Water Resources and Future Generations

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A new principle has emerged in international environmental law — the principle of intergenerational equity. By focusing on the future, the principle of intergenerational equity enables States and other actors to build mutual trust in the development, conservation, and use of water resources. Since no one actor, whether a State or other party, can alone ensure that there will be adequate fresh water for future generations, the concern for our descendants points to the need for cooperation among relevant parties. It also highlights the importance of addressing equity issues among the present generation, since all parties must be both willing and able to fulfill intergenerational responsibilities.

This article identifies some of the intergenerational water resource problems in Israel, the West Bank and Gaza Strip and Jordan, elaborates the theory of intergenerational equity and its implications for intragenerational equity, and applies the intergenerational lens to water problems in the region. Although this analysis is directed to water resources, it also applies to effectively nonrenewable resources (i.e., oil or natural gas), to water, air and land pollution, and to renewable resources, such as forests, soils or biological resources [1].

I. Intergenerational Water Problems [2]

There are three general intergenerational problems between our generation

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1 The general analysis can also be applied to cultural resources.

2 This section is based on the following book: E. Brown Weiss *In Fairness to Future Generations* (New-York, 1989) 232–246.

and future generations in the use of water resources: quality, quantity and access.

The first problem is one of degraded water quality of both surface and ground water. This can be caused by toxic contamination or by salt water intrusion, and can burden future generations. While most toxic contamination of surface water can be removed, the flushing times in lakes may be decades to a century or more [3]. The cost of removing contamination may be so serious as to make the contamination essentially irreversible. With ground water, the costs of toxic contamination may be sufficient to preclude further use of the aquifer, and therefore impose a particularly heavy burden on future generations [4].

Salt-water intrusion, caused by the pumping of ground water at excessive rates so that salt water is able to flow in and replace the fresh water, is hard to reverse at acceptable costs. Salination of ground water supplies may lead to abandoning the aquifer. Seawater intrusion has been a serious problem in recent years in coastal aquifers in Israel and the Gaza Strip [5].

Degradation of water resources can have severe adverse effects on the environment. It can damage the ecosystem and reduce the uses to which the water would otherwise be put, such as for fisheries, contact sports and recreation. Contamination can damage ecosystem services of water by killing plants, fish and other forms of animal life.

The second intergenerational problem is the depletion of fresh water resources. Technically, water is never lost, only changed in form. Nonetheless, the availability of fresh water resources in particular places or at given times is a serious problem. Often this will be a problem of higher real prices to future generations of fresh water. Pumping ground water faster than the recharge rates can lead to surface water depletion because of the hydrological links. This could, in some areas, leave once fertile agricultural areas barren and cause human populations to move. This problem is aggravated if the recharge areas of aquifers are not adequately protected.

3 *Ibid*, at p. 233; National Research Council of the United States and The Royal Society of Canada "The Great Lakes Water Quality Agreement: an Evolving Instrument for Ecosystem Management" *Great Lakes Water Quality Agreement* (1985) 47 (hereinafter: "Great Lakes Water Quality agreement").

4 *Ibid*, at p. 51.

5 National Academy of Sciences (U.S.). Committee on Sustainable Water Supplies for the Middle East *Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan* (Washington D.C., 1999) 123 (hereinafter: "Water for the Future").

Depletion of nonrechargeable aquifers also raises intergenerational concerns. Once these so-called fossil water are consumed, they cannot be replenished. Consumption of nonrenewable aquifers is a global problem occurring in the United States, Northern Africa and other parts of the world.

Because most countries do not put a price on water as a resource, other than the cost of transport and purification, ground water is often much cheaper than surface water. This increases the rate at which ground water is depleted and can raise the real price of water to future generations.

