Water flowing under the law

Laster R., Gat J., Livney D.

in

Hamdy A. (ed.), Monti R. (ed.).
Food security under water scarcity in the Middle East: Problems and solutions

Bari : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 65

2005
pages 123-132

WATER FLOWING UNDER THE LAW

R. Laster*, J. Gat and D. Livney*****
* Faculty of Law, The Hebrew University of Jerusalem, Israel. E-mail: richard@laster.co.il
** Weitzman Institute of Technology, Rehovot, Israel. E-mail: jgat@bgumail.bgu.ac.il
***Laster and Gouldman Law Firm, Jerusalem, Israel. E-mail: livney@gezer.org.il

SUMMARY – Like a bridge over troubled waters, the law can act to soothe disputes over water use. That, in fact, is the genius of the law in democratic countries. Water law is that compendium of rules that protects natural resources as it provides man with a life force. When used wisely, water law can be a tool for understanding and well being; when ignored, a blunt instrument of deprivation.

Keywords: hydrology, riparian rights, prior appropriation, drainage boards, Master Plan, river basin commissions, integrated water resources management

1. INTRODUCTION

The supply of clean and readily available water is one of the most basic needs of any population and, as such, a ready spark for rivalry, dispute and conflict when in short supply. Like a bridge over troubled waters, the law can act to soothe disputes over water use and misuse.

The law at its best is an important mechanism for protecting the weak and under-privileged, defending the innocent and compensating the injured, restoring the just balance within the community and insuring its future. Water law is that compendium of rules that also protects the natural resource while justly providing man with a life force.

Water laws must flow with the rules of hydrology and should act within the framework of the natural water cycle. Throughout history, however, man has violated the flow of the water cycle, often aided by unwise laws, and this has led to water regimes that are unhealthy environmentally, inefficient economically and prejudiced socially. Water scholars today are in agreement that water law must be guided by the logic of the water cycle and that it cannot be constrained within artificial boundaries. This is true within a sovereign nation where surface and groundwater cross a political divide, as well as between countries sharing a water source that crosses national boundaries.

In order to prove the hypothesis set out above, we will first introduce the regional water cycle, its problems and projected developments to insure adequate and sustainable water supply for all stakeholders. Following that, the existing legal and administrative framework will be reviewed, with some suggestions how best to harness it to the task ahead.

In order to prevent water conflicts from developing into physical contact, societies developed legal norms to channel the conflict into a public forum – often a court of law. These norms evolved over time into the water law principles as we know them today. As the world's water supply decreases and scarcity increases, these principles are constantly being adjusted. This article makes the argument that water law must flow with the hydrological cycle and a cultured forum for debate should be established to pre-empt conflict rather than "manage" it.

2. THE NATURAL WATER CYCLE UNDER DIFFERENT CLIMATE REGIMES

The lands lining the eastern shores of the Mediterranean Sea are notoriously deficient in water, with a long rainless summer season, a marked geographic disparity of rainfall between the north and south as well as between the highlands and low lying areas. Climate ranges from temperate or semi-arid in the north to arid in the south and the inland valleys. There is only one major river system along the Rift Valley (the Jordan River) with more minor perennial rivulets draining into the coastal plain.

Occasional transient flashfloods during the rainy season are particularly notable in the drylands. Groundwater, the other major source of water, also originates primarily along the mountainous backbone of the regions and drains into more arid areas.

From the dawn of history the pattern of human settlements was influenced by the availability of drinking water, with the location of preferred sites near the emergence of springs, along the course of a river, or wherever shallow dug-wells encountered fresh underground water. As a rule, this dictated rather low-lying locations far away from the headwaters of the hydrological systems concerned, including places to which water could be conveyed by gravitational flow in aqueducts. Where security or other reasons dictated settlements near the mountain tops, these had to evolve elaborate storage facilities for the seasonally occurring rainfall.

As long as the scale of settlement was modest the natural river flow served as a cleansing tool that ensured a continuous supply of reasonably clean waters. As communities grew in scale, conflict among users erupted between those living on the riverbanks, the *riva,* which led to the term rivals, or rivalry, meaning those in conflict.

