

## CHAPTER 11

### How groundwater ownership and rights influence groundwater intensive use management

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**ABSTRACT:** A comparative analysis of groundwater legislation suggests that groundwater is losing its traditional private property connotation, and that individual rights in it accrue from a grant of user-type rights by the government or the courts. Case law shows that compensation claims on the grounds of taking private property rights in groundwater are unlikely to succeed. Legislation seeks to enhance the effectiveness of governmental permit determinations through planning mechanisms and users' participation in groundwater management. Implementation and enforcement are critical to the effectiveness of groundwater legislation, but the available record is sketchy. Shared groundwater issues in federal countries tend to be settled through inter-state agreement or court litigation. Further erosion of private groundwater ownership, and regulation by government, are to be expected, especially in case of overdraft and pollution. When government and/or the judiciary are weak, control by groundwater users, constituted as groups under statutory law or custom, is to be viewed as an alternative to regulation.

#### 1 INTRODUCTION

It is difficult to find fault with the axiom that private ownership of a common-pool type resource like groundwater acts as a powerful incentive to each owner to draw as much benefit from his/her share as is possible under given technological and economic conditions, before other fellow owners do likewise and impinge upon the first owner's privilege. Private ownership of groundwater carries with it the seeds of overexploitation and, eventually, depletion of the resource. This axiom, so to speak, lies dormant and harmless until such time as technology and the economics of drilling and groundwater extraction, evolving as the demand for an ever scarcer, generally good-quality resource grows, make drilling at increasing depths and extraction of increasing volumes an attractive proposition. No landowner will want then to miss the train, thus sparking a rush to the aquifer and to its intensive development by all who can afford it. Overdraft conditions are sure to emerge as a result, locally

and on a larger scale. In Texas (USA), Gujarat (India) and in the Pakistani Punjab, for instance, where the *rule of capture* allows landowners to extract freely groundwater from under their lands, aquifers overdraft is a widespread problem.

In anticipation or in reaction to these problems, legal systems, particularly in water-scarce areas, have sought to replace private ownership rights in groundwater with *user-type* rights granted and regulated by government in the form of a permit. The replacement can be the result of legislation phasing out private groundwater ownership altogether, and vesting ownership—or other equivalent legal status—of groundwater resources in the government on behalf of the people. Where such a radical departure from entrenched legal tradition is not feasible, legal systems have sought to equally qualify the private ownership rights of landowners in groundwater by gradually bringing the digging and drilling of boreholes, the construction of wells and the abstraction and use of groundwater

resources under government control in areas where overdraft conditions have emerged or are likely to emerge. To the extent that both approaches entail restrictions to the landowner's individual and entrenched property rights in groundwater, there is a risk that the legislation, or specific determinations made under it, be challenged in court and result in complex judicial disputes as to their legitimacy, given the special protection normally provided under constitutional provisions to private ownership. Experience suggests, however, that collision and confrontation can be avoided and that challenges of legitimacy can be effectively resisted.

While arguably capable of relieving groundwater resources of actual –or of the risk of– overdraft, government-controlled drilling and extraction under a permit system are no guarantee that no stress will ever occur. For one thing, decision-making is an imperfect science, and groundwater allocation decisions can be made and drilling and extraction permits granted which may equally well result in overdraft conditions as a private ownership *régime* of groundwater. On the other hand, ultimately the effectiveness of a permit system of groundwater extraction is dependent on the willingness of permittees to comply with the original terms and conditions of their respective permits, and possible subsequent tightening up of the same, and on the government's resolve to enforce them. Experience shows that neither can be taken for granted. Available experience seems also to suggest, however, that approaches are available to enhancing the permittees' willingness to comply with permit restraints –and that *user* rights obtained and, at the time of the original grant or subsequently, qualified as a result of high-quality, participatory decisions stand a better chance of being adhered to by permittees, resulting in a more effective relief for a given aquifer under stress, than top-down government-imposed decisions and restrictions.

This chapter will illustrate the process of erosion of the traditional prerogatives of groundwater owners, showing, on the basis of specific country situations, the solutions that have been adopted to achieve a compromise between groundwater ownership and rights on the one hand, and regulation on the other. It will also illustrate approaches adopted to enhancing the effectiveness of *user*-type rights, granted under a government permit system, in restraining

groundwater withdrawals, should overdraft conditions be anticipated or actually emerge in a particular area.

## 2 PRIVATE OWNERSHIP OF GROUNDWATER

### 2.1 *Private ownership of groundwater in different legal systems*

The principle of Roman Law by which groundwater is the property of the owner of the overlying land has been until recently the dominant rule in the countries following the tradition of the French Napoleonic Civil Code, such as France, Italy and Spain. The land owner had an exclusive right to use and dispose of the water underlying the land, subject to the respect of the equal rights of neighbouring land owners and to the regulations in force. For instance, under Article 552 of the French Civil Code, "ownership of land includes ownership of everything above and below the surface..." The land owner "...may carry out below the surface all the operations and excavations which he deems appropriate and withdraw from these excavations all the products that they may yield, subject to restrictions arising out of mining and police legislation and regulations".

Similarly, under the common law tradition of England and Wales, the holder of a title to land has an exclusive right to the use of all waters located below the land, provided that these waters are *percolating*, i.e. do not flow into defined channels. The landholder may take unlimited quantities of these waters without regard for other withdrawals. Conversely, the use of groundwater flowing into defined channels is subject to the riparian doctrine, according to which the owner or occupier of land adjacent to a natural stream is entitled to the use of the waters flowing past the land as an incident of the ownership or occupancy of such land (Teklaff 1972).