The third problem is one of equitable access to fresh water resources. Everyone needs potable water, but many people do not have it. Poor communities may suffer serious water pollution and lack potable water[6]. This condition is often passed on between generations, even though wealthier communities in the county do not suffer such problems. Climate change may have significant impacts on communities in the area of origin, and on the fauna and flora in the ecosystem, which may not be reversible. Certain agricultural practices, which export water through crop exports, may hinder equitable access too.

II. The Proposed Theory of Intergenerational Equity[7]

A. The Basic Elements

Two relationships characterize the principle of intergenerational equity: the relationship between us and past/future generations and the relationship between us and the natural system of which we are a part. As members of the present generation, we hold the Earth in trust for future generations. At the same time, we are beneficiaries entitled to use and benefit from it. All generations are inherently linked to other generations, past and future, in using the common patrimony of the Earth. As a generation inherits the rights of access to use and to benefit from the environment, it also inherits the correlative obligations to care for it.

The theory of intergenerational equity stipulates that all generations have an equal place in relation to the natural system. There is no basis for preferring the present generation over future generations in their use of the

6 The UNDP Urban Indicators Programme reports that 18.6% of people in developing countries lack access to potable water, compared to 0.4% of people in industrial countries. See UNDP, Global Urban Observatory, Urban Indicators Programme [URL:Http://www.undp.org/un/habitat/guo/infrastr.htm] (last visited on 17.4.2000).

7 See generally, Brown Weiss, *supra* note 2.

planet. This assumption is deeply rooted in international law. The preamble to the Universal Declaration of Human Rights begins, "[w]hereas recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world"[8]. The reference to all members of the human family brings all generations within its scope. The reference to equal and inalienable rights affirms the basic equality of generations in the human family.

Each generation can and should use the natural system to improve the human condition. Improvements should be conserved for future generations. If one generation degrades the environment severely, however, it will have violated its intergenerational obligations relating to the care of the natural system. In such cases, other generations may have an obligation to restore the robustness of the system, with costs distributed across generations[9]. For example, if a river or lake important to future generations is polluted due to actions taken fifty years ago, the present generation should not leave it as polluted as before. The present generation is obligated to help clean the river or lake, but could distribute the costs over several generations either through revenue bonds or other financing mechanisms. The higher income that is generated may be able to offset the costs in reversing the pollution. The anchor of a legal framework is thus the notion of equality as the norm connecting sequential generations in their use and care of the environment.

The corollary is the concept of partnership between humans and nature and between sequences of humans born. It is a partnership not only between those who are living, but also between those who are living, those who are dead and those who are yet born. The purpose of the partnership is to realize and protect the welfare and well being of every generation in relation to the natural environment. This requires sustaining the life support systems, the ecological processes, the environmental conditions, and the cultural resources that are necessary for our survival and well being and for the robustness of the natural system. We are a part of the natural system. The question, then, is how to determine what constitutes "fairness" between generations. We could attempt to imagine what environmental ethic we would espouse as members of a generation if we did not know where along the spectrum of time we are living, whether we are near the first or last generation. Presumably, we would want to leave the environment at a minimum no worse off than we found

8 Universal declaration of Human Rights, *G.A. Res.* 217A (III) (Dec. 10, 1948).

9 Great Lakes Water Quality Agreement, *supra* note 3, at p. 108.

it [10]. That does not mean that we should not use the resources at our disposal to improve our own well being, or to improve the quality of the environment. To the contrary. It is inevitable that we will change the environment as we use it, on balance, we should leave the planet no worse off than we found it.

B. Principles of Intergenerational Equity

What principles of intergenerational equity derive from the intergenerational ethic described above? Four criteria apply. First, such principles should permit present generations to use resources today, but not at great expense to future generations. Nor should present generations be required to sacrifice greatly for the benefit of future generations. Second, the application of the principles must be reasonably clear. Third, the principles cannot require that we predict the values of future generations, for we cannot. Rather we can give them the necessary materials and environments which will permit them to meet their own demands and pursue their own values. Finally, as applied internationally, the principle must be consistent with the values and cultural traditions of the different countries of the world. Application of these criteria gives rise to a set of three principles: options, quality and access.