The increase and spread of anthropogenic activities, which were made possible by the advent of mechanized pumping and deep drilling techniques, resulted in changes in land use including on or near the influx areas of the water supply systems, e.g. the headwater of rivers or the groundwater recharge sites. Thus more and more of the sources of clean freshwaters were invaded by salinity and other stressful and hazardous components. Groundwater was once thought to be relatively immune to deterioration when compared to surface waters, thus constituting a safe reserve for freshwater supply. In reality, it just takes a little longer before the full impact of the deterioration of the aquifers becomes apparent.

The availability of adequate freshwater of appropriate quality has become a limiting factor for development worldwide. In the more humid regions the major concern is the deterioration of water quality due to pollution inputs. In the semi-arid and arid regions, where water scarcity was always a dominant problem, the interference with the natural system as a result of over-exploitation of both surface and ground waters and the effects of changes in land usage on the groundwater recharge and surface drainage fluxes has a dual effect. Not only does the water quality deteriorate due to pollution from urban, industrial and agricultural practices, but there is also a build-up of salinity in the soil and water resulting in further worsening of the water scarcity.

One needs to recognize some basic differences between the natural water flow scheme through the atmosphere/land-surface/plant-cover interface under different climate settings. One should note, among other effects, the different role of the surface runoff on the groundwater recharge flux. In the more humid regions both the transpiration and the runoff detracts from the groundwater recharge; in the semi-arid climate zone where there is a reasonably developed soil and plant cover but a less favourable water balance, the major factor regulating the groundwater recharge flux is the soil-water balance, which is dominated by the evapotranspiration flux, leaving only the excess of the precipitation input to recharge the groundwater. Surface runoff is normally minor and of secondary importance, unlike the situation in more humid regions. In contrast, in the arid zones the rainfall amounts fall short of the water deficit in the surface layer and any substantial groundwater recharge can take place only following the accumulation of water at a potential infiltration site as a result of surface runoff (Schoeller, 1959). It therefore follows that the sensitivity to pollution of groundwater by any surface-accumulated material is not the same under these different hydrologic regimes, and any development scheme must take cognizance of these factors, as discussed below.

In spite of the sparse vegetation, ecology and hydrology are also closely linked under dryland conditions (Gat, 2002). Obviously the availability of water, in time and space, dictates the extent and nature of the vegetation cover; the latter, due to its influence on the surface water balance, the surface morphology and the stability of the soil cover, in turn controls the hydrological pathways of the incoming precipitation, in particular the relative magnitudes of the surface runoff and the evapo-transpiration losses. These together determine whether there is an excess of water for deeper percolation and for the formation of reserves for the dry period, which are the basis for the survival of perennial plants. One has to realize, moreover, that the inherent salinity build-up under an evaporation-dominated hydrological regime exerts the ultimate control on the survival of the biota.

Occasional water excesses for flushing the accumulated salinity are then necessary for maintaining the natural equilibrium in the arid system.

The important role of surface and sub-surface runoff from less arid border regions on the water supply in the downstream arid zone cannot be over-emphasized. In addition to their direct utilization, they play a role, through bank infiltration, as a supplier of water to shallow groundwater pockets (as exemplified in the Nile Valley). As a recipient of drainage streams and as a flushing agent, these large fluxes of water also add to the preservation of the quality of water and soil.

Based on this scenario, it is evident that in the more humid zones the preservation of water quality requires measures for the prevention of pollution at the source and the employment of mitigation (cleanup) practices of the water resources in-situ or prior to supply. A more holistic approach is required in the dry regions, an approach that encompasses the consideration of the natural eco-hydrological continuum as well as the totality of human activity in the watershed, as outlined below.

3. ANTHROPOGENIC EFFECTS ON THE WATER RESOURCES WITH SPECIAL REFERENCE TO THE EASTERN MEDITERRANEAN REGION

The effect of human activities on the quantities and quality of the freshwater sources, groundwater in particular, is manifold. The full impact of these effects depends on the scale and location of the interfering activity. To what extent such effects are considered beneficial or harmful depends on value judgments (for example whether conservation of the natural condition or benefit to society are rated higher) and on the socio-economic evaluation of alternative scenarios.

The first of these interferences is the result of change of land use, for example deforestation or forestation, agricultural cultivation of land; in particular by irrigated agriculture, and finally the blocking of the surface for water infiltration by urban development. The drainage of wetland and marshes is another such activity that was considered beneficial and desirable, but which later was recognized as a source for contamination of nitrates and phosphorus, as exemplified by the cases of Lake Hula in the Jordan River Valley and in the coastal plain of Israel (Ronen *et al.*, 1983). The diversion or damming of the natural water streams, including the operation of storage reservoirs, is another activity with possibly far-reaching effects on the state of the hydrologic system (Adar *et al.*, 1991), far beyond the original intention of the planner. Finally, the release or recycling of solutes, nutrients and chemicals has both direct and indirect effects on the quality and utility of the water resources.

