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Israeli/Palestinian transboundary stream restoration and management: lessons for the future

Alon Tal [a], Nader Al Khateeb [b], Neta Nagouker [c], Hila Akerman [c], Mousa Diabat [c d], Alice Nassar [b], Roey Angel [e], Muath Abu Sadah [f], Yaron Hershkovitz [g], Avital Gasith [g], Amjad Aliewi [f], Dima Halawani [b], Adam Abramson [a], Amjad Assi [f], Jonathan B. Laronne [h] & Lior Asaf [i]

[a] Blaustein Institutes for Desert Research, Ben Gurion University of the Negev, Israel

[b] Water and Environmental Development Organization (WEDO), Palestinian Authority

[c] The Arava Institute for Environmental Studies, Israel

[d] Oregon State University, USA

[e] Max-Planck-Institute for Terrestial Microbiology, Marburg, Germany

[f] House of Water and Environment, Palestinian Authority

[g] Department of Zoology, Tel Aviv University, Israel

[h] Department of Geography and Environmental Development, Ben Gurion University of the Negev, Israel

[i] Earth Institute, Columbia University, New York, USA

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Research paper

Israeli/Palestinian transboundary stream restoration and management: lessons for the future

ALON TAL, *Blaustein Institutes for Desert Research, Ben Gurion University of the Negev, Israel. Email: alontal@bgu.ac.il*

NADER AL KHATEEB, *Water and Environmental Development Organization (WEDO), Palestinian Authority*

NETA NAGOUKER, *The Arava Institute for Environmental Studies, Israel*

HILA AKERMAN, *The Arava Institute for Environmental Studies, Israel*

MOUSA DIABAT, *The Arava Institute for Environmental Studies, Israel*; *Oregon State University, USA*

ALICE NASSAR, *Water and Environmental Development Organization (WEDO), Palestinian Authority*

ROEY ANGEL, *Max-Planck-Institute for Terrestial Microbiology, Marburg, Germany*

MUATH ABU SADAH, *House of Water and Environment, Palestinian Authority*

YARON HERSHKOVITZ, *Department of Zoology, Tel Aviv University, Israel*

AVITAL GASITH, *Department of Zoology, Tel Aviv University, Israel*

AMJAD ALIEWI, *House of Water and Environment, Palestinian Authority*

DIMA HALAWANI, *Water and Environmental Development Organization (WEDO), Palestinian Authority*

ADAM ABRAMSON, *Blaustein Institutes for Desert Research, Ben Gurion University of the Negev, Israel*

AMJAD ASSI, *House of Water and Environment, Palestinian Authority*

JONATHAN B. LARONNE, *Department of Geography and Environmental Development, Ben Gurion University of the Negev, Israel*

LIOR ASAF, *Earth Institute, Columbia University, New York, USA*

ABSTRACT

A 3 year study between a joint Palestinian and Israeli research team monitored two of their major shared watersheds: the Zomar/Alexander and the Hebron/Besor basins. The extremely degraded water quality conditions were traced to a variety of point and non-point pollution sources. This article summarizes the team's recommendations for future management activities if a coordinated rehabilitation effort is to be successful. A common restoration strategy should include transboundary planning that encompasses the entire watershed, with reduction in phosphorus loadings being a top shared priority. The sides should agree on common 'in-stream' standards and pollution reduction goals. Pollution reduction strategies must focus on eliminating contaminants at the source, rather than continuing present interventions that attempt to mitigate or treat pollutants after they are already in the stream. Non-point source controls, especially for agricultural runoff, have not been a priority until now, but must be adopted for water quality objectives to be met. Only through a joint rehabilitation strategy will progress be made in restoring the quality of these important natural resources.

