Water Rights and Other Alternative to Groundwater Management in India

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Abstract: Today the nationwide major concern in water resource management is how to check the fast depleting ground water. The stage of groundwater development increased from 37.2 percent in 1998 to 58 percent in 2004 and the over-exploited blocks increased from 310 in 2001 to 839 in 2004. The existing economic, technical, social and regulatory methods have almost failed to tackle the problem. Pumping technology facilitated by subsidized or free power is mainly responsible for rapid expansion in the over-exploitation of groundwater resources in India for irrigation, domestic, industrial requirements and other uses. Many scholars and the Union and state governments propose stringent groundwater law in the country. Model Bill to "Regulate and Control of Groundwater Development" is being circulated by Ministry of Water Resources to all the state governments and advised that it be passed by all the states to deal with the problem of groundwater depletion. As per the Constitution water resource management falls under the State subject and it is the responsibility of respective states to manage their water resources. Surface water management remains the focal area of government as large investments were made in construction of dams and canals system. Ground water largely remains in the domain of private property except the experiment of public tubewells in north Indian states. In the era of privatization and emphasis on Public-Private partnership solutions to resolve the groundwater crisis is also guided by the macro policies. Despite this, Government still feels that Model Bill is panacea for the problem of over-exploitation of groundwater resources.

Major overdraft problems have been addressed using an approach based primarily on education, extension, and crop system economics. The Water Right based approach covering legal and regulatory provisions and community management of groundwater resources has got better potential solution to the present problem of ground water in India. These two approaches are discussed in this paper.

ALTERNATIVE APPROACHES

There are three complementary rather than alternative options to deal with alarming groundwater situation. These include management of ground water (i) as an economic good, (ii) by legal and regulatory provisions, and (iii) as a community resource. May be that each of these provisions may not work if applied independently and solution to the problems may lie in using all the three together. The first alternative is widely discussed and debated (Rathore, 2002), therefore, the remaining two alternatives are discussed in this paper.

Right to Water

Water is most vital natural resource for sustenance of life. One who owns water or has absolute rights over it, therefore, has absolute power over the life of other living beings including animals, birds, plants, trees and insects. Rights over water have existed in most ancient laws such as the Hindu *Dharma Shastras* and the Islamic laws. Some continue to exist as *customary social rights* that are recognized in law even though they may not be granted by law. Such rights are *contractual rights* not in the sense of a legal contract but as a social contract of people with the state, or with society, or with each other to share water and let every one—the state and/or society—use water for the benefit of all. The principles of justice and benefit of all that are assumed as the basis of such contracts are invariably violated in exercising such contracts. It is argued by some that the right to water is a *natural* right in the sense that human survival is biologically not possible without water as seventy per cent of the human body consists of water. Since people have a natural right to survive they have a natural right to water even if they do not own it. Such rights are termed as *claim-rights.* Water belongs to this category because people have a right to life and as life cannot survive without water, *ipso facto,* people and other living beings have a natural claim to water.

Rights Framework[1]

Resource governance structure (State control, private property, community control, open access, and distributed or shared governance) and the socio-economic and political scenario determine the rights over resources. Rights are subject to limits and changes in fundamental to a clear understanding of any natural resource policy analysis. Rights are the instruments by which any society controls and orders human inter-dependence and resolves the question of who gets what. Property is not simply a derivation of a physical fact. It also reflects a social choice of the kind of efforts that are counted in creating an image in an individual's mind about the knowledge of a person's rights. A community usually defines property rights either by a common problem or by the mutual advantage of joint action. In the absence of rules that govern through social organisation, human relations settle down to a sheer play of power against power. Alternative rights are of interest because of their effect on the economic performance of outcomes. Rights define potential opportunities and the opportunities of one person are shaped by the opportunities of others.

