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**Can “Integrated Water Resources Management”
silence Malthusian concerns?
The case of Central Asia**

Abstract

The debate on international water problems is largely dichotomous. It is split between the more analytical perspective of International Relations (IR) and related social sciences, on the one hand, and rather normative, problem-solving contributions, on the other hand. While the IR discourse focuses on resource conflicts, the prospects of water wars, and opportunities or problems of international water regimes, the normative discourse concentrates on prescriptive concepts like the Dublin Principles, international water law or “Integrated Water Resources Management” (IWRM).

The paper aims at exploring how these rather separate spheres can link up productively in order to ease the solving of international water problems. Therefore, it demonstrates the complementary character of the Malthusian discourse on resource conflicts and the concept of IWRM by scrutinising a regional example of severe water-related problems.

Central Asia – and the Aral Sea Basin in particular – clearly constitutes a water “hot spot”. Malthusian analyses highlight international upstream-downstream conflicts over relative water distribution (hydropower generation in upstream countries vs. irrigation in downstream countries), growing transboundary conflicts over absolute distribution (notably caused by ambitious Turkmen development projects and the expected recovery of Afghan agriculture), as well as regular intra-state violence motivated by competition over scarce water resources.

The paper shows how most of these problems could effectively be handled by adopting IWRM principles for water management: Basin-wide inter-sectoral integration creates opportunities for win-win solutions; demand management could largely reduce absolute pressure on water resources; and decentralised management structures would mitigate local water conflicts.

However, neither Malthusian analyses nor the concept of IWRM contain receipts for effectively implementing these potential solutions. On the contrary, a perspective of political economy reveals how vested interests prevent reforms within the cotton-growing agriculture in downstream countries, which alone would enable inter-sectoral flexibility, a shift towards demand-management and the decentralisation and democratisation of local water management.

In consequence, both IR approaches and normative concepts like IWRM need to be complemented by a profound knowledge of domestic politics within affected states if they are to identify realistic ways for solving water problems.

1 Introduction: Analytical vs. normative views on international water problems

If problems related to freshwater have grown in past decades due to demography, economic development and the internationalisation of river basins, so has the number of concepts aiming to explain and alleviate these problems. On the one hand, analytical concepts like “Water Stress” (Falkenmark 1989) “Adaptive Capacity” (Turton/Ohlsson 1999), “Virtual Water” (Allan 2003) or “Environmental Security” (Brauch 2003) have been developed in the realm of social sciences, including International Relations. Many of these contributions were intended to clarify in how far Malthusian¹ assumptions about scarcity-induced water conflicts are justified. On the other hand, rather normative concepts such as the “reasonable and equitable use” of transboundary waters, the minimum ecological flow requirement, the Dublin Principles or the Bonn Keys have resulted from diverse political fora, where policy-makers and practitioners have formulated recommendations, guidelines and prescriptions for better water management. Based on these principles, “Integrated Water Resources Management” (IWRM) has emerged as the state-of-the-art model of ideal water management.

It is astonishing to note, however, how far the water discourse’s analytical and normative layer remain disconnected. Both constitute largely separate spheres, although – theoretically – they are complementary and supposed to build on each other: Analytical approaches should identify, forecast and render intelligible water problems. Based on their analyses, normative guidelines and practical tools could be developed or chosen in order to solve these problems.

¹ The (Neo-)Malthusian approach derives its name from Thomas Malthus’ *Essay on the Principle of Population* (1798), which draw a gloomy picture of demography-induced resource scarcity, necessarily leading to either famine or war. With regard to water conflicts, (Neo-)Malthusians point out the conflictive consequences of growing water scarcity. While both Malthusians and Neo-Malthusians share this general conviction, classic Malthusians perceive water conflicts as a direct consequence of increased competition over water (cf. Starr 1991), whereas Neo-Malthusians stress that water scarcity rather indirectly leads to conflicts via its socio-economic consequences like decreasing agricultural productivity or overall economic decline (cf. Homer-Dixon 1999).

In practice, this complementary relationship rarely materialises. Most work on water problems either concentrates on scientific analysis or focuses on principles of “good” water management. Although this dichotomy is not surprising considering the different origins of the analytical and normative concepts, it certainly constitutes a missed opportunity.

The present paper intends to explore ways for overcoming the dichotomy by scrutinizing a well-known regional example of severe water-related problems: Central Asia. This region² – with its highly symbolic Aral Sea turned into Aral Desert – is a “hot spot” for Malthusian analysts, who highlight serious inter- and inner-state water conflicts (cf. Klötzli 1996). In addition, Central Asia is probably the region where international donors have deployed most efforts to improve water management. Among others, programmes under the label of IWRM are implemented in the Ferghana Valley (Swiss Development Cooperation; cf. IWMI/SIC 2005) and in the Chu and Talas River basins (TACIS). Linking the water discourse’s analytical and normative layer, the present paper investigates in how far IWRM actually offers adequate answers to Malthusian concerns vis-à-vis Central Asian water problems.

The text proceeds as follows: First, water conflicts in Central Asia are analysed under a Malthusian perspective (2). Second, components of IWRM are discussed as potential solutions to these conflicts (3). The question then arises what impedes the implementation of these IWRM-inspired solutions. Thus, respective obstacles are identified third (4). The chapter concludes with a recommendation for future research in “hydropolitics” (5).

2 Malthusian concerns regarding Central Asia

Central Asia in general and the Aral Sea basin in particular might be the region where humankind has most consequently realised its “hydraulic mission”. While the Syr Darya and

² In this text, Central Asia is defined as encompassing Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

the Amu Darya have seen irrigated agriculture for more than 2.000 years (Glazovsky 1995)³, it is not until Soviet times, however, that development planners have fundamentally changed the basin's ecological balance.⁴ Responding to a search for autarky in cotton production, irrigation expanded from about 2,5 million hectares to 7,5 million hectares of irrigated area (O'Hara 1998: 4). In consequence, the river water inflow into the Aral Sea decreased from about 56 km³ prior to 1960 to 43 km³ in the 1960s, 17 km³ in the 1970s and it almost ceased in the 1980s (ibid.). The resulting desiccation of the Sea and the complete halt to its fishing industry did not come as a surprise but were deliberately taken into account as negative side-effects of the ambitious irrigation programmes.

Despite its enormous ecological costs, this development scheme did work until the dismantling of the Soviet Union. With the internationalisation of the Aral Sea basin in 1991⁵, however, the Moscow-led overall management of the basin's resources disappeared.⁶ Competing interests stopped being balanced by cross-Union compensations. Demography and the post-Soviet economic crisis led to increased pressure on agriculture, accompanied by a sharp deterioration of irrigation infrastructure due to lacking maintenance and repair. In this

³ According to O'Hara, basic irrigation schemes in the Aral Sea basin date back as far as 8,000 years (O'Hara 1998: 2).