The common feature of the legal systems just mentioned is, in broad terms, that the use of groundwater is dependent on the *régime* of overlying land, thereby endowing the private land owner or title holder with a privileged right. This concept has spread to the countries that have derived their legal system from Europe, but has soon been adapted to the prevailing conditions (Caponera 1992).

A preferential entitlement to groundwater was recognized to the land owner by the federal Civil Code of Argentina, in spite of the public nature of groundwater. However, even before a 1967 amendment to the Code had placed groundwater in the public domain, several provinces had introduced a permit system for the abstraction and use of the resource, as over-exploitation –and the risk of depletion– was already a matter of concern (Teklaff 1972). In Mexico, the 1917 Constitution permits the extraction of groundwater and its appropriation by the owner of the overlying land, but provides that, in the public interest, the public administration may regulate this extraction and, if necessary, establish protected zones (Article 27).

The common law riparian rights system was exported from Britain to Australia, but was soon abandoned in favour of a permit system, because water resources being a scarce commodity, riparianism would have constrained the development of human settlements and irrigated agriculture.

In the Eastern USA, water law has also developed along the lines of the common law riparianism, but a system of prior appropriation has evolved in the Western States as a result of the gold rush of the 1840s. Under this system, the person who first appropriates water acquires priority of right as against any later –junior– appropriators, and once the right is established it becomes an exclusive one, ceasing only if the water is no longer put to beneficial use. This rule applies to flowing groundwater, while rights over *percolating* groundwater are excluded from prior appropriation. In California, the owner of the overlying land may take as much groundwater as s/he can reasonably put to beneficial use on the land, subject to the correlative rights of neighbouring overlying land owners. As long as it is exercised in a reasonable manner to serve a beneficial use, this overlying right has priority over appropriative rights, although in the event of overdraft it is subject to reduction in respect of other overlying rights. The legal system of Texas still recognizes absolute groundwater ownership under the *rule of capture*, whereby the land owner owns all the groundwaters he captures through pumping, and has an incentive to do so lest the water is captured by someone else.

Finally, in Islamic countries groundwater –and water in general– is viewed as a gift of God to the whole community and, as such, may not

be privately owned. Only wells may be owned, giving the owner a priority user right over the water s/he extracts. The ownership of a well entails the ownership of a certain extent of adjacent land, which constitutes the *harim*, or protected area, within which no new wells may be dug. The Ottoman Civil Code *Mejelle*, which consolidated the *Shari'a* and customary rules into a code, confirmed this principle, which is still surviving in a number of Islamic countries which were once part of the Ottoman Empire. Article 1234 of this Code defines water, including groundwater, as a non-saleable commodity to which everyone has a right (Caponera 1973, 1992).

## 2.2 *Restraining private ownership rights short of regulation*

In the fewer and fewer countries where private ownership of groundwater holds sway and where, as a result, government regulation of groundwater rights is not a viable option, the only practicable course available to restraining groundwater withdrawals is for the concerned landowners to agree on self-imposed restrictive measures, with government nudging the process along. In Texas, for instance, rights to groundwater follow the rule of capture and are based on land ownership. The rule of capture limits liability between landowners for withdrawing groundwater, but does not authorize administrative intervention, at least in principle. For this reason, management measures with respect to groundwaters experiencing overdraft mainly focus on the development and promotion of conservation technologies, public awareness raising and education programmes. Groundwater Conservation Districts, traditionally formed on petition and vote by affected property owners, tend now to be formed also at government's instigation of a property owners' election to create a district in so-called *critical areas*, i.e. areas experiencing overdraft or contamination, based on studies conducted by government. Whereas these districts have varied powers including permitting, well spacing and setting the amount of withdrawals, most of them have deferred to the rule of capture and have not imposed mandatory restrictions on the affected landowners' rights to pump and on the amount of water extracted. Most have opted, as a result, for voluntary self-restraint and educational programmes (see Box 1).

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Box 1. Texas: managing groundwater overdraft under private ownership of the resource.

The High Plains Underground Water Conservation District in Northern Texas offers an interesting example of successful overdraft management without defying the rule of capture. Management is mainly based on education and the promotion of conservation technologies. In its work, the staff of the District interacts with farmers and research institutions (Burke & Moench 2000).

Nevertheless, under Texas water law, groundwater conservation districts are mandated to protect groundwater. Therefore, they have three regulatory tools at their disposal: spacing requirements, production limitations and production fees. Many districts above the Ogallala aquifer have adopted well spacing requirements. The rule of capture still applies, this meaning that A may not sue B for taking all the water. But the districts' spacing regulations help protect *both* properties. Elsewhere, such as in Houston and San Antonio, spacing requirements would have little or no effect, as the problems are land subsidence and dropping aquifer levels in periods of drought, respectively. In both locations the current method of regulation is to limit the amount of water that can be produced from each well. As aquifer depletion becomes more of a problem and cities look at rural groundwater supplies as their future water source, more and more districts are adopting production limitations. Production fees, the third tool, is only available to few districts in the State. These districts may charge a fee for each gallon of water either allocated in a permit or actually pumped. The fee serves as an incentive to reduce production. Only one district –the Harris-Galveston Coastal Subsidence District– has adopted a fee schedule designed to create an economic disincentive to pumping groundwater.