Property rights institutions are part of cultural capital (includes social and institutional capital) by which resource user communities convert natural capital (resources and ecological services) into human made capital or the inputs of production (Berker and Folke, 1992, 1994). Institutional or cultural capital includes how people in any society view the natural resource use, values and ethics including customs/norms, religion along with culturally transmitted knowledge. For alternative policies and governance in managing natural resources in general and CPRs in particular require understanding of the social relationship and working of these institutions under alternative property rights regimes and resource governance system across agro-ecological regions and socio-cultural environments.

A resource regime is an explicit or implicit structure or institutional arrangement or working rules of rights and duties characterizing the relationship of co-users to one another with respect to a specific natural resource. According to Bromley property rights regimes or resource management regimes in resources can be classified under four possible categories: state property (where the secure claim rests

[1] For detailed discussion see Marothia, D.K. (2002) Institutionalizing Common Pool Resources.

with the government); private property (where the claim rests with an individual or corporation); common property (individuals have claims on collective goods as members of an organised group); and open access (or no property regime with no secure claims). The basic requirement for any property regime is an authority system that can guarantee the security of expectations for the rights holders. When the authority system breaks down, a particular resource regime degenerates. Under such a situation, new institutional arrangements are used to define the resource regimes over natural resources and authority systems protect the interests of those holding the rights under a particular regime. These concepts have their roots in institutional economics.

Renewable CPRs have been managed and controlled under different management regimes in India. These resources can be managed sustainably under state or common or private property regimes and are also subject to being degraded. There are many overlaps and combinations of State (public), community and private management systems or governance structures in managing resources or the eco-system. In other words often resources are managed at the interface of different property regimes. Enough evidence is available in India when resources managed under a common property regime degrade into open access due to weak property rights regimes, inadequate institutional arrangements and breakdown of the authority system. Examples are also available when renewable resources degraded under an open access system brought under a State or private or community management regime through appropriate changes in the institutional arrangements. Many researchers and policy makers have suggested privatization or State control of resources as a solution to arrest degradation of these resources and the ecosystem. However, it has been widely experienced that government or State control over natural resources has shown a relatively weak record. In turn, resource management under common and private property regimes has increasingly come to be seen as better alternatives to State management regime. However, there are two important arguments against "pure" private or "pure" common property regimes. First, the government has the larger ecological and bio-diversity concerns that extend many times beyond a sectoral management concept of a particular resource and interest of local community; and second, there is no guarantee that the local communities/resource users will organise themselves into an effective authority system to design rules for managing a particular resource. Dissatisfaction with traditional failure of "pure" community natural resource management and "pure" government control has led to great interest in distributed governance.

State or government control with active local communities' involvement has recently been identified as a feasible option in managing CPRs. Local communities may be able to design and administer institutional arrangements that are workable with least transaction costs. The local communities have cumulative traditional knowledge about the resources and the well-tested local technologies that may be useful in designing effective institutional arrangements. Locally enforced institutional arrangements may have the advantage of greater acceptability; and hence may face less resistance in implementation than the institutional arrangements designed by the external agencies and imposed externally on the resource users in a particular eco-system. These alternative perspectives suggest that distributed governance or shared management might prove more effective than any form of "pure" government or "pure" local community management. It is being recognized that management can be shared among the State, local communities (resource users) and private enterprises in various ways. Alternative management approaches have recently been used by several researchers to achieve distributed governance, i.e. how rights and responsibilities are distributed among and within the State, local communities and resource using institutes. A large number of the resource development programmes in India failed or could not yield anticipated outcomes due to lack of understanding on the part of the

researchers, administrators, planners about the issues related to distributed application in the socio-economic network of village life. In recent years, particularly in the eighties several developmental programmes for water, forestry, fisheries and rehabilitation of waste and wetlands resources have been introduced and a few of them were managed under the distributed governance or shared management system. In these projects local communities/resource user groups and the State or local government shared the responsibility of managing CPRs by combining appropriate institutional skills of local resource users/local committees and technical, administration and financial resources available with the states. This paper argues in favour of distributed governance for managing CPRs through alternative approaches of management.