⁴ Cf.: "Like the Tsarist rulers before, the Soviets believed that Central Asia could become a major cotton growing region if the irrigation network was expanded. But while Tsarists plans failed because they were dependent on financing from the private sector, the Soviets covered the construction costs of large scale irrigation schemes from central funds" (O'Hara 1998: 4).

⁵ Actually, the Amu Darya basin had been international even before, with Afghanistan and Iran as non-Soviet riparians. However, this had had only minor consequences if compared to the independence of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The end of the Soviet Union led to a constellation where the Syr Darya, for instance, crosses four international borders before reaching the Aral Sea.

⁶ Towards the end of the Soviet Union, regional water management had already turned increasingly conflictive, leading to the establishment of two basin management organisations – one for the Syr Darya and one for the Amu Darya –, both based in Uzbekistan (Sehring 2002: 11). However, the main directives were still received from Moscow, quotas being set by the Ministry of Land Reclamation and Water Management in close coordination with the Ministry of Energy (ICG 2002: 6).

context, diverse inter- and intra-state water conflicts got apparent, which will be discussed in the following sections.

2.1 *International conflicts over relative water distribution*⁷

In Soviet times, numerous reservoirs were built in the two upstream Soviet Republics of Kyrgyzstan and Tajikistan in order to guarantee sufficient irrigation water downstream in late summer, when the natural water flow from snow and glacier melt decreases. Hydropower generation only came as an additional gain from the reservoirs, while priority was clearly given to irrigation needs in Uzbekistan, Kazakhstan and Turkmenistan. This perspective changed when the former Soviet Republics gained independence. As supply of energy resources from downstream countries (electric power and coal from Kazakhstan, fuel oil and gas from Uzbekistan) switched to world market prices and the two comparatively less developed upstream countries started to feel the financial burden of maintaining the large dams on their territory, their interest in changing river management priorities towards hydropower generation increased. In this context, the newly independent riparian states adopted a provisional agreement in 1992 in order to uphold the Soviet-time management scheme, fearing the unexpected consequences of uncoordinated river management. Since 1995, bilateral barter deals were concluded on an annual basis, rewarding water regulation services by Kyrgyz dams with the free delivery of energy resources from downstream states and a purchase guarantee for surplus Kyrgyz electricity in summer months.⁸ In March 1998, this cooperation scheme was renewed within the framework of the Central Asian Economic Community (CAEC), when the Prime Ministers of Kazakhstan, Kyrgyzstan, and Uzbekistan

⁷ For a general discussion of relative distribution conflicts, see Lipiszewski 1996: 128-131.

⁸ For a summary on water releases and energy resource supplies stipulated by the agreements and actually delivered in 1995-1999, see Antipova et al. 2002.

signed a treaty on the use of water and energy resources of the Syr Darya basin. They were joint by Tajikistan in 1999 (Antipova et al. 2002).⁹

However, these agreements proved unreliable (De Martino et al. 2005: 22). Kyrgyz authorities responded by prioritising hydropower generation in the regulation of the main Toktogul reservoir to unmet promises of energy resources supply by downstream states. Consequently, the share of Toktogul releases for irrigation needs decreased from 69% to 34% since 1993, while winter releases for hydropower generation increased from 31% to 66% (Giese/Sehring/Trouchine 2004: 8). This led to downstream flooding in winter months – due to the frozen and dammed river bed – and to water shortages in the crop-growing season.

The lack of compliance to regional agreements can be explained by the prisoners' dilemma in which the riparian states are trapped: In absence of an overall authority compliance with agreed-upon rules becomes a rather risky undertaking. If Kyrgyzstan reduces hydropower production in winter, for instance, it nevertheless cannot be sure that subsequent compensations materialise in case that the following summer's irrigation needs are below average thanks to above-average rainfall. Consequently, the riparian states lack trust in each other, increasing the unreliability of their common agreements.

This upstream-downstream conflict over relative (i.e. seasonal) distribution of water between hydropower generation in upstream countries and irrigation in downstream countries is a good illustration of Aaron Wolf's argument on the importance of institutions for the successful management of inter-state water conflicts (Wolf 2001: 10): The pace of change (i.e. the internationalisation of the river basin) exceeds the institutional capacity to absorb that change. The two river basin organisations created in Soviet times are not recognised by riparians other than Uzbekistan and factually operate only on Uzbek territory. With the

⁹ In general, the conflict is less acute along the Amu Darya, since the latter is less regulated by upstream reservoirs than the Syr Darya. Thus, no comparable agreement has been signed yet for the Amu Darya.

International Fund for the Aral Sea (IFAS) and the Interstate Council for the Aral Sea Basin (ICAB), international donors have set up externally-driven institutions without real capacity to influence regional water policies (Sehring 2002: 16-18). The Interstate Commission for Water Coordination (ICWC) performs better in this regard, but is also lacking substantial authority. It seems that only the old Soviet network of water experts prevents an escalation of the water conflict. Bilateral negotiations take place annually at the level of (vice) prime ministers, where seasonal water distribution and the delivery of energy resources are decided.

Correlating with Malthusian theses, the relative distribution conflict finally got virulent with the increase in importance of water for the riparian states in general and for Kyrgyzstan in particular. As industry nearly completely collapsed after independence and other natural resources – with the exception of some limited gold reserves – are scarce in this largely mountainous country, water is perceived as Kyrgyzstan's only wealth. A growing nationalist discourse in Kyrgyz politics demands payments for the water from downstream users just like Kyrgyzstan has to pay for fuel imports. In 1997, the Kyrgyz parliament even adopted a law postulating this principle for regional water cooperation (O'Hara 1998: 6).

2.2 International conflicts over absolute water distribution

While the relative distribution conflict between upstream hydropower generation and downstream irrigation clearly is at the centre of the region's water problems, issues of absolute water distribution progressively gain importance. Together with the management regime of the big reservoirs, the quotas for water consumption from Soviet times were confirmed in 1992. These quotas are represented in table 1.

Table 1: Flow formation and water allocation in the Aral Sea basin				
Country	Amu Darya		Syr Darya	
	Flow formation (km ³)	Quota (km ³)	Flow formation (km ³)	Quota (km ³)
Afghanistan	11,6	0	0	0
Kazakhstan	0	0	2,4	12,3
Kyrgyzstan	1,6	0,2	27,6	4,0
Tajikistan	59,9	9,1	1,0	2,5
Turkmenistan	1,5	22,0	0	0
Uzbekistan	4,7	33,9	6,2	19,7
Total	79,4	65,2	37,2	38,5

Source: Adapted from McKinney 2003: 193.