In the more temperate regions of the area, especially the mountainous backbone along the eastern Mediterranean shores which is composed primarily of limestone, most of the incoming precipitation percolates rather rapidly into the ground. Up to 35% continues to form groundwater (Goldschmidt and Jacobs, 1958) and then emerges in springs at lower elevations. Direct surface runoff is usually only a minor component and the mostly perennial rivers that then drain into the coastal plain and the sea are fed by these springs. The extraction of water from the headwaters of the aquifer and the lowering of the water table had an immediate impact, resulting in a severe reduction of the spring discharge. This, in turn, caused the riverbeds to run dry, as well as allowing saline water bodies and seawater to enter the aquifer. The latter phenomenon is most prominent in the coastal plain, underlain by a phreatic aquifer, and is accelerated by the urban development whereby part of the local direct groundwater recharge is blocked by the pavements and housing.

The effects enumerated above become noticeable much later after the dissemination of the contaminants and salinity throughout the water sources, often too late for simple remedial actions to be taken. Among the most worrisome developments is the gradual accumulation of salts and chemicals in the soil and water under fields that are irrigated with recycled waters.

Under more arid conditions, the fragile natural balance is endangered by development schemes of all types and sizes, whether agricultural, urban or industrial. This occurs in a number of counts, not the least due to the physical interference with the hydrological pathways.

Deterioration of the water quality results primarily from release of chemicals (fertilizers, sewage effluent or toxic chemicals) beyond the natural remediation capacity of the soils and aquifers. In addition, the advertent and inadvertent release of waters from large-scale development projects that

use imported extraneous waters or desalinization schemes for supplying their water demands, may overload the natural drainage channels. Since the water discharge now takes place all year around, replacing the episodic and ephemeral discharges of the natural water cycle, a profound ecological change in the drainage channels can occur, such as enabling perennial plants to take hold. Their presence at the potential infiltration sites of the winter floodwaters will then affect the water balance and, in extreme situations, may curtail the natural groundwater-recharge flux.

Given the present population distribution and the inheritance of past malpractices, both the continuous operation and any increase in activity within the framework of the existing infrastructure necessitates an adjustment of the water supply and discharge networks so as to sanitize contaminated sources or substitute an alternative water supply for those affected. However, in the planning of new development projects a more forward-looking approach is indicated, namely one which will not only satisfy the requirements of the planned operation but ensure a continuous sustainable water supply without jeopardizing the surface and groundwater systems. When applied to Israel and the Palestinian Authority, the inseparability of ground water sources and the effect of human activities both on ground and surface water require joint cooperation.

4. REMEDIAL MEASURES AND CONSIDERATIONS FOR PLANNING A SUSTAINABLE WATER SUPPLY

Due to a long period of uncontrolled operation and development, the occurrence of accidental spills, as well as natural calamities such as a consecutive drought years, many of the aquifers have deteriorated to an extent that their utilization is curtailed as a source of potable waters or for indiscriminate use for irrigating sensitive crops. Many streams and other water sources, as well as the plants and animals that depend on them, have been seriously damaged. In dealing with the situation for optimal benefits of all, one must distinguish between:

1. The present state of the aquifers and other water sources and the measures to be taken for their remediation,
2. The operational changes to be introduced into the present system in order to prevent further harmful effects,
3. The planning of future developments in a sustainable manner.

All of these require, first and foremost, a detailed monitoring of the “state of health” of the aquifers and other water sources (a baseline study) in order to identify the problem sites. Secondly, as complete as possible a hydrological model of the aquifers is required, including the transit times and mixing and flow patterns, in order to be able to predict the future dissemination of the salts or pollutants under different operational scenarios.

Possible strategies for dealing with the deterioration of the water quality can then be considered. The water requirement of all users can obviously be satisfied by proper technical means such as water imports or relocations, desalinization, as well as proper prevention of pollution, remediation, clean up and recycling. However, these measures, if applied locally on an ad-hoc basis as an emergency procedure, may impose an unbearable and unjust economic burden on some of the stakeholders (who are not necessarily those responsible for the problem). Instead, the water quality could be improved by the equitable planning and sharing of the local and regional water resources based on an optimal hydro-economic scenario.

