

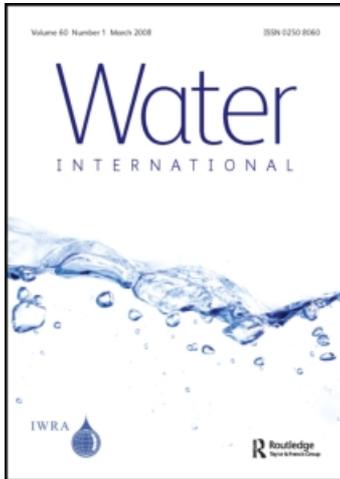
This article was downloaded by: [Greco, Francesca]

On: 6 December 2008

Access details: Access Details: [subscription number 906444625]

Publisher Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Water International

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t792815876>

The Disi project: an internal/external analysis

Eugenia Ferragina ^a; Francesca Greco ^b

^a Istituto di Studi sulle Società del Mediterraneo (Institute of Studies on Mediterranean Society), ISSM, Consiglio Nazionale delle Ricerche (National Research Council), CNR Naples, Naples, Italy ^b Independent Consultant, Orvieto, Italy

Online Publication Date: 01 December 2008

To cite this Article Ferragina, Eugenia and Greco, Francesca(2008)'The Disi project: an internal/external analysis',Water International,33:4,451 — 463

To link to this Article: DOI: 10.1080/02508060802504412

URL: <http://dx.doi.org/10.1080/02508060802504412>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

The Disi project: an internal/external analysis

Eugenia Ferragina^{a*} and Francesca Greco^b

^a*Istituto di Studi sulle Società del Mediterraneo (Institute of Studies on Mediterranean Society), ISSM, Consiglio Nazionale delle Ricerche (National Research Council), CNR Naples, Naples, Italy;*

^b*Independent Consultant, Orvieto, Italy*

(Received 30 March 2007; final version received 25 September 2008)

This paper tries to shed some light on the Disi–Amman pipeline project, which is still under study in the current water-policy literature. Our first finding is that Disi plays an important role in the national water discourse even though it is not sustainable and it is not clear for how long it will be exploitable. Second, we argue that Jordan’s approach to the Disi is basically to silence the whole issue, and that a “quiet pumping race” between Jordan and Saudi Arabia is currently going on.

Keywords: Disi; Jordan; fossil groundwater; environment

Introduction

At the international level, it is common for a shared water resource to be disputed among different countries (Frey 1993). Asymmetrical distribution of power among countries consequently leads to asymmetrical access to water resources. In some cases, a specific form of unilateral exploitation is at work: “precautionary use.” This is a non-cooperative use where a state exploits part of a shared resource in order to acquire a right over it. In this case, the aim is to create a *de facto* situation giving rise, over time, to use by precedent or, better, to an acquired right to the resource.

In this paper we review the Disi project in Jordan in light of such asymmetries and consider the exploitation of this fossil aquifer in the general context of the water situation in Jordan, with special reference to national and international actors and their role both inside and outside the country (Figure 1).

The Disi aquifer: characteristics and modes of exploitation of a shared fossil aquifer

The Disi aquifer, part of the Rum–Saq–Tabuk subsystem, which includes the northern part of Saudi Arabia bordering on Jordan, has a generally uniform structure. It is 250 km long, 50 km wide, and over 1000 m deep (ESCWA 2000). It is a fossil aquifer, that is, a reserve of water accumulated over 30,000 years, with very low recharge rates.¹ It was discovered during a study carried out by the UNDP in 1969 (see Figure 2).

Since the 1980s, Saudi Arabia’s high extraction rates changed the aquifer’s flow pattern, producing a very extensive conical depression that deviates the flow from its natural north-east

*Corresponding author. Email: eugenia.ferragina@issm.cnr.it

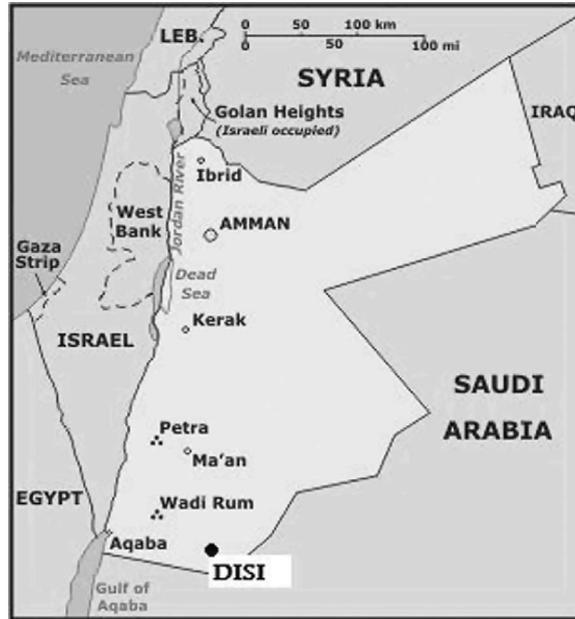


Figure 1. Map of Jordan.