Conservation of options can be characterized as maintaining the diversity of the resource base. The principle rests on the premise that diversity, like quality, contributes to robustness. This does not necessarily imply maximizing diversity; it requires preserving of those components of diversity that provide for maximum robustness in the system. Applied to water it means developing and maintaining options for reducing demand and increasing supply. This includes support for scientific research into more efficient methods of extraction and reuse and measures for reducing water demand. The principle of conserving options requires that, on balance, diversity of the resource base be maintained.

Conservation of quality is an obligation to preserve the quality of the environment. It requires that each generation leave the environment in no worse condition than received. Environmental degradation in one area must be balanced by improvements in another. Certainly there will be trade-offs between conservation of environmental quality and economic development, but the trade-offs must be used in a way that protects the planet for both present and future generations [11].

10 See generally, J. Rawls *A Theory of Justice* (Cambridge, 1971).

11 Great Lakes Water Quality Agreement, *supra* note 3, at p. 108.

Conservation of access gives the members of the present generation a reasonable right of access to the benefits of the environment. This right stems from the principle that each generation has the rights of a beneficiary to use a resource. It is a nondiscriminatory, equitable right. Future generations should not be required to pay an extraordinarily high price for essential resources because the present generation refuses to put a price on the resource, effectively deferring the cost of its depletion to future generations. In the context of water, it means that everyone has a right to potable water. This principle also means providing equitable access to the poorest members of the international community today to fresh water resources [12].

These principles can be translated into a set of intergenerational rights and obligations.

C. Intragenerational equity

Intergenerational equity encompasses intragenerational equity, or equity among people living today. Members of the present generation also possess rights to enjoy natural resources. These rights are associated with corresponding duties, duties that members of the present generation have toward other generations and toward members of the same generation. Poor communities often suffer a disproportionate share of environmental burdens [13]. In the urban setting, this translates into a lack of potable water, increased exposure to industrial hazards, and poor neighborhoods that are dumping grounds for toxic wastes [14]. Poverty in rural settings forces communities to exploit forests, soils, and other resources unsustainably. The rights to comparable access and to the benefits of the environment must be guaranteed to poor communities so that they can pass the environment on to future generations in a condition no worse than they received it. These rights can be partly assured through having access to information about environmental consequences and participating in decisions affecting their access and use of the environment [15].

12 Brown Weiss, *supra* note 2, at p. 45.

13 E. Benvenisti "Collective Action in the Utilization of Shared Freshwater: The Challenges of International Water Resources Law" 90 *Am. J. Int'l L.* (1996) 384, 406. (Arguing that when "negotiating a water-use agreement, [parties] should be contrained in the choice of possible outcomes by human rights considerations").

14 E. Brown Weiss "A Reply to Barresi's 'Beyond Fairness to Future Generations'" 11 *Tul. Envt'l L.J.* (1997) 89, 91.

15 *Ibid*, ibid. The Water Academy in France drafted a Social Charter for Water in connection with the Second World Water Forum, held in The Hague, Netherlands, March 17–22, 2000. The draft Charter focused on facilitating local participation in water management activities.

III. Establishment of Principle of Intergenerational Equity in International Law

Intergenerational equity is becoming part of international and national jurisprudence. The responsibilities of the present generation toward future generations have been referred to in many international instruments, most pointedly in the recent UNESCO Declaration on the Responsibilities of the Present Generations Toward Future Generations [16].

Since 1993 the issue has been discussed in the jurisprudence of the International Court of Justice. In the 1993 case of Denmark v. Norway [17], a maritime boundary delimitation case, Judge Weeramantry noted in his Separate Opinion, in the section discussing "Equity in Global Terms", that "[r]espect for these elemental constituents of the inheritance of succeeding generations, dictated rules and attitudes based upon a concept of an equitable sharing which was both horizontal in regard to the present generation and vertical for the benefit of generations yet to come" [18].

