Groundwater Law and Administration in Developing Countries

Otto, J.M.; Schrevel A.

GROUNDWATER LAW AND ADMINISTRATION IN DEVELOPING COUNTRIES

J. M. Otto

Van Vollenhoven Institute for Law and Administration in Non-Western Countries, Leyden University, Rapenburg 33, 2311 GG Leyden (email: jfwijo@ruljur.leidenuniv.nl)

Introduction

Several groundwater experts have recently observed that groundwater in developing countries is by and large being left unmanaged (e.g. Katar Singh 1995; Van Steenbergen 1997). They have repeatedly deplored the absence of effective regulatory mechanisms. Nevertheless, a consensus now seems to be growing that groundwater is too valuable to be left unmanaged ; law and administration are needed to preserve the quantity and quality of groundwater. Moreover, the feeling is that the inequity resulting from existing legal doctrine calls for better law (Moench 1995: p.1; Prasad and Sarkar 1994: p.153). There are various suggestions as to what kind of law and what kind of management system should be entrusted with these new tasks.

Groundwater protection may or may not be a new issue, it is by no means the only subject that governments in developing countries try to administer and regulate properly, and then find themselves at a loss. In other words, many of the problems identified and the solutions suggested with regard to law and administration of groundwater in developing countries are not unique to that sector. They may occur in many other areas, from food distribution, building licences, to marriage law or land reform. The similarities of the administrative and legal aspects of those problems and solutions have even resulted in two fully-fledged fields of study: "development administration" and "law and development".

Since the 1950s, "development administration" has gradually become a subdiscipline of public administration to describe and prescribe practices of public administration in the Third World. The core subjects of this subdiscipline include policy analysis, implementation, decentralisation, intermediate organisations and participation, institution-building, administrative culture, and corruption. Certain concepts and theories from this field may bear relevance to the questions addressed in this workshop.

Even earlier than the 1950s, the role of law in Asia and Africa had become the subject of intense debate. Colonial scholarship had already acknowledged "customary law", "religious law", and many other "local normative systems" as "other conceptions of law". Yet, the colonial states and their successors - the states of the developing world - all established constitutions, laws and regulations, as well as ministries and local governments to enforce these laws and regulations, and courts for their interpretation in the settlement of conflicts. Since the 1960s, legal sciences have been enriched by what is known as "law and development" studies, in which the role of law and legal institutions in development processes have been critically assessed. Again, parts of this literature may be useful to the participants of this workshop.

The organisers of this workshop have provided us with a two-fold question: What are the principles of proper management of groundwater reserves, and how can proper management

regimes be installed, given the conditions that prevail in many developing countries? I have been asked to comment on the legal and administrative conditions that prevail in developing countries, and to comment on various suggestions concerning groundwater law and administration.

In my comments, I shall first take you to the field of "development administration" to see what it has to offer. This is, in the first place, the search for an appropriate role of the state amidst competing claims that market forces or local groups should be the prime movers of development. Besides development administration has much to say about institutional strengthening. We shall then make a brief tour around the field of "law and development". Since groundwater is a natural resource which needs protection, it is a concern of environmental law and management. Therefore, I shall make some comments on our experiences with environmental law and administration in developing countries, with some examples from field research in Indonesia. Then, lastly, I shall turn to groundwater law and administration, listing problems to be solved and then commenting on the legal and organisational measures that have been suggested to solve them. I shall respond to this workshop's question by suggesting a set of basic rules for proper groundwater legislation and organisational frameworks for groundwater management.

The role of the state

Both law and public administration have always been closely associated with "states", and rightly so, I think . The problem, however, is that strong, effective, and law-abiding states are not the rule, as we have learned from practice and from studies. Literature on all sectors of development, including groundwater management, is filled with examples of laws and policies that have been badly implemented. This sad experience has actually affected the paradigms of development. In his book, Management Dimensions of Development, Milton Esman, one of the grand old men of development administration, described, how during the last decades, the naive, optimistic expectations of an almighty state that prevailed in the 1960s shifted to new creeds according to which the state fails almost everywhere and in all areas (Esman 1991: p. 1-19).

Three competing paradigms : towards a pragmatic consensus

Free-market ideologists, who believe in the "market", and workers at the grassroots, who believe in "local voluntary organisation", have united to this end. To my mind, there is a danger that the one naive belief - in the state - has been replaced by other naive beliefs. Esman has argued that these ideological stands - defending either state, market, or NGO as the prime mover of development - are rather one-sided. He has called for a pragmatic consensus to be reached in particular settings (Esman 1991). I fully agree with him on this point. Town planning, for example, should both learn from informal housing practices and build on market forces, but it should also remain an activity of government and regulation.

My brief excursion through the literature on groundwater management, though, shows that, with some authors, the three paradigmatic positions are still popular. In a recent book about groundwater law in developing countries, which focused on Indian states with comparative excursions to China and the USA, this is clearly expressed (Moench 1995). Others advocate pragmatic, flexible arrangements in which state, market, and grassroots associations can all play their roles (Van Steenbergen 1997: p. 81).

The case of India

The Indian case, which is described in the book by Moench (1995), is spectacular in that in 1970 the federal government had already prepared a draft bill on groundwater, and suggested to the states that it be enacted. The states, being politically dominated by big landowners, gave no follow-up. In 1992, the consequences of a groundwater crisis having become more visible in many states, the central government presented a new bill. So far, only one state, Maharastra, has more or less enacted this legislation, while Gujarat has also passed some legislation. Moench's book, which is the only recent book on groundwater law in a developing country that I could lay my hands on, reflects discussions by Indians, Chinese, and Americans about the bill and related issues. While all authors agree about the seriousness of the problem, they disagree about the strategies to be followed because they are generally tied up with one of the three paradigmatic positions.

The Secretary of the Central Groundwater Board in New Delhi, Mr S.C. Sharma, pleads for government intervention by legislation to establish new groundwater authorities in each state with the power to issue and cancel permits for groundwater extraction (Sharma 1995). This approach of "direct state control" is shared by many others in the state apparatus (Chandrasekhar 1995). They actually call for water rights to be vested in the state.