Source: Central Intelligence Agency (n.d.).

direction.² Exploitation of this non-renewable resource allowed Saudi Arabia to make a paradox come true: it became an arid country capable of exporting cereals worldwide. In the 1990s, this policy changed due to the overall economic situation of the country.³ According to Jordanian experts, in 1995 the withdrawal rate was about 1.4 billion cubic metre per annum, while in 2004 it was estimated by Jordan government at about 800 million cubic metre (MCM).⁴

In Jordan, initially the Disi aquifer was only exploited to supply water to the local population. Jordan's rate of exploitation of the aquifer increased in the second half of the 1980s, when four large agro-business companies (Ram, Wafa, Arabco, Gramco) obtained a concession for the land above the aquifer from the Jordanian government, while some small agricultural companies established themselves in the area of Quwaira undertaking cultivation projects to supply the city of Aqaba. According to official data provided by the Water Authority of Jordan (WAJ) and the Ministry of Water and Irrigation, over the last few years the average annual extraction rate from the Disi aquifer has oscillated between 70 and 80 MCM.

The data regarding the real extraction rate are difficult to find as the contract signed by the companies with the Jordanian government only provides for payment for the land concession (1.5 cents per hectare). It does not set any quantitative limitations to groundwater extraction, or provide for a consumption monitoring system. Furthermore, a huge amount of the irrigation water used by these companies is lost through evapotranspiration because of the very hot temperatures prevailing in the area (Figure 3).⁵

The Disi–Amman pipeline

The project for the construction of the Disi–Amman pipeline was conceived in the context of a water emergency that became especially evident in the 1990s (Barham 1998, Ferragina 2001, 2003).

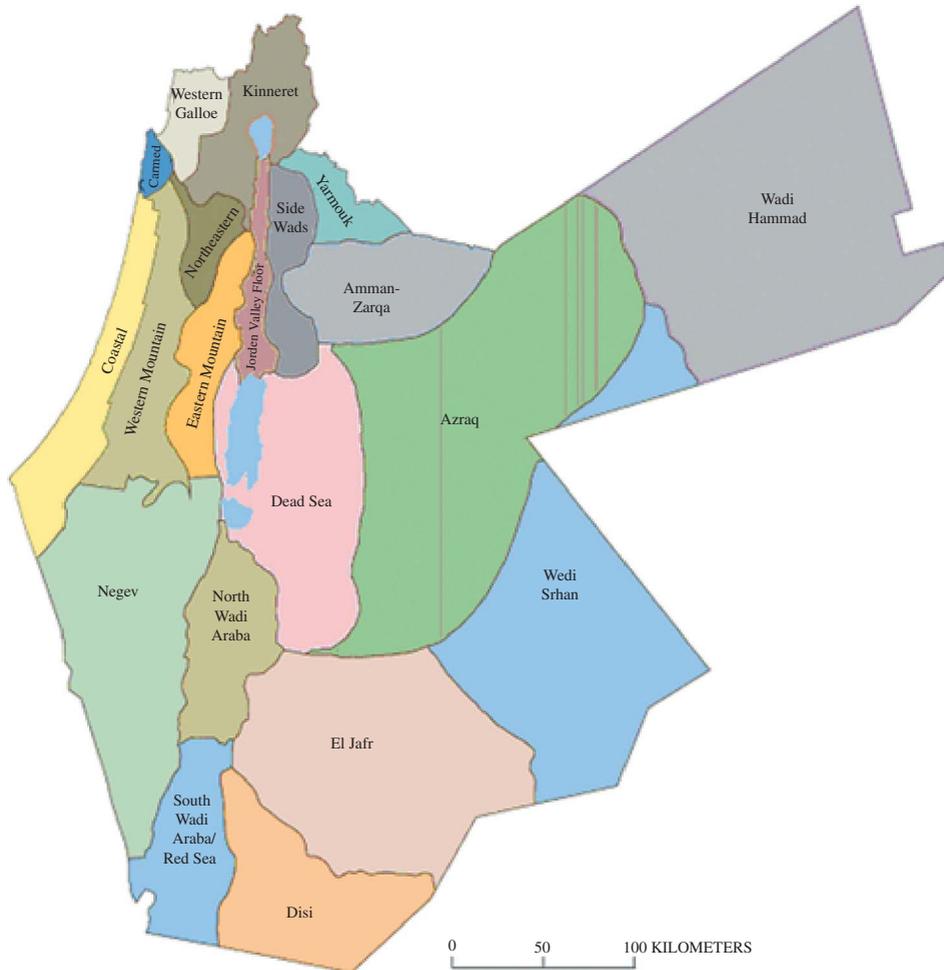


Figure 2. The underground aquifers in Jordan.
 Source: US Geological Survey (n.d.).

The Jordanian government drafted a project for the building of a 325-km pipeline from Disi to Amman, where most of the country's demand for water is concentrated. The overall cost of the work was estimated at ca. 625 million dollars. The project envisaged the digging of 65 wells to tap the aquifer and the building of several intermediate plants for the pumping and raising of water to overcome the 250-m difference in altitude between the aquifer and Amman (MEED 2002). Completion of the project was envisaged in five years.

The tapping of this fossil aquifer in the south of the country offered several advantages. It was an abundant resource, and the water was pure. Its exploitation did not require any difficult political negotiations. Finally, the project was not encumbered by the veto of other countries. Thus, in 1996 the Jordanian government commissioned an environmental feasibility plan to Harza, a US company which had been working on projects for the exploitation of water resources in the Jordan Valley since the 1960s.