The interests of future generations also arose in the 1995 Nuclear Test Case [19], in which New Zealand sought to challenge the proposed French underground nuclear tests in the Pacific on the basis of the 1974 Judgment in the Nuclear Test Cases. While the Court's Judgment declined to assume jurisdiction since underground rather than atmospheric tests as in 1974 were involved, Judge Weeramantry's dissenting opinion observed that New Zealand's complaint that its rights are affected does not relate only to the rights of people presently in existence. The rights of the people of New Zealand include the rights of unborn posterity. Those are rights, which

16 UNESCO Declaration on the Responsibilities of the Present Generations Towards Future Generations, UNESCO General Conference, 29th Session, available at [URL:Http://www.unesco.org] (last visited on 20.11.2000). The principle has also been referred to in the Convention for the Protection of the World Cultural and Natural Heritage; The United Nations Framework Convention on Climate Change and Convention on Biological Diversity; The Rio Declaration on Environment and Development; The Vienna Declaration and Programme of Action; And the United Nations General Assembly resolutions relating to the protection of the global climate for present and future generations. *Ibid*, at pmbl.

17 *Case Concerning Maritime Delimitation in the Area Between Greenland and Jan Mayen* (Denmark v. Norway), 1993 I.C.J. 38.

18 *Ibid*, ibid.

19 *Request for Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgement of 20 December 1974 in the Nuclear Tests* (New Zealand v. France), 1995 I.C.J. 288.

a nation is entitled, and indeed obliged, to protect[20]. He noted that the "principle of intergenerational equity is an important and rapidly developing principle of contemporary environmental law which must inevitably be a concern of this Court".

In the 1996 I.C.J. Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, the Court explicitly recognized the relevance of future generations. The Court noted that the effects on future generations are relevant in applying international law. "[I]n order correctly to apply to the present case the Charter law on the use of force and the law applicable in armed conflict, in particular humanitarian law, it is imperative for the Court to take account of the unique characteristics of nuclear weapons, and in particular... their ability to cause damage to generations to come"[21]. The Court observed that the environment "represents the living space, the quality of life and the very health of human beings, including generations unborn", and declared that the "general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment"[22]. The Court reaffirmed these statements in the 1997 Danube case between Hungary and Slovakia[23].

While the Court did not pronounce upon a principle of intergenerational equity, Judge Weeramantry, then Vice President of Court, noted in his dissenting opinion that "the rights of future generations have passed the stage when they were merely an embryonic right struggling for recognition. They have woven themselves into international law through major treaties, through juristic opinion and through general principles of law recognized by civilized nations". He forcefully argued that the Court "as the principal judicial organ of the United Nations... must, in its jurisprudence, pay due recognition to the rights of future generations"[24]. Later, in a separate opinion in the Danube Dams Case, Judge Weeramantry argued that the first principle of modern environmental law is "the principle of trusteeship of earth resources" and recognized "the principle of intergenerational rights"[25]. The ecological practices of different cultures over centuries and the ingrained

20 *Ibid*, at p. 341 (Weeramantry, J., dissenting opinion).

21 *Legality of the Threat or Use of Nuclear Weapons*, 1996(I) I.C.J. 226, 244.

22 *Ibid*, at pp. 241–242.

23 *Case Concerning the Gabçikovo-Nagymaros Project* (Hungary v. Slovakia), 1997 I.C.J. 41.

24 *Supra* note 21, at p. 455 (Weeramantry, J., dissenting opinion).

25 *Supra* note 23, at pp. 102, 108, 110 (Weeramantry, J., separate opinion).

values of civilizations support both of these principles, he noted. These are the foundation of intergenerational equity.

IV. Intergenerational Lens for Water Resource Problems

It is useful to apply the intergenerational lens to fresh water resources in order to analyze the implications of the principle for fresh water resources management.