Alternative Governance

The governance can be shared among State, communities and private interest groups in various ways. In other words, distributed governance is the extended version of the standard regimes of property rights (State, common and private property, open access). Distributed governance involves external institutional arrangements among the government and local communities or resource users as well as internal institutional arrangements within local community institutions or resource users, government, local communities and private parties utilizing common pool resources each brings different interests, capabilities and understanding to the resource management process. These alternative institutional perspectives shape the decision-making process among the government and local resource user communities and within members of the local community for managing a resource by converting unorganised structures into the organised ones or going concern.

An external governance structure has essentially three alternatives of management systems, namely, *rights-based management* (the government grant usufruct rights to individual resource users/party under well-specified constraint conditions and assumes the role of monopoly over the resource base and retains all responsibility/authority for conservation decision), *co-management* (to transfer a large part of the decision-making process to local bodies). These systems have been functional in various parts of India to manage CPRs. These alternative management systems have their inherent strengths and weaknesses.

Three alternative internal institutional arrangements have closely been associated with the concept of distributed governance – *self-organising institutions* (institutional and organisational decisions remain with the local communities and the government may use the institutional building capacity to support and gain strength from self-organisation), *communal management* (to reduce the existing authority of State and vest more localized interest), *cooperative management* (membership is limited with well-defined working rules for collective governance) and *corporate* (under the corporate governance the owners and shareholders of the corporation would operate under governance rules typical of private corporations). The degree of authority that the government could grant to local organisation varies with the internal governance structure. If management is to be most effective and efficient, two features should be characterised distributed management. Firstly, institutional arrangements for local community and government be clearly defined and the potential for prolonged and costly disagreements among resource user groups and government administration be minimized. Second, the decision-making structure should be shared at different levels of administration so that costs and benefits of any decision are internalized within some cohesive alternative governance systems managing minor irrigation tanks and groundwater resources.

Saleth and others have proposed the adoption of public trust concepts as the basic element defining the rights and duties associated with sovereign "ownership" of water resources (Moench, 1994a; Saleth, 1996). Public trust concepts would define the state as holding water as an inalienable trust for current and future generations and would imply that the state has a duty to protect the resource base as part of its obligation. They would also limit private use rights to situations not conflicting with trust obligations.

Reform of common law rights under which ground water is a chattel to land has also been proposed. Transferable rights to ground water could, in theory, encourage efficiency and enable the use of market mechanisms for allocating water to high-value uses. The main stumbling block has been identifying practical mechanisms for defining and administering private rights under Indian conditions.

LEGAL AND REGULATORY PROVISIONS

The second option to deal with the problem of ground water over development is the legal option of changing existing water laws. While enacting any law, firstly, a case has to be taken to guarantee social justice, particularly the poor households. Secondly, if the state is to use the law to regulate the use of water resources, how can the people use the law to make the state more accountable and efficient? This is particularly important because the popular impression is that the state itself is instrumental in bringing about massive depletion of water resources through inappropriate forest and irrigation policies and also in creating great inequalities in the distribution of water (Singh, 1992). As in the case of large canals the control over water resources is taken away from people compared to the type of control they have over tanks or wells. What is being noticed in the case of government-operated schemes is that the resource is inequitably distributed and rich/powerful interests have gained more control while the poor have been left out.

Inefficient Water Use and Groundwater Law

The attack on current groundwater rules focuses on their inefficiency. The absolute ownership privilege fails to give groundwater users good signals of the true costs and benefits of the water they are pumping. There are three sources of poor signalling under absolute ownership: (i) the common pool externality, (ii) the public good nature of pumping lifts, and (iii) the lack of means to transfer water claims.