In planning for future developments, again the first stage of any rational planning scheme is the study of the natural water cycle, by following it from the precipitation input, through the partitioning into surface runoff, infiltration and groundwater recharge near the land surface and up to the discharge by surface and subsurface flow. This needs to be done both on the local and the regional scale, within the climatic and geo-hydrological context and with due regard to the eco-hydrological feedback. Special attention must be focused on the space and time variability of the precipitation inputs and its expression in the hydrological systems and on the geo-chemical interactions and natural remediation capacity in the subsurface.

The next step is to determine the *safe yield* of an aquatic system and to limit the extraction of water accordingly. Looking at it simplistically, the safe and optimal amount to be extracted should equal the amount of replenishment to the system, whether by natural or artificial recharge. Even this

basic concept is not unambiguous, however: the year-to-year fluctuations and especially drought periods need to be considered so as to prevent irreversible damage (such as by encroachment of saline water bodies, especially in a coastal setting, during low water stand) (Baer, 2002). Curtailing the natural discharge may also adversely affect downstream users. What appears to be a safe procedure for part of the system does not necessarily meet this criterion on a watershed scale. Moreover, as painfully observed in the Israeli Coastal Plain Aquifer, a geo-hydrologically closed system without outflow (where the water extraction is compensated by an equivalent input of recycled water of poorer quality) will invariably result in the build-up of the salinity. Thus one has to distinguish between a *safe yield in terms of water quantity* and a *safe yield in terms of water quality.*

Development projects, whether urban expansion, agricultural and recreational activities or industrialization, affect the natural water cycle not only because of the extraction of water in order to supply water to them and because of the discharge of salinity or pollutants in the effluent flux. They also interfere with the natural recharge or discharge pathways, due to changes in surface structure and morphology as well as by enhancement or reduction of the evapotranspiration component in the water balance. When the demand for water of whatever quality exceeds the possibilities of local supply and is satisfied by water imports, one can be faced paradoxically with an amount of water that exceeds the natural drainage and remediation capabilities, resulting in “disasters” such as flooding, soil erosion, etc.

An “ideal planning scheme” would place a new development project at a site with the least sensitivity with regards to the natural environment and in proximity to the supply of water of appropriate quality whether from local water resources, recycled or imported waters. The planning should also ensure that any harmful effluent be contained or treated with a high degree of certainty. Economic considerations that balance the conflicting claims of these different issues, such as the cost of supplying fresh water, the cost of cleanup operations and discharge schemes, as well as the cost of nature rehabilitation will usually be the deciding issue. Different schemes of dealing with pollution problems that can be considered will be discussed below. Finally a continuous monitoring network needs to be established as part of the operational scheme to verify the safety of the water supply network in the future.

A number of factors stand in the way of implementing such an idealized approach. Foremost among them are the antecedent situations and existing infrastructures which impinge on future developments. Further, socio-political constraints may have to be recognized. The best and apparently optimal scheme may not stand the test of time because of unforeseeable developments that change the physical or economic situation. For example a climate change, in particular a change of the precipitation pattern, will affect the water cycle as a whole and the availability of water resources. New technologies may change our concepts of what can or cannot be done at reasonable costs and make accepted solutions obsolete. A case in point is the reduced cost of desalinized water near the seacoast that can nowadays compete with water conduit schemes from inland water supply sources. Taking such uncertainties into account suggests flexibility in planning and management and may favour the preference of localized and relatively modest solutions to large costly schemes.

5. SOURCES OF WATER LAW

Economists and environmentalists know that man refuses to act for the benefit of a common good at the expense of his own personal gain. Some water law systems have embedded man’s natural instincts into law, for example, the Riparian Rights Doctrine and the Prior Appropriation Doctrine. Most of the western world adopted the Riparian Rights system, meaning that those living along the banks of a river have the right to withdraw water and also to pollute the source. The Riparian Rights system was, at the time of its creation, a functional system. With very few people living in the world, people came to live near a water source in order to use it. Management of water use and misuse was by conflict resolution between upper and lower riparians. Over time, however, when water sources were captured and carried over long distances this system no longer had the same importance as it had historically. This led to the second major type of water system, the Prior Appropriation system which encouraged entrepreneurial ingenuity in water rights. The first person, not necessarily the person living on the banks of the river, to make beneficial use of a water source was able to take as much as needed for the beneficial use. Junior appropriators followed suit until a water source reached its conflict level. At that point, regulators stepped in.