The most controversial aspect of the project was its environmental impact, since Disi is a fossil aquifer, and hence not renewable. The issue of relationships with Saudi Arabia, however,

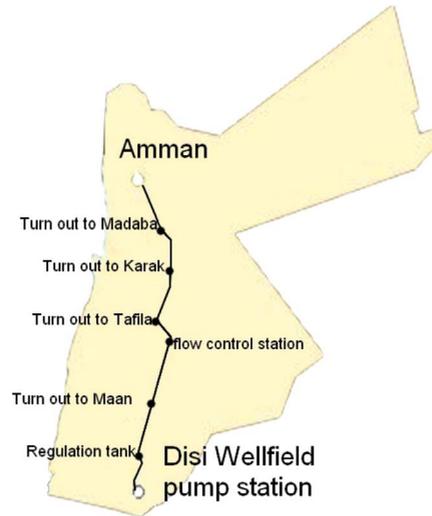


Figure 3. The Disi water pipeline.

also raised a major concern at the World Bank. As the World Bank officially reported later in a document published in 2004:

[The] Disi groundwater resource is shared between Saudi Arabia and Jordan and World Bank investment would require non-objection by Saudi Arabia under the Bank's safeguard policy. (Keith Pitmann 2004)

As a consequence, the Disi project did not receive any World Bank grant or other international cooperation funding. Jordan was thus forced to resort to a build-operate-transfer (BOT) scheme: it issued an international tender call for the planning, implementation and management of the project over 40 years, after which the pipeline was to be turned over to the Jordanian government.⁶

The Disi project was weighted down with strong environmental, economic and social concerns. Many regarded the aquifer as a capital asset that needed to be preserved in view of the uncertain future of the country's water resources, which were being undermined by climatic changes and high demographic pressure. Furthermore, the exploitation of the huge non-renewable reservoir threatened to alter the local microclimate and aggravate erosion, with negative repercussions on the flora and fauna of the fragile local desert ecosystem. Harza's feasibility study stressed the danger of saltwater infiltration from the aquifer overlying Disi, the Khreim aquifer (Figure 4), which would have deteriorated the water of the Disi and thus definitively jeopardized the project.

As to economic concerns, uncertainty about the final costs of the project could affect water prices for Amman users. Dr Munther Haddadin, former minister of Water and Irrigation, drew attention on many occasions to the issue of the energy cost of the Disi project (Haddadin 2004). He claimed that the total cost of Disi water, considering collection and treatment, would be five times higher than the affordable threshold for the Jordanian population. The affordable price is \$37.5 per capita a year, or 2% of the annual per capita income, according to the World Bank, while Disi would cost the Jordanian final user \$198.70 per year (i.e. 13.3% of the current per capita income).⁷

In the light of these economic concerns, to prevent discontent from rising among the population and jeopardizing the project, in 2001 the government decided to change the pure BOT

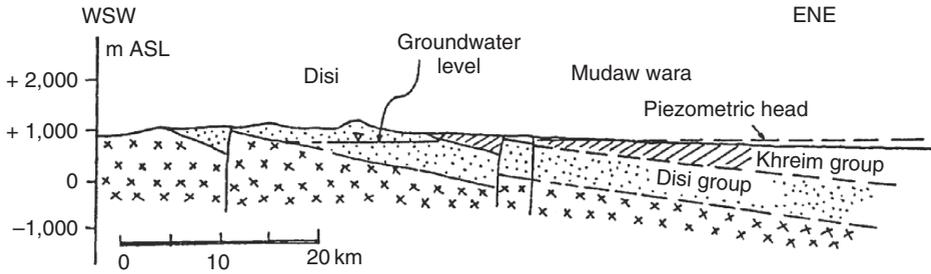


Figure 4. The Khreim aquifer.
 Source: Salameh and Gedeon, 1999.

scheme to a mixed BOT solution by offering a non-refundable \$200 million grant. Furthermore, a government institution, the Social Security Foundation, was eventually going to give out another \$100 million to the consortium that won the tender.

The estimated cost of the Disi project was compounded by its energy costs, because the Disi water needs to be raised to overcome the 250-m difference in altitude between the aquifer and the capital (Aloul 2004). In January 2004 the Jordanian government was forced to increase the price of oil to make up for the loss of Iraqi oil. In an article for the *Jordan Times*, the Jordanian Minister of Water and Irrigation El-Nasser stressed the risk of a dramatic cost increase as a result of rising oil prices on international markets.

The high overall costs of the project eventually played a role in the negative outcome of the first BOT operation. The tender call, issued in 2001, was nearly won by the American consortium Saudi Oger, Black & Veatch International in 2004.⁸ In August 2004, the Saudi Oger consortium submitted an offer to adjust its bid to the Jordanian target price, but the offer was still too high for the Jordanian government and the international bid failed.⁹

Jordan launched a new financial bid in 2006 and at the end of 2007 the Turkish company GAMA Energy AS – a subsidiary of GAMA Holding AS – was declared the winner. Following a total investment of \$1 billion and operation and maintenance of the facilities for 25 years, the project shall be transferred back to the Kingdom of Jordan on expiry of this time period (GAMA 2007).

Internal and external actors in the Disi project: controversial data and silent issues

All large-scale projects concerning shared water resources face delicate issues that result in confrontations at the national and international level if not properly addressed. As ancient and recent Middle Eastern history bears out, water is a strategic resource for power balances, and these power balances involve internal and external actors (Ferragina 1998).

The Ministry of Water and Irrigation was certainly the main internal actor in the Disi–Amman pipeline project. In an article written together with a World Bank official in 1999, former Minister of Water and Irrigation Hasim El-Nasser – at the time Secretary-General – stressed the seriousness of Jordan’s water situation, which, he argued, called for the taking of action to contain demand, but also for the exploitation of the Disi fossil aquifer (El-Nasser and Macoun 1999).