A. Applying the Principles to Water Resource Problems

Principles of intergenerational equity may assist in resolving the water recovery problems identified earlier by striking an appropriate balance between the rights and obligations of this generation and of the rights and obligations of future generations.

Application of the options principle means maintaining a diverse water supply, including both ground and surface water, and utilizing the options for reducing demand and increasing supplies. It could mean a moratorium on the mining of aquifers and tighter restrictions on the depletion of nonrechargeable aquifers. It also requires reexamining systems for subsidizing water for agriculture. It argues for reuse of water to maintain adequate water supplies.

The second principle, quality, requires further actions to avoid serious toxic and saline contamination of ground water aquifers and of surface water, where damage would be irreversible, or effectively so. The principle would require actions to prevent saline intrusion of ground water aquifers and saline intrusion of surface water from the rise in sea level. It could mean that planning for the location of dams should consider projected sea level rise to ensure that the waters downstream do not become subject to saline intrusion. In building dams, application of the principle might require removing trees in the area to be submerged under water and other measures to extend the lifetime of the water reservoir. It could also require more effective steps to prevent toxic pollution of surface and ground water.

Finally, application of the third principle, equitable access, requires that the present generation incorporate the full cost of supplying water resources, so that the real price of the water resources is not significantly higher to future generations than to the present generation. This means leveling differentials in price between surface and ground water, so as to decrease the mining of ground water aquifers. Moreover, it may lead to a right to water, defined as

a right to potable water and to nondiscriminatory bearing of environmental burdens — e.g., protection from water pollution[26].

B. Strategies for Incorporating Intergenerational Equity Into Decisions Affecting Water Resources

Many strategies are available to include intergenerational equity considerations in water resource decisions. As noted above, we need to give representation to the interests of future generations in the marketplace, in political and administrative decision making and perhaps in judicial bodies. In marketing water, the price needs to reflect full costs, including to future generations[27]. For certain issues, we may need an ombudsman for future generations[28]. Strategies that are important to implementing intergenerational equity are outlined below.

1. Monitoring. A good monitoring system is needed in order to know what water resources are available and the quality of these resources. All parts of any hydrological region need to collect data on water resources, develop common formats for collecting the data and processes for sharing or exchanging the data. Relevant data includes the amount of rainfall in the region, the amount of water consumed throughout the region, contamination of both ground and surface waters and sources of contamination and other relevant measurements.

2. Scientific and technical research. Research which would not be sup-

26 Several scholars in law and other disciplines have proposed a human right to water as part of international human rights law. See e.g., S.C. McCaffrey "A Human Right to Water: Domestic and International Implications" 5 *Geo.Intl. Envtl. L. Rev.* (1992) 1, 5–12. Although there was considerable support for this concept at the Second World Water Forum in March 2000, the Ministers at the Conference declined to do so. The right to water proposed in the present article defines the right as focused on potable water and as including the burdens from water pollution; P.H. Gleick "The Human Right to Water" 1 *Water Policy* (1998) 487, 501.

27 "Free market arrangements to transfer and reallocate water are frequently criticized for failing to take account the legitimate interests of other parties who are not directly involved in the transactions but who do nevertheless incur costs because of the transfer". Water for the Future, *supra* note 5, at p. 115.

28 Great Lakes Water Quality Agreement, *supra* note 3, at p. 100. The committee on the report for the Great Lakes Water Quality Agreement notes the possibility establishing an ombudsman for the Great Lakes basin ecosystem. The report notes that an ombudsman would be useful to warn of adverse impacts on water quality and the Great Lakes ecosystem; it could provide a focus for both enhancing the productivity of the ecosystem and sustaining its renewal; and it could facilitate public participation in carrying out ecosystem objectives.

ported in the private sector, but which is important to maintain the quality and accessibility of water resources for future generations, is an important strategy for implementing intergenerational equity. For example, research to promote understanding of the fate and transport of pollutants in ground water aquifers, research on reuse of waste water, and research to facilitate efficient development and use of alternatives water resources (such as desalination of brackish water) ought to be viewed as implementing intergenerational obligations. If nonrechargeable aquifers are depleted, there may be an obligation to engage in research aimed at making more efficient use of water supplies and making alternative supplies available at equitable prices.