Keywords: Watershed management; stream restoration; transboundary; Israel; Palestine

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1 Introduction

For some time, environmental managers have attempted to address the practical implications of the truism that water does not recognize political borders. It is estimated that the world contains 260 transboundary river basins (Gleick 2004). Since 1814, some 600 bi-and multi-lateral international agreements deal with non-navigational aspects of water management (Kiss and Shelton 2004). The complex, historic, religious and territorial rivalries and tensions of the Middle East are exacerbated by the scarcity of water and the large number of surface and ground water borders that traverse geopolitical boundaries (Shuval and Hassan 2007). After over a century of enmity between Israelis and Palestinians, there is also a scarcity of trust that is so critical to resolving water conflicts and launching coordinated management strategies. Moreover, the contrast between Israel's post-industrial economy and the developing dynamics that characterize its Arab neighbours makes implementation of a common restoration strategy even more difficult.

While much discussion has taken place regarding Palestinian–Israeli ground water management, surface water resources have not been the focus of intense research or policy discussions. Despite modest restoration efforts, most transboundary streams in the region are contaminated and characterized by widespread pollution from Palestinian sources (typically raw sewage), as well as a variety of point and non-point sources from within Israel (Avimelech and Ayalon 1999, Morel 2006). The unabated pollution harms in-stream ecosystems, contaminates ground water and constitutes a general aesthetic and health hazard (Adler 1995, Hassan and Egozi 2001). Managing these natural resources is particularly challenging given the tense security situation and the difficulty of facilitating cooperation between the governments of two vastly different national entities (Feitelson and Hadad, 2001, Goodale 2003). As the sides muddle forward towards ultimate geopolitical reconciliation, meaningful environmental cooperation will require unusual determination and resourcefulness.

Because geographically their combined territories are relatively small, and the streams flow in both directions across national borders, unilateral management decisions appear to produce disappointing results. This was the starting point of a 3-year study conducted by a joint Israeli–Palestinian team of two of the area's major watersheds (Tal *et al.* 2010). In the semi-arid southern region, the Hebron/Besor stream basin remains highly polluted, primarily from municipal wastes (Israel Ministry of the Environment 2008). Further north, the Zomar/Alexander watershed has shown some improvement (Israel Ministry of the Environment 2007). Monitoring, however, suggests that point and non-point source pollution continue to substantially affect stream water quality. To a great extent, stream restoration in arid and semi-arid regions is a painfully slow process, where patience is required and incremental improvement is the best expected outcome. Our research suggests that there is a substantial basis for agreement about the necessary components of a bi-national stream restoration strategy and that with sufficient political will and funding, such progress can be attained.

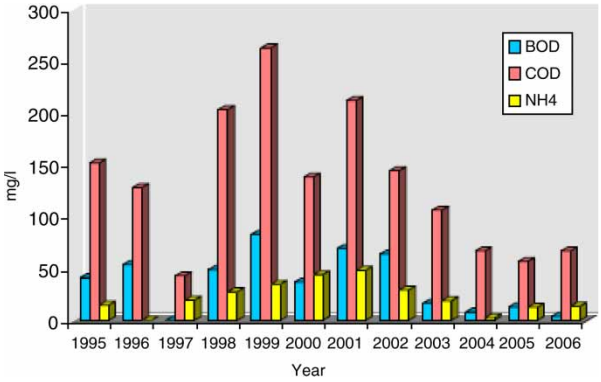

Figure 1 BOD, COD and NH_4 average concentration in the Alexander stream from 1995–2006.
Source: Israel Nature and Parks Authority.

While past initiatives have not produced exceptional results, they have left some basis for optimism. When efforts are based on a coordinated masterplan, environmental progress has been discernible. Israel's Nature and Parks Authority has been in charge of monitoring Israeli streams since the 1970s. Their monitoring programme includes spring and fall sampling along different stations in the Alexander stream. The Authority's data suggest that there has been an improvement in stream conditions since restoration efforts became operational in the year 2000 (Figure 1). A recent report based on several decades of bi-annual sampling at 10 stations along the stream confirms that most of the pollution sources have been removed. This is reflected in a precipitous drop in BOD and COD levels (Israel Ministry of the Environment 2008). However, the data also show that the decline in pollution concentration parameters is inconsistent and for some parameters, such as ammonia, progress has slowed or levelled off since 2003.