Marcus Moench, the book's editor, however, maintains that state regulation is probably not the optimum approach, because there is little hope of effective implementation. He considers the law-oriented "direct state control" approach too "insulated from local involvement" and suggests that it may well be obstructed by the wealthy, politically influential well-owners (Moench 1995(b): p. 39-41). In search of an alternative, he identifies an "overall tendency in current water resources management thinking" ..." towards greater participation", and he then calls for legislative structures to provide avenues for participation and local management (Moench 1995(b): p. 42). He meets with the approval of others, who suggest that indeed the problem can be solved by voluntary efforts by right-thinking persons (Srinivas 1995), with the help of a traditional culture of co-operation (Turnquist 1995), or through a new system of co-operative societies (Katar Singh 1995; cfr van Steenbergen and Oliemans 1997: p. 14). It occurs to me that some of these authors are confusing "local" with "non-governmental" which might actually blur the real issues at stake. Anyway, Moench himself concludes also that fully decentralised approaches based for example on private ownership or village level groups, will not be sufficiently effective either (Moench 1995(a):p. 3).

Later, Moench spots another "major trend in current water management thinking", which is "the potential use of economic levers and water markets". Markets would facilitate private transactions, shifting water to higher-value/lower-volume use (Moench 1995(b): p. 44). Only potential negative effects - the author calls them "social and environmental externalities" - could then be addressed by direct state control and regulation.

Looking then for what would, in the Indian case, constitute an optimum mix of legislation, voluntary initiatives, and market forces, some authors refer to American experience with law and administration, especially from semi-arid areas in the western states of the USA They suggest that this provides useful models and recipes (Katar Singh 1995: p. 73; Moench 1995(b): p. 47; Thomas 1995; Turnquist 1995: p. 90). Only one of them, Chhatrapati Singh (1995) explicitly raises the question "whether legislative approaches used overseas and by international conventions have any bearing upon the Indian situation, given the political, economic, and social set-up of India". I agree with this author that this question needs an answer based on research. In the meantime, I would suggest a cautious approach since this set-up in India and other developing countries is indeed quite different from that of the USA and other western countries.

Development administration

"Administration", according to Herbert Simon, "is getting things done". In developing countries, the "thing to get done" is called development. This consists of a broad list of policy objectives. So development is an umbrella concept comprising, say, a dozen constituent processes, each of which refers to progress in a certain field.

Development policy

The processes of development concern nation-building, security, economic growth, social justice, education, health, environmental protection, democracy, authenticity, and, I would like to add here, good governance and legal certainty. Those are the goals of development, which, in most countries, are elaborated in sectoral state policies. The great development debates mainly deal with the interrelationships between these processes and, when their goals conflict, with which is the preferable one: security or democratisation, security or legal certainty, economic growth or environmental protection, economic growth or social justice, social justice or cultural authenticity? Such conflicts between different goals of development are at the bottom of most dilemmas of law and administration. Any sensible policy must be based on a careful balancing of interests and a deliberate preference for certain objectives over others.

Groundwater management is no exception. The groundwater crisis, for example, raises issues of political stability and security, of economic growth, of environmental protection, of social justice, of public health, of good governance, and of legal certainty. They all contain wonderful development goals, but there are several conflicts and tensions between them. Strict environmental protection may, for example, decrease economic growth, antagonise big landowners, reduce legal certainty, thereby endangering stability and co-operation with good governance.

In the words of groundwater management expert Smith (1995: p. 139): "There is no real correct answer to the question what is good groundwater management". I quote, "The answer depends upon what values a system seeks to maximise. One might as well ask: whose values?" (Smith 1995: p. 140)

Institutions and policy implementation

To get the formation and implementation of state policy actually done, administrators and civil servants operate organisations - big, medium, and small. Most of these institutions are oriented towards improving the condition of people (i.e. they are people-oriented).Each developmental goal, elaborated into sub-goals and tasks, has been entrusted to one of more of such institutions: security to police, education to schools, health to primary health units, agricultural growth to agricultural co-operatives and rural banks, irrigation to water bureaux, and so on. New tasks have always led to the establishment of new institutions, which, in turn, have created the perennial and unavoidable problems of administrative co-ordination and competition.

Those who advocate a greater role for local management organisations may well know that there are all kinds of local organisations. They include deconcentrated state offices, decentralised local government councils, co-operative associations, beneficiaries' councils, community development committees, traditional authorities (cfr. Uphoff and Esman 1974).

They all act locally. Using the term "local management" in contrast to "state management" would therefore create confusion. Another terminological issue is the use of "institution" as a broad term that includes: arrangements, associations, rules, regulations, and behavioural patterns (Schrevel 1997: p. 7, citing Coward). Personally, I prefer to use "institution" as an equivalent to "organisation", as most people do in development administration, rather than helping to introduce such confusing expert jargon. Actually, the general principle of using clear terminology is always helpful, also in groundwater resource management.

Development requires effective organisations that can turn tasks into results. Which factors determine whether such an organisation is effective in the sense that it can implement its tasks? There is a theory of three-fold support to implementation processes which I have derived from one of the theories of development administration that has survived the 1960s: the Institution-Building Model. On the basis of that theory, I submit that a successful implementation of tasks requires three-fold support: from the institution itself, from the target group, and from the wider context. The institution itself needs three things: resources, internal structure, and leadership. Whether the target group complies with the organisation's policy depends upon their interest, their access, as well as the reach and the possible use of force by the organisation. Social contexts include the social and cultural context, the economic and financial context, and the political context of both institution and target group. Although this theory was developed in the 1960s for state institutions, it can also be applied to semi-public or private organisations aimed at people-oriented development.

Among the greatest threats to effective organisations are corruption and red tape - phenomena that one finds throughout society - in national governments, local governments, as well as in private associations. Each framework of policy, law, and organisation may sooner or later be confronted with the forces of corruption. It ought to be anticipated as much as possible. The fight against corruption should be an integrated part of any groundwater management effort as well as of its organisational design.