These two doctrines, so well ensconced in western countries, make conflict a part of the management system. Palestine, under the control of the Ottoman Empire, managed surface and ground water under a different set of principles. The Ottoman Empire was ruled under a system of law called the Magelle, which set out the basic principles of water law that were first used in Roman times. Flowing water belonged to the negative community. No one could gain possession over a river or stream and even those using wells had to allow equitable access to short-term users. Due to their mutual inheritance of the Magelle, Israel and the Palestinian Authority are not locked in an historical network of laws managed by conflict and mediation. Israel and the Palestinian Authority owe nothing to "private" owners of water which would prevent flexibility of management, environmental protection and fair allocation. Both have legislated water laws that maintain central control over all water sources and all uses including environmental protection. Yet Israel and the Palestinian Authority are caught in another web that inhibits creating a joint system of water management: the web of jealousy, fear, honour and hate, which is the cause of all conflicts.

Since a conflict resolution managerial system is not endemic in both Israel and the Palestinian Authority, water experts from both entities, not burdened by fear, jealousy or hate, can promote joint collective action. This paper will show the way to collective action by use of the "expert" approach, by calling upon drainage basin experts from both entities, working in mirror agencies, to design and implement a joint master plan for trans-boundary waters.

6. MOVING FROM CONFLICT TO COLLECTIVE ACTION

In order to avoid mistakes made in other countries, Israel and the Palestinian Authority need to create a management system that encourages collective action within the hydrological unit. Looking at other management systems in the world for inspiration, one finds an almost unanimous recommendation for integrated water resources management. In addition, Europe encourages collective action to the point where sovereignty gives way to subsidiary. Both concepts put protection of the commons above protection of the individual. Both systems encourage collective action rather than conflict resolution. For Israel and the Palestinian Authority, where conflict is a way of life, taking another tack could only improve the political climate, not to speak of the hydrological cycle.

6.1. The present regime for protecting the hydrological system

6.1.1. Israel

Israel has one of the most admired compendiums of water laws in the world. Beginning in the 1950's the Israel Knesset passed four water laws to give the state total control over all water sources. Control, not ownership. The water sources of Israel belong to the people, and the government manages them in trust for the people. In charge of this system is a water commissioner appointed by the full cabinet for a designated term, and he is given statutory powers to act using his professional judgment. In addition to the water commissioner there is a government company (Mekorot) serving as a bulk supplier of water to all towns and cities. Sewage treatment is a local or regional component of the system and the weakest link in the water management system. Drainage and run-off are handled by eleven drainage boards whose borders are drawn along catchment basin lines.

6.1.2. The Palestinian Authority

The Palestinian Water Law also recognizes the government's control over water sources allowing no private ownership of running waters. Like Israel, there is a bulk supplier of water, while distribution and sewage control are in the hands of local authorities. Unlike Israel, however, the Palestinian Authority has not created drainage boards along catchment basin lines. Instead, the Palestinian Authority intends to create a utility system with area-wide water companies owned by municipalities for water supply and sewage control. This, however, leaves the ecological aspects of streams and stream management outside the system.

During the last ten years, as Israel has slowly depleted all of its surface waters, the public has demanded more amenity uses from the remaining waters. Several crises added force to the public's demands. In the 1980's several cases of polio were attributed to sewage water in the Hadera River. In

the 1990's an Australian contingent of athletes who came to attend the Maccabi Games fell into the Yarkon River from a poorly constructed bridge. Several of them claim to have suffered severe injuries due to exposure to the polluted waters. In 2003, a government committee was set up to investigate the connection between rates of cancer in young navy "seals" and their diving in the Kishon River near Haifa. The committee produced a divided opinion but depicted in vivid terms the tenure of the river's waters and their polluted quality. These events encouraged the government to rehabilitate the Yarkon and Kishon Rivers. It also gave additional impetus to the Ministry of Environment to add environmental issues to Israel's drainage boards in addition to their powers to prevent flooding and soil erosion.