Further progress in attaining restoration objectives will not be meaningful in the watersheds studied, as well as in managing other transboundary resources in the region, until a number of fundamental changes in present approaches are adopted. In this article, the implications of the study results for future, transboundary, and restoration efforts in the Middle East and beyond are presented.

2 Transboundary planning

To ensure long-term cooperation, the riparians must remain committed to executing restoration plans for transboundary watershed restoration. This is an inherently protracted process that requires institutional and political stamina. The violent political dynamics of the Middle East and the associated obstacles for cooperation on the ground add a level of complexity to implementation that cannot be underestimated. The achievements attained heretofore, through the myriad initiatives on

both sides, reflect a pragmatism that implicitly recognizes that the perfect river rehabilitation plan may indeed be the enemy of the 'good' one. Incremental improvements through model waste treatment plants have reduced contamination in the field and provided a sense of momentum. But any isolated improvements in water quality and the landscape to date have only set the stage for the more comprehensive environmental progress that is needed. The time has come to move to the next level where real recreational and ecological benefits can be enjoyed by both Israelis and Palestinians.

As a result of cooperation spawned by the Oslo peace accords, plans were prepared for restoration of the Zomar/Alexander watershed. The restoration strategy includes an aggressive pollution mitigation programme and sewage treatment upgrading, reducing stream bank slope to enable vegetation and human access to the waterline, installation of dams and fish ladders as well as numerous demonstration projects (Brandeis 2005, Society for Ecological Restoration International 2010). Today these plans should be amended to include greater emphasis on controlling non-point pollution sources. Clear interim and long-term goals regarding the use of different segments of the streams, with greater resolution defining common and differentiated responsibilities for implementation by the parties should be set according to the preferences of stakeholders on both sides. For example, the study included a survey of Israeli stakeholders regarding expressed preferences for future designated uses of streams. Swimming was deemed an admirable, but very distant and presently unrealistic objective. Recreational boating and fishing, however, were identified as more practical and readily attained. Palestinians unexpectedly expressed a clear preference for directing treated effluents to stream flow and restoration, rather than sending the waste water directly for irrigation in agriculture that faces pervasive shortages and was thus anticipated to be ranked as a higher priority (Abramson *et al.* 2010). Plans must translate these inclinations into operational objectives with time-tables and funding mechanisms.

3 Common 'in-stream' standards and pollution reduction goals

To date, neither Palestinians nor Israelis have set formal, legally binding stream standards for water quality in the streams located in the two watersheds studied. Israel has begun to phase in new discharge standards for waste water treatment discharged into the stream and Palestinians have agreed to meet a '20/30' (BOD/suspended solids) secondary treatment level. Yet, these 'discharge' standards fall short of full in-stream criteria, including biological indicators. For successful implementation, transboundary plans must contain detailed, quantitative criteria to monitor progress. These chemical and biological parameters should be driven by prioritized stream-uses. Pollution levels can be ratcheted down with time as interim milestones are attained and ultimate water quality objectives pursued.

Once in-stream standards are established, clear goals must be set for source and non-point pollution source reductions. Table 1 includes site-specific/pollution-specific objectives based on monitoring results and present Israeli recommendations for in-stream quality in the Alexander stream. While these improvements will take some time to implement, without formal adoption of these benchmarks and timetables for progress, it is unlikely that progress will be attained.

4 The proximity principle

During the past decade, Israel has established treatment facilities in both watersheds studied that are designed to capture and treat Palestinian sewage as it crosses the border. The plants were originally conceived as a pragmatic response to the environmental paralysis produced by political instability. Given the lack of symmetry in economic capacity and present levels of governance, Israel took proactive action to intercept and reduce the predominant pollution sources reaching the streams in its jurisdiction.