A striking aspect in El-Nasser’s analysis was the contrast between his lucid grasp of the weaknesses of Jordan’s water policy (lack of control on consumption, strong subsidies to agriculture and cropping strategies based on low-value agricultural products) and the solutions that he himself was proposing. While insisting on integrated management and demand

control, El-Nasser was still advocating the construction of the Disi–Amman pipeline, comparing the exploitation of fossil water to that of other non-renewable natural resources such as oil and gas.¹⁰

Another crucial internal actor of the Disi project was Consolidated Consultant. The Jordanian government commissioned this private consulting company to prepare a new environmental feasibility study to be submitted to the World Bank. This study benefited from the collaboration of several experts and the participation of public institutions (ministries, municipal governments, the Water Authority and the Jordan Valley Authority), government environmental institutions (the Royal Scientific Society, the Royal Society for the Conservation of Nature and the Jordan Environment Society), some NGOs (Friends of the Earth, etc.), and representatives of civil society, mainly Bedouin traditional authorities.¹¹ The consultation process also involved stakeholders and local associations.¹² An international committee examined the report before its submission to the World Bank.¹³

Scientific and academic experts also played an important role in building consensus around the Disi project. In 1999, Prof. Elias Salameh published a study on the renewability of the fossil aquifer where he argued that, at that time, the rate of exploitation being 80–90 MCM per annum, the aquifer was threatened with exhaustion and salinization (Salameh and Gedeon 1999). Interviewed in 2002, Salameh gave a somewhat more optimistic assessment of the project, claiming that the aquifer could sustain a per annum extraction rate of 100 MCM for 40 years, and a maximum of 70 MCM per annum over 100 years.¹⁴ In both cases, however, Salameh was still speaking of rates that were far below those planned by the Ministry of Water and Irrigation (100 MCM for 100 years).¹⁵ Thus, while declaring himself in favour of the exploitation of the aquifer, he cautioned that all exploitation of Disi for irrigation had to cease, to safeguard both the quantity and quality of its water. In a recent interview in 2007, he said “we will not be able to extract water from Disi with farms siphoning off the water. Scientifically speaking, we cannot do that because of underground pressure. We might end up losing everything” (Irin News 2008). The opinion of Dr Munther Haddadin, former minister of Water and Irrigation, was especially critical.¹⁶ As mentioned above, apart from the concerns regarding the energy cost of the Disi project, Haddadin also underlined the danger that water losses in Amman could jeopardize the potential benefits of the whole project (Haddadin 2006, p. 144). The Jordanian government’s decision of February 2008 to increase fuel prices by 20–50% is making this prediction come true.¹⁷

Governmental institutions dealing with the environment, such as the Royal Scientific Society and the Royal Society for the Conservation of the Nature, were supporting the project. Friends of the Earth Middle East, one of the most important environmental NGOs in the country, was invited by Consolidated Consultant to take part in the debate on the Disi pipeline during the preparation of the feasibility plan. On that occasion they criticized the project, but did not formally reject it. Their main criticism concerned the risk that the high percentage of water losses in the Amman distribution network would eventually invalidate the benefits from Disi. Friends of the Earth Middle East also expressed a negative view of the final use of the Disi water. In the absence of a separate network for domestic water supply, they argued, part of the high-quality water from the fossil aquifer would be misguidedly destined to both the industrial and the touristic sector in the Aqaba zone (Friends of the Earth Middle East 2002). Only in recent times (2007) did they clearly speak against the project, addressing the issues of its unsustainable environmental impact and the fossil nature of its water (Friends of the Earth Middle East 2007).

Farmers also played an important role in the Disi project. Although the rate of exploitation of the aquifer for agricultural purposes increased in the second half of the 1980s, the planning of the Disi–Amman pipeline forced the country to reconsider the allocation of the Disi water.¹⁸ The

Jordanian government declared that, upon expiration of the contracts in 2011, all exploitation of the aquifer for irrigation would be ceased. An exception would be made for small plots cultivated by the local population.

From the beginning, the problem appeared difficult to solve. The government pledged itself not to renew the contracts, but this engagement appeared difficult to honour, since major agro-business companies – owned by former senior government officials – had made huge investments to set agricultural production under way.¹⁹ Indeed, the agro-business companies are still pressing for a renewal of their contracts.

Local communities should have been the main actor in the Disi project, since the populations of the south risked losing their control over the aquifer, but were not consulted during the preparation of the project, and were eventually involved later on, during the design and implementation phase, with the sole aim to overcome any opposition against the project (Abu-Anzeh 2006). Even the beneficiaries of the project, the Amman residents, were threatened with a steep rise of water prices in case of an increase in energy costs (Aloul 2004). To gain the population's support, the government was emphasizing the positive effects of the project on the development of the South: job opportunities, improved infrastructures, more water for the villages along the pipeline. At the same time, the government let very little technical information leak through, thus depriving the population of objective data to evaluate the real impact of the project on their living conditions.