3. Intergenerational impact assessments. The need to focus on assessing the long-term impacts of our water development and use, particularly in light of the scientific uncertainty regarding changing climate conditions, suggests the desirability of intergenerational impact statements. The process should consider the possible impacts of proposed actions on future generations by starting from their interests and working backwards to the present day. The intergenerational impacts could be addressed in a separate "intergenerational assessment" or as part of an environmental impact assessment. Options should also be evaluated for their impact on equity among members of the present generation; satisfying intragenerational equity is important to assuring intergenerational equity.

4. Maintenance. We have to revise how we think about the question of maintenance from a matter often perceived to be of minor importance when considering new capital investments to a matter that raises significant intergenerational concerns. If we build municipal sewage treatment plants, develop large data banks on some issue or construct costly water conveyance devices and do not consider their maintenance, they may be used only briefly because of subsequent maintenance costs. This practice expands resources for our own marginal benefit at the expense of future generations. This suggests that the ease and cost of maintenance should be an explicit criteria in the design and development of projects. Second, it suggests that facilities that use water resources should be kept in good repair so that water resources are not unnecessarily wasted[29].

29 Moreover, earthen ditches with 70 percent loss rates, as some of them in the Western part of the United States have had, are not a proper way to transport water from an intergenerational perspective. See *Coffin et al. v. The Left Hand Ditch Co.*, 6 Colo. 443 (1882) (holding that prior appropriation, even if it means carrying water far across the land, is the law governing water resources in Colorado).

The report, *Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan*[30], which was conducted jointly by the U.S. National Academy of Sciences, the Royal Scientific Society of Jordan, the Israel Academy of Science and Humanities, and the Palestine Academy for Science and Technology, adopted intergenerational equity as one of the five criteria for its work and for evaluating options for water resource management. It noted that "[t]here is an important concept embodied in the terms sustainability and intergenerational equity — the idea that the present generation's children and grandchildren should have at least as much ability to use the resource as does the present generation. Intergenerational equity includes the sustainable use of water resources"[31]. The report views Israel, the West Bank and Gaza, and Jordan as an hydrological region, and offers findings and evaluations of a range of options for achieving sustainable use of water resources. These findings include the following:

1. Reduce demand. Reducing demand means using water more efficiently and considering reuse of supplies[32]. This is an important and promising option that is often overlooked. In the United States, for example, attention has shifted from building new dams and otherwise creating new sources of supply to measures that reduce demand, as by more efficient irrigation technology, household items and so forth. Indeed there are proposals to dismantle several existing dams to protect fisheries and environmental services.

2. Conserve existing water supplies. There are a number of measures that can conserve existing water supplies, which thereby promote both intra- and intergenerational equity. These include repairing leaks in distribution and sewer systems, metering water connections, rationing and recycling. There are also other voluntary measures such as installing water-saving plumbing fixtures in showerheads, toilets and washing machines and limiting lawn and garden water to restricted periods.

3. Reduce demands from agriculture. Agricultural use is the biggest consumer of water in the Middle East and elsewhere in the world. As the Report notes, agricultural uses need to be reevaluated as nonagricultural demand grows and the cost of water becomes higher. The agricultural sector needs to consider more efficient ways to use water, possibly by adopting modern farming techniques such as computer controlled drip irrigation

30 This section is based on Water for the Future, *supra* note 5, at Chapter 5, Options for the Future — Balancing Water Demand and Water Resources.

31 *Ibid*, at p. 2.

32 *Ibid*, at p. 158.

methods and improved hybrid seeds and seedlings. If these methods are implemented, it is estimated that farmers in the West Bank would be able to irrigate nearly ten times the land area with the same amount of water.