Table 1 Pollution reduction needed to meet water quality standards.[a]

Date	Station	Pollution loads (kg/event)			Required load (kg/event)			%Reduction TP	%Reduction NH_4
		TN	TP	NH_4	TN	TP	NH_4		
16–19 December 2005	Elyashiv	2265	1323	1961		426	639	68	67
24–26 December 2005	Elyashiv	6871	3006	6129		1104	1656	63	73
14–16 January 2006	Elyashiv	1142	741	545		389	584	48	0
24–26 January 2006	Elyashiv	2411	2012	1629		581	873	71	46
9–10 February 2006	Elyashiv	17,562	5529	17,236		3252	4878	41	72
24–26 December 2005	R-57	3841	2045	4609		1152	1728	44	63
16–19 December 2005	R-57	3122	2832	1934		743	1116	74	42
9–10 February 2006	R-57	4660	2654	4495		1450	2175	45	52
24–26 December 2005	Nablus	2009	321	2777		214	322	33	88
24–26 January 2006	Nablus	319	53	332		39	59	26	82
9–10 February 2006	Nablus	6492	818	6438	5455	546	818	33	87

Source: Israel Ministry of Environment (www.sviva.gov.il).

[a]Based on Israeli water quality standards: TN = 10 mg/l; TP = 1 mg/l; NH4 = 1.5 mg/l.

This policy was an exigency; it does not constitute an effective, long-term, hydrological strategy.

Assuming that they receive industrial effluent that have undergone pre-treatment, wastewater treatment plants can successfully reduce organic loading in the streams and improve water quality. In the Zomar/Alexander watershed, however, treatment of the discharges from Palestinian olive oil production facilities at Israel's Yad Hanah municipal wastewater facility has not been effective. Pre-treatment for these and other effluents with such high organic levels is essential if downstream sewage treatment is to function at a high level.

While plans are in the work for better treatment of this waste stream, considerable quantities of waste water continue to percolate into ground water after leaving Nablus stream (Brandeis 2003). During certain extreme rain events the flow has proved to be overwhelming. The result is the transport of extremely high levels of organic materials, which often exceed present capacity at the treatment facility. This in turn leads to 'emergency' bypass discharges that result in periodic fish kills and general deterioration in ambient stream conditions.

The interface with ground water is also a critical element of local hydrology, which has not been adequately considered. In the upper reaches of the Hebron/Besor watershed, the loss of up to 90% of the sewage effluents to infiltration also requires a rethinking of present assumptions (Tal *et al.* 2010). The treatment facility currently under construction inside the Israeli border at the Shoket juncture should offer some immediate improvement in the surface water conditions in the stream flowing through the city of Beer Sheva. But in the long run, ground water resources may still be compromised. While infiltration in the Zomar is somewhat more modest, a full half of the sewage may be contaminating ground water resources.

Conveyance of wastes to distant treatment facilities frequently is not sound and leads to escape of contaminants. Consequently, a basic axiom of environmental management has emerged requiring that treatment of wastes of all kinds should take place as close as possible to the source of the discharges (Faure and Skogh 2003). This has become codified in international environmental law (e.g. the Basel Convention for Transport of Hazardous Wastes or EU waste management policy as stated in EC Treaty, 174(2)) (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989, Scheuer 2005). While future infrastructure and normative frameworks should consider waste treatment and *utilization* of effluents at a *regional* level, the focus on *treatment* must be local. Alternatively, and in the interim, untreated wastes can be transported to regional treatment centres in pipes to prevent water loss/contamination and the risk of human exposure while it is in transit.

5 Identifying and addressing all point sources

The findings of the study confirm that despite the improvement in water quality that has been achieved since the beginning of restoration activities, pollution levels contained in the base flows will prevent the attainment of any of the potential uses in transboundary streams. In a justifiable 'worst things first' approach, wastewater treatment has been the focus of efforts to date. Yet, additional pollution sources, from the Palestinian olive oil and stone cutting industries – Israeli industrial zones, fish ponds and fruit juice plants will sabotage water quality progress unless they are systematically identified and abated. Enforcement efforts are now under way in Israel to address these pollution sources, but compliance remains inadequate. The Palestinian regulatory capacity has been considerably weakened in recent years and substantial institutional strengthening will probably be required before results will be seen in improved pollution discharge levels.