The quotas potentially restrict water use in agriculture, as irrigation accounts for over 90% of the region's water consumption. Currently, however, not all riparian states make full use of their quota, since the deterioration of irrigation infrastructure limits their capacities for water abstraction. Kyrgyzstan, for instance, leaves more than 2 km³ of its water share to downstream neighbours. Yet, this does not lead to additional water reaching the Aral Sea, as most water unused by upstream regions is consumed by irrigated agriculture in the Sea's delta region, where canal tail ends already suffer from regular water scarcity in dry years. In addition, water consumption upstream is supposed to rebound in the future, as the Kyrgyz and the Tajik economy recover from post-independence economic crisis respective civil war.

What is more, the recovery of Afghanistan from civil war and Taliban rule raises some additional concerns. It is expected that Afghan water consumption will increase soon, as its rural population has few economic alternatives to irrigated agriculture besides poppy cropping. This will significantly reduce the flow of the Amu Darya, where competition over

absolute water distribution is already intense. International development agencies accelerate this trend by assisting with the rehabilitation of Afghan irrigation infrastructure, aiming at stabilising the war-torn country (Giese/Sehring/Trouchine 2004: 20-23).

Further pressure on the Amu Darya results from ambitious development projects in Turkmenistan. First, the Turkmen leadership is currently extending the Karakum Canal, the world's longest canal (1,300 km), which accounts for 19% of total water abstraction from the Amu Darya. As the canal is not lined with cement, just dug into the desert sand, water losses through infiltration are enormous (Giese/Sehring/Trouchine 2004: 13-16). Second, the Turkmen president has announced the creation of an artificial "Lake of the Golden Century" in the Karakum desert, which is planned to provide additional opportunities for irrigation, but also for recreational activities until 2010. Although the Turkmen side affirms that the Lake will be alimented solely by drainage water, this does not seem to be realistic. In order to guarantee a minimum quality of the Lake's water – if possible at all – additional water will have to come from the Amu Darya (Giese/Sehring/Trouchine 2004: 17-19).

Increasing Turkmen water abstraction from the Amu Darya risks escalating already existing conflicts with Uzbek farmers in the river's delta. Near the Tuyamuyun Hydroengineering Complex, where irrigation canals routinely cross the Uzbek-Turkmen border, competition over irrigation water has already motivated Turkmen authorities to construct an additional – highly inefficient – primary canal, located exclusively on Turkmen territory, intended to decrease dependence on Uzbek water delivery (personal communication, Giese/Sehring/Trouchine 2004: 17). As Turkmen and Uzbek farmers in these downstream regions are increasingly insecure of getting sufficient irrigation water, they sometimes deliberately block drainage canals in order to assure at least a minimum of soil moisture for the following year, though being aware of the fact that this significantly accelerates the salinisation of their soil (personal communication).

Competition over scarce irrigation water has not led to inter-state violence up to date, although transboundary skirmishes between local communities have already been reported.¹⁰ However, the foreseeable sharp increase of water scarcity in downstream regions augments the prospect of further deteriorating relations between Turkmenistan and Uzbekistan. It is not necessary to adhere to water-war scenarios¹¹ to suppose that conflicts over absolute water distribution will contribute to regional instability and create enormous challenges for inter-state cooperation.

2.3 Intra-state scarcity conflicts

Research has revealed that water conflicts generally tend to be more intense the lower their geographical scale. While no international water war has ever occurred in modern times, local water conflicts can turn extremely violent (Wolf 1998).

This also shows to be true for Central Asia (cf. ICG 2002: 5). In areas where overall river flow, storage capacities and distribution networks cannot guarantee sufficient irrigation water to all farmers, water distribution gets a highly conflictive issue.¹² Water-stealing among farmers and village communities is a usual phenomenon, and distribution points frequently have to be guarded during the irrigational season. Similar to the Turkmen-Uzbek case referred to above, it is not uncommon to see physical solutions to water-stealing problems: Water users suffering from water stealing dig alternative canals in order to better control water delivery to their fields. Although these non-lined and uncovered canals lead to enormous

¹⁰ “There have also been continued problems in shared irrigation zones. Confronted with water shortages, Uzbeks and Turkmen in the lower Amu Darya region have sent raiding parties across to border to destroy pumping stations and irrigation canals” (O’Hara 1998: 7).

¹¹ For a critique of Malthusian approaches to “hydropolitics”, see Kipping 2005.

¹² It should be underlines that violent conflict over water is not a new phenomenon in Central Asia, but already known from ancient times: “Given the importance of water to Central Asian society it is not surprising that conflicts emerged. Disputes occurred at a number of levels. Most tended to be localised and were mainly concerned with gaining control over irrigated lands rather than water per se. But gaining control over water was of considerable importance not only because of its economic implications, but also because water could be used to control and subjugate people” (O’Hara 1998: 3).

water losses (usually up to 80%), their beneficiaries still regard them as the only and thus rational way for solving their problems with water stealing (cf. Herrfahrdt et al. forthcoming). The inability to reach consensual and viable agreements between competing water users illustrates the severity of the respective water conflicts. Inter-personal violence occurs when guards confront water thieves or in cases where individual farmers or whole village communities resort to violence against competing water users. Casualties are not exceptional, although these conflicts normally stop short of becoming deadly. As rivers and canals frequently cross international borders – most visibly in the Ferghana Valley – these essentially local conflicts often contain a transnational dimension, what makes them even more difficult to resolve. Polarisation and escalation along ethnic lines occurs as well (De Martino et al. 2005: 28), although these cleavages seems to be overstated in the media.

In addition, competition over water – which is difficult to distinguish from competition over land, as agricultural land in Central Asia normally means irrigated land due to the semiarid and arid climate – indirectly leads to conflicts via migration, a causal mechanism stressed by Thomas Homer-Dixon (Homer-Dixon 1999: 93-96). Pressure on cultivable land is highest in the densely populated Ferghana Valley¹³, sometimes aggravated by soil degradation such as water-logging and salinisation. In combination with lacking economic alternatives, people either look for work abroad (Russia and Kazakhstan are frequent destinations) or move to less densely populated areas like the Kyrgyz Batken Oblast. However, there is hardly any unused but usable land left over. Thus, these scarcity-induced migration movements result in increased competitions over resources in the places of destination, sometimes causing violent

¹³ The Ferghana Valley alone accounts for 45% of the irrigated area of the Syr Darya Basin (O'Hara 1998: 6).

conflicts as well. This occurred in Kok-Tash and Shorsu as well as in the Arka and Kistakuz regions of south-west Kyrgyzstan, for instance (De Martino et al. 2005: 18-19, 25-28).¹⁴

3 IWRM as a possible answer to Malthusian concerns?

As seen above, serious water conflicts – international relative and absolute distribution conflicts as well as intra-state scarcity conflicts – exist in Central Asia, and several factors make believe that their intensity is likely to increase in the future. How could regional (water)¹⁵ policies handle these conflicts in order to contribute¹⁶ to a more peaceful and cooperative development of the region?