Most articles on groundwater management touch upon some of the factors involved in research preceding implementation, but only partially. What we need is a number of regional case studies that systematically uncover three things. First, what happens inside groundwater institutions; which equipment, leadership, personnel, and behavioural changes would be needed for effective implementation of policy and law? Secondly, how do different types of water-users actually perceive their own groundwater practices and the upcoming crisis; how do they interact, communicate, relate to various types of local institutions, so as to find out what could really be expected from state intervention, self-organisation, or a mixture of both? Thirdly, how would the implementation of alternative groundwater policies be affected by the wider contexts, notably by political power structures (both centrally and locally), economic forces, and socio-cultural value systems? It is quite a job, but far from impossible. When foreign experts get involved in making policy recommendations and suggesting arrangements, preceding field research becomes mandatory. A good example is given by van Steenbergen's Ph.D. research, in which he presents three case studies in Baluchistan. Marked differences between the three areas are demonstrated, in the roles played by government institutions and local groups, by legislation and customary rules, and by the different target groups in those three areas.

Decentralisation

Because groundwater management is a new task for the state, and no precise division of tasks has yet been made between the levels of central, regional, and local government, much of the recent debates on management of groundwater resources focus on the issue of

decentralisation. According to Moench (1995(a): p.1) the primary tension in India's growing debate on groundwater law, is "between those advocating centralised regulatory structures and those who view decentralised approaches as being both more implementable and equitable. World-wide, many people think highly of decentralisation because of its connotation with democracy. Nevertheless, departing from a simple slogan such as "decentralisation good, centralisation bad" would be a gross mistake. For decentralisation can take on many forms (e.g. "democratic" devolution as well as "managerial" deconcentration). Some of these forms would clearly aggravate problems instead of solving them.

In several parts of Africa and Asia, devolution in the health sector has already proved a disaster (Gilson 1994; Dreesens 1997) . In China, as we can also learn from Moench's book, rapid decentralisation of water management has not yet brought about the hoped for benefits. Anyhow, key functions of groundwater management (e.g. hydrological research and data analysis) should definitely remain with the central government.

From studies in development administration, it has been learnt that no generalisations ought to be made on the relationship between decentralisation and development. It has rather been suggested that this relationship be deconstructed. First, it should be acknowledged that full decentralisation means the transfer of the four-fold set of tasks, resources, legal powers, and actual decision-making power. Quite often, only parts of this set are transferred. Besides, there are innumerable variations of decentralisation.

Reflection on an appropriate arrangement in a particular case (e.g. groundwater management in a given country) requires pondering the following questions: Which goals of development are actually sought? Which degree of decentralisation would then be desirable? Should there be many tasks, powers, resources, or just a few? And which form of decentralisation would be most appropriate? For example, is it the British model of devolution in which private citizens have taken the initiative to pool their resources and rule their locality, or the French model of deconcentration in which central government has penetrated all lower levels of governments with appointed officials who administer local affairs (Alderfer 1960)? Which particular type of decisions should be transferred to lower levels: major policy decisions, minor executive decisions?

To my great surprise, many authors overlook the fact that whether decentralisation is desirable or not depends on the capacities of the transferring level as compared with the capacities of the receiving level. The transfer of tasks from a well-run directorate of a national ministry to a provincial board, full of corrupt, unskilled officials without any resources, is doomed to fail.

The endemic weakness of intermediate organisations

It has often been assumed that "intermediate organisations" should emerge to link the values and structures of the state with those of the communities. Communities consist of strong informal networks of family members, friends, clans, caste associations, groups of believers , saving groups. They sometimes back parts of the state, parts of the markets, and even sometimes parts of NGOs. Many efforts have been made to organise those communities into some sort of local management organisation - from the famous Community Development in India since the 1950s to the co-operative movements. Most efforts have failed since intermediate organisations must lack a real power base. They fit neither into the local community structure nor into national states. In practice, either power holders from local communities took over, or the supervising government agency squashed the intermediate organisation to death. Yet many observers of groundwater problems support the need for

some form of "intermediate level institutional framework" linking both national levels to local levels and state to society (see Moench(1995a): p. 2).

It is striking that, as late as in 1997, Indian authors again suggest that the co-operative model be followed. Katar Singh (1995: p. 76) suggests that "Landowners need to be organised into some sort of formal association under some law so that their activities are legitimised and their decisions legally backed up". He proposes that landowners be obliged to form co-operative water associations, which would make and enforce all necessary rules on pumpage, pricing, and the sale of water. He then wants to vest the landowners' water rights in the co-operative associations. The rights could be sold on lease to individuals for a certain period. The associations would pay a fee to the government. The farmers would buy shares in the association. All wells should be transferred to the association. The society should then auction to its members the right to use tubewells for irrigation or to sell water. "We know", writes Katar Singh, "that it is a novel idea beset with numerous legal, financial, operational, and managerial difficulties in its implementation. But the serious consequences of not doing anything warrant immediate action." (Katar Singh 1995).

Actually, the idea is not at all new, and we have learned from many instances that it did not work. Co-operatives are much too often hothouse plants in the cold - intermediate organisations with goals that are displaced by the goals of private or state actors.

All these failures do not wash away the need for governments and NGOs to communicate intensively with the target groups about policy and about the organisational forms to be chosen. In India's recent groundwater bill it is proposed that each state establishes groundwater boards. Representation of water users would be one way to establish a mechanism for consultation. People who may be affected by state intervention, ought to be consulted about their experiences, ideas and preferences. Representation in a regional board is not sufficient though. Hearings in rural areas should also be convened to listen to other voices as well as to explain the background of the state's groundwater management.

Law and development

Legal certainty

One of the dimensions of development is the increase in legal certainty This requires good legislation, lawful administration, and independent judicial decision-making. In most developing countries, much progress has yet to be made in these three areas. Legislation has frequently been inconsistent, unrealistic, and inaccessible. Administration has been plagued by unrealistic planning, lack of skills and resources, sloppy registration, bad communication, lowmorale, corruption, and a marked lack of attention to legal aspects. Judiciaries have been much less independent and also less professional than constitutions suggest.

Thus, in the average developing country, there is no properly functioning legal system; it is rather, as an Asian colleague once put it, a system in-the-making. So, on the one hand, nobody would deny that law is relevant and indispensable in managing a country; on the other hand, most insiders know that in practice the legal system does not work properly.

The need for inside knowledge of the law means that, when designing legal policy instruments, one should keep in mind that, although one should respect the law, in practice one cannot fully rely on its enforcement. Yet before adding new elements, one has to know

the legal system. In the first place, this will guarantee that new legislation is consistent with the basic legislation already in place. In the second place, in a given country, some parts of the legal and administrative system may do better than others (e.g. tax administration may be much more efficient than land registration, courts may act more efficiently and independently in criminal law cases than in administrative law cases, or provincial governments may have better law-making skills than local governments). Such inside knowledge of legal systems is vital in drafting new regulations. More than once, however, drafters in developing countries adopt regulations from other legal systems or from international treaties.

