0.40	0.03	0.30	1.80	3.70	0.04	0.40	0.10	0.50	N/A	N/A	N/A	N/A
Irrigation-system level														
RWS[1], MLB[2]	0.44	0.81	0.45	0.68	0.24	0.56	0.44	0.08	0.45	0.81	N/A	N/A	N/A	N/A
RWS, SRB[3]	0.22	0.40	0.29	0.42	0.22	0.40	0.22	0.40	0.21	0.45	N/A	N/A	N/A	N/A
PWirr[2], MLB (kg m^{-3})	1.06	0.74	1.05	0.78	2.00	1.06	1.07	0.74	1.06	0.74	N/A	N/A	N/A	N/A
PWirr, SRB (kg m^{-3})	1.97	1.29	1.67	1.26	1.97	1.29	1.97	1.29	2.06	1.14	N/A	N/A	N/A	N/A
PWirr, MLB ($ m^{-3})	1.33	0.92	1.31	0.97	2.50	1.33	1.33	0.92	1.32	0.92	N/A	N/A	N/A	N/A
PWirr, SRB ($ m^{-3})	2.46	1.61	2.09	1.57	2.46	1.61	2.46	1.61	2.58	1.42	N/A	N/A	N/A	N/A
Field level														
Cotton														
Yield (kg ha^{-1})	1,620	2,739	1,439	2,527	N/A	N/A	N/A	N/A	1,629	3,268	1,508	2,860	1,080	2,040
Tpot[3] mm y^{-1}	703	513	832	597	N/A	N/A	N/A	N/A	703	513	703	513	703	513
Tact[4] mm y^{-1}	307	395	307	435	N/A	N/A	N/A	N/A	280	441	268	391	129	274
Eact[5]mm y^{-1}	187	204	188	208	N/A	N/A	N/A	N/A	227	224	194	207	169	191

(*Table 7.3 continued*)

(Table 7.3 continued)

	Baseline Scenario		*Scenario 1*		*Scenario 2*		*Scenario 3*		*Scenario 4a*		*Scenario 4b*		*Scenario 5*	
	Dry	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*
Grape														
Yield (kg ha^{-1})	3,316	4,193	2,350	3,846	N/A	N/A	N/A	N/A	3,576	4,495	3,838	4,630	3,090	3,609
Tpot mm y^{-1}	1,056	859	1,277	1,031	N/A	N/A	N/A	N/A	1,056	859	1,056	859	1,056	859
Tact mm y^{-1}	684	782	635	854	N/A	N/A	N/A	N/A	631	742	647	779	462	620
Eact mm y^{-1}	146	154	147	156	N/A	N/A	N/A	N/A	169	167	147	156	134	148

Source: Kite et al. (2001: 22)

Note: Results from the different scenarios for the three scales considered. Scenario 1 is the climate, Scenario 2 maintains a minimum base flow, Scenario 3 increases water allocation for urban and industrial use, Scenario 4 extends the irrigation season, and Scenario 5 uses less water for irrigation. The dry and wet years are 1992 and 1997 respectively.

[1]RWS is relative water supply defined as the ratio of the irrigation applied to the crop transpiration.

[2]PWirr is the crop productivity per cubic metre of water applied.

[3]Tpot is potential crop transpiration.

[4]Tact is actual crop transpiration.

[5]Eact is actual soil evaporation.

N/A indicates not applicable for the given scenario–scale combination.

Box 7.5: Impact of Different Scenarios for the Three Scales Considered

Basin-level impacts

In terms of overall basin conditions, climate change has by far the greatest impact if current management practices and water allocation practices are maintained. Average flows decrease to about two-thirds of their current levels in a wet year and by almost half in a dry year. Minimum flows fall by roughly a quarter in both wet years and dry years, with virtually no flow in a dry year. This has serious environmental implications not only because the wet lands will continue to be damaged in such dry conditions but also because pollutant concentrations will be even higher than current levels. The other scenarios have much less impact at basin level. The increase in urban water extraction has no significant impact compared to present conditions. This is because urban water extractions remain small compared to agricultural use and making changes in the way irrigation water is allocated and managed does not have much impact on total depletion or on return flows from irrigation schemes.

Irrigation system-level impacts

In terms of relative water supply the greatest impact comes from climate change (Scenario 1) and increasing minimum base flow (Scenario 2). The effects are felt more in the lower part of the basin than in the upper part and result in much lower relative water supply. The effect on the productivity of water is also mainly restricted to the lower part of the basin, but the trend reverses: lower relative water supplies are associated with higher productivity of water. The other scenarios have very little impact on conditions at irrigation system level.

Field-scale impacts

Climate change (Scenario 1) will reduce crop yields as precipitation will be lower and potential evaporative demand will increase. The effect is to reduce current yields by nearly 9 per cent in a wet year and by 11 per cent in a dry year. Extending the irrigation season has positive effects on yields (Scenarios 4a and 4b). In Scenario 4a, irrigation interval does not change but the amount of water applied per irrigation will be reduced. In Scenario 4b, it was assumed that the interval between subsequent applications would increase, but that the amount of water applied per

(*Box 7.5 continued*)

(*Box 7.5 continued*)

turn would remain the same as in the base scenario. In Scenario 4a, wet year predicted cotton yields increase by 19 per cent while grape yields increase by 7 per cent. In dry years, cotton yields remain unchanged but grape yields increase by 8 per cent. For Scenario 4b, cotton yields in wet years are slightly higher than at present, but dry year yields are lower. However, these scenarios result in the highest grape yield in both wet and dry years. This indicates that farmers might consider modifying their irrigation practices with more frequent but smaller applications for cotton and less frequent but larger application for grapes. Finally, a decrease in irrigation inputs from 500mm/season to 300mm/season (Scenario 5) will reduce the expected yields, with cotton suffering more from this effect than that of grapes.

It may be stated that the limited scenarios discussed represent the most likely changes that are to take place in the future; however, with the existing model and data sets many more scenarios can be defined and tested. The advantage of the approach adopted here is that it is not difficult to compare different alternatives and see which ones will be most likely to be acceptable to different water users. Apart from Scenario 1, which cannot be controlled, efforts to save water can result in continued irrigated agriculture with high yields and productivity. This suggests that there are still possibilities for maintaining high overall output from the basin without the agriculture sector losing out.

In conclusion, it may be stated that many water basins are facing water shortages due to increasing demands on water from all sectors. It is vital that key information about water use and availability is presented in a way that can benefit policy-makers. Choices, trade-offs and evaluation must be described using appropriate tools for IWRM.

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8

Water Allocation between Agriculture and Hydropower: A Case Study of Kalthota Irrigation Scheme, Sri Lanka

LALANI IMBULANA

1. INTRODUCTION

Water Resources and Irrigated Agriculture

SRI LANKA HAS 103 river basins, out of which 17 basins have a drainage area of over 1,000 sq km. Most of these rivers commence from the central hills and flow into lower regions in different directions and ultimately reach the sea. These 17 basins cover 62 per cent of total land area of the country, while the largest one, the Mahaweli basin, spreads over nearly 16 per cent of the land.

The average annual rainfall of 1,900 mm brings 132 billion cubic metres (BCM) of water resources to the country during the north-east and south-west monsoon periods. The country is divided into two broad climatic zones based on the annual rainfall: the wet zone and dry zone. The wet zone receives an average annual rainfall of more than 2,000 mm and the dry zone receives below 2,000 mm. The wet zone covers around 25 per cent of the total land area. The dry zone receives most rainfall from October to January during the north-east monsoon period, supplemented by lower amounts of rain during April to May from the south-west monsoon. The wet zone gets rain during the south-west monsoon as well as the north-east monsoon.

Sri Lanka is an agricultural country having a total land area of 65,610 sq km, out of which about 24 per cent is used for agricultural purposes. About 75 per cent of the country's population lives in rural areas and around 40 per cent of the people depend on agriculture for their livelihood. Agriculture has been the mainstay of Sri Lanka's national economy for a very long time, though the importance has diminished in recent years. The agriculture sector currently contributes about 22 per cent of the GDP, with paddy representing only 3.5 per cent. In 1999 it accounted for 13.4 per cent of the Gross Domestic Product (GDP) but employed 36.3 per cent of the active labour force (Department of Census and Statistics, 2000a).

The present trend is towards contribution of agriculture to GDP decreasing further. However, agriculture, especially paddy cultivation, plays a major role in the rural economy, despite its low returns to farmers. Rural development basically depends on water resources and agricultural development. The major user of the water resource is the agriculture sector. The other uses, such as domestic, industrial, ecological and environmental, are comparatively small. Recent estimates show that the irrigated agriculture sub-sector utilises about 90 per cent of the developed water resources of the country.

The total cropped land area in Sri Lanka is about 1.9 million ha, which is 29 per cent of the total land area. Out of this, about 635,350 ha of land is provided with irrigation facilities. Most of these irrigated lands are located in the dry zone and mainly developed for paddy cultivation, accounting for more than 75 per cent of total paddy production in the country. Present rice production, including that from rainfed area, is sufficient to meet more than 90 per cent of the country's needs. Rice is the staple food in Sri Lanka and considered as the most important agricultural sub-sector in the country as this brings food security to the rural population to some extent.

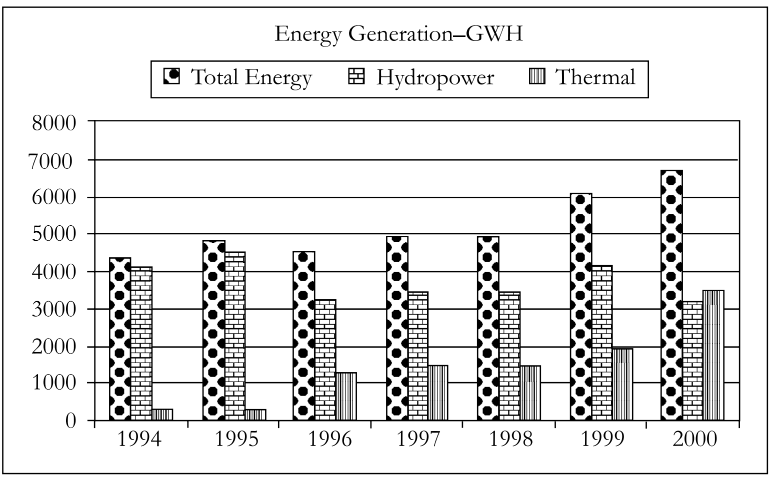
Energy Generation and Hydropower in Sri Lanka

The Ceylon Electricity Board (CEB), a government-owned monopoly, is responsible for generation and transmission of electrical power in the whole country. About 56 per cent of Sri Lankan households were supplied with electricity in 2000. The present trend is that the annual total energy demand increases by 10 per cent. The total energy demand is supplied through hydropower, thermal power of CEB and through hired private power. The purchases of private power increase annually as the total installed capacity belonging to CEB is not sufficient to meet the increasing total demand.

Hydropower has been the major contributor to electricity generation since the introduction of electricity. The dependence on hydropower slightly diminished since the recent establishment of thermal power plants to meet the increasing demand for energy. Thermal power generation is comparatively more expensive than hydropower, despite petroleum products being available to CEB with duty exemption from another state monopoly.

Figure 8.1 shows the energy generation by each source for the 1994–2000 period.

Figure 8.1: Energy Generation by Different Sources



Source: CEB–*Statistical Digest*, 2000

The present base load is 450 MW and it gets doubled to 900 MW during the morning peak. The night peak is around 1,380 MW, which is almost three times the base load. The operational arrangement is to supply the peak loads with the available hydropower and to cover the deficit through thermal power. In the absence of full hydropower capacity due to insufficient storage in the reservoirs, the CEB is compelled to hire private power, which is much more expensive than hydropower energy.

In 2001, the CEB could not supply the total demand as the water storage in the reservoirs was very minimal and was not sufficient to cover the total energy requirement during peak hours. Even though thermal and hired private power were used extensively, the CEB had to impose severe power cuts, not only during peak hours but also during the daytime. The CEB spent huge sums of money on hired power, as the rates are much higher than for hydropower or thermal power production. For example, in 2000 expenditure on private and hired thermal power purchases was Rs 5,352 million at an average unit cost of Rs 6.10 per kWH (CEB 2000).

Hydropower

Sri Lanka has, by virtue of its topography, a very limited potential for hydropower and most of the available potential has already been developed. The first hydropower station was commenced in 1950 with an installed capacity of 25 MW (Arumugam 1969). Since then until the last decade there was a rapid expansion of hydroelectric projects that brought the country's total installed capacity to 1,137 MW from 12 major hydropower projects located in three river basins. An additional major hydropower project is under construction in Kalu Ganga river basin that will supplement the present capacity in early 2003. The majority of the power stations are located in the biggest river basin, the Mahaweli river basin. Another five hydropower stations are located in a water-rich basin in the wet zone. There is one station in the Walawe river basin and this chapter discuss this project in detail.

Table 8.1 gives details of power stations and the installed capacities available in Sri Lanka and their energy generation from 1999–2001.

Sri Lanka's hydropower generating system depends on the monsoon rains, mainly the south-west monsoon, and its timely arrival, intensity and adequacy. The energy production from hydropower is low during the dry months, especially from January to June. Due to inadequate rainfall received in the upper catchments since 1995, storage in most of the hydropower reservoirs dropped and this affected the energy generation considerably.

A considerable portion of the hydropower is generated under multipurpose water resources development projects that provide water for agriculture as well. Though hydropower generation does not consume water, incompatibility of irrigation demand and water demand for power generation causes operational problems.

Table 8.1: Installed Capacities and Energy Generation

Type	*Installed Capacity (MW)*	*Number of Power Stations*	*Generation 1999 (GWH)*	*Generation 2000 (GWH)*	*Generation 2001 (GWH)*
CEB					
Hydropower	1,137	12	4,152	3,154	3,045
Thermal power	4,53	6	1,396	2,235	1,896
Wind power	3	1	3	3	3
Private power	244	–	–	–	–
Mini hydropower	–	–	18	43	65
Thermal	–	–	507	916	1,170
Hired thermal	–	–	–	364	341
TOTAL	1,837		6,076	6,715	6,520

Source: CEB, Statistical Digest, 2000
Note: GWH = Giga Watt Hours
MW = Mega Watt

2. The Case

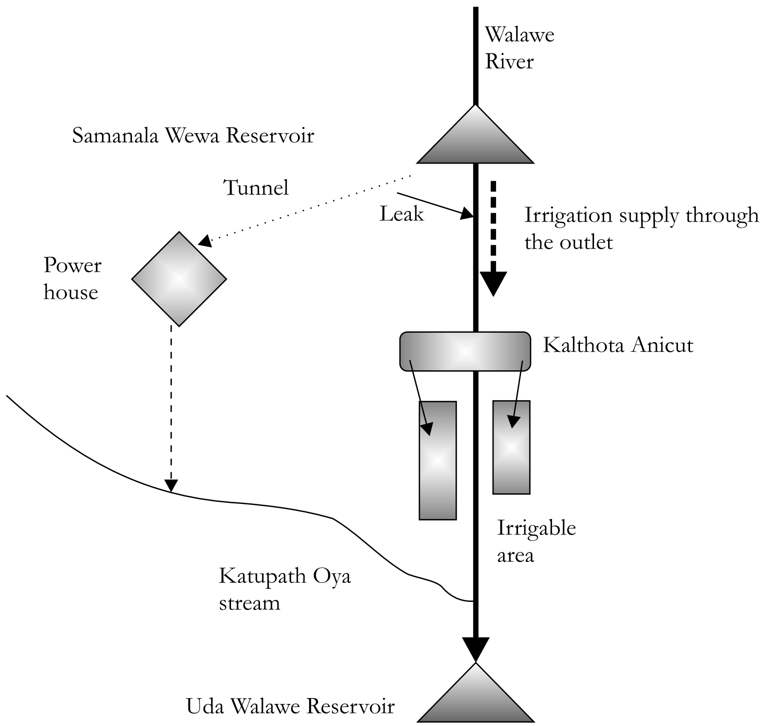
This chapter discusses a case of water sharing activity between the agriculture sector and hydropower sector in the Walawe river basin. The agricultural project (the Kalthota Irrigation Scheme) and the hydropower project (the Samanala Wewa reservoir) are both located in the upper segment of the Walawe river basin. The Kalthota irrigation scheme is an ancient diversion irrigation scheme restored in 1892, whereas the Samanala Wewa reservoir was constructed and impounded exactly 100 years after the Kalthota scheme restoration. The Samanala Wewa reservoir is located at the upstream of the Kalthota diversion structure and this obstructed the free flow to the irrigation scheme.

Figure 8.2 shows the main features of the irrigation scheme, the hydropower project and some other important components.

Walawe River

The Walawe river, the sixth largest river in Sri Lanka, is located in the southern part of the country and has a drainage area of 2,321 sq km. The Walawe river commences from the central hills, has a length of 132 km and falls to the sea at Ambalantota. There are seven major

Figure 8.2: Line Diagram of Main Features of the Walawe Basin Case Study



tributaries draining into the river. The Walawe river basin benefits from both the south-west and north-east monsoon rains that give an average annual rainfall of 1,860 mm. The upper segment lies in the wet zone and has a drainage area of 545 sq km with an average rainfall of 3,680 mm. The lower reach lies in the dry zone has a drainage area of 1,776 sq km and receives around 1,178 mm rainfall. This rainfall brings total water resources to the Walawe river basin of around 4.6 BCM (World Water Assessment Programme—Ruhunu Basins).

Samanala Wewa Hydropower Project

In 1992 the Samanala Wewa reservoir was constructed across the Walawe River just downstream of the confluence with Belihul Oya to harness the hydropower potential available in the Walawe river basin. This reservoir intercepts a highly productive catchment of 353 sq km and has a capacity of 278 MCM to store water at its full supply level of 460 m above mean sea level. The reservoir has a crest length of 530 m and a height of 100 m above the riverbed level. The water stored in the reservoir is diverted along a 5.4 km long tunnel to the power station located at Kapugala. The installed capacity of the powerhouse is 120 MW (2 × 60 MW), which is about 10 per cent of the total installed hydropower capacity in Sri Lanka. The tailrace canal of the powerhouse is connected to the Katupath Oya, a tributary stream of the Walawe River that connects to the Walawe river downstream of the Kalthota scheme.

The main objective of the project was to supplement the installed hydropower capacity, which, considering its national economy, has become an essential requirement of the country. The project was designed to produce firm electrical energy of 420 GWH annually and some secondary energy too.

With the construction of the Samanala Wewa reservoir, the inflow to the Kalthota irrigation scheme was totally cut off. An irrigation outlet is provided in the Samanala Wewa dam to supply the irrigation requirements of the Kalthota scheme and also to satisfy the environmental and ecological needs downstream of the Samanala Wewa reservoir. The Samanala Wewa reservoir is located in a geologically complicated area, and immediately after initial trial filling commenced in mid-1991 a major leak of around 2.5 cu m/s in the right-bank was observed. The reservoir was therefore not raised to its full supply level and major remedial works on the dam and surrounding area were carried out. Some deep grout curtain was provided after detailed studies and the second trial impounding was done in March 1992. The grouting did not bring results as favourable as expected and the leak appeared again in almost the same quantity as earlier. A group of internationally reputed experts were consulted on this matter and through investigations and detailed studies were carried out in the reservoir bed and the surrounding area. This team concluded that the dam was safe for full reservoir operation and recommended carrying out wet blanketing in the reservoir bed only in selected areas to reduce the leakage for economic reasons but not for safety reasons. From 1992 October till 1997 the reservoir was kept 30 m below the full supply level as a safety measure. As recommended by the consultants, wet blanketing was commenced in late 1997 and carried out in two phases. It was done in selected areas and completed in 1999. Even though this is an expensive engineering solution, the leakage was reduced by about 25 per cent due to sealing of most of the seepage paths and ultimately resulted in increased energy production. The present leak is around 1.6 cu m/s.

Uda Walawe Project

The Uda Walawe reservoir is located in the middle reach of the Walawe river basin, downstream of the Kalthota scheme. The reservoir is constructed across the Walawe river, was commissioned in 1968 and has a capacity of 269 MCM at full supply level. The reservoir intercepts a catchment of 1,152 sq km, including the Samanala Wewa catchment. This is mainly an irrigation project with an irrigated extent of 17,940 ha. With the new construction of Samanala Wewa, the Uda Walawe scheme is also partly affected as it gets water only if power is generated at Samanala Wewa.

Kalthota Irrigation Scheme

The Kalthota Irrigation Scheme is an ancient diversion scheme constructed across Walawe river. This scheme was restored in 1892 by constructing a right-bank canal and again renovated in 1956 by construction of a separate anicut (weir) to divert water to the left bank and extending the right-bank canal. With these improvements this scheme provides irrigation facilities for 920 ha. Almost the entire area is developed for paddy cultivation in both seasons. The right-bank canal is 11.5 km long and crosses a number of drainage streams. This canal irrigates 610 ha. The left bank canal is 5 km long and branches off into 3 distributaries; the total irrigated area in the left bank is 310 ha. All the irrigated lands lie between the contour canals and the river, which is a narrow strip on both sides of the river.

The catchment area at the Kalthota diversion structure is 410 sq km. With the recent construction of the Samanala Wewa reservoir in the upstream, the net catchment area has been reduced to 56 sq km (Walawe Ganga Basin, Final Report, WMS). This irrigation scheme is located in a very remote area, which is about 40 km away from the main town. Almost all the village development activities are linked with the agricultural activities as most of the village population is engaged in agriculture. There are over 1,600 farmer families within the scheme. The farmers in the Kalthota scheme are mainly subsistence farmers and their livelihood is agriculture. Other employment opportunities available in the village are very minimal.

Most parts of the irrigated area consist of alluvial soil with high sand content, which is not very suitable for paddy cultivation due to low water-holding capacity. The topographic conditions prevailing in the area aggravate this problem, resulting in high water consumption in paddy cultivation even during rainy seasons. The water usage of the Kalthota irrigation scheme is very high compared to other irrigation schemes in the country. But the Kalthota farmers are used to cultivating paddy in both *Maha* (wet period) and *Yala* (dry period) seasons annually, as agriculture is their main livelihood.

Each season Kalthota scheme receives water from Samanala Wewa through the irrigation outlet, in addition to the leak. The flow from the leak is around 1.6 cu m/s which is not sufficient to meet the full irrigation requirement. The balance quantity required is released through the irrigation valve, depending on the crop requirement at different growth stages. During rainy seasons the additional release from the valve varies according to the drainage inflow to the river between the reservoir and the Kalthota anicut. Even though the water usage at the Kalthota scheme is high, the paddy yields are around 5.0 MT/ha, which is above the national average yield of major irrigation schemes. The annual contribution to the national paddy production is around 9,000 MT, with an economic value of Rs 145 million.

The Kalthota irrigation scheme is operated and maintained by the Irrigation Department through the Irrigation Engineer (Ratnapura Division) under the supervision of the Regional Director (Colombo Region). A technically qualified project manager is stationed at the scheme to carry out the operation, water management, maintenance of the main system and also to organise farmer organisation activities, conduct the monthly project management committee meetings, and organise training and demonstrations.

Early in 1989 the government introduced a new policy to adopt participatory irrigation management in irrigation schemes, with the objective of improving overall management and performance. With this, the farmers were supposed to manage the operation and maintenance of the distribution system by contributing their labour and other resources. Accordingly, 13 system-level farmer organisations have been formed in the Kalthota scheme. At present these farmer organisations have taken over the entire sub-system after extensive training on water management, financial management and seasonal planning provided by the Irrigation Department.

3. Water Management and Allocation in the Walawe Basin

Since 1970 the Mahaweli Authority of Sri Lanka (MASL), an organisation functioning under the Ministry of Irrigation and Water Management, has been responsible for the implementation, operation and maintenance of the Mahaweli Ganga development programme, the biggest water resources development programme in Sri Lanka. In addition to the irrigation schemes in the Mahaweli river basin, MASL operates and manages the Uda Walawa scheme in the Walawe basin and is also responsible for water allocations in the Walawe basin. The MASL, with the assistance of other ministries and agencies related to the water sector, has established the Water Management Secretariat (WMS) in 1980–81. WMS is the decision-making body in sectoral water allocations in the Mahaweli and Walawe basins and is also responsible for collection and analysis of hydro-meteorological data, cultivation data, energy productions and system performance. Based on these data, seasonal planning, regulation and forecasting, the sectoral water allocation for multiple usage is decided.

The WMS conducts a weekly water panel meeting to discuss and decide weekly water allocations for different sectors, especially for irrigation and energy in the Mahaweli and Walawe basins. The water panel consist of officers from Irrigation Department, MASL, CEB, National Water Supply & Drainage Board and others. These officers are responsible for providing necessary information, water requirements, weekly data, the cultivation plans and performance to WMS at the water panel meeting. The important issues coming up from time to time—such as effects due to droughts, floods, emergency repairs, water shortages, and weather conditions, which affect cultivation as well as energy generation—are discussed at length at this meeting and decisions are taken that attempt to satisfy all sectoral requirements in a fair manner. These decisions are conveyed back to the implementing officers in the field by the responsible officers.

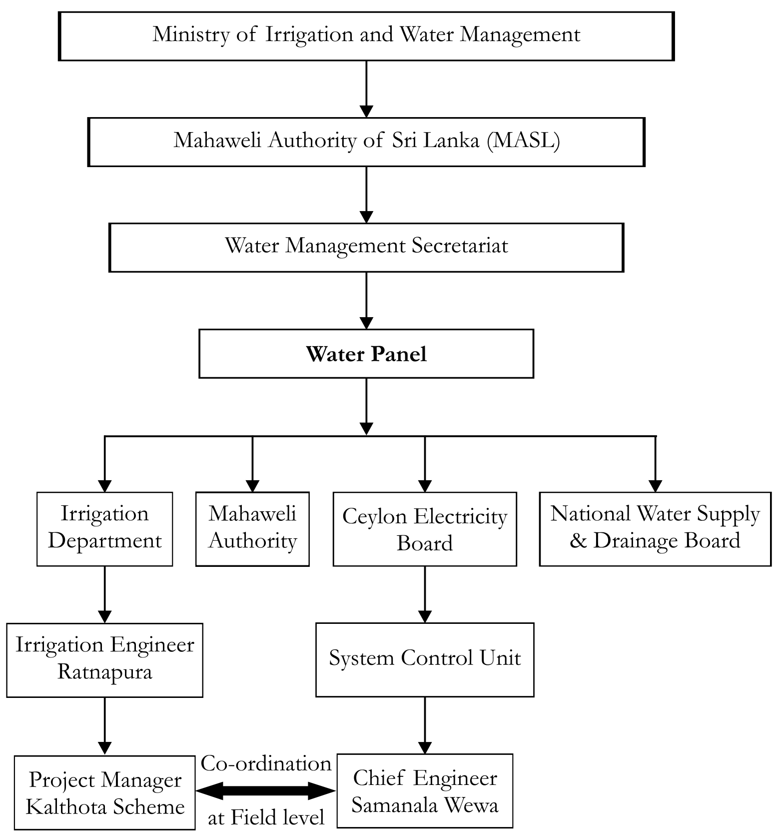
The WMS uses two computer models to examine operating policy options. A monthly time-step model and a reservoir simulation model are used to assess broad operating alternatives. A weekly time-step model is also used to carry out weekly analyses. Both models fully represent the principal irrigation diversions.

At the beginning of each cultivation season, the WMS prepares a seasonal operation plan (SOP), which is discussed at a special meeting attended by officers and farmer representative from each irrigation scheme coming under Mahaweli and Walawe river basins. The SOP gives all the details such as area that can be cultivated, commencement and last date of cultivation, total water allocation for each irrigation scheme on monthly basis, expected monthly rainfall, monthly energy generation from each indiviual power station, predicted reservoir storages and their behaviour through the season, total and monthly diversions at each diversion points, etc. The respective organisations are responsible for the implementation of this SOP as per the recommendations agreed at the seasonal meeting.

Accordingly, at the beginning of every cultivation season, Kalthota farmers conduct the '*Kanna* meeting' with all the farmers of the scheme, relevant officers from the Irrigation Department, Agriculture Department, Ceylon Electricity Board, Divisional Secretary office and others. This meeting is chaired by the Divisional Secretary of the district. At this meeting all farmers are informed of the recommendations made at the SOP meeting, about the water issue dates, last date of water issues, cropping calendar, and other matters. The detailed water requirement schedule during the entire cultivation season is prepared by the Project Manager with the concurrence of farmers and submitted to the Irrigation Department head office and to the WMS. This document governs the weekly water allocations decided at the water panel meeting. The respective officers convey the decisions taken at the panel meeting to the field officers for implementation.

The Samanala Wewa chief engineer is responsible for carrying out the instructions received from the System Control Unit of CEB Kalthota water releases. Similarly, the Kalthota Project Manager also gets the information through the Irrigation Department head office about the amount allocated for Kalthota scheme. In addition, the

Figure 8.3: Responsibility and Information Flow



communication linkage created between the CEB officers at Samanala Wewa hydropower station and the Project Manager at Kalthota scheme helps to optimise the water use efficiency at field level. Even though the water allocations are done on a weekly basis at the WMS, the Samanala Wewa chief engineer and Kalthota Project Manager reduce the quantity depending on the rainfall received at the Kalthota scheme. But none have the authority to increase the quantity for any reason unless approval is given by the WMS.

4. Consequences of Water Sharing

There are three major groups involved in the water-sharing activity between the Kalthota irrigation scheme and the Samanala Wewa hydropower project: the Irrigation Department, Kalthota farmers and the Ceylon Electricity Board. Each group has their own difficulties and different problems pertaining to their involvement, roles and responsibilities. Some of these problems have effects on the national economy, whereas some problems have social, technical, economic and cultural dimensions.

Due to the upstream water extractions for hydropower generation in the Walawe river, the farmers living in the irrigation scheme had to undergo several difficulties and hardships related to water availability for their cultivation as well as for their daily needs. The Irrigation Department, being the responsible agency for water management, system operations, and organising and coordinating institutional development activities with farmer organisations in the Kalthota scheme, intervened and played a major role in easing these problems by adopting different strategies depending on the problem. Similarly, the Ceylon Electricity Board also had its own problems with respect to efficient and economic utilisation of available resources for maximisation of energy generation to meet the ever-increasing energy demands.

Problems Created and Benefits Received by Farmers in the Kalthota Scheme

The Kalthota irrigation scheme was the first water resources development project implemented in the upper reaches of the Walawe basin. The Samanala Wewa hydropower project was commenced exactly 100 years after that. With the new development, farmers of the Kalthota scheme had to face several problems immediately after the impounding of the Samanala Wewa reservoir. The flow of the Walawe river at Kalthota was reduced and slowly dried up within a few weeks, and this created a panic situation in Kalthota village among farmers and villagers. The CEB released water as per the agreed amount for irrigation purposes in addition to the leak, but the total flow was much lower than the normal river flow and this quantity was not sufficient to keep the farmers and villagers satisfied. This situation created serious problems for the Irrigation Department, CEB, other officers concerned and also for the politicians in the area. To overcome these problems, the officers from the Irrigation Department, CEB and Water Management Secretariat had several discussions and finally decided to raise the irrigation release above the previously agreed quantity. With time, the panic situation gradually diminished and farmers slowly adjusted to the new conditions.

Even though there are some benefits received by the farmers with the new development, at the very beginning farmers were not aware about these advantages and also reluctant to accept them. To change the attitudes and traditional practices of the farmers and also to educate them on the new development and its importance to the national economy, several awareness and training programmes on integrated water resources management and participatory irrigation management programmes were conducted by the Irrigation Department with the support of the CEB. As a result, after a few years farmers realised the importance of the Samanala Wewa hydropower project, its contribution to the national economy and also the other advantages and benefits received by them.

The problems faced and benefits received by the Kalthota scheme farmers are listed in Table 8.2 and categorised into two sections, i.e., before construction of Samanala Wewa and after construction of Samanala Wewa.

An elaboration of these benefits and problems is given below.

Before Samanala Wewa

Easy access to water The farmers had easy access to water at all times before construction of Samanala Wewa as there was no development

Table 8.2: Problems and Benefits Received by Farmers from the Kalthota Scheme

Before construction of Samanala Wewa	
Easy access to water	Benefit
Unlimited water	Benefit
Water shortages during dry seasons	Problem (for both farmers & managers)
After construction of Samanala Wewa	
More reliable water supply	Benefit
Limited quantity at specific period	Problem
Adherence to inflexible cultivation pattern	Problem
Less water shortage problems	Benefit
Threat/Fear of not getting water	Problem

project or any major extraction from the Walawe river upstream of the Kalthota scheme. Farmers did not practice any rotational water distribution and there were no other water management practices carried out previously, mainly due to easily available water in the river.

This easy access to water may have caused excessive water application to paddy fields, resulting in reduced production. From the officers' point of view this can be considered as a problem that farmers had before the new development. But the farmers are of the view that this facility was a benefit to them.

Unlimited water The Walawe river is a perennial river with a substantial flow even during dry periods, as it benefits from both north-east and south-west monsoonal rains. Farmers of the Kalthota scheme used this resource without any control throughout the year, as there was no interruption by any other source. This facility was mainly enjoyed by the head-end farmers in both right-bank and left-bank canals, whereas in very dry years farmers at the tail end faced some difficulties in getting enough water to their paddy fields. But generally farmers believe that the unlimited water they enjoyed before Samanala Wewa construction was a benefit.

Water shortages during dry seasons There are no records on any crop failures during any dry season, but according to the information gathered from farmers there have been few instances where crops died due to insufficient water in very dry years. This phenomenon can be considered as a problem for both farmers and officers before construction of Samanala Wewa.

After Samanala Wewa

More reliable water supply After the construction of Samanala Wewa, Kalthota farmers get their water for cultivation through the irrigation outlet of the reservoir. The required quantities and the periods are decided by the project manager and the farmers at the cultivation committee. The CEB releases this agreed quantity at the required time. Therefore the farmers have a reliable water supply and this can be considered as an important benefit received by the farmers.

Limited quantity at specific period After the commissioning of Samanala Wewa, farmers are getting a limited quantity of water, which is only available during a specific period during the cultivation season. To manage this limited quantity efficiently, the Irrigation Department introduced a rotational water distribution method where farmers get water only at a specific time. Initially farmers had a lot of problems with this new water distribution method, as they were not used to it. Therefore the farmers consider this as a problem they faced with the new development.

Adherence to inflexible cultivation calendar In every irrigation scheme a seasonal cultivation calendar is prepared and discussed at the cultivation meeting before a cultivation season commences. Even though this was practiced in the Kalthota scheme before the construction of Samanala Wewa, the adherence by farmers to the dates fixed for first and last dates of water release and land preparation period was very poor, as there was no strict control over the water distribution in the field. This practice resulted in high water usage and also adverse effects on crop production due to pest attacks, including low yields and low-quality rice.

But with the new development, farmers were compelled to adhere to an inflexible cultivation calendar and to the water releases and rotational distribution dates, as they know the difficulties of getting an extension to water release periods. From the farmers' point of view this issue is a problem.