The press, too, was giving optimistic reports about the future increase of the water supply and the beneficial effects of the project, but no article was published giving clear information about the quantity of water actually being drawn from the aquifer, the forbidding of its use for irrigation or the future price of water for Amman users. The quantity of water to be pumped from Disi changed every year both in the press and in the official data from the Ministry of Water and Irrigation, as follows:

- 1993: El-Nasser speaks of 125 MCM a year over 50 years (Schiffler 1998, p. 223).
- 1997: Halliburton KBR official indicates a maximum of 40–50 years at a rate of 100 MCM.
- 1996: Feasibility studies by consultancy companies hired by the Minister of Water and Irrigation give an estimate of only 50 years, at a rate of only 80 MCM per year (Harza Group 1996).
- 1999: The *Jordan Times* speaks of 200 years with a rate of 100 MCM a year.
- 2002: The *Jordan Times* suggests 100 years with a rate of 80 MCM a year, in both cases without citing its sources (*Jordan Times*, 17 October 1999, 8 January 2002).
- 2001: The *Jordan Times* states that Disi will provide 100 MCM a year for 100 years (14 August 2001, 12 February 2001).
- 2002: A report published by USAID refers to 50 MCM a year for 100 years (USAID 2002).
- In an interview in March 2002, the Minister of Water and Irrigation, El-Nasser, gave assurances that Disi would provide 200 MCM per year for 200 years (Greco 2002).
- Various officials interviewed between February and April 2002 mention periods going from 100 and 150 years at a rate of 80 MCM a year (Greco 2003).

The political and economic support of the international community and large multilateral organisms is just as important as internal consensus for the success of major international water projects. Because of its difficult economic situation, Jordan necessarily had to combine the contracting out of projects to the private sector with soft loans to limit their costs and reduce their social impact.

International cooperation institutions such as the World Bank maintained an extremely ambiguous attitude towards the Disi–Amman pipeline project, in that, while refusing to finance

the project for the environmental reasons detailed so far, they never openly condemned it (Global Water Intelligence 2001).²⁰ We might assume that one of the reasons why international funding institutions did not criticize the Disi project – in particular as regards the giving away of water to agro-business – was that Israel had been exploiting the Mountain Aquifer of West Bank since 1967 to grow grapefruit in the Negev desert, and Saudi Arabia, too, had used fossil water for its agriculture in the past. Basically, Jordan was doing the same as its neighbouring countries.

As regards the competing actor for the exploitation of the Disi, that is, Saudi Arabia, Jordan publicly accused the country in 1992 of overexploiting the aquifer. In 1999, it renewed its accusation, without getting any reaction from the Saudis. During the same year, the Saudi government was informed of Jordan's exploitation of the aquifer, but "did not formally respond, although the Jordanian Minister was advised that the Saudis had no objection" (World Bank 1999). This is a clear case of "voluntarily silencing" the issue for the media and the public. In the following years, the two parties showed by their actions that they would not cooperate and would continue taking unilateral decisions concerning the exploitation of their shared aquifer.

Actually, Saudi Arabia appears to have been totally absent in the debate on the Disi–Amman project. Its silence during the last year is possibly a sign that Saudi Arabia exploitation has reached the threshold beyond which the aquifer begins to deteriorate and salinization of the soil sets in. Negotiating an agreement with Jordan would have required the country to disclose its extraction rates, which are against all environmental norms.²¹

In the last analysis, it appears that there is a misinformation problem affecting the Disi–Amman conveyance system resulting in the present silencing of the issues concerning the project. To use a term employed by Barry Buzan *et al.* (1998), Jordan has been adopting a "securitization" strategy in recent years. An issue can be securitized in order to keep it within the sphere of national security and out of the political debate. This can be followed by violence²² or, as in this case, by a non-action strategy, simply by silencing the issue (Greco 2005). A will to carry out strategies in silence may account for the low profile of the public debate over the Disi aquifer.

The missing relationships

In our first analysis describing the position of the different actors involved in the Disi project, it appears that some relationships are missing. Both the southern village communities affected by the project and the end users in Amman exposed to a rise of the price of water in case of rises in electricity costs had no influence on the Ministry of Water and Irrigation. Nor was there any influence from the media, which are not informing people and have not opened a public debate on the Disi project.

Another important missing relationship is that between Saudi Arabia and Jordan.²³ The lack of an agreement between Jordan and Saudi Arabia over the Disi aquifer was partially explained by Shapland and Chatterton. Regarding Saudi Arabia's lack of reaction to accusations of over-exploiting Disi, Shapland suggested that the country did not want the issue to become a subject of public discussion. This avoidance of diplomatic exposure, creating a black hole in the media and public opinion, is a case of "voluntarily silencing" the issue.

The lack of contact between the two governments can only stand in the way of the most effective exploitation of the resource of both countries. At worst it could lead to a pumping race. (Shapland 1997)

Another useful political analysis of Disi was put forward by Chatterton:

The leap in consumption in Jordan in the period since 1990 has also in a sense been due to a scramble to obtain water. . . . Jordan has increased its water consumption by pumping the shared Disi aquifer

which lies across its Southern international border with Saudi Arabia. . . . In the 1990s, however, in order to establish its “rights” over the groundwater Jordan has been developing wells from which water has been pumped to irrigated crop production. Such water rights may not be sustainable in the long term but they are significant to establish negotiating positions. (Chatterton 1996, p. 356)

Both of these comments point to a “prior use” strategy. Shapland speaks of a “pumping race”, and it is indeed clear that we are dealing here with a zero-sum game. We cannot but agree with Shapland and Chatterton that Jordan is trying to create a *de facto* situation to avoid the risk of losing the Disi water in the future. Considering the behaviour of the two countries, their lack of agreement over this shared resource and the complete silence surrounding the issue, we can definitely conclude that a “silent” pumping race between the two countries is going on, and that the Jordanian government began tapping the Disi aquifer in the 1990s as a preventive manoeuvre to be able to support its claim to its water in the future.