IWRM figures as the “mantra” (Waterbury 1997: 279) of ideal water management and is promoted as such in Central Asia. What options does the concept offer for managing the water conflicts described above? In order to answer this question, the concept of IWRM will be shortly presented in the following paragraphs before its applicability to the different types of Central Asian water conflicts will be discussed.

Since the early 1990s, IWRM has established itself as a nearly universally accepted model of water management, with the 1992 International Conference on Water and the Environment in Dublin generally considered as its origin. IWRM aims at improving water governance by introducing interdisciplinary thinking into a field traditionally dominated by engineers and technicians. IWRM has in fact been developed in response to growing problems of the formerly predominant “engineering” and “supply-side” approach to water

¹⁴ The well-known Osh clashes between ethnic Kyrgyz and ethnic Uzbek in 1990 also appear to have been motivated by competition over irrigated land: “The Osh riots occurred after a Kyrgyz co-operative was given official permission to use irrigated lands on an Uzbek Kolhoz to build residential buildings [...]. Over 300 people are believed to have died and more than a 1000 were injured during these clashes and following them the Uzbek minority in Kyrgyzstan claimed an autonomy status in the Osh region” (O’Hara 1998: 6).

¹⁵ While IWRM focuses on water policies, the concept’s implications reach far beyond the water sector in the strict sense (cf. below).

¹⁶ Although water conflicts play a major role in Central Asian politics, their importance should not be overestimated either. The repressive character of most of the region’s regimes, the criminal economy or social inequalities are other main factors of instability and conflict in Central Asia.

management, which cared little about environmental, social and even economic externalities of water policies, focussing instead on making water supply fit increasing demand (GWP 2005: 1).

IWRM, in contrast, pursues a holistic, integrated approach to water management.¹⁷ But what does “integration” mean in this context? Following the understanding of IWRM put forward by Herrfahrdt et al. (forthcoming), IWRM requires three-fold integration: ecological, sectoral and regulatory.

Ecological integration demands that water management adopts an eco-system approach, systematically taking into consideration ecological interdependencies. In consequence, water should be managed according to hydrological boundaries, i.e. catchment and sub-catchment areas, not along artificial administrative boundaries (Argawal et al. 1999: 24). Managing hydrological units as a whole eases the internalisation of positive and negative externalities arising downstream, such as reduced water flow, pollution, but also flood protection by upstream dams. Furthermore, questions of water quantity should not be isolated from aspects of water quality (Argawal et al. 1999: 25), as both are important, and they are interlinked.¹⁸ In the past, water quantity issues have dominated water policies, whereas problems of pollution, changes in temperature, or eutrophication have received much less attention. In addition, ecological integration demands that development planners consider the impacts of land use on the water cycle and the consequences of water use for land areas (Argawal et al. 1999: 24). Key issues of water-land interaction include altered flow regimes due to modified land cover

¹⁷ The Global Water Partnership (GWP) defines IWRM as „a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (Argawal et al. 1999: 22, cf. also: WWAP 2003: 299).

¹⁸ Available water might be sufficient in quantity but of a quality that prohibits its use for household consumption or even for irrigation. Water users might also compensate poor water quality by increasing their quantitative demand. If irrigation water is saline, for instance, the risk increases that fields salinise. In this case, considerable amounts of water are needed for washing the salt out of the top soil prior to the following cropping season – a process known as “leaching”.

(most acute in the case of deforestation or over-grassing), erosion, the siltation of reservoirs and canals as well as water-logging and the salinisation of irrigated land.

Sectoral integration, reframing the objectives of water management, signifies that ecological, economic and social externalities of water use are internalised in order to maximise the societal benefit of water use. While the conventional engineering approach did not think of nature as a legitimate water user, IWRM does. In periods of water scarcity, for example, minimum “ecological flows” are to be guaranteed in order to sustain vital functions of the ecosystem. In relation to the economic sphere, sectoral integration demands that the benefits of water use be weighted against the costs of water supply and sewage treatment. In general, full-cost pricing should be strived for. This principle enhances overall economic efficiency and reduces public financial burdens, thus guaranteeing financial sustainability of water services (Argawal et al. 1999, 41-42). In addition, all water-using activities (such as agriculture, fishing, power generation, manufacturing, household provision with drinking water, transport, tourism, etc.) should be jointly taken into account. By this means, water allocation can be oriented towards the most beneficial economic uses. In practice, scarce water resources have often been directed to economically less productive, but politically powerful actors, most often agriculture. Finally, sectoral integration requires that the social consequences of water management are not lost out of view. These include effects on poverty, gender relations or public health, which should all be taken into account by water managers.

Regulatory integration in turn concentrates on the managerial aspects of water governance. In contrast to the conventional top-down, centralised approach to water management, IWRM states that decision-making structures should be organized according to the principle of subsidiarity. Decisions should thus be taken at the lowest appropriate level (Argawal et al. 1999: 15-17). Participation of water end users is to be increased in order to limit transaction costs, to boost the “user-friendliness” of management institutions, and to

improve communication between water managers and water users. In addition, decisions need to be based on adequate data. As IWRM is holistic in its ambition, data requirements for its realisation are considerable (Argawal et al. 1999: 51-54). Even in cases where ecological data are available and used, socio-economic variables – such as the amount and timing of water demand in different economic sectors, the elasticity of demand in function of water prices, reactions of water users to rationing, water use efficiency, etc. – continue to be widely ignored.¹⁹ Finally, water management should combine supply-side measures with demand-management, which aims at promoting efficiency of water use and prioritising demands. Respective instrument include reducing water losses by rehabilitating infrastructure, adapting irrigation norms, and providing incentives for water saving. Economic tools like cost-effective, volumetric water fees and water markets are possible means for encouraging water-saving and selecting between competing demands.

IWRM cannot provide a detailed blueprint for ideal water management, as the broad framework of IWRM always needs to be operationalised in function of the affected society's specific preferences and conditions. However, the concept offers a whole set of broadly applicable tools for improving water management. It can thus assist societies with overcoming second-order – or “structurally induced” (Turton/Ohlsson 1999) – water scarcity. In how far IWRM can consequently contribute to solving the Central Asian water conflicts will be analysed in the following sections.