Fewer water shortage periods Before construction of Samanala Wewa, farmers faced some problems of water shortages during very dry years. But with the new development, it is very unlikely that farmers will face this problem again. For example, the 2002 *Yala* season (May to October) was drier than average and the water storage of most of the reservoirs in the entire country was very much below average. Due to late onset of monsoon rainfall the commencement of cultivation for *Maha* 2002–2003 season was delayed until December. But in the Kalthota scheme, farmers had the opportunity to commence their cultivation in early October, which is the most suitable period to start *Maha* season cultivation. This was mainly due to the regular flow from the Samanala Wewa reservoir and also due to the priority given to Kalthota farmers considering their water rights. Therefore this issue can be considered as the most important benefit received by the Kalthota farmers.

Threat/Fear of not getting water The CEB implemented a compensation programme for not doing cultivation at Kalthota scheme during three *Yala* seasons. This programme was initially accepted but later rejected by farmers for several reasons as discussed below. Still the farmers have the fear that the government or the CEB may introduce a similar programme at any time to save water in the Samanala Wewa for hydropower generation. This is another problem faced by the farmers with the water-sharing activity.

Compensation Programme

During the 1996 *Yala* season, the compensation package was first introduced for farmers for not doing cultivation. This was implemented in the tail ends of the left-bank and right-bank canals. During this season only 55 per cent of the total area was supplied with water through the irrigation valve. Farmers were compensated with an amount of Rs 18,750/ha. The same programme was implemented for the entire left bank in *Yala* 1997 and 1998, and the compensation was increased to Rs 35,000/ha. For several reasons this programme was discontinued.

Reasons for failure of the compensation package

Financial difficulties during the following season Initially the farmers accepted the compensation mainly for the large sum of money received. Even though the amount paid was attractive, the farmers who are poor in financial management spent most of the money at once and were left with very little money at the end of the season. The farmers had severe problems to commence their *Maha* cultivation with the little money in hand.

No food security in rice to the entire family There were instances where some farmers who spent money unwisely were left without any money to supply basic needs of the family such as rice, milk and vegetables. If cultivation would have been done the farmers could have harvested around 4–5 mt of paddy from one hectare of land, which would have brought food security in rice to the entire family during the next season.

Strong opposition from women In the traditional society the male members of the family normally make decisions. In Kalthota too the initial decision to accept the compensation package was made by the head of the household who is normally a male. However, the benefit of the compensation package was not equally distributed among family members. Occasionally, having a large amount of money resulted in social evils such as drunkenness. As a result, there was a strong opposition from the female members of the Kalthota scheme and this contributed to the rejection of compensation programme.

Cultural and social disruption People of the village complained of the loneliness in the village resulting from the decreased intensity of activities related to agriculture. Normally land preparation and harvesting require mutual help and this contributes to social harmony. Apart from the problems such as drunkenness mentioned earlier, staying and idling at home caused health problems to a few farmers.

Environmental effects Irrigation contributes to the recharge of groundwater; thus, cutting off the irrigation supply contributed to localised drying up of wells. Similar detrimental effects were observed on livestock, for whom finding a source of water and also finding food for cattle in the absence of hay production became more tedious.

Problems Faced by the Irrigation Department

The Irrigation Department, being the responsible agency for operations, main system management, water management and institutional development, had to intervene directly with the farmers as well as with the CEB in water release matters to overcome the difficulties encountered immediately after the impounding of the Samanala Wewa reservoir. The river flow was reduced and completely dried up within a few weeks. Even though the farmers were aware about the reduction in flow in the river, they could not accept the change and this caused a panic situation in the area. But with time the farmers and villagers got used to the new conditions. The Irrigation Department had to play a major role in educating farmers on the new developments and also about water management.

The main problems that the Irrigation Department had to face and actions taken by the Department are summarised in Table 8.3.

The most critical problem out of those mentioned in Table 8.3 is the high irrigation duty, as it has a direct effect on the additional water releases from Samanala Wewa.

High irrigation allowance The Kalthota irrigation system has a very high irrigation allowance in paddy cultivation. Even though this was a known problem earlier, not much serious attention was given to it, because there was not much downstream effect as the excess water drains back to the river. According to past records the irrigation allowance was 3.0 m (10 ft) in *Maha* (rainy) season and 4.0 m (13 ft) during *Yala* (dry) season. This value is about twice the irrigation allowances in well-performing schemes in other parts of the country. Considering the economic value of the water that is released from Samanala Wewa, the department had to take immediate action to minimise the irrigation allowance.

When analysing the Kalthota scheme in the above context, it can be seen that all adverse factors were present, such as high canal conveyance losses, high farm losses due to unsuitable soil type, etc.

High conveyance losses in the canals To improve water management activities, the Kalthota scheme was included in the National Irrigation Rehabilitation Project for rehabilitation in 1992. Rehabilitation

Table 8.3: Problems and Action Taken by Irrigation Department

Problems	*Actions Taken*
Controlling the social unrest created among farmers and villagers immediately after impounding.	Discussions with farmers; Discussion with CEB to increase water releases through outlet.
Educating farmers about the benefits received by them.	Conducting awareness programmes jointly with the CEB.
High irrigation allowance due to	
• High losses in the delivery system.	• Included in the National Irrigation Rehabilitation Project to improve the delivery system.
• High farm losses due to soil type and topography.	• Conduct awareness, training and demonstrations on organic fertiliser applications to improve the soil structure.
• Traditional water issuing practices.	• Introduction of rotational water issue system.
• Longer land preparation period and non adherence to the cultivation calendar.	• Conduct awareness and training programmes; provision of farm tractors by CEB.
• Cultivation of high water consuming crops like paddy.	• Conduct awareness programmes to motivate farmers to grow Other Field Crops (OFCs).

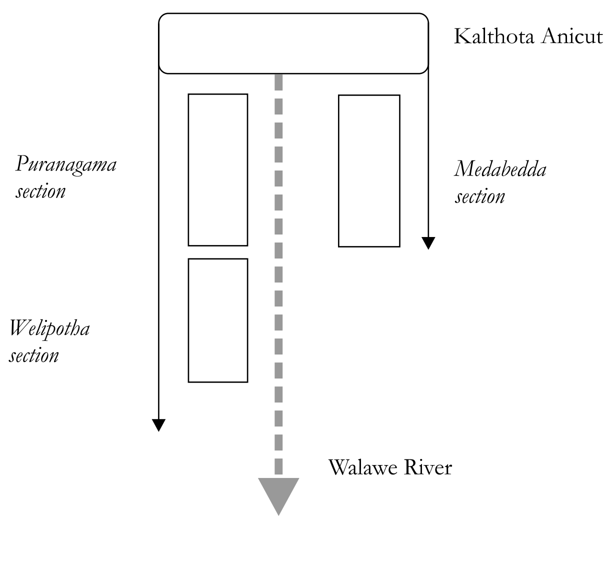
works were completed in 2000 and only the most essential structural improvements in the main canal system were done due to limited funds allocated for the scheme. The rehabilitation works improved the water management in the main canal due to reduced losses in the main canal.

High farm losses Due to the soil type in the area and steep land slopes, the on-farm losses are very high. In the Kalthota scheme the major reason for high allowances can be identified as high farm losses. In most of the areas in the scheme, the soil texture consists of high sand content and less minor particles, which results in very low water-holding capacities. Intensive application of chemical fertiliser for a long period had aggravated these conditions badly. This situation can be improved only through improving the soil texture through increasing minor particle content in the soil. Recently the Agriculture Department has advised on this matter and recommended to apply organic fertiliser in each season. Therefore, several training and demonstration programmes were conducted by the Irrigation Department with assistance from the Agriculture Department and CEB in an integrated approach.

Water release practices and rotational distribution method From the inception of Kalthota, farmers used to divert water to their paddy fields continuously as there were no water management practices adopted due to freely available water in the river. With the new development, methodical water management practices were slowly introduced with the intention to save water. Therefore, arrangements were made to distribute water in a staggered manner with a rotational distribution system.

At present, water distribution is done in three staggers in the three sections as shown in Figure 8.4. The Medabedda section receives water first from the leak for land preparation. The allowed land preparation period is 21 days. The second irrigation turn commences in Welipotha section after 15 days of the first date of water release for Medabedda section. In the first rotation turn, the land preparation

Figure 8.4: Water Distribution Arrangement in Kalthota Scheme



requirement is met through the water coming from the leak, and with the commencement of the second rotation turn, an additional quantity of water is taken from the Samanala Wewa. The last rotation turn is for Puranagama, which commences after 21 days of the first turn. During the land preparation period each field canal is supplied with water continuously and after the land preparation period the rotational releases commence. With the rotational distribution each field canal gets water only for three days per week.

Longer land preparation period Another problem faced by the Irrigation Department is farmer practices in land preparation methods. From the information gathered from farmers, it was found that the period taken for land preparation was around four to six weeks. It is clear that the longer land preparation period results in higher allowances. The recommended period for land preparation by the Agriculture Department is only 21 days, while in water short schemes in other parts of the country some farmers take only 14 days for land preparation. The inadequacy of tractors, draught power and labour required for land preparation aggravated this problem to some extent. The Irrigation Department was able to convince the CEB about these problems and as a result the CEB purchased some farm tractors and donated these to a few selected farmers.

Cultivation of high water consuming crops The Irrigation Department made several attempts to motivate farmers towards cultivation of Other Field Crops (OFCs), at least during the dry season. The CEB also supported this and came-up with several proposals to overcome difficulties in selling the agricultural produce. All these attempts failed due to strong opposition from farmers and the Irrigation Department, and the CEB have dropped this idea and concentrated on other water-saving methods.

Training provided By considering the above facts farmers were given extensive training on water-saving techniques, timely cultivation, crop management, and on-farm water management, and demonstrations on organic fertiliser application. The CEB is involved in most of these training and demonstration programmes through providing machinery and equipment and financial assistance for payment of incentives.

As a result, farmers are now applying organic fertiliser consisting of paddy-hay, cowdung, tree leaves and other biomass, as per Agriculture Department recommendations. As a water-saving technique through increasing water-holding capacity, this can be taken as a sustainable solution where effective results can be seen only after several years. Farmers are very much encouraged by this demonstration programme due to the indirect benefits they have received, such as low production cost, increased production due to high yields and increased profitability. The Department has initiated a programme in Kalthota to measure and monitor the percolation losses at paddy fields to assess the water savings.

Even though the officers emphasise timely cultivation, minimising land preparation periods, and short-term varies of paddy, there still are farmers who consume a very high quantity of water by not adhering to the instructions given to them. After 10 years of project implementation the water managers of the Irrigation Department are still in a process of changing the attitudes of the farmers towards efficient water management.

Problems Faced by the Ceylon Electricity Board (CEB)

The CEB's main objective is to generate the maximum energy at the Samanala Wewa power station, satisfying the integrated power generation pattern of the entire network of the country. The annual planned energy generation from Samanala Wewa is 420 GWH. From 1992 to 1997 the reservoir was not filled and kept under observation until remedial measures were taken to reduce the leak. During this period the total inflows to the reservoir were used for energy generation. A maximum of 351 GWH was generated in 1993. Figures 8.5 to 8.7 show the annual energy generation, reservoir storage and annual rainfall respectively.

One main concern of CEB was to utilise and get the maximum benefit of the water coming through the leak for Kalthota cultivation. With this intention the CEB joined the Irrigation Department and provided possible assistance in various ways.

The CEB's main concern is to reduce the irrigation releases as much as possible, especially during the *Yala* (dry) season when the rainfall is low. During the dry season the water requirement for paddy cultivation

Figure 8.5: Annual Power Generation at Samanala Wewa

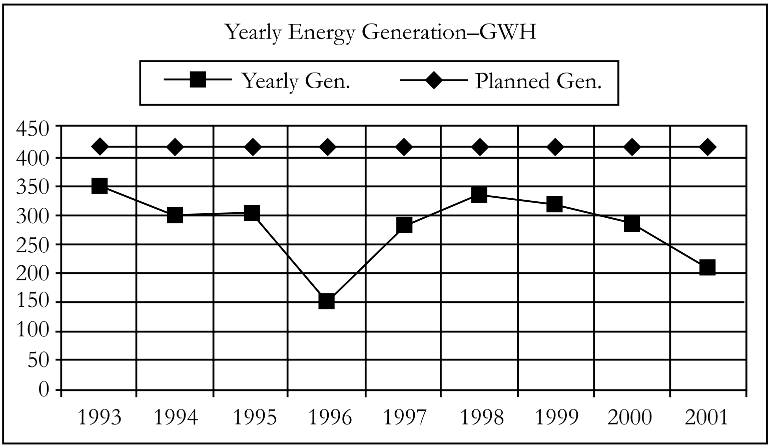
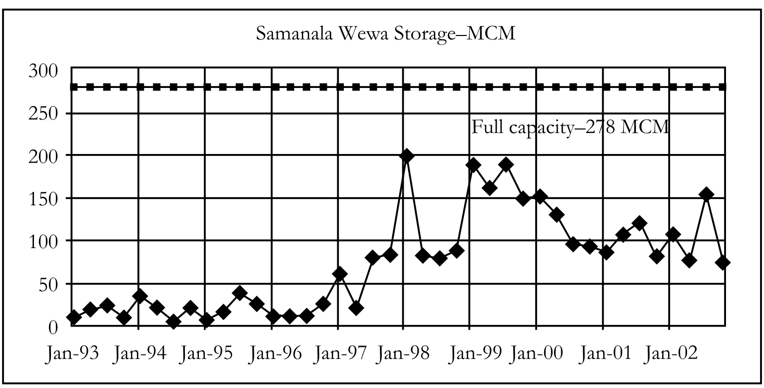
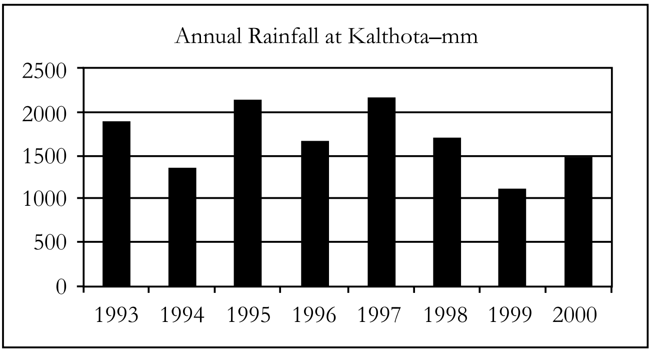


Figure 8.6: Samanala Wewa Storage



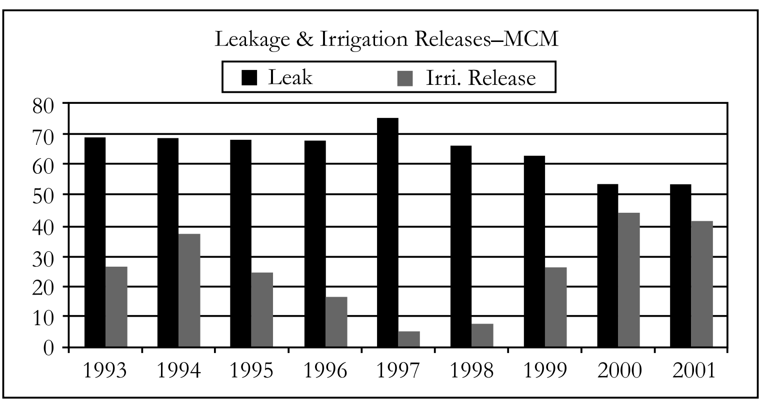
Source: CEB–Samanala Wewa

Figure 8.7: Annual Rainfall at Kalthota



The annual irrigation releases and the leakage are shown in Figure 8.8 below. In 1996, 1997 and 1998 the irrigation releases were low due to the compensation programmes.

Figure 8.8: Leakage and Irrigation Release at Samanala Wewa



Source: CEB–Samanala Wewa

is also higher than the *Maha* (wet) season due to high temperatures, high wind speed that increase the evapo-transpiration. If drought conditions prevail during the *Yala* season due to low south-west monsoon rainfall, the CEB faces difficulties in supplying water to Kalthota and to Uda Walawe due to power generation requirements.

Some of the proposals and actions taken by the CEB in the view of optimising power generation through reducing irrigation releases are:

- Paying compensation to farmers for not doing cultivation, as explained earlier.
- Providing funds to farmer organisations to purchase tractors and other agricultural equipment to facilitate better water management.
- Incentive payment of Rs 1,000 per acre (0.4 ha) for farmers who attempt to grow other field crops that consume less water than paddy.
- Incentive payment for farmers who have applied organic fertiliser to their fields.
- Agreed to finance construction of an anicut across Katupath Oya and to pump water to the tail-end section of RB main canal of Kalthota scheme. Katupath Oya anicut has been constructed with CEB funds but proposals for providing pumping facilities were not taken up.
- Agreed to finance another diversion scheme from Weli Oya to supplement the Kalthota left-bank canal. This proposal was not considered for detailed investigation, as it is not economically feasible.
- Proposed to construct several small weirs across Walawe river in between Samanala Wewa and Kalthota anicut, to store water coming from the leak and to use this during the cultivation season.

5. Discussion

Even though several solutions have been suggested by the CEB and some of them were partially implemented, some solutions such as the compensation programme and the incentive payment for other field-crop growers were not accepted by the farmer community. The demonstration programme on organic fertiliser application carried out by the Irrigation Department is very attractive and well accepted by the farmers due to the advantages that are experienced.

The main objective of this demonstration programme is to improve land productivity and water productivity. In the case of the Kalthota scheme the most important issue is how to increase water productivity. Improvements in water-holding capacity of the soil through application of organic fertiliser cannot be observed within two or three seasons. It may take a longer period, depending on the farmer's motivation. It is planned to measure the on-farm water losses in the paddy fields where organic fertiliser has been applied and not applied, and to compare the results during the 2003 *Yala* season.

The CEB initiated a similar programme with the collaboration of the Ministry of Agriculture as a water-saving measure. This method is called System of Rice Intensification, a wet and dry irrigation method where a considerable reduction in water usage is expected. The CEB is implementing this programme with the assistance of the project manager of the Kalthota scheme and financial support is given to farmers for purchase of agricultural inputs. In addition, some equipment such as farm tractors and weeders were distributed among farmers who have followed the new method. Similarly, an attractive crop insurance programme has also been introduced to the farmers by the CEB. All these actions have been taken by the CEB mostly to encourage and to motivate the farmers away from their traditional cultivation practice to water-saving technologies.

These interventions are very much appreciated and encouraged by the farmers due to the tangible benefits gained. Among these benefits, increased yields and low production cost are the most attractive. The crop-cutting survey results of the demonstration plots have shown that the yields have doubled in some fields. So far, no action has been taken to measure the changes in water usage under this method. But there are future plans to measure the water issues in individual farm lots to assess the actual water saving. Under the normal cultivation method water is issued to paddy fields every three days, whereas with the new method, during the maturing period of the plant water requirement is lower than in the normal cultivation method. This requirement can be supplied by applying water to the paddy field every six days.

Both methods discussed above are cost-effective and acceptable to the farmers. The involvement of the agricultural officers in both methods is essential to provide advice on fertiliser application, pest and weed control, and selection of better quality seeds to obtain high yields. At present there are four agricultural instructors employed by the Agriculture Department in the Kalthota Scheme. This integrated approach has brought very good results in Kalthota, not only in irrigation and water management but also in social and cultural aspects in the small village.

In addition to the above actions to improve water productivity, there is another hardware intervention proposed by the CEB, which is being examined. The proposal is to pump the drainage water that flows back to the river to feed the tail end area of the right bank canal. For this, detailed surveys are to be done on the quantity of water that flows back to the river. The CEB has given its consent to finance this project if it is feasible.

6. Conclusion

The Kalthota and Samanala Wewa water-sharing experience is indicative of emerging problems in the water sector and also water resources allocation issues among different water users. Though hydropower does not consume water when considered at the basin level, this case study shows that there are location-specific impacts. Similarly, though water losses at the Kalthota scheme end up at Uda Walawe, and are therefore not wasted, high withdrawals for Kalthota deprives hydropower generation at Samanala Wewa.

This case study emphasises the need for an Integrated Water Resources Management approach in sectoral allocations. Positive signs are that while the CEB pays attention to development of additional water resources and improving water management in agriculture, farmers and officials have realised the value of water and also the importance of other uses. The available options emphasise the importance of technical aspects. Scientific irrigation scheduling, crop selection, conveyance efficiency improvement and better water management will contribute heavily to reduce the water demand for irrigation. The situation also highlights the necessity of having a good monitoring system and a database containing parameters such as soil properties, permeability and climatic factors such as evapo-transpiration.

These have to be effected through extensive stakeholder dialogue. The unresolved constraints include marketing problems of other field crops and require attitudinal changes. Other relevant issues that were relatively inadequately studied include gender aspects of the water management and rural agriculture.

The experiences critically examine the validity of concepts such as 'efficiency' and 'wastage'. Though the water lost as seepage and percolation ultimately finds its way to Uda Walawe irrigation scheme downstream, this water could have been more beneficially used for power generation in the upstream Samanala Wewa. Therefore, while the basin-level efficiency could have been high, scheme-level efficiency is also an important variable in the equation. Similarly, water used for power generation is not consumed, and is available for use within the basin. However, diversion for power generation reduces water for agriculture immediately downstream of the diversion point.

Eventually, these issues have to be addressed by an appropriate policy framework. Otherwise problems will be attended to based on personal interest, and conflicts can arise when the interest fades away.

There are different economic, social, political, cultural and technical dimensions of rural agriculture that have a bearing on water resources allocation among sectors. When the national economy is concerned, the economic dimension with regard to the value of water in energy generation is very important compared to the agricultural production. However, technically or economically feasible solutions are not always socially acceptable. Therefore, the Kalthota experience supports the theory that water has a social, economic and cultural value. All these dimensions should be taken into account in a viable solution.

Overall, the lessons learnt highlight the need for management of water resources in an integrated manner. The basin level water allocation and sharing decisions should be based on intersectoral requirements and their relative importance measured with due regard to the multiple dimensions of water resources management.

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9

Inter/Intra-Sector Coordination as a Means to IWRM: The Case of Sri Lanka

RANJITH RATNAYAKE

1. CONTEXT AND BACKGROUND

THE CONCEPT OF Integrated Water Resource Management (IWRM) has been an integral part of Sri Lanka's hydraulic civilisation dating from the 6th century BC. The ecosystems built around reservoirs sought to conserve and protect source areas and catchments while cultivating the downstream for human sustenance.

This hydraulic society that sustained over many centuries treated water with great respect and value and its use was regulated by edicts issued by kings as well as customary rights and obligations as determined by the community. A decline of this irrigation-based civilisation, compounded by the enactment of the Waste Lands Ordinance of 1840, which vested in the state large extents of individual and community lands whose title could not be established to the satisfaction of the colonial government, brought within state control a large extent of the land resources of the country. The revenue- and function-oriented state administrative and financial structures established by the colonial government removed any vestiges of integration that existed at the local level and led to state-regulated supervision rather than a community-led self-regulated management of our natural resource base.

The decline of this ancient irrigation civilisation and emergence of a plantation-led export agriculture with the opening of large plantations in the central hills and wet zone areas (which had earlier essentially been conserved as source areas), combined with the attendant influx of large populations to these areas, changed the emphasis to a sector-based development approach which was quickly adopted and practised. These policies were facilitated through large peasant settlements which saw movement from populated wet zone areas to the dry zone. The period after the Second World War saw a focus on food security though rice self-sufficiency emerging as the major development initiative led by national interests. Large extents of land were brought under irrigation settlements in the dry zone from 1929 and were expanded consequent to the Land Development Ordinance of 1935. These sector-based initiatives developed over the last several decades are now placing stresses on the demand/supply equilibrium that existed with respect to water availability, especially in the dry zone, where population pressure, better living standards and urbanisation are requiring diversion of water hitherto captured and used by agriculture without constraint.

2. Institutional and Legal Environment

In Sri Lanka, over 50 acts and 40 agencies deal with water. This has led to confusion, duplication and inaction. In the absence of clear water rights safeguarded legally, water rights are linked to the land base, and appropriation and extraction is therefore based on land ownership.

This also applies to groundwater, which has, without regulation or physical impediments to extraction, led to over-exploitation, thus affecting the quality and sustainability of this resource as well. By the 1980s stresses from competing uses were already being felt, especially in the dry zone areas.

At operational level in the field and at national level some institutional mechanisms have been set up to coordinate and integrate as far as possible such sectoral/sub-sectoral activities as part of the development administration process. Nevertheless, one of the major drawbacks of such committees, especially at implementation level, has been their inability to integrate and regulate environmental concerns successfully into development activities. Environmental considerations have often been relegated to the backburner and regulation and enforcement have suffered due to lack of administrative and political will, in the face of pursuing development interests at any cost.

Water resources are intrinsically tied to land and its use, and therefore the protection of this resource is affected by activities in sectors such as land, forestry and mining. Amendments to the Soil Conservation Act in 1996 and the Mines and Minerals Act in 1995 have reinforced protection of water resources. Amendments to the Irrigation Ordinance in 1994 and Water Resources Board Act in 2000 have reinforced participatory management and monitoring aspects.

The main legal enactments affecting water resources are:

- State Lands Ordinance
- Municipal/Urban Councils Ordinance
- Irrigation Ordinance
- Water Development Law
- Mahaweli Authority Act
- Land Acquisition Act
- Agrarian Development Act
- Soil Conservation Act
- Water Resources Board Act
- Mines & Minerals Act
- Water Supply and Drainage Law
- Electricity Act
- Thirteenth Amendment to the Constitution
- Fauna and Flora Protection Ordinance
- Land Development Ordinance
- Forest Ordinance
- Fisheries & Aquatic Resources Act
- Pradeshiya Sabhas Act

3. The Resource Base

Sri Lanka's land area of 65,600 sq km receives a mean annual rainfall of about 1,900 mm, ranging from 900 mm in parts of the dry zone to about 6,000 mm in the central hills. The dry zone, which constitutes about 80 per cent of the land area, receives less than 2,000 mm. It is estimated that 35 to 40 per cent of total rainfall contributes to run off. Annual water resources of Sri Lanka, defined as amount of sustainable water produced by all water sources, is estimated at 43.2 cu km.

Some estimates place the combined volume of primary water diverted from all three sectors (Agriculture, Domestic supply and Industry) at about 8.5 cu km or 19 per cent of annual water resources (Imbulana and Ratnayake 2000). Groundwater resources are estimated at 7.25 cu km (Manchanayake and Maddumabandara 1999).

Though it appears that Sri Lanka has adequate water resources in aggregate terms, problems of a bimodal monsoonal rainfall regime is causing stress on the demand and supply situation and impacting on economic activities in what is still a rural-based society. Water withdrawals for agriculture, industry and domestic needs are estimated as 85, 5 and 6 per cent of developed water resources respectively.

At current population levels of 19.0 million, the per capita availability is estimated at about 2,400 cu m/year, and at a predicted population threshold of 23.0 million in 2,025 per capita availability would be around 1,900 cu m/year, still above the minimum acceptable level of 1,700 cu m/year set by FAO (Food and Agriculture Organisation) (Falkenmark et al. 1989). Of the current population of 6.0 million urban and 13.0 million rural dwellers, about 32 per cent are served by piped water, 11 per cent by tubewells, 24 per cent by dug wells and 33 per cent by others. Seventy-five per cent of the urban population and 14 per cent of the rural population is served by piped water. About 25 per cent of the population is not served by sanitary facilities.

Sri Lanka's electricity supply is still mainly dependent on hydropower, which is an important though non-consumptive user. The present installed hydro capacity is about 1,145 MW of a total of 1,673 MW, with new hydro potential identified as 800 MW.

The global water resources situation in the next 25 years has been analysed in several studies. A study by the International Water Management Institute (IWMI), using two criteria for assessing water scarcity and analysing 116 countries divided into five categories in order of decreasing water scarcity, has placed Sri Lanka in group five, where it is predicted that the country would not need additional water resources if irrigation effectiveness were improved.

Recent analysis of water resources indicate a positive situation overall. However the significant spatial and temporal variations in water availability need to be addressed before they become major issues. A major part of the rainfall is confined to the north-east and south-west monsoons, and even these monsoons show considerable variation. A recent analysis shows that more than half of the 103 rivers in Sri Lanka have a zero or negligible flow in the *Yala* Season (Amerasinghe 1999). Demand for water far exceeds supply throughout the dry zone and the deficit in Mahaweli areas, south-eastern and north-western dry zone areas are estimated at 200, 920 and 1,400 million cubic metre (MCM) respectively (Mosley 1994). These deficits, especially in the Mahaweli areas, are balanced by trans-basin diversions amounting to 2,400 MCM. A further 600 MCM is planned for diversion in the near future to NWP & SP (North Western Province and Southern Province) and Mahaweli areas.

4. Water Resource Utilisation

Water for Food and Rural Development

Eighty-five per cent of Sri Lanka's developed water resources are used for agri-culture. Some estimates rate the combined volume of primary water diverted by the three sectors of agriculture, domestic water supply and industry at present at around 10 cu km on annual availability (8.5 cu km in 1995) (Imbulana and Ratnayake 2000).

Approximately 2,400 MCM of water is diverted from the wet zone areas to the dry zone for agriculture with 600 MCM planned as future diversions. Eighty per cent of Sri Lanka's rice production comes from irrigation with 21 per cent from minor and 59 per cent from major schemes. Agriculture constitutes 18 per cent of GDP, while irrigated agriculture accounts for about 3 per cent. Over 65 per cent of the population lives in rural areas while around 40 per cent finds employment in agriculture with 20 per cent in the paddy sector.

Due to a very broad peasant production base subject to vagaries of climate and markets, cyclic seasonal fluctuation is noted, resulting in productivity levels that keep margins, and hence incomes, low. The worst affected are the full-time paddy farmers (Mahaweli and major schemes) with little opportunity for off-farm activity. Average yields of 3.7 tons/ha if raised to 4.2 tons/ha can meet all rice needs at 100 kg/capita. However, this would keep the paddy sector stagnant and farmers poor. Paddy is profitable beyond 5 tons and attractive at 6 tons/ha, allowing adequate margins to full-time paddy farmers. The low-risk low return scenario is acceptable to part-time farmers who mostly grow for consumption needs and seek income through employment in other sectors.

Water productivity is somewhat low and an IWMI study in 14 schemes gives the following figures:

Maximum	*Minimum*	*Average*
0.7	0.17	0.40 kg/m3
6.3	1.54	3.57 Rs./m3

Project/system efficiency with levels of 30–35 per cent too is considered below the acceptable level set by FAO of 45–50 per cent. However, basin efficiency levels are quite high, as return flows are captured in cascade systems adopted in the dry zone areas. Basin efficiencies of 70–85 per cent for major and greater than 85 per cent for many minor cascades are seen in NCP/NWP (North Central Province/ North Western Province) areas.

Of an area of 735,000 ha developed for rice cultivation, paddy is cultivated on around 550,000 ha in *Maha* and 300,000 ha in *Yala*. Vegetable cultivation is estimated at 78,000 ha, with 33,000 ha in the dry zone. Around 200,000 ha of rain fed land is also cultivated, mostly paddy during the wet season.

It is estimated that sector consolidation by 2025 will result in adjustment of cultivated areas. The irrigated area is expected to consolidate from 560,000 ha to 475,000 ha and rainfed from 200,000 ha to 120,000 ha with around 250,000 ha providing full employment in agriculture, mainly in Mahaweli and other major schemes.

Water and Urban Development

Domestic water accounts for only 6 per cent of water withdrawals of developed water resources. The current population comprises of 6.0 million urban dwellers and 13.0 million rural people, of which about 32 per cent are served by pipe-borne water, 11 per cent by tubewells, 24 per cent by dug wells and 33 per cent by other means. Seventy-five per cent of the urban population and only 14 per cent of the rural population are served by pipe-borne water. About 25 per cent of the population are not served by sanitary facilities. Of the urban population only 20 per cent receive a 24-hour service and of all the piped water supply schemes only a third have the capacity for 24-hour supply. The urban population is projected to increase beyond 50 per cent by 2025, at which level our population would have stabilised to a threshold of 23 million (Presidential Task Force on Housing & Urban Development 1998).

Stresses are already being felt in some dry zone areas where increased population, urbanisation and better living standards are demanding higher supplies of domestic water. Regular water supply schemes are normally serviced from major reservoirs (like Anuradhapura, Trincomalee, Polonnaruwa, Ampara) and increased demand is impacting on cultivation, especially as certain minimum levels need to be maintained for pumping. Thus water from agriculture needs to be diverted to domestic water requirements. It is estimated that a rural population of over 11 million in 2025 would require around 500 MCM for domestic needs at 100 litres/day with over 200 MCM being required by 5 million in the dry zone agricultural areas. The current urban population, which stands at 30 per cent of the total, is expected to reach above 50 per cent by 2025, with an urban population of up to 12 million.

The government has set a goal of providing access to safe drinking water and basic sanitation to all citizens by the year 2010. National Policy for Rural Water Supply and Sanitation Sector (2001) contains the policy principles that guide the provision of drinking water and sanitation. Sanitation is closely linked to domestic water supply. However, traditionally sanitation has been accorded lower priority as a basic need. Sanitation requires individual as well as community commitment to prevent health hazards arising from shortcomings in waste disposal.

5. Towards IWRM

In recent times the National Conservation Strategy (1988), the Irrigation Management Policy Support Activity (1992), the National Environmental Action Plan (1998) and other global and local initiatives have led to a focus on IWRM through provision of forums, discussions and development of strategic frameworks and directions.

The need for sector-based development activities in water resources to be planned and managed in an integrated and holistic manner is now accepted. Present activities are implemented within boundaries that have no relation to catchments, basins or other hydrological parameters. Administrative and political divisions as currently operational bisect a basin by using rivers and streams as operational boundaries. This has complicated management of water, especially where it is limited. This has to be reconciled.

There are no clear institutional arrangements and instruments for transactions between sectors and competing needs. No recourse to arbitrary decision-making relating to water use by the executive exists, and it has mostly been the poor who have suffered. Through the political and economic leverage they command, the rich have been able to access most of their requirements.

Initiatives such as the setting up of the Water Resources Council and the Water Resources Secretariat (1995), development of the draft policy and the overarching Law on Water Resources (2000), and now the establishment of the Interim Water Resources Authority (NWRA) provide the necessary institutional and legal support for an holistic approach to Integrated Water Resources Management or IWRM. Transformation of the Mahaweli Authority to a River Basin Management Authority of Sri Lanka's largest river basin (10,327 sq km) are indicative of the positive developments in this direction. River basin planning for purposes of resource allocation for non-Mahaweli areas is being considered as well. Concomitant improvement in participatory management and stakeholder involvement in irrigation and water related activities over the last two decades and addressing of gender issues have reinforced efforts in internalising integrated management approaches in water management. Issues of equity, accessibility and meeting basic needs are as important as imputation of economic value and need to be considered as well.

The concept of IWRM has attracted attention following several international conferences starting with Dublin 1992. However, neither has IWRM been unambiguously defined nor has the question of how it is to be implemented been fully addressed. It now connotes fashionable jargon used loosely in relation to water resource use and conservation, and therefore some clarity of what is meant is required.

The Global Water Partnership (GWP) has highlighted the fact that while certain basic principles underlying IWRM may be commonly applicable, independent of context and stage of economic and social development, there is no blueprint as to how such principles can be put into practice. Practical implementation of approaches derived from common principles must reflect the variations and diversities in local conditions.