In a California landmark case adjudicated by that State's Supreme Court in August 2000, restraint of the water rights held by property owners overlying the overdrafted Mojave aquifer was sought by fellow water rights holders in the courts, and failed. Restraint was sought under a court-arbitrated groundwater management plan involving an across-the-board

cut in withdrawals from the aquifer, which would have undermined the strong property connotation of groundwater rights in favour of an equitable apportionment of available groundwater resources in the aquifer. Both the plan and the cuts it contemplated were effectively resisted in court by a group of farmer irrigators and by one city, whose claim that the plan and cuts would be in violation of their groundwater rights was eventually upheld, after a decade-long litigation (see Box 2).

Box 2. California: The Mojave Basin Adjudication.

The California Supreme Court decision in *city of Barstow v. Mojave Water Agency* (Mojave Basin Adjudication, *Cal. 4<sup>th</sup>*, 2000 D.A.R.9265 (Cal. 2000)) rejected the view that groundwater, even in an overdrafted basin, should be allocated according to the doctrine of equitable apportionment, and reaffirmed the water rights priority system as the way for California to allocate a scarce resource.

Groundwater overdrafts in the Mojave basin began in the 1950s and reached alarming rates in the 1980s, due to intensive agricultural use. Agricultural use alone exceeded the natural safe yield of the basin by nearly four-fold. This situation led, in 1990, to a complaint by the city of Barstow charging overuse of water by agricultural producers. The Mojave Water Agency, wholesale water supplier for the region, filed a cross-complaint in 1991, seeking a general water rights adjudication. The trial court ordered a *litigation standstill* during which a group of negotiators composed of municipal water purveyors and farmers attempted to work out a physical solution –a groundwater management plan– to correct the overdraft. The principle underlying the physical solution was that all users should equitably suffer a reduction in their respective share –in this case a 20% reduction over 5 years– in accordance with the doctrine of equitable apportionment.

While a majority of users stipulated to the physical solution, a number of farmers and the city of Adelanto claimed that the solution did not take into account the priority of their respective groundwater rights and did not stipulate. The trial court rejected the claim, applying the physical solution to the non-stipulating parties.

The Court of Appeal reversed the trial court's decision, ordering the trial judge to exclude from the physical solution those few farmers who did not stipulate to it –the *Cardozo* appellants. The Supreme Court confirmed the Court of Appeal's decision.

After summarizing the main legal doctrines and precedents relating to groundwater, the Supreme Court reached the conclusion that an equitable physical solution must take into account water rights priorities to the extent that these priorities do not lead to unreasonable use. Overlying rights have priority over appropriative rights, but are limited, under Article X, Section 2, of the California Constitution, "to such water as shall be reasonably required for the beneficial use to be served". An overlying right may be subject to appropriation by prescription when it is not exercised for the statutory period of five years. In case of overdraft, an overlying right may be reduced only in respect of other overlying –correlative– rights. In substance, the Supreme Court recognized the right of the *Cardozo* appellants, overlying land owners, to pump groundwater for use on their land, this right being superior to appropriative rights in the absence of prescriptive rights, and being subject to reduction only in respect of other overlying rights in case of water shortage. The Court ruled that the physical solution should remain in place for those who stipulated to it, but directed the trial judge "to exclude the *Cardozo* appellants and to grant them injunctive relief protecting their overlying water rights to the current and prospective reasonable and beneficial need for water on their respective properties".

As commentators have put it, the recent decision of the Supreme Court in the *Mojave Adjudication* has rejected the view that groundwater should be allocated according to equity and has reaffirmed the water rights priority system and the private property values underpinning it (Aladjem 2000, Kidman & Gardner 2000).

The Texas approach and experience and the *Mojave* judgment attest to the limited ability of legal systems to effectively restrain groundwater rights which are grounded on private ownership of the resource or have a strong private property connotation.

### 3 FROM PRIVATE OWNERSHIP TO REGULATION

The intensive use of groundwater and its impact on the availability and level of the resource have bred a progressive erosion of the traditional rule by which the owner or occupier of land owns the underlying groundwater, or has exclusive rights over it. Recent legislation has succeeded, through various means, to bring groundwater under state control, thus allowing governments to introduce measures to regulate and control the allocation and use of the resource in the public interest, thereby preventing the emergence of conflicts among competing demands.

Where the national legal systems used to recognize the private ownership of groundwater, the most important legal reform has been bringing groundwater within the public domain of the state, such as in the case of Spain, France and Italy, which adopted new water laws in 1985, 1992 and 1994, respectively. In Argentina, groundwater was declared public by an amendment to the federal Civil Code in 1967, as was mentioned earlier.

The result of bringing groundwater under state control was also attained in those countries where the legislation did not recognize ownership rights, but exclusive rights of use were nevertheless vested in the land owner or title holder, or could be acquired through prior appropriation. In the Australian State of Victoria, for instance, riparian rights have been eroded through the vesting in the state of superior user rights first with the 1886 Irrigation Act (Teklaff 1972) and, more recently, under the 1989 Water Act. New South Wales has abolished common law riparian rights through the Water Management Act 2000. Rights to the control, use and flow of groundwater now vest in the state. In California, the courts have clarified in recent (2000) litigation that the state does not have an ownership interest in groundwater belonging to overlying landowners, yet the "non-proprietary, regulatory" interest the state has been acknowledged to hold empowers it to "make water policy that preserves and regulates" groundwater and brings its development and use under state control (*State of California v. Superior Court* (2000) 78 Cal.App.4<sup>th</sup> 1019, 1027). Elsewhere in the Western USA, groundwater resources have been brought under state control through the *public trust* doctrine devel-

oped by the courts of law (Burchi 1999). The *public trust* concept, whereby water is held by the state in trust for the public, has been borrowed by South Africa's 1998 National Water Act, whereby all water resources, including groundwater, have been effectively brought under government disposition and control.