Chatterton points out that there was no need to rent out the land overlying Disi to private farmers; indeed, the farmers were enticed with a very convenient contract (no tax on water and almost no limitation on their choice of crops). Thanks to this policy, the government was able to attain an extraction rate of 70 MCM a year, a quantity which was sufficient to support its claim against Saudi Arabia in the international arena.²⁴

The Minister of Water and Irrigation officially classified as “secret information” data such as the renewability of the aquifer, its present capacity and the environmental impact of the project.²⁵ The Disi question was treated as a national security issue and thus became a non-negotiable matter, as official declarations to the national press and public speeches made in 2004 bear out.

During the international conference on water demand management, Bridging the Gap, held at Amman in June 2004, the Minister of Water and Irrigation, Hasim El-Nasser, refused to answer questions regarding the Disi project. He justified his behaviour as “prevention for possible information escape, which could damage the success of the project.”²⁶

Since water is crucial for the security of Middle Eastern states, the emergence of a “water security dispute” between Saudi Arabia and Jordan is quite likely, especially considering the similarity of their attitude to water resources. In the case of the Disi issue, the lack of a political debate, non-consistent information and the two countries’ wish to secure a common resource for their own exclusive use are clear symptoms of this “security” syndrome affecting both the countries.

Conclusion

It is unlikely that the pumping race between Saudi Arabia and Jordan will ever lead to an open conflict. The two countries have only recently shown a will to collaborate in the management of their shared resource, however, they still do not publicly communicate or exchange information. A quiet pumping race is going on, and there is no incentive for the two countries to put a stop to it and cooperate. The nature of the aquifer also plays a key role in this. A fossil aquifer does not guarantee a long-term return on a state’s investment, so the incentive for cooperation is low. The resulting state of affairs concerning Saudi Arabia is an instance of what has been called the “tragedy of the commons”: a situation where attempts to maximize the satisfaction of individual needs lead to the depletion of a scarce natural resource.

From an internal point of view, the whole history of the Disi project is marked by a constant lack of transparency. The Ministry of Water and Irrigation has strongly supported the Disi pipeline, but never promoted any public debate over the risks involved in the exploitation of a fossil aquifer. Neither was any voice raised against the project from other Jordanian institutions, included the recently founded Ministry of Environment. A truly participatory approach to

environmental issues may be the only way to create an interaction between institutional enforcement and social awareness of water problems.

Jordan's water deficit, which is expected to increase over the next decades, cannot be overcome without exercising a real control over the water demand. The same amounts of Disi water currently used in agriculture will be obtained from treated wastewater by 2020. More freshwater could be obtained by eliminating unaccountable-for water, by stopping illegal underground water drilling and by reducing the export of water-intensive agricultural products. Moreover, Disi risks increasing imbalances and social inequality. For a long time now, Jordan has been conveying water to Amman from all over the country at high economic, environmental and social costs. Nowadays it would be more convenient to exploit Disi in a much less intensive way, utilizing its water to improve the living conditions of the underdeveloped south (Ghazal 2007).

The lack of a clear water strategy in Jordan and the obstacles in the way of attempts to reach a political turning point make the Disi project still a priority for Jordan's water security. Under-debated, difficult to evaluate by policy analysts and researchers and beset with many economic and environmental uncertainties, the big water project is just ready to start. The latest news about the quantity of water and the duration of the project are 100 MCM a year for 50 years. Engineer Ali Subah from the Ministry of Water and Irrigation (Jordan) talks about a "memorandum of understanding" between the two countries, signed in 2007, but the contents of this document are not known and nothing has been signed yet by the ministry in person.²⁷ Despite this lack of transparency, the inauguration of the works was held on 3 August 2008.

Notes

1. Estimations of the recharge rate and total capacity of the Disi aquifer are totally discordant. In an article published in 1999, Elias Salameh estimated the annual recharge rate at 40–48 MCM. Direct sources at the Ministry of Water and Irrigation gave an estimate more consistent with the fossil nature of the aquifer. In an interview granted to the authors in 2004, a functionary spoke of a recharge rate of merely 2 MCM per annum. In an interview dating from the same year, Consolidated Consultant estimated the annual recharge rate at less than 1.5 MCM. Cf. Salameh and Gedeon (1999).
2. The exploitation of fossil aquifers threatens the environment in several ways, including the alteration of the hydro-geologic balance, which in its turn affects the oasis.
3. Agricultural subsidies were dramatically curtailed in the early 1990s in the framework of governmental deficit reduction plans. Bureau of Economic and Business Affairs, US Department of State, *Country reports on economic policy and trade practices*, February 2002.
4. Data provided by the Secretary-General of the Ministry of Water and Irrigation Sa'ad Bakri during an interview to the authors held in February 2004. According to Elais Salameh, instead, Saudi Arabia extracts more than 1 billion cubic metre per annum from Disi, and is already facing serious overexploitation problems, increasing salt content in the water, and salinization of the land overlying the aquifer. These environmental problems, says Salameh, are confirmed by aerial photos indicating continuous moving of drilling areas.
5. The large agro-business companies presently exploiting the Disi aquifer produce grain for the foreign market, despite Jordan's huge cereal deficit. It is a sort of virtual water export versus virtual water imports, the first being a profit for the private companies, the second a cost for the Jordanian government.
6. The project was due to be completed within five years from the closing of the international bid. Hence, the concession of the pipeline would have expired after 35 years. The winner consortium would have conveyed the water to the pipeline's turnout points, where the government would have taken over, paying the private consortium and collecting bills from users. Today, the winning company GAMA is declaring that it will hand the operation back to the government within 25 years, while the press agency IRIN NEWS still refers to 40 years, as in the previous scheme. Source: <http://www.irinnews.org/PrintReport.aspx?ReportId=74679> (accessed 18 November 2008). Data on the duration of the Disi project are not clear (IRIN Middle East 2007).
7. Interview with Dr Munther Haddadin during the international water management conference Bridging the Gap, held in Jordan, 29 May–3 June 2004.

