

# Coping with disintegration of a river-basin management system: multi-dimensional issues in Central Asia

Kai Wegerich

*Irrigation and Water Engineering Group, Wageningen University, Nieuwe Kanaal 11, 6709 PA Wageningen, The Netherlands. Tel: +31 317482750. E-mail: wegerich@yahoo.com*

Received 30 July 2002; accepted in revised form 7 November 2003

---

## Abstract

Prior to independence the Soviet system focused on the geographical boundaries of the Syr Darya Basin and managed the environmental resources according to these boundaries. Hence, the riparian states were tied together through the management of water, energy and food products. After independence, the individual states focused on national interests, and this development led to destabilisation. The Syr Darya Basin shows that national strategies for a natural resource use have created instability. Complex cooperation incorporating water, energy and agriculture is necessary. An issue linkage approach and a wider understanding of common pooled resources can create stability for the whole basin.

*Keywords:* Agriculture; Central Asia; Common pool resources; Disintegrated management; Energy; Issue linkage; Syr Darya Basin; Water

---

## Introduction

The disintegration of the Soviet Union transformed administrative boundaries into national boundaries and integrated national water management approaches into trans-national ones. The collapse of the Soviet system, with integrated water, energy and food sectors, created new and very serious risks and security challenges for the independent states. Since independence, much has been written on the potential for water wars in Central Asia. While shortly after independence attention was focused on the potential disputes over water allocation amongst the riparian states, in recent years analysis has focused on the conflicting uses of water upstream and downstream and the interdependence between energy and water. This paper discusses the different water resource problems and the disputes arising between Kyrgyzstan and Uzbekistan. Two conclusions are offered. First, a single sector approach on water alone destabilises the whole region, a multi-sector approach is necessary for sustainable management and

peace over resource utilisation in the region. Second, because water is a common pool resource, all the benefiting riparian states have to be responsible in contributing to the costs of operation and maintenance of the water management structures.

The paper first gives a brief introduction to general water management approaches; this is followed by a short background to water management in Central Asia. Afterwards, the paper will distinguish the different water management problems arising from the disintegration of the Soviet Union, such as the problems of water institutions, water allocation and water service provision.

### Water management approaches

The International Conference on Freshwater (ICF) (2001) held in Bonn in 2001 recommended watersheds and river basins as primary frames of reference for water resources management. ICF suggested that “cooperation across internal and international boundaries should be intensified as a means to share the upstream and downstream benefits” and that “water should be equitably and sustainably allocated”. The concept of trans-boundary rivers with emphasis on sustainability and equitable use is enhanced by the concept of hydrosolidarity (cf. Falkenmark, 2001) Hydrosolidarity stresses upstream/downstream water “needs”. The concept addresses human, food and ecological security on a basin scale arguing that this could be reached through basin management institutions. Trans-boundary rivers can be classified as common pool resources (CPRs). These are resources, which are utilised by two or more users. Ostrom *et al.* (1994) distinguish between two types of CPR problems: appropriation and provision. The appropriation problem of a CPR is related to the subtractability of the benefits consumed by one member from those available to others. Provision problems are related to the operation and maintenance (O&M) of the resource delivery system.

However, not every upstream resource utilisation subtracts benefits from the downstream users. In the case of water for upstream hydroelectric power production and for downstream irrigation a win–win or a zero–sum solution is possible. A win–win solution occurs when water is released in the period when both sectors can utilise the water at the same time; water release in the irrigation period. However, releases in a time period in which the water is not needed for irrigation implies benefits for the energy sector and no benefits for the irrigation sector. Hence, subtractability of benefits is dependent on other factors, such as method of utilisation and time.

As mentioned above, sharing a resource implies sharing the costs of operation and maintenance of the resource management structures. While on the local scale this approach is already used, on the international level it is new and contested. However, methods already exist for trans-boundary O&M cost allocation. Hutchens (1999) utilises the “Use of Facility” method to establish the O&M costs for all members using trans-boundary facilities. According to this method the costs for providing water supply are allocated to the countries in proportion to the water received.

In this paper, Elwert’s (2002) enlarged concept of conflict is utilised. The concept covers a wide variety of phenomena ranging from procedures and social interaction (“tamed conflict”) to higher levels of conflicts (“violent conflict”).