The logical consequence of vesting groundwater ownership, superior user rights or public trusteeship in the state is that only use rights may accrue to the owner or occupier of the overlying land. These rights are granted by the state in the form of licences, permits, authorizations or concessions, and the state may, in the public interest, limit them, or subject them to terms and conditions, with a view to preventing the depletion of the resource.

In some of the countries just mentioned this action has collided with the well established principle, sanctioned in the national constitutions, by which private ownership is inviolable and any taking of private property must be accompanied by the payment of compensation to the owner. A challenge to the vesting of groundwater in the state public domain by the 1985 Water Act was rejected by the Spanish Constitutional Court in 1988, on the grounds that groundwater extraction must be regulated in the general interest, and that the 1985 Act granted to the holders of registered rights over formerly private groundwater protection against any newcomers and against the administration itself (González Pérez 1989, Menéndez Rexach 1989). Similar challenges of unconstitutionality have been consistently rejected by the courts in Arizona and New Mexico (USA), as legislation both states had adopted in the early 1980s to replace the rule of capture with a permit system of groundwater extraction and use was challenged on takings grounds (Burchi 1999). Italy's 1994 Water Act also survived scrutiny by the courts on a takings case challenging the statute's provisions transferring ownership of all groundwaters to the state.

Consistently, it would appear, challenges of unconstitutionality and attendant compensation claims have failed, and the new regulatory legislation has been upheld by the courts. All the same, experience shows that the risk of collision is real. Surely this risk, and the prospect of mass-scale claims of compensation on grounds of takings of constitutionally protected private property rights, plays a role in the apparent fail-

ure so far of countries like India and Pakistan to come to grips, through the policy- and law-making regulatory process, with the widespread and mounting overdraft of groundwater resources in the two countries.

#### 4 THE REGULATORY FRAMEWORK OF GROUNDWATER MANAGEMENT AND OF GROUNDWATER USER RIGHTS

##### 4.1 *The Permit System*

As a result of the government becoming the owner or trustee of a nation's groundwater resources, the abstraction and use of groundwater are subject to a permit by the competent water administration –or by the courts in some of the Western USA. A permit is not required when a land owner extracts a limited quantity of the resource, such as in the case of Spain, or when the water is put to use for limited domestic, irrigation and livestock watering purposes (Australian States of Victoria and New South Wales).

Permits are granted upon an application that undergoes close administrative scrutiny and, normally, a public review process during which those who might be adversely affected by the intended use are called to express their opinion. Permits have a limited duration and are subject to terms and conditions as to the quantity of groundwater that may be abstracted and the rate of abstraction, amongst other things. An important requirement under a permit is that information should be provided to the water administration. Permits are reviewed periodically and may be reduced or forfeited for non-use, or adjusted to changing circumstances, as reflected in a water resources plan, or forfeited to re-allocate the water to other users. An entitlement to compensation arises whenever a permit holder is dispossessed of his/her right, or part thereof, through no fault of his/hers, except in cases of *force majeure*. A permit may also be suspended or forfeited when the holder fails to pay water charges, or violates the conditions attached to it or legal provisions. Failure to obtain a groundwater permit normally entails the application of an administrative fine, or prosecution before the courts and the application of penal sanctions. In Israel, the sanction may even consist of the imprisonment of the offender, in addition to the sealing of the well (Burchi 1994).

The legislation introducing a permit system may encounter resistance from the user community, which is inclined to see the administrative interference that system implementation entails as a restriction to individual freedom. For this reason, the legislation tends to recognize and protect existing groundwater uses, and to require adjustment to the new legal *régime* over a period of time. Much debated transitional provisions in the Spanish Water Act allowed users of private groundwater under the previous *régime* to register their water rights with the competent basin authority within three years from the entry into force of the Act, and to continue to use the water for a period of fifty years, enjoying thereafter priority when they applied for a concession under the Act. The New South Wales Water Management Act 2000 provides for a smooth transition from licences granted under the Water Act 1912 to the new system of licences. Mexico's National Waters Act, 1992 made registration of existing rights and claims mandatory, under a stringent deadline. These deadlines were later relaxed twice, and such relaxation and a more user-friendly approach overall resulted in the eventual success of the registration programme called for by the Law, which ended up taking much longer than had been anticipated by the drafters of the Law.

A paramount concern underpinning groundwater permit systems is the security of tenure of groundwater rights, which is an incentive to invest in the efficient use and conservation of groundwater resources. In response to this concern for security, legislators tend to indicate in a manner as clear as possible, the duration for which a groundwater use permit may be granted and the circumstances under which a permit may be suspended or revoked. Appeal mechanisms are normally made available under the legislation in the event of dissatisfaction with administrative decisions to grant – or not to grant – a permit, and compensation is provided for whenever a variation downward, or the revocation of a permit, becomes necessary in view of changes to the provisions of a water resources plan, or of the need to re-allocate the water to other users. New South Wales offers an example of how these issues tend to be addressed: water licences have now a longer duration than under the Water Act 1912, and the licence holder is entitled to compensation when the licence is cancelled due to no fault of his/hers. This enti-

tlement was not contemplated by the Water Act 1912 (NSW Department of Land and Water Conservation 2001). Finally, the registration of permits with the government water administration provides certainty as to the existence of the groundwater rights acquired under them, and allows permit holders to protect such rights against any claims by later applicants.