3.1 Contributions of IWRM to solve conflicts over relative water distribution

The relative distribution conflict in Central Asia is a problem of inter-sectoral integration, in essence: between hydropower generation upstream and irrigation needs downstream. This conflict remained latent in Soviet times: The unique sovereignty over most of the Aral Sea

¹⁹ The integration of these two types of data constitutes a particular challenge, as the “human factor” still does not receive sufficient attention in water management (Kluge 2005: 36-37).

basin assured final arbitration, generally in favour of irrigation needs. At the same time, overall Soviet planning provided a satisfactory level of compensatory transfers to the upstream Soviet Republics. The relative distribution conflict only got acute when this overall sovereignty and planning disappeared in 1991 and gave way to a far-reaching segmentation of the Aral Sea basin. This made the inter-sectoral cleavage largely coincide with international borders, turning *Kyrgyz* (and *Tajik*)²⁰ hydropower interests against *Uzbek*, *Kazakh* (and *Turkmen*) agricultural interests. In consequence, inter-sectoral externalities became international externalities, decreasing interest in internalising these externalities in order to increase the total benefit of water use: Upstream users lack incentives to minimize the negative externalities of hydropower generation, while downstream users have little interest to reward positive externalities from flow regulation upstream as long as they cannot effectively control flow regulation.

A typical upstream-downstream conflict thus arose due to the predominance of artificial international boundaries over hydrological units. The promotion of *river basins as the adequate level of water management* – a key component of IWRM – is the logical answer to this problem. Basin-wide integration would ease the needed *integration of all water-using economic activities* (mainly hydropower generation and irrigated agriculture in this case), a further key element of IWRM. The consideration of these two principles would increase the economic rationality of water use and thus augment the total economic benefit derived from it. This in turn means that win-win solutions for solving the relative distribution conflict would become possible. The Toktogul and other dams' flow regime could be turned towards generating the highest absolute gain, independently of the economic sector and nation-state where these profits accrue. Thanks to the resulting upwards move of the Pareto Frontier – speaking in economic terms – all basin countries could improve their position compared to the

²⁰ Cf. footnote 9.

current situation. For this to become feasible, an adequate rule and trustworthy mechanisms for distributing the surplus gain need to be found. Furthermore, a type of basin-wide authority would have to enforce the agreed-upon rules, solving the current prisoners' dilemma.

While this appears to be a rather idealistic and theoretical solution, some progress in this direction has already been made: Under the heading of IWRM, two water-energy consortia have been established for managing the Talas and Chu River basins, which cross the Kyrgyz-Kazakh border. Thanks to Kazakh funds invested in hydropower projects on Kyrgyz territory, Kazakhstan will gain partial control over upstream flow management. Joint decision-making structures in turn will ease a holistic management of these two rivers. Although the latter are of minor importance if compared to the Amu or Syr Darya, their cooperation schemes could still serve as examples for the whole Aral Sea basin. Despite contrasting, IWRM-inspired declarations by IFAS or ICWC, basin-wide integration regarding the two major streams remains limited to the inherited quota system from Soviet times and the barter agreements mentioned above. Uzbekistan has recently begun to contribute in kind to the maintenance of the Toktogul reservoir. However, this might result more from fear of an ill-maintained dam upstream than from a genuine recognition of the flow regulation services provided by Kyrgyz infrastructure.

3.2 Contributions of IWRM to solve conflicts over absolute water distribution

If IWRM can defuse the international conflicts over relative water distribution, what can it contribute to settling the international conflicts over absolute water distribution in the Aral Sea basin? In order to answer this question, one needs to recall the origin of these most "Malthusian" conflicts first. Examining water use patterns in Central Asia, the extremely high

per capita consumption can hardly be overlooked.²¹ High dependence on irrigated agriculture (90% of regional water consumption) together with highly inefficient irrigation practices²² account one of the highest per capita water consumptions in the world. Only this fact is able explain the absolute distribution conflicts described above, which persist in spite of an overall water availability that can be deemed satisfactory (personal communication). Although Uzbekistan and Turkmenistan suffer from “absolute” respective “chronic” scarcity of *internal* water resources (according to Falkenmark’s Water Stress Index), *external* inflows from Tajikistan and Kyrgyzstan would be largely sufficient to satisfy average water needs (cf. ICG 2002: 4, Mason/Bichsel/Hagmann 2003: 10, De Martino et al. 2005: 21).

Considering the fact that the region’s renewable water resources are already overused (hence the fate of the Aral Sea), conventional supply-side measures – intended to increase overall water availability – offer no solution to this problem. Better suited is the *demand-side approach* IWRM promotes. Potential for water saving is enormous in Central Asia, since more than half of the abstracted irrigation water is lost through infiltration and evaporation from irrigation canals before reaching the fields. The predominant but highly inefficient surface or furrow irrigation leads to additional losses. Deliberate over-watering, induced by outdated irrigation norms, is a frequent phenomenon as well. On average, the Central Asian countries use 1.5 times more water than recommended by water experts (ICG 2002: 12).

Introducing hard – i.e. physical – and soft – i.e. regulatory and institutional – measures of demand management might significantly reduce rivalry over absolute water distribution. Initial investments into water-saving technology and infrastructure (lined and covered canals, sprinkler or drip irrigation) can be provided by public authorities, assisted by donor agencies

²¹ Per capita consumption in Central Asia is only topped by consumption rates in the USA (confidential paper: 22).

²² In Uzbekistan, for example, 8,000-10,000 m³ of irrigation water (water used for leaching not included) are applied for one hectare of cotton – compared to 1,500 m³ physiologically needed by the plants. With the same amount of water, Israeli farmers produce 6-7 times as much as cotton (confidential paper: 15).

if necessary. The main efforts, however, would have to come from the water users themselves. Consequently, appropriate incentives for water-saving need to be created. They would include the introduction of full-cost water fees. Currently, the latter are either inexistent or largely symbolic in Central Asia. The fees should be calculated according to actual water use (volumetric fees) rather than in function of irrigated hectares. Theoretically, water markets would most efficiently provide incentives for water saving, but they are ambitious to establish. Adapting irrigation norms to crops' real water needs would also significantly contribute to decreasing water demand.