Law families

When studying the use of legal transplants into a foreign legal system, jurists generally follow the path carved out by their colleagues of comparative law, like the famous René David from France or Konrad Zweigert from Germany. From them, we have learnt that the world has a few major legal systems that have more or less spread over the world: common law, continental law, socialist law, and a group of "other conceptions of law". The assumption is that the legal systems of most countries, including developing countries, are essentially based on, or are at least closely related to, these mother systems, which mainly originate from Great Britain and the United States, as far as common law is concerned, from France and Germany for the continental law, and from the Soviet Union for the socialist law. The "other conceptions of law" include major, well developed, religious normative systems, such as Islamic law and Hindu law, as well as customary law, which is essentially unwritten and local.

Common Law or the Anglo-American group of legal systems is widespread throughout former parts of the British Empire in Asia and Africa, North America, Australia, and, of course, Great Britain itself. This law is basically judge-made law rather than being laid down in comprehensive laws and codes. It requires a strong and independent judiciary, but leaves it to individual citizens to call upon a court, except in criminal cases. Much of the available groundwater management literature is written in English and refers to certain problems with the "common law". Indian experts complain that British Common Law has left them with a rights structure that allows no legal limits to groundwater extraction by individual landowners (Moench 1995(a): p. 1).

Continental Law or the Roman-German group is widespread throughout those parts of Asia, Africa, and Latin-America that once formed part of the other colonial powers such as France, Spain, Portugal, Germany, Italy, The Netherlands, and Belgium, and also in some countries that were not colonised such as Japan, China, Taiwan, Thailand, and Turkey. The law here is basically made by legislators. Major examples are the Napoleonic codes dating from approximately 1800, and, later, some German codes. Recently, the new Dutch civil code has served as a model in many parts of Eastern Europe and the former Soviet Union. So, the continental system requires strong, highly skilled legislators. While private property and freedom of contract belong to its core elements, it also embodies a strong bureaucratic tradition in which the administration actually allocates rights to citizens by granting or cancelling a permit or licence.

Socialist law also used to be a major family before the collapse of the communist empire in 1989. It originates from the continental law, but key elements such as private property and freedom of contract have been replaced by socialist notions. For natural resources, this doctrine would focus on their social function and on the sovereign rights of the people as embodied in public ownership of land, water, and forests.

There can be no doubt that, of old, customary and religious rules on groundwater have developed in those areas that experienced a practical need for it. From a historical perspective, religious rules, notably Islamic rules, can essentially be considered a continuation, or reform, of local custom in certain areas of the Middle East during the early Middle Ages. Such rules are therefore often too limited in scope to function as an autonomous basis for new groundwater management. On the other hand, insofar as they have an appeal with local populations because of their practical and or symbolic value, an effort should be made to incorporate such rules in emerging legal regimes. An authoritative book on water laws in Muslim countries was written in the 1950s by the Italian lawyer Dante Caponera, and it was recently revised. It shows that the Islam contains certain provisions regarding water, some of which regard restrictions on water use. One example is the bordering land of a well, the so-called *harim*, on which it is forbidden to dig a new well so as not to affect the quality or the quantity of existing wells. Another example is the Islamic rule that water should be the common entitlement of all Muslims and that it is forbidden to sell it (Caponera 1954: p. 17). Brief recapitulations of the water laws of Muslim countries can also be found in Chandrasekhar (1995: p. 20-21) , while Van Steenbergen (1997) demonstrates how the *harim* rules have successfully been applied in Baluchistan.

Legal pluralism

During the 1970s and 1980s western academic studies of laws in developing countries have been dominated by the paradigm of legal pluralism, as it was developed in legal anthropology. The monopoly of the state in law-making was rejected, and rules produced by any kind of ethnic, social, or functional group were labelled as "law". The theoretical and political underpinning of this trend can be traced back to colonial days, when local customs were called *adat* law (*adat* is the Bahasa Indonesia term for custom) , folk law, or customary law in order to justify the recognition and application of local, social rules of the people, not only by indigenous courts but also by colonial state courts. For some time after independence, many countries maintained the idea that their legal system, or considerable parts of it, could be founded on customary law or religious law. In most fields of law, this idea has faded with time. In some fields, however, notably in family law and a few parts of land law and criminal law, this idea has been pursued by incorporating religious and customary rules in the state's legal system.

After the rapid social and economic changes of the last decades, I think we should be hesitant to give general legal recognition to "folk-law" systems as such. I rather believe that legislators, judges, and legal scholars should consider, case by case, to what extent elements of local culture, such as customary rules, deserve recognition as law.

Law-making in developing countries

Against this comparative and historical background, we must realise that the making of effective law in developing countries is not an easy job. If a country belongs to the continental tradition (e.g. Indonesia or Brazil), it may face other legal problems than countries bound to the common law doctrine (e.g. Pakistan or Tanzania). Yet, in matters of land and water in Indonesia or Ghana, customary law may still play a more significant role than religious law, whereas in Pakistan, being an Islamic state, religious law is important. In both Tanzania and Indonesia, the socialist imprints on natural-resources law are still visible, but all countries have subscribed to international treaties that are often framed in the English language,

smuggling in all kinds of concepts that have developed in common-law countries. So, from a purely technical viewpoint, coherent law-making is already quite a challenge.

At the same time, apart from technical considerations, the law-makers are caught up in several fields of tension. Firstly, should they follow trends set by international bodies or western countries, or should they come up with something clearly national and authentic, something visibly Pakistani, Indonesian, or Egyptian? Secondly, should they give in to ethnic pressure from fundamentalist parties by stressing and strengthening the old rules derived from Hinduism, Islam, or the culture of Zulus or Zapatics? Thirdly, in many law-making processes, there is still the tension between state-led socialism and market-led capitalism, the latter having lately been strongly promoted in the Third World by donor countries and institutions since Reagan and Thatcher decided in the 1980s that that was better for their own countries. Fourthly, there is the tension between authoritarian, centralist approaches and democratic, decentralised approaches, again the latter being happily promoted by donors, since we have found that decentralisation and democracy work rather well in the west. In the fifth and last place, there is severe tension between the rule of law as the supreme standard of all human action, and the actual normative standards - or the lack of them - in the daily processes of informal, and often illegal, fixing and wangling that play such dominant roles in the lives of the people in developing countries. In discussing useful laws and other policy instruments, we should beware of those fields of tension, and try to help in finding a proper, stable position in their midst.