Clear and secure groundwater rights are also a must whenever legal systems allow water markets, such as in the case of the Western USA, Australia, New Zealand, Mexico, Chile and Peru. Groundwater markets may offer a solution to the waste and overuse of the resource, as they provide an incentive to use it efficiently and conserve it in order to obtain a profit from its sale. However, in the absence of regulation markets may also have negative social, environmental and third-party effects, as they may result in rural communities being deprived of the water out of which they make a living on the one hand, and in uncontrolled population growth in large cities on the other. Therefore, although with a few exceptions of which Chile is an example, water rights markets are normally subject to administrative control (Solanes 1999). Under the Mexican National Waters Act, water rights transactions are subject to authorization by the National Water Commission whenever a transaction is likely to affect the hydrological conditions of a basin or aquifer, or when it adversely affects third parties (Garduño 1999). Groundwater rights, however, have been overallocated, so that withdrawals exceed the natural recharge capacity of aquifers and markets do not offer a solution to groundwater depletion (Kemper 1999).

#### 4.2 *Responding to/anticipating overdraft: declaration of areas subject to special protection measures*

When the risk of depletion from the intensive use of groundwater so warrants, legislation tends to empower the competent authority to designate special groundwater control, management or conservation areas where more stringent restrictions than those available elsewhere may be imposed on the rights of groundwater users, or where the granting of new permits may be subject to severer tests than elsewhere.

In Spain, recent legislation contemplates the declaration of special groundwater control areas

within which withdrawals may be limited or *frozen* pending the adoption of a recovery plan for the aquifer. The mechanism adopted by Spain, which contemplates the participation of the users, is illustrated briefly in Box 3.

Box 3. Spain: A new legal framework for overdrafted aquifers.

Through amendments to the Water Act of 1985 (Law 46/1999 of 14 December 1999 since replaced by the consolidated text approved by Royal Legislative Decree 1/2001), Spain has introduced a new legal framework for overdrafted aquifers.

The basin authorities are empowered to declare an aquifer, or part thereof, as overexploited or at risk of becoming so. This declaration, which may intervene either upon the proposal of a users' community or *ex officio*, triggers the formulation of an aquifer management plan setting out measures for the recovery of the aquifer, including the metering of abstractions.

Pending the adoption of a plan by the competent basin authority, restrictions may be imposed upon existing groundwater abstraction rights so as to reduce the volume of withdrawals, and new applications are not entertained. Reportedly, the power to declare overexploited aquifers *ex officio* has not been exercised frequently so far, largely due to the fact that the main concern of the governing boards of the basin authorities, which are under strong political influence, is to preserve economic interests rather than the interests of future generations (Moreu 2001).

The new legislation has placed groundwater users under an obligation to establish a users' community in the case of declaration of an overexploited aquifer. Failure to form a community within six months from the declaration results in the establishment of such a community at the initiative of the basin authority. The legislation provides for agreements between the users' communities and the basin authorities for effective policing of the abstraction and use of groundwater. These agreements may provide for the replacement of individual groundwater abstraction rights with communal abstraction rights (Moreu 2001).

A similar approach is also reflected in the new Water Management Act of New South

Wales (Australia), as shown in Box 4. Equally in France, under pressure from increasing groundwater use, particularly for irrigation in the Poitou-Charentes region and in the Garonne basin, the Water Act of 1992 has attracted all wells and groundwater extractions in areas designated by the *préfet* as *chronic groundwater shortage* areas within the scope of permit requirements, regardless of the amounts of water which are extracted. Elsewhere in the country, no or differentiated requirements would apply depending on the amounts of groundwater which are extracted. In Wyoming (USA), where groundwater extraction and use are governed by prior appropriation, *control areas* can be established where applications for new groundwater extraction permits are no longer granted as a matter of course, but may be approved only after surviving a string of tests, hearings and reviews. The control area mechanism is provided for by the legislation in force in the majority of the Western States of the USA.

Under the legislation presently in force in Namibia, which dates back to 1964 and which is due for reform in the near future, groundwater protected zones have been proclaimed in respect of large aquifers. In many of these areas the national water company NamWater has production boreholes. Farmers in those same areas have agreed to be compensated, in cash or in-kind, in case their own boreholes run dry. In-kind compensation consists of the deepening of existing boreholes, or connecting to piped water supply lines.

It is worth noting that in all the examples just cited, the users, whose groundwater extraction rights undergo limitations in the interest of the recovery of the resource, play a paramount role in the determination of the measures to be introduced (see also Section 5.2).

#### 4.3 Implementation and enforcement of regulatory legislation

Implementation and enforcement of general permit requirements and of specific additional or alternative restrictions targeted to the recovery of overdrafted aquifers are critical to the effectiveness of the legislation and to its ultimate credibility, let alone to the achievement of the groundwater management objectives underpinning such legislation. The litigation of determinations made by government under the authori-

ty of groundwater regulatory legislation, and the number of successful prosecutions of violations of such legislation, are reliable indicators of, respectively, the implementation of such legislation and of its enforcement, and the vigour with which both are pursued. For instance, intense litigation has been reported in connection with permit determinations made to curb groundwater exploitation in the intensely irrigated areas in the Paris basin, in Central France, in the Poitou-Charentes region and in the Garonne river valley. Such litigation attests to the vigorous implementation and use by government of the regulatory tools provided by the groundwater legislation. Information on litigation and on prosecutions under regulatory water resources legislation in general, and under groundwater resources legislation in particular, is, however, sporadic, and the un-availability of systematic surveys precludes drawing credible conclusions of general import on this delicate issue.