In addition to demand management, two further components of IWRM would help solving the problems behind the absolute distribution conflicts: First, a better *integration of water quality aspects* could decrease quantity problems. At the moment, huge amounts of drainage water cannot be re-used for irrigation because of their high levels of salinity and pollution by fertiliser and pesticides. This water is directed into desert depressions where it feeds ecologically dead lakes. If irrigation norms and techniques as well as the application of agro-chemicals are adapted to quality concerns, drainage water might constitute additional irrigation water. Second, a better *consideration of water-land interaction* would decrease water needs as well. The current patterns of over-watering create a vicious circle of water-logging, salinisation and the need of annually leaching the fields before the crop-growing season. Up to 30% of total water abstracted from the rivers are used for leaching. These volumes could be saved for irrigation needs or ecological flows if irrigation practices improve.

3.3 Contributions of IWRM to solve intra-state scarcity conflicts

The causes of the absolute distribution conflicts between the riparian states are usually similar to the causes of intra-state conflicts over absolute distribution: The bad state of irrigation infrastructure, highly inefficient irrigation practices and inadequate irrigation norms

lead to water scarcity amid globally sufficient water. Again, measures of *demand-management* are the adequate response.

In comparison to primary canals of national importance, infrastructure at the secondary and tertiary level are in even worse states, however. Insufficient maintenance and repair lead to frequent break-downs of conveyance and distribution systems, leaving whole communities without water. While a minimum funding of primary infrastructure is normally secured by the state, water end users are usually left on their own. This means that the principle of *cost-recovery* – a key component of IWRM – gains particular significance at the local level. Full-costs pricing for irrigation services at the secondary and tertiary level can halt the decay of irrigation infrastructure and enable water managers to improve service quality. In consequence, the economic sustainability of water management promoted by IWRM can reduce local grievances and rivalry caused by water scarcity.

However; as economising water and irrigation service improvements cannot be realised ad hoc and water availability might be simply insufficient in some places, distribution conflicts will continue to arise. Adequate mechanisms for conflict management are needed for these cases. It is generally agreed that the responsiveness of water management to users' grievances and needs is best where management decisions are taken at the lowest appropriate level – corresponding to the *principle of subsidiarity*, another feature of IWRM. While water management was extremely centralised in Soviet times, distribution conflicts among the increasing number of private farmers are most likely to be solved if allocation decisions are based on users' participation.

One possible – and broadly used – instrument to facilitate participation is the creation of Water User Associations (WUAs). Irrigation farmers are encouraged to unite within these organisations to manage their own water supply at the local level. They are expected to decide on water distribution themselves and to care and pay for infrastructure operation and

maintenance. Similar to other forms of decentralisation, this direct implication of end users in service provision is supposed to improve the quality and promptness of water management through the strengthening of bottom-up communication and control (Mott MacDonald 2003). The WUA-model promoted by international donors (the World Bank and the Asian Development Bank in particular) also foresees the establishment of a specific conflict resolution committee in each WUA. If they gain strength and ownership, these participatory mechanisms could significantly contribute to preventing local scarcity conflicts.

4 Barriers to the implementation of IWRM-solutions to Malthusian concerns

The analysis above has shown that IWRM generally has the potential to enhance “second order resources” and thus the adaptive capacity riparians need to de-escalate and constructively manage their water conflicts. IWRM-inspired reforms offer substantial gains to all water users and could decrease regional tensions over water.

However, progress into this direction has been limited up to date. Official declarations routinely make reference to IWRM, but concrete action is lacking. Thus, the question arises how this gap between the conceptual appeal of IWRM on the one hand and the lack of governmental action towards its – in theory mutually beneficial – implementation on the other hand can be explained.

Simply put, IWRM is politically blind, although it was explicitly developed in response to technocratic engineers’ water management. With regard to the prospects of international basin-wide management, creating win-win solutions by re-allocating water presupposes that property rights are defined in advance. If the initial distribution of water use rights is already controversial, it remains unclear how benefits from joint management should be distributed and individual losses compensated. IWRM does not provide answers to asymmetries in power distribution either. Uzbekistan as the regional hegemonic power is much less dependent on

the other riparians' cooperation than vice versa. Overcoming cooperation problems for realising win-win solutions also presupposes a minimum of mutual trust and confidence as well as a strong arbitrating authority, as the Institutionalist perspective of IR emphasises.

However, these genuine problems of international cooperation do not seem to constitute the core of the problem. Property rights are more or less formally defined by the Soviet quota system and subsequent agreements (Ryabtsev 2003: 1). The principle of win-win exchanges of irrigation water against energy has been accepted and partly implemented. Uzbekistan's military and economic power is balanced by Kyrgyzstan's control over the Toktogul dam, illustrated by the fact that the Kyrgyz did already change its flow regime in Uzbekistan's disfavour.²³ Personal networks from Soviet times make sure that the international conflicts do not escalate, and the Central Asian states display impressive solidarity in applying for funds from international donors for the generalised "Conferencitis" and "Workshopitis" of IFAS and the ICWC (cf. Sehring 2002: 13-15, 18; Mason/Bichsel/Hagmann 2003: 21).

By far more challenging is the implementation of demand-management as a means for mitigating absolute distribution conflicts, which represent a much acuter danger than the international conflict over relative water distribution. Besides public investment into better infrastructure, incentives for water-saving are key in this regard. These incentives are however difficult to implement in the economic context of Tajikistan, Turkmenistan and, most importantly, Uzbekistan. In contrast to Kazakhstan and Kyrgyzstan, land privatisation has remained superficial or virtually non-existent (Turkmenistan) in these three countries. The lack of secure and long-term land rights diminishes farmers' interest to invest into better, water-saving infrastructure, which would prevent water-logging and salinisation of the soil.

²³ The possibility of compensating military weakness with geographical position in hydropolitics is underlined by Beach et al. 2000: 56.

In addition, agricultural markets are strictly regulated, if not to say repressive. Farmers are not free to choose what they plant, and production targets are maintained until today. Most importantly, farmers are ordered to grow a high percentage of cotton, a rather water-intensive crop. The cotton market in turn is controlled by official (Turkmenistan) or unofficial (Uzbekistan, Tajikistan) monopolies, which buy the produce at prices far below the world market and thus pick up significant rents. Forced labour – mostly schoolchildren and students – is widely used by authorities for the cotton harvest in order to further reduce production costs (ICG 2005: 17-25). In the end, the miserable prices paid to farmers do not allow introducing or raising water fees, a crucial element for increasing water use efficiency.