8. Several major international companies took part in the bid. Fourteen consortiums passed the pre-qualification stage at the time of the first BOT scheme.
9. Some private companies reports are talking about the Disi BOT as one of the worst in the world, due to its high-risk characteristics. "Disi water-project is an example of a BOT-model which has proved very damaging elsewhere in the world" (Hall and Lobina 2006).
10. Interview granted to the authors by former minister Dr Hasim El-Nasser: Amman, 28 March 2002.
11. The legislative election of 1997 showed the enduring importance of tribes in the political life of Jordan and the role that tribal leaders (sheikhs) still maintain in its society (Jungen 2002).
12. Focus groups were formed to discuss the main issues of the project. Their views were included in the first draft of the study submitted to the World Bank. A final version was then prepared, taking account of the World Bank's comments, and submitted again to the World Bank.
13. An update of the feasibility study commissioned by the government to the English company Scott & Wilson was also underway at that time.
14. According to Prof. Salameh, the fossil aquifer is threatened by contamination. An extraction rate of 100 MCM per annum, if maintained for over 40 years, is going to lower the groundwater level, causing intrusions from overlying saline aquifers like the Khreim and the Jafr. Furthermore, the lowering of the aquifer's level would require the digging of deeper wells, and hence raise the energy costs of the project.
15. Actually, this estimate should include another 20 MCM per annum for Aqaba. Over the last few years, this city's water requirements have increased steeply following the expansion of the tourist sector and the growth of industrial activities as a consequence of the creation of the Aqaba Special Economic Zone (ASEZ) in 2001 (MEED 2003).
16. Haddadin introduced a new concept, related and somehow opposite to virtual water: "shadow water." According to him, this new term is more accurate and location-specific because it embraces industrial water saved through imports as well as water saved by food imports. This new term implies that the water saved through imports reflects or is a shadow of the real water used to produce the imported commodities in their countries of origin. Shadow water is the scarce indigenous water resources that the importation of agricultural and industrial commodities saves or replaces.
17. At the beginning of 2008 the government decided to allow fuel prices to float freely, and to lift subsidies on basic commodities including food, cooking, oil and gas.
18. The agro-business companies mainly irrigate by sprinkler, so that big amounts of water are lost through evapotranspiration.
19. In Disi, farm fuel, machinery, seeds, fertilizers and manpower are imported; the only Jordanian input is the most scarce one: water.
20. The Jordan government decided to go ahead with Disi without financial contributions from neighboring Arab states or funding pledges from donor institutions such as the World Bank (GWI 2001).
21. The increasing pressure on underground resources was probably a consequence of the obsolescence of many desalinating plants built between 1975 and 1985. Incentives to agriculture in an impossible quest for food self-sufficiency, the lack of control on tapping by farmers and the inefficiency of irrigation and drainage systems were leading to an irreversible deterioration of the country's groundwater resources (Al Alawi and Abdulrazzak 1994)
22. On "violization", see Neumann (1998). See also Zeitoun and Warner (2006).
23. Saudi Arabia has largely ignored Jordan's complaints about its misuse of the aquifer.
24. Because of Saudi Arabia's economic and political supremacy, Jordan had less bargaining power in the Disi negotiation.
25. Interview granted to the authors in February 2004 by Sa'ad Bakri, Secretary-General of the Ministry of Water and Irrigation.
26. Interview granted to the authors in February 2004.
27. The memorandum of understanding has been signed by the Secretary-General of the Ministry of Water and Irrigation of Jordan in 2007, according to a public comment of Engineer Ali Subah given in August 2008 at the World Water Week congress in Stockholm.

References

- Abu-Anzeh, N., 2006. Community participation as a measure of self-sustainable social-environmental planning. *The case of Disi area settlements, Jordan*, King Saud University, College of Architecture and Urban Planning, Riyadh, Saudi Arabia. Available from: <http://faculty.ksu.edu.sa/abuanzeh/My%20Publications/English%20Publications/Community%20Participation-2006.pdf> (Accessed 18 November 2008).