## 5 ENHANCING THE RESTRAINING POTENTIAL OF GROUNDWATER USER RIGHTS

### 5.1 *Enhancing the quality of governmental groundwater-related permitting: water resources planning*

Water resources planning is becoming ever more an essential tool for the integration of development and management measures, including water pollution control, into a formal instrument which is adopted in a transparent manner after consultation and with the participation of water users and stakeholders. Water legislation normally does not provide for groundwater resources planning as such, but may indicate the aquifer –like the river basin– as the unit for planning purposes. The French Water Act of 1992, for instance, regulates general water resources plans (*SDAGE*), and detailed master plans covering specific basins, sub-basins or aquifers (*SAGE*). Measures for the protection and recovery of aquifers may be taken on the basis of the latter plans, and the plans become a useful parameter for the allocation of groundwater among competing users. Basin plans under the Spanish Water Act are also formed with the participation of users, and provide for standards of priority and compatibility of uses, for the establishment of protection zones and for the introduction of measures to

recover affected resources, amongst other things. Concessions issued by the basin authorities must be consistent with these plans. Both the French and the Spanish water plans are binding on the government water administration. As a consequence, permit decisions may be challenged before the courts if they are inconsistent with planning provisions. In France, for instance, a legal challenge was brought against the grant of a permit for the extraction of groundwater for industrial use from an aquifer which the relevant *SDAGE* (for the Seine-Normandie region) had reserved for drinking water use. The decision was quashed by the court and the permit withdrawn.

Also in Texas (USA), legislation passed in 1997 instituted a complex water planning system at regional and at the state level and gave the planning determinations a binding effect which they did not use to have under previous legislation. As a result, actions by, among others, the Groundwater Conservation districts must conform to the adopted plans. However, as noted earlier, the regulatory authority of such districts –and of Government outside such districts– in relation to groundwater extraction and use is severely restricted by the prevailing *common law rule of capture*. As a result, the impact of planning determinations on the allocative decisions made by the landowners is speculative at best (Burchi 1999).

Irrespective of water resources planning as a normal function of water administration, legislation also intervenes, in some cases, to introduce specific or contingency groundwater management plans providing for measures that would otherwise not be applicable. In Uruguay, for instance, a master plan for the management of the Guarani aquifer at the national level was approved by decree in the year 2000, although planning is not contemplated in general terms by the Water Act. The master plan empowers the government to grant groundwater abstraction and use permits under conditions more stringent than those attached to permits for groundwater abstraction elsewhere.

### 5.2 *Participation of groundwater users in decision-making*

Recent water legislation tends to promote the participation of groundwater users in decisions affecting their rights and expectations. Such par-

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ticipation is at the root of a better understanding of the problems arising in connection with the overexploitation of groundwater, leading to the acceptance of measures and restrictions that would otherwise be unpopular.

Legislation recently enacted in Spain has made the formation of water users' communities mandatory in the case of overdrafted aquifers so declared by the basin authorities. Together with the basin authorities, the communities participate in water management and, in particular, in the administration and policing of groundwater abstraction rights (see Box 3).

Since 1995, a number of *Groundwater Technical Committees (Comités Técnicos de Aguas Subterráneas -COTAS)* have been established in Mexico under the auspices of the *Comisión Nacional de Aguas (CNA)*, to allow the participation of users, together with federal, state and local agencies, in the formulation and implementation of programmes for aquifer preservation and recovery and of groundwater regulations, amongst other things. Although the establishment of these committees is not contemplated in the 1992 National Waters Act, the Act stipulates freedom of association for those intending to jointly develop and use water resources (Garduño 1999). The status of the COTAS is unclear, particularly where it concerns their legal configuration, tasks and autonomy in relation to the Federal Government. The COTAS are consultative organizations, the decisions of which may –or may not– be taken into account by the CNA. Against this backdrop, in the state of Guanajuato, where groundwater overdraft is particularly severe, the COTAS have been promoted with enthusiasm, and are considered as fully-fledged users' organizations canvassing all groundwater users and stakeholders within an aquifer. In substance, the COTAS are being viewed in Guanajuato as user-level management institutions. The issue of their legal status remains to be resolved, and this is a key requirement if the COTAS are to become responsible for regulating groundwater extraction, as has been recently recommended (Wester *et al.* 2000)<sup>1</sup>.

<sup>1</sup> A solution to the problem of overextraction could be to grant a concession for a whole aquifer to the COTAS. The COTAS would become responsible for ensuring that withdrawals do not exceed the sustainable yield of the aquifer, under the overall supervision of the CNA, the State Water Commission and the competent River Basin Council.

Box 4. Australia: the management of aquifers under stress in New South Wales.

A number of groundwater systems in New South Wales (NSW) are overexploited or at risk of becoming so. The Namoi system offers the most extreme example of overallocation, as a large number of licences that are unused (*sleepers*) or only partially or occasionally used (*dozers*) could become active, thereby creating conflicts among competing demands. Another aquifer at risk of depletion is the Great Artesian Basin (GAB), which underlies the Northwest of NSW and large areas of Queensland, South Australia and the Northern Territory.