The four Dublin principles (see Chapter 1) are significantly the most accepted and promote changes which are considered fundamental to improved water resources management. The Dublin principles aim at wise water management with a focus on the poor, as bad water management hurts the poor most. IWRM is thus an integrating mechanism leading us from sub-sectoral to cross-sectoral water management (see the GWP definition of IWRM in Chapter 1).

Translation of the principles into action requires consideration of three fundamental elements of IWRM: (1) an *enabling environment* which will set the rules; (2) *institutional roles* and functions that define the players who make use of; and (3) the *management instruments*.

The state is seen as the enabler and its mandate would be to

- Formulate national policies,
- Enact water resources legislation, and
- Define/separate the regulatory/service provision functions.

Institutional roles identify participants and coordinator at all levels and across sectors by

- Anchoring the coordination at the highest level,
- Creating coordinating bodies at basin level, and
- Devolving responsibility to the lowest appropriate level.

6. Multipurpose Projects in the Water Sector

Irrigation projects starting with Nachaduwa in 1929 were established as part of a human resettlement programme. Peasant settlements based on irrigated agriculture were established in the dry zone areas as a measure of relieving population pressure in the wet zone and in Sri Lanka's efforts towards self-sufficiency in rice. The first project that deviated from a sector-based approach was the Gal Oya Project, Sri Lanka's first multi-purpose project developed on the Tennessee Valley Authority (TVA) model. Initiated in 1948, the project, though based on irrigated land settlement, provided for many agro-industries as well as hydropower and other industries such as tile making and carpentry, using the raw materials in the region. An 'Area of Authority' was determined and a statutory body, the Gal Oya Development Board (GODB), established to handle all these multi-sectoral aspects under a single umbrella institution. A similar arrangement was implemented for the Uda Walawe Project, where the GODB was renamed the River Valleys Development Board and required to implement this project in 1967. The concept was that after initial establishment and consolidation of the project the Board would hand over the respective functions to the normal line agencies in the state administration. This happened in Gal Oya where the left bank was handed over in 1963 and the right bank in 1971, enabling the pioneering experience of GODB to be moved to Uda Walawe. Similarly the Mahaweli Board, established in 1969 to develop the Mahaweli, was upgraded to the Mahaweli Authority of Sri Lanka (MASL) in 1981 under an Act which conferred wide powers to enable it to handle the accelerated Mahaweli Programme. Some of the areas of responsibility of the Mahaweli Authority have also been transferred to the normal administration. This model reduced to a minimum the problems in inter-sectoral coordination and enabled an integrated and balanced approach to development to be implemented, especially during the construction, settlement and consolidation phases of project development. MASL is now in the process of transforming itself into a River Basin Authority with functions extending to the entire basin but more in a monitoring, regulating and facilitating role than in that of a service provider.

7. Inter/Intra-Sector Coordination Arrangements

Several institutional arrangements have existed since the mid-1950s for inter/intra water sector coordination at various levels.

Institutions for Coordination

Certain arrangements such as the District Agricultural Committee (DAC), Sub-Committee of DAC under the Irrigation Ordinance, and District Coordinating Committees (DCC) have been in place since the mid-1950s for effecting integration of development activities at district level. Considering that over 85 per cent of developed water is for irrigated agriculture, the focus of these committees has been mostly on water-related activities, especially in the dry zone.

At national level, Parliamentary Consultative Committees have functioned since 1948 for activities under sector ministries, and this institution has provided political oversight to development programmes being undertaken. Several parliamentary sub-committees such as that for Economic Affairs and Infrastructure have also over time functioned on a needs basis. Table 9.1 provides information on the coordination arrangements currently effective in the water sector.

Table 9.1: Existing Institutional Arrangements for Coordination in the Water Sector

	Type	*Legally Constituted*	*Administratively Formed*
National Level (Legislative)	Parliament	Parliamentary Consultative Committee	Economic Affairs/ Infrastructure Sub-Committees
National Level (Policy Implementation)	Cross-cutting	–	(a) Development/ Secretaries Committee (b) Committee Integrating Environment & Development Policy (CIEDP) (c) Committee on Environmental Policy Management (CEPOM—for Water)
	Sectoral		(a) Central Coordinating Committee on Irrigation Management (CCCIM)

(*Table 9.1 continued*)

(*Table 9.1 continued*)

	Type	*Legally Constituted*	*Administratively Formed*
			(b) National Committee on Water Supply & Sanitation (NWSS)
	Project-based (Time-bound)		(a) National Steering Committees for Project Implementation
Regional/Basin	Cross-cutting		MASL Water Panel
Provincial	Cross-cutting		(a) Provincial Coordinating Committee
	Cross-cutting		(b) Provincial Environmental Coordinating Committee
	Sectoral		(c) Provincial Coordinating Committee for Water and Sanitation
District/Division	Cross-cutting	Environment and Law Enforcement Committee	(a) District Coordinating Committee (DCC) (b) Divisional Coordinating Committee
	Sectoral	District Agriculture Committee (DAC)	
	Sectoral	Sub-Committee of DAC	
Major Irrigation Projects	Project-based/ Sectoral	Project Management Committee (PMC)	

Project/Programme-based Coordination

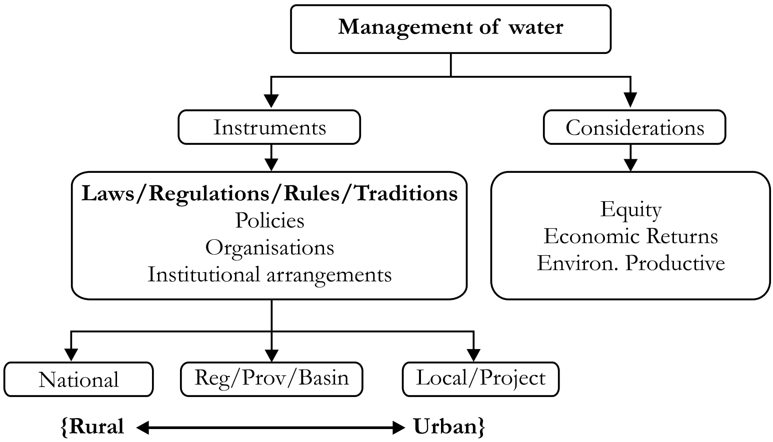
Consequent to the IBRD Mission of 1967 (Paperzak Mission), Sri Lanka's first attempt at setting up an integration mechanism for the agricultural sector was conceived.

The Special Projects Programme of 1969 set up a matrix type coordination of agency inputs into agriculture (irrigated) in selected major irrigation settlements through a system of project management with a Project Manager (as *primus inter pares*) linked to existing institutions such as DAC/DCC. National coordination was handled at the highest level with a National Ministerial Committee headed by the prime minister. The nodal agency and secretariat for implementing the programme was the Land Commissioner's Department, which was the responsible agency for major agricultural settlements. The Integrated Rural Development Projects (IRDP), initially World Bank-funded and initiated in 1976, covering the Matale/Kurunegala districts under the Ministry of Plan Implementation (Regional Development Division), had a similar arrangement for inter-sectoral coordination. There was a Project Director for each district who liased with the respective agencies and was subject to oversight by the Government Agents who linked up these programmes with general development activities in each district and with the coordination mechanisms such as DAC/DCC. The IRDP initiative involved many development sectors such as housing, roads, irrigation, agriculture, water supply, communication, and small industries. However, these being development-oriented with financial components, this facilitated obtaining the necessary priority levels and cooperation of sector ministries and agencies. Conservation and environmental aspects were yet to be included at this stage.

The year 1976 saw the first irrigation sub-sector rehabilitation project being implemented (also with World Bank assistance)—the Tank Irrigation Modernisation Project (TIMP). This was followed by the USAID-funded Galoya Rehabilitation Project, which included for the first time a major component for institutional development to facilitate farmer participation in rehabilitation efforts. Both projects followed similar coordination arrangements as the IRDP but with links only to mostly agricultural sector institutions. Similar project management arrangements have been set up in all development sectors since these early projects, and are now a common practice of national/project-level coordination with a Project Director in place.

The various linkages indicating the instruments and considerations in the management of water as currently in place are depicted in Figure 9.1.

Figure 9.1: Linkages in Water Management



National	:	CCCIM, SCWSS
Regional	:	DCC, DAC, DAC Sub-Committee, SDA
Basin	:	MASL–Water Panel
Local/Project	:	PMC, 'Kanna' Meeting

Thus a culture of integration of institutions in water sector development activities has existed over the last four decades. Nevertheless, due to these efforts being linked to funding and other incentives for cooperation, they have been able to secure the necessary priority consideration of the other line agencies. Donor-led initiatives requiring addressing of environmental concerns in recent projects have also been able to be implemented with some success, as certain conditions/covenants have required to be adhered to for release of funding to various sectors and institutions and compliance was required for acquisition of funds for the other development efforts as well. Examination of the mandated functions of the various agencies and institutional arrangements for coordination between sectors show a gradual evolution of a culture of integration among sectors in so far as development initiatives were concerned. There was gradual realisation of the need to confront environmental issues (since Rio/Dublin) and also donor requirements that environmental considerations be addressed together with the promulgation of the National Environmental Act in 1980 making it mandatory that Environmental Impact Assessments

(EIA) be carried out before commencement of large-scale development projects.

Since 1988, with public participation in the EIA process being legalised, and with active local community participation and dialogue between stakeholder groups, an integrated approach to natural resource management is gradually developing. The latest amendments to many legislative enactments in the natural resources sector encourage co-management and participation, giving legal basis to such decision-making. However, certain past enactments such as Fauna and Flora Protection Ordinance restrict meaningful community participation. In the forestry, domestic water and irrigation sectors a high degree of stakeholder input has led to greater inter-agency coordination of efforts in view of the common target groups and communities being served.

The Shared Control of Resources Project (SCOR), implemented in 1993 by IWMI with funding by USAID, was the first attempt to link upstream/downstream stakeholders and interests, and undertake planning and implementation on a watershed basis. One watershed in the dry zone (Huruluwewa–NCP) and another in the wet zone (Nilwala–SP) provided insights and experience in handling development, institutional and environmental issues in the context of competing demands, uses and conflicts in a watershed.

However, there exist some difficulties in allocating priorities for united action unless there are financial components included, as line agencies tend to give priority to their own initiatives and a mismatch of activities sometimes occurs.

Regulation and Enforcement

While integration is taking place in developments efforts with some degree of success, the same cannot be said for regulation/enforcement, especially when implemented through a decentralised mode. Therefore, notwithstanding the many acts and institutions dealing with water and other natural resources, the fact remains that regulation is inhibited by the 'development' culture that prevails, which is in turn reinforced by the political process, where there is little keenness to support regulation and enforcement, and even less administrative and political will, especially at local levels.

The enactment of environmental laws and the establishment of the Central Environmental Authority is having some impact as regards environmental issues. In the water sector however, little interest exists to follow this path. The multiplicity of laws and agencies provide opportunities for inaction or passing the buck.

Beneficiary Involvement

Beneficiary involvement and later participatory management in the water sector was initiated first in the irrigation sub-sector in 1979 with the implementation of the USAID-funded Galoya Rehabilitation Project.

Beneficial outcomes, including some from individual initiatives at Kimbulwana Oya, Minipe and other places, resulted in expanding these efforts to other major systems as well, and by 1984, with the creation of a separate Irrigation Management Division under the Ministry, the Integrated Management of Major Agricultural Settlements (IMMAS) programme was set up with a system of coordination of services through a Project Manager. Farmer Organisations set up for representation and functioning through a tiered system resulted in greater involvement of farmers in system level decision-making. A similar programme (MANIS—Management of Irrigation Schemes) for other Irrigation Department major schemes was started in 1986, followed by a programme in 1988 for the Mahaweli Systems, which already had a Project Manager system in place. Participatory management was accepted by government as a policy in 1989 and amendments to the Irrigation Ordinance in 1994 provided legal backstopping to these institutional arrangements. Joint management of systems with Farmer Organisations in the 1990s has by 1999 resulted in the formation of Farmer Companies by system-level farmer organisations, who with the assistance of professional staff of their own are handling entire systems (for example Ridi Bendi Ela) as a prelude to taking over more and more responsibilities in system management and implementation of the agricultural programme.

Institutional arrangements such as the Project Management Committees, which have since been given legal recognition, have increasingly taken over the decision-making as regards allocation and distribution of water for cultivation in systems, as well as the development and monitoring of the seasonal agricultural plan and deciding on priorities for action under systems Operations and Maintenance (O&M). In addition Farmer Organisations cooperate with the respective agencies, banks and other private sector agencies with respect to arranging for supply of inputs and sale of agricultural produce.

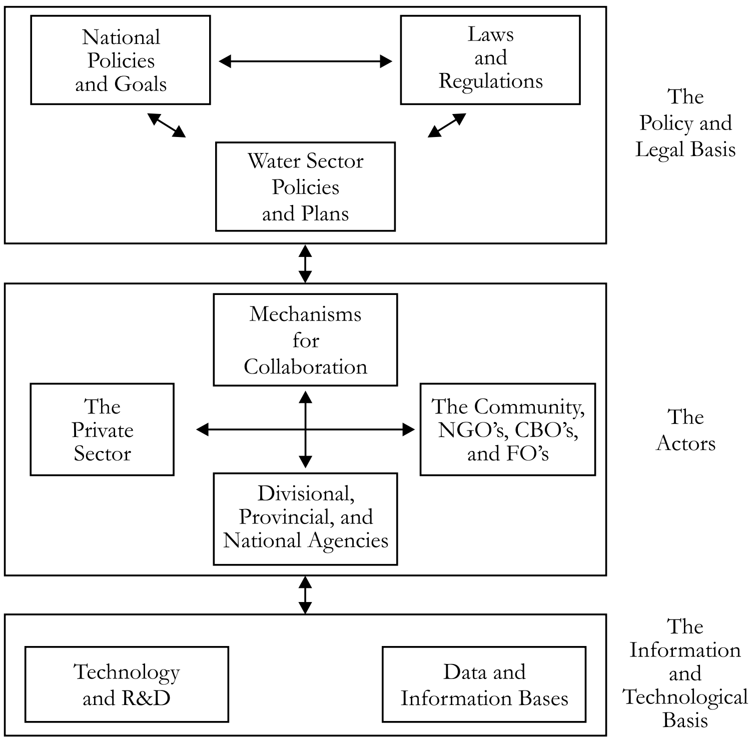
The new concept of Farmer Companies provides for the extension of the decision-making process to one of employment of professionals to undertake and implement the decisions made. The Ridi Bendi Ela Farm Company now employs its own engineer and agronomist in addition to a general manager for its work. The proposed extension of this programme to other major systems on the one hand and a decision to hand over systems less than 400 ha to Farmer Organisations on the other will reduce intra-sectoral intervention levels by the state agencies at the system level. The programme for joint system management in the larger systems area is also reducing the role of the state as a service provider in O&M in major systems.

8. Way Forward

The need to meet competing demands which are placing stresses on the demand/supply equilibrium, during low flows and droughts on the one hand and the increasing level of pollution of both surface and groundwater with little or no base flows required for environmental purposes during dry periods on the other, have brought to the fore the need for an integrated approach to management of water resources.

Sri Lanka's initial activity relating to IWRM was a Comprehensive Water Resource Assessment Project funded by the ADB and undertaken in 1993. It identified a strategic action plan for the water sector and outlined certain activities and institutional arrangements to be followed to enable the water sector activities to be integrated and managed in a holistic manner.

Figure 9.2: Strategic Framework of Comprehensive Water Resource Assessment Project



Source: Mosley (1994)

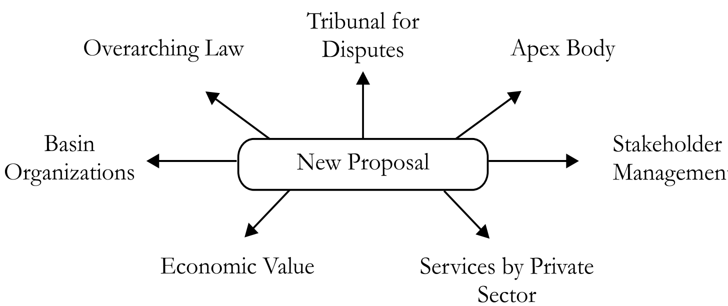
The need for a coherent integrated policy and strategic framework for water resources management and an overarching law to provide the necessary legal support is now accepted. The policy now being finalised anticipates providing for the following:

(*a*) An apex body for management and regulation of the water sector. An interim National Water Resources Authority (NWRA) has already been established.

(*b*) An enabling law to support integration and harmonisation of activities in the water sector providing the legal basis for administration and regulation.

(*c*) Provision of property rights to water to promote efficiency and economic use of water with adequate safeguards to ensure equity and protect the vulnerable and the poor.
(*d*) Recognition that water is a basic need of all living beings and safeguards to ensure environmental needs are met.
(*e*) A tribunal for settlement of disputes.
(*f*) Basin/Area-level organisations for stakeholder participation in allocation planning and decision-making.
(*g*) Service provision to be essentially by the private sector, CBOs and NGOs, Farmer Organisations/Companies etc., with state agencies mainly handling allocation, bulk supply and regulation.

Figure 9.3: Linkages of New Policy



National Water Resources Authority (NWRA)
National Water Resources Act (Legal Backstopping)
National Water Resources Council (Advise)
National Water Tribunal (Conflict Resolution)

The need to promote the concept of IWRM to reinforce the above and create the necessary awareness and expertise through capacity building is considered crucial. An initiative by the Sri Lanka National Water Partnership (SLNWP), under its programme of developing Public–Private Partnerships, has enabled the initiation of academic/ professional training in IWRM.

The Post Graduate Institute of Agriculture (PGIA) now conducts a M.Sc./M.Phil. course on IWRM and of 23 students currently undertaking the course, sponsorships have been obtained for several from a multinational (Unilever), which has agreed to support the programme through sponsorships over the next few years. A stream of professionals will thus enter the water sector with a sound understanding of IWRM. In addition the setting up of Area Water Partnerships (AWP) in several critical basins is laying the foundation for stakeholder participation in the River Basin Committees that will be formed under the proposed Water Resources Policy.

River management as a function is not assigned to any agency. Currently the administrative representative of government at local level (GA, AGA) is invariably the delegated authority under various Acts. The Irrigation Department handles aspects such as measurement of stage, flood forecasting, clearing of sand bars at estuaries and civil works on river embankments on a needs basis, but is not charged with any management or regulation of the entire river, especially inter-provincial rivers. This is an aspect that needs consideration in the near future. A programme termed '*Pavithra Ganga*' or 'clean river' has been inaugurated with a view to ensure unpolluted clean waterways. This programme being undertaken by the Ministry of Irrigation and Water Management and the Ministry of Environment and Natural Resources emphasises clean rivers. Commitment at the highest political and policy levels augers well for such a programme, given the rapid increase in pollution from both point and non-point sources and environment of river banks. Perhaps this will lead to assigning of regulatory functions of at least the larger inter-provincial rivers to an agency.

The trend of setting up institutions to cover subject or function areas that are part of a sector or even sub-sector, as is currently happening, could cause problems for coordination and integration. The multiplicity of ministries, rather than providing focused priorities, often leads to implementation programmes led by political expediency, which may detract and in some instances delay integration of efforts towards a common goal. Nevertheless, the continued and increasing involvement of beneficiaries and other stakeholders can have a moderating effect and lead to a positive effect overall.

In overall terms the emerging environment appears to be conducive for prudent and sustainable development and management of the country's water resources if all the institutional arrangements and legal and strategic frameworks are in place before irreversible impacts or costly mitigation measures become necessary to set things right.

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10

Approaching IWRM through Multi-Stakeholders' Dialogue: Some Experiences from South India

S. JANAKARAJAN

1. CORE ARGUMENT

THIS CHAPTER REVIEWS the historical development of competing demand for water and the implications for local water supply options and local environment. A fractured institutional set-up and its failure to deliver solutions have been identified as the primary hindrances to applying the IWRM formula in the specific Indian context. The case study conducted in the Palar river basin in Tamil Nadu state in south India is used as the primary source material for this analysis, supplemented by information drawn from two other river basins in the state, viz., Noyyal and Cauvery. This chapter also attempts to make a case for approaching the IWRM formula through multi-stakeholders' dialogue process in a context where 'everything has failed'.

The road map of the chapter is as follows: Sections 2, 3 and 4 introduce case study material from the Palar, Noyyal and Cauvery river basins (see Figure 10.1) with a view to highlighting intensity and complexity of problems and discussing the nature of institutional failure in handling a near-crisis situation in these river basins. Section 5 presents the case for the inapplicability of the IWRM tool under the complex conditions described in Section 4. Section 6 makes the case for approaching the IWRM tool through a multi-stakeholders' dialogue (MSD) process.

2. PALAR RIVER BASIN

The Palar river basin covers an area of about 18,300 sq km, of which approximately 11,000 sq km lie within the (Tamil Nadu) state's borders.

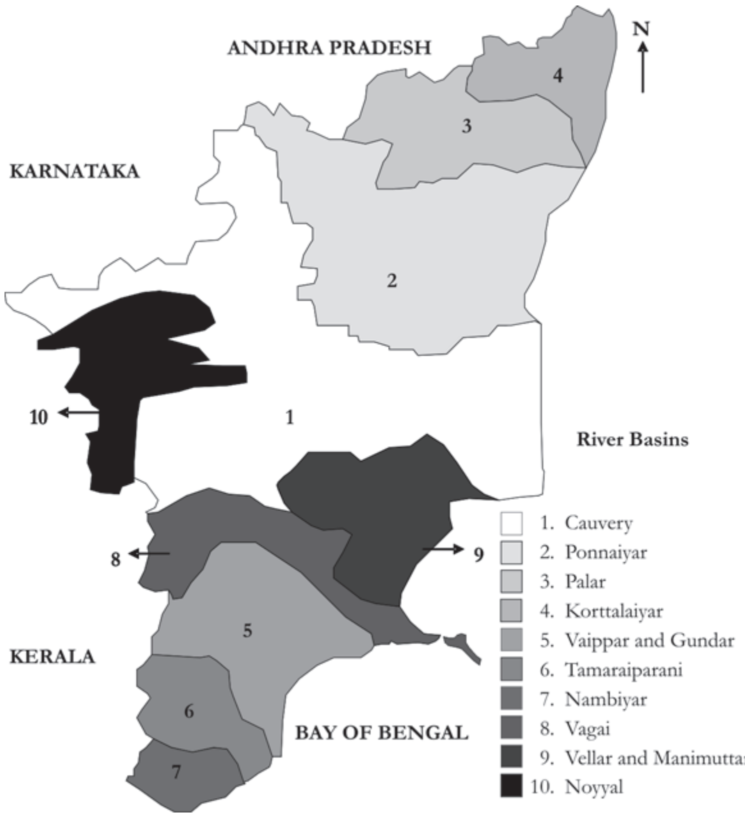
Average annual rainfall ranges from 800 to 1,200 mm. Most of it is contributed by the south-west and north-east monsoons. The climate is tropical and highly humid. The evapo-transpiration rate is as high as 2,000 mm per year, which is much higher than the annual rainfall. Flash floods occur only during the north-east monsoon months. The Palar is a water deficit basin (Institute for Water Studies 1992). Major irrigated crops in this basin are paddy, sugarcane, groundnut and, to some extent, banana. Major unirrigated crops are coarse cereals.

Tanks have historically been the most important surface irrigation source in the basin (Janakarajan 1993). There are no storage reservoirs constructed across this river but one finds a series of seven anicuts (diversion weirs) feeding a large number of irrigation tanks. The total number of tanks filled by these anicuts is about 700. These are called system tanks and have a total irrigation command area of around 61,000 hectares. Besides system tanks, an unknown number of non-system tanks also exist in the basin. The concentration of system tanks is high in the lower part of the basin as compared to the upper reaches. Groundwater is the primary source of irrigation in the upper reaches of the basin.

Besides tanks there were numerous spring channels which had their origin in the Palar river or its tributaries, irrigating thousands of hectares of land situated along both sides of the river. According to the Institute of Water Studies, there were about 606 spring channels which took off from the Palar river (Institute for Water Studies 2000). In many villages, spring channels remain even now, but in a dilapidated and silted condition. While in many of these channels river water has stopped flowing long ago, in some of them untreated effluent is discharged by the tanning industries. These two sources, tanks and spring channels, constitute the main traditional sources of water supply in this basin.

As tanks and springs (the major surface irrigation sources) are becoming more and more undependable or defunct, wells have emerged as the major source of irrigation in the basin area. Wells contribute to about 75 per cent of the total net irrigated area (Rajagopal and Vaidyanathan 1998). The density of wells varies from 0.74 to 2.82 per hectare (Institute for Water Studies 1992). Groundwater utilisation is

Figure 10.1: River Basins of Tamil Nadu State, South India



as high as 92 per cent. Groundwater is also the major source for drinking and industrial water needs. Quality, however, varies considerably across the basin. The State Groundwater Board has while assessing the available groundwater potential in the river basin not addressed the issue of water quality.

Urbanisation, Rural–Urban Water Market and Competing Demands for Water

Tamil Nadu is highly urbanised compared to most other Indian states. It ranks second in overall urbanisation, and first using a wider composite index. As per the 2001 Census, the degree of urbanisation in

Tamil Nadu is 43 per cent.[1] The rapid urbanisation process has, together with speedy industrialisation, created enormous pressure on the basic services in towns, the most important of which is water.

In the past three or four decades, many fast-growing towns in the state have depended upon pumping of groundwater in the adjoining rural areas for their domestic and industrial water needs. Chennai metropolitan city also receives supplies substantially from peri-urban areas, transported through tanker-trucks. A rough estimate during the summer of 2003 puts the total number of trips made each day by these trucks at 12,000, transporting a total quantity of 120 million litres of water per day (mld). A major portion of this water is drawn from the Palar basin. Besides, over 200 mld of water is pumped directly from the Palar riverbed for meeting industrial and drinking water needs around Chennai city. Even a part of the Chennai city's drinking water requirement is met by pumping from this river. Hundreds of villages and small towns located adjacent to the river get water supply from the riverbed aquifer. Most important of all, about 650 leather tanneries located in this basin consume about 80 mld of water. This water is pumped and transported either from the adjoining villages or directly from the riverbed.

The agricultural sector is still the single largest user of groundwater. Indeed, from this point of view, the proportion of total water used/demanded by domestic and industrial sectors may appear small and insignificant. But these sectors demand only good quality water, which is available only in some tracts. The result is a very high incidence of rural–urban water transaction. Water transportation takes place from a set of select villages, where the water table has as a consequence dropped quite deep, affecting agricultural production badly.

The fast urbanisation process, the increasing demographic pressure and expansion of industrial activity have generated competing

[1] The Census of India classifies an area as urban only if the following three conditions are satisfied: population size should be more than 5,000, proportion of total workers employed in the non-farm sector should be 75 per cent and population density should be 400 persons per sq km.

demands for groundwater.[2] As competing demands for groundwater have increased over time, conflicts or conflicting interests have also emerged among various user groups. The word 'conflict' need not in the present context be understood as referring to physical violence, but should rather be seen as a potential force for competition and change.

Leather Industry and Pollution Problems

The leather industry has been the most significant industrial activity in the Palar basin.

- At the all-India level, the leather industry contributes to 7 per cent of the country's export earnings.
- Finished leather has been exported since the early 1980s, when the Government of India banned the export of semi-finished leather. Since then, the number of tanneries multiplied in the country and the tanning technology has also changed from eco-friendly vegetable tanning to chrome tanning.
- Export earnings of the leather industry shot up from a mere Rs 0.32 billion in 1965 to Rs 100 billion in 2001.
- This industry provides direct employment to over 2 million people in the country.
- Fifty-one per cent of leather exports originate from the southern states and 70 per cent of the tanning industries are concentrated in this region.
- Of the total exports from south India, Tamil Nadu alone contributes to about 90 per cent, the value of which is Rs 50 billion.
- Seventy-five per cent of the tanning industries of the State are concentrated in the Palar basin, contributing over 30 per cent of the country's exports.

[2] The transformation processes in Latin American countries have contributed to a similar competing demand for water, resulting in growing contamination and vulnerability of human settlements in marginalised areas (see Moreyra 2001).

While these facts about the leather industry may appear quite heartening, the impact of tannery pollution on the local economy, agriculture and people is discouraging, demoralising and frightening.[3]

- On average, 35–45 litres of wastewater is discharged per kg of raw skin/hide processed. The total quantity of water used by the tanneries in the basin is a minimum of 60 mld. The quantity of effluent discharged from tanneries which are supposed to be connected to one of the eight Common Effluent Treatment Plants (CETPs) installed in the Palar basin is 37.5 mld. This is 1,125 million litres per month and 13,500 million litres per year or 13.5 mcm per year.
- The extent of effluent generated by processing one kilogram of raw hides and skins to finished leather is around 34 litres. Therefore, the total weight of the raw hides and skins processed works out to 1.1 million kg per day. (I follow this method of arriving at this information due to non-availability of data.)
- For each 100 kg of raw hides and skins processed, solid waste generation is 38.5–62 kg. The 100 kg of raw hides and skins is reduced to 20–32 kg of finished leather after processing.
- According to a study carried out by Stanley Associates, sponsored by the Asian Development Bank and executed by the Tamil Nadu Pollution Control Board, the pollution load in the Palar river is extremely threatening—(all parameters are in kilograms per day) TSS (Total Suspended Solids): 29,938; TDS (Total Dissolved Solids): 400,302; Chloride: 101,434; Sulphide: 3,818; BOD (Biological Oxygen Demand): 23,496; COD (Chemical Oxygen Demand): 70,990; Total Chromium: 474; Cyanide: 22.
- According to this study, the Palar basin is one of the worst-affected river basins in India due to industrial pollution, where groundwater is quite heavily contaminated. 'Judging by the

[3] Most of the information provided in this section has been collected through a survey carried out during the years 1997–99 in 51 villages of the Palar basin. This was a part of the research funded by the International Development Research Centre, Canada. For more details, see Janakarajan (2002).

amount and strength of the effluents, it is likely that the aggregate tannery effluent will have an adverse effect on the groundwater quality in the entire area and also on the Palar river, where the effluents are finally getting mixed' (ADB 1994: 1.30 Volume III).

- The Tamil Nadu Water Supply and Drainage Board (TWAD Board) conducted a study in 1997, collecting random samples of water along the Palar river to a distance of about 60 km. The results were compared with a study conducted by the Kings Institute in 1968. This indicates that TDS has increased by 79 per cent in the upstream tannery cluster. The study also found that in the downstream reaches of the river the value of TDS stood at 142 per cent. This establishes that movement of pollutants is significant. The report also indicates that even if tanneries completely stop releasing the effluent into the river, the extent of inorganic chemical constituents already dumped in the river cannot be recovered even in the long run (TWAD Board 1997).
- Drinking water is sold at Rs 2 per pot in Ambur, which is one of the worst-affected towns. An epidemic spread in the town in 1997, in which eight people were killed. Consumption of the polluted drinking water was alleged to be the reason for the outbreak of the epidemic (*Indian Express*, 8 April 1997).
- A detailed survey of eight villages conducted in this basin indicates that the value of land has come down drastically due to degradation of groundwater and soil salinity.
- Area cultivated under paddy has come down by more than 50 per cent in the affected villages since 1980. Incidence of crop failure is very high.
- A local agricultural research station confirmed poor germination of seeds, stunted vegetative growth, poor grain formation, reduced grain weight and low quality output. Furthermore, research indicates salinity in the coconut water, reduced size of the nuts and falling buttons.
- The net area irrigated by wells in the affected villages is quite low compared to that in of unaffected villages. More than 60 per cent of the wells in the affected villages are defunct due to water contamination. The investments that have gone into those wells are also lost.

- Soil salinity is widely prevalent in the affected villages.
- Yield of paddy per well in the affected villages is 628 kg, whereas in the unaffected villages the yield of paddy per well works out to 7,118 kg.
- Of the 51 sample villages that were selected for the survey, 42 were very badly affected, 3 were moderately affected, 3 were marginally affected and 2 were unaffected.
- Groundwater quality data collected by various agencies indicate a very high level of contamination (ADB 1994). Of the 110 sample wells in the affected villages, 104 reported water contamination and 38 have been completely abandoned.
- Forced migration of people from villages is taking place, which is both permanent and semi-permanent in nature.
- Consumption of contaminated water is commonly seen. The common health problems reported are skin allergies, asthma and gastritis.

To sum up, the extreme stress in the river basin is caused due to the following reasons (these are both reasons and manifestations, and it is difficult to differentiate between them):

- The traditional irrigation sources such as tanks and spring channels are on the decline.
- There has been competing demand for groundwater among agricultural, industrial and domestic sectors.
- The groundwater table has been progressively falling.
- Declining agricultural activity, yield, farm income and employment.
- Flourishing rural–urban water trade, drawing water out of agriculture.
- Contamination and drying up of the riverbed aquifer, which was the most important source of drinking and irrigation for hundreds of villages and towns in this basin.
- Drinking water crisis, and the emergence of a market for drinking water in the urban, semi-urban and rural areas.

- Declining groundwater quality and increasing number of abandoned wells; increasing indebtedness among farmers due to lost investment on wells.
- Declining life expectancy of tannery workers as well as people in the basin area; fear of impotency due to the consumption of contaminated water (see Box 10.1).

Box 10.1: Case Study: Farmers' Perception of the Ambur Tannery Cluster, where CETPs Are Located

This is one of the big clusters, where tannery concentration is very high. The present author has surveyed 21 villages in this cluster. There are 52 tanneries located within the boundary of these villages and another 280 are located in a radius of 10 km from the sample villages. The untreated effluent passes through many villages in this cluster before reaching the river. There are four CETPs located in this cluster but, according to farmers, they very rarely work; however, the effluent from the tanneries does pass through the CETPs before reaching the river. The area is stinking very badly. Water is contaminated and the air is severely polluted due to spraying of chemicals on leather. In many villages, effluent is discharged into tanks, streams and springs. In some villages, effluent is discharged into open fields. High incidence of mosquitoes results in health problems. Tanneries have contaminated the sweet groundwater that was available until 1980. Agricultural activities have stagnated: Due to poor yield and high incidence of crop failure, farmers do not show any interest in cultivation. More than 50 spring channels, which used to supply water directly from the base flows of the river, have been in disuse primarily due to effluent discharge.

Besides, no efforts have been made so far for the disposal or treatment of sludge, which contains a very high level of chromium and other heavy metals and chemicals. The sludge generated is stored in various open sites very close to residential areas or near the riverbeds. During rainy days, sludge deposit gets washed away slowly and spread to agricultural fields causing enormous problems to the village community. There was a news item in the *Hindu*, dated 16 April 2000, titled 'Residents up in arms against tannery pollution', since sludge was dumped in the burial

(*Box 10.1 continued*)

(*Box 10.1 continued*)

ground meant for the Scheduled Castes of three villages near Ambur town for many years. The Vellore Citizens' Forum sent letters to all the state authorities and the TNPCB, urging them to take immediate steps with a view to protecting the people. But it was reported that no action has been taken so far by the TNPCB.

This is an extremely stressed regime, in which the primary stakeholders—the farmers—are quite hostile to tannery owners. The situation was fluid. However, such a volatile situation could have been contained had there been some thoughtful policy measures. But unfortunately, all policy measures hitherto have failed to address these important issues of conflicts in the use of water: the competing demand for water and the relationship between overuse of groundwater and pollution on the one hand and rural–urban migration, deteriorating health due to water contamination and emerging livelihood problems on the other.