How developing countries have coped with such complexities and tensions of law in development can be illustrated with many examples. Since our main concern is with the management of natural resources, in particular of groundwater, I shall now give some attention to the relevant fields of law and policy, being the environmental management and the environmental law of developing countries.

The development of environmental management and law

A new legal-institutional infrastructure

Over the last decades, most developing countries have established a body of policies and regulations to protect natural resources. Since the UN Conference on the Environment in 1972 in Stockholm, these countries have ratified many environmental treaties (Otto 1991). At present, most countries have their environmental management act, their ministry of public authority for environmental protection, their sectoral plans and regulations and licensing systems concerning nuisance, water pollution, industrial pollution, air pollution, as well as the protection of soils, forests and other nature reserves, and their flora and fauna. In many countries, efforts are underway to set up environmental management offices at regional and local levels.

Often, the present environmental legislation is already supposed to provide some broad protection to groundwater, but it seems that the time has now come to regulate groundwater protection more explicitly and more precisely. A few years ago, a UNESCO study group suggested that indeed groundwater protection law should be seen as a new branch of environmental law. What would that mean?

The objectives of creating a branch of the law are usually two-fold. Firstly, certain policy objectives are deemed desirable, and secondly, it is intended to create legal certainty in a particular area of human action. Legal certainty is one of the major goals of any legal system.

In any given area, the degree of legal certainty basically depends on three conditions: firstly, on the prevalence of legislation that is recognisable and consistent; secondly, on the prevalence of state institutions that themselves comply with those rules and induce private citizens to do the same; and last but not least, the prevalence of effective judicial remedies in cases of non-compliance. In short, all three parts of the trias politica need to be in good shape; otherwise legal certainty will suffer.

How is the condition with regard to environmental law (Otto 1996: p. 33)? Several studies on the environmental laws of Indonesia and India give us the following indications and hypotheses as points of departure (Otto 1991; Munneke and Otto 1990). For the following sections, I have drawn quite heavily on our research in Indonesia, but I have few reasons to assume that the condition of environmental law in other developing countries will be either much stronger or much weaker.

Environmental legislation

During the 1980s, considerable progress was made in environmental policy-making and legislation. International principles of environmental policy law, formulated by the Grundland Commission and by commissions of legal experts, have found expression in national policies, programmes, and laws. Environmental law became an important subject, also in developing countries: it was included in the curricula of law faculties, in the practice of business firms and legal consultants, in the extension programmes of NGOs, and in international development co-operation programmes.

Legislation often seems to be fairly coherent and more accessible than the laws in many other fields. Yet, three legislative bottlenecks must be mentioned. Firstly, many legislative provisions are still very broad and ambiguous, so they badly need implementing regulations, which have often been delayed. Secondly, eclectic absorption of legal concepts from different legal systems has sometimes led to confusion (e.g. the connection between new permit systems for, say, the control of water pollution, with existing nuisance permit systems; or the transplantation of the North American concept of environmental impact assessment, which seemed at one point not to fit in with the existing Continental-Dutch system based on laws and licensing). Such misfits have led to many calls for the co-ordination or harmonisation of environmental law. Thirdly, environmental law is in many instances connected to, and even dependent on, other fields of law. In order to have a polluter sentenced according to criminal law, courts will have to rely on the existing criminal law and criminal procedure law, especially the law of evidence. In order to accept claims from environmental pressure groups, the courts must conform to the law of civil procedure. If the law is not clear on these points, all depends on an administrative and judicial interpretation.

Environmental administration

In the administration of environmental protection, four major challenges have posed themselves: policy co-ordination, beefing up central organisation, decentralisation, and administrative culture. Most of these issues have already been dealt with in a general sense in section 2, "Development Administration".

Although the concept of sustainable development has found its way into five-year plans and other policy documents, the ministries that are primarily geared towards economic growth (e.g. agriculture, industry, public works, transport) simply outweigh a ministry of the

environment, and dominate national policy-making. Yet, to fulfil its mission, this ministry must try to influence decision-making processes in these often hostile ministries. This requires a strong homebase and highly skilled officials and strong political backing from the top. In Indonesia there even is no full-fledged ministry for the environment since the government is of the opinion that a lighter co-ordination mechanism is better equipped to deal with the other ministries. On the other hand, a central agency was established after the model of the American Environmental Protection Agency.

But even with hard bureaucratic infighting and many resources, it has proved to be very difficult to build a strong central institution for environmental management in times when economic growth is limited or even absent and when governments are supposed to shrink rather than expand. Moreover, provincial and local governments are seldom strong partners in environmental management. Local entrepreneurs and other economic interest groups will often be able to put more pressure on them than NGOs can do. Don't forget that the role of the local press, the natural partner of environmental NGOs, is still often curtailed so that it cannot reveal environmental scandals to the public.

Changing administrative culture remains difficult but is a conditio sine qua non. Corrupt practices are part and parcel of environmental administration. All sorts of do's and don'ts are circumvented: licenses are bought, officials are bribed, and honest leadership to control the controllers is in short supply. These, briefly, are some basic problems of environmental administration, which may also apply to groundwater management.

Environment in the courts

It is before the courts that weaknesses in the legislation become fully exposed, but there are other problems as well. In environmental cases, courts in developing countries are confronted with the following challenges: access, innovation, unity, and dissemination (Otto 1996: p 51-58)

Access is a problem because victims of pollution, often poor people, seldom have the financial means, administrative skills, and mental state needed to start a court case against a company. They are therefore dependent on institutions that perform social litigation on their behalf. At least in Indonesia, recent case law on locus standi of such environmental NGOs has already improved access.

As regards innovation, impartiality, and judicial activism, some countries clearly have a better reputation than others: India, Egypt, and Ghana can be considered more developed than, say, Indonesia or China (Tiruchelvam 1983; Otto 1995; Pompe 1996). Indeed, available literature on South Asia suggests that court cases sometimes play a role. In Van Steenbergen's Baluchistan cases, though, it seemed a venue to protract old enmities rather than a way to resolve groundwater dispute. One of the dangers of adapting American legal models is that it is precisely the American systems that have powerful, independent and innovative judges, who make big landholders, and even governments, obey their indictments while conditions outside the western world are so different.