Following the publication, in 1996, of a *National Framework for Improved Groundwater Management in Australia*, the NSW Government issued the *State Groundwater Framework Policy* in 1997, and announced that committees would be set up to develop groundwater management plans, amongst other things, even in the absence of a legal framework for their formation. Two groundwater management committees were formed for the GAB, one to devise management strategies within NSW, and the other to negotiate inter-state commitments to the management of the aquifer. Both committees are made up of government and user representatives.

It was clear by then that new legislation was needed to replace the obsolete provisions of the Water Act 1912. Between 1998 and 2000 a number of discussion papers, a white paper and a draft Water Management Bill were widely distributed and public comments sought. The Bill was extensively debated in Parliament (S. Smith 2000), and was enacted in 2000.

The Water Management Act 2000 requires that in allocating water resources priority be given to water sources, including surface and groundwater systems, under environmental stress. These sources are to be classified according to their level of stress, risk and conservation value by December 2001, and this classification determines priorities for management activities. To protect groundwaters that are classified as being under environmental stress, the Minister has the power to declare groundwater management areas

and to establish groundwater management committees to advise him on the necessary measures. The government, the local councils, the water users and the interest groups present in the groundwater management areas so declared must be represented in the groundwater management committees.

Amongst other things, the committees are responsible for developing draft aquifer management plans in consultation with the community. These plans undergo a public review process and are approved by the Minister. Once approved, they have a 10-year duration, are subject to mid-term review and audit, and are binding upon the public authorities and the water users.

One of the main components of an aquifer management plan is the Bulk Access Regime (BAR), i.e. sharing rules that determine how much water will be available for extraction by licenced water users. The Act provides for compensation to be claimable by a licensee when the BAR is modified to his/her detriment during the term of the plan. In addition to the measures necessary for the protection and rehabilitation of an aquifer, a plan may provide for the identification of those activities which, by interfering with the *régime* of an aquifer, are subject to an *aquifer interference approval* under the Act.

As to the allocation of groundwater to different users, the Act introduces a dual system of water access licences and water use approvals. While a use approval refers to the hydraulic works or to the water use as such, an access licence entitles its holder to a share in the water available in a specified aquifer (*share component*) and to extract the water at a given time and locations, in specified quantities and in the respect of specified conditions (*extraction component*). The access licence has a duration of 15 years (20 years for water utilities) and is a tradable commodity.

The implementation of the new licencing system is expected to start before the end of 2002. In the transitional period, licences granted under the Water Act 1912 will remain valid. Their holders will then be given preference over applications for new licences (NSW Department of Land and Water Conservation 2001).

Groundwater management committees have recently been formed in Australia to draw up plans for the sustainable management of the aquifers most at risk of overexploitation (NSW Department of Land and Water Conservation 1998). The situation in New South Wales is outlined in Box 4.

In the High Plains Underground Water Conservation District of Texas, the participation of the private sector, together with government, in the development of management measures for the Ogallala Aquifer has arrested the decline of the aquifer (see Box 1). In the groundwater management districts of Kansas, also, land owners and water users are represented in the management bodies and participate in management decisions. The districts have been vested by State legislation with considerable powers. Amongst other things, they may adopt, amend and enforce groundwater conservation and management policies, hold and sell groundwater rights, levy water charges, recommend regulations, and recommend the establishment of intensive groundwater use control areas where full regulatory powers may be exercised by the state authorities (Burke & Moench 2000).

Box 5. The contract for the *nappe astienne* (Hérault).

The *nappe astienne* (Hérault) contract, made in 1997, aims at preventing saltwater intrusion in the aquifer, at ensuring a steady supply of water in the area, at checking the loss of water due to artesian pressure and to leaky piping systems, at controlling faulty boreholes and at ensuring that all new boreholes comply with good engineering practice. The overall goal is to improve the general conditions under which groundwater extraction is carried out, without, however, impairing the more than 600 boreholes and wells in existence or the 4.6 Mm<sup>3</sup> of groundwater extracted annually. No action with a view to remedying the sub-standard quality of interconnected surface waters is contemplated by the contract either (Billet 2001).

The public/private sector partnership, and water users' ownership of decisions, underpin France's innovative use of contractual instruments for the management of aquifers under stress. The contract between government and groundwater users (*contrat de nappe*) is seen

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and used as an instrument binding groundwater users to remedy the vulnerability of an aquifer to overexploitation or pollution, by adopting such aquifer management measures as are agreed to among them and with government. The contract aims at integrated management, canvassing the dynamics of a given aquifer and the users' population dependent on it. However, *groundwater contracts* fall short of curtailing existing groundwater users' rights (see Box 5)

Finally, the participation of users in groundwater management is already part of the tradition of a number of countries, even in the absence of legislation on the subject. In Yemen, for instance, local communities manage water supply systems, and a few have implemented schemes to protect groundwater used for drinking purposes from intensive agricultural use. In Gujarat, India, there is a large farmer movement based on hindu tradition to recharge dug wells in hard rock areas (Burke & Moench 2000). Where this type of involvement exists, legislation cannot avoid taking it into consideration, and absorbing it into formal management mechanisms.

## 6 INTERSTATE COOPERATION IN FEDERAL COUNTRIES

Management of groundwater resources straddling the border between or among state or provinces in a federal country can posit issues of coordination or harmonization of the groundwater policies and legislation of the concerned states or provinces, with a view to the integrated and holistic management of the resource. These issues tend to be addressed through inter-state or inter-provincial agreement, exceptionally through litigation before the country's Supreme Court.