6.2. The Kidron Plan

With this momentum, the Dead Sea Drainage Board approached the Palestinian Water Authority to develop a joint master plan for the Kidron River (Hebrew)/ Wadi Nar (Arabic), an intermittent stream that flows from Jerusalem to the Dead Sea. The stream, or wadi, is dry most of the year but for the past several years has carried run-off and sewage from Jerusalem and the surrounding areas to the Dead Sea. Along its banks are historical sites and breathtaking views but due to the stench of the river, breath taking is problematic. In the past, there have been laudable plans to build joint sewage treatment plants in the Kidron hydrological basin but none of these plans were executed due in part to the lack of the joint vision and collective action. The new initiative of the Palestinian Authority and the Dead Sea Drainage Board has the advantage of putting the plan before implementation. What kind of stream do we want? What quality of water? To what quality to purify sewage? Who is best suited to receive the treated effluent? What historical sites to develop? What are the needs of the stakeholders? All these questions of water needs are to be discussed and resolved in a joint master plan.

7. WHERE DO WE GO FROM HERE? INTEGRATED WATER RESOURCES MANAGEMENT

One of the driving forces behind Europe's success in improving surface water quality is the adoption of the principle of collective action. The Rhine Commission, created over a hundred years ago, is a model of cooperative action among sovereign states. Recently Europe passed a Directive requiring catchment basin management as a rule and not a guideline for all transboundary water resources in Europe (EU Directive).

What is Integrated Water Resources Management?

Integrated Water Resources Management (IWRM) brings together all the different uses, studying in depth how they interact with one another, and deriving the optimal sustainable benefits. This includes recognizing nature's and humans' right to an adequate supply of clean water for legitimate uses, rather than the conventional approach based on historical rights or location within the watershed (upstream vs. downstream location).

Putting IWRM into practice requires a clearly delineated institutional structure that best suits the needs of the parties. These institutions can be within each country or they can be international. They may be strictly for the purpose of information collection, coordination and distribution; a full-fledged governing body; or something in between. For any institution to be effective, it must have:

- Diverse and comprehensive sources of information that are up to date.
- Logical data for determining water needs, including quantity and quality of water entering, remaining and leaving an aquifer, stream, and other water bodies within the catchment basin.
- Scientific criteria for determining water quality and quantity, and economic criteria for determining cost and income.
- An efficient forum for exchange of that information.
- Public access and involvement.
- Transparency by creating appropriate mechanisms for a public overview.

If it is a governing body, it must also contain:

- An agreed-upon charter describing its powers and responsibilities, and its decision making process. The powers include setting the quantity and quality of water entering, remaining and leaving water bodies, and deciding on the permitted uses and distribution of these waters.
- Planning and decision-making bodies.
- Enforcement mechanisms.
- Dispute resolution mechanisms.
- A source of income to carry out its activities.

All these need to be responsive to changes, whether the changes are local or regional, short or long term, political, economic, natural, or technical (for example drought years or other natural disasters, desalination and other technological developments, population increase or decrease).

To create a governing body for carrying out the above principles, both Israel and the Palestinian Authority should have back to back drainage boards or hydrological basin boards. Once created and in operative effect, the governments could then think in terms of creating an overall water management authority that would be an integrated program. This would serve as a function for future discussion, consideration, deliberation, arbitration and decision making on water issues in the region.

Israeli water law has created drainage authorities as described above, throughout the entire country. The law must be refined, however, in order to give the Israeli drainage authorities the powers described in the axioms above. As it now stands, the law gives drainage authorities power over flood protection and prevention of runoff but little power over amenity uses. The boards' statutory authority is controlled by representative of their region, and they are transparent and accountable for their actions. In 2003, two drainage boards received additional environmental protection powers under authority granted them by the Ministry of Environment. At present, one of the authorities is pursuing additional power to become a land conservation authority. This will enable the drainage board to prevent agricultural misuse of land to reduce flooding and water pollution. They are lacking, however, full panoply of powers to carry out water resources management as described above. Yet, they can still serve as a platform for joint management of a transboundary river. What is needed, however, is a mirror authority on the Palestine side. With such a mirror authority, the two authorities could then work in tandem in one of two ways, either as a river basin commission or as a joint authority.