- Al Alawi, J. and Abdulrazzak, M., 1994. Water in the Arabian peninsula: problems and perspectives. In: P. Rogers and P. Lydon, eds. *Water in the Arab World*. Harvard: Harvard University Press, 171–202.
- Aloul, S., 2004. Water charges to rise in case electricity price goes up. *Jordan Times*, 8 February.
- Barham, N., 1998. *Human impact on the water problems*. The case of Jordan. Unpublished paper. Amman: Jordan University.
- Buzan, B., 1997. A rethinking security after the Cold War. *Cooperation and Conflict*, 32 (1), 5–28.
- Buzan, B., Waever, O. and de Wilde, J., 1998. *Security: a new framework for analysis*. London: Lynne Rienner Publishers.
- Central Intelligence Agency, n.d. *The Fact Book*. Available from: <https://www.cia.gov/library/publications/the-world-factbook/geos/jo.html#Geo> (Accessed 18 November 2008).
- Chatterton, B.L., 1996. Closing a water resource; some policy considerations. In: P. Howsam and R. Carter, eds. *Water policy: allocation and management in practice*. London: E & FN Spon, 355–361.
- Economic and Social Commission for Western Asia (ESCWA), 2000. *Assessment of legal aspects of the management of shared water resources in the ESCWA region*. New York: United Nations.
- El Nasser, H. and Macoun, A., 1999. Groundwater resources management in Jordan: policy and regulatory issues. In: M.A. Salman, ed. *Groundwater: legal and policy perspectives: proceedings of a world bank seminar*, Washington DC: World Bank Publications.
- Ferragina, E., ed., 1998. *L'acqua nei paesi mediterranei*. Bologna: Il Mulino.
- Ferragina, E., 2001. Social adaptive capacity to a water scarcity situation: the case study of Jordan. In: R. Joffé, ed. *Jordan at the millennium: transitions in contemporary Jordan (1989–2000)*. London: Hurst & Co, 346–367.
- Ferragina, E., ed., 2003. *Acqua e Sviluppo, una politica delle risorse idriche per il futuro del Mediterraneo*. Bologna: Il Mulino.
- Frey, F.W., 1993. The political context of conflict and cooperation over international river basins. *Water International*, 18, 54–68.
- Friends of the Earth Middle East, July 2002. *Non governmental report on the way to sustainability* [online]. Presented at the World Summit for sustainable development. Available from: http://www.foeme.org/index_images/dinamicas/publications/publ47_1.pdf (Accessed 18 November 2008).
- Friends of the Earth Middle East, January 2007. Newsletter [online]. Available from: <http://www.foeme.org/docs/newsletter42.htm>.
- GAMA 2007. *Disi-Mudawara-Amman Project*, 22 October 2007 [online]. Published on GAMA official website. Available from: <http://www.gama.com.tr/international/english/newsfromusdetay.php?Id=37> (Accessed 18 November 2008).
- Ghazal, M., 2007. Bring the people to Disi aquifer, not water to the city. *Jordan Times*, Thursday, 18 January, p. 2.
- Greco, F., 2002. *Progetti di sviluppo idrico in Giordania: il caso Disi-Amman*. Unpublished thesis. University of Bologna.
- Greco, F., 2003. L'acquedotto Disi in Giordania. *Afriche e Orienti*, 3–4, 63–75.
- Greco, F., 2005. *The Securitization of the Disi aquifer: a silent conflict between Jordan and Saudi Arabia*. First workshop on hydro-hegemony. London: King's College. Available from: http://www.soas.ac.uk/research/our_research/projects/waterissues/papers/38415.pdf (Accessed 18 November 2008).
- Global Water Intelligence (GWI), 2001. Jordan asks for Disi pre-qualifications. *Global Water Intelligence*, 2, 9 September 2001.
- Haddadin, M.J., 2004. Natural synergy of water and energy, *Bridging the gap*, 29 May–3 June 2004, Dead Sea, Jordan.
- Haddadin, M.J., 2006. *Water resources in Jordan: evolving policies for development, the environment, and conflict resolution*. Washington, DC: Resources for the Future Press.
- Hall, D. and Lobina, E., 2006. *Pipe dream: failure of the private sector to invest in water services in developing countries*. London: PSIRU. Available from: <http://www.psir.org/reports/2006-03-W-investment.pdf> (Accessed 18 November 2008).
- Harza Group, 1996. The water conveyance system from Disi-Mudawarra to Amman. Feasibility study report, vol. 2. Harza Group.
- IRIN Middle East, 2007. *Jordan: US \$600 million project to end water shortage*. UN Office for the Coordination of Human Affairs, [online]. Available from: <http://www.irinnews.org/PrintReport.aspx?ReportId=74679> [Accessed 7 October 2007] and available in Arabic from: <http://arabic.irinnews.org/ReportArabic.aspx?SID=358> (Accessed 18 November 2008).
- Jungen, C., 2002. Tribalism in Kerak: past memories, present realities. In: G. Joffé, ed. *Jordan in transition*. London: Hurst and Company, 191–207.

- MEED, 2002, Amman embarks on Disi, *Middle East Economic Digest*, 11 January 2002.
- MEED, 2003, Special Report Jordan, *Middle East Economic Digest*, 15 August 2003.
- Ministry of Water and Irrigation, 1997. *Jordan Water Strategy*, Policy paper. Amman: The Hashemite Kingdom of Jordan.
- Neumann, I.B., 1998. Identity and the outbreak of war: or why the Copenhagen school should include the idea of “Violisation” in its framework of analysis. *International Journal of Peace Studies*, 3 (1), 7–22.
- Pitman, G.T.K., 2004. Jordan. *An evaluation of bank assistance for water development and management*, A country assistance evaluation. Washington, DC: World Bank.
- Salameh, E. and Gedeon, R., 1999. *Renewability of Disi–Wadi Yutum aquifers’ water using isotopes and hydrogeologic analyses*. Amman: University of Jordan.
- Schiffler, M., 1998. *The economics of groundwater management in arid countries. Theory, international experience and a case study of Jordan*. London: Frank Cass.
- Shapland, G., 1997. *Rivers of discord. International water disputes in the Middle East*. New York: St Martin’s Press.
- USAID, 2002. *Jordan: IBRD—Disi Amman conveyor project*. United States Agency for International Development. Available from: http://www.usaid.gov/pubs/mdb/east_north_africa.html (Accessed 18 November 2008).
- US Geological Survey, n.d. Available at: <http://www.exact-me.org/trends/index.htm> (Accessed 23 November 2008).
- Zeitoun, M. and Warner, J. 2006. Hydro-hegemony: a framework for analysis of transboundary water conflicts. *Water Policy*, 8, 435–460.