In Australia, for instance, steps have been taken towards inter-state cooperation with a view to arriving at common or harmonized groundwater management measures. A remarkable effort was made in this direction through the conclusion, in 1985, of a Border Groundwaters Agreement between the Australian states of Victoria and South Australia, which share important groundwater resources that were under a threat of depletion due to competing withdrawals on both sides of the border. The Agreement provides for an interstate technical

committee to undertake periodical reviews of the state of the resources within the designated area and recommend the necessary measures. This arrangement seems to function effectively, in contrast with the difficulties generally experienced in the management of shared surface water resources. This is due to the fact that informal technical cooperation between the two states had been established before the conclusion of the Agreement.

In the USA, a number of Supreme Court decisions have laid the foundations for increased federal involvement in groundwater management in the absence of interstate agreements, based on an expansion of the reservation doctrine so as to include groundwater. In *Cappaert v. United States* (426 U.S. 128, 48 L. Ed. 2<sup>nd</sup> 523 96 S.Ct.2062, 1976), the Court asserted that "the United States can protect its water from subsequent diversion, whether the diversion is of surface or groundwater" (Z.A. Smith 2000). In *Sporhase v. Nebraska* (458 U.S. 941, 102 S.Ct. 3456, 1982), the Court opened the door to federal control over groundwater on non-federal land by finding groundwater an article of commerce, therefore subject to federal regulation under the commerce clause. The Court noted that the multistate character of the Ogallala Aquifer called for "a significant federal interest in conservation as well as in fair allocation of this diminishing resource", and affirmed that groundwater overdraft "is a national problem and Congress has the power to deal with it" (*ibidem*).

Besides general issues of coordination and harmonization of policies and legislation across state borders, the fact of groundwaters straddling the border between two or more states or provinces within a federal country can be the source of legal complications if the ownership or regulatory *régimes* are different across such state borders. Such different *régimes* reflect obviously different management policies, which impinge however on one and the same resource. This may be under intense pressure on one side of the border where private ownership controls groundwater extraction, while on the other side regulatory controls may be in effect, the impact of which is obviously undermined by the lack of the same controls across the state line. For instance, the Ogallala Aquifer is the most important water-bearing formation of the High Plains regional aquifer in the Central-Western USA, which underlies the States of Colorado, Kansas,

Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. Low precipitation, limited surface water resources and intensive agricultural use have been at the roots of a steady decline, which has prompted the creation of groundwater management districts in most of the concerned states to control extraction. Land owners and water users are represented in the management bodies of the districts and participate in decision-making.

While groundwater management districts in Colorado and Nebraska have broad regulatory powers, ranging from the formulation of management plans to the power to set pumping limitations and well spacing rules, and to the power to reject applications for new wells, the authority of similar districts in Texas is limited because the rule of capture prevails, although good results have been achieved in the state with regard to the protection of the aquifer (see Box 1).

## 7 CONCLUSIONS. CHALLENGES AND OPPORTUNITIES

Private ownership of groundwater carries a built-in incentive to extract as much groundwater as is possible under the prevailing circumstances of the technology and the economics of drilling and extraction.

The comparative analysis of the groundwater legislation passed in recent times in different countries suggests that groundwater is fast losing the intense private property connotation it has traditionally held and that individual rights in it no longer accrue from ownership of overlying land but from a grant of the government or of the courts. The public domain status of groundwater underpins the usufructuary nature of individual groundwater rights and the authority of the Government to grant such rights.

Vested private property rights in groundwater need to be accommodated by new legislation, with the available case law suggesting that compensation claims are most unlikely to succeed.

Regulated rights in groundwater provide the regulator with the flexibility needed to adjust allocation patterns to changing circumstances, to restrain the mining of groundwater and to practise the conjunctive use of surface and underground water, without detracting from the

security of tenure which is desirable for investment decisions.

Groundwater legislation of recent vintage seeks to enhance the quality and effectiveness of governmental permit determinations and of relevant prescriptions and restrictions through groundwater planning mechanisms and users' participation in groundwater extraction decision-making and policing.

Clearly the way forward lies in the further erosion of private ownership of groundwater or, where it is politically acceptable, the overhauling of it and the vesting of it, or of some equivalent legal status, in the state on behalf of the public. In parallel, particularly in situations of overdraft, it is difficult to find substitutes for regulation by government. What is less clear is where the *right* balance should be struck between private ownership and government regulation, in situations where private property values are hard to die and a clear case for overdraft has been established. Also, a functioning government and judiciary are central to the effectiveness of regulation, as measured by implementation and enforcement of the same. In situations where either or both are weak or unavailable, the answer probably lies in alternative, local-scale control by concerned groundwater users, constituted as formal groups under statutory law or also as informal groups under customary law and practices. Regardless, direct users' responsibility in the management of discrete aquifers under stress is an option in the direction of user ownership of hard decisions. Direct allocative authority by users' groups acting under a bulk grant and delegation from government, and the exercise of delegated policing authority, are specific options worthy of being explored.

The issue of balancing private ownership of groundwater and government regulation of extraction and use can become intractable when different legal approaches exist on different sides of an inter-state border in federal countries, with the rules prevailing in one state spreading overdraft conditions across the border in respect of a common aquifer. No alternative exists in these instances to a negotiated solution through inter-state agreement or to a court-arbitrated solution as a result of inter-state litigation before the country's supreme court, underpinned by the available body of international water resources law.

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