Consequently, significant advances in demand-management presuppose more liberal land and agricultural markets in Tajikistan, Turkmenistan and Uzbekistan (ICG 2002: 2). Substantial liberalisation is however unlikely to occur, since the cotton business plays a key role in the countries' political economy (ICG 2005: 12-16, Mason/Bichsel/Hagmann 2003: 21). In Uzbekistan, for example, half of the national hard currency revenues is earned by cotton exports (personal communication). National elites monopolise the rents from this lucrative business. At the same time, farmers are increasingly trapped in debt, as they are less and less able to pay back loans for agricultural inputs provided by the same cotton companies. Due to this increasing dependence, national and local elites successfully control the rural population, whose economic situation has significantly worsened since Soviet times while their Kolkhozes and Sovkhozes have not changed much more than their legal form.

This political economy of the cotton industry provides additional explanations for the fact that the decentralisation of irrigation management hardly advances in Uzbekistan and Turkmenistan. Even where the political environment is more liberal – in Kazakhstan and Kyrgyzstan – and numerous WUAs have been created, they face severe difficulties. Similar to most decentralisation efforts, WUAs are appealing in theory but more difficult to make work

in practice. Local power asymmetries do not disappear with the simple establishment of these associations and their conflict-preventing potential thus struggles to materialise (cf. Herrfahrdt et al. forthcoming).

5 Conclusion: How to advance?

The Malthus-inspired, social science discourse on resource conflicts is able to adequately describe Central Asia's main water conflicts: the international upstream-downstream conflict over relative water distribution, the international upstream-downstream conflicts over absolute water distribution as well as the diverse local scarcity conflicts. As we have seen, the normative concept of IWRM is complementary to the social science analyses: it suggests promising ways for managing the conflicts in question. Basin-wide integrated management and resulting inter-sectoral re-allocation of water resources would create win-win-solutions to the relative distribution conflict. The integration of quality aspects, a better consideration of water-land interaction and, above all, demand-management could mitigate the causes of absolute distribution conflicts. Finally, decentralisation of and user participation in water management would support conflict management at the local level.

However, a third element – in addition to the conflict analyses and IWRM – is lacking: strategies how to implement the proposed solutions. While IWRM in theory creates opportunities for compensating short-term losers of water management reforms, illegitimate, vested interests in maintaining the status quo can hardly hope to gain from it. In our example, the national elites benefiting from the political economy of cotton will not be willing to accept far-reaching, IWRM-inspired reforms, however beneficial they would be for their respective societies and Central Asia as a whole.

If social science analyses of water problems in conjunction with normative concepts like IWRM are meant to have impact “in the real world”, efforts need to be intensified in the area

of implementation strategies.²⁴ Based on an adequate problem analysis, IWRM indicates the direction to take, but it cannot tell how to make decision-makers choose this direction. If the gap between analytical tools and normative concepts can relatively easily be bridged, as demonstrated in this article, the gap between theory and action is a more challenging one. Social science approaches and normative concepts like IWRM need to be complemented by a profound knowledge of domestic politics and power structures of the societies in question if they are to identify realistic ways for solving water problems. Both analytical and normative thinking in hydro politics should keep this in mind in order to ease the prospects for seeing possible solutions materialise in practice.

²⁴ A publication to be built on in this regard is „Catalysing Change“ by GWP (GWP-TEC 2004).

Bibliography

- Allan, Tony, 2003: "Virtual Water - the Water, Food, and Trade Nexus: Useful Concept or Misleading Metaphor?", in: *Water International*, 28,1: 4-11.
- Antipova, Elena; Alexi Zyryanov; Daene McKinney; Andre Savitsky, 2002: "Optimization of Syr Darya Water and Energy Uses", in: *Water International*, 27,4 (URL: <http://www.ce.utexas.edu/prof/mckinney/papers/aral/28-Antipova-WI-02.pdf>, download: 16. May 2005): 504-516.
- Argawal, Anil; de los Angeles, Marian S.; Bhatia, Ramesh; Chéret, Ivan; Davila-Poblete, Sonia; Falkenmark, Malin; Gonzalez Villarreal, Fernando; Jønch-Clausen, Torkil; Ait Kadi, Mohammed; Kindler, Janusz; Rees, Judith; Roberts, Paul; Rogers, Peter; Solanes, Miguel; Wright, Albert, 1999: *Integrated Water Resources Management*, TAC Background Paper No. 4 (Stockholm: GWP Technical Advisory Committee).
- Beach, Heather L.; Hammer, Jesse; Hewitt, J. Joseph; Kaufman, Edy; Kurki, Anja; Oppenheimer, Joe A.; Wolf, Aaron T., 2000: *Transboundary freshwater dispute resolution: Theory, practice and annotated references* (Tokyo; New York; Paris: United Nations University Press).
- Brauch, Hans Günter, 2003: "Towards a Fourth Phase of Research on Human and Environmental Security and Peace: Conceptual Conclusions", in: Brauch, Hans Günter; Liotta, P.H.; Marquina, Antonio; Rogers, Paul F.; El-Sayed Selim, Mohammad (eds.): *Security and environment in the Mediterranean – Conceptualising security and environmental conflicts* (Berlin; Heidelberg; New York: Springer): 919-953.
- De Martino, Luigi; Carlsson, Annica; Rampolla, Gianluca; Kadyrzhanova, Inkar; Svedberg, Peter; Denisov, Nickolai; Novikov, Viktor; Rekacewicz, Philippe; Simonett, Otto; Fernandez Skaalvik, Janet; del Pietro, Dominique; Rizzolio, Diana; Palosaari, Marika, 2005: *Environment and Security – Transforming Risks into Cooperation - Central Asia, Ferghana / Osh / Khujand Area* (Vienna; Geneva; Bratislava; Brussels: OSCE; UNEP; UNDP; NATO).
- Falkenmark, Malin, 1989: "The Massive Water Scarcity Now Threatening Africa – Why Isn't It Being Addressed?", in: *Ambio*, 18,2: 112-118.
- Giese, Ernst; Sehring, Jenniver; Trouchine, Alexej, 2004: „Zwischenstaatliche Wassernutzungskonflikte in Zentralasien“, Working Paper No. 18 of the Zentrum für internationale Entwicklungs- und Umweltforschung (ZEU) (Justus Liebig University Gießen; URL: <http://www.uni-giessen.de/zeu/papers/discPap#2318.pdf>, download: 9 November 2004).
- Glazovsky, Nikita F., 1995: "The Aral Sea Basin", in: Kasperson, Jeanne X.; Kasperson, Roger E.; Turner, B. L. (eds.): *Regions at Risk: Comparisons of Threatened Environment* (Tokyo; New York; Paris: United Nations University Press; URL: <http://www.unu.edu/unupress/unupbooks/uu14re/uu14re0a.htm> - 3. The Aral Sea Basin, download: 15 April 2005).
- Global Water Partnership (GWP), 2005: "Policy choices and challenges. Why and how IWRM?" (URL: http://gwpforum.netmasters05.netmasters.nl/zappengine/objects/Policy_Choices_and_Challenges.doc, download: 18.05.2005).
- Global Water Partnership Technical Committee (GWP-TEC), 2004: *Catalyzing Change: A handbook for developing integrated water resources management (IWRM) and water efficiency strategies* (Stockholm: GWP Technical Committee).