6 Addressing non-point source discharges

In most water management schemes there is a natural progression. Initial attention focuses on abating point sources, which cause an acute public health or ecological insult – with most strategies for addressing non-point sources being as diffused as the pollution sources themselves. Only later does the imperative of controlling non-point runoff become apparent. Past efforts have overlooked the critical contribution of non-point sources to water contamination.

This is surely the case for both of the watersheds considered in our study. While Israel justifiably is concerned about point source discharges in the Palestinian Authority – the study confirms that some 60% of the non-point source discharges in the Zomar/Alexander watershed are actually on the western side of the green line and can be associated with Israeli runoff. Measurements in the field show that non-point sources leave enormous pollution loads in the stream: nutrient loads were found to flow through the stream in storm events, contributing 26% and 38% of the yearly loads calculated for total nitrogen and total phosphorous, respectively. While rainfall is less frequent in the Hebron/Besor watershed, during major events, the non-point source contribution was also conspicuous – 19% and 44% of the yearly loads calculated for total nitrogen and total phosphorous, respectively.

The actual non-point source profile is not uniform and requires site-specific planning. In the Zomar-Alexander watershed, the non-point contribution appears to be predominantly Israeli. Palestinian non-point sources include leaching from solid waste disposal sites, runoff from roads, etc. But Palestinian agriculture in the watershed is far less intensive than in Israel and is dominated by olive tree plantings, which are already based on terracing systems, that were historically designed for their soil and water conservation qualities. This dynamic is different in the south, where roughly half of the total phosphorous in the Hebron/Besor watershed and three-quarters of the suspended solids that reach the stream bed are linked to rainfall events. Palestinian agricultural activity is relatively more intensive in

the upstream, Hebron region and makes a meaningful contribution to loadings. A restoration strategy that ignores the contribution of urban and agricultural runoff will ultimately be unsuccessful.

7 Cost-effective 'point' and 'non-point' reduction tradeoffs

Facilitating best management practices for non-point source controls requires a fundamentally different policy approach than controlling point sources. It is axiomatic in public policy that as the number of actors increases, the difficulty of attaining compliance grows exponentially. Non-point source controls therefore constitute an enormous institutional and regulatory challenge. For instance, there is much resistance from farmers at adopting practices such as conservation tillage or filter strips, which in fact may not be in a given farmer's narrow self-interest (Knopt 2006).

While command and control regulation of agricultural discharges has proved successful (Rosenthal 1990), international experience suggests that the agricultural community will be better able to implement pollution controls when it is supported by government agricultural extension services and receives remuneration and compensation for direct investment in infrastructure (Taylor 2000). Until now, institutionally, government support for river restoration has been solely associated with environmental protection agencies. For successful restoration of the Zomar/Alexander and the Hebron/Besor streams, it will be important to engage the respective Ministries of Agriculture as partners.

In the absence of pollution control at the source, 'Best Management Practices' on site, including buffer strips along the stream bank are a promising approach to ameliorating the impact of non-point source loadings. Establishing parks along the stream is also an important stage in enlisting the public and transforming streams from a perceived hazard to an attractive recreational resource. Funding to this end may take the form of support for beautification and recreational projects. Palestinian park infrastructure along the stream beds, however, by comparison to that in Israel remains minimal. Promoting beautification and park projects should be a focus of international assistance, both for domestic Palestinian quality of life reasons as well as transboundary ecological ones.

8 Focus on phosphorus

Any strategy for addressing total loadings in the watershed needs to partition nutrient discharges into their different components. While nitrogen/nitrate concentrations have seen a significant drop, phosphorus continues to pollute both watersheds. Without control of phosphorus, stream eutrophication will only grow worse (Carpenter 2008). The non-point source contribution is particularly important in this context, with increased P concentrations arising during and after storm events. Existing water quality in base-flow and storm-water does not comply with any of the national or international standards that might be adopted in these streams. If in-stream standards are to be met, P levels should not be higher than 1.0 mg/l. This will require a total reduction of between 45–74% for total phosphorus.