Mitigation and Regulatory Measures and the Role of Public Agencies

Although the need for effluent treatment always existed ever since the industry shifted from vegetable tanning to chrome tanning, it was only after the intervention of the judiciary in the mid-1990s that effluent treatment became mandatory for running a tanning unit. The Water (Prevention and Control of Pollution) Act was first passed in 1974 by the Government of India; this Act was adopted in Tamil Nadu in 1981 and the State Government constituted the Tamil Nadu Pollution Control Board (TNPCB) in 1982. The Board has prescribed the pollution standards and tolerance limits for various pollutants present in effluent water that may be let into inland surface water, public sewers, marine coastal areas or inland. Unfortunately this act and all other subsequent prescriptions of the TNPCB remained only on paper. In fact, the whole episode came into the public eye only after the Vellore Citizens' Welfare Forum (a non-governmental organisation) filed a public interest petition before the Supreme Court in 1991. In a historic judgement on 1 May 1995, the Supreme Court ordered closure of all tanning units that do not have a facility for treating effluent water. The Court directed the National Environmental Engineering Research Institute (NEERI) to examine the feasibility of erecting Common Effluent Treatment Plants (CETPs). After the recommendations of the NEERI in 1996, the idea of CETPs came into existence in Tamil Nadu.

The concept of CETP has become prominent basically due to non-viability of smaller units to have their own individual treatment plants. The smaller units constitute about 90 per cent of the industry. Further, for an individual unit it may help in reducing the pollution abatement costs due to operation of economies of scale in wastewater treatment. The TNPCB has initiated a CETP project to enable treatment of effluent water released by clusters of tanneries and dyeing and bleaching units located in various parts of the state. A total of 56 CETPs have been proposed to be erected all over the state, of which 27 would treat tannery effluent. Another 27 would treat the effluent from dyeing and bleaching industries, and of the remaining two, one each would focus on treating wastewater from hotels and hospitals. Twenty-two out of 27 CETPs proposed to be erected for treating tannery effluent in the state are proposed to be located in the Palar basin. In addition there were 65 individual effluent treatment plants (IETPs) in the Palar basin in 1996 (MSE 1998).

The state has promoted the CETPs by way of providing subsidies. While the Government of India provided 25 per cent of the cost, the state government extended a matching grant. The rest is met through beneficiary contributions and by borrowing from financial institutions. The tanners in Tamil Nadu claim that they have invested Rs 500 million for pollution control measures (Hashim 1996).

The CETPs are designed to maintain the prescribed standards with respect to only a few chemical parameters such as BOD, COD, pH and TSS. These CETPs will do nothing about removing TDS (which is the major pollutant), chromium, colour, odour, etc., from the effluent. TDS levels in the typical untreated tannery effluent ranges from 10 g/l to 17.3 g/l. The tolerance limit prescribed by the Tamil Nadu Pollution Control Board is 2.1 g/l. Only some fixed parameters such as BOD and COD are treated and the basic pollutant, TDS, remains at a very high level even after the treatment (MSE 1998). In other words, since these CETPs and IETPs are not designed to treat

TDS, the salt level will continue to remain at a very high level in the basin area (see Box 10.1, which narrates farmers' perception of a tannery cluster in the basin).

Response of Civil Society, Judicial Activism and the Birth of the Loss of Ecology Authority

Organised people's response to the severity of pollution in the Palar basin has been witnessed only in recent times. A small organisation called Community Action for Development was the first organised effort to condemn the environmental degradation caused by tanneries. It was formed in one of the badly affected towns, Ambur, in the late 1980s. Its sustainability was uncertain due to threats posed by the tannery owners. The organiser of this movement therefore started writing in a national newspaper and generated some public awareness. In 1991 a movement called Vellore Palar Protection Movement was started and has been reasonably active in the basin. They organised many demonstrations and protest marches. Each year, when the tannery owners organise an International Leather Trade Fair in Chennai, the volunteers of this movement distribute pamphlets to foreign buyers, describing the extent to which the environment is damaged due to leather tanning. An organisation called *Pasumai Thayagam* (an outfit of one of the leading political parties in Tamil Nadu) organised many protest meetings and demonstrations in the basin with a view to organising people. Another organisation called Trust Help has made a video film and a case against the tanneries was presented to the International Water Tribunal in the year 1992 held at Stockholm, Sweden. Peace Trust, yet another organisation, organised a public hearing on tannery pollution issue in Chennai on 29 June 1996.

The most vital response to the acute pollution problems caused by the tanneries came from the Vellore Citizens' Welfare Forum. A Public Interest Litigation case, under Article 32 of the Constitution, was filed by them in 1991 before the Supreme Court of India against the tanners. The Supreme Court in its judgement in 1996 clearly upheld the precautionary principle and the 'polluter pays' principle as the most fundamental and essential features of sustainable development.

I quote an excerpt from what is regarded as a far-reaching judgement delivered by the Supreme Court (*Vellore Citizens' Welfare Forum vs. Union of India* [AIR 1996 SC 2715]):

> It is no doubt correct that the leather industry in India has become a major foreign exchange earner and at present Tamil Nadu is the leading exporter of finished leather accounting for approximately 80 per cent of the country's export. Though the leather industry is of vital importance to the country as it generates foreign exchange and provides employment avenues, it has no right to destroy the ecology, degrade environment and pose as a health-hazard. It cannot be permitted to expand or even to continue with the present production unless it tackles by itself the problem of pollution created by the said industry.

With a view to compensating the affected farmers in the region, the judges ordered and directed the Government of India to constitute an authority under Section 3 (3) of the Environment (Protection) Act, 1986, with all the powers necessary to deal with the situation created by the tanneries before September 1996. This authority constituted by the Government of India shall implement the 'precautionary principle' and the 'polluters pays' principle.

> The authority shall, with the help of expert opinion and after giving opportunity to the concerned polluters assess the loss to the ecology/environment in the affected areas and shall also identify the individuals/families who have suffered because of the pollution and shall assess the compensation to be paid to the said individuals/families. The authority shall further determine the compensation to be recovered from the polluters as cost of reversing the damaged environment.

The judgement also indicated that the authority should compute the compensation under two heads: reversal of ecology and payment to individuals. The Court also directed all the tanneries to install effluent treatment plants within a stipulated time period (30 November 1996). The Supreme Court imposed a fine of Rs 10,000 on each tannery located in the State of Tamil Nadu. This money, along with compensation to be recovered from the tanneries, should form what the Court called an 'Environment Protection Fund', which should be used for restoring the damaged environment. The Court also ordered that the tanneries which fail to pay the fine should be closed.

Thus, as per the directions given by the Supreme Court of India, The Loss of Ecology Authority (Prevention and Payment of Compensation) (LEA) was constituted. While the Authority was carrying on its work, tannery owners filed a case in April 2000, alleging that the Authority was investigating into the matter beyond its scope. Therefore they pleaded that the Court should intervene to stop the entire proceedings of the Authority. But the Court dismissed this petition. The Authority completed its work and submitted its report to the Government of India in January 2001. The Authority identified 15,165 hectares belonging to 29,193 farmers spread over the entire district of Vellore in the basin as affected land area and recommended a total compensation of Rs 268 million. This amount will be recovered from 546 tanneries identified by the Authority in the basin on the basis of the extent of effluent discharge.

Anomalies associated with the findings and recommendations of the Loss of Ecology Authority (LEA)

Although the pollution caused by tanneries started affecting the basin area many decades ago, the compensation recommended by the LEA covers only the period from August 1991 to December 1998. Further, as per the original ruling of the Supreme Court, the LEA was to receive petitions from the affected farmers, but the LEA has instead identified them by using its own mechanism.

Compensation was computed on the basis of TDS level in the irrigation wells. If TDS is in the range of 1,000 to 2,100 mg/l, then compensation payable is Rs 1,000 per hectare per year. If TDS level is 2,100 to 3,500 mg/l, then compensation payable is Rs 2,000 per hectare per year. Rs 6,500 is paid as compensation if TDS is in the range of 3,500 to 4,900. If it exceeds even this level, Rs 14,000 is paid as compensation per hectare per year. It is easy to identify the irrigation wells with TDS levels, but how could one arrive at land area affected by using the data pertaining to TDS level in the irrigation wells? The

LEA adopted a simple method in which all the land area that is irrigated by that well has been taken to be the affected plots of land. This is fine and logical. But what is the method of identifying the land area irrigated by an affected well? This is where the anomaly crops up. Instead of asking the farmers themselves, the land area located in the same survey number in which an affected well is also located has been taken as the land area affected. But in reality, area irrigated by a well cuts across survey numbers. Further, in many cases, no well is located in a particular survey number. Should one conclude in such a case that no land has been affected? Furthermore, degradation of land and soil salinity have occurred not only due to irrigating with polluted water but also due to disposal of the untreated effluent and sludge in the open fields, tanks and spring channels. Therefore, land area affected has been grossly understated. The actual area affected that deserves compensation must be several times more.

Moreover, compensation towards investment lost in the contaminated wells is not considered. Each farmer has spent considerable money in well digging and deepening. The depth of wells in this region is between 40 and 100 feet (12 and 30 metres). The wells are masonry with a large diameter (round or square). On average, according to our survey, a farmer will have to spend at least Rs 100,000 for a masonry well of 40 feet and another Rs 25,000 towards pump shed, motor and pumpset. The average number of wells per village in this region is around 200. Therefore the compensation payable towards defunct wells alone would be Rs 25 million per village. There are hundreds of affected villages in this basin.

Until two or three decades ago this basin was considered the second rice bowl of Tamil Nadu. Paddy yield used to be at least 4,500 kg/hectare. At present, in many of the affected villages the land is kept fallow or a coconut crop is raised which produces no yield. In addition, it is necessary to calculate compensation towards damages to land, human and animal health; damages to hundreds of spring channels, tanks and the river and riverbed aquifer; mental agony to people fleeing the region (environmental refugees), etc. Indeed, the damages in this basin are dramatic and incalculable.

For these reasons, although the LEA was constituted by the Government of India as directed by the Supreme Court with very good intentions, this act has not solved the problem of pollution or water scarcity. The judicial intervention was successful in creating awareness but has not ensured sustainable development in the basin.

Hostile responses from tanners and the emerging deadlock

A survey of 74 tanneries in the Palar basin (MSE 1998) gives the perception of tannery owners with regard to pollution standards maintained by them. Their complaints are: (1) They switched from vegetable tanning to chrome tanning in response to the Government's policy to boost exports of finished leather and leather goods rather than exporting semi-finished leather; (2) The tolerance level of BOD is too stringent compared to what is prescribed by many other exporting nations; (3) TDS levels (2,100 mg/l) were fixed without calculating the cost involved in reaching such standards, and (4) Existing CETPs are not designed to attain such levels of prescribed standards.

On the Supreme Court's direction that polluters should pay for the restoration of the ecology and compensation for the victims, 'about four-fifths of the tanners said that the Government and society should bear most of the burden. Many of them asked why the tanners alone be penalized for the past environmental degradation' (Madras School of Economics 1998: 184). They have even gone to the extent of asserting that the notification of the Government of India conferring power to Loss of Ecology Authority is *ultra vires* of the Environment (Protection) Act 1996 and the provisions of the Constitution. They also added that the Authority has no jurisdiction to assess or demand compensation in law and that the Authority claiming compensation violates the principles of natural justice.

The most popular view is that the polluters should pay for the damages. But what is the practical mechanism through which one can ensure that the industries do internalise environmental costs? This is difficult, particularly in a situation where there exists a nexus between bureaucrats and polluters. Norms are prescribed by the TNPCB, which do not comply with the Supreme Court order. The judiciary has not been able to go any further. Under these circumstances, how to make sure that the polluters follow the TNPCB's regulations in following the standards prescribed by them?

The Supreme Court gave three options to the tanners: joining a CETP, erecting one's own IETP, or relocating a tannery. But none of these decisions are going to help or make sure that the environmental damages made so far will be set right. Nor do these decisions ensure that the tanneries will follow the standards prescribed by the TNPCB. A mere erection of an IETP or being a part of a CETP or dislocating a unit would hardly provide solutions to past and present problems. Nor would any punitive measures such as imprisonment help. Is there a way to break this deadlock?

3. Noyyal River Basin

Due to heavy concentration of dyeing and bleaching industries, the Noyyal, like the Palar, is a heavily polluted river basin. This river is a tributary of the river Cauvery. This river basin is a water-scarce region. Average annual rainfall in this region is about 850 mm, which is 10 per cent less than the state average of 930 mm. Historically, this basin hardly ever had access to conventional surface sources of irrigation such as tanks, springs and canals. In the absence of any reliable surface water resource, groundwater assumed the role of the only local water supply option for irrigation and domestic use as well as for industrial needs.

The knitwear industry concentrated in Tirupur town contributes over Rs 50 billion per annum by way of foreign exchange and provides employment to over 100,000 people. Irrespective of landholding position, young people (men, women and children) prefer to work in these industries rather than in agriculture. As per the meso-level survey conducted in 41 villages in this basin, over one-fifth of the total population is employed in this industry (see Table 10.1).

There are over 850 dyeing and bleaching units functioning in Tirupur, whose operations depend heavily upon good quality water. In the absence of any other source of water, these units have been transporting groundwater from the rural areas by truck-tankers. Out of 100 million litres of water used per day in this town, private water supply alone is 60 mld. A rough estimate puts the number of truck-tankers that transport water to the town at 900 to 1000, of which

Table 10.1: Percentage of Total Population Engaged in Knitwear, Dyeing and Bleaching Industries in Tirupur Town from Sample Villages

Clusters of Villages	*Number of Villages in Cluster*	*Percentage of Total Population Engaged in Knitwear and Dyeing and Bleaching Industries in Tirupur*			
		Male	*Female*	*Children*	*Total*
Cluster-1	4	8.0	4.7	1.4	14.1
Cluster-2	5	20.6	8.2	2.6	31.4
Cluster-3	2	17.1	7.5	1.7	26.3
Cluster-4	2	11.8	5.6	0.4	17.8
Cluster-5	7	14.4	9.1	6.6	30.1
Cluster-6	4	7.4	5.1	1.4	13.9
Cluster-7	6	6.7	3.6	0.3	10.6
Cluster-8	6	19.0	8.2	3.2	30.4
Cluster-9	5	15.8	9.1	3.2	28.1

Source: Survey by the author, 1997–2000

about 90 per cent are owned by the industry owners (as reported by a union leader in Tirupur).

One of the important processes in the making of knitwear products is dyeing and bleaching. This particular process not only consumes an enormous quantity of water, but almost the same quantity of water is discharged as effluent. The major part of the effluent is discharged into the Noyyal river and to a significant extent in other small streams such as the Nallar and Jamunai rivers. Available evidence confirms that the effluent discharged by these units is quite hazardous, causing serious health problems. This is evident from the type and quantity of chemicals used in the bleaching and dyeing processes. In the process of dyeing and bleaching, the chemicals used for 100 kg of cloth are: wetting oil (with 100 per cent concentration) 500 gm; caustic soda 4 kg; sodium peroxide 4 kg; hydrochloric acid 8 kg; soda ash 15 kg; acetic acid 3 kg; common salt 10 kg; and petroleum oil 2 kg. This particular process is heavily water-consuming and requires 40,000 litres per 100 kg of cloth. On an average, a dyeing unit can process 20 tons of cloth per month or about 700 kg per day, consuming about 8 million litres of water per month or 280,000 litres of water per day (Palanichamy and Palanisamy 1994). The use of common salt alone works out to 595,000 kg per day. The estimated water requirement of the bleaching and dyeing units in Tirupur is over 100 mld, of which about 60 per cent is met by groundwater transported by the truck-tankers from the rural neighbourhood.

This was the position in 1994. The requirement of water in 2004 has crossed 120 million litres per day. What is really disturbing is the fact that so much of effluent discharge has already caused permanent damage to the river, top soil and most important of all, the groundwater. As groundwater is contaminated, agriculture as the key occupation has been abandoned in many villages (ADB 1994: Vol. II).

An assessment was made to measure the pollutants discharged by dyeing and bleaching units in this basin (MSE 1998). According to this study, average TDS level was 7,595 mg/l, TSS was 620 mg/l, BOD and COD were 281 mg/l and 907 mg/l respectively, chloride was 3,244 mg/l and sulphide was 566 mg/l. This study also estimated pollution load (volume of effluent times concentration level) for six main parameters (see Table 10.2).

Table 10.2: Pollution Load of Six Major Parameters in the Noyyal Basin

Parameters	*Pollution Load in kg/day*
TSS (Total Suspended Solids)	41,150
TDS (Total Dissolved Solids)	480,465
BOD (Biological Oxygen Demand)	18,652
COD (Chemical Oxygen Demand)	57,438
Chloride	221,224
Sulphide	33,946

Source: MSE 1998

Effluent generated in this industry eventually gets stored in the Orathapalayam reservoir constructed across this river. The reservoir has never functioned well as an irrigation reservoir. Instead, this reservoir performed the role of a storage reservoir for the polluted water generated by the Tirupur industries. The reservoir was completed in 1991 but never opened for irrigation. Groundwater is contaminated in all the villages along the river course from Tirupur to the dam, a distance of about 10 km, and in villages up to 20 km downstream of the dam (Blomqvist 1996).

Mitigation Measures: To Augment Water Supply Rather than to Solve the Problem of Pollution

Until 1996, when the Madras High Court ordered the closure of all dyeing and bleaching industries which do not have wastewater treatment facility, there was hardly any pollution regulatory and monitoring mechanism operating in Tirupur town. The court order in August 1997 directed the TNPCB to take appropriate steps to ensure that no pollution was caused by the polluting industries and that these industries were not allowed to function except in accordance with rules and regulations specified by law. Eventually the idea of Common Effluent Treatment Plant (CETP) was promoted by TNPCB, which was a measure welcomed by the polluting industries. Thus, eight CETPs were located in different locations of industrial clusters with a total capacity of 45,300 kl/d with 50 per cent Government subsidy (shared equally by the state and central governments). But it is very difficult to ensure the proper functioning of these CETPs, as there are no effective law enforcement and monitoring mechanisms. Moreover, like the tannery sector, these CETPs are not designed to treat TDS, which is the biggest pollutant (generating about 595,000 kg per day). Therefore, the pollution load has not come down in any way, a fact which may be confirmed from the observation that the water stored in the Orathapalayam reservoir continues to be unused for irrigation and poses a big threat to the environment.

The state government is, without resolving the pollution problem, planning to bring more water to these industries from another river called the Bhavani—thereby resorting to a supply augmentation measure rather than approaching the issue through demand-side interventions (such as stressing the need for recycling treated water). New Tirupur Area Development Corporation Limited (NTADCL) is the company promoted to supply water to the industries of Tirupur town and to the domestic users. This project aims to supply 185 million litres of water per day to cater to the needs of over 850 dyeing and bleaching units located in this area as well as to supply water to 1.6 million people located in the Tirupur municipality and the adjacent panchayats. Total estimated cost of the project (which is a private initiative) is Rs 12 billion and it is expected to be in operation in six years' time. The Tamil Nadu Chief Minister has already laid the foundation stone on 20 June 2002. However, treatment of effluent generated by the industries is not included in the mandate of the company. This will have serious implications for the already degraded environment.

State Failure

Government Order (G.O. No. 213, I) dated 30 March 1989 prohibits establishment of any polluting industry at a distance closer than 1 km from rivers. This G.O. has been subsequently amended to the effect that the 1 km norm been extended to 3 km. Noyyal is one of the notified rivers in the G.O. Since the Noyyal river is dry and because whatever water flows in the river is not used for irrigation, the Tirupur Dyers' Association wanted exemption from this G.O. Strangely enough, the Government of Tamil Nadu has constructed a dam across this river (the already mentioned Orathapalayam dam) in the year 1992, about 10 km below Tirupur town, with a view to providing irrigation for 8,000 hectares. This dam's catchment area is 2,245 sq km, which encompasses most of the area where dyeing and bleaching units are concentrated. A large quantity of water (about 120 mld) consumed by the Tirupur dyeing and bleaching units is conveniently let into the Noyyal river (in the form of untreated trade effluent). Thus, the dam effectively performs the role of a storage reservoir for the contaminated water. In February 1997 the water from the overflowing Orathapalayam reservoir was released with a view to minimise the damage to the villages around the reservoir. Since the dam was opened without any prior public notice, it resulted in great havoc to crops, animals, soil and groundwater in the downstream areas. This polluted water from the dam joined the river Cauvery 32 km downstream. It is reported that several hundreds of animals collapsed after drinking this water. A few petitions were filed in the High Court protesting against the decision of the government to release the polluted water and claimed compensation for the damage. Even though it was a scarcity period, realising the gravity of the situation the Tamil Nadu Government decided to release 20,000 cusecs of water from the upstream Mettur dam (constructed across the main river Cauvery), basically to dilute the pollution load.

4. Cauvery River Basin

In the preceding two sections, the problem of acute water crisis (due to overuse and pollution) and institutional failure were discussed with reference to the Palar and Noyyal river basins. The issues encountered in these two river basins relate to a single state: Tamil Nadu. However, this section pertains to a crisis situation and state failure in which more than one state is involved.

The Cauvery is one of the important rivers of peninsular India. Karnataka and Tamil Nadu are the major states staking claims on the Cauvery water. Kerala and Pondicherry are the other riparian states which benefit in a small way. Therefore, Cauvery is an inter-state river as per the provisions of the Constitution of India. The Cauvery river basin is spread over an area of 87,900 sq km, which accounts for nearly 2.7 per cent of the total geographical area of the country. The basin covers an area of 48,730 sq km in Tamil Nadu and 36,240 sq km in Karnataka. The river travels a distance of 800 km before reaching the Bay of Bengal on the southern Tamil Nadu coast.

The Cauvery river has the dubious distinction of being one of the most disputed and litigious rivers in contemporary India. Whenever the monsoons fail, the conflict between the two major riparian states explodes, at times even taking a violent turn. Indeed, the recent episode of inter-state dispute has prompted the Supreme Court and the Government of India to consider seriously the possibility of linking of Himalayan rivers with the rivers in the peninsular India (what is popularly known as Ganga–Cauvery link).

The Cauvery water dispute between the riparian States is quite different from other inter-state water disputes such as the Krishna, Godavari or Narmada. In the case of the latter, the disputes revolve around the utilisation of the untapped potential in the concerned rivers. The Cauvery dispute is, in contrast, around the issue of allocation and reallocation of already committed and used water.

The recent events (in the agricultural season 2002–2003) that followed the Supreme Court's directives to the Karnataka Government to release at least 0.8 TMC ft (thousand million cubic feet) of water to Tamil Nadu almost created a constitutional crisis. This is unprecedented in the history of any inter-state water disputes in India. Realising the tricky situation, the Supreme Court immediately intervened and passed strict orders. As a result, the chief minister of Karnataka not only tendered an unconditional apology for having disregarded the Supreme Court's directives, but also started releasing water. The Karnataka chief minister has taken this decision despite strong protests from the Cauvery-basin farmers in his State. There was a sigh of relief from many quarters, in particular from civil society in both States. However, the situation that followed the release of water was quite grim in Karnataka: farmers' violence caused enormous damage to public property and the state of affairs compelled the Karnataka Government to impose curfew in one of the basin districts (Mandya). The Congress MP from Mandya sent in his resignation letter.

The tourism industry in Karnataka was very badly hit due to the violent farmers' agitation, which received wide public support in the state. According to the State Tourism Commissioner, 95 per cent of foreign tourists cancelled their hotel bookings (*India Travel Times*, October 2002). Agitated farmers set the engine of the Delhi-bound Swarna Jayanthi Express ablaze on 5 October 2002 at Maddur railway station in Karnataka, protesting against the Supreme Court order which directed the Government of Karnataka to release water to Tamil Nadu.

Under these violent circumstances, it is very difficult to speculate for how long the crest gates of the Krishnarajasagar dam will remain open to augment the water supply to the Mettur dam. It further raises a pertinent question: can the Supreme Court provide a lasting solution to this century-old problem? In the past several distress years, tensions between both the states have cropped up and often resulted in violence, the worst form of which was witnessed in December 1991, when thousands of Tamils and their property were the target of attack in Karnataka.

A careful analysis of the long-standing dispute between Karnataka and Tamil Nadu exposes the sense of distrust that they show to each other. Karnataka, since it came in late to utilise the Cauvery water, believes that its legitimate entitlement has been too restricted. Tamil Nadu on the other hand has had a much earlier and a more rapid history of development of irrigation in the Cauvery basin. Tamil Nadu, being a lower riparian state, feels that it is at the receiving end, both literally and metaphorically. The anxiety is caused mainly because the state has to bear the brunt of the burden of floods, drought, and pollution. But none of these burdens negates the fact that the state's food production has depended and will continue to depend strongly on the availability of water in the Mettur dam, and that the livelihoods of millions of people in the lower part of the basin area are contingent on the flow of water in the river. Tamil Nadu finds it devastating and thorny to be at the mercy and goodwill of the Karnataka Government during each scarcity year. Through the intervention of the Supreme Court, Tamil Nadu therefore seeks a clear title and definition of its share of Cauvery water.

The establishment of the Cauvery Water Tribunal as per the provisions of the Constitution of India is expected to give a permanent solution. Pending the final adjudication, the tribunal has given only the interim award, according to which the Karnataka was supposed to release 205 TMC ft water per year. Ideally, in a federal structure such as India, the Tribunal's award (whether interim or final) shall be both decisive and binding for all parties concerned, as otherwise it would result in lots of unpleasantness and eventually to a constitutional crisis.

Nevertheless, given the past history and hard positions already taken by both states, it is very difficult to suppose that the final award would end the dispute. Perhaps it may result in the eruption of fresh disputes! This is not to be construed as cynicism but rather as a note of precaution. This is to be anticipated in our democratic set-up, characterised by unprincipled and myopic political ambitions. Indeed, the Cauvery water has become a matter of ever-intensifying political dialogue and an election issue since the 50-year-old agreement expired in 1974. Each contending party and the party in power championed the cause of the Cauvery delta farmers in their respective states. People in both states have shown emotional responses and cultural attachments to Cauvery water. Unfortunately, political dialogues that have taken place so far in both States have only promoted regional chauvinism. The dispute between Tamil Nadu and Karnataka seems to shake the very foundation of India's federalism despite the interventions of the central government and India's highest judicial authority. The dispute has become deep-rooted and bitter. Can we break the stalemate?

5. Applicability of IWRM under Complex Conditions in South Asia

Required Enabling Environment

Water resources across the world are heavily stressed due to a multiplicity of factors. The three most important factors that warrant careful use and management of water resources are: (1) increasing demographic pressure and livelihood problems, (2) vast urban expansion, and (3) rapid industrial progress. Conventional strategies hitherto adopted have failed to address these issues adequately. In this context, the IWRM tool provides a clear basis for a careful use of existing water resources. The GWP's definition of IWRM quoted in Chapter 1 states that IWRM deals with water in its entirety: economic, social and ecosystems of a basin or region.

Its utility will be immeasurable if there is an enabling environment to follow such an approach, such as a proper institutional structure to implement and monitor, good governance and political will. IWRM demands certain requirements (clear laws and institutional roles for example) that cannot be avoided. This may require facing-up to difficult trade-offs and choices have to be made. The local circumstances and political will for change and progress need to be taken in to account (GWP 2002: 1). The enabling environment required for adopting IWRM may be summarised as follows:

- Policies: setting goals for water use, protection and conservation. These policies have to be drafted at the highest level of government.
- Developing appropriate water laws.
- Creating a conducive institutional framework or adapting existing institutions.
- Use of appropriate management strategies: the key elements are assessment of water resources, maintaining a balance between water for livelihood and water for ecology and making efforts to popularise demand-side interventions for a more efficient use of water.

Complexities of River Basins in South Asia

River basins and irrigation systems in South Asia are marred with complexities and fractured institutional structures, which pose an enormous and effective constraint for adopting an IWRM framework. What are these problems?

- Myopic policies, competitive populism of successive governments and lack of political will for good governance.
- Disintegrated/uncoordinated/fractured institutional structures.
- Low cost recovery rates.
- Lack of information flow.
- Lack of scientific data generation.
- Inadequate and unscientific planning which have resulted in chronic upstream and downstream conflicts, mismatch between groundwater recharge and extraction and waterlogging and salinity problems.
- Growing population and increasing demand for water for attaining food security.
- Rapid urbanisation process resulting in increase in drinking water needs and sanitation, industrial expansion which demands more water, and competing demand for scarce water across sectors and emerging conflicts.
- Growing problem of water pollution. Laws exist but without effective law enforcement mechanisms.
- Progressive decline in the groundwater table and competitive deepening of wells.

Conflicting interests among water various water users (stakeholders) have been on the rise:

- Between head- and tail-enders within an irrigation command area or a river basin;
- Between economic efficiency and welfare (such as between high-value users and use of water for agricultural production);
- Across uses and users (inter-sectoral conflicts);
- Between groundwater and surface water;
- Between urban and rural areas;

- Across states within a country (inter-state water disputes);
- Between countries over water sharing (India, Bangladesh and Nepal);
- Between ecosystem and economic development or to maintain balance between livelihood and water as a vital natural resource; and
- Between present and future generations of water users.

Policy Requirements in the Indian Context

Policies

Water policies have indeed been drafted at the highest possible government level in India, once in 1987 and the other in 2002. Quite apart from several shortcomings, the National Water Policy (NWP) in its present form is nothing more than a statement of intentions. The NWP is not taken up seriously by any state in India because the policy is neither supported by legislation nor supported by a concrete, time-bound action plan. Therefore, the NWP in India has very little operational impact due to lack of institutional mechanisms to plan, coordinate and implement water development across state boundaries and among users (a clear example of a fractured institutional structure). The NWP in its present form has no relevance, as its implementation requires constitutional amendments. For instance, there is a move to link all rivers in India. This requires, besides all other hurdles, a constitutional amendment to nationalise all water resources in the country. Whether this proposition will be acceptable to all states in India is a moot question.

Develop appropriate water laws

Are there no laws to take care of the provisions of IWRM in India? Comprehensive laws have been enacted in India with suitable amendments in the Constitution after the 1972 UN Conference on the Human Environment held in Stockholm. Until that time, the water and environmental laws in the country were very weak. The 42nd Amendment of the Indian Constitution passed in 1974 was a landmark. This enabled a series of environmental protection laws, the most important of which is The Water (the Prevention and Control of Pollution) Act.

Dilip Biswas (2001: 1), the present Chairman of the Central Pollution Control Board has confessed, 'Enforcement of such legislation is a challenging task because of various reasons including the inherent flaws in the laws and infirmity of enforcement machinery.' He further adds that though environmental laws and specific empowered authorities have been set up for pollution prevention and payment towards compensation, the monitoring mechanism for implementation is undefined. This is quite true in the case of the pollution in the Palar and Noyyal river basins discussed in earlier sections.

Leather tanneries have been classified under 'red industries' (heavily polluting industry) as per the provisions of law. This warrants installation of treatment plants and treatment of effluent water to the prescribed standards before letting it out. But this was never done until the intervention of the Supreme Court through a public interest litigation filed by the Vellore Citizens' Forum in 1991. At present, though many tanneries have treatment plants, the effluent water is either untreated or under-treated. In other words, the Supreme Court has delivered what is regarded as an historic verdict, but the country lacks enforcement and monitoring mechanisms, good governance and a committed bureaucratic and political set-up which would have made the Supreme Court's intervention effective and rewarding.

Similar is the case of the Noyyal river basin. As per the provisions of law, no polluting industries could be set up within a distance of 1 km from rivers, streams and other waterbodies. But there is a large concentration of tanneries and dyeing and bleaching industries just by the riverside. The audacity of dyers in the Noyyal basin is such that they wanted exemption from this government order, since according to them the Noyyal is a dead river, which carries nothing but the wastewater discharged by them. The height of inconsistency of government policy and of an uncoordinated institutional structure are reflected in the construction of the Orathapalayam dam as discussed above, which was never opened for irrigation.

Similarly, there are laws to share water across states and water tribunals have been set up whenever needed with a view to arbitrating between states. But the recent episode of the Cauvery water dispute between Tamil Nadu and Karnataka has crossed all limits and the chief minister of the latter state has declined to obey even the Supreme Court order when he was directed to release a certain quantum of water to the lower riparian state. Only when the Supreme Court issued an ultimatum did the Karnataka Chief Minister release water for a few days.

Creating a conductive institutional framework or adapting existing institutions
The existing institutional structure is so fragmented that no co-ordinated action for planning, implementation and monitoring is possible. First of all, in India water is a state subject. This has developed a good deal of vested interests in the various states; cooperation in water-sharing among states is virtually breaking down. Within Tamil Nadu, the Water Resources Organisation (WRO), which is supposed to be the parent organisation for all water-related activities, is standing apart from other government agencies which are also connected to water. The State Pollution Control Board, which is primarily responsible for controlling water and air pollution, does not undertake any coordinated activity with the WRO, as illustrated by the Orathapalayam dam. The Revenue Department (involved in cost recovery) is considered a rival organisation by the WRO, as it enjoys more powers as compared to other departments. For instance, the WRO cannot take any punitive action against defaulters in an irrigation system. At best it can lodge a police complaint or can report to the Revenue Department. It is the Revenue Department that is authorised to take action against such defaulters. Similarly, the WRO can do nothing about the polluters of waterbodies which are under its control. The Agricultural Engineering Department (which works on issues relating to installing community wells, waterlogging, sanitation, land reclamation, creating recharge structures, and on farm development work) is detached from the WRO and other agencies. Most important of all, state agencies such as Groundwater Boards, Drinking Water Supply and Drainage Boards, the Metro Water Department, which are directly involved in water use and management, have neither information flow among them nor any synchronised activity with the WRO or other agencies. Ironically, each one of these agencies gathers and maintains data relating to water for their restricted purposes but does not share it with other agencies.

In other words, the existing institutional structure is such that it neither pays attention to create a proper organisational framework nor develops appropriate human resources for well-defined coordinated activities. The net result is gross institutional failure in handling growing water management challenges. To get more clarity on this aspect, the entire economy can be divided into three sub-systems: the natural sub-system, the user sub-system and the institutional sub-system. The natural sub-system represents total water available in the country from all sources, i.e., the total supply. The user sub-system represents basically all water users such as agriculture, industry, the domestic sector, fishery, ecosystem and so forth, i.e., the total demand. The institutional sub-system represents the systems managers, i.e., the government/official agencies. As long as an equilibrium between natural and user sub-systems exists or as long as demand does not exceed supply, major problems will not surface. However, when there is mismatch between demand and supply, with demand exceeding supply, it is the responsibility of the institutional sub-system to intervene and restore equilibrium. In the current South Asian context the institutional sub-system is so weak, feeble and fractured that it has not only failed to restore equilibrium but also complicated the matter further.