Ground water is a "common pool" resource under the absolute ownership rule, meaning that independent individuals exploit the common supply. Each unit of water pumped in excess of recharge has a scarcity cost because it depletes future supplies. The absolute owners do not suffer the scarcity cost of their own pumping, however, since future scarcity will be shared among all users of the common pool. Because the pumper on third parties (neighbouring pumpers) imposes it, the scarcity cost is called an "external" cost of pumping. Since the absolute owner will not pay the cost, a pumper who is economically "rational" will not count it as a cost. Each pumper, then, treats the stock as though it were not scarce, or as though it had zero price, with the result that the resource is inefficiently overused. Lifts are allowed to increase at an inefficiently rapid rate, and distribution of water among competing users will be inefficient because the right to use water is not transferable (Singh, 1992). Each of these dimensions affects the distribution of wealth and power.

The absolute ownership gives the landowner firstly, a claim on all income that can be created by the use of the water beneath his or her land, so long as there is water beneath the land. Under absolute

ownership, a landowner has complete discretion over when to irrigate, what lands to irrigate, and how intensively to irrigate. The flexibility that comes with this discretion may itself be very valuable in adjusting to changes in prices and in weather conditions. On the cost side, the absolute owner lacks the authority to guarantee that there will be water available in the future with which to irrigate.

On the cost side, the landowner is exposed to the costs of the depletion of the stock by other landowners. An alternative rule must offer farmers incomes net of costs at least as great as these expected under absolute ownership. Since by presumption the resource is being operated inefficiently, a more "efficient" rule would improve net benefits to the irrigation farmers unless water is put to alternative use of higher returns.

Thirdly, absolute ownership gives landowners a real property right that could not be taken from them by state action without the payment of compensation.

The public good problem requires a collective solution, while the disregard of future scarcity costs may be internalized either by privatization or by regulation. The regulation should take care of the following:

- Which may be cost effective, so that irrigators follow voluntarily.
- If private benefits are large enough to encourage conservation practices at the limit of existing technology, voluntary compliance would be consistent with full provision of the public good.
- Regulation should retain the flexibility of irrigators to adjust to climate and price changes.

However, no property system will be adopted which injures interested parties who are powerful enough, through their command over economic, social or political factors, to keep it from being adopted. Therefore, regulations should provide incentive to poor farmers to organize and protect their future interests.

The basic issues in water law are that of rights, i.e. what kind of rights the people have, and what are the rights of the State. The question of the State's accountability to the people and the people's accountability to each other and to the State cannot be worked out unless we are clear about the legal framework of rights in water. It has been observed in India, as well as in other parts of the world, that in the absence of clearly defined water rights many irrigation schemes have failed to function desirably (Gerbrandy and Hoogendam, 1996; Nederlof and Wayjen, 1996). Likewise, the groundwater rights should be clearly defined before enacting any additional laws to regulate groundwater use.

The present position of laws applicable in case of ground water is as follows: According to the Easement Act of 1882, a person has no natural or customary right over ground water, whether collected in a well, or passing through springs or flowing in an undefined course. Any diminution of such water by neighbours, therefore, gives no ground for action under the Easement Act. However, rights to ground water belong to the landowner, since it forms part of the dominant heritage. The tenancy laws of the State govern land ownership. There is no mention and limitation on the use of ground water in the existing State Water laws. The consequence of such a legal framework is that only landowners can own ground water. The ultimate result is over-exploitation of ground water. It is very clear in case of the groundwater laws that the landowners have absolute rights over ground water, while the State has no rights whatsoever. It is only in case of public wells or tubewells that the State has the right to regulate usage.

Considering that water is a vital resource for life, being deprived of it is simply a violation of a fundamental human right. In order to protect this right in national and state water policy while prioritizing water allocation among its different usage drinking water is kept on top priority. Yet there

are large numbers of identified drinking water coverage problem villages in the country. In fact, prioritization of water use must be a central concern for water legislation.

Scholars and policy makers believe that rights to ground water should be those of use and not of ownership (Vaidyanathan, 1996). If ownership has to be decided, it could be with the state, but with use rights going to the community. The community can be a village or number of villages situated in a hydrogeological zone. In addition, the regulatory rights should be transferred to the community. The State should facilitate the functioning of the community in its efforts to harness and conserve water resources, by providing technical and financial inputs for monitoring ground water and the status of water balance in the zone. It would require some special efforts to organize communities around water resources in such a manner. Keeping the above-discussed issues in mind an alternative draft Groundwater Act was prepared by the Rajasthan Jal Biradari.