This focus on phosphorus should drive the technologies which are employed and are encouraged as part of shared future management plans. For example, constructed wetlands have enormous advantages as nutrient sinks and as natural recreational sites. Yet, they are not an effective way for reducing phosphorus concentrations in surface waters (Osborne and Kovacic 1993). Other management practices will be needed to lower P levels to an acceptable level.

9 Long-term monitoring

To monitor progress, rehabilitation efforts must be accompanied by a programme of continuous monitoring of base flow and storm events. Progress in reducing point and non-point sources should be essential. And in addition to chemical monitoring, biological monitoring should be integrated into long-term monitoring plans.

Ephemeral streams have never been a meaningful source of drinking water and their transformation into perennial effluent streams will not change that. Yet, the new water bodies can sustain ecological systems and offer important recreational venues. Monitoring should be designed to reflect progress (or deterioration) for these uses. The sensitivity of macro-inverebrates to contrasting environmental conditions makes this group the most appropriate indicator for assessing streams' ecological health. The technical plan should also be flexibly designed in order to expand the involvement of the local populations (students and adults) in monitoring efforts.

10 The imperative of cooperation

Our research suggests that stream restoration in semi-arid watersheds is made more complex by the addition of wastewater that transforms an 'ephemeral' into a 'perennial' stream. Yet, many would argue that if wastewater is treated appropriately, these unnatural sources of water have the potential to create a new natural resource which improves on the original hydrological regime.

When watersheds traverse political boundaries – and especially boundaries that are characterized by political tensions – the task of stream restoration is more challenging. The cooperation that a joint restoration strategy requires can engender unanticipated benefits in terms of confidence building and reduction of tensions.

Experience to date suggests that cooperation in stream restoration at the local 'municipal' level between neighbouring cities may be more robust and able to withstand political turbulence than joint environmental efforts at the macro-level between

central governments. It was this stamina as well as the regulation of pollution discharges, clean-up efforts, park network, bicycle paths and transboundary cooperation that contributed to the 2003 awarding of the prestigious international *Riverprize* in Brisbane, Australia for restoration efforts in the Zomar/Alexander basin (International River Foundation 2010).

It also appears that international assistance is essential for evening the playing field between Israeli and Palestinian water managers. The contribution of the German Government to waste water management in the Zomar/Alexander watershed and the US commitment to improving Palestinian infrastructure in numerous other locations will remain crucial for the foreseeable future.

The technologies and management strategies *are* certainly available for solving the pollution problems of the two watersheds studied, as well as other shared Palestinian–Israeli water resources. The primary obstacles to environmental progress in recent years have been economic and geopolitical. Without sufficient resources for sanitary infrastructure, pre-treatment of industrial facilities and best management practices for non-point runoff, progress will remain elusive. Coordinated efforts and real cooperation are also essential if there is to be an effective restoration of local streams. As Israel and its neighbours consider the form of a final peace accord, a pragmatic, cooperative response, based on sound scientific data can strengthen future regional agreements and provide a more sustainable future for their shared natural resources.

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References

Abramson, A., *et al.*, 2010. Stream restoration as a basis for Israeli–Palestinian cooperation – a comparative analysis of two transboundary rivers. *Journal of River Basin Management*, 8 (1), 39–53.

Adler, R.W., 1995. Addressing barriers to watershed protection. *Environmental Law*, 25 (4), 973–1106.

Avimelech, Y. and Ayalon, O., 1999. *National environmental priorities in Israel*, The S. Neaman Institute for Advanced Studies in Science and Technology, Technion, Israel Institute of Technology.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989, Available from: http://www.basel.int/

Brandeis, A., 2003. *Summary of activity 2002. Restoration of the Alexander stream*. The Alexander Restoration Administration.