Unity in judicial decision-making is another problem in many developing countries, where Supreme Courts have backlogs that count into the thousands, so that it will take many years before firm case law can be established at the highest level.

In the meantime, in many countries, the dissemination of the decisions of lower courts remains troublesome so that they are not always exposed to public and academic scrutiny, or

even to other courts. The registration and smooth communication of court decisions would, of course, be in the interest of parties - including NGOs, police, and prosecutors - to obtain points of reference in preparing new cases.

When we study the environmental law in developing countries, we find many such conditions. The situation may not be very encouraging for drafters of new groundwater legislation. Understandably, many observers have been attracted to management systems that are less oriented towards law and administration such as common property resources management. However, it is not self-evident that this can provide a way out. As Nibbering has demonstrated to this workshop, it can only work if it is easy for resource users to co-ordinate their actions. If they cannot, the state and the market are better alternatives. Probably, one has to be prepared for a reality in which none of the alternative systems can be very effective. But if the goal is making effective legislation one should be realistic and face the gloomy realities of legal process, unfair markets and quarrelling local groups rather than play to the gallery.

Groundwater law and administration

The problems

According to the literature, there are at least five main groundwater problems to be solved:
1. The danger of exhaustion of groundwater reserves, now or in the future;
2. Falling watertables causing harvest losses, rising costs of pumping, and land subsidence;
3. Tail-end deprivation;
4. Salinisation due to rising watertables;
5. Loss of usability due to pollution.

The first three problems call for a reduction in groundwater extraction; the fourth problem calls for a carefully balanced combination of pumping, irrigation, and drainage; the fifth problem calls for the control of water pollution. In this section, I shall focus on the three related problems and, at the end, shall briefly comment on the other two. It is important to note here that, in practice, these problems do not have to occur simultaneously or at the same place. This calls for a differentiated, adaptable management regime.

Basic rules and institutions for groundwater control

At the moment in many developing countries, land owners drill and pump as they like (Moench 1995: p. 50), and there is a growing consensus that this must be stopped. But how? After the above account of the conditions of law and administration in developing countries - especially in environmental management - the questions remain: what amount and what type of law are needed, what kind of institutional framework is needed, and which solutions are needed in case specific legal and administrative bottlenecks occur?

Let me first sketch some very rough outlines, which can be elaborated in greater detail later. On the basis of the literature that I have gone through, I suggest that there are a few basic rules and a few basic institutions that together constitute the heart of a groundwater management system, and about which a general consensus has grown (Chandrasekhar 1995:22-23).

1. There must be a legal limit to the freedom of landowners to drill and pump as they like;
2. There must be a Lower Groundwater Institution (LGI) at a regional or local level;
3. The LGI must register all wells and users in its area;
4. The LGI must regulate and re-allocate rights to drill and use groundwater, either through a licensing system or otherwise.
5. The LGI must conduct direct monitoring and supervision;
6. There must be a Higher (national or provincial) Groundwater Institution (HGI);
7. The HGI has the task and powers to collect and analyse hydrological data on groundwater;
8. The HGI also has the task and powers to make a classification of areas according to the urgency of groundwater problems and the specific management regime needed;
9. The HGI has the task and powers to co-ordinate its policy with other higher government institutions;
10. The HGI has the task and powers to oversee groundwater management at a higher level.

My impression is that these basic rules reflect a general consensus among most governments and experts. Yet, there are two serious problems surrounding these rules.
The first problem concerns the composition of the Lower Groundwater Institution that is needed, and the type of rules it will make and/or enforce. To arrive at an optimum arrangement, the factors mentioned in the previous sections should be thoroughly analysed.

The second problem is simply that there will be widespread resistance from landowners against limitations imposed on their freedom. Their opposition will, of course, focus on rules and institutions that regulate and reallocate the unlimited groundwater rights that have been so much in their interest. To achieve their political and economic goals, they will also use legal and administrative arguments, which we shall discuss below.

What kind of lower groundwater institution?

Generally speaking, there are three basic models for Lower Groundwater Institutions: a government office, a people's group, or a mixed government-people's institution. The first two correspond with two of the three paradigms that were discussed in the introduction of this paper: state and local groups.

Certainly, each model has its pros and cons, and different conditions in different countries call for different models. Two books, one by Van Steenbergen (1997) and the other by Moench (1995), give us helpful information: Van Steenbergen especially by his empirical case materials, and Moench because he gives us so many different approaches, some of them based on doubtful argumentation.

Let us take a look at the three case studies from Baluchistan by Van Steenbergen (1997). In Kuchlak, the people's group of *"kareze"* management collapsed; the people's group managing collective dug wells collapsed as well. Finally, on the basis of new legislation, a set of decisions by the Provincial Water Board settling water disputes brought some control, albeit rather limited.

In Mastung, a people's group of tribal elders made serious efforts to control all water users, but their influence on new dug-well developers was too limited and disputes continued until the government, the local administration, took the initiative to gather the group of elders and, together with them, to establish rules. A supervising organisation was created consisting of three elders to issue permits and safeguard the rules. The elders found little time to attend to

their duties, however, so this people's group also collapsed. Gradually, responsibilities shifted to the government.

In Panjgur, a highly dispersed and informal people's group of *"kareze"* shareholders is in power. They control the area and intimidate potential dug-well developers to protect their *"kareze"*. If their intimidation has no effect, the government will usually back them and decide the case.

Summarising, people's groups often play a role, but they have a tendency to collapse. Government officers have an important role to play as conflict settlers and as partners in rule-making and rule-enforcement. No mixed institutions were created.

The USA provides some examples of highly sophisticated people's groups. As the scarcity of groundwater became acute and conflicts arose, farmers and other water appropriators - in response to court orders and after long deliberations - created water districts and established water users' associations to regulate pumping and impose other constraints (Katar Singh 1995: p. 75-76).

The participants pooled money, technical information, agreed to have voluntary cutbacks of 25-30%, and each year reported their withdrawals. The associations hired staff (i.e. water masters) for the monitoring and sanctioning.