4. Harvest local runoff and floodwaters. By harvesting local runoff and floodwaters, it would be possible to increase water supplies for dryland agriculture[33].

5. Reduce water loss through evaporation by planting many crops close together in controlled environments. According to the Report, this method conserves land and water, avoids soil salinization and produces high yield crops[34]. Avoiding the salinization of soils is particularly important to intergenerational equity, for the effects are long-term and costly to address.

6. Use the abundant brackish water to irrigate some crops such as tomatoes and melons (salinity-tolerant crops)[35].

7. Use treated wastewater for subsurface irrigation[36].

8. Signal consumers about the true price of water. This measure could be effected by charging higher rates for water during peak periods, and by applying surcharges for excessive use[37].

9. Develop new sources of fresh water. New sources of water could be created by reusing wastewater, by building desalination plants or, some meteorologists contend, by seeding the clouds[38].

10. Import water from outside the hydrological region. Turkey, for example, has proposed to convey fresh water to Israel. While such options usually draw considerable public attention no matter where they may be proposed, from the intergenerational perspective, there may be attendant hazards associated with them that need to be considered. These include the loss of water en route, ecosystem effects in the area of origin and the difficulty of incorporating in present calculations the future needs for the water in the area of origin. Such schemes may also remove an important incentive in the receiving area to make water use more efficient and to explore other technologies such as reuse.

33 *Ibid*, at p. 160.
34 *Ibid*, ibid.
35 *Ibid*, ibid.
36 *Ibid*, ibid.
37 *Ibid*, ibid.
38 *Ibid*, ibid.

V. Ground Water as Case Study: The Mountain Aquifer

The Mountain Aquifer is one of the largest water resource in the Middle East region, supplying Israel with approximately one third of its annual water consumption and the Palestinians with almost 90% of their consumption[39]. Pollution of the aquifer raises very significant intergenerational issues, because the pollution may be very difficult to reverse, at least with acceptable costs. The three major sources of contamination of the Mountain Aquifer are domestic, industrial and agricultural. Inadequate wastewater treatment facilities account for most of the domestic contamination. There is inadequate wastewater collection or treatment system in most Palestinian cities and rural areas and although most Israeli settlements have wastewater collection systems, the water is dumped into surrounding areas instead of being treated[40]. Extensive use of agrochemicals, pesticides and fertilizers for irrigation in the agricultural practices above the Mountain Aquifer leads to contamination of the ground water supplies. Farmers regularly use agrochemicals, and much of the rural population uses untreated sewage for irrigation[41].

Although there is little information about industrial pollution in this region, there is evidence that untreated wastewater (sometimes containing heavy metals or other dangerous substances) from factories is being dumped into areas where it can seep into the ground water supply[42].

From an intergenerational perspective, it is important that all actors cooperate in preventing the contamination of the aquifer. This means the actors must both be willing and have the capacity to do so. In his analysis on cooperation over the Mountain Aquifer, Moshe Hirsch writes, "[s]ignificant discharge of pollutants into the reservoir by either party will generate negative payoffs for both, since both parties share the same pool. The pollutants in the underground reservoir know no political boundaries. This does not mean that the positive payoffs generated to the parties from using uncontaminated water are the same"[43]. As Eyal Benvenisti and Haim Gvirtzman note, effective

39 M. Hirsch "Game Theory, International Law and Future Environmental Cooperation in the Middle East" 27 *Denv. J. Int'l L. & Pol'y* (1998) 75.

40 *Ibid*, at pp. 103–104.

41 *Ibid*, at p. 104.

42 *Ibid*, at pp. 104–105.

43 *Ibid*, at p. 106.

management of this underground resource necessitates shared information and cooperation[44].