In addition to rights reform, administrative and management frameworks are needed guided by few principles (see WB Report, 1998). An alternative management framework is implicit in the Model Bill prepared by the CGWB. This framework could be implemented either through legislation or through administration. The directives emanating from the recent Supreme Court (SC) decision give the CGWB the authority to implement this type of framework through administrative mechanisms. But it will be extremely difficult to implement as it entails state governments to cooperate. As groundwater management is a State subject SC directive is violation of the Constitutional provision and the State Groundwater Departments have a feeling of marginalization.

Successful implementation of the management framework proposed by CGWB would depend heavily on the process for (i) notification of areas, (ii) education of the local population and formation of local management districts, and (iii) resolution of conflicts. One potential process is outlined in detail in Moench (1996). This framework has been included to demonstrate how the alternative framework might be implemented in practice. Substantial experience exists in other parts of the world with implementing frameworks similar to this and with designing legislation to support them (WB, 1998).

It is suggested that international experiences should be reviewed with regard to legal frameworks and management through district-type structures and their potential applicability to India. The review should also evaluate existing customary law within India and identify those aspects that, if formalized, could support management. Finally, the review should draw on existing preliminary efforts to draft alternative groundwater management legislation suitable to India. Two pilot projects to test groundwater management are already in progress in Rajasthan. Experiences from pilot projects implemented through existing administrative powers could provide the experience and insights be used in further refining the proposed draft to finally drafting appropriate groundwater legislation.

Community Management of Groundwater Resources

The third alternative is community participation in management of groundwater resources. Traditionally, individuals have considered water fetched from wells located on their lands to be private property. Since society has sanctioned such treatment, it seems very difficult to change such *defacto* property rights very quickly. It is often argued that the enactment of groundwater law to abolish private property rights to water can change the situation. On the other hand, refuting this argument, others argue that in order to enforce such a law the State would have to post agents, thereby adding one more class of "rent seekers" to the existing system and no guarantee of better control over the depletion

of the resource. This group sees more community controlled water resource management as a more pragmatic approach.

The problems with community participation are: (i) the process is too slow to be applied widely and the notion of community participation is poorly defined; (ii) community based activities often depend on the driving force of one charismatic person or a small group of motivated people. In spite of the good intentions of such people, partisan politics have often interfered; (iii) sometimes even the community participation projects become manipulative. For such reasons, most of the cooperatives and community development experiments of the 1950's and 1960's ended in failure.

The other negative outcomes of participation can be that it is possible that participation will bring about the development of the 'participating elite' in a community and therefore, contribute to inequality. There is always a political dimension to participation since it is tied to changes in the control of resources. Regardless of the intentions of those who administer programmes, it is even possible that political demands can lead to violence.

In spite of these negative factors, community participation remains an important factor in addressing groundwater management issues. User group management of natural resources has always existed in some form in India. Recently successful efforts have been made by number of NGO's to establish that it can even work today under changed environment and natural resources can be better managed by user-groups (Moench, 1992; Iyer and Roy, 2000).

The large body of theoretical and empirical literature deals with the distinction between Common Property Resources (CPRs) and Open Access Resources (OARs)[2] and it largely cites example of land resources and little about water resources. Within water resources it is mostly the surface water resources, such as, lakes, rivers, ponds, the issues related to groundwater are largely unattended. Groundwater resources basically are Common Pool Resources (CPR) and have open access but because of its physical location i.e. beneath land, presently the access is restricted by the ownership of land, which is mostly privately owned. Hence, it is governed by a property regime and contradicts the principle of open access. It does not strictly adhere the definition of CPR where the physical boundaries, ownership, and controls are clearly defined or identifiable. In a strict sense it does not exclude the non-owners of land or non-members of the group from any claims to use of the resource.[3]

In case of CPRs there exists a common property rights, the user is part of a community and there are practical rules to co-ordinate resource utilization. There are certain community-based authorities to enforce rules and define the contexts in which conventions and contracts are negotiated. The authority system and the co-operative ethic provide the users assurance about the expected behaviour of other users, unable coordination and minimize free riding (Runge, 1992). The assurance problem, that is, the uncertainty about the expected actions of others, can be minimized by the community institutions if there exist homogeneity of interests among users and strong regulatory mechanisms. Increasing heterogeneity of the community makes cooperation increasingly difficult. State interventions aimed to economic development of rural areas by way of assets distribution and conservation and management of natural resources has mostly added to increasing community hydrogenate and breaking up of traditional CPR management institutions.

On the other hand an OAR is not governed by an enforceable property regime, there is no restriction on entry of resource appropriators. In India, more often than not, state property resources have become

[2] For detailed discussion on the subject see Ostrom (1990), pp. 1-28.

[3] For definition and theoretical discussion on CPRs and OARs see Ciriacy-Wantrup and Bishop (1975), Bromly & Cernea (1989), Runge (1981), Ostrom (1980) and Shanmugaratnam (1994).

de facto private or open access resources due to the state's failure to enforce property rights for various reasons such as, high transaction costs, corruption of enforcement agencies and lack of political will (Jodha, 1992; Shanmugaratnam, 1996).

Most writers on CPR's argued that because of the tragedy of commons, environmental problems cannot be solved through cooperation and the rationale for government with major coercive power is overwhelming (Ophula, 1973; Hardin, 1978; Leviathan, 1973; Heilbroner, 1974; Ehrenfeld, 1972; Carruthers and Stoner 1981).

The presumption that a strong external input is necessary to avoid tragedies of the commons leads to recommendations that central government should control most natural resource systems. Different authors have endorsed this view with variations on extent of control or nature of control. The policy advice to centralize the control and regulation of natural resources, such as grazing lands, forests, and fisheries, has been followed extensively, particularly in developing countries.

Other policy analysts, influenced by the same models, have used equally strong terms in calling for the imposition of private property rights whenever resources are owned in common (Demsetz, 1967; Johnson, 1972; Smith, 1981; Sinn, 1984; Welch, 1983; Smith, 1981). They suggested that "the only way to avoid the tragedy of the commons in natural resources and wildlife is to end the common property system by creating a system of private property rights". Welch asserted that privatization of the commons was the optimal solution for all common-pool problems. His major concern was how to impose private ownership when those currently using a commons were unwilling to change to a set of private rights to the commons.

It is difficult to know exactly what analysts mean when they refer to the necessity of developing private rights to some Common Pool Resources (CPRs). It is clear that when they refer to land, they mean to divide the land into separate parcels and assign individual rights to hold, use, and transfer these parcels as individual owners desire. In regard to non-stationary resources, such as water, it is unclear what the establishment of private rights means. As Colin Clark (1980) has pointed out, the "tragedy of the commons" has proved particularly difficult to counteract in the case of resources where the establishment of individual property rights is virtually out of the question.

Both centralization advocates and privatization advocates accept as a central tenet that institutional change must come from outside and be imposed on the individual affected. Despite sharing a faith in the necessity and efficacy of "the state" to change institutions as to increase efficiency, the institutional changes they recommended could hardly be further apart.

Ostrum argues that "getting the institutions right" is a difficult, time consuming, conflict invoking process. It is a process that requires reliable information about time and place variables as well as a broad repertoire of culturally acceptable rules. New institutional arrangements do not work in field as they do in abstract models unless the models are well specified and empirically valid and the participants in a field setting understand how to make the new rules work.