According to Katar Singh, "India could learn many lessons from this experience and design a similar strategy (see section 3, on intermediate organisations). A plea for immediate action deserves our support, but is this the right direction? Surprisingly enough, the same author, Katar Singh, in the same article, describes an experimental project, supported by Norway from 1974 until 1987, with joint ownership of tubewells by small farmers, but which did not succeed because of intra-group conflicts, a weak position vis-a-vis competing tubewells (private and public), an inability of the group to frame appropriate rules, a lack of participation of members in decision-making, and an inadequate power supply.

Essentially similar reasons led to the collapse of agricultural co-operatives in many developing countries. Van Steenbergen's cases from Kuchlak and Mastung follow the same direction.

Katar Singh (1995: p. 97, footnote 18) also warns against pseudo-co-operative societies, and this warning should be taken seriously. In developing countries, it is highly probable that a co-operative society will develop either into a cover-organisation of the local strongmen or into a local extension of the central government. One can easily agree with Katar Singh's thesis that, for the success of any group endeavour in natural resources management, the rules for equitable sharing must be framed and enforced ruthlessly by the group (Katar Singh 1995: p. 77), but it must also be acknowledged that empirical evidence suggests that this seldom occurs.

Active government intervention seems indispensable. The next question then becomes: should such intervention be undertaken by a deconcentrated, sectoral office for water management or by the local administration? My suggestion would be to create regional water boards, chaired by the chief of a province or district, but technically supervised and supported by one of the water management ministries or the ministry of the environment.

Members of such water boards should include expert officials and regional leaders, representing the values and interests of the people. The representation of people in such boards helps to establish the principle of consultation. People whose fate will be affected by

state intervention should be consulted to hear their experiences, ideas, and preferences. However, representation in a regional board is not enough. Regular meetings in rural areas should be convened to listen to other voices as well, and to explain the background of groundwater management.

Legal bottlenecks?

Basic Rule 1 suggests that there be legal limits to the freedom of landowners to use and sell the groundwater they extract from underneath their land. Much of the literature on India suggests that, in common-law countries like India, such limits would be against the law.

It is suggested that there are four legal doctrines in common law, none of which allows for state control. I do not agree with that suggestion. Indeed, the oldest common law doctrine is the riparian doctrine or absolute ownership doctrine, which scarcely limits the rights of landowners to extract groundwater; implicitly, their share is absolute (Katar Singh 1995: p. 75). This doctrine, however, has been supplemented by the doctrine of reasonable use. According to this, groundwater rights are limited to "reasonable use" on overlying land. A third doctrine goes one step further: the doctrine of correlative rights that has been developed in the United States. It says that, in times of scarcity, the court, if called upon, would permit the overlying owners, as correlative or co-equal owner, to have access to their proportionate share. So the court, if called upon, would limit the rights to "proportionate share with reasonable use". As these doctrines all attribute rights to landowners, one may ask what would be the rights of tenants and landless labour, especially when they have had access to groundwater in the past. Coming to their rescue, common law jurists have developed a fourth principle: the doctrine of prior appropriation. It states that first water rights are vested in those who were first in time, regardless of land ownership (Turnquist: p. 88 , footnote 26).

From this account, we can learn two things. In the first place, even in common law doctrine, limits have already been set according to reasonable use and proportionate share. But in the second place, the control according to common law rests in the hands of citizens who call upon courts to make decisions with new rules that are obeyed. The latter condition would seldom work in developing countries because of access problems and problems with efficiency and impartiality on the side of the courts (see section 5, "Environment in the courts").

One may then ask with what right can the government itself set up a control and licensing system to stop landowners from using groundwater, which they regard as their private property, and, in this respect, whether the legal conditions differ between common law countries and continental law countries.

The new Dutch Civil Code, which can be considered the most modern civil code in continental law countries, holds a pleasant surprise. It states in Book 5, Section 3, on "Property of Immovables", that the property of land includes, unless the law states otherwise, the groundwater that has come to the surface by a source, well, or pump. The legislator assumes that groundwater is res nullius (nobody's thing) until it has been brought to the surface (Stolker 1994: p. 311). In other words, until it is pumped up to the surface, it is no one's property. Whether a landowner is allowed to extract it, and how, and in which quantity, can certainly be decided by administrative law. Moreover, the groundwater will become the landowner's property "unless the law states otherwise". So, in this continental code, I can see no legal problem in groundwater control.

I have tried to find out what common law doctrine has to say about this matter. It is clear that under common law groundwater cab also become the landowner's property through accession. It is also evident that environmental law can put limits to an owner's use of his property. But I have no decisive information on whether groundwater is a res nullius, before it is pumped up. Anyway, I would not be surprised if this whole argument that has developed in India would be very weak from a legal point of view, and not more than a quasi-legal cover for strong economic and political interests. Further study, however, is needed to sound this out.

Since law in developing countries is often ineffective anyhow, some observers turn to religious or customary rules. It is easy to suggest that local water-use rights are equitable and should therefore be backed and legitimised by state law (Katar Singh 1995: p. 78). I do not believe that this can be a panacea, as I explained above when I referred to legal pluralism (section 4).
When problems become urgent, rules must be clear and, if necessary, enforceable in the end by state authorities. This calls for legislation, rather than mere reference to traditional rules. Having said this, I hasten to add that legislation can be national, regional, or local, that legislation should be simple, and, inasmuch as possible, should reflect the values and norms of the communities addressed. The rules framed by local administration, together with tribal elders in Baluchistan, could therefore have taken the shape of a regional regulation, enforceable before the courts, and thus adding to legal certainty in groundwater management.

Conclusion

It has often been proposed that local groups should be involved in groundwater management and that legislation should conform to local ideas. One must agree. that terms like participation, local management, local acceptance, legal pluralism and decentralisation have a pleasant ring. However, in some areas landowners must really be stopped from pumping as they like , against their will but for the sake of other people and future generations. Here the need arises for strict administration and law enforcement with strong backing of a central government. If there is no political will or administrative capacity to do so, escalation into an armed conflict should not come as a surprise.

This article suggests that state intervention for groundwater management is a must. Political agenda-building to make protection of groundwater resources a priority issue is badly needed. The question of decentralisation should be addressed systematically. Implementation problems are to be anticipated by focusing on institutions, target groups as well as social contexts. The internal structure of local groundwater institutions should minimise opportunities for corruption. In order to build strong institutions, mechanisms must be developed for consultation with targets groups of local users. In this respect self-organisation by local groups ought to be welcomed but not imposed.