Protecting the recharge area of an aquifer from contamination is important for all aquifers. From the intergenerational lens, land use planning and monitoring of pollutants and pollutant generating activities affecting recharge areas are important components of sustainable water management. There are also other activities that can prevent ground water contamination, such as: building and maintaining municipal sewage treatment plants and controlling nonpoint source pollution in agricultural runoff.

Ground water overdraft is a significant problem in parts of the Middle East[45]. Protecting rechargeable aquifers means monitoring whether withdrawals exceed recharge rates and giving increased attention to land use planning that preserves the porosity of the surface[46]. This requires an understanding of the recharge rates and the development of monitoring equipment[47]. We must also develop a system that effectively narrows the existing price differential between ground water and other water supplies. A critical problem in many countries is that groundwater is much less expensive than surface water, which leads to the loss of aquifers at the expense of future generations[48]. In some cases, it may be useful to develop guidelines and/or agreements to control the mining of ground water in interstate and/or international aquifers[49].

Sometimes, achieving sustainability may require following an unsustainable trajectory, such as by mining ground water[50]. But if we need to mine aquifers, we should not do it for uses such as for watering lawns (as in the Twin Cities in Minnesota) or for growing cotton (as in Texas). Rather we should engage in research and development into efficient uses and into alternative sources of fresh water — including through reuse of wastewater.

44 E. Benvenisti & H. Gvirtzman "Harnessing International Law to Determine Israeli-Palestinian Water Rights: The Mountain Aquifer" 33 *Nat. Res. J.* (1993) 543, 565.

45 Water for the Future, *supra* note 5, at p. 126.

46 "With proper management, most aquifers can provide a sustainable water supply and the basis for maintaining ecosystem biodiversity, as long as they are recharged". Water for the Future, *supra* note 5, at p. 126.

47 *Ibid*, at p. 123.

48 *Ibid*, at p.129. The authors of this report note that groundwater overdraft is always self-terminating and the environmental impacts are almost always negative.

49 A. Berkley Rodgers & A.E. Utton "The Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters" 25 *Nat. Res. J.* (1985) 713.

50 The author is indebted to Henry J. Vaux, Jr. for this point.

Conclusion

There are some lessons that can be learned from the principle of intergenerational equity, as applied to water issues in the Middle East. First, intergenerational equity provides a framework for regional cooperation to turn potential conflict over water into a positive sum game in which every participant wins. Second, everyone needs access to water for basic needs. Intragenerational equity must be achieved if we are going to ensure fairness to future generations. Third, a system of monitoring, information exchange, scientific research and cooperative management should be in place to ensure sustainable water resources for future generations. Fourth, a water management regime should provide for and maintain a variety of options for managing demand for water and for augmenting supply. Fifth, we need to pay close attention to water quality, in addition to water quantity. If we do not, we will deprive both ourselves and future generations of essential ecosystem services, and we will raise costs of water to future generations. Finally, we need to treat allocation of water resources in the context of the ecological system from which they come. This involves coordinating surface water, ground water and land use systems. In the past we have been fortunate in using natural resources. When resources have become scarce and the prices have risen, uses have become more efficient or substitutes have been discovered or invented that could serve the same function. Fresh water, however, is different. Technically it does not disappear, it only changes form. But our actions today have long-term effects on the availability and quality of fresh water and on people's access to it. Since there is no known substitute for fresh water, we need to ensure an equitable bearing of the burdens and benefits of water use to future generations, as well as to the present. Technology can help to offer more efficient water use and to provide affordable water supplies. But technology is not sufficient. If we are not careful today, we can impose heavy costs on our children for cleaning up rivers, streams and lakes that we have polluted. We can leave our great grandchildren and generations beyond a legacy of eroded watersheds, polluted ground water and contaminated lake and river bottoms, which may be very difficult to reverse, if at all. Since water is essential for our human needs and for the robustness of ecosystems, equity requires that we conserve it for future generations. Focusing on the future may facilitate the cooperation needed today to ensure fresh water resources for both present and future generations.