Common property resource management provides a complex system of rules and conventions regulating individual rights to a variety of natural resources including grazing lands, forests and water. Although management of resources as common property has proved to be a stable form of resource management in some traditional societies, the combination of population growth, technology change, climate and political forces have destabilized many existing common property management institutions. Much of the current literature on CPR's leads to a general, but false, conclusion that common property is universally mismanaged. In the context of poverty, natural resource dependency and resulting uncertainties, incentive structures are created that may make common property a comparatively rational

solution to certain problems of resource management. Researchers and planners have often called for the imposition of private property rights. However, perhaps in most cases, private rights have failed to stop over use when implemented, and in many cases may have contributed to an even more rapid degradation of resources and increased inequality in already unequal distribution.

In case of groundwater resources the problem of 'Tragedy of the Commons' (Hardin, 1968) or 'Prisoners dilemma game' referencing to individual strategies regardless of the expected actions of others in the use of common resources are also not strictly applicable as it fails to take into account the effects of non-separable externalities on private costs (Runge, 1981, 1992).

Development policies and demographic and technological changes have contributed to the trend of privatization of land and agricultural expansion in most parts of India (Shanmugaratnam, 1996). Availability of water for irrigation from underground and surface sources has dramatized this trend. The high variability in annual rainfall in arid and semi-arid areas creates further dependence on ground water that is unequally located under ground and unequally accessible to holdings of different size and location. Consequently the gains of ground water are unequally shared by the society. It has also led to breakdown of traditional common property resource management institutions.

The issues of how best to govern natural resources used by many individuals in common are no more settled as some writings about the "tragedy of the commons" recommended that 'the state' control most natural resources to prevent their destruction. While others recommend that privatizing those resources will resolve the problem. What one can observe is that neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource systems. It may be also that we do not have the necessary intellectual tools or models to understand the array of problems that are associated with governing and managing natural resource systems and the reasons why some institutions seem to work in some settings and not others.

The role of village level conventions, including common property institutions to reinforce expectations of collective behaviour leading to a critical mass of individuals to adopt such a solution to groundwater use as a cooperative strategy is the ultimate solution. If the user group functions optimally, common property institutions can lead to equilibrium outcomes in which each individual is assured that a critical mass of others will cooperate, so that they too will have an incentive to do so. Of course, common property institutions do not always provide this assurance. If the state recognizes these institutions and gives them the authority to manage groundwater resources, the chances are good that these will work efficiently.

Sugden (1984) has argued that the more homogeneous a community is, the more likely it is that the outcomes will be optimal. Conversely, the more heterogeneous it is, the more difficult coordination becomes. As the heterogeneity of the group increases, and as the resource constraints facing it become more severe, common property rules may become increasingly difficult to maintain (Johnson and Libecap, 1982). A heterogeneous community will require more enforcement of agreements. The enforcement may emerge from inside the group or be imposed from outside. The key element determining the success or failure of institutions is, therefore, the extent to which they foster coordinated expectations in relation to a particular physical and social environment. The fairness implicit in joint access may prove a highly assuring feature of common property agreements. Frequently, the relative benefits accruing to individual members of the group are somewhat less than under a system of exclusive use right. If some assurance regarding the actions of others is provided, via an institutional rule, it is possible to achieve the desired goal of the group even though the benefit to the individual may be lower. Indian experience in management of natural resources, i.e., land, water and forest, in

different parts of the country by NGOs, people and government can definitely help in evolving solutions to groundwater management.[4]

Cooperative solutions are most likely to succeed where the locus of decision-making is a relatively small, cohesive body. However, individuals who have high discount rates and little mutual trust tend to act independently, rarely communicate well and are often unwilling to enter into binding agreements for monitoring and enforcement. Overall, they are unlikely to choose jointly beneficial strategies unless such strategies happen to be their dominant strategies.

Ground water in Rajasthan is drawn by digging wells and tubewells owned under joint or individual private ownership mostly by landowners. There is little homogeneity in asset ownership, caste, class and access to the resources, and yet the chance of coming together to form management systems where everyone can benefit is strong, as there is a strong trade off in favour of joining. There is recognition that acting independently will aggravate the crisis situation, and may even force people to migrate or depend on unirrigated crops and non-farm enterprises.

Both, heterogeneity of group members and variation in availability of groundwater, need serious consideration in order to determine the level of organization. It seems feasible to form a group at the village level and also a higher level group of villages at river and/or groundwater basin level. This has been tried in Rajasthan by the NGO named Tarun Bharat Sangh in the Alwar district by formation of River Basin Parliament.

River Basin Approach

A river basin is a surface hydrological boundary having an integrated drainage system. A river basin is a functional unit established by physical relationship for the purpose of water resource management (both surface and ground) where activities in one part can indicate a chain of environmental impacts affecting other parts of the basin. It is the combination of soil, water and vegetation based activities which affect the sustainability of resource use in a basin. Impacts on one resource invariably affect the status of others, suggesting that externalities of this type are generally non-separable.

There are several cases where surface water is treated as a common property resource and collectively managed successfully. However, in the case of the groundwater situation, the idea of the "tragedy of the commons" applies all too well. Ground water is perceived as private property rather than as a common pool resource even though the externalities in groundwater use are fairly widely understood. Too many well owners "ride free", overtly concerned with their own benefit. These multiple individual actions have contributed collectively to the continuous depletion of the groundwater resource. The problem comes from the fact that individual wells tap water from what is physically a common pool. Unless groundwater is perceived in this way, as a 'public good', the problem cannot be resolved.

In order to develop cooperative institutions around ground water it is important to ask the following questions: (i) what economic incentives do the well owners have to participate?, (ii) how do these incentives vary with the size of landholding?, (iii) what social and cultural attributes are correlated with cooperation or defection?

The collective consequences of individual behaviour if properly understood by well owners and the local population in general may generate enough pressure to enable people to organize around groundwater issues. However, unless there is a situation in which there is little loss to individual well

[4] For critical review of different JFM and WSM projects particularly by AKRSP, TBS Sewa Mandir, Anna Hazare, Ralegaon Siddhi, Pani Panchayat, etc. see Iyer and Roy (2000).

owners and there is a benefit to all other community members, it will be very difficult to ensure cooperation. There are a number of actions that can be taken to assure widespread access to any benefits. For example, it is possible to ensure the same or higher level of returns from the land with less consumption of water by adopting technologies that support the efficient use of water and its conservation or by changing cropping pattern and irrigation practices. With this goal in mind, the government can extend support with a technology package, price incentives, sprinkler and other such water saving devices, and prompt and appropriate extension services. The activities planned under various government programmes to improve replenishment of ground water, such as watershed development, land development, soil conservation, and afforestation can be carried out at much lower cost if a cooperative institution is already in place. The lessons learned from the watershed programme implementation within Rajasthan, as well as in other Indian states, can be helpful in planning the formation of such institutions. A large number of NGO's working in the rural areas can be involved in the formation of these groups and in creating awareness among people of the groundwater problems. Rather than thinking of groundwater based collective action institutions as solutions to the regular public good problem, it is perhaps more appropriate to think of such institutions as a bundle of opportunities that solve different problems for different individuals. But that links the success of the individual to the survival of the group as a whole. Finally, it seems that village resources can only be managed in an efficient and sustainable manner if the single village *panchayat* can be revived. This *panchayat* must ensure equal participation by all sections of the community, free of political ideology as far as possible and focus on the developmental problems of the village.

To summarize, to initiate efforts to control the groundwater disaster the following steps are required:

(i) Define water rights in such a way that use rights are held by the community rather than the individual (community resource);
(ii) Provide legal support to new institutions and organizations to manage groundwater resources;
(iii) Review the alternative Groundwater Act, which takes care of the problems discussed above and provides provision of groundwater recharge by the community by generating funds within the system.
(iii) Organize a social movement around water by creating mass awareness among all sections of society and forming groups at the village level;
(iv) Adopt the river basin as the basis of planning for sustainable management of all natural resources including water;
(v) Evaluate the impact of economic policies that may encourage excess groundwater extraction, particularly the agricultural input and output policies; and
(vi) Use price policy and subsidy instruments to conserve ground water.

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