Appropriate management strategies

The fractured institutional structure, combined with myopic populist policies and lack of political will, stand in the way of adopting any management instruments prescribed by IWRM. In the IWRM perspective, the vital instrument for moving towards sustainable use and development is to ensure that resources and ecosystems are given economic value and that external costs are internalised into market prices. The key strategy suggested has been demand-side intervention for a better and efficient use of water rather than resorting to supply augmentation measures. This basically involves the use of price as a regulatory mechanism for better water management. Recycling of water for industrial purposes is regarded as another key element of the management strategy. Private sector participation in such a process is inevitable. We have seen already the kind of private sector participation being planned in the Noyyal river basin: a private company has been promoted that is trying to sell water from another river basin to industries and domestic users without a plan for addressing wastewater generation, which is going to add to the existing pollution of the already stressed river basin. Another case in point is the free electricity supplied to agricultural pumpsets in Tamil Nadu, which contributes to an already stressed groundwater regime. Knowing fully well that introduction of tariffs to farm pumpsets could be used as an effective economic instrument to regulate the groundwater table, the successive governments in power dare not introduce electricity tariffs due to the fear of losing votes (see Janakarajan, forthcoming).

To sum up, complexities and variabilities in the institutional structures of South Asian countries do not provide the required enabling environment to adopt strategies prescribed by the IWRM tool. Nevertheless, the emerging water crisis leaves no option but to work hard to achieve the fruits of IWRM. How to adopt the IWRM tool in a situation 'where everything has failed'? A multi-stakeholders' dialogue (MSD) approach may be attempted to try out the IWRM strategies.

6. Approaching IWRM through Multi-stakeholders' Dialogue: The Experience of the Palar River Basin

In an atmosphere of intense competition and bitter conflicts, how does one bring together the various stakeholders for a dialogue and coordinated action? Who should initiate the multi-stakeholders' dialogue (MSD)—the government or NGOs or academics or any other group interested in civil society? The real usefulness of MSD lies in the fact that it provides a platform for all stakeholders to express their views and concerns and discuss them with other stakeholders. It provides an enabling environment for a better understanding and analysis of the situation. Stakeholders will be able to appreciate other stakeholders' problems, keeping in mind the welfare of the society at large. The state, on the other hand, will be enabled to take a better view of the matter, taking into account the grassroot-level realities. This will help the authorities to make better management and investment decisions. In other words, IWRM cannot be superimposed, certainly not in an atmosphere in which law enforcement mechanisms are very weak; rather, it has to be bottom-up and induced by the stakeholders. Because government institutions have not been successful in solving the problems of people on their own, 'it is in the best interest of government to try and facilitate such direct negotiations and become a welcomed arbiter instead of being considered as the incapable bully who wants to decide everything without taking into consideration the local realities' (Chert 2000: 20).

As may be seen from an earlier section, everything has failed in the Palar river basin, including interventions from the highest judicial authority of the country. This is the state of affairs in which multi-stakeholders' dialogue was attempted in the Palar basin, with a view to finding solutions to problems of growing water scarcity and pollution.

Multi-stakeholders' Meeting

The first step was to organise a meeting of multi-stakeholders with participants drawn mostly from the Palar river basin. The preparatory research and the initial stakeholder analysis carried out in the basin were found immensely useful in organising this meeting (for details on stakeholder analysis see Janakarajan 2000a). However, to involve tannery owners (the main polluters) in the meeting was found to be very difficult. Tanners were initially even refusing to meet with the present author. It took a couple of months for him to win their confidence. Their main reservation was that 'although the economy has gained by leather industry over a long period of time, everyone uses every single opportunity to destroy us; and the often suggested solution is the closure which will destroy not only tanners but also all those who are supported by this industry directly and indirectly' (Secretary, All India Skin and Hide Tanners Merchants' Association, at Chennai). Moreover, they articulated a mixed response, expressing fear, anguish, defenselessness and also a sense of pride in their positive contributions to the economy. Only after repeated visits and after giving the assurance that the closure of the industry was not the solution, they agreed to participate in the meeting. There were 12 participants from the tannery sector and all of them participated in the dialogue for two full days.

We encountered much greater difficulty in involving the government officials, in particular those from the Tamil Nadu Pollution

Control Board (TNPCB). Many officials called it a 'sensitive matter' and expressed fear about participating in the meeting. Altogether there were five officials from the government, which included one from the TNPCB. All of them stayed for not more than half a day.

Other participants from the Palar river basin were (representing) farmers, NGOs, local doctors, residents of local towns, microbiologists, lawyers, media persons, academics and the interested general public. Thus the, 'Multi-stakeholders' Meeting of Water Users of the Palar River Basin*'* was held on 28 and 29 January 2002 at Chennai, with 120 participants.[4]

The basic objectives of this meeting were:

- To take stock of use and abuse of water in the basin in the overall context of urban and industrial expansion and in the context of poverty, food security and hunger.
- To assess and examine who are the defaulters of law, and their positive and negative contributions to society and economy.
- To bring together various stakeholders for a fruitful dialogue with a view to hear, debate, document and make public their voices.
- To find ways to prevent further degradation of natural resources in question and to work towards sustainable development with a common agenda within a framework acceptable to all stakeholders.
- Most important of all, to find ways to turn situations of conflict and distrust into opportunities for mutual aid and cooperation.

Before beginning the dialogue on the first day, there were panelists' presentations on various aspects of water use and abuse with particular reference to the basin. Various stakeholders made a total of 12 presentations on the following topics:

[4] This was a part of the ongoing research in the Palar basin 'Local Water Supply and Conservation Responses', funded by the International Development Research Centre (IDRC), Canada. The meeting was jointly organised by the Madras Institute of Development Studies and IDRC.

- Aspects of the leather industry and its contributions to the economy (by the president of the tanners' association);
- Unsustainable development of the leather industry (by a farmer-cum-mediaperson);
- Stressed agriculture and stressed farmers (by a farmer);
- Environmental damage assessment (by an academic);
- Challenges posed by the leather industry to humanity (by a NGO);
- Working conditions of employees in the leather industry (by an academic);
- Sand mining and its implications in the Palar river (by a NGO);
- Prior attempts of civil society to save Palar (by a NGO);
- Available legal recourse to save Palar (by an activist lawyer);
- Water pollution and declining yield (by a farmer);
- Dying traditional irrigation sources such as spring channels (by an academic); and
- Critical assessment of the Loss of Ecology Authority (by a local mediaperson).

There were many heated arguments and the discussion was lively. At one stage, the discussion was quite intense and many strong words were used. In fact, one of the tanners stood up with an outburst: 'We (tanners) are treated like Afghan refugees; what sin have we committed except involving ourselves in this dirty business.' But the heat started to come down in the afternoon, which got reflected through the tone of another tanner: 'So far, we (farmers and tanners) were meeting only in the courts; for the first time we are meeting in a same platform with a view to sharing the concerns.' At this stage farmers were also yielding and recognised the need for a solution other than 'closure'.

In the dialogue process, remedial recourses for the problem of effluent discharge and environmental pollution were debated and discussed extensively. The dialogue centred around the following issues.

- Do we need new laws?
- Legal remedies—filing public interest litigation cases; would it help the cause?

- Technologically more efficient IETPs and CETPs: use cleaner technologies and recycle the treated water. Do we have an efficient monitoring mechanism?
- Put pressure on the Loss of Ecology Authority for the reversal of ecology. Is it possible?

Towards the end of the meeting there was a big sigh of relief. At that time it was widely acknowledged that MSD is a process and not a one-off meeting. Therefore, there was a general agreement to form a committee from among those who were present so that the dialogue process could be carried further. The result was the birth of the 'Social Committee' with 24 members representing different stakeholders. The two-day meeting was given wide publicity by the media, which carried stories for two days.

Formation of a social committee

The second step was to carry on with the MSD process through the Social Committee (later renamed as Multi-stakeholders' Committee of Water Users of the Palar River Basin) constituted at the end of the MSD meeting.

The objectives of Multi-stakeholders' Committee of Water Users of the Palar River Basin are:

- A comprehensive attempt will be made with an interdisciplinary focus to document information pertaining to water and environment in the Palar basin. In particular, the Committee will spend considerable time taking stock of available water resources in the basin (both surface and groundwater), the use pattern of water, (competing) demand pattern for water, water flow details in the river at different points, water quality details at different points within the basin and information relating to sand mining from the riverbed.
- To monitor pollution levels in the surface and groundwater at different strategic points within the basin.
- To measure the quantum of water consumed by different sectors such as agriculture, industrial and domestic users; to measure also the quantum of water that goes into tanneries, the quantum

of water that goes out of tanneries after use, the quantum of water that goes into the CETPs for treatment and the quantum of water that is released out of CETPs after treatment. To measure also the quality of water at various inlet and outlet points.

- To measure the actual quantum of water that goes out of the basin for non-agricultural uses such as for domestic and industrial purposes, amusement parks, etc.
- Reversal of ecology: Reversal of ecology is a package, which involves
  - ➢ Revamping of traditional irrigation sources such as tanks and springs, as a measure of providing adequate irrigation water as well as to recharge groundwater;
  - ➢ Channelling water into the Palar River in order to increase water flow;
  - ➢ Preventing sand mining;
  - ➢ Preventing polluted water (both from industries and from domestic sewage), whether treated or untreated, from entering the river;
  - ➢ Removing encroachments in the Palar River; and
  - ➢ Suggesting cleaner technology for water treatment.
- Developing rapport with various government agencies such as TNPCB, NEERI, CLRI, PWD, TWAD Board, National River Authority, Department of Mines and Minerals, District Administration, Department of Industries and Commerce, etc.
- Critically assessing the findings of the Loss of Ecology Authority and their recommendations for the reversal of ecology.

In order to carry out these responsibilities the Committee decided to involve experts in the concerned fields.

Major outcome of the committee's deliberations

On the recommendation of the World Bank, in 2001 the state government has constituted 'The Palar Basin Board'.[5] This Board meets

[5] Through Government Order, G.O. No. Ms. 31, Public Works W2 Dept., dated 12 January 2001.

very infrequently and after a few years there is already a need for 'revival'.[6] The Committee meets frequently and in the first 10 months did and decided the following:

1. It has been unanimously agreed that the closure of tanneries is not the solution; the members have committed themselves to finding solutions not only to pollution but also for restoring the ecology of the basin.
2. Different stakeholders have agreed to share information among themselves, so that more useful and concrete decisions can be made. In particular, tanners who were hitherto denying any access to information have agreed to share with all the details pertaining to tanneries and CETPs, and have also agreed to open access to tanneries and CETPs with a view to enabling the committee members to visit their sites at any time. This is considered one of the most positive outcomes of the committee in a short span of time.
3. It was felt that the prevention of any further pollution in the basin is the first step required towards reversal of ecology.
4. Thus, the Committee contemplates, by way of finding solutions to the problem of water pollution (including for TDS, which is at the moment untouched), handing over of effluent to a private water treatment company and payment according to the services provided by them. In this method of water treatment by a third party, the accountability rests with the water-treatment company and not with the tanneries. This is the biggest advantage of a third-party involvement in wastewater treatment. The tannery owners in particular welcome this move, but they want the state and the central governments to share in the fixed cost. If the governments (both at the state and the centre) provide subsidies, tanners claim that the cost

[6] See http://www.thehindu.com/2006/01/16/stories/2006011616330700.htm and http://www.thehindu.com/2006/02/06/stories/2006020615060800.htm for recent news items on the Board. Also see http://www.tn.gov.in/policynotes/archives/policy2003-04/pwd2003-2004-21-23.htm.

of water treatment will come down to about Rs 70/cu m. Otherwise, as per the quotation received by the committee from a Malaysian company, it works out to Rs 350/cu m; one other company has quoted Rs 250/cu m. The average total effluent generated by the tanneries in the basin is about 20,000 cu m per day (minimum). Therefore, the tanners stand to gain in a big way if the governments agree to provide subsidy. The tanners presented both proposals to the All India Hides Skin Tanners Merchants Association; their response was not encouraging. They still consider that the costs on TDS treatment are high. However, in the mean-time the tanners have installed a reverse osmosis (RO) plant to treat TDS as a pilot measure to work out the actual costs, and they want the help of the Committee to put pressure on the government to meet the capital cost of RO plants, so that tanners could bear the operating costs. The committee is in the meantime making further enquiries about various cost options of wastewater treatment.

5. The committee is also studying the option of transporting raw hides and skins from slaughterhouses from all over the country through cold-storage mobile trucks. By this method, the TDS menace could be completely eliminated since a large quantity of salt is applied only as a preservation technique. If raw hides and skins are brought to tanning industries through cold-storage trucks, then a large quantity of water—at least 20 litres per kilogram of hides and skins—could be saved. This quantity of water is used only for washing away the salt.
6. Publication of proceedings of the MSD meeting: One of the main objectives of the MSD meeting was to make public voices of all stakeholders. With a view to fulfilling this objective, the entire two days' proceedings were recorded, transcribed, translated, edited and published in the form of a book. It includes the translated version of all papers presented in the meeting. The book, a priced (but subsidised) publication, was released in December 2003 by the governor of Tamil Nadu.

Looking into the Future

Challenges

- Keeping the committee intact is a real challenge. One of participants in the MSD meeting—an activist lawyer who filed the first PIL case against the tanners in 1991—still believes that the closure of tanneries is the only solution to the problem of pollution. Not only has he refused membership in the Social Committee, he persuaded a couple of farmer-members to dissociate themselves from the committee. Therefore the committee needs to be fully prepared to deal with issues of this kind.
- To mobilise financial support to carry on with the tasks and objectives of the Social Committee.

Strategies

- Developing rapport with government agencies at all levels with a view to (*a*) getting access to official information (database), (*b*) influencing the policies of the Government, and (*c*) executing objectives of the Committee with the endorsement and financial support of the Government.
- World Bank officials, who were impressed with the performance of our Social Committee, advised the State Water Resources Organisation (WRO) to coordinate their activities with the Social Committee. It was suggested that a few members could represent the Committee at the official Palar Basin Board (in the capacity of unofficial members) and a few members from the official Board could represent that Board at the Committee. This suggestion strongly recognises the positive contribution of the Committee. This kind of mutual understanding is absolutely necessary, and would go a long way in contributing to the restoration of ecology in the Palar basin.
- Generate data, both primary and secondary, on all aspects of the basin.
- Develop village-level stakeholder units with the motivation of (*a*) spreading awareness for the restoration ecology in the basin,

(*b*) to generate primary data in each village concerning crop details, water use, conditions of surface and groundwater bodies, groundwater levels, water quality characteristics, documenting water conflicts, documenting details relating to encroachments, etc., (*c*) to develop a monitoring mechanism for preventing further pollution, to regulate water use (both surface and groundwater), and (*d*) to regulate water markets. The activities of village-level stakeholder units would need official sanction from the Social Committee only to prevent any unlawful activity of the stakeholder units.

7. Approaching IWRM through Multi-stakeholders' Dialogue: The Experience in the Cauvery River Basin

The experience gained and a little bit of success attained in the Palar river basin prompted this author to initiate a MSD in the Cauvery river basin. As outlined above, the intensity of the dispute between the two states involved has crossed all limits. In this context a MSD meeting will be organised involving farmers of both major riparian states: Tamil Nadu and Karnataka. The meeting is scheduled for 27 and 28 February 2003 (with the financial support of IWMI–TATA Water Policy Programme Anand).[7]

Rationale

What is the rationale for promoting a dialogue between farmers of Tamil Nadu and Karnataka? As indicated earlier, farmers have for a very long time been listening to what the political parties and bureaucrats have been saying on this matter. Due to this type of politicisation, a large communication gap exists between farmers of Tamil Nadu and Karnataka. The information flow is virtually nil. On the contrary, wrong data and misinformation have further widened the gap between

[7] The present paper discusses only the preparation of the Cauvery Dialogue, and is not updated for events between writing and publication. On the Cauvery Dialogue, see for instance the following media reports: http://www.hinduonnet.com/fline/fl2010/stories/20030523003509800.htm and http://www.hinduonnet.com/fline/fl2013/stories/20030704007513000.htm.

the actual water users of the respective states. Following are some of the issues on which there exists a communication gap, either due to lack of information flow or due to lack of understanding:

1. Farmers in Karnataka believe that the Thanjavur farmers grow three crops in a year using Cauvery water. By three crops, they refer to *kuruvai, thaladi* and *samba*. But these are not crops but seasons. While the first two are short-duration seasons, the last one is a long-duration season. Given the available water (which never exceeds eight months' supply even in the best years), Tamil Nadu farmers can grow either two short-duration crops (*kuruvai* and *thaladi*) or one long-duration crop (*samba*). The crop months of the three seasons together work out to 14 (4+4+6). Therefore, it is impossible to grow three crops in three subsequent seasons using Cauvery water. This is an ill-conceived notion, which prevails primarily due to a communication gap between farmers of both states. The dialogue process would help bridging such gaps.
2. There is a feeling among farmers of Karnataka that Tamil Nadu has massive unutilised groundwater potential in the delta region and that the farmers there are unwilling to shift their crop pattern from paddy to less water-intensive crops. Moreover, it is often stated that Tamil Nadu farmers need to adjust their farming to the growing scarcity conditions. First of all, the data published by the Central Groundwater Board gives exactly the opposite indication. In 1992, groundwater development in Nagappattinam district (eastern part of the Cauvery delta) is 100 per cent. Block-wise information in this district indicates that in six out of eight blocks groundwater is over-exploited; the remaining two blocks were categorised as dark blocks where the groundwater development is in the range of 85–100 per cent. It is obvious that in the last 10 years the situation would have worsened. Second, until 1931 when the Krishnarajasagar dam was commissioned, the utilisation of water from the Cauvery river for agriculture entirely depended upon the river course or run-off of the river or on water diverted through the anicuts (weirs). In other words, water kept

flowing downwards and flooded the delta region of the lower riparian state. This long history of flooding and waterlogging has resulted in soil salinity, and as a consequence the land in this delta region has become unsuitable for any crop other than paddy. Annual crops like sugarcane, banana and oilseeds are cultivated in the western part of the delta using canal water supplemented by groundwater, where waterlogging is not an acute problem (viz., in Thanjavur district). However, there is an element of truth in the apprehensions expressed by Karnataka farmers that the delta farmers in Tamil Nadu are not willing to adjust to the growing scarcity conditions in the basin.

3. There is an absolute necessity to educate farmers of both the states about the relevance and the significance of the federal structure.
4. There is a need to promote a dialogue with a view to differentiating 'use rights' from 'exclusive rights'. The problem arises mainly because of the feeling of such exclusiveness, particularly among farmers in Karnataka. They were misguided for so long and need to be educated. It is the responsibility of the governments in both the states to educate farmers that no single state can have an exclusive right over the Cauvery waters. Until now, all the political parties have failed in their duty to educate farmers about this distinction. All successive governments in both states have spent their energy in politicising the issue, thereby promoting regional chauvinism. Indeed, the kind of competitive populist policies pursued by successive governments in Tamil Nadu and Karnataka have made this issue more delicate and ghastly. Therefore, a continuing dialogue among the farming community seems to be the only way out of the current stalemate.
5. There is an absolute necessity to modernise the canal network and the pattern of irrigation in the lower delta regions of Tamil Nadu, which would save easily a third of the water now applied for irrigation.
6. Dialogue is absolutely necessary to undo all the hitherto built-up apprehensions and misgivings, and to create a climate of

warmth, sense of caring and sharing and to promote an intense feeling of brotherhood and fraternity.

There may be more reasons why dialogue between farmers of both states should take place. But the need for a 'non-official initiative' such as the one suggested above could be the first step towards finding a lasting solution.

How to Set in Motion the MSD?

Steps involved

- As a beginning, two meetings of farmers' representatives (leaders who exercise control among the farming community) of both the states will be organised, one in Chennai (on 27 and 28 February 2003, at Madras Institute of Development Studies) and the other at Mysore (Karnataka) during April 2003. Non-farmers such as academics, politicians and bureaucrats will also be invited but they will not be given any prominent role.
- At the end of the second meeting, a Joint Stakeholders' Council, primarily consisting of farmers' representatives from both states (and also from Pondicherry and Kerala), will be constituted to carry out the task of periodically assessing, analysing and prescribing mechanisms for water sharing.

Agenda of the meeting
Each meeting will be of two days' duration. On the first day there will be presentations of papers representing the basin regions of Karnataka and Tamil Nadu. The themes of the papers will centre largely around the supply and demand pattern for water, water supply conditions of surface and groundwater, conditions of canal network, critical analysis of the present water management techniques, prospects of water-saving techniques, legal issues and on overall institutional failure. The second day will be fully devoted to dialogue. The number of participants in each meeting will be around 120 (40 farmers each from Tamil Nadu and Karnataka and 40 others).

Research output
One of the objectives of the MSD attempt in the Cauvery basin is to put together the views of the water users of Cauvery water in both the states and their responses towards resolving this age-old dispute. So far the views of water users' have not been heard and what we have been hearing are the views either of bureaucrats or academicians—hence the present initiative attempts to survey the Cauvery command areas of both the States with a view to documenting the voices of water users. The views of water users and the outcome of the stakeholders' dialogue meetings will be made public. Therefore, one of the aims is to bring out the views of Cauvery farmers along with the papers presented in the workshop in the form of a book. The book will also contain a chapter on the significance of multi-stakeholders' dialogue as an approach to sustainable use. The book will be published in both Kannada and Tamil.

Coordinator's role in the present endeavour
The dialogue coordinator will perform the role of a catalyst. His input will be crucial in organising the first two meetings of farmers, in the formation of the Stakeholders' Council and in bringing out the publication. In all other subsequent events and activities undertaken by the Stakeholders' Council, the coordinator will have a restricted role.

8. Summing up

This chapter has reviewed the historical developments of competing demand for water in three river basins of South India: Palar, Noyyal (marred by acute scarcity, overuse and pollution problems) and Cauvery (facing a deadlock due to bitter inter-state dispute in water sharing). It has been argued that in all the three cases the state has failed to deliver solutions due to myopic policies which centre around short-term political gains, addressing the issue of water scarcity only through supply-side interventions, i.e., through more investments in supply-augmenting measures without paying due attention to recovery of costs and failing to provide efficient water delivery systems through using water saving techniques such as modernising canal networks, promoting the use of recycled water and so forth. In other words, what one encounters is a fractured institutional set-up stained with bad governance and ineffective law enforcement and monitoring mechanisms. In this context, the applicability of IWRM was discussed to restore a 'delicate balance between livelihood and water as a resource'. The pre-requisites needed for the application of IWRM principles are strong and good governance, and law enforcement and monitoring mechanisms. In the South Asian context at least, this is some distance away. However, if one does not insist on a top-down approach, IWRM principles can still be adopted with suitable modifications through stakeholder participation, in what may be regarded as a bottom-up approach. This is precisely what was attempted through a MSD process in the Palar and Cauvery river basins in southern India. A beginning has been made. Sustained efforts, time and resources have to be put in to translate all these into tangible results. Further, much depends upon the kind of support provided by the government.

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11

Water Transfers Out of Agriculture: Towards a Win-Win Solution? A Case Study of Thuruwila, Sri Lanka[1]

KUSUM ATHUKORALA

They took our water—what are we to do?
– Peasant lament in *Fontamara*,
Ignazio Silone

1. INTRODUCTION

IRRIGATED AGRICULTURE IN many parts of monsoonal Asia has a history of over two thousand years. Practiced in farmer-managed systems, it typically supported rice cultivation. Sri Lanka, in particular, boasts of several thousands of irrigation reservoirs (locally known as *Wew* or *Kulam* but also referred to as tanks), usually strings of them in cascades within river basins, with a high level of technical precision for water storage and distribution. The technical excellence of the physical system in Sri Lanka that supported rice cultivation of this period, earned for its society the term 'hydraulic civilisation', and the country was fittingly referred to as the 'Granary of the East'.

The hallmark of irrigated rice cultivation in Sri Lanka at that time was its closely woven networks of water-use systems, integrated with

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adequate environmental reserves, such as well-protected watersheds and catchments, wetlands and estuaries. Each cascade of reservoirs along a river had specific areas for cultivation, distinctly separated from areas for conservation of forests and other natural resources. Each cascade provided water for rice as well as other food crops, for household animals as well as for wildlife, for crop production as well as for food processing.

The development activities fostered by the state and individuals in ancient Sri Lanka recognised the principle of co-existence between man and nature. Most ancient Sri Lankan irrigation systems, which provided the main source of livelihood for the people, were thus built for 'the benefit of the country' and also 'out of compassion for all living creatures'. The *Mahavamsa*, the premier historical chronicle in Sri Lanka, enunciates the principle of common property resources, equity of access and state trusteeship as follows: 'O great King, the birds of the air and the beasts have as equal a right to move and move about in any part of the land as thou. The land belongs to the people and all living beings; thou art only the guardian of it.' This was in circa 223 BC.

In modern times, the size and complexity of competing water demands have compounded this pattern of smooth co-existence; communities depending on irrigated rice cultivation confront the stresses of intersectoral competition in what seems to be an escalating trend. The case study of Thuruwila, a village in the Anuradhapura District in the North Central Province of Sri Lanka, which mobilised itself to meet a crisis related to an inter-sectoral water transfer, illustrates the scope of this challenge.

2. Background

Many of the ancient reservoirs fell into disrepair with the fall of the Sinhala kingdoms in the dry zone of north central Sri Lanka but some continued to support cultivation without a break up to the present times. Many small village reservoirs (known as *Purana Wew*—ancient resevoirs) with their own watersheds, viewed and utilised as a common property resource, supported communities known as *Purana*

Gam (ancient village). The operation and maintenance of the tank was seen as a joint responsibility and the leadership in organising cultivation was undertaken by the *Vel Vidane* (cultivation manager who was also responsible for water delivery).

With the state-sponsored thrust for agricultural food production during the British colonial period and in early independent Sri Lanka, the irrigation systems in the dry zone, both large and small, saw a resurgence. Ancient tanks were rehabilitated, new reservoirs such as Gal Oya built and the surplus population from the wet zone were settled in irrigation settlements in the North Central and Eastern Provinces.

Recently some of these tanks have been tapped for non-agricultural uses, sometimes for industrial use but more often to provide drinking water to adjacent urban settlements. The demand for water continues to grow, especially in the urban context in a situation where there is high seasonal variability in water availability.

Due to these escalating non-agricultural demands, the agricultural sector, and in particular the major water user, irrigated agriculture comes under growing pressure. There has been little recognition of this increasingly common phenomenon and its possible short- and long-term impacts on rural communities in Sri Lanka. Periodically, media reports of community protests against proposed water transfers out of agriculture have appeared. Ideally such water transfers should be planned in a manner that the rural and urban groups are both benefited while minimising negative impacts on prior users. In a situation where prior consent is not sought and consensus building through community consultations is ignored, such a water transfer may amount to expropriation of rural water rights and lead to major changes in affected communities, such as loss of livelihood and related poverty, migration and resultant urban congestion.

Water transfers out of agriculture are not a phenomenon limited to Sri Lanka but are increasingly experienced in the neighbouring sub-continent. In 2002 the International Food Policy Research Institute (IFPRI) supported by the Ford Foundation undertook a regional study of water transfers out of agriculture in Nepal, India and Sri Lanka. In preparation for the IFPRI study, a number of options where impending water transfers had given rise to community tensions were examined for the selection of a study site. Thuruwila, a medium-sized tank of 5,200 acre-feet in the North Central Province, identified to augment drinking water supply to Anuradhapura, was eventually selected.

3. Politics and Method

This study was complicated due to the fact that it started up at a point where the community was negotiating with the agencies, especially the National Water Supply and Drainage Board (NWSDB), to effect changes in the project while contemplating the possibility of legal action to obtain a court order to stop the water transfer. Soon after the community went to the Human Rights Commission with the issue, and subsequently the Movement to Save Thuruwila (TSV) filed a case in Supreme Court (SC). The research team faced a major problem, as the Department of Irrigation (ID), which was to undertake a study of the hydrological implications of the project, opted to stop working on the study even though no official withdrawal statement to that effect was made. The support from the regional Department of Irrigation too correspondingly declined.

The research team encountered mixed reactions in the community once the case was filed. Some sections of the community viewed the research team with suspicion as ‘spies of the Water Board’ since the study had started up after the protest movement started gathering momentum. Others thought that they were supporters of the Department of Irrigation since the ID had facilitated the first meeting of the research team with the community in the village temple. The relationship with the NWSDB project staff too became problematic, as some of the junior NWSDB project staff tended to see the research team as an intrusion which opposed their project. After the SC case was concluded, it seemed to be a general closing of ranks by officers of all agencies against the dissidents of the TSV, since it was felt that they had dared to pose a challenge to the bureaucracy.

This study therefore presents the different viewpoints of a group of stakeholders engaged in a particular critical moment in a conflict as regards use and control of a water resource. There is no attempt to present opinions and judgements that support any one particular group. One has to be mindful of the fact that the tense situations encountered by the community and officers due to the heightened atmosphere of the SC case may have hindered total objectivity of response in some cases. It certainly did act at times as a constraint to reaching all the stakeholders. Research methods used are given in Box 11.1.

Box 11.1: Research Methods

Both primary and secondary information was used for this study. The study used a range of techniques focusing on involving a cross section of stakeholders connected to the planned transfer.

Site selection: This study was originally planned as a joint activity with the Department of Irrigation; thus Thuruwila was selected for this study in consultation with that department. The media highlighted several other irrigation systems, which had experienced similar situations with farmers protesting over concerns for livelihood security in view of an impending water transfer. However, the Thuruwila site was selected in view of its importance due to its proximity to Anuradhapura, the regional hub of the North Central Province.

Research team: The study team was to consist of a principal researcher working with two designated officers from the Irrigation Department (ID). This group attended the study's inception workshop in Tamil Nadu Agricultural University (TNAU), Coimbatore, India, along with the Director General, Department of Irrigation (ID). The ID officers were instrumental in facilitating the initial field-level activities of the research team in Thuruwila as well as in collection of secondary data from the ID. However, the ID officers were placed in a difficult position when the Thuruwila community subsequently filed a petition in the Supreme Court (SC) claiming infringement of their fundamental rights by the project proponent, the National Water Supply and Drainage Board (NWSDB). Though there was no official withdrawal from the study, the Department of Irrigation felt that they could no longer take an active part in it. There was a corresponding decline in the interest of field-level officers of the ID, and access to some information thereafter became problematic.

Data collection: Data collection was carried out from April 2002 to July 2004. The mixed-gender team members were not resident during this

(*Box 11.1 continued*)

(*Box 11.1 continued*)

entire period but made periodic visits. During some periods (e.g., the census of users and census of fishery carried out in September 2002) the entire team was present in the field. However, links were maintained with the main actors and community volunteers through periodic visits and frequent communication. The last visit to Thuruwila prior to finalising the End of Activity Report was carried out in July 2004. The Census about the uses and users of Thuruwila tank and the Fishery census were carried out from 1–7 September 2002.

Media scan: Since it was felt that inter-sectoral conflicts related to water transfers out of agriculture were becoming an emerging issue in the rural sector of Sri Lanka, a full scan of new items appearing in Sinhala language newspapers and a partial scan of English newspaper were undertaken during the period January–December 2002. From that point onwards a limited scan was carried out intermittently.

Participant observation: During this study, the entire team lived at different times in the village or, when lodging was not available within the community, in the vicinity. Detailed and repeated interviews were carried out with primary stakeholders in the affected area about their livelihood and their perception of the impending water transfer and its impact on the community. Special focus group interviews were carried out with the various users of the Thuruwila tank: community and religious leaders, farmers, fishermen, and women's groups. Information was collected by participating in the meetings of the Funeral Assistance Society (*Maranadhara Samithiya*—FAS) and Thuruwila Farmer Organisation (FO), the two most important societies in the village. The FAS is of utmost importance to most Sri Lankan communities—the Sri Lankan funeral customs makes community support from the community essential. The FO usually consists only of landholders. Therefore, of the two organisations, the FAS is more broad-based as it includes almost all the families in the community. The organised community movement against the proposed water transfer known as *Thuruwila Surakeeme Vyaparaya* (Movement to Save Thuruwila Tank—TSV) originated from the strong base of the FAS.

Census of users and uses: During this census, three selected sites around the tank were covered from 7 AM to 7 PM, and data obtained on the number of users visiting Thuruwila per day, gender, the uses of the tank, the distance travelled to the tank, time and date (see Annexure 1)

(*Box 11.1 continued*)

(*Box 11.1 continued*)

Census of fishery: A week-long census of the fishery at Thuruwila tank carried out an assessment of four out of the five main landing sites at Thuruwila tank.

Group discussions: Those who were engaged in activities regarding Thuruwila, e.g., fishermen, youth, Funeral Assistance Society, women's group, landless agricultural labourers, S*amurdi* (allowance for low-income families) recipients, and possible oustees in nearby villages were met in focus groups for discussions.

Individual interviews with key informants: Respondents for this exercise were chosen in such a way that they represented all sectors of the community. The village leaders, supporters and opponents of the water transfer, state officers, elected representatives, persons whose land was earmarked for inundation, and those persons whose livelihood was the harvesting of lotus, extraction of sand and fishing were selected for these discussions. Among them were male and female leaders of *Attam* (reciprocal labour) groups, whose members carry out land preparation and paddy harvesting on a contract basis.

Secondary information: Reports available from state agencies on the proposed transfer, and correspondence regarding this project in the area, legal documents and media reports were collected. A listing of traditional ceremonies and folk chants with historical references to rice cultivation was part of the community discourse to support its claims.

The number of stakeholders resident within and outside Thuruwila interviewed for this study is given in Table 11.1.

Table 11.1: Number of Persons Interviewed for Thuruwila Study

Category	*No.*
Govt. Officers	24
Politicians	4
Systems-level Farmer Organisation Representatives	3
Non-governmental Organisations	3
Community	189

4. The Pre-Transfer Situation

Anuradhapura, the regional centre of the North Central Province (NCP), the ancient capital of Sri Lanka and a venerated centre of

Buddhist pilgrimage, is situated amidst a complex network of ancient irrigation reservoirs. In modern times, these reservoirs have been tapped for other purposes as well, mainly for urban water supply. For administrative purposes Anuradhapura has two sections: the Old City (known as '*Pooja Nagaraya*' or Sacred City) and the modern Anuradhapura New Town. The entire area was formerly covered by the ancient city and has numerous excavated and unexcavated archaeological sites.

The population of the modern city of Anuradhapura has grown from 71,893 in 1981 to 84,171 in 2002 (Anuradhapura Urban Council 2004). As it is a major pilgrimage centre, twice a year in on full moon (*Poya*) days in the months of *Vesak* (May) and *Poson* (June), Anuradhapura has up to 1.3 to 1.5 million pilgrims respectively visiting. *Poson Poya* celebrates the establishment of Buddhism in Sri Lanka with the visit of Ven. Mahinda Thero, son of the Indian Emperor Dharmasoka. His sister Ven. Sangamitta Therini who initiated female ordination in Sri Lanka, later brought a Sacred *Bo* sapling (from the sacred *Bo* tree, under which the Buddha attained enlightenment) to its current site of veneration. Therefore it is possible to say that apart from the Sacred Temple of the Tooth in Kandy, Anuradhapura is the most important centre of Buddhist worship in Sri Lanka.

The large influx of pilgrims is a source of income to the town but also poses a major strain on its resources, especially water resources, since both pilgrimage peak periods occurs in the dry season and Anuradhapura gets rain only from the north-east monsoon in October–December.

During the past 20 years, due to the civil conflict in the north and east of the country, Anuradhapura has become a major staging post for the armed forces, thereby increasing its permanent and transit population. It now has six major camps for the armed forces. Water supply to the armed forces is unmonitored and free.

With the decay of the Sinhala kingdoms of the North Central Province and the transfer of the capital to the south, the ancient hydraulic civilisation of the North Central Province decayed, but small tank-centred communities—*Purana Gam*—continued to cultivate the land. Therefore most irrigation systems of the *Purana Gam* (ancient villages) have an unbroken supportive tradition of ceremonies related to paddy cultivation. The community under the leadership of the *Vel Vidane*, which position was hereditary until the Paddy Lands Ordinance of 1956 abolished it, carried out the maintenance of the tank and water management.

According to community sources, Thuruwila has a much longer history than other *Purana* (ancient) reservoirs, since it is the fourth reservoir to be constructed in Anuradhapura and is referred to in the Sri Lankan historical record *Mahavamsa* as *'Tharaccavapi'*, with a probable date of construction in the 6th century BC . Rehabilitated by the British government in 1882, due to its excellent catchment the Thuruwila tank has failed rice cultivation only once in living memory (in 1976). In 1946, under the Irrigation Act No. 32, Thuruwila was listed as a medium-sized reservoir and vested in the state. The maintenance of the tank was then handed over to the Department of Irrigation, for the first time divesting the community of its sole rights over the tank and use of its waters. Even at the time of the study, the community elders spoke with bitterness of this transfer of ownership as a 'takeover of our heritage'. Since the ownership and maintenance of the tank legally passed from community to the state when the water transfer was first mooted, the consultations were between the NWSDB, the project proponent and the Department of Irrigation, the current 'owner' of the tank.

In Thuruwila, the historicity of the tanks and its origins is later seen to be a source of community pride and inspiration for the *Thuruwila Surakeeme Vyaparaya* (TSV), which used its history to strongly uphold their water rights. That Thuruwila was part of an ancient settlement seems undeniable even by mere observation of the site. Archaeological remains in the area include part of a polished stone rampart said to be a palace (*Paththirippuwa*); this was partially damaged when the bund was raised in the late 1970s. Remains of a cofferdam in neighbouring Damanawila and the remains of an ancient *vihara* in Mandugala, now destroyed by treasure hunters, also testify to the antiquity of the site.

The Thuruwila tank, like many other Sri Lankan irrigation systems, is multi-functional. It provides two seasons of rice irrigation and supports permanent vegetation such as coconut. It provides water for drinking, washing, hygiene and rearing of livestock. A census of the tank carried out by the IFPRI study team indicates that the uses of the tank are varied and the users themselves are not confined to the community but also include the population of surrounding villages, up to 12 km away, as well as families from Anuradhapura itself (see Annexure 1). Fishing, collection of lotus flowers and roots, and sand harvesting are among the less recognised uses of the tank, which serve to provide a slender livelihood to the landless, marginalised poor.

As yet Thuruwila retains many characteristics of *Purana Gam*. The *Purana Gam* paddy fields are named (unlike numbered tracts in irrigated settlements). *Thattumaru* and *Kattimaru* (rotation of right of cultivation and plots among the kin group) is a special characteristic in a *Purana* village. It keeps the family landholding undivided by maintaining ancestral lands as one block, facilitating equity in usage among the family members. The close-knit kin group, which goes beyond cultivation purposes, is a special characteristic in a *Purana* village. Up to modern times, it had its own community decision-making mechanism known as the *Variga Sabha*, which promoted cooperation among the extended family and ensured conflict resolution through consensus. *Attams* (reciprocal labour groups) are as yet common in Thuruwila, usually among kin groups. This_long history of cooperation is seen as the main reason that there was no physical violence experienced despite the many tensions in Thuruwila during the crisis.

More conservative in its social norms and more dependent on irrigated agriculture than the modern irrigated settlements nearby, the *Purana* village of Thuruwila maintains an ongoing tradition of agricultural rituals and festivals, from which the villagers derive a strong sense of identity. Rice cultivation in Thuruwila, as in many other irrigation-based systems in the North Central Province, commences with rituals including the *Kiri Ithireema* ceremony (ceremonial boiling of milk on the tank bund—this is to ensure the prosperity of the harvest). Another pre-cultivation ceremony in Thuruwila which is less commonly seen in rural Sri Lanka is the *Mutti Nameeme* (cleansing of vessels) carried out before the *Kiri Ithireema* and *Aluth Sahal Mangalyaya* (harvest festival). The historical references and chants used in the ceremonies play an integral part in the supportive discourse used by the community in Thuruwila to support its *Purana Gam* identity and, by extension, its ancient water rights.

Neighbouring villages, mostly named after a cluster of feeder tanks (Vettankulum, Kaluarachchigama, Rotawewa and Siyambalagaswewa) acknowledge the pre-eminent position of Thuruwila; most of these outlying villages are considered by the Thuruwila group to be inferior in caste, communities with whom connections such as kinship through marriage is rare. The proposed transfer affects these communities too, perhaps even more than Thuruwila, due to possible inundation. But perhaps due to the prevailing limited connections between communities, they did not join the Thuruwila protest, except on one occasion.

Table 11.2: Demographic Data

Place	*Population*	*Families*	*Women*	*Men*
Siyambalagaswewa	131	39	65	66
Vettankulum	458	147	227	231
Rathmalwetiya	69	17	45	24
Selesthimaduwa	453	135	233	220
Rotawewa	264	85	124	140
Mawathawewa	425	133	238	187
Thuruwila	1,800	400	907	893

Like many irrigation systems in Sri Lanka, Thuruwila was a community-managed system with a hereditary *Vel Vidane,* until it was vested in the state. The *Vel Vidane* family continues to be involved in water management through the now operational Farmer Organisation (FO). At the beginning of each cultivation season, a *Kanna* (cultivation) meeting is held with all farmers with the Divisional Secretary and Irrigation Engineer in attendance. This is attended by landholders who decide on cultivation pattern, date of water issue, management of water rotations, crop type, etc. Earlier these decisions were the sole prerogative of the community, but some loss of decision-making rights was experienced with the 1960 Agrarian Services Act, which reclassified Thuruwila from *Purana* tank to an Irrigation Services reservoir.

The main source of livelihood for Thuruwila and the adjoining villages is paddy cultivation. Thuruwila incomes have been much more closely aligned with paddy cultivation than other irrigation systems in the region because of the tank's ability to constantly support two full cultivation seasons (*Yala* and *Maha*). Some income is also derived

Table 11.3: Land Use in Thuruwila

1. Land	Acres
Privately owned land	188
Temple land	3
Housing development authority	35
Water project	12
2. Agricultural land	
Paddy fields	
Farmed by the owners	90
Tenant farmers (*Ande*)	25
Rotating cultivation (*Thattumaru* system)	63
Total paddy fields	178
Swidden (*Chena*) land	335
Total agricultural land	513
3. Government land owned by the Divisional Secretariat	225

from remittances from garment factories and Middle Eastern employment for women; girls in particular tend to migrate for work in garment factories prior to marriage. Some younger men migrate seasonally to find work in urban areas in between peak cultivation periods.

Those landholders who do not cultivate their own fields due to some reason (employment outside village, lack of labour, shortage of ready cash) or the ones who confront financial difficulties and need ready cash usually give out their fields to be worked as '*Badhu*' (cash lease, which at the time of the study was SL Rs 3,500–4,000 for an acre for one season) or on *Vee Poronduwa* (lease payment in paddy at a fixed payment of 20–25 bushels per acre per season). The lessees are usually landless persons from the village or kin group. Sometimes adult children lease out lands from the parents. Landless persons derive considerable income through leases and agricultural labour, even though they have not been recognised as stakeholders/farmers for the purpose of negotiations in relation to the water transfer.

Apart from irrigated rice cultivation, the second most important source of livelihood is fishing, especially for the second and third generation who live in the villages that are situated around Thuruwila tank. A substantial group earns its living through fishing, which is also an important source of nutrition for the community. It was noted that though the NCP villages often have high levels of child malnutrition, Thuruwila does not fall into this category.

The Thuruwila fishery was intensely studied for six days during the census of fish catch. The fishermen lay their nets twice a day: one group at about 6.30–7.30 PM and the other at 6.55–8.30 AM. Those who fish in the Thuruwila tank use the nearby fishing ports: Thuruwila, Nellikulum, Siyambalagaswewa, Rathmalwetiya and Dembatawewa. The majority of fishermen are, however, from Thuruwila.

The fish catch varies from time to time according to the rainfall, wind and other weather patterns. The upper part of the lake yields a higher catch than the lower part. Fishers' experiences regarding the amount (in kg) that is collected by each boat according to the months are as follows:

*February–May	35–40	
*November–January	8–10	
*June–September	4–5	windy season
*October–December	5–6	rainy season

About 500–600 people fish from all surrounding areas but the number of fishermen declines according to season and availability of fish. Therefore when fish catches are reduced in the windy season, only about 100–150 persons continue fishing. Even this number changes according to the circumstances. In the lean season, fishing is merely for consumption needs and not for sale. Often these fishermen are the landless 'second sons' from the poorest families, who also cultivate paddy fields periodically under the *Thattumaru* system.

Gathering of lotus yams as well as lotus flowers (to be sold at the Sacred *Bo* Tree in Anuradhapura) provide a livelihood for the very poor while seasonal sand extraction for building purposes is another source of income.

5. Nature of Proposed Transfer

The Anuradhapura water supply project was initiated in 1950 and expansion was expected within a period of 20 years. Nevertheless financial constraints posed delays. Finally, in 1993, support was obtained from Asian Development Bank and the French government. The new water supply project for Anuradhapura urban and sub-urban areas, which experience an annual six months drought, was intended to be a total solution with the sub-urban areas getting most of the planned benefits. The National Water Supply and Drainage Board (NWSDB), which had hitherto supplied domestic water to the city of Anuradhapura through extractions from Nuwara Wewa and Tissa Wewa, made several attempts to meet the increased demand by increasing the volume of extractions, but failed to get agreement due to objections from the Department of Irrigation, which repeatedly expressed concern on possible adverse impacts on farmers.

Water in most of the wells in this area has a high percentage of fluoride and is also very saline in some areas. Therefore it was seen as important to utilise a surface resource for the augmentation. Rather than promoting small separate projects for a particular area, the NWSDB felt it was more appropriate to initiate one permanent, durable and complete water supply project in the Anuradhapura area.

The coverage at present in Anuradhapura is as follows: domestic connections 56 per cent; commercial establishments 8 per cent; and governmental institutions 36 per cent (including army camps for which water supply is unmonitored and free). The coverage of the expansion was as seen in Table 11.4:

The project was planned to augment current supply as shown in Table 11.5.

Table 11.4: Population and Coverage

	Current	*Prospective*
Beneficiaries	56,000 (This 56,000 is our of the total population of 120,000)	156,000
Hours of supply	8–12	24

Table 11.5: Proposed Extension of Water Supply

	Current Amount MGD	*Prospective Amount MGD*
Intake of Nuwara Wewa	2.5	2.5
Intake of Tissa Wewa	1.0	1.0
Wells in Mihintale	0.2	0.5
New intake in Thuruwila	–	4.6
Total	3.7	8.6

In 1994 a window of opportunity for reaching inter-agency agreement on supply of water to Anuradhapura was presented when the Irrigation Department suggested the use of a medium-sized tank 20 km away from Anuradhapura (Thuruwila Wewa) as a storage tank. It was proposed that Thuruwila tank be used for temporary stocking of excess water from the large Mahaweli River project, which would release a daily supplementary intake of 25,000 cusecs. Thuruwila was to be replenished by water from the Mahaweli project and its size was to be enlarged (bund raised by two feet) to accommodate the amount of extra water. This solution would, it was felt, reduce the difficulties that may have arisen had the alternative solution, an increased intake from Nuwara Wewa, been selected.

Available documentation does not suggest that the planning process included the formulation of a water-saving strategy or an overall system rehabilitation for the current Anuradhapura system. Neither is an in-depth feasibility report focused on a stakeholder consultation processes available. The NWSDB choice of option seem to have been more guided by the anticipated level of intensity of possible protests from Tissa Wewa and Nuwara Wewa as against those from Thuruwila. The Government of Sri Lanka Pre-Feasibility study (1997) states as follows:

> … the majority of households in Thuruwila do not favour the idea of water extraction (for urban water supply) from the tank … A reasonable number of households disagree with the water extraction from the tank as they feel that this would affect their cultivation … the majority of the farmers in Thuruwila do not oppose the extractions of water provided that their needs are fulfilled. Their main concerns were water for cultivation in two seasons … It has been promised that … sufficient water [is] ensured. It is evident that the Thuruwila option would be less problematic (in comparison to an increased urban water supply from Nuwarawewa and Tissawewa) and would not create any social unrest.

It is noted that the owners of lands worked under Nuwara Wewa and Tissa Wewa include parliamentarians, national and provincial level ministers, provincial level politicians and many wealthy persons in the province.

In keeping with ADB requirement of having to secure a written commitment from the owner of the source as a pre-condition for project funding, the NWSDB was able to get agreement for using the Thuruwila tank from the Department of Irrigation. There was no felt need by either agency to inform the community through community consultations during the early planning stages or during the period of inter-agency negotiation. From 2000 onwards, some scant information regarding the project did reach the community via politicians and meetings with a few selected community leaders. At these meetings, economic benefits including employment opportunities accruing through water transfer were suggested and promises of compensation, including land-for-land compensation, were made. However, when the community finally realised the full implications of the project, a process of collective action culminating in a campaign of dissent claiming customary rights over the tank, based on their long history of managing the tank, was launched.

The reasons for the community gathering its resources to oppose the transfer were:

(*a*) The security of livelihood following the project was the major cause for concern for Thuruwila farmers who had ample food security with their successful two seasons of cultivation.

(*b*) Currently Anuradhapura is receiving drought relief for the third consecutive year. Thuruwila was almost the only system in the NCP that did not need drought relief.

(*c*) Farmers doubted the possibility of a transfer of 25,000 cusecs from the Mahaweli project for the project, as the Mahaweli System H itself is chronically water short—its *Yala* (dry season) is usually cultivated on a *Bethma* (field-sharing) basis. Moreover, the transfer was to be made available in the wet season, but the Thuruwila tank would more often than not spill over, sometimes several times, during the monsoon rains.

(*d*) The tank-based irrigation system and related livelihoods provided a strong sense of identity for Thuruwila, which prized its *Purana Gam* status. Having enjoyed decision-making rights over the use of the tank (although on a diminishing scale) the community saw the proposed transfer alienating that right.

(*e*) The fear of further erosion of its *Purana Gam* characteristics and lifestyle.

The following excerpts from community statements capture the perceptions of the Thuruwila community:

For the moment we've managed to farm without any trouble. But in future, paddy fields will be inundated, environment will be polluted, people won't be able to fish, and they will lose their homes …

Now they are earning an income from plantains and coconuts. This won't be that successful after the project. This income will be lost …

About 30 tractor owners will lose their work, so will the paddy mill owners …

Freshwater fish supply will be limited if fishing is banned …

Inundation of paddy fields and stoppage of fishery cause malnutrition of children …

The sand miners will lose their income…

A tax should be paid to us if water is taken from farming to the city.

For the moment we are cultivating in both seasons [Yala and Maha]. Don't know whether water will be spared in the future…

Out of the 14 families in Rathmalwetiya, 10 engage in cattle rearing. They use Thuruwila. They will be unable to do so in the future … as there isn't enough space with the inundation.

The sluice will be controlled … so we won't be able to take water when we want.

The daily water needs in the city are about 4,500 litres, which means that every single drop of the Thuruwila Wewa will be taken …

No details of compensation are known … about 42 houses would be affected [the NWSDB estimates indicated that only two houses of squatters would be affected].

A further concern was the cultural loss which may have been incurred if the planned structures were to be constructed over unexcavated archaeological sites. The project area is thought to have extensive unexcavated sites, as it is part of the ancient Anuradhapura kingdom. The Archaeology Antiquities (Amendment) Act No. 24 of 1998, section 43A, titled 'Impact assessment of proposed development projects', states that 1 per cent of a development project is retained and the Department of Archaeology be requested to carry out an archaeology impact assessment within a month. However, the Department of Archaeology currently seems to be too weak and short of manpower to implement this act. Therefore there was no move by the Department of Archaeology to make use of this clause.

6. Mobilising Action Resources

While accepting the need to provide water to the Sacred City of Anuradhapura, TSV put forward its own set of alternatives, which would not damage Thuruwila's own water security and livelihood. The project proponent did not accept this solution. The TSV demanded and was denied relevant data (including project report, environmental reports and the agreement between the ID and NWSDB).

When it was quite clear that their proposals would not be heeded, in October 2001 the FAS formed the *Thuruwila Surakeeme Kamituwa* (Committee to Save Thuruwila). The TSK, using the FAS as its organisational forum, mobilised external resources including the media as part of their campaign. They tried to unify the whole village on one platform and thus appointed two committees: (*a*) information gathering committee and the (*b*) education committee. External organisations including local and national NGOs (PALTRA, Janodaya, Green Movement of Sri Lanka) contributed to build awareness within the community about the Thuruwila protest. Eventually the TSK managed to build a national-level group to support their campaign including support for provision of legal costs.

Various methods were employed to mobilise and build awareness in the community. This included invocations to guardian deities of the reservoir (*Kadawara Pooja*), Buddhist ceremonies (*Bodhi Puja*), black flags campaigns and protest posters. Families contributed financially towards costs of the campaign, with an amount of Rs 100 (US$ 1) from each family. The chief priest of the temple, traditionally the leader and guide in a *Purana* village, played a significant role in the dissent. Apart from a few significant exceptions, in particular one family, the majority of the village supported the TSK. It is remarkable that the key figures supporting and opposing the transfer within the village were both 'outsiders' who had married into the village.

Selected villagers, men and women, attended mobilisation training conducted by NGOs. Women in particular came forward in tense situations such as those which arose when the police was brought into the village when land surveys were being conducted, challenging them to try and arrest the leaders of the dissent. Physical violence was, however, averted due to the dissenters' control of their supporters and the social cohesion within the village. Barbed wire fences belonging to the NWSDB property were damaged and boards put up on the bund by the NWSDB torn down.

In the immediate vicinity of Thuruwila is Eppawela, well known for its collective action campaign which successfully challenged the attempt of a subsidiary of a multinational, Freeport Macmoran, to start open-cast mining of phosphate. The Thuruwila dissenters initially drew strength from the fact that the Supreme Court upheld the right of the Eppawela community to block the entry of the multinational but tried to negotiate a settlement. When the possibility of legal action finally seemed unavoidable, the TSK was renamed as Thuruwila Surakeeme Vyaparaya (TSV) and launched a campaign to collect 25,000 signatures for a protest petition at the sacred *Udamaluwa* (Sacred *Bo* tree) and Mahamewunawa park. In 2001 it also held an exhibition of protest banners in a '*Poson* Day *Adhistana Pooja*' on the most sacred of all Anuradhapura festivals, the *Poson Poya* (full moon day in June).

Through such protests, TSV was able to get coverage for its cause in the print and visual media. Sustained coverage in the Sinhala language newspapers (*Ravaya, Dinamina, Diwaina* and *Lakbima*) was important in building awareness among the extended group of stakeholders, especially those who could be affected in the long term. For instance the neighbouring Mahaweli System H farmers who suffer perennial water-short *Yala* cultivations were first made aware of the MASL plans for a water transfer through the media.

However, to a certain extent most members of the community refused to believe that the transfer would actually happen until large pipes were unloaded in the village. At that point almost the entire village barring one family united to support the TSV. To this end they held a workshop in Anuradhapura and invited all relevant agencies. Not all invitees attended this programme.

When the project was first mooted, both opponents and proponents sought the support of politicians. All information (scant as it was) regarding the project came to the community via politicians. Politicians of different camps were approached by their supporters in the TSV in a search for redress, and the proposed transfer was made a platform issue in the subsequent general election. However due to the proportional representation system operational in Sri Lanka, the smaller vote base of Thuruwila lost out to the larger vote base of Anuradhapura—in one recorded instance one politician promised to oppose the transfer in Thuruwila while supporting it in a meeting in Anuradhapura on the same day.

It was only when the dissidents totally lost faith in the willingness of ruling party politicians to provide redress that they finally took their case to the Human Rights Commission and ultimately went to Supreme Court (SC) in mid-2002 (*S.C.F.R.329/2002,* decided on 30.09.2002, unreported).

The main issues raised by the TSV were lack of information and the loss of livelihood. In the SC it was felt that they neither had strong enough evidence to request an injunction, nor could they prove that no community consultations were made at all. Therefore a settlement was negotiated. (see Annexure 3), whereby the SC upheld the right of the Thuruwila farmers to cultivate two seasons, giving priority to livelihoods. But though they have since lost two cultivation seasons due to the ongoing rehabilitation work, the community has not invoked the court ruling and applied for compensation. Short-term employment opportunities have been made available with the system rehabilitation. The TSV leaders have been sidelined to an extent and have become disheartened; some have 'been won over' with the lure of contracts.

In 2004, with a new government coming into power, the TSV has once again sought the assistance of the politicians. The process of petitioning political decision-makers was resumed in June 2004 with a letter being sent to the newly appointed Minister of Irrigation of the ruling coalition requesting redress.

7. National Water Policy Formulation Processes and its Impact on the Thuruwila Issue

In the mid-1990s an attempt was made to rationalise the large number of acts and ordinances related to water in Sri Lanka. A Water Resources Secretariat set up under the Ministry of Finance and Planning developed a national water policy document, entitled the National Water Resources Policy and Institutional Arrangements. The Asian Development Bank (ADB), Food and Agriculture Organisation (FAO) and the Netherlands government supported this activity from 1996.

The policy formulation process followed by the ADB-sponsored project in the initial stages was led by the agency-dominant process often followed in policy formulation, though there had been a few policy issues such as forestry where public participation had been requested. The Water Resources Council was created, predominantly with the involvement of ministry secretaries and state officers. It did, however, have NGO representatives. The Cabinet approved the policy in March 2001.

In a situation which was unusual for Sri Lanka, following a media exposé a strong public outcry was raised against the water policy. A wave of protests by NGOs and farmer groups saw it as a major platform issue at the subsequent General Elections of 2001. Of major concern in the original draft policy was the leading statement that 'All water belongs to the state.' This envisaged role for the state interestingly was contradicted in yet another national policy, the National Land Policy of Sri Lanka (formulated under the Sustainable Management of Land Resources in Sri Lanka UNDP project SLR 97/016), which states: *'People's participation in the sustainable use of Land resources will be promoted and the rule of the state will be limited to that of a facilitator/manager.'*

There was a growing fear that the proposed tradable water entitlements could lead to the control of water resources by multinational corporations. The top-down policy process did not make positive reference to Sri Lanka's history of successful community management of water resources, thereby strengthening the arguments of anti-privatisation lobbyists.

The water policy was reformulated in 2003, which initiated an Interim National Water Resources Authority (INWRA), designed to function as an apex body in the water sector. Following the fall of the incumbent government in the general elections of 2004, and the emergence of a coalition government with a Marxist coalition partner, there has been another interesting development in the policy process.

The former government had housed the interim National Water Resources Authority in the Ministry of Irrigation and Water Management. The new government split up all activities under this ministry between the Ministry of River Basin Development and Rajarata Development and the Ministry of Agriculture, Livestock Development, Lands and Irrigation. The former ministry has continued to have discussions for continuation of the earlier policy process. The latter, whose Marxist-oriented minister had consistently criticised the ADB-funded water policy formulation process while in the opposition, has set up, quite separately, an in-house task force, to develop once more a 'home grown' policy document. In late 2003 he called for public comments on a document termed 'Foundation for an Indigenous Water Policy'. The Interim National Water Resources Authority (INWRA) has reportedly been working separately on yet another revision of the draft water policy originally formulated in 2001.

Apart from the fear of loss of livelihood, the Thuruwila project was thus played out within this broader scenario where water resources management became a key issue in national politics. Since the protest regarding the water transfer happened to go parallel to a national outcry over the proposed formulation of a new National Water Resources Policy, water privatisation became one of the fears that fuelled the Thuruwila protest.

The public hostility and fears regarding the draft water policy were seen to stem to a great extent from the lack of adequate consultation, as was the case with Thuruwila. A further contentious situation centring on the water sector arose when another draft Act, the Water Sector Reforms Act of 2003, which had not seen any public consultation at all, was challenged in Supreme Court on the basis that it would strengthen privatisation; it was ruled in the SC that it be referred to the Provincial Councils, since according to the Sri Lankan Constitution water was a subject devolved for determination at provincial level.

The Thuruwila issue was deeply coloured by the ongoing problems related to the abortive attempts at formulating a national water policy. It raised the fears of water privatisation, which in the face of lack of adequate information-sharing mechanisms by Thuruwila project proponents, were believed by many of those involved in the protests. Like the water policy, it too suffered negative consequences due to lack of adequate information and timely public consultation.

8. The Thuruwila Crisis—Avoidable or Inevitable?

Thuruwila is not alone in facing this situation: nine other sites in Sri Lanka are experiencing or have experienced farmer concerns against water transfers. However, Thuruwila is unique in that it has sought legal redress claiming infringement of fundamental rights and engaged in a prolonged campaign to raise awareness regarding its right to water.

The crisis related to the water transfer and its consequences has created a lasting impact on Thuruwila. Apart from the possible future losses related to livelihoods and water security, community harmony has been seriously and probably irretrievably fractured. Was this situation inevitable or could it have been averted?

Opposition to the project arose mainly due to the perceived loss of livelihood as well as loss of decision-making rights of the community over what they consider to be their water heritage: Since the dissident group never objected totally to the project in the first instance (giving water to pilgrims is considered a particularly meritorious act for Buddhists), had there been greater transparency, timely information and an appropriate negotiation mechanism—all of which have strong global acceptance under IWRM—much of the tension could have been averted.

Sri Lanka has a strong Environmental Impact Assessment (EIA) framework, which has been seen to be effective in many cases to uphold local interests through mandatory community consultations. But currently it is not mandatory for water supply projects to conduct an EIA. Such a mechanism would have ensured that timely consultations were held and any dissenting voices and alternate proposals taken into consideration by the mandatory Public Hearing. Comprehensive EIAs, especially with emphasis on social impact assessments at the feasibility stage may be particularly useful in identifying stakeholder needs and responses as well as in defusing community protests. This situation calls for expertise from the agencies concerned or external social auditors. However, lack of social impact assessments in a project does not always stem from lack of available expertise: it could be due to the lack of organisational will or a lack of an enabling environment. As was seen in Thuruwila, the existing and easily accessible in-house social science expertise of the NWSDB was not utilised to check what is perceived as an avoidable situation.

It is somewhat surprising that this crisis occurred within a NWSDB project. The NWSDB has, especially in the area of rural water supply, pioneered many initiatives in participatory management and community consultations and has an official policy for rural water supply and for urban water supply. Both policies mention the importance of participatory decision-making and consultative process. The Rural Water Supply Policy also specifically recognises the importance of the role of women.

The NWSDB is also the only water agency in Sri Lanka which has its own in-house cadre of experienced sociologists. Therefore it is a matter for conjecture why the available in-house expertise was not mobilised in a timely and effective manner to defuse tensions in Thuruwila. A possible answer is that the Anuradhapura project is listed as an urban project and therefore the sociologists whose work is mostly concentrated on rural water supply projects were not automatically included in the team.

Thus rural–urban water transfers seem to fall into a grey area between rural and urban water policies, and are not covered adequately by either. This relatively new phenomenon calls for a new institutional response in the form of a framework or guidelines. Since the state has responsibility to provide drinking water to its citizens and ensure livelihood security and food security, water transfers out of agriculture, which bring together all these issues, call for a national policy response.

The Thuruwila case highlights the need for community consultations on pursuance of IWRM principles. It has led to an increased recognition of prior water rights. There are indications that policy makers within the water sector have now begun to recognise this situation.

> Use of water sources for drinking purpose has been a major issue during last few years. Strong resistance from farmers, traditional villagers, groups with vested interests and environmentalists had created public outcry against the use of water sources for urban water supply (Dissanayake 2003: 8–9).

Partly in response to this situation, the new Guidelines for Community Participation in Implementation of Urban Water Supply under ADB projects recommend guidelines for agency action in future projects (see Annexure 2).

Stakeholders have been narrowly defined for purpose of the compensation by the project as landholders only, thereby ignoring multifunctional uses of the reservoir and its impact on provision of livelihoods other than agriculture, especially for the poor. Broad-based feasibility studies that would have revealed the wider range of uses and extended network of users of Thuruwila reservoir (see Annexure 1) would have been useful at the project feasibility stage.

9. Conclusion

The case of Thuruwila gives some interesting insights into the impacts of emerging instances of water transfers, an escalating phenomenon affecting rural communities sustained by irrigated paddy cultivation in many Asian locations. Irrigated agriculture is under pressure from demands for water from urban and industrial sectors with their greater political and economic clout, resulting in major impacts on livelihoods, landscape and cultures. Strong urban and industrial interests are able to ally with political power to effect water transfers with minimal consultations with rural users. The lack of space or will for a negotiation mechanism results in an erosion of livelihood and the asset base of the rural poor. Consequent friction would further damage an already strained social fabric, especially in situations such as Sri Lanka, which has seen long-term civil conflict.

Global discourse on integrated water resource management is replete with catchphrases such as consultation, informed choice and participatory mechanisms. Integrated water resource management, with its emphasis on participation and community consultation, is accepted as the most sustainable way forward, and national IWRM plans are part of the MDGs. Nevertheless, many processes currently governing inter-sectoral transfers are weak in terms of creating opportunities for negotiation and recognition of compensation for affected stakeholders. Such water transfers are most likely to sideline community decision-making in favour of decisions by a strong 'hydrocracy'.

Erosion of the centuries-old tradition of community responsibility and the corresponding advancement of state authority has weakened efforts and ability of affected communities to press their claims. Therefore there is a need to formulate national guidelines for dealing with such situations. Such guidelines would also be useful in protecting communities' prior rights even in situations where water resources such as springs and streams are being tapped for the increasing production of bottled water.

Globally the right to drinking water is recognised as a priority and water transfers out of agriculture will be needed to feed the 'thirsty cities'. What then are the factors that will support balanced and equitable water transfer cognisant of the main principles of IWRM? What type of efforts are needed, leading to a democratisation of decision-making regarding water transfers and a mitigation of Thuruwila-type stress-filled situations for the rural communities whose livelihood is tied up to irrigated agriculture?

The World Commission on Dams (WCD) has raised awareness of the situation of affected and displaced persons due to dam development. The WCD process has highlighted and gained broad acceptance for establishing the participation of affected persons in decision-making, restoration of livelihood and equity in compensation. Such a process for formulating guidelines with an inclusive approach is now needed in the case of rural–urban water transfers. Formulating a framework, strengthening the rights to consultation and compensation mechanisms of marginalised groups will support marginalised groups such as the landless poor, low castes and women who are too weak to enforce or even present their claims.

A broader interpretation of the roles and rights of stakeholders (not only those living directly within affected communities, as was shown by the Thuruwila census) is also seen as necessary to provide equity. The multi-functional uses of water and the multifaceted livelihoods supported by a water resource such as a reservoir or river need to be identified.

Compensation, if available for the dispossessed in Thuruwila, would, in the current context, be cash. Cash compensation, unlike land compensation, has been recognised in many instances of displacement as not sustaining livelihoods. Recognition for compensation for lost livelihoods in the current context would benefit only legal landholders and not the marginalised squatters and agricultural labourers whose contribution is a major resource for the rural economy. It is also the poor who would be the first to migrate if their asset base is eroded due to diminished sources of income.

Tension in water transfers carried out with a limited consultative process is partly due to the lack of a suitable guideline or policy framework within the agencies and the fact that existent laws do not recognise such instances. That situations such as the Thuruwila case had a definite positive impact on the project proponent is made clear from the preparation of 'Guidelines for Community Participation in Implementation of Urban Water Supply under ADB Projects' issued in 2003 (see Annexure 2), which highlights the need for negotiation, respect of prior user rights and the NWSDB's own responsibility in mitigating adverse impact in social, environmental and cultural aspects in future transfers.

Water professionals, and to a lesser extent the politicians, are seen to have been the leading decision-makers in the Thuruwila case. If situations such as Thuruwila are to be avoided, professional attitudes need to undergo a dramatic change so as to replace the supremacy of the professionals with the pre-eminence of community concerns.

The need in the new millennium is for socially cognisant and environmentally sensitive water professionals who are trained to be able to move outside a purely technocentric orientation. Training in universities and other professional training institutes with its emphasis on specialisation promotes the supremacy of professionals. It gives inadequate recognition of the more holistic community wisdom, which has long contributed to the sustenance of Asian irrigation systems. In Sri Lanka there is frequent and just pride of water professionals regarding its 2,500-year-old ancient irrigation systems by professionals, but it is not always adequately recognised that this feat was due to a collective effort by the community and the state. Though the role of the farmer in operation and maintenance of systems below distributary canal level is constantly emphasised by state programmes, the right of the farmer to define his needs of irrigation water and safeguard prior rights is not adequately recognised. Therefore intra-agency capacity-building programmes, which support the development of a community orientation, need to be initiated.

The displacement and protests associated with various high-profile projects in Asia are well-known in the water sector. Most of the projects that have generated such protests are financed by international agencies, which subscribe to integrated water management principles and support the need for community consultations. However, there are practical problems when these agency norms need to be operationalised at ground level. The importance of negotiation and adequate flow of information to stakeholder is seen in the Thuruwila case, where the lack of information, or even misinformation, about the project as well as fear of losing decision-making rights over their reservoir created opposition to the water transfer. The willingness of a sensitised local staff to support community consultations and to recognise the importance of social dynamics and community identity can become a key factor in minimising tensions related to water transfers. Therefore the significance of the roles and responsibilities of donors and financial institutions in ensuring equity for rural communities in water transfers cannot be sufficiently stressed.

Finally it may be necessary that rural–urban water transfers are preceded by attempts to rehabilitate existing urban systems to control system losses while water conservation strategies are introduced to the rural source system to cushion the impact of possible reduced availability of irrigation water.

In the 21st century, Asian rural sector irrigation systems will be in-creasingly called upon to reallocate water resources to cater to the needs of urban centres. Water transfers out of agriculture are necessary and inevitable. The various stakeholders, at different levels and agencies must work towards a win-win solution, improving consultative processes towards consensus-building through negotiation in order to ensure equity and support for rural communities and livelihoods. Then such water transfers need not and will not inflict avoidable social trauma and livelihood losses on rural communities.

Annexure 1

Census of Users and Uses—Observation of Thuruwila Tank in *Yala*. 1 September 2002 to 7 September 2002.

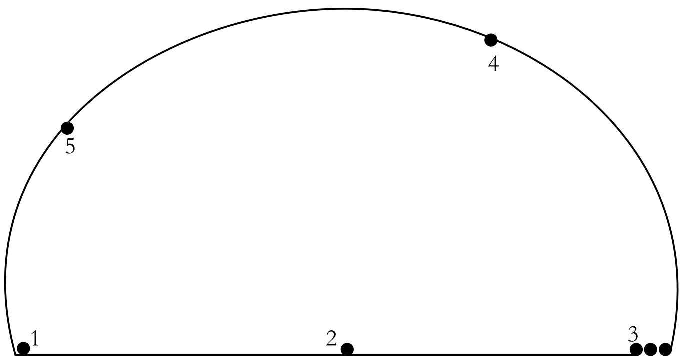
1. Information about the uses and users of Thuruwila tank was gathered from 1–7 September 2002. During this period most of the surrounding tanks and canals had little or no water since the cultivation season was at the end. Two researchers and two assistants from the village maintained a constant presence on selected sections of the tank from 7 AM to 7 PM. This observation was conducted at the tail end of the *Yala* season. In Thuruwila tank there are several well-defined and safe bathing spots where users congregate. Five such bathing sites were selected for the census. They are:

(1) Thuruwila spill
(2) Thuruwila '*Goda sorowwa*'—Upper level sluice
(3) Thuruwila '*Mada sorowwa*'—Lower level sluice
(4) Siyambalagaswewa
(5) Dembatawewa

The sites which were selected for observations were points 1, 2 and 3.

A surprisingly large number of persons visited the tank during this period, from as far away as Anuradhapura and from 39 surrounding villages. The distance from Thuruwila to those particular places ranges from about 1/4 km to 12 km.

Figure 11.1: Selection of Bathing Sites for Census

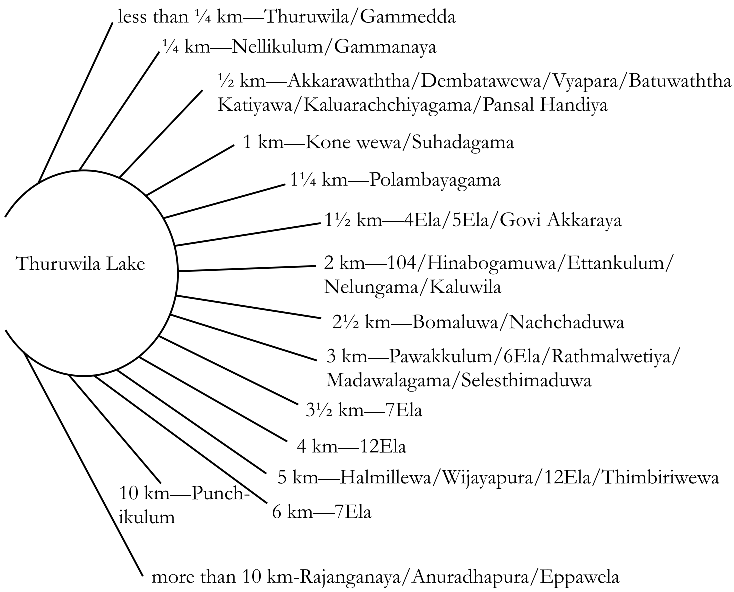


During the late *Yala* season, water is available only in Nachchaduwa and in Thuruwila. Therefore a large number of people come to Thuruwila to fulfil their daily needs: bathing, washing, etc. The number of uses rises during weekends. Compared to other tanks in the vicinity, the water in Thuruwila is perceived as very clean and always abundant. Due to this reason Thuruwila villagers take water for drinking from the tank. Though there are several wells in the village some of them are seen as not being 'good enough for drinking' (bad taste). In addition Thuruwila water is taken for cooking, washing kitchen utensils and hygiene purposes. The other uses/advantages of this lake are availability of water to wash vehicles, picking flowers to offer and sell at temples, watering of livestock, etc.

The number of users by type of use observed during the Census is as follows

* Number of users	=	4,141
* Bathing + washing	=	4,087
* Drinking + cooking	=	90
* Other uses	=	82

Figure 11.2: Place of Origin and Distance Travelled by Users of Thuruwila Tank



Livelihood uses from Thuruwila Lake through collection of lotus yams and extraction of sand were not calculated for the census.

The users' mode of transportation was as follows

(1)	By foot	1,060	
(2)	Bicycle	687	
(3)	Motor cycle	207	
(4)	Tractor	45	
(5)	Van	06	
(6)	Lorry	02	
(7)	Other	05	(bus/three-wheelers)

Interestingly, the official project documents and feasibility studies do not list the range of extended users of Thuruwila tank as stakeholders.

Annexure 2

Excerpt from Dissanayake (2003: 8–9):

Use of water sources for drinking purpose has been a major issue during last few years. Strong resistance from farmers, traditional villagers, groups with vested interests and environmentalists had created public outcry against the use of water sources for urban water supply …

General notion is that people, especially farmers in the areas where water sources are located do not receive any benefits from the WS schemes while penalising them of having same opportunity to use water for their farmlands. Certain groups of people and organisations have capitalised the issues related to the extraction of water from the sources and created social unrest among the farmers and other users. On the other hand, no action have been taken to invest towards water resource development (including water management) and also this has not been considered as compulsory elements in the competitive situation in obtaining raw water for urban water supply.

Being the leading responsible organisation in urban water supply sector, NWS& DB should understand their responsibility in mitigating adverse impact in social, environmental and cultural aspects in using existing water sources and continue the provision of water supply to urban communities. Also the implementers (NWS&DB) should respect the right of existing users of water sources and to take initiatives to formulate innovative systems to safeguard the livelihood of the existing users, e.g., Compensation for the existing users in the event of bad effects in their livelihood, comprehensive relocation programme for the existing users if necessary etc.

In addition the implementing agencies (NWS&DB) should, as far as possible, include the people in the vicinity of the water sources for the benefits.

Annexure 3

Excerpt from Rajapakse (2005):

Article 12(1) of Sri Lanka's Constitution has been invoked in relation to water at least twice in recent years. The first occasion was the fundamental rights case of H.B. Dissanayake and 8 others v. Gamini Jayawickrema Perera, *Minister of Irrigation and Water Management and 5 others, better known as the 'Thuruwila case'. The petitioners in this case were rice farmers who had traditionally cultivated their lands with water from the Thuruwila Tank, a self-contained rain-fed tank in Sri Lanka's agriculturally rich Anuradhapura District in the North Central Province. An Asian Development Bank sponsored water supply scheme for the nearby Anuradhapura New Town proposed to convert this self-contained tank into a storage basin to accumulate water from the Mahaweli River system (Sri Lanka's longest and most important river system) during the rainy season and feed the New Town during the dry season. The capacity of the Tank was to be increased so that 21,000 cu m of water per day could be drawn from it up to the year 2020 and the draw-out increased to 36,500 cu.m. thereafter. No mention was made as to how the water needs of the Thuruwila farmers were to be met.*

The farmers went to court on the basis of an imminent infringement of their fundamental rights under Articles 12(1) and 14(1)(g)—right to equality and right to engage in any lawful occupation, profession, trade, business or enterprise of one's choice. The Court, conscious of the water needs of both the farmers and the town folk, encouraged the parties to formulate a scheme that would look to the interests of both. Terms of settlement were accordingly entered that illustrate the degree of practical detail that is often required in judgements on economic rights. The main terms of the settlement were:

- *The Mahaweli Authority would as far as practicable ensure a daily input of 27,000 cu.m of water into the Tank;*
- *The maximum daily draw-out from the Tank would not exceed 21,000 cu m;*
- *In any event the daily draw-out would not exceed the input;*
- *The daily input and draw-out would be monitored by instruments and a record kept, which would be accessible to the petitioners and other members of the public;*
- *Rs 2 million was to be made available to compensate the petitioners for any losses suffered as a result of the project;*
- *In the event of damage being caused to the tank bund in the execution of the project, the petitioners would be entitled to pursue additional claims for compensation from the relevant authorities.*

Apart from the nature of the settlement, this case was unusual because, while most fundamental rights cases involve the alleged violation of the rights of a *person or group of persons by State action, this case required the State to balance the fundamental rights of two competing groups of persons, namely the urban and rural water users of water from the same water body. Ironically, the decision in this case was recorded just one month before the United Nations Economic and Social Council adopted General Comment No. 15 of 2002 on the right to water, which lays down the duties of a State in ensuring equitable distribution of water resources.*

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12

Asserting the Rights of the Toiling Peasantry for Water Use: The Movement of the Dam Oustees and the Drought-Affected Toilers in South Maharashtra

ANANT PHADKE AND BHARAT PATANKAR*

Part I: The Anti-Drought Movement in South Maharashtra

1. DROUGHT-PRONE AREAS IN MAHARASHTRA

BEFORE WE DEAL with the social movement, we provide some background about the drought-prone areas in Maharashtra. Maharashtra is situated in the western part of central India. It is considered one of the relatively better developed states. Looking at indicators like per capita income, industrial output, electricity generation, roads and communication facilities, Maharashtra does appear to be more developed than other states. However, if Mumbai—the biggest and the only megacity in Maharashtra—is left out, the average for the rest of the Maharashtra drops down substantially. For example, in 1998–99, the average per capita annual income for Maharashtra, Mumbai, and Maharashtra excluding Mumbai was Rs 21,950, 46,550 and 18,650 respectively. This is because agriculture, which forms the backbone of Maharashtra's rural economy, has still not been modernised 55 years after independence from the colonial rule of the British.

The low productivity in agriculture is not because of feudal or semi-feudal relations as in the states of Bihar or Orissa.[1] The average

*We are thankful to K.J. Joy and Suhas Paranjape for their comments on the first draft of this paper. The usual disclaimer applies.

[1] In Maharashtra feudal relations have been overcome through 'revolution from above' because of 'pressure from below', i.e., through the Tenancy Act legislated

low productivity of agriculture in Maharashtra is mainly caused by lack of widespread irrigation facilities, which is a pre-condition for further modernisation of agriculture. The seasonal, annual rainfall in Maharashtra is 750 mm on average, ranging from 3,500 mm in mountainous parts of the Konkan area to a mere 400–500 mm in large parts of districts like Sangli, Solapur, Ahmednagar and Pune. There is a low-rainfall zone of less than 650 mm on the east side of the mountainous ridge of the Sahyadris, which runs north-south along the western coastal side of Maharashtra. Equally important is the great deal of variability from year to year; hence, in these areas 80 per cent dependable rainfall is only 300 to 400 mm. If there is a small deficit or irregularity in the monsoon rains, the situation in this low-rainfall zone becomes critical with substantial drop in agricultural output.[2]

This critical dependence on rainfall is despite the fact that Maharashtra has built the highest number of dams in India, investing billions of dollars on dams. The water in those dams is not judiciously and equitably distributed. Through gravity canals, the impounded water reaches only a very small area downstream. Thus a small area gets plenty of water and other drought-prone villages are left dry. Lack of irrigation facilities is the key reason for the lack of modernisation in agriculture and hence for backwardness of this agriculture.

The drought-proneness has increased because of two reasons. There has been widespread denudation of land which was once under green cover of various kinds. Hence, more of the rainwater is washed off, turning the natural streams, rivulets and ponds dry within a couple

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by the state to fulfil the pressure created from below by the peasantry for land reforms during their participation in the freedom struggle against the British Rule as well as immediately after Independence. The tenancy system was abolished with the help of this act in 1956 when the erstwhile feudal landlords by and large chose to become capitalist farmers. However, in areas such as south Maharashtra, there was a strong movement against feudalism as well as against British rule. In such areas, it was largely the tenant farmers who exercised their right to land and put an end to feudal relations.

[2] The eastern part of Maharashtra gets fairly regular annual rainfall of about 1,000 mm, and is hence drought-free. But in this area semi-feudal relations have lingered on.

of months after the monsoon rains. Most of them were perennial streams and storages before this ‘development’. Second, there has been widespread and stupendous rise in unregulated pumping of groundwater in these low-rainfall areas. The number of wells in these areas increased from 0.4 million in 1960 to 1.1 million in 1991. Recharge of groundwater has decreased due to extensive depletion of bio-cover. The result of this ‘development’ has been that out of about 43,000 villages in Maharashtra, by 1986 about 14,000 villages had a serious problem of water supply. This proportion has not changed despite various good schemes of water supply to the villages. The situation has in fact worsened; in about 25 per cent of villages in Maharashtra, water for domestic use is supplied from outside through water tankers for four months of the year!

Though millions of people live in the officially acknowledged 87 drought-prone talukas, they have no say in remedying this situation. Only a small proportion amongst the peasants have the resources to install tubewells and pumps, especially when there is need to go deeper to be able to tap and pump water, as water levels have been going down. In Maharashtra, 85 per cent of the area has compact basalt and therefore geological features are such that aquifers are small, isolated and localised. It is no wonder that a large proportion of tubewells dug in Maharashtra have turned out to be dry. This boring was done by vested interests who made money by cheating the peasantry through false promises.

Water scarcity affects not only the peasantry but also all other toilers in the water-scarce areas. Yet they too have no influence over the water scenario, including the nature of water use. For example when the powers that be decide to grow water-intensive crops like sugarcane to start a sugar factory in a drought-prone area, ordinary people put up no opposition. Sugarcane is the only crop which, for a variety of reasons, gives assured, reasonable income to the farmers in Maharashtra. Hence, farmers even in low-rainfall zones are yearning for a cooperative sugar factory in their area. More often than not, most of the water available for low-rainfall zones through a scheme is used by tiny ‘sugar-belt’ islands. Sugarcane consumes ten times as much water per hectare as coarse cereal crops like *jowar* (sorghum) or crops like groundnut. Second, the yield in kilocalories per cubic feet of water is 43, 35, and 24 for *jowar* (sorghum), wheat and sugarcane respectively. Despite this, sugarcane is preferred for the reason mentioned above. Only about 3 per cent of cultivable land in Maharashtra is under sugarcane, but it consumes 60 per cent of the irrigated water. Only 14 per cent of the land under cultivation receives irrigation. Sugarcane can be grown with much less water and can be part of the crop mix where water is not scarce. But monoculture of sugarcane in Maharashtra is unacceptable.

The struggle to overcome drought in Maharashtra has to be threefold: to harness more water resources in low-rainfall zones, to distribute the captive water equitably, and to achieve optimal productivity of water. The ordinary people have hardly any control over these three aspects. The worst sufferers are the people in low-rainfall zones. The peasantry in these areas is going through hell, especially in lean seasons, but has no control over the resources that are so central to its life.

2. The Three-Pronged Solution to Drought

A silver lining to this whole depressing situation has arisen due to a powerful movement, especially during the last 10 years, of the toiling peasants in the low-rainfall zone of south Maharashtra. The dam oustees and the drought-affected are both extremely unorganised, highly vulnerable sections of the toiling peasantry who have no control over the dam water with which their life is so crucially connected. The dam-affected people's lives have been literally drowned in the dam water, without getting any compensatory benefit from it. The drought-affected people have been kept away from the dam water though they have every right to its use.

A strong movement of both those sections has been built in large parts of low-rainfall south Maharashtra. Moreover, recently there has been a programmatic unity of these two sections. This unity is extremely important, since the drought-affected people are usually pitted against the dam-affected people, as has been the case, for example, in the case of the Sardar Sarovar dam in Gujarat. This movement has been able to gather wide and powerful support for its three-pronged solution, the components of which are:

(1) In low-rainfall zones, to use exogenous water to supplement ground and surface water made available through local watershed development.
(2) Proper rehabilitation of the dam oustees before completion of the dam construction. Attempt to choose dam site and height that would lead to minimum submergence and displacement. Ensuring the right of the dam oustees to the dam water.
(3) Equitable distribution of the water to fulfil basic needs and to open a path towards sustainable prosperity. The frugal use of dam water implies a crop pattern quite different from the dominant pattern and lays the basis of sustainable, dispersed agro-industrial prosperity.

This solution has emerged through a prolonged dialogue and engagement with the various stakeholders: the drought-affected and the dam-affected toiling people; civil society groups like socially committed scientists, technologists and activists of the People's Science Movement; breakaway sections of politicians from ruling political parties; bureaucrats in the irrigation departments; administrators; ministers; mediapersons, etc. This process is based on:

- A very tenacious search for almost two decades for a new path of development and politics;
- Creative thinking by activists, in collaboration with pro-people scientists/technologists;
- Extremely hard work of mobilising the dispersed, vulnerable toilers;
- Their innovative, arduous struggles, fought with a 'do-or-die spirit';
- Scientific positions and strength of mass mobilisations, and patient negotiations with decision-makers.

We describe below some of the struggles, and their achievements as well as limitations. We then discuss the issue of relations amongst the various stakeholders.

3. The Origins, The Perspective

The anti-drought movement in Khanapur taluka of the eastern part of the Sangli district from the early 1980s onwards gave rise to the perspective that informed the much larger movement in the 1990s. This movement was led by a new left-wing mass organisation, the 'Mukti Sangharsha Chalval' (MSC), meaning 'movement for struggle for liberation'. This mass organisation was led by activists of the Shramik Mukti Dal, a new type of left-wing political organisation. The MSC had its origin in the famous prolonged strike of the textile workers in Mumbai, the capital of Maharashtra state. This historic, prolonged strike could not achieve its demands, and a large number of textile workers along with their leading elements, , instead of going back to work in the factories, went back to their villages to sustain themselves to carry on the strike. In Khanapur taluka, which belongs to the low-rainfall zone, the MSC was formed, and it organised these workers into a determined struggle for their rights as labourers in the Employment Guarantee Scheme. Though there were many achievements of this movement, it was realised that the basic problem of this area is drought. Unless a strategy was forged to eradicate drought, the movement would not progress towards its aim of 'liberation'. It would remain a movement of agricultural labourers for their immediate demands, and get stuck perennially at the same level of demand for employment, better wages and better working conditions. It was therefore planned to forge a united front of agricultural labourers with the toiling peasantry on the issue of drought eradication.

There were intense discussions about drought eradication amongst the activists of the MSC; with the people in the region; and with activists and experts of the People's Science Movement in Maharashtra. A series of attempts were made to devise a new strategy of drought eradication. This included a survey conducted by the activists of MSC (walking miles together) of the wells, rivers and their jack wells to find out why these schemes have failed by discussing the issue with the villagers in an in-depth manner. With the help of the activists of the Lok Vidnyan Sanghatana (LVS) the People's Science Organisation in Maharashtra, a 'Science-March' was organised in October 1984 to instil confidence amongst the people that drought could be overcome through people's science and technology and that it is not a god-given calamity to which there is no solution. Ironically, some of the 'experts' in the LVS felt that the area is not fit for productive agriculture but appropriate only for rearing sheep as was done by a section of the local peasantry; and the rest of population should migrate to ecologically better-suited areas for agriculture or shift to industrial development! However, when the activists of MSC with a more inquisitive, open mind held discussions with the elders in the area, it emerged that not long ago (about 50 years back) the area had a lot of vegetation and sustainable agriculture. However, 'development' during the past 50 years had led to extensive deforestation and drying up of the perennial rivulets and rivers.

One telling example of this deleterious development was uncontrolled, rapacious excavation of sand from riverbeds for the construction industry. This had led to the drying up of the wells in the nearby farms. This realisation led to a prolonged, successful struggle to stop this unlimited excavation of sand. During this struggle, the idea of the Baliraja dam was conceived. Detailed discussions with the people of the villages-Balawadi and Tandulwadi on the two sides of the river Yerala revealed that there is a good site for a small dam between the two villages. If villages get the preferential right to excavate a limited amount of sand in the river in their village and sell it after paying due royalty to the government, and if this money can finance this small dam, it will eradicate drought in these two villages. The riverbed would be permanently submerged, leaving no scope for its further excavation. The water table in the two adjoining villages would rise and protective lift irrigation would ensure timely water supply to the crops in critical times with the help of this 4.5 metre-high, 120 metre-long tiny dam, which would provide protective irrigation to 380 hectares of 400 families in these two villages.

This idea led to an alliance between the poor, toiling peasantry, the MSC leadership and socially committed engineers and science-activists, supported by progressive intellectuals and mediapersons in the cities. Despite many difficulties, the tiny Baliraja dam was built. Accounts of this struggle along with the issues raises by the struggle are available (Joy and Rao 1988; Phadke 1989; Phadke 1998). An equally important part of the movement for building the dam was the issue of equitable distribution of water and of the crop pattern. Detailed discussions with the local people—and with K.R. Datye and Suhas Paranjape, the socially committed engineers/scientists of CASAD (Centre for Applied Systems Analysis in Development)—led to the conclusion that in the given local conditions, assuming a 'normal' rainfall year for that area, 'sustainable' agriculture (which would also lay the basis of dispersed agro-industrial development) would be possible if 1,400 cu m of water is reliably available per year to a peasant family-farm of 3 acres to supplement rainfed agriculture.

It was pointed out by these experts that through on-farm scientific experiments it has now been well established that 10 cu m of water, if properly used, can yield 30 kg of dry biomass. It was estimated that for minimum livelihood, including needs like educational expenses, a peasant family of five persons would need a production of 18 tonnes of dry biomass. With a water productivity of 30 kg per 10 cu m, this would require a total water supply of 6,000 cu m. This includes both water directly used by plants ('in situ') and applied water. To this has to be added 400 cu m for domestic use/cattle. In case of the Baliraja experiment, the local water harvested through this dam was 1,400 cu m per family for agricultural use and 600 cu m for domestic/cattle use. The rest was assumed to be available directly through rainwater. But to work out a general model of sustainable agriculture, it was estimated that for an area with an average annual rainfall of 500 mm and with 80 per cent dependability, the assured rainfall assumption has to be 300 mm. With this assumption, the local availability of water works out to at the most about 4,200 cu m. This includes water directly used by plants ('in situ' water) and maximum local harvesting of water through a full-fledged local watershed development programme. This leaves a deficit of about 1,800 cu m of water at the farm level for sustainable agriculture. To this has to be added 400 cu m for domestic use. This total deficit of 2,200 cu m must be made up with the supply of exogenous water from some dam. It was thus argued that at the dam-source, 3,000 cu m of water should be made available for drought eradication.

The results of a five-year (1986–1991) research project called the 'Wasteland Integration Research Project', supported by CASAD and carried out in various centres like Nandurbar, Benapur and Balawadi, also provided scientific support to the claim of sustainable agriculture and a particular crop pattern with minimum amount of exogenous water. In 1985, in a Marathi booklet titled 'Drought Eradication', Shramik Mukti Dal argued for this new perspective on drought eradication. Availability of a reliable source of water of exogenous water of 3,000 cu m to every family, under local control of the people; and a mixed crop pattern consisting of a certain ratio between grains, vegetables, fruits, fodder, biomass for fuel and agro-industrial use was the key component of this new strategy of drought eradication and sustainable agro-industrial development.

This norm of water use was substantially different from the norm suggested by the widely respected expert committee appointed by the government of Maharashtra in 1978. It was popularly known as the Dandekar–Deuskar–Deshmukh committee. V.M. Dandekar was a renowned economist, V.R. Deuskar was a senior expert in irrigation engineering and Com. Datta Deshmukh of the Lal Nishan Party [Red Flag Party] had been in the forefront of the anti-drought movement sparked by the severe drought of 1972. 'The Drought Relief and Rehabilitation Committee' consisted of representatives from various political parties, and intellectuals from the famous Gokhale Institute of Economics and Politics in Pune (Dr. V.M. Dandekar was its director). It played an important role in shaping civil society's response to the severe drought in Maharashtra in 1972. The left parties, especially the Lal Nishan Party, organised a number of struggles during this drought and their leader Com. Datta Deshmukh played a significant role in suggesting long-term solutions to the problem of drought. The committee's report in 1978–79 is to be seen in the backdrop of the widely felt need of changing the water policy in Maharashtra to prevent drought.

The Dandekar–Deuskar–Deshmukh committee (the 'Three D' committee) argued for a total of 750 mm of irrigation per acre. This is equivalent to 9,000 cu m of water for 3 acres. This was a very progressive step then, because the committee has suggested that this water be given only for eight months during the year, so that it cannot be used for sugarcane, which requires water throughout the year. However, later on, bowing to the powerful lobby of sugar factories, it was decided that 10 per cent of the area could grow sugarcane and part of the water would therefore be provided throughout the year for sugarcane. However, as mentioned above, SMD proposed a minimum exogenous supply of only 3,000 cu m at source level.

The strategy suggested by the Shramik Mukti Dal with the help of the experts in CASAD was different in three important respects:

(1) Exogenous water should be used only as supplementary to local watershed development. While suggesting this norm of 30 inches (750 mm) per acre, the 'Three D' committee had not thought of water that can be made available through local watershed development, because in those days the importance of local watershed development had not been established amongst the experts.

(2) The total minimum water requirement per family should be estimated on the basis of water needs to attain minimum livelihood and to get a small surplus for sustainable development towards agro-industrial prosperity. As mentioned above, this would require exogenous water of about 3,000 cu m at source. Furthermore, applied water is to be used in a particular, judicious way to make the agriculture 'regenerative', as K.R. Datye puts it. This judicious use implies allocating, out of a 3 acre farm, 1 acre each to food grains, fruits and vegetables, and a variety of high-value biomass through agro-forestry. Converted into per acre quantities, this at-source requirement of 1,000 cu m of exogenous water is about one-third the norm suggested by the 'Three-D" committee!

It was pointed out by SMD and the concerned experts in CASAD that on-farm research showed that with a reliable source of water the food-production per acre can be triple that in the lean years. Hence, decreased area under foodgrains would not decrease foodgrain production. On-farm research had shown that with assured availability of water, the biomass yield could increase from 3 tons/hectare year in lean years to even 15 tons/hectare year because of the increase in availability of assured water from 300 mm to 500 mm.

(3) The water supply should be delinked from land ownership. The SMD strategy argued for equal rights of the landless to water. The principle of equitable distribution was first enunciated by Vilasrao Salunkhe of the Pani Panchayat (meaning 'water-forum'). The Pani Panchayat had done pioneering work of equal distribution of water amongst members of the lift irrigation society in Purandar Taluka of Pune district. But given the very nature of the scheme, the landless were excluded in practice, as they were not members of the lift irrigation society. SMD argued that the landless should definitely have an equal right to water. They would take land for cultivation from others on lease and this would establish a tradition, which would help to bring land distribution as a concrete option later.

Though all farmers in Balawadi-Tandulwadi agreed with the crop pattern mentioned above, this has not been followed because the last stage of the construction of the dam, which was to consist of innovative 'falling gates', has not yet been completed due to lack of funds. Whichever families could be supplied water got only part of their requirement and hence could not follow the agreed crop pattern. However, sugarcane is not grown on the Baliraja water. Second, there is no exogenous supply of water to these two villages. The Baliraja dam is part of the local harvesting of water. This is sufficient as a supplement to the rains only in years of good rainfall. Despite these limitations, the Baliraja dam movement remains the source and inspiration for a new strategy of drought eradication.

Restructuring of the 'Takari Lift Irrigation Scheme'

Based on the Baliraja experience, the MSC demanded a restructuring of the Takari lift irrigation scheme in Khanapur taluka. The plan for this huge lift irrigation scheme costing Rs 2,800 million consisted of lifting 4.6 TMC water up to 116 m by using 31 MW of power to supply it to the low-rainfall zone. But as per the conventional plan, only about 13,000 hectares would be irrigated, covering eight villages fully and 22 partially. The MSC, with the help of concerned experts in CASAD, put forth an alternative plan of allocating 3,000 cu m to each family in 60 villages to cover 60,000 hectares of land.

A broad conference was convened on 15 May 1989 to launch the struggle for equitable distribution of water in the Takari scheme. A memorandum signed by 1,520 peasants was sent to the chief minister in August 1989, followed by resolutions passed by 12 gram panchayats in that area. The signature campaign went on to gather thousands of signatures with the help of a poster exhibition. A conference was organised on 6 December 1990, in which 2,500 people participated and where state level leaders of toilers like Dr Baba Adhav addressed the gathering. This was followed by a month-long campaign, including a ten-day *padayatra* (foot march) along the canal where land was being submerged. This culminated in the *rasta roko* (road blockade) of 29 March, when men, women, children, cattle and carts from 16 villages obstructed roads at 12 places, blocking all the roads in the taluka including the Karad-Vijapur road, the Vita-Sangli road and the old Satara road. Indefinite *chavni andolan* (an occupation of the taluka centre with cattle) was launched in May, holding it as a 'people's court', before which all candidates contesting for the elections were invited to clarify their position on the issue of drought and development.

Ultimately, in October 1989 the Chief Engineer in the irrigation department in Mumbai came to the negotiating table and in a widely attended meeting at Kolhapur in Shivaji University agreed that the movement can form Water Users' Associations (WUAs), and that the irrigation department would give water on a pilot basis to the WUAs, who in turn can distribute the water on family basis. He also agreed to allow lifting of part of the water to include those villages which have not been included in the command area. This was a very important victory! For the first time, the government had agreed to equitable distribution of water. The Baliraja model of equitable distribution was not an exception. The demand for 'equitable distribution of water' was catching the imagination of the people, as well as getting social acceptance among a section of intellectuals, politicians and the press. This experience created confidence in the leadership to take this strategy for a much wider agitation in other drought-prone talukas in South Maharashtra.

Full Blossoming of the 'Right To Water' Movement

The success of the 'Baliraja struggle', the increasing response to the 'Takari struggle' and the increasing demands of the people in neighbouring drought-affected areas to launch such a struggle in their area attracted the attention of Nagnath Anna Naikawdi, the legendary, 75-year-old enthusiastic and highly respected left-wing leader of the toiling people in Sangli district. 'Anna' was part of the revolutionary section of the freedom struggle in Satara district in the 1940s, a part of the '*Patri-Sarkar*', the parallel government that was the alternative power in Satara district. Anna has been one of the few leaders in that area who has after independence refused to be co-opted in the Congress government. A veteran of a series of struggles, Anna is the leader of the Hutatma (meaning martyr) Kisan Ahir Cooperative Sugar Factory in Walve taluka of Sangli District. Kisan Ahir is the martyr of an earlier struggle. This factory is a rare example of high efficiency, no corruption, full transparency and high commitment of the peasants and workers. The sugar yield of this factory has consistently been the highest in Maharashtra, gives the highest price to cane growers who are the members of this cooperative venture and highest bonus to its workers. Members of the 'Hutatma factory' under the leadership of 'Anna' decided to use part of the surplus of the factory to help toiling people's movements. Millions of rupees are being spent annually in this fashion.

Anna Naikawdi, activists of the Shramik Mukti Dal, Com. Nana Shetye of the Lal Nishan Party (Leninist) and other left-wing leaders came together to form a broad front, the Shetmajoor Kashtakari Shetkari Sanghatana (SKSS) (landless labourers and toiling peasant's organisation), in a big conference in Kini on 26 May 1993; attended by more than 25,000 people. This conference was addressed by many leftist leaders in Maharashtra, like Com. Govindrao Pansare, Dr Baba Adhav and the socially oriented film celebrity, Mr Nilu Phule from Pune. The new organisation was declared to be the joint front for struggles of the rural people in South Maharashtra to eradicate drought.

However, later on the participation of other leaders in the affairs and struggles under the banner of SKSS became somewhat limited. Part of the reason was that not every leader was convinced about the principle of equitable water distribution. The upper sections of the peasantry, who are not in favour of equitable distribution, influenced some local leaders. Some leaders, especially those who are removed from the ground reality in the drought-prone areas, feel that the 'real issue' of land redistribution should be taken up and that too much importance is being given to the water issue. The importance of irrigated water and electricity as a means of production and its specificity of being mobile has escaped such doctrinaire thinking. That equitable distribution of water including equal share to the landless labourers would concretely create hunger for land amongst the landless also escapes conventional urban leaders. That there is no better way today to develop a basis for widespread demand for land redistribution is also not realised. In general, there is not adequate creativity to find solutions to the complex problems.

Toilers from the lowermost castes (*dalits*) form the bulk of the landless labourers. Irrigation water is as important as land in drought-prone areas. Hence the equitable right to water for the landless also means access to an important means of production to the lowermost castes. This would create the material basis of abolition of the caste hierarchy. Similar is the case of women who are deserted by their husbands. The deserted women are in thousands and are one of the most oppressed, marginalised sub-sections of the landless labourers. Equitable share in water distribution to these property-less women has far reaching social consequences. This social aspect also escapes the attention of those who think only in class terms and tend to be caste- and gender-blind.

Local activists and leaders have, however, grasped the value of this demand. Well-known senior leader of the Peasant and Worker's Party (PWP), Ganapatrao Deshmukh, from a drought-prone taluka (Sangola), has consistently mobilised his followers in large numbers in favour of this demand. The leaders of the ruling-class parties have understood the threat this demand poses to their political hegemony. Some of the leaders from the ruling parties tried to subvert the movement, whereas a handful sided with this demand. Their support to this demand may not last long, yet it is an important indicator of the potential of this movement to divide the ruling class leaders and hence to undermine the hegemony of their political parties.

Though the conventional leadership has been somewhat equivocal about this demand and its significance, toilers from the drought-prone areas have built a movement around it. This movement took a very systematic form in Aatpadi taluka, which belongs to the low-rainfall zone. Inspired by the Kini Parishad and under the leadership of this new organisation, the people of Aatpadi launched their movement on 11 July 1993 with a rally of more than 25,000 people. Within eight days, more than 66,000 signatures (almost all the adults in Aatpadi taluka) were collected on the memorandum demanding a share of water from the Dhom and Ujani dams for equitable distribution of water to all the households including the landless. These signatures, submitted to the then chief minister, Mr Sharad Pawar, however failed to elicit any positive response from him. It was therefore followed with the resolutions of all the 56 gram panchayats, signed by all the members of these bodies, including those belonging to the Congress Party. By 30 August, all kinds of organisations in the taluka, from cooperative societies to workers' unions to ex-army-men's associations as well teachers and students sent copies of resolutions supporting the original memorandum to the chief minister. This culminated in the resolution passed in the taluka panchayat in support of this demand. From September 1993 onwards, there were a number of rallies at village level, attended by all the villagers. In 10 adjoining villages, meetings would start simultaneously at 8 PM, addressed by local activists and also by women.

The state government responded by announcing that it would give water to Aatpadi taluka from the dam to be built at Urmodi. But the problem is that the construction of the Urmodi dam was yet to begin and hence this promise was just a weak attempt to deflate the movement. In 1994, the movement responded by declaring non-payment of land revenue till the demand for their due share in the Krishna water was met. This was a politically challenging step, unprecedented in this area after independence. It challenges the very legitimacy of the state. But the drought-prone people were determined this time, after being unable to muster enough courage to launch this step in 1993. As an expression of the solidarity of the people, in July 1994 two innovative *jatha* programmes were organised. Within 20 days, all 80 villages in the taluka had participated in the *jatha*. This was followed by a special women's *jatha* programme in the same fashion for 20 days from October 10. Women not only participated in the *jatha* but also conducted its affairs. During this programme, people vowed not to pay land revenue till their demands were met.

4. Restructuring of the Tembhu Scheme

The movement in Aatpadi taluka reached a qualitatively new phase when there was an opportunity to propose an alternative use of the Tembhu lift irrigation scheme in Aatpadi taluka. The 'Tembhu Scheme' is an ambitious, massive lift irrigation scheme in Satara district which would lift 22 TMC of water from Krishna basin in five different stages, to supply it to 79,600 hectares in 173 villages in six talukas in the low-rainfall zone of Sangli, Satara and Solapur districts in South Maharashtra. Out of this, 4.4 TMC would be available for Aatpadi taluka. Through a series of intense struggles, the SKSS had demanded restructuring of the scheme to apply the principle of equitable water distribution. Thanks to these intense struggles which eroded the hegemony of the ruling parties, the government finally agreed in September 2001 to prepare a plan to restructure the scheme for the Aatpadi taluka, with a view to equitable distribution of water, which would benefit 22,000 families and irrigate 7,400 more hectares with a water allocation of 5,000 cu m per family. Twenty-one more villages would now get water from this restructured scheme in Aatpadi taluka. The irrigation department has now proposed such a plan, which would cost an estimated additional 1,000 million rupees (US$ 20 million). It is for the first time that a government depart-ment has prepared an alternative detailed plan as per the norm set by the toiling people's movement! K.J. Joy and Suhas Paranjape of SOPPECOM have argued in a recent paper in some detail as to how this restructuring can be viable financially and energy-wise (Joy and Paranjape 2002).

On 22 August 2002 the Chief Minister gave instructions for giving administrative sanction to this plan within three months. However, the bureaucracy is taking its own time to follow the written assurance given by the Chief Minister! There is a long way to go to get additional funds for the above restructuring of this scheme. But this unprecedented victory of the rural toilers in Aatpadi taluka for their right to water use exemplifies the potential of this demand of equitable water distribution in drought-prone areas, in moving towards significant transformation in favour of the toiling peasantry.

The movement for equitable distribution of the dam water spread to 13 talukas in the low-rainfall zone of Sangli, Satara and Solapur districts. Given the response in the form of big rallies of tens of thousands of people, some individuals from the left parties and even from the Congress party supported this demand. The Nationalist Congress Party included this demand in its election manifesto for the Maharashtra Vidhan Sabha election in September 1999. After coming into power as a constituent of the Democratic Front government, it dilly-dallied in fulfilling its election-promise. But as a result of intense, sustained pressure of repeated mass mobilisation of thousands of water-starved villagers, the government accepted the principle of 'equitable distribution of dammed water', albeit only in case of new dams. Though this policy excludes the old dams, it is undoubtedly a step forward, and constitutes a victory for the movement. Equitable water distribution on per capita basis (access to water on the basis of number of people) has been included (in fact as the first item in the list) in the 51-point common minimum programme suggested by the N.D. Patil Committee appointed by this same Democratic Front government on assuming office in 2000 after the elections. The pressure to implement this policy and to include the old dams in equitable water distribution continues to be mounted with mass-mobilisations.

The severe drought in Sangli district in 2003–2004, worse than the 1972 drought, has also led to innovative proposals from the leadership of the anti-drought movement. Campaigns, including marches, sit-ins (*dharnas*) have been constantly taking place. These have not simply demanded more funds from the government for 'famine relief.' Rather the focus has continued to be on restructuring and carrying through the canals that will bring water to the farmers in the drought-affected villages. It has been pointed out that for four out of the six talukas (Kadegaon, Khanapur, Aatpadi and Sangola) in the Tembhu scheme, the government of Maharashtra would have to spend about Rs 800 crores until June 2004 only to provide relief schemes such as cattle camps, Employment Guarantee Scheme projects and water tankers bringing drinking water to these villages. However, the work of completing the main canal of the Tembhu scheme up to Sangola would cost only Rs 250 crores and would provide water for about 200 villages in these four talukas, obviating the need for the government to go on spending hundreds of crores of rupees during drought years only for temporary relief. The farmers would take the responsibility of using this water as a supplement to the water harvested through local watershed development and for equally sharing this dam water. To the objection that this would be financially unsustainable, the farmers have responded that they would pay the full electricity and water charges from next year onwards. A powerful movement on these demands culminating into a total *bandh* (closure) in Aatpadi taluka on 15 September 2003 resulted in an agreement in principle by the government that the main canal would be completed on a war footing once funds were available.

In the neighbouring Tasgao taluka, also part of the Tembhu scheme, a strong movement developed, which culminated in an indefinite sit-in of thousands of farmers in front of the Sangli collectorate from 1 December 2003. Given the severe drought situation, the significant mobilisation of the farmers and popular support for their cause, the minister has given an assurance that he would extend the scheme to all 79 rather than the originally planned 51 villages (some of them partially) by distributing water in proportion to the population. All families would get water as all villages have agreed to equitable water distribution amongst and within villages. This has been a major victory in the direction of equitable water distribution.

The 2003–2004 drought has thus intensified the pressure for equitable water distribution, especially because the movement has put forth innovative, concrete proposals to eradicate drought, which would require less funds than for purely temporary measures of providing famine relief. Moreover, defiant struggles have been launched to press for these proposals—struggles which have a lot of popular appeal and support of the local press and local politicians. Now the tussle is between the status quo, the myopic interests of the ruling factions and financial stringency generated by the decade old neo-liberal policy on one hand, and the pressure of the next general elections due in June 2004 on the other. With this background, it would be quite instructive to see as to what extent the government actually allocates funds to fulfil its written promises in response to the various struggles being launched by the Shetmajoor Kashtakari Shetkari Sanghatana (SKSS).

Part II: The Dam Oustees Movement in South Maharashtra

Maharashtra has to its credit the highest number of large dams in India. The state tended to give a very raw deal to dam oustees and the lives of thousands were devastated by displacement. During the pre-independence period, a valiant attempt was made under the leadership of 'Senapati' (meaning army chief) Bapat, the renowned freedom fighter. But this 'Mulshi Satyagraha' could not muster much strength. However, after independence, leaders like Dr Baba Adhav and Com. Datta Deshmukh gradually organised these vulnerable sections under the umbrella of the Maharashtra Rajya Dharan Grasta Va Prakalpa Grasta Shetakari Parishad (MRDPSP), meaning Maharashtra State Dam- and Project-Affected Farmers' Organisation.

As a result of these consistent struggles and efforts, in 1986 the Maharashtra government had to enact the Maharashtra Rehabilitation of the Project Affected Act. This act, which is the most progressive in India, provides for, amongst other things, 13 civic amenities (now increased to 18), ranging from houses to piped water supply to drainage to a school for the newly settled villages of the dam oustees. What is more important, it provides for agricultural land to the oustees in a progressive manner. Thus all oustees who owned less than 2 acres of land would get 2 acres in the command area. This was due to the consistent efforts of the 'Parishad'. The 'Parishad' had demanded 'developmental rehabilitation' arguing very justly that the dam-oustees sacrifice their ancestral villages and they should hence get more developmental opportunities in their new locations and their standard of living should improve along with those who benefit from the dam water. The actual implementation of this law has been tardy, as the ruling class and the bureaucrats have no genuine commitment to the rights of this vulnerable section. The implementation has been proportional to the organised efforts of the Parishad.

5. Spate of New Struggles

The Parishad opened a new page in its history when a spate of new innovative, militant struggles were launched in South Maharashtra from the late 1990s in response to the government's new initiative and hurry in completing the work on some dams and also a few new ones before 31 May 2000. This hurry was because of the inter-state water dispute tribunal's award in 1975 (known as the Bachawat Award), which had specified that if the quota allocated to the concerned states (Maharashtra, Karnataka, Andhra Pradesh) was not utilised by May 2000, then the unutilised share would come under consideration during the next round of negotiations. Since the Maharashtra Government had lagged behind in full utilisation of its share of water, it desperately tried to expedite dam construction in the Krishna Valley to fully utilise its share before 31 May 2000.

These dam constructions were being pushed through without proper rehabilitation of the dam-affected villages. However, the MRDPSP (mentioned above) in South Maharashtra was determined to teach the government a lesson. It led a number of defiant struggles in 1997–98, in which the dam constructions were forcibly stopped at various dam sites like Chitri, Wang-Marathwadi and Urmodi in particular. Fierce political struggles ensued; every effort was made by the ruling establishment to break the unity and determination of the aggressive mass mobilisation. But there was unprecedented, systematic opposition by the project-affected people led by a very unyielding leadership. As a result, dam construction could go ahead only in step with the fulfilment of the promises as regards rehabilitation. A notable feature of this movement was that it would always insist on written assurances from higher authorities, and would give a call to the people to forcibly stop the construction of the dam if these time-bound written promises were not met. The police could not launch an offensive given the scale of mobilisation, the larger support to that movement and the innovative forms of struggles, which were extensively reported in the local press. Second, there was no time to wear down the movement; there was this hurry to complete as much dam construction as possible before 31 May 2000. The ruling establishment was, therefore, forced to go on the defensive.

In October 1999, there was an intensive phase of the movement in which there were *gheraos* (encirclements) of the government offices. This was particularly intense in the three district headquarters of Kolhapur, Sangli, and Satara. This was extensively reported in the local press (a typical headline would read: 'Nine hours of *gherao* of the collectorate'). The authorities were therefore forced to give written promises as regards rehabilitation of the dam oustees. Since then, pressure has been continuously and successfully put on the bureaucracy to implement the various assurances. For example, as per the act passed in 1986 ('Maharashtra Rehabilitation of the Project Affected'), the rehabilitated villages should be provided with 13 civic amenities, which include school with playground, piped water supply, constructed drainages, cemetery, etc. Generally, only some of these amenities are provided. Here, thanks to the pressure of the movement, the dam-work was halted if the rehabilitation work did not progress properly, and the rehabilitated villages have hence been provided with all these 13 amenities. Further, villagers did not allow dam work to start unless the alternative land was transferred in these oustees' names and did not allow the work to be completed unless all the dam oustees get actual possession of the alternative land.

The government officials were in a conciliatory mood. They had to give written promises and were forced to observe at least the key promises. The officials arrange for the transport of the village-representatives to go to the meetings with the officials. The newly resettled villages look better than the original villages. There are brick-houses and not thatched huts; there is piped water supply; wide-roads with constructed drainages on both sides; a school with a playground, etc. All 13 civic facilities are being arranged. In addition, directives had to be given to provide five more civic facilities. The villagers are, however, struggling to cultivate the newly allotted land, as there is some resistance from the original landowners. But with organised strength, problems are being solved. When one talks to the dam oustees, the sense of pride and militancy is apparent in their talk along with the lament of being forced to leave the original village.

Monthly Irrigation Compensation

The Maharashtra Rehabilitation of the Project Affected Act stipulates that the dam oustees would get irrigated land in the command area. But generally the irrigation facilities in the command area do not reach the land given to the oustees for years. The dam oustees movement in South Maharashtra therefore demanded that the oustees be given a monthly remuneration to compensate for this loss of income till irrigation actually reaches their allotted land. This unusual demand met with a lot of resistance from the officialdom. But, the dam oustees were in a 'do-or-die' mood. The oustees of the Marathwadi dam forcibly halted the construction of this dam for 20 days in the crucial pre-monsoon period. The other dam-affected people threatened to halt construction at other dam sites. The authorities finally yielded and gave a written assurance that the earlier decision in February 2000, of giving compensatory remuneration of Rs 600 per month to the oustees till they get irrigated water for their allotted land, would be implemented immediately. Similarly, an indefinite *dharna* (sit-in) of hundreds of Warana-dam oustees in Kolhapur from 24 May, on this issue and other demands, forced the authorities to concede the demands of the Warana-dam oustees on the 10th day of the *dharna*. This compensatory irrigation allowance is indeed unprecedented. However, the government has been dilly-dallying about the payment after the first monthly instalment was paid. The reason given is that the state coffers are almost empty. But why should the dam oustees, who have already suffered so much, pay the price for the faulty policies of the government, which have led to this crisis in the government's finances? When the dam construction would be over, the dam oustees would not have any bargaining power. Hence the fierce efforts of the movement to extract its rightful demands 'here and now'.

Indefinite Sit-in Struggle in Satara

Despite the written assurances by the authorities to the dam oustees of various dams, many of the promises still remained to be fulfilled even after months of follow-up. The oustees therefore decided to launch a big united struggle to press for their pending demands. Seven local militant dam oustees' organisations from different dam projects in Satara district came together to launch, in front of the District collector's office, a 'do-or-die', indefinite round-the-clock 'sit-in struggle' (*Thiyya Andolan*) to press for their pending demands. Under the banner of the 'Maharashtra State Dam Oustees and Project-Affected Peasants' Organisation', the 'sit-in struggle' was launched on 24 December 2001 with a 10,000-strong *morcha*. Over two thousand dam oustees continued this march into the indefinite 'sit-in' till the demands, including those for financial allocation', were granted by the highest authority, i.e., at the ministerial level.

Given the strength and determination of the 'sit-in', it received support from various sections. In fact, there was later a sort of competition amongst local politicians to support it! This was politically ominous for the ruling alliance. Hence on the 10th day, the Chief Minister, Mr Vilasrao Deshmukh, invited the leaders for talks, during which most of the demands were granted. The agitationists decided to continue the 'sit-in' till a written communication from the chief minister was in hand. The ruling elite stretched the patience of the dam oustees by taking six full days to send the written minutes of the meeting. On the 16th day, the agitationists' 'sit-in' decided to walk towards Mumbai to get these minutes. And then they came by fax! The callousness of the bureaucracy was matched by the fierce determination of the dam oustees. In Kolhapur, an indefinite 'sit-in' by about a thousand oustees of the Warana Wildlife Sanctuary was going on for over a month from November end. Their demands were also conceded during the 2 January talks: Rs 2.5 crores were sanctioned to pay the outstanding dues towards the cost of the oustees' houses, trees, etc.

The 'sit-in' has resulted in the actual delivery of ownership deeds of a minimum of two acres each to all the dam oustees in Satara district, irrespective of their landholding. The 1988 act had provided for an acre each but the dam oustees in Satara have successfully claimed 2 acres each. Second, the CM sanctioned Rs 2 crores towards the outstanding dues to the dam oustees of the 'water-allowance'. Two years earlier the dam oustees had demanded and won this unique 'water allowance'.

The unfortunate part of the story continued. The dam oustees did not receive their dues even a year after the written promise in

January 2002 by no less an authority than the Chief Minister. The dam oustees therefore once again went on an indefinite 'sit-in' in Satara, Sangli and Kolhapur, in front of the collectors' offices from 6 January 2003 onwards. This was a most determined, united, round-the-clock agitation which lasted for 24 days. There were 3000, 500 and 300 dam oustees respectively in this 'sit-in' in these three places. It continued even during a period of political crisis when the chief minister resigned due to internal squabbles in the Congress Party, which was the leading party in the ruling coalition. This chief minister had agreed to most of the demands of the 'sit-in' in the previous week. When everybody advised the dam oustees to suspend the agitation as the cabinet was not functional, the dam oustee continued the 'sit-in' with a 'do-or-die' spirit. Finally the new chief minister had to come to the negotiating table immediately after assuming office and give written orders for releasing the dues of the dam oustees, worth Rs 400 million. This included the dues for the payment of the monthly irrigation compensation allowance. This demand was the one that was negotiated in the most determined way by the leadership and was finally won. This was indeed a historic struggle and victory. No such victorious, prolonged, big 'sit-in' of the rural toiling peasantry had taken place in Maharashtra during last decades.

The Programmatic Unity of the Dam-Affected and Water-Starved Toilers

The struggle of the dam-affected and the drought-affected toilers reached its peak when there was a united mobilisation and programmatic unity of the two. In 1999, from 27 October, there was a three-day-long *dharna* simultaneously in 13 talukas in the low-rainfall zone in three districts, in support of various demands of the people in both dam-affected areas and water-scarce areas. Generally, the ruling class pits these two sections of the people against each other. But in these *dharnas*, in which a total of about one lakh people participated, it was demanded that the dam-construction be completed in time, but with full rehabilitation of the dam-affected, and that equitable water distribution of the dam water be done for drought eradication. This was an unprecedented *dharna* in South Maharashtra in terms of the nature of its demands and the scale of mobilisation around it. Earlier also, there has been programmatic unity in the struggle of these two sections. For example, the dam oustees of the Wang dam continued the stoppage of the dam construction in August 1999, even after all their demands were met, because the demand of the drought-affected people was not complied with. The obstruction to the dam construction was lifted only after the authorities agreed to start the canal work of the Tembhu scheme to supply water to the drought-prone area. In fact the canal work was restarted at the hands of one of the dam oustees of the Wang dam!

One of the important demands by the dam oustees during the 'sit-in' struggle in Satara in December 2001–January 2002, was not for themselves but for the people in the drought-prone areas, i.e., the demand for equitable distribution of the impounded water in the existing dams, at the rate of 3,000 cu m of water annually per family, including the landless families. Concretely, the 'sit-in' demanded no further progress in any dam construction in Satara district till the water in existing dams was equitably distributed. They specifically demanded equitable water distribution from the Kanher dam for the coming season to the adjoining drought-prone talukas, and an embargo on new dam construction till the water distribution system of this dam was completed. This demand signifies the *programmatic unity* of the dam oustees with the drought-affected. Second, it also opposes in concrete terms the privatisation and commercialisation of the dammed water.

During the last 10–15 years in Maharashtra, the pattern is not to construct canals for the dams, and to simply discharge water into the river. This water is then lifted up by those villagers along the bank of the canal who can afford to do so. Equitable distribution of water would mean a stop to this practice; and would mean construction of canals, lifts, etc., through public funds and for wider distribution of water. The 'sit-in' of the dam oustees was serious about this demand, and hence during the negotiations on 2 January, the Chief Minister of Maharashtra, Mr Vilasrao Deshmukh, had to agree that when funds for further construction of dams were available, they would be spent as a priority to build distribution mechanisms and that the water would be equitably distributed. This was a victory of the unity of the dam oustees and the drought-affected.

Attitude towards Dams

The Narmada Bachao Andolan (NBA) led by Medha Patkar and others have not participated or actively supported any of these above struggles. This is partly because of their totally negative attitude towards all big dams. The case against increasing the height of the Sardar Sarovar dam is very strong and all toiling people's organisations have supported the NBA on this issue. It is true that big dams have generally yielded only a small proportion of their promised benefits, and at a much higher human and material cost. But there cannot be an abstract, ahistorical dictum against all big dams.

For example, the Koyana dam's site in Maharashtra has been a very good one. It has provided pollution-free electricity at a cost lower than any other source. It has also provided irrigation to thousands of farmers in Koyana–Krishna belt in Satara and Sangli districts; and its water can play a key role in eradicating drought in the rest of the area if it is equitably distributed. The Koyana dam oustees were cheated and their lives were uprooted and spoiled. But unlike Sardar Sarovar, their number was comparatively small and they could have been properly rehabilitated. In fact, with the help of the 1986 Act, the Koyana Dharangrasta Sangram Sanghatan made intensive efforts to get compensatory land to the Koyana oustees and even 25 years after the displacement, hundreds of Koyana oustees got such a land. The government was forced to apply the provisions of the 1986 act to the Koyana oustees who were ousted many years before the act came into force. About 1,500 families are still to get their dues and some of the demands of the Koyana oustees are still pending.

The Jeevan Hakka Sanrakshan Samiti (meaning Right to Life Protection Committee), affiliated to the NBA, is also trying in its own way and perspective to press for the demands of the Koyana oustees. The perspective of this Samiti is that the dam-affected would not leave the area and their traditional rights be preserved. The point is that the Koyana dam has far more positive potential than has been realised so far. As K.R. Datye puts it, the attitude towards dams like the Koyana dam should be 'to struggle for what it should have achieved but did not'. Along with the movement for proper rehabilitation of all the Koyana oustees, the focus now has to be also on the demand to realise the positive potential of the Koyana dam for drought eradication.

The NBA, however, feels that drought can be eradicated solely with local watershed development and exogenous water from dams is not required. This may be true in some parts of the country. But in Maharashtra the topography, nature of soil and climate, population density, variability in the monsoon rains in the rain shadow area where dependable rainfall is only 300 mm, all put severe limitations on the capacity of local watershed development. Locally available water is enough for subsistence in years of good rainfall, but it is quite inadequate in lean and drought years. Detailed scientific estimates show that on average, about 60 per cent of water requirement can be met with local watershed development in such areas in Maharashtra and, as mentioned above, 3,000 cu m of exogenous water is required at source to meet the requirements of a 3 acre family farm to support five persons on sustainable agriculture and to create small biomass surplus to move towards dispersed, sustainable agro-industrial prosperity.

It may be pointed out that the drought eradication and prosperity in the famous Ralegaon-Shindi experiment led by Anna Hazare would not have been complete without the use of exogenous water from the Kukadi canal. There is other evidence in favour of this holistic perspective of the need to use exogenous water in drought-prone areas in Maharashtra to supplement local watershed development. It is this holistic perspective that has informed the toiling peasants' movement in south Maharashtra for the rights of the dam oustees and the drought-prone for water use and for livelihood.

The SMD, in its Marathi booklet published in May 1997 '*Krishna Khoryache Pani, Rabanarya Janatecha Paryay*' ('The Water in the Krishna Basin: The alternative of the toiling people') argued in a detailed manner that the water already impounded in various dams in the Krishna basin is adequate to supply 3,000 cu m to every family in the basin if it is equally distributed; even after taking into account the needs of the urban areas, the needs of the existing sugarcane crop and industrial needs.

The emphasis of the movement is on proper utilisation of the water impounded in existing dams. However, whenever necessary, new dams have been opposed. For example, the movement has been opposing the Sarpanala dam in Kolhapur district, on the grounds of being unnecessary for the development in that area, and, as described below, had argued for a total recasting of the Uchangi dam Scheme to replace this dam with three smaller dams. Furthermore, the SKSS successfully demanded that water-distribution of the 'Tembhu' scheme and of the Urmodi dam be completed first before resuming the remaining construction of the dams at Urmodi and 'Wang' in Satara district. Thus the attitude of this movement towards dams has been scientific and holistic.

The Struggle for an Alternative to the Uchangi Dam

The struggle for an alternative to the Uchangi dam is different in some ways. Yet, it may not be out of place to describe this struggle here, as it has its own lessons to offer. Uchangi is a small village in the Aajara taluka of Kolhapur district, more than 100 km away from the struggles described above. Besides, it is in a high-rainfall area and there is no drought-prone area nearby. However, the Maharashtra Government decided to build a dam on Tar-Ohal, a small river in the Aajara region. This dam would submerge partly or wholly six villages to impound 660 million cubic feet (mcft) of water. In 1986, the affected villagers had pointed out that in Aajara area, given the topography and the annual average rainfall of about 4,000 mm, the same amount of water could easily be impounded with a number of smaller dams. But this suggestion was ignored. When the irrigation department actively started preparation for this dam in November 1997, thousands of men and women in these six villages actively opposed it under the leadership of the Shramik Mukti Dal (SMD). This stiff opposition forced the local authorities to call a meeting of the affected villagers and the activists of the SMD with the district-level officials. In this meeting the officials had to agree that if a scientific alternative is prepared to the proposed scheme, then the government would consider such an alternative with an open mind. This agreement was the first of a series of pioneering achievements of this movement. If the relevant data were made available, the well-known expert Mr K.R. Datye and his associates in Society for Promoting Participative Eco-system Management (SOPPECOM) showed willingness to help out in preparing this alternative. In 1997–98, the villagers of Chaphawade, Jeur, and Chitale carried out a systematic survey, under the guidance of pro-people experts. Participative Resource Mapping (PRM) of the area was carried out to assess the possibility of an alternative.

A rough plan was prepared on the basis of this survey and PRM. But some systematic topographical survey data were needed to prepare any concrete alternative plan. Only the government could provide these data. The irrigation department refused to give these data, as this information is supposed to be an 'official secret'! Though there was no 'Right to Information Act' then, the movement demanded this information as a matter of right and also submitted the preliminary, rough alternative plan. The district-level authorities arbitrarily rejected this plan and also rejected the demand that the whole matter be discussed with the higher authorities in the Maharashtra Krishna Valley Development Corporation (MKVDC). They tried to start the dam construction in June 1998. There was severe opposition to the starting of the dam work. Despite heavy rains, almost all the villagers from Chaphawade and Jeur and many from Chitale sat down along with their cattle at the dam site to oppose construction. A police force of more than 1,000 local police and State Reserve Police were waiting to charge down on the protestors. At the last moment the Superintendent of Police, beat a retreat in view of the determined opposition of the villagers. The demand to provide topo-sheets of the area and to hold discussion with higher authorities was also agreed to. This was an unprecedented victory for the movement.

Despite this assurance, the irrigation department took 16 months to obtain permission from 'higher authorities' to give this information. Moreover, it attempted to start work on the dam once again. The movement led by SMD again foiled such attempts and ultimately the government had to provide the concerned topo-sheets. Despite the inadequacies of the data provided, the concerned experts from SOPPECOM and activists of the movement submitted an outline of an alternative plan in 1999. This alternative plan consisted of three smaller dams at Khetoba, Dhamanshet and Cheralakatta on the rivulet

Tar-Ohal. They together would impound 624 mcft of water. As per the alternative plan, each family would get 3,000 cu m of dam-water, in accordance with the principle of equitable water for sustainable development. The rest of the water could come from local watershed development. This alternative plan would irrigate almost double the area compared to that in the government plan. If the alternative plan were to be accepted, nobody would face displacement and very little good quality land would be submerged.

The engineers of the MKVDC agreed that Khetoba village, one of the sites in the alternative plan, was a good site. They agreed to build a small dam there and, as a consequence, to reduce the height of the Uchangi dam by 2 metres. However, they rejected the two other sites suggested in the alternative plan on the grounds that they do not meet the cost criteria of the irrigation department. The SOPPECOM experts argued that the very parameters used by the irrigation department were questionable from a modern, scientific viewpoint. Besides, tried and tested techniques to reduce dam construction cost were available. However, the MKVDC officials pleaded their inability to go beyond government norms and techniques.

The government had to agree to build a second dam, and also to modify the present plan by reducing the height of the dam by 2 metres so that none of the houses in the village *gaothans* (village settlements) in these six villages would be submerged. This was an achievement in itself. Good quality land near the riverbed would be submerged, but the government has agreed to lift water from the dam to irrigate at its own cost the un-submerged land in the upstream affected villages (this was also an unprecedented step). Yet, the modified MKVDC plan of the Uchangi dam was not acceptable to the villagers as a substantial part of their good quality land would be submerged. After a lot of discussion it was ultimately decided that the villagers would express their opposition to the modified plan by courting arrest on the inaugural day of dam construction, but would then focus on forcing the government to implement the various promises made as part of the modified plan. Some villagers felt somewhat frustrated and the tempo of the movement got weakened after this firm refusal of the government to scrap the Uchangi site.

Part III: Lessons Learnt

6. The Limitations

The movement described in this paper could force the government to negotiate with stakeholders like the drought-affected and dam-affected. With the help of concerned pro-people scientists from CASAD and SOPPECOM, the movement could also force the government to restructure the projects. However, in actualising these gains there have been some limitations.

(1) As mentioned earlier, the last stage of the Baliraja dam has not been completed as yet due to lack of funding from the government. Hence only 100 hectares are currently under irrigation compared to 380 hectares planned. There has been inadequate follow-up of the matter as compared to what is required in the face of bureaucratic hurdles.

Since there is no exogenous water supply to these two villages, this would continue to cause a lot of problems during years of low, irregular rainfall.

(2) The struggle against the Uchangi dam was only partially successful. Though the government agreed to build, as per the demand of the movement, a small dam at Khetoba, and hence decided to reduce the height of the Uchangi dam by 2 metres, it refused to build two more small alternative dams to replace the Uchangi dam as suggested by the movement.

So far, there has not been adequate support in the command area of the Uchangi dam for the slogan of equitable distribution of water leading to extension of irrigation to more families. The ruling parties have created an image of SMD as dam opponents and anti-developmentalists. The movement has not been able to break this image, as it has been somewhat weakened after the staunch refusal of the government to fully accept the alternative plan of replacing the Uchangi dam with three small dams at more appropriate sites.

(3) The implementation of even written promises by the authorities has been tardy. Some of the written promises given by the chief minister in January 2002, in response to the 'sit-in' in Satara, had not been implemented one year after the 'sit-in'. The various dues of the dam-oustees were being paid only after one more 'sit-in' for 24 days in January 2003. The Maharashtra government's economy is on the verge of collapse because of its own faulty policies. The poor are being made to pay the price for this.

These three limitations indicate that despite the valiant, innovative struggles mentioned above, it is extremely difficult for the vulnerable sections of the society to achieve even their basic demands. More thought needs to be given to achieving a broader and stronger unity of different sections of the toiling people.

(4) The leadership in the movement realises that local watershed development is the basis of use of exogenous water. This has been an important point in some of the mass awareness campaigns. Elsewhere, the focus of the movement, of the propaganda, of the agitation, etc., has been on asserting the right to equitable distribution of exogenous water. Much more awareness and work needs to be done on this issue of various ways to harness local water. Otherwise when exogenous water is available, the targeted productivity would not be achieved due to deficiencies in the local harvesting of water and the economics of paying for the lifting of water would be jeopardised.

(5) Though women's participation in the agitations has been very much there, there is virtual absence of women in the leadership. In the Baliraja movement, two educated, middle-class woman activists, Nagmani and Gauri, were involved full time in this movement. During this period, a kind of leadership from the toiling peasant women was gradually emerging at the local level. In the absence of such activists, it is very difficult for women to come forward in the leadership in a traditional peasant society.

7. Postscript

Historic Struggles and Gains in 2004–2005

In 2003–04, Western Maharashtra suffered a very severe drought, which was worse than the one that occurred in 1972. Almost 70 talukas were affected. Thousands of cattle were butchered in some talukas because there was no fodder or water to keep them alive. It seemed that thousands of people, men, women and children, would be forced to leave their homes in search of livelihood, perhaps never to return home. In response to this situation, a round-the-clock *Thiyya Andolan* (indefinite 'sit-in') was launched by the Pani Sangharsh Chalwal (Water Agitation Movement) from 19th January 2004 in front of the Maharashtra Krishna Valley Development Corporation (MKVDC) office in Pune. This was partly a response to this deadly drought and partly the culmination of a decade of struggles for the right to water and the right to rehabilitation. About 7,000 people from the drought-affected and dam-affected areas of south-west Maharashtra participated in this agitation. The *andolan* was the largest indefinite 'sit-in' of the rural toilers in Maharashtra in many decades. It was also one of the most disciplined ones. The round-the-clock *Thiyya* ended successfully in two days.

Led by the veterans of the rural toilers' movement in Western Maharashtra—Nagnath Anna Naikawdi, Ganapatrao Deshmukh, Dr Bharat Patankar and Dr Baba Adhav, this movement created quite a stir in the ruling political circles due to the evident determination and large mobilisation for a *Thiyya Andolan*, and the forthcoming elections. On the second day of this unprecedented struggle, the Home Minister Mr R.R. Patil (who was part of this water rights movement before he became the minister) and the Irrigation Minister Mr Ajit Pawar had to come in front of the *Thiyya Andolan* to announce their package, which conceded, though only partially, the demands of the *Thiyya*. They together announced the following:

- Rs 1,500 crores would be made available and spent before March end since the central government has given the sanction to raise Rs 1,500 crores through MKVDC bonds. Of this, Rs 1,150 crores would be used for the Krishna river basin and the remainder for the Marathwada and Vidarbha areas of Maharashtra. More funds would be mobilised after 31 March.

- Rs 230 crores of the Rs 1,500 crores announced would be used for the rehabilitation of the dam-affected.
- Equitable distribution of water has been accepted in principle but the *Andolan* and government would jointly try to resolve the various practical and political problems involved in equitable distribution of water.
- Priority allocation of water to industry over agriculture, mentioned in the Water Policy, will be re-examined and discussed with the Central Government after which a decision would be taken.

This has been a partial victory for this *Andolan* as their demands were met half way!

This Pune *Thiyya* was followed by a *Thiyya* in Mumbai on 14–15 February 2005 to further press the demand for the policy of equitable water distribution. On 14–15 February, the Azad Maidan in Mumbai saw one of the few determined agitations in recent times. About a thousand drought and dam-affected peasants from six districts in South Maharashtra and Konkan (Kolhapur, Satara, Sangli, Solapur, Sindhudurg and Ratnagiri) gathered to press for policy-level changes. This time led only by the Shramik Mukti Dal and the related 'Water Struggle Movement', this agitation demanded a concrete policy decision for equitable water distribution and for better rehabilitation policy and for increased financial provisions for the proper rehabilitation of the dam oustees.

On the second day of this 'sit-in struggle' ('*dharna*'), there was a detailed meeting of the delegation with Mr R.R. Patil, the Deputy Chief Minister; Mr Ramraje Nimbalkar, Minister for Water Resources, (Krishna basin); and later with Mr Patangrao Kadam, Minister for Cooperation and Rehabilitation. During these negotiations, the ministers agreed that if people in a taluka form water users' societies and decide to redistribute water amongst themselves equitably, the government would agree to such redrawing of water distribution, provided all the beneficiaries under the existing plan would also receive water equitably. The ministers agreed that, as pilot schemes, the irrigation department would actively cooperate in three talukas—Kadegaon, Tasgaon and Aatpadi—by providing technical assistance to redraw the current canal schemes in accordance to the principle of equitable water distribution. This decision goes much beyond the earlier official decisions in response to earlier agitations which 'agreed in principle' to adopt the equitable water distribution policy.

The government did not concede the demand to allocate additional funds required to implement the redrawn, equitable water distribution schemes, saying that the state government does not have the resources. The ministers however agreed to take up the issue with the Centre for modifying Article 371 of the Indian Constitution, which impinges upon the state government that it should allocate funds on a priority basis to make up for the developmental backlog created in the previous schemes. Since the overall backlog is quite substantial in areas like Vidarbha and Marathwada, funds are now given on a priority basis to these regions. Dr Bharat Patankar of the Shramik Mukti Dal has argued that the irrigation backlog in the drought-prone areas is qualitatively different as it affects people's right to livelihood. Hence, special funds should be allocated to overcome this backlog by broadening/modifying the meaning and scope of Article 371 and this backlog should not be clubbed with general backlog. The ministers agreed with this argument and promised to take up the matter with the central government.

Dam Oustees' Rehabilitation

One of the major impediments to proper rehabilitation has been paucity of funds. Since the Maharashtra government has not fulfilled its 'developmental backlog' for Vidarbha and Marathwada, whatever funds are made available for irrigation would be spent on a priority basis on overcoming this backlog, leaving very little funds for development and hence even for rehabilitation of dam oustees in south-west Maharashtra. The Shramik Mukti Dal has been demanding that the fund for rehabilitation should be delinked from the backlog issue.

During the Mumbai negotiations, the deputy chief minister agreed to explore this option of creating a special sub-head for rehabilitation fund, so that allocation for rehabilitation could be delinked from the backlog issue.

A number of other demands were conceded during the meeting with the minister for rehabilitation and cooperation. One such crucial demand was that as per the 'Urmodi pattern', the dam-work should proceed only to the extent rehabilitation work is completed. It was also agreed that the Rehabilitation Act would be modified in tune with the note submitted by the movement. This note includes, among other things, a provision that till the time the dam oustees do not get irrigation for their newly allotted plots of land, they would be paid a monthly 'irrigation allowance'. This agreement is a major achievement of the dam oustees' movement.

The new wave of dam- and drought-affected peasants' struggles has been seen in south Maharashtra since 1998. The ruling circles have been more responsive to this movement during the last couple of years, because in this period the movement has changed its strategy to become more political and not remained only an 'issue-based' movement. The Shramik Mukti Dal has threatened the political base of the ruling parties by specifically challenging the elected representatives of the ruling parties on these issues. In the Vidhan Sabha elections in August 2004, it extracted written commitments for equitable water distribution from the election candidates. The ministerial-level negotiations and the conceding of the majority of the policy demands within two days of this agitation was a result of this new strategy of politicisation of this issue.

It will be interesting to see what and how progress is made about actually allocating additional funds for equitable water distribution and for rehabilitation of dam oustees. It will also be interesting to see how the Shramik Mukti Das will launch the announced Maharashtra-level movement for enactment of a law for equitable distribution of dam water, with villages getting water allocation in proportion to the population.

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