- Herrfahrdt, Elke; Kipping, Martin; Pickardt, Tanja; Polak, Mathias; Rohrer, Caroline; Wolff, Carl Felix, forthcoming: *Water Management in the Kyrgyz Agricultural Sector – On its Way to IWRM?* (Bonn: German Development Institute).
- Homer-Dixon, Thomas, 1999: *Environment, Scarcity, and Violence* (Princeton; Oxford: Princeton University Press).
- International Crisis Group (ICG), 2002: “Central Asia: Water and Conflict”, ICG Asia Report No. 34 (Brussels: ICG).
- International Crisis Group (ICG), 2005: *The Curse of Cotton: Central Asia’s Destructive Monoculture*, ICG Asia Report No. 93 (Brussels: ICG).
- International Water Management Institute (IWMI); Scientific Information Center ICWC (SIC), 2005: “Integrated Water Resources Management in the Ferghana Valley” (URL: http://www.iwrm.icwc-aral.uz/index/i_en.htm, download: 27 January 2005).
- Kipping, Martin, 2005: “Wasserkonflikte und Wasserkooperation am Senegalfluss“, in: Kipping, Martin / Lindemann, Stefan: *Konflikte und Kooperation um Wasser – Wasserpolitik am Senegalfluss und internationales Flussmanagement im Südlichen Afrika* (Münster: Lit-Verlag): 22-107.
- Klötzli, Stefan, 1996: “Politisch-geographische Konfliktanalyse einer Ökoregion: das Beispiel Zentralasien“, in: Baechler, Günther; Böge, Volker; Klötzli, Stefan; Libiszewski, Stephan; Spillmann, Kurt R.: *Kriegsursache Umweltzerstörung – Ökologische Konflikte in der Dritten Welt und Wege ihrer friedlichen Bearbeitung*, ENCOP Final Report, Vol. 1 (Chur; Zürich: Rüegger): 239-290.
- Kluge, Thomas, 2005: “Kritische Betrachtung des Ansatzes ‘Integriertes Wasserressourcenmanagement’ (IWRM)“, in: Neubert, Susanne; Scheumann, Waltina; van Edig, Annette; Huppert, Walter (eds): *Integriertes Wasserressourcenmanagement (IWRM). Ein Konzept in die Praxis überführen* (Baden-Baden: Nomos): 31-43.
- Lipiszewski, Stephan, 1997: “Internationale Konflikte um die Nutzung fließender Gewässer“, in: Baechler, Günther; Böge, Volker; Klötzli, Stefan; Libiszewski, Stephan; Spillmann, Kurt R.: *Kriegsursache Umweltzerstörung – Ökologische Konflikte in der Dritten Welt und Wege ihrer friedlichen Bearbeitung*, ENCOP Final Report, Vol. 1 (Chur; Zürich: Rüegger): 117-166.
- Mason, Simon A.; Bichsel, Christine; Hagmann, Tobias, 2003: “Trickling Down or Spilling Over? Exploring Links between International and Sub-national Water Conflicts in the Eastern Nile and Syr Daria Basin”, Paper to be presented at the ECPR Joint Sessions of Workshops, Workshop "Geography, Conflict and Cooperation", Edinburgh, UK, 28 March - 2 April 2003 (URL: <http://www.nccr-north-south.unibe.ch/document/document.asp?ID=1141&refTitle=the%20NCCR%20North-South&Context=NCCR>, download: 2 July 2005).
- McKinney, Daene C., 2003: “Cooperative Management of Transboundary Water Resources in Central Asia”, in: Burghart, Daniel L.; Sabonis-Helf, Theresa (eds.): *In the Tracks of Tamerlane – Central Asia’s Path into the 21st Century* (Washington: National Defense University Press; URL: <http://www.ndu.edu/ctnsp/tamerlane/Tamerlane-Chapter9.pdf>, download: 20 April 2005): 187-219.
- Mott MacDonald, 2003: *Privatization/Transfer of Irrigation Management in Central Asia*, (Cambridge: Department for International Development).

- O'Hara, Sarah L., 1998: "Water and Conflict in Central Asia", Proceedings of the Political Studies Association Annual Conference 1998 (URL: <http://www.psa.ac.uk/cps/1998/ohara.pdf>, download: 23 February 2005).
- Ryabtsev, A. D., 2003: "10 Years of Regional Collaboration in Shared Water Resources Management of Central Asia", Prepared for the 3rd World Water Forum, Kyoto, Japan, March 18 (URL: http://www.adb.org/Documents/Presentations/RC_Shared_Water/Ryabtsev.pdf , download: 16 April 2005).
- Sehring, Jenniver, 2002: *Kooperation bei Wasserkonflikten: Die Bemühungen um nachhaltiges Wassermanagement in Zentralasien* (Mainz: Institut für Politikwissenschaft, Abteilung Politische Auslandsstudien und Entwicklungspolitik; URL: http://www.uni-giessen.de/zeu/Papers/Sehring_30.pdf, download: 10 February 2005).
- Starr, Joyce R., 1991: "Water Wars", in: *Foreign Policy*, 82: 17-36.
- Turton, Antony; Ohlsson, Leif, 1999: "Water Scarcity and Social Adaptive Capacity: Towards an Understanding of the Social Dynamics of Managing Water Scarcity in Developing Countries", Paper presented at the Workshop on Water and Social Stability at the 9th Stockholm Water Symposium on Urban Stability through Integrated Water-Related Management, hosted by the Stockholm Water Institute (SIWI), Stockholm, Sweden, 9-12 August.
- Waterbury, John, 1997: "Between Unilateralism and Comprehensive Accords: Modest Steps toward Cooperation in International River Basins", in: *Water Resources Development*, 13,3: 279-289.
- Wolf, Aaron T., 2001: "Transboundary waters: Sharing benefits, lessons learned", Thematic Background Paper to the International Conference on Freshwater „Water – a key to sustainable development“, Bonn, FRG, 3-7 December.
- Wolf, Aaron T., 1998: "Conflict and Cooperation along International Waterways", in: *Water Policy*, 1,2: 251-265
- World Water Assessment Program (WWAP), 2003: *Water for People, Water for Life. The United Nations World Water Development Report* (Paris: UNESCO; Berghahn Books).