Any groundwater law aims at an increase of legal certainty in its field. However, general conditions in most developing countries are such that one cannot rely on the effectiveness of a legal system. Yet one should make the best of it and therefore try to understand the roots and the structure of the national legal system concerned. New groundwater legislation needs to be brought in harmony with existing environmental law and other relevant legislation. Thus, legal models for groundwater control from other countries should not simply be transplanted. Whether indigenous rules of religious or traditional origin should be incorporated ought to be decided on a case to case basis. It is for sure, though, that , whether in common law, civil law or indigenous law, water rights based on landownership must be limited.

Before governments can control groundwater resources research should be carried out not only in hydrology but also in the socio-economics of groundwater users and use as well as in development administration and law. Such research should aim at finding pragmatic solutions enabling state, market and local groups to contribute to good groundwater management (Moench 1995(b): p. 47). The basic rules developed in this article can serve as a point of departure.

References

Alderfer, H. 1964. *Local Government in Developing Countries.* McGraw Hill, New York.

Aldwell, C.R., L. Alföldi, and H.G. van Waegeningh. 1991. Legislation and Regulation. In: *Integrated Land-use Planning and Groundwater Protection in Rural Areas : A Comparative Study of Planning and Management Methodologies.* Technical Documents in Hydrology. International Hydrological Programme, UNESCO, Paris.

Caponera, D.A. 1954. *Water Laws in Moslem Countries.* FAO, Rome.

Chandrashekhar, H. 1995. Formation of Better Management Techniques and Legislative Control on Utilisation of Groundwater Resources. In: *Groundwater Law : The Growing Debate..* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Chhatrapati Singh. 1995. Research Agenda for Groundwater Law in India. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Esman, M.J. 1991. *Management Dimensions of Development : Perspectives and Strategies.* Kumarian Press, West Hartford.

Dreesens, J. 1997. *Decentralisation and Health Care in the Philippines.* Master's Thesis. Stae University, Leyden.

Frerks, G., and J.M. Otto. 1996. *Decentralisation and Development : A Review of Development Administration Literature : In Commemoration of Dr Haile K. Asmerom.* Research Report 96/2. Van Vollenhoven Institute, Leyden

Gilson, L., P. Kilima, and M. Tanner. 1994. Local Government Decentralisation and the Health Sector in Tanzania. In: *Public Administration and Development.* 14 (5): 451-478.

Katar Singh. 1995. Co-operative Property Rights as an Instrument of Managing Groundwater. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Moench, M. 1995 (a). Introduction. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Moench, M. 1995 (b). Approaches to Groundwater Management : To Control or Enable? In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Munneke, H.F. and J.M.Otto. 1990. Milieuwetgeving in India en Indonesië, een vergelijkende studie. In: *Milieu, Tijdschrift voor Milieukunde* 1990: 1-7.

Otto, J.M. 1987. *Aan de voet van de piramide : Overheidsinstellingen en plattelandsontwikkeling in Egypte : een onderzoek aan de basis.* Ph.D. Thesis, DSWO Press. State University, Leiden..

Otto, J.M. 1991. International Law and Environmental Legislation in Developing Countries, with special reference to India and Indonesia. In: *Leyden Journal of International Law* 4 (1): 110-117

Otto, J.M. 1995. Jurists, Nation Building, and Social Tensions in Egypt. In: *Designers of Development; Intellectuals and Technocrats in the Third World.* B. Galjart and P. Silva (Eds.). Research School CNWS, Leyden. pp. 107-128.

Otto, J.M. 1996. Implementation of Environmental Law in Indonesia : Some Administrative and Judicial Challenges. In: *Indonesian Law and Administration Review.* 2 (1): 32-71.

Pompe, S. 1996. *The Supreme Court of Indonesia : Fifty years of Judicial Development.* Ph.D. Thesis, State University, Leyden.

Prasad, R.K., and T.K. Sarkar. 1995. Management of Groundwater Resources in India. In: *Water Lifting Devices and Groundwater Management for Irrigation.* Report of the Expert Consultation of The Asian Network on Water Lifting Devices for Irrigation, FAO Regional Office for Asia and the Pacific (RAPA). RAPA Publication 1994/5, Bangkok.

Schrevel, A. 1997. *Managing an Open-Access Resource : Groundwater.* Paper presented at the Workshop on Groundwater Management, 12-14 October, 1997. ILRI, Wageningen.

Sharma, S.C. 1995. Regulation of Groundwater Development in India : Existing Provisions and Future Options. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Smith, Z. 1995. Managing Groundwater in the Western United States : Lessons for India. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Srinivas, M. 1995. A Critique of the Proposed Groundwater Bill. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Steenbergen, F. van,. 1997. *Institutional Change in Local Water Resource Management : Cases from Balochistan.* Ph.D. Thesis, State University Utrecht.

Steenbergen, F. van, and W. Oliemans. 1997. *Groundwater Resource Management in Pakistan.* Paper presented at the Workshop on Groundwater Management, 12-14 October 1997. ILRI, Wageningen.

Stolker, C.J.J.M. 1994. Book 5, title 3. In: *Tekst en Commentaar: Burgerlijk wetboek.* J. Nieuwenhuis, C. Stolker, L. Valk (eds.) . Kluwer, Deventer.

Tiruchelvam, N. 1983. Introduction. In: *The Role of the Judiciary in Plural Societies.* N. Tiruchelvam and R. Coomaraswamy (Eds.). Frances Pinter, London. pp. vii-xxii.

Thomas, G.A. 1995. Centralised Versus Decentralised Approaches to Groundwater Management and Allocation in the Context of Overdevelopment. In: *Groundwater Law : The Growing Debate.* VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Turnquist, S. 1995. Water Quality and Water Rights : Issues for Groundwater Management in India. In: *Groundwater Law : The Growing Debate.* M. Moench (Ed.). VIKSAT Pacific Institute Collaborative Groundwater Project, Ahmedabad.

Uphoff, N., and M. Esman. 1974. *Local Organisations for Rural Development : Analysis of Asian Experience.* Cornell University Press, Ithaca.