In the case of Central Asia, provision and allocation problems are the leading issues in the discourse on water management between the riparian states. Any solution will have to incorporate them. To understand the problem fully one has to consider the historical background of water management in the region.

## Background

Because of central control and basin management, the utilisation of the rivers did not correspond to the administrative boundaries and the interests of the administrative zones. During the Soviet era, the Central Asian rivers (Amu Darya and Syr Darya and their tributaries) as well as their regulating structures were managed according to the borders of the river basin. The borders between the republics were only administrative and therefore did not hinder basin management of the Amu Darya and Syr Darya. The Ministry of Land Reclamation and Water Resources of the USSR (MLR&WR) headed the Central Asian Water Authority. All republican institutions and republican interests in resource utilisation were subordinated to the Central Authority in Moscow and to the greater interest of the Soviet Union. “The ministries of the Central Asian republics were extensions of the ministry in Moscow. They were responsible for fulfilling the centralised plans and norms. Their role in decision-making was limited to providing data to the centre.” (Renger, 1998) An SIC (Scientific Information Centre) ICWC (Interstate Coordinating Water Commission) report (1999) states that the subordination was two-fold, sectorial [irrigated agriculture] and national. Lange (2001) explains the sectorial subordination, he states, “the water management infrastructure was designed for a unified purpose and placed where it made sense geologically”. Within the basin framework the dams and reservoirs were built upstream in the mountains, while the irrigation areas were downstream in the valleys and in the steppes. The water management constructions were built to enhance irrigation in the downstream regions. To use the dams for agricultural purposes, water had to be released in the summer and autumn to supply irrigation. The basin framework approach had the benefit of total control over water and efficient water management for irrigation.

In the Russian empire, the focus was on cotton production in the Aral Sea Basin. The Russian Revolution did not bring a change in the economic specialisation of the region. Under the Soviet virgin land policy and the beginning of the “hydraulic mission” the area under irrigation expanded further. Khrushchev initiated the virgin land policy in 1953. The project was supposed to raise agricultural productivity. By 1956 an additional 88.6 million hectares of land was cultivated in the Soviet Union, mainly in Kazakhstan and Western Siberia. As part of the “virgin land” project. Khrushchev promoted the idea of expanding the irrigated areas in Central Asia. (Rumer, 1989, 88–89) The Karakum canal in Turkmenistan, the Amu-Bukhara and the South Hunger steppe canal in Uzbekistan give an indication of the dimension of the water management constructions. While in 1965 an area of 4.5 million hectares was irrigated in Central Asia, by independence the total irrigated area had increased by an additional 2.5 million hectares. Because of the Soviet policy to enhance irrigation productivity of the region, equal water distribution between the riparian administrative units was not considered. Hence, it came to a skewed distribution between water producing and water using countries (see Table 1).

Table 1. Water flow in the Aral Sea Basin watershed (World Bank, 1996).

Country	Amu Dar'ya	Syr Dar'ya	Total	Water used in agriculture	Water used in industry
Afghanistan	6.18	–	6.18	–	–
Kazakhstan	–	4.5	4.5	27.41	6.26
Kyrgyzstan	1.9	27.4	29.3	9.5	0.59
Tajikistan	62.9	1.1	64	10.96	0.91
Turkmenistan	2.78	–	2.78	23.29	0.49
Uzbekistan	4.7	4.14	8.84	54.37	3.68
Total	78.46	37.14	115.6	125.53	11.93

In the Soviet system there were no disputes between upstream and downstream interests. Upstream and downstream riparian units benefited through the regional approach, using water, energy and food as common pool resources. Owing to the forced focus on irrigation, the upstream water management constructions, such as dams and reservoirs, did not produce hydroelectric power when it was most needed in the upstream regions, which is during the winter season. The dams released water during the summer when the downstream riparian administrative units needed water for agriculture. Because all the republics were unified in one country, energy was provided during the winter from Russia and the downstream regions, which are rich in oil and gas.

With independence and the shift from a single administrative unit to autonomous states, the regional approach of water management was at risk. The international “security and conflict community” assumed that Central Asia would have water disputes and water wars. Smith’s (1995) statement reflects these thoughts; “nowhere in the world is the potential for conflict over the use of natural resources as strong as in Central Asia”. The United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2000) confirms this, stating “friction is coming to the surface quite frequently due to different interests and possibilities”. While shortly after independence analysis focused on potential disