Water MOVES

A Quarterly Newsletter on Water Governance

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Foreword

Hardeep Singh

In the Indian context where water is generally accepted as a key to improve livelihoods of a large number of poor people, the issue of Water Governance is one of building social support for equitable and sustainable development of the resource, based on comprehensive participatory planning. Water governance involves formal and informal institutions through which authority is exercised to allocate and regulate the resource while there is a need to harness and use water for maximum societal good. Concerns have been raised regarding water scarcity, pollution of water bodies, deterioration of water infrastructure, and lack of social justice in access to water. The need for an adaptive framework for Integrated Water Resource Management (IWRM) has been voiced at various levels and of late there has been an increased interest in water governance as a result of a perceived change in the role of state to one of a minimal facilitator. Critical questions have been raised about this new paradigm of governance, especially on accountability and depoliticisation of public spaces. There is a need to critically examine theories and practices underpinning the new governance paradigm especially from the angularity of poor and marginalised sections of society.

While policies, organizational structures and public regulatory systems like the Farmer-Managed Irrigation Systems Acts and Water Regulatory Authorities have been brought into effect in a few states, in the absence of a clear strategy, the concept of IWRM has not been translated into practice on the ground. There is a need to develop a methodology taking into account particularities of livelihood systems, agrarian structure and institutions in the various regions (basins) to evolve models for democratic water governance.

Institutional approaches to water governance have been limited to making laws, setting up regulatory organisations, turning over management of irrigation systems to users, and specifying water rights. These moves have emerged from a specific understanding of problems in water management. The problems are stated in terms of economy, ecology, and politics, together with law and administration, as well as social values, including various conceptions of rights. These formulations are underpinned by a general conception that one has at any time about interaction between nature and human agency within a long, enduring but nevertheless potentially changing social structure.

contradictory development of social reproduction together with technological breakthrough offers a context for the change. New institutions engendering new sets of rules are conceived for solving problems and meeting social objectives. The new principles are cast into propositional forms embodying theory, beliefs and values. The institutions are supposed to bring structural change by refashioning principles underlying ownership right and the usage of the resource. Since adoption of the new rules engenders conflicting material interests these become effective only after a lot of contestation. Old institutional principles and arrangements continue long after formalization of the new institutions. New institutions can be considered as established only when these have systemic constraining property. The institution does not do this on its own but needs to be acted upon by social actors. This requires willingness and preparedness on the part of actors. A well thought out action plan for building required capacities of social actors based on understanding of a process of emergence of new institution can help bring change in a desired direction.

This newsletter seeks to provide space to highlight various aspects of water governance and put forward workable suggestions on the subject.

Integrated Water Resource Management

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The article highlights the concept of Integrated Water Resource Management (IWRM) as an emerging one, which has shifted the traditional focus on water development to water allocation and management. The article is based on a talk by N.C. Narayanan at the National Consultative Group Meeting of the Water Governance Project in New Delhi on 28th October, 2007.

Revisiting the concepts of sustainable development is a necessity. There is a need to identify how the concept of sustainable development parallels Integrated Water Resource Management (IWRM).

In the post independence period, development was given an uncritical meaning, and was tantamount to economic growth and vice versa. Industrial modernity was perceived as a trigger to development and the state was considered as a provider of development. There was an uncritical hope that growth would bring development. Capitalistic and socialistic development models, which had then gained prominence, did not debate about development as it is viewed now. Thus, industrial modernity was perceived as development, and the state as an engine of growth. Critical development perspectives that emerged from Latin American experiences in the 1960s were nothing but third world challenges to the existing dominant paradigm. This type of global capitalistic growth of the first world was resulting in underdevelopment of third world economies. It was in this context that the perception of development and underdevelopment as being sides of the same coin emerged.

Structural economists while attempting to tackle the concept of development did empirical studies that showed how terms of trade, which had existed between the 1860s and 1930s were unfavourable to developing countries. Developing countries were exporters of primary products and net importers of technology and developed goods. Thus, the terms of trade were getting progressively unfavourable. This was the basis for the dependency structuralism argument where the whole systemic point of modernization, growth and industrial capitalism as the panacea of development were fiercely challenged.

Another theory that emerged was the alternative development theory, which was followed by neo-liberalism at a much later stage. By 1970s, poverty became rampant and it was widely felt that modernization and growth were not trickling down in any way. So development had to be redefined as an endogenous process with components of people's participation, empowerment etc. which continues in civil society debates till date. Government also responded to these debates by adopting the strategy of direct attack on poverty by launching programmes like 20-Point Programme, Garibi Hatao amongst others.

The oil shock of 1970s had triggered massive fiscal crises in developing countries. IMF and World Bank put forth some suggestions for economic stabilisation and bailing developing countries out of the resultant economic and political turmoil. Thus structural adjustment, liberalisation, and deregulation became the new buzzwords which continue to reign even now. It should be noted that these concepts first emerged from the first world consensus that was championed by Ronald Reagan and Margaret Thatcher . Yet another factor that influenced development thinking was the 'Washington Consensus'. Despite all these maneuverings, poverty still persisted especially in the developing world, which led to radical rethinking about whether the adopted model of development was one that the world really needed. The result was that the concept of development was critiqued by many. One of the positive contributions came from Amartya Sen who suggested the 'Human Development' concept, and another from UNDP, guided by Mahboob-Ul-Haq of Pakistan, which refined the human development paradigm into 'Human Development Index (HDI)'. The crux of HDI was that it treated development as not just GNP per capital, but sought to translate development into indicators such as literacy, longevity, and infant mortality. Later more measures of indices, composite indices and international comparisons were also developed to suit requirements of various sections of populations. Thus, development began to be looked at from the social angle.

There are four conflicts intrinsic to the concept of sustainable development. These internal contradictions are (a) present versus future (b) human well-being versus protection of nature (c) poor versus rich and (d) local versus global or rather here versus elsewhere. The concept of sustainable development should hypothetically balance economic, social and political dimensions.

IWRM needs to be understood in the context of recently emerged concepts of development. J.A. Allan introduced the following five paradigms in water sector development:

a. Pre-modern (before 1950): This paradigm emphasized local livelihood provision while addressing domestic and livelihood water as an inviolable social resource. Regardless of professed commitment to this basic understanding that prevailed in this era, there had been violations because of power relations.

b. Industrial Modernity (1950s): The second paradigm featured the hydraulic mission, which asserted that nature could be controlled and water could be appropriated for productive use. Government, irrigators, and power generators were engaged in essential activities in this phase.

c. Late Modernity (Late 1970s and 1980s): The characteristic of this era was that there was an uncertainty over nature's capacity to sustain rapid development and hence the generally shared perception was that nature cannot be controlled. It was also widely felt that water as a part of environment was essential for environmental services. Hence, water should be returned to the environment from irrigation as environmental considerations have prime value.

d. Economic Efficiency (Early 1990s): In this paradigm, water is perceived as an economic resource with a definite economic value. Water began to be addressed as a resource which should be used according to the principle of allocative efficiency. Yet, economic principles were considered prime.

e. IWRM (Late 1990s onwards): This is a reflective paradigm, which combines all the above paradigms. It treats river basin as a fundamental unit so that there is a smooth shift from water development to water management. The water management process is projected as one with a participatory, inclusive and integrated approach. This paradigm introduced water allocation and management as political processes.

While the developing world is at a stage of hydraulic modernity, the hydraulic mission paradigm is fast shifting in the developed world. Developing countries are still continuing with the water development paradigm while developed countries are focusing on water management. Drawing from various perspectives, the definition that captures various characteristics of IWRM is "a process involving all stakeholders in the watershed or basin, who together as a group, cooperatively work toward identifying the watershed's resource issues and concerns, as well as develop and implement a water resource management plan with solutions that are environmentally, socially and economically sustainable. The uniqueness of IWRM concept is that it provides for integration of various sectors and areas of water management. Broad integrations involve different uses of water, analytical perspectives, different institutions responsible for water management, geographical integration and integration of water resource management into a broader agenda of development.

Water allocation is basically a political process. The need for negotiations and optimal outcomes due to competing claims and cooperative interests over water management always exist. However, there is a need to identify platforms such as multi-stake holder platforms where there is free interaction of various stakeholders without being unmindful of the fact that there are power relations within which actors relate on these platforms. These platforms should ideally be level-playing. Though WTO is hailed as a global level-playing platform, the perplexing part is the initial endowments with which people come to this platform. Negotiations and outcomes of interactions at such platforms are greatly dependent on initial endowments of actors.

Elements of IWRM

There are three intrinsic elements of the IWRM concept namely;

a. River Basin Management: the concerns of which span into technical assessments and integration, geographic integration and centralised allocation system.

b. Stakeholder Participation and Negotiation: involves close participation of various stakeholder organisations and communities including water users.

c. Privatisation/Liberalisation: the underlying assumption behind these is that the market can allocate water more efficiently than any other institution. Supra-national institutions such as World Bank and IMF are actively promoting this.

IWRM Principles

a. Gender Principles: This includes participation, evaluation and feedback of women and an assessment of impacts on them.

b. Institutional Principles: This includes the principle of management at lowest appropriate levels and the principle of participation by all.

c. Economic Principles: Water is projected as a 'scarce' resource and hence there is a pressing need for 'allocative' efficiency. Principles of water pricing and privatisation are suggested. This is ferociously opposed and rejected by all developing countries but still pushed through indirectly by organisations like World Water Council, Global Water Partnership (GWP) and others.

Understanding IWRM requires unpacking of its concepts which involves analysing essential arguments of economic uses, social justice arguments, and environmental sustainability in relation to water and most significantly, the power that translates into allocation because who gets what in the process is politically determined. The focal point of discussion on IWRM is allocation in the light of social and environmental concerns. Therefore, IWRM is not just about more efficient management of physical resources such as land, water, forests, fisheries, livestock, etc. but also about reforming human systems to enable people to obtain sustainable and equitable benefits from them.

Conclusion

The concept of development has been given different connotations in the recent past. Similarly, different interpretations of development are also reflected in the water sector. Like internal conflicts within the analytical framework of sustainable development as well as in the five paradigms of water sector development, IWRM also has multiple objectives and conflicts embedded within.

IWRM could be equated with the metaphoric 'nirvana concept' as this is incontrovertibly economically viable, socially just, environmentally sustainable and politically acceptable. However, there is a need to contextualise all IWRM discussions and unpack its components.

Groundwater: An Introduction to a Fragile Resource

Himanshu Kulkarni & S. B. Deolankar, *ACWADAM, Pune*

It is generally believed that the fundamental cause of most water-related problems in the country is rainfall, or rather its scarcity. However, a study of rainfall statistics over the last century reveals that in most areas, average annual normal rainfall has not reduced significantly. Rainfall vagaries are still as pronounced as they have been during the entire course of the last century. What then has affected the national water resources scenario, resulting in omni-present water scarcities in summer?

India is a unique country in its diversity, be it physiographic, climatic, cultural or in its socio-economic fabric. Despite giant leaps in the fields of engineering and technology, which have attempted to address crucial issues like scarcity of water resources through irrigation projects, the water resources problem still looms large in a variety of ways. Primarily, demand-to-supply ratio for a primary resource like water will always be higher in the scenario of a rapidly burgeoning population. High urbanization indices, decrease in agricultural areas, degradation of lands, and deforestation, amongst others, are some of the major issues that have direct linkages to problems of water resources in the country.

The increasing demand for water, as a consequence, has effectively meant looking for supplementary sources and in such situations, 'groundwater' has been an inevitable option. Increasing use of groundwater, not only for agriculture but also for urban areas, is a cause for great alarm. Already there are authenticated reports regarding the crises of groundwater from various regions of the country. These crises are compounded by the diversity in physiography, agro-climatic factors, and most significantly in the variable geological framework that hosts groundwater. The problems are manifold, and range from summer scarcity to extreme deterioration of water quality. Rampant over-exploitation, in the absence of any voluntary and/or legislative regulation and control, has caused a depletion of groundwater resources in many regions, especially within domains of hard-rock, exposed over large tracts of the country. An obvious indication of over-exploitation has been a long-term decline of water levels in wells from affected areas. Groundwater quality deterioration has been reported from some parts due to a variety of causes ranging from contamination by various wastes to leaching of fertilizers and pesticides to the water table.

The groundwater scenario of Maharashtra is a case in point. While statistics indicate that there is good potential for agriculture in the state, with total cultivable area in the state being in excess of 21 million hectares, only 11% of this land in 1984 was under irrigation. Although, presently, the situation is stated to be far better in terms of cropped area, water resources throughout the state are stressed. More than 60% of the irrigated land is supported entirely by groundwater and the situation would be similar in many other states of India. Notwithstanding exact statistics, groundwater is a significant component of irrigation and its overall use in rural as well as urban sectors has increased enormously.

Groundwater Resource Development

The last three decades have witnessed ubiquitous groundwater resources 'development' with the onus surely on creating sources in the form of wells, bore wells and tube wells and on a more formal level, generating projections of development potential of the resource. Groundwater management is relatively new to groundwater policies, where managing the resource base is concerned. The Deccan basaltic lava flows, which are made up of rocks of volcanic origin, cover over 80% of the area within Maharashtra. The development of groundwater from these hard-rocks has been quite haphazard leading to major problems like over-exploitation, deterioration of groundwater quality, salt-water incursion in coastal areas, increased costs of lifting water in areas of falling water-levels etc. Surely, the blame does not necessarily go to the state alone since a large chunk of developed groundwater infrastructure is private. Obviously, the proportion of groundwater abstraction through private infrastructure is also bound to be high. The range of quantitative groundwater problems is so wide that some areas experience acute water shortages whereas others have waterlogging problems leading to salinisation of soils and large-scale degradation of land. If there is one common reason behind the groundwater syndrome in Maharashtra, it is the dearth of a systematic hydro-geological approach to groundwater resources evaluation, development and management. It is more than likely that situations in other states are no different.

In light of this background, it would be interesting to understand the importance of groundwater, which is practically a part of every citizen's life either directly or indirectly. It would not be difficult to supply statistics on how groundwater resources have deteriorated, but the objective of this article is to sensitise the reader as to how important it is to conserve and protect it so as to ensure its effective anthropogenic and environmental roles.

The Importance of Groundwater

The importance of groundwater is easily overlooked and is considered a hidden resource; a partially seen asset at most. Its importance lies in the fact that although it is a part of our daily lives, it remains largely out of sight. Groundwater constitutes a significant source of water supply in many regions of the world and happens to be the only source of water in many parts of India. Large tracts of rural India still depend on groundwater to meet daily water needs, both for agriculture and for domestic purposes. Unfortunately, many still believe that groundwater is only a supplement to the more easily perceived surface water resource, and therefore is only of secondary importance. Inadequate knowledge of groundwater resources, especially as far as users are concerned, has led to serious consequences of quantitative and qualitative nature cutting across user-bases in agriculture, industry and households.

Groundwater occurs in an 'aquifer', a medium capable of storing and allowing water to flow. In other words, an aquifer stores groundwater and also allows it to flow in certain directions, based on the openings in the rock or rock material. The flow is also governed by basic hydraulic principles. Aquifers are partially or fully saturated portions of rocks or rock matter, wherein saturation is usually a result of water infiltrating the ground after rainfall. The mechanism of natural infiltration allows slow passage of water through the ground, ensuring good quality and consistent chemical composition of groundwater. Uncontaminated groundwater is usually suitable as drinking water in its in-situ state.

Groundwater is pumped from wells, tube wells, bore wells along with other less popular mechanisms as a source of water supply. At the same time, groundwater naturally emerges from aquifers by way of springs. Quite often, springs and seepage emerging from aquifers provide the entire flow to streams and rivers during dry seasons, which themselves can be quite prolonged in large parts of India. Wetlands usually derive their sustained feed of water from aquifers discharging to the land surface through springs and/or seeps. Hence, we can observe stream flows extending into non-rain periods (often as perennial stream flows throughout the year as still evident in many parts of the Konkan). This stream flow is actually groundwater flowing out on the surface. Large-scale groundwater abstraction reduces natural discharges to surface water environments and has been known to profoundly affect aquatic environments, including wetlands. Groundwater development requires balancing anthropogenic needs with ecological considerations.

Groundwater is a replenishable resource, the host framework of rocks and rock material along with rainfall or other sources of recharge, defining limits of replenishment. It has sustained civilisations spanning centuries and continues to do so even today. Nature's mechanism of rejuvenating aquifers provides us with a resource that can sustain use over prolonged periods of time. However, the key to its sustained use is the mode of use itself. With scant regard to the manner in which we use water in general, and groundwater in particular, an obvious fallout has repeated stress on water resource bases. These stresses are manifested both in the form of depletion in quantity and deterioration in the quality of groundwater.

Haphazard use of a resource that can only be partially observed has over time caused large scale deterioration of groundwater quality. Aquifers and the groundwater they contain are prone to pollution and though aquifers have some natural capacity to filter out wastes, there is a limit to their absorbing and neutralising capacity. Intensification of agricultural activity, industrial growth and urbanisation are some factors that have added to the potential risk of contamination of groundwater.

Groundwater pollution may remain undetected for a long time as it generally occurs slowly and signs of such pollution are apparent only when the problem has truly set in. It may take years to become apparent in a water supply scheme. The remedy for a polluted aquifer is costly and sometimes infeasible. Hence, sensitivity and awareness are required to understand processes leading to contamination of the groundwater resource.

Groundwater resources have been subjected to large-scale over-exploitation as a consequence of the shift from use of individual wells to large scale development of groundwater from potential aquifers and within large river catchments, irrespective of specific aquifer-based investigations. Implications of over-exploitation of groundwater are evident in the form of declining water levels and seawater intrusion into coastal aquifers. At the same time, it is likely that in other areas canal networks have led to a steady rise in water levels thus causing drainage problems or water logging. However, most studies are watershed-based and aquifer-based planning and management is still to catch on, both in practice and in policy.

In order to ensure sustainable use of groundwater resources, in the backdrop of quantitative and qualitative problems, aquifer management on a large scale is necessary. However, modern management of aquifers is more complex than that of a surface reservoir. Such management requires information about variation in aquifer properties like porosity and permeability of the rocks, sources of recharge, natural discharge conditions, effects of pumping of groundwater etc.

Hydrogeology: The Science of Groundwater

The science of groundwater is called 'hydrogeology'. It helps develop a correct understanding of aquifers which requires the interaction of various disciplines: geology, physics, chemistry, engineering, mathematics and even biology. However, the basis of developing an understanding of groundwater occurrence and movement is to be able to define a physical framework for its occurrence. This understanding is achieved through sciences of geology and hydrogeology, which describe geometry of rocks and rock material in which groundwater occurs, moves and processes involved in the occurrence and movement of groundwater. Hydrogeology describes the natural quality of groundwater within various media as well as effects of human lifestyle and practices on groundwater, while providing information on how groundwater supplies can be efficiently used.

Groundwater resources development in policy has noticed a shift from a regional to a local perspective. This is quite a promising move because it attempts to bridge the gap between practice and policy through a process of decentralization in *water governance*. Even in a broader context, water resources planning in developing countries like India has concentrated on sectoral site-specific development. Groundwater development, in this context, has meant more wells, energized mechanisms of greater water lifting capacities and intensification of the search for more sources of groundwater through latest technologies. In short, groundwater development has progressed in a manner catering only to the growing demand of water for agriculture, industry and households. However, development opportunities in present and future times will be equity and sustainability of the resource, with the former leading to conflicts at various levels. Consequently, emphasis in planning will increasingly have to shift to management of groundwater including its equitable distribution and sustainable use. Hence, even though the planning objectives are similar to earlier scenarios (food security, economic development, removal of socio-economic disparities etc.), there ought to be a greater emphasis on factors of environmental protection and sustainability of groundwater resources. Groundwater resources planning, development and management will be a complex task because the level of understanding of this hidden resource is often quite rudimentary.

Initiatives in groundwater management programmes are emerging in response to various problems ranging from food security to agricultural development, deforestation and land degradation to water scarcity, soil salinization and water-logging to droughts, and so on. The implementation of programmes involving groundwater does not necessarily have a hydrogeological thrust, with many factors taken for granted. Watershed Development and Environmental Protection and Management are two major areas wherein there is further scope for specific initiatives in groundwater management as well as improving the hydrogeological inputs to these programmes.

Sustainable development of groundwater resources cannot be complete without efficient systems of groundwater management. Over-exploitation of groundwater resources is likely even after efficient measures like watershed development are put in place. A majority of watershed development programmes assume benefits to groundwater regimes within respective watersheds after artificial recharge measures and water conservation mechanisms are put in place. Often, watershed development measures tend to create a tacit impression that recharge has increased groundwater resources and groundwater abstraction can therefore be sustained manifold. Many such programmes suffer in terms of 'optimization' of groundwater resources, although they are executed with a noble objective. Realistically, groundwater resources are limited by the geological framework within which they are naturally or artificially mobilized and their storage and transmission is more often a function of the host medium than of the water itself. Unlike surface water, which can be more easily observed and understood, groundwater remains somewhat enigmatic by virtue of remaining almost wholly concealed within the host medium. Groundwater use, especially in hard-rock regions of India has remained strongly individualistic, although legislation in many states like Maharashtra is inclined to treat it as the common property resource that it truly is.

In a country like India, issues linked to groundwater are being brought to the forefront, with the media playing a major role in highlighting them. Using this as a platform, there is a need to create sensitivity and awareness through frontiers of knowledge available on groundwater in order to manage it sustainably. Moreover, groundwater conservation only can ensure its anthropogenic and environmental utilities. We must therefore change our perception of the most misunderstood of all natural resources by treating it as a 'resource' rather than as a mere source of water supply.

Water Sector Governance: A Note on Robust Watershed Hydrology Modelling Options for Participative Governance

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Choosing a model for watershed hydrology is not a simple task given the labyrinth of literature available. At an academic level there are hundreds of models on watershed hydrology, many of which aim at specific components of the water cycle. A recent review (Singh and Woolhiser, 2002) of mathematical modelling of watershed hydrology carried out as a 150th Anniversary Paper for the American Society of Civil Engineers lists a sample of sixty models and carries a list of over 350 references. Hence, it is important to put forward the context and purpose of the watershed modelling exercise being undertaken as also assumptions under which models are being suggested.

For this purpose, modelling is being looked at as an instrument of participative governance in the water sector. Participative governance requires a common agreement on the assessment of a resource and a discussion of how different stakeholders will utilise it. This is a process bounded in time and requires methods that allow for participation, are readily understood in principle and are robust i.e.- can give reasonable estimates rapidly on the basis of existing data and allows exploration of different scenarios and implications albeit on the basis of some further exploration and information. The problem here is of walking the tight rope. Most participative methods lack reasonably validated quantification. They are good for qualitative trends and information while being transparent, though quantification is poor. In contrast, scientific methods claim high precision in quantification, but are time consuming, require a lot more data than is generally available and are opaque.

One of the best examples of this is watershed development, an intervention that is simultaneously bio-physical as well as socio-economic. Reviews suggest that despite there being umpteen reports and evaluations on them, very little reasonably accurate data is available. Thus a good estimate of what changes watershed development has brought about in the hydrology of particular watersheds and, equally importantly, in the hydrology of the sub-basins and basins that they fall in is limited. Similarly, watershed development planning has rarely included a reasonably good assessment of potential changes in hydrology and water availability and used it as a basis for planning and monitoring. A reason for this could be lack of awareness of need for a minimum bio-physical benchmark, as a result of which it becomes impossible to evaluate impacts. This becomes important in view of conflicting and controversial claims that are being made about spread of watershed development.

While its proponents have generally argued that watershed development increases water availability in a sub-basin while improving and stabilising flow regimes, there have also been claims that it is is resulting in a decrease in downstream water availability while some of the extra watershed treatment work has little or no effect on water regimes downstream. Under such circumstances anyone who wants to seriously evaluate potential of watershed treatment, small water harvesting structures or land treatment has to turn to modelling as a possible option. However, the approach of choosing a modelling procedure for practitioners will differ from an academic exercise in a number of ways.

The model to be chosen must be robust enough to take account of constraints under which such an exercise will take place. For instance, nature of data that can be available routinely from a watershed project is a constraint. Another is the level (or lack) of sophistication of secondary data that can be routinely available for and costs of obtaining the same. The technical expertise in computation, mathematical modelling, simulation, GIS/RS techniques, etc. also act as a constraint. Thus the model has to be adaptable to primary and secondary data constraints and as far as possible be free from complex mathematical computation and specialisation. At the same time it must have the potential of refining its estimates if better data or computational and analytical tools become available. It is with this framework that the matter of making an initial choice of possible modelling options has been approached.

Reasonable initial results are expected from the model with the following data sets -

a. Meteorological data: Daily rainfall and daily (monthly) pan evaporation data for nearest taluka place/ IMD station

b. Data for the watershed/sub-basin: broad slope classification , broad soil type classification , land-cover, and cropping pattern.

Better data collected at the village level should subsequently be able to refine estimates. At the level of a sub-basin, a strategically located medium irrigation structure that maintains flow data could be used tocheck results. In absence of flow data at the watershed exit point, many of the models can not be used especially those that postulate watershed parameters that require calibration through watershed flow monitoring. It is to be noted that models aimed at determining peak runoffs, modelling storm flows and hydrographs cannot be used as the modelling exercise here is not aimed at peak flows. It therefore dispenses with time of concentration and other variables, which are specifically related to storm processes through time. Hence, even though the suggested model borrows from runoff models that are used in peak flow estimation, it does so only in order to assess water yield rather than its variation over typical storm durations.

An analysis of the ASCE review shows that basic theoretical models have been laid down in the 60s and 70s and later developments have mainly been computational and technical improvements such as adaptation to later techniques like GIS/RS, computer processing, finite element, dispersed modelling, amongst others. These basic models are more amenable to constraints that need to be worked under. The model suggested for the Water Governance Project relies on time tested basic models that have been shown to work reasonably well. Work by Tideman (1998) and SOPPECOM's earlier efforts based on Datye's modified models[1] have been relied on. They form essential elements in exploring the degree of assurance local resources provide, the components of variable and assured water resources available, the supplements needed from the larger system, etc. The model thus becomes an instrument for tackling most allocation issues at the heart of water governance. However, significance of these issues cannot be highlighted unless the model is seen to operate within a normative framework that is compatible with principles of sustainable/regenerative use, equitable access and participatory/deliberative democracy.

The Modified Datye Critical Rainfall Model

The model that has been suggested for the Water Governance Project is 'Modified Datye's Model with Critical Rainfall'. The advantage of the Haan model and its modification by Datye is that it takes account of evapotranspiration in a more rigorous manner. By their nature, peak runoff estimation methods may tend to overestimate runoff. A flipside of Haan's model is that its proper application needs, either rainfall intensities over small time intervals using data from continuous records or simulation models that convert daily rainfall figures into a simulated distribution. The latter condition is difficult to fulfil because of lack of recording stations and validated simulation models for Indian conditions. As a result, the critical daily rainfall method may give us a more workable initial estimate. Moreover, being derived from a composite index, the infiltration controlling parameter is no longer restricted to soil characteristics alone. Generation of runoff has been correlated with upper and lower bounds of the critical daily rainfall. Datye has utilised a critical daily rainfall range between 25 and 75 mm or a corresponding infiltration capacity. High runoff producing conditions can be associated with the lower bound value of 25 mm and low runoff producing conditions with an upper bound of about 75 mm. These values may also be amenable to observation. The model is presented in the box below in the form of equations.

Infiltration

$Rc = 15 + 75\,(1 - W/100)$

Where: Rc = Critical Rainfall; W = Composite Cook's factor based on Cook's table.

$I = Rc$ when $R >= Rc$
$I = R$ when $R < Rc$

Where: I = Infiltration Rate; R = Rainfall

Evapotranspiration

$Ea = [Ma/(1-p)Mca]Ep$ when $R < Rc$, and
$Ea = 0.5\,[Ma/(1-p)Mca]Ep$ when $Rc >= Rc$

Where: Ea = Actual Evapotranspiration; Ep = Potential Evapotranspiration = Kc.Eto; Kc = Crop Factor; Eto = Maximum Evapotranspiration for Theoretical Crop; Ma = Available Soil Moisture in the Soil Zone; Mca = Maximum Soil Moisture Available in the Soil (at Field Capacity); p = Parameter Denoting Fraction of Available Moisture Required to be Present for Ea to Equal Ep

Surface Runoff

$Rus = R - I$

Where: Rus = Direct Surface Runoff

Deep Seepage

$Sd = I - \delta M$

Where: Sd = Deep Seepage; δM = Change in Soil Moisture Storage in the Root Zone

$Sd = Rur + Gwr + Ia$

Where: Rur = Return Flow Contribution to Runoff; Gwr = Groundwater Recharge; Ia = Initial Abstraction of Moisture to Compensate for Loss of Moisture from the Entire Soil During Non-crop Period.

Return flow

$Rur = \alpha\,(Sd - Ia)$

Deep seepage is a composite term comprising three components namely groundwater recharge, return flow appearing as runoff from base flow in channels, and initial abstraction. In order to determine individual components, an estimate of the above components is needed. Estimate of initial abstraction is based on the basic SCS model. However, there is a need to see how the methods sit together. There are studies that argue that the SCS method of working out *Ia* based on curve number tends to overestimate its value, especially for low rainfall conditions. Studies also show that these values are within allowable limits of variation if the entire range of variation in rainfall conditions is considered. Some sort of postulation dependent on antecedent moisture condition could be worked into the model. However, this needs to be verified in actual studies, and the water governance project could take this up. As for return flow, most models assume a modest value for α, the proportion of deep seepage that returns as base flow contribution. The reason behind this lies in nature of small watersheds where channel interactions are not predominant. Return flow is assumed to be less in small watersheds and Datye has suggested a value of 0.2 for α. However, when we come to a sub-basin level estimation, channel interactions predominate along drainage lines in lower reaches. Unfortunately that leaves things rather indeterminate. As an initial approximation it may be postulated that α varies with watershed size, for example, $\alpha = 0.2 + 0.15 \log(A/500)$ and A is area of watershed in hectare for watersheds up to medium size, say 50,000 ha.) The option here is to determine either of these as a residual value. In one option a higher value of α may be hypothesised by treating groundwater recharge as a residual and the value can be checked with an independent assessment of groundwater recharge. Alternatively, an assessment of groundwater recharge can be carried out and value of a based on residual estimate can be checked as to whether it is within a reasonable range.

Datye's incorporation of root zone processes in a more systematic manner is important on two counts: first, it gives us a more reasonable estimate of evapotranspiration and secondly, it is a tool for potential productivity assessment and determination of applied water needs as well. In combination with yield assessment functions, it gives a good method of biomass planning. Datye applies a very similar model for tree stands and for field crops, bringing them both under the scope of the FAO recommended method of yield and water estimation. Datye's adoption of the evapotranspiration component of Haan's model and its modifications can thus be profitably incorporated in other modelling options as well.

There is a need for an empirical flow pattern, which can be related to model results. That is why it is important to plan a study in a way in which it incorporates a terminal structure at sub-basin level where regular flow observations are routinely recorded at least on a daily basis. It is probably better to compare monthly and yearly flows over a period as recommended by modellers, even though actual calculations may take place at daily levels. What is essential is to have a set of empirical observations against which the model parameters may be assessed. If we have this exit flow information to empirically ground our efforts, then this common exercise will also become a step in validating, improving and refining the proposed model.

Footnotes: 1 - SOPPECOM and VIKSAT (2003) and Paranjape et al (2001)

People's Movements Related to Water Issues in South Maharashtra

Bharat Patankar, Shramik Mukti Dal, Sangli

Bharat Patankar, an activist in the working class movement (Shramik Mukti Dal) has led the drought eradication movement, Baliraja dam movement and equitable water distribution movement in rural south Maharashtra. The article is based on a talk by him at the National Consultative Group Meeting of the Water Governance Project in New Delhi on 28th October, 2007.

The severe drought that hit southern Maharashtra in the 1980s created a background for the emergence of large-scale water related people's movements, which came to be known as 'Mukti Sangharsh' movements. Severity of drought could be gauged from the fact that per capita availability of water was around 120 cum./year in the area, which left no water for meeting irrigation needs. The Chitale Commission, set up to study and advise the Maharashtra government, quoted international studies and stated that irrigation was possible in the region only when at least 1000 cum. water is made available per capita each year.

The grim drought situation that prevailed in 90 tahsils of south Maharashtra forced migration and displacement of people due to non-availability of water for irrigation that had assumed alarming proportions. A water analysis exercise initiated in these drought-hit villages studied existing and traditional agricultural practices. During this process, assistance of the people's science movement was drawn and science *yatras* or *melas* were organized to sensitise people of the region on maximising productivity with water available for irrigation. Later, a proposal encompassing watershed development as a component was prepared based on wide experience of working with the people. The proposal was finalised following an exhaustive survey of the region and after educating people on how IWRM could be done in the bounds of a village itself.

As a background to the proposal, a thorough study of rivers of the area was also done which revealed that even if hundred percent watershed development is accomplished, the minimum livelihood needs of all cannot be met. This led to a proposal to bring exogenous water to the drought-affected sub-basin from water sources of the same river valley in order to supplement water generated by local watershed development.

Watershed Development

One of the characteristic features of the watershed development undertaken was that it did not pursue single-village oriented watershed development. People demanded that government undertake watershed works through its department under the Employment Guarantee Scheme which the Maharashtra government had instated way back in 1973 after bowing to the persistent demands from workers including industrial workers. The Employment Guarantee Scheme Act was novel in many aspects. First, it was the first of its kind in the country, second, it was launched after demands from workers and thirdly, workers had voluntarily asked government to deduct certain amount from their salaries for managing the drought eradication works under the scheme. Ever since the promulgation of the Act, deductions from salaries of workers and revenue from farmers of irrigated areas fund the scheme.

Of the total scheme outlay, seventy-five percent was earmarked for funding water conservation works. The government did not follow this. This led to protests by people's movements. Annoyed by the government's apathy to water conservation works, people of the region rejected all department works. People persistently insisted for water conservation works even when the daily wage was as low as one rupee in 1983. The Government had to consider the demands of the people and accept their proposals. Thus water conservation works were taken up on a large scale in the water scarce regions. Now there is no further possibility of watershed development in these regions.

Takari Scheme

The people's movement suggested another scheme, Takari lift irrigation scheme for transferring water from higher rainfall areas to rainfall deficient areas. The struggle was initially for equitable water distribution. An 'experimental' type of demand of 3000 cum per household for irrigation purpose, including locally available water and water brought from outside was put forward. As the transit loss was as high as 50 per cent, the demand was later revised to at least 5000 cu.m. per household water at the source.

Rehabilitation and Command Area Development

Rehabilitation and command area development involve some ticklish issues as there are apparent conflict of interests of people involved. New dams are needed for augmenting irrigation facility but dams cause appalling misery to people and displacement. As one of the first, the region also witnessed a new revolution of adequately accommodating the apparently conflicting interests of people of command and submergence areas. People of the command areas insisted that the displaced have to be given land and facilities there itself as compensation. Though there were government sponsored arm-twisting and sinister efforts to pit farmers of command area against the displaced for wrecking the opposition of the latter, people's prudence defeated these clandestine efforts.

Rehabilitation Act

The Maharashtra Rehabilitation of the Project Affected Act, 1986 is unique in the sense that it came into existence not as a result of the progressiveness of government but as an outcome of people's action. A rehabilitation authority was set up which had to be consulted by the dam/project authority before the start of work regardless of the type and size of project. 'Rehabilitation first then dam/project' policy came into existence with this Act. As a policy, the project authority has to propose a minimum displacement alternative. People's movements press for zero displacement and if displaced, people have to be rehabilitated in the command area.

There was a notion widely subscribed to throughout the country that movement of displaced people and their adequate rehabilitation are impossibilities and that the interests of the displaced and the command people could not be equitably met. However, the 25 year experience in south Maharashtra proves that these are realisable. The movement pressed for developmental rehabilitation of the evictees. The evictees should be entitled to a better life when resettled. The Maharashtra Rehabilitation Act should be followed as it provides for rehabilitating evictees in the command area by acquiring command area land through ceiling on land holdings.

Demand for Change in Irrigation Law

People have been insisting that the existing irrigation law of the state has to be overhauled. Equitable water distribution in context of the prevailing irrigation law only meets the water requirement of the 'arbitrarily defined' command area, head-reach to tail-end, with no scope of command area expansion. The existing government structure would not agree to any suggestion of increasing the command area with frugal use of available irrigation water. Besides, the definition of 'equity' in the context of irrigation water as used by Maharashtra government is absurd as it speaks of distribution of water amongst people who have sufficient land with them. People have been opposing this on the contention that the equitable water distribution should be based on the biomass requirement of eighteen tonnes per household per year and the quantity of

Three core issues were taken up by the people's movement in order to gather wide support on water issues namely:

a. In drought affected low rainfall areas the amount of water available through watershed development is inadequate and therefore there is a need for drawing water from exogenous sources

b. Water should be available to every person regardless of ones landholding in view of the biomass requirement of individuals.

c. There should be expansion of command area. If people are going to save water, then people should be allowed to expand the command area.

Book Review

Right To Water: Human Rights, State Legislation And Civil Society Initiatives In India *by Priya Sangameswaran. Technical Report, Centre for Interdisciplinary Studies in Environment and Development (CISED), Bangalore, January 2007*

Rajesh Ramakrishnan

The dominant discourse on water in India today is one of sector reforms- irrigation management transfer and demand-responsive approaches in drinking water supply. Cost recovery and appropriate pricing of water are themes underlying these with the concept of water as an economic good being the basis. The dominant discourse is led by the Union and State Governments, with strategic inputs from bilateral and multilateral donors. Against this dominant discourse, there are various rights-based approaches championed by both NGOs as well as people's movements, and a proliferation of 'rights talk'. These approaches are not entirely clear and often lack cohesion.

In this excellent monograph, cutting through the thicket of sector reforms and rights talk, Priya Sangameswaran attempts to bring conceptual clarity to rights over water and examines different dimensions of these rights. Further, she also examines the extent to which international and national policies as well as legislations support various elements of the right to water, and how civil society initiatives engage with different aspects of these rights. In doing this, Sangameswaran keeps her focus squarely on questions of social justice and equity. Sangameswaran draws on her doctoral thesis on equity in community-based development based on fieldwork in Maharashtra, and extensive secondary research on the concept of rights, as well as on international and national laws and policies on human rights and water rights. The result is a slim volume of 7 chapters, whose size belies an enormous amount of work that has obviously gone into it, which is easy to read but must have been fiendishly difficult to organise.

In her review of rights-based concepts, Sangameswaran examines the different types of human rights, their evolution at the international level, the debates surrounding human rights, Amartya Sen's and Martha Nussbaum's work on entitlements, endowments and capabilities, and then focuses on the utility of institutionalising a right to water. The right to development and rights-based approaches to development are carefully distinguished, as are water rights and right to water. Sangameswaran's unpacking of the right to water is extremely useful in bringing clarity to the concept. The focus is on seven dimensions- the scope of right to water duties and responsibilities implied by the right, ownership of water resources, water delivery systems, pricing of water, the relation of right to water with other rights, and changes in the international arena (water-related and otherwise) following the ascendance of neo-liberalism, that will have an impact on the content and working of the right to water. These dimensions of the right to water are used to analyse how the right plays out at different levels- from the international to the national, and specifically to Maharashtra.

A chapter is devoted to the evolution of the right to water in the international human rights regime, Constitutional and legal status of right to water in India, and shaping of different dimensions of the right by laws and policies. This enables readers to appreciate the lacunae in Central-level policies and legislation, as well as limitations in the working of the right to water at State levels. The understanding of the latter is enriched by a detailed examination of Maharashtra, which has had both a long history of both State Government and civil society initiatives on water, and which is also at the cutting edge of current reform strategies. The penultimate chapter provides a flavour of civil society initiatives, their strategies and the dimensions of water that they focus on, dwelling more on initiatives against Coca-Cola at Plachimada in Kerala, privatisation of the Sheonath river in Chhattisgarh, and the gamut of initiatives in Maharashtra on rehabilitation of dam-affected populations, alternative approaches to dams, equitable distribution of water, sustainable use of water, gender and access to water, and engagements with the Government during the recent process of reforms in the water sector. Considering the variety and depth of such initiatives, this is understandably a sketchy chapter, but a more detailed treatment would have been outside the scope of this volume.

On the whole, this monograph, with its separate examination of state and civil society initiatives from a cogent rights framework and with a clear sympathy for equity and justice, sets the stage for deeper explorations in the emerging area of water governance, particularly the need for informed and refined engagement of movements and CSOs in the state. Scholars and practioners would benefit from the clarity that is the outcome of work that has gone into this monograph.

Policy Update

Report of the Expert Group on "Ground Water Management and Ownership", Planning Commission, Government of India, September 2007

Water Governance Project Team

The September 2007 report of the Expert Group on 'Ground Water Management and Ownership' of the Planning Commission while drawing attention to the resource depletion aspects and recommending cooperative management of groundwater has downplayed the over-exploitation and pollution of water by commercial and industrial units. Some of the notable points of the report are presented below.

The report takes stock of the availability and use of groundwater and outlines the extent, causes and consequences of groundwater exploitation. The overall stage of groundwater development in the country (58 %) masks the high degree of variability in availability and development throughout the country. The report suggests the need for exploiting the untapped 'static' water, which if untapped creates stagnant conditions and over time provides the necessary time factor for the deterioration in quality. The rising demand for groundwater from agriculture has been attributed to the legal/ regulatory regime governing groundwater and partly to the minimum support price policy and agricultural trade policy currently being followed. The report states that the "...problem has been compounded by the availability of cheap/ subsidised or even free power in many states, since power is a main component of the cost of groundwater. Moreover, electric supply is not metered and a flat tariff is charged depending on horsepower of the pump. This makes the marginal cost of power zero and provides farmers with little incentive to use power or water more efficiently." The consequences of groundwater exploitation like the fallout on marginal/ small farmers as well as the contamination due to geogenic factors resulting in increased levels of arsenic, fluoride etc. have been highlighted in the report. The environmental impacts of overexploitation leading to reduction in essential base flow to rivers and streams, and diminished spring flows has been discussed.

The urgency, scope and efficacy of groundwater recharge particularly artificial recharge have been discussed. Other than the usual practice of constructing civil structures (such as percolation tanks, check dams, recharge shafts etc.), the creation of additional bank storage in the flood plains of perennial rivers by withdrawal of groundwater during non-monsoon season and facilitating recharge/ infiltration of a fraction of floodwater during rainy season has been suggested. As per the Master Plan for Artificial Recharge of Groundwater in India, CGWB, 2002, the feasibility of artificial recharge in the country has been estimated to 36.5 BCM annually. The report says that the selection of sites and types of recharge structures are not always compatible with the hydro-geological and hydrological conditions. It cites impact assessment studies, which suggest that the investment per hectare of land irrigated for many of these schemes is comparable to investment in surface irrigation, particularly when the cost of delays, which typically occur in the surface irrigation, is adequately accounted for. However, even with full development of artificial recharge, groundwater availability would remain limited, and hence, the report suggests cooperative management by users to facilitate groundwater use in an equitable manner.

The report reviews legal positions concerning groundwater use by individuals and the emerging role of Central government in groundwater management. The report states that the "...Indian legal system in respect of groundwater has two important characteristics. First, the system is 'mixed' or 'pluralistic' and includes statutory provisions, precedential court decisions, doctrines and principles deriving from the British common law system, international agreements, religious (personal) law and customary law and practices... Secondly, different parts of the system are not well integrated with each other, resulting in overlapping regulations in many areas. Methods of legal interpretations have to be adjusted accordingly."

Right to groundwater in India is linked to land ownership, its source being the Indian Easement Act, 1882 which in turn is derived from a 19th century British doctrine that distinguishes water flowing in 'defined channels' and percolating water. The limits to an individual's right to exploit groundwater have been tested in the Coca-Cola case *'Perumatty Grama panchayat vs. State of Kerala'* which considered the Article 21 of the Constitution (right to life) and observed that the state as a trustee is under a legal duty to protect the natural resources and that the resources meant for public use cannot be converted into private ownership.

The report deals with the constitutional provisions related to the legislative powers of the State and the Centre. Under the Constitution, water is included in Entry 17 of List II in the Seventh Schedule i.e. in the State List. The entry is however subject to the provisions of the Entry 56 of List I in the Seventh Schedule i.e. the Union List. The role that the Government is expected to play in groundwater development and management is outlined in the National Environment Policy and National Water Policy. Furthermore, the PRIs have been enabled to deal with drinking water and minor irrigation under the Eleventh Schedule of the constitution. The Supreme Court had issued directions to GoI in 1996 to set up a Central Ground Water Authority under the Environment Protection Act, 1986 for the purpose of regulation and control of groundwater development. The Expert Group report suggests some measures to make the enactments by the States more effective (a) improved scientific monitoring of groundwater using piezometers (b) regulation/ restriction of groundwater uses in the area (c) enforcement of regulation to be made effective through users group/ community participation like village Ground Water Cooperation Committee (GWCC).

The report suggests that the Central Ground Water Board along with the State Ground Water Board assist the State Government in controlling over exploitation through negative and positive incentives such as restricting institutional loans, limiting electricity supply and by strengthening the oversight of the community specially that of the user group. The positive incentives can be supported for rainwater harvesting and watershed development. Also, the CGWB and SGWB will prepare suitable guidelines for aquifer water management based planning for use of groundwater. Efforts should be made to converge the schemes for watershed development, rain water harvesting etc., apart from involving of panchayat in critical and semi-critical areas.

The domestic and international experience (Spain and Mexico) in groundwater management has been discussed and lessons drawn from them. The enactments by some of the State governments as well as their approach and experience with groundwater legislation has been dealt with. The commonalities among State legislation, according to the Expert Group Report are (a)Excessive reliance is on state imposed control mechanisms and very little emphasis on cooperative management. (b) Sanctions are over limited area and over limited period of time. Penalties are coercive, heavy-handed and in the nature of criminal sanctions. (c) Typically, the process involves licensing procedures to regulate digging of wells (number and depth of wells)

The report lists the shortcomings in these legislations as (a) reliance on control mechanism (a permit system) to restrict the number of wells (b) restriction on number of wells can be rendered ineffective by increasing the power of the pumpset (c) procedure for appeals against sanctions likely to be misused and, (d) right to use groundwater bestowed on those who already have sunk a well leading to inequity.

The report suggests a number of initiatives to promote groundwater sustainability. As it is politically difficult to raise power tariff for agricultural users especially because canal water is cheap, the Expert Group suggested to make farmers account for the marginal cost of pumping water, they be given an entitlement upfront of about, Rs. 6000 corresponding to 3000 Kwhr at Rs. 2/ Kwhr. The charges for their consumption will be deducted from this amount and the surplus if any, will be handed over to the farmers at the end of the year. This approach may be tested on a pilot basis to examine if the transaction costs of implementation can be kept manageable. Feeder separation for agricultural pumps have been suggested to help manage and monitor electricity supply to farmers, and also provide a way of reducing ground water extraction in situations of rapid drawdown by restricting supply of electricity.

Instead of banning further exploitation in semi-critical and critical blocks, government should offer incentives for community management of new wells, construction of recharge structures, energy saving devices like installation of capacitors and frictionless foot valves and adoption of micro-irrigation.

The report concluded by emphasising the need for all states to introduce a modified groundwater legislation encompassing inter alia the role and responsibility of water user groups, the panchayats and the Government.

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