"River basin commissions may coordinate the monitoring and research effort, add legitimacy to the monitoring and research results and in this way provide a common, generally agreed upon, factual basis for management. They furthermore offer the basin states a platform for coordinating their policy and management. River basin commissions can also prepare River Basin Management, RBM Plans, and programs, but after adoption by the commission, they still need to be adopted by the basin's countries or a "minister's conference." (Mostert *et al*., 1999) River basin commissions may also oversee the implementation of the plan's programs, but implementation remains the responsibility of the basin countries. Finally, river basin commissions can play a significant role in resolving river related international conflicts. They constitute a relatively informal forum for discussion, may help in selecting fact-finders and arbitrators or may even serve as fact-finders and arbitrators themselves. (Mostert *et al*., 1999)

River basin commissions can be organized in different ways but there is always a plenary commission, usually consisting of national representatives and meeting once or twice a year. The work of the plenary commission can be supported by working groups, project groups, and or expert groups. Moreover, the commission may have an independent secretariat in charge of preparing the meetings, publishing annual reports giving information to the public, etc. Alternatively, the secretariat function can be performed by one of the states concerned or may alternate between the member states.

River basin commissions have decision making and policing powers. They can independently adopt plans, programs and dialogue, and implement them or enforce their implementation. International river basin authorities usually have a limited scope. They usually do not deal with policy issues or with specific operations, they are just constructing and implementing joint infrastructure and enforcing shipping regulations.

The structure of river basin authorities can be the same as that of river basin commissions with a plenary commission sub-group and a secretariat…(they can also serve) as a method for cooperation between river basins, both as a form of development and cooperation and cooperation between comparable partners." (Mostert *et al.*, 1999).

8. CONCLUSION

Homo-sapiens' ability to adapt to change has enabled him to develop principles of social change in order to avoid physical combat. Laws have developed over the centuries to enable water users and mis-users to exploit water resources without causing physical conflict. These laws, however, were designed by legislators to manage a conflict and not a water source. As a result, water resources depleted in quantity and deteriorated in quality. With the evolution of environmental principles, natural systems of water flow came to the attention of legislators who developed rules for management of a catchment basin to avoid conflict rather than to manage it.

Today, these rules have broadened to include integrated water resource management, a holistic view of a catchment basin using the precautionary principle to prevent unwelcome effects of the water source on its environment and cumulative effects of the environment on the water source. How can the modern principles of water law be integrated into the management of water resources crossing the border between Israel and the Palestinian Authority? By encouraging each entity to create a catchment basin within its own territory and then create a joint commission of both authorities. It is suggested that this can be done even during a time of conflict between the two entities because the suggested platform is regional and not national in scope. Often regional interests overshadow national conflicts, especially when the local elements benefit from the suggested forum.

REFERENCES

Adar, E. M., Issar, A. S. and Gev, I. (1991), Soil salinisation process in a semi-arid wetland basin: the effect of reservoirs on a shallow aquifer, In: "*Hydrological Basis of Ecologically Sound Management of soil and Groundwater",* (H.P.Nachtnebel and K.Kovar, Ed) IAHS Publ. No.202, pp103-112.

Baer, J (2002), Opening Remarks at the Workshop on Stressed Aquifers, CWST, Ben-Gurion University of the Negev.

CWST (2001), The management of water supply and effluent discharge for urban development in the arid zone, *Report on a workshop by the Center for Water Science and Technology*, Ben-Gurion University.

Fisher,F.M., Arlosoroff,S., Eckstein,Z., Haddadin,M., Hamati,S.G., Huber-Lee,A., Jarrar,A., Jayyousi,A., Shamir,U. and Wesseling,H. (2002), Optimal water management and conflict *resolution*: The Middle East Water Project, *Water Resources Research* **38:**25-1-17.

Gat, J. R. (1972), Water Resources Research in Israel, *Bulletin of the Atomic Scientists* October 1972:24-28.

Gat, J. R. (2002), The eco-hydrological feedbacks as constraints on the development of drylands, *Ecohydrology & Hydrobiology* 2: 61-65.

Goldschmidt,M.J. and Jacobs,M. (1958), Precipitation over and replenishment of the Yarkon and Nahal Taninim underground catchment, *Hydrological Paper No.3,* Israeli Hydrological Service*,* Jerusalem.

Mostert, E., Van Beek, E., Bouman, N.W.M., Hey, E., Savenije, H.H.G., Thissen, W.A.H. (1999), River Basin Management and Planning, Keynote paper for International Workshop on River Basin Management, The Hague, 27-29 October,

Ronen, D., Kanfi,Y. and Magaritz,M. (1983), Sources of nitrates in groundwater of the Coastal Plain of Israel, *Water Research* 17:1499-1503.