Brandeis, A., 2005. Restoration and management of degraded river basins – the Alexander River case study. *In*: A. Ostfield and J. Tyson, eds. *River basin restoration and management*. London: IWA.

Carpenter, S., 2008. Phosphorus control is critical to mitigating eutrophication. *Proceedings of the National Academy of Sciences*, 105 (32), 11039–11040.

Faure, M.G. and Skogh, G., 2003. *The economic analysis of environmental policy and law: an introduction*. Cheltenham: Edward Elgar Publishing.

Feitelson, E. and Hadad, M., 2001. *Management of shared groundwater resources*. The Israeli-Palestinian Case with International Perspectives. Ottawa: International Development Research Center.

Gleick, P.H., 2004. *The World's Water 2002–2003: the biennial report on freshwater resources*. Washington: Island Press.

Goodale, U.M., 2003. *Trans-boundary protected areas: the viability of regional conservation*. Philadelphia, PA: Haworth Press.

Hassan, M.A. and Egozi, R., 2001. Impact of wastewater discharge on the channel morphology of ephemeral streams. *Earth Surface Processes and Landforms*, 26, 1285–1302.

International River Foundation, 2010. International Thiess Prize Winners, Alexander River, Israel, in cooperation with the Palestinians [online]. Available from: http://www.riverfoundation.org.au//index.php?option=com_content&task=view&id=64&Itemid=83

Israel Ministry of the Environment, 2007. *Alexander stream, pollutant loading rankings, 1994–2006*, Jerusalem [online]. Available from: http://www.sviva.gov.il/Enviroment/Static/Binaries/ModulKvatzim/alexander_2008_2.pdf [Accessed 21 February 2010].

Israel Ministry of the Environment, 2008. *Alexander stream*, Water and Stream Monitoring. Report of activities for 2007 Jerusalem, 47–49 [online]. Available from: http://www.sviva.gov.il/Enviroment/Static/Binaries/index_pirsumim/p0478_1.pdf

Israel Ministry of the Environment, 2008. *Beer Sheva and Besor Streams*, Water and Stream Monitoring, Report of Activities for 2007 Jerusalem, 74–77 [online]. Available from: http://www.sviva.gov.il/Enviroment/Static/Binaries/index_pirsumim/p0478_1.pdf

Kiss, A. and Shelton, D., 2004. *International environmental law*. Ardsley, NY: Transnational Publishers.

Knopt, E., 2006. *Economics of beneficial management practices among Saskatchewan crop producers: an analysis towards new perennial crops*. Working Paper, Prepared for Saskatchewan Wetland Conservation Corporation, Regina, Saskatchewan Watershed Authority.

Morel, 2006. Security and the environment in the Middle East water issues. *Environmental Security and Environmental Management: The Role of Risk Assessment*. 17–24.

Osborne, L.L. and Kovacic, D.A., 1993. Riparian vegetated buffer strips in water quality restoration and stream management. *Freshwater Biology*, 29, 243–258.

Rosenthal, A., 1990. State agricultural pollution regulation, a quantitative assessment. *Water Environment and Technology*, 2 (8), 50–58.

Scheuer, S., 2005. *EU environmental policy handbook, a critical analysis of EU environmental legislation*. Brussels: European Environmental Bureau.

Shuval, H. and Hassan, D., eds., 2007. *Water resources in the Middle East: Israel-Palestinian water issues – from conflict to cooperation*. Berlin: Springer-Verlag.

Society for Ecological Restoration International, 2010. *Israel: case study detail*, Alexander River Restoration Project [online]. Available from: http://www.globalrestorationnetwork.org/database/case-study/?id=113 [Accessed 29 April 2010].

Tal, A., *et al.*, 2010. Chemical and biological monitoring in ephemeral and intermittent streams: a study of two transboundary Palestinian–Israeli watersheds. *Journal of River Basin Management*, 8 (2), 185–205.

Taylor, M.A., 2000. Incentive-based solutions to agricultural environmental problems: recent developments in theory and practice. *Journal of Agricultural and Applied Economics*, 32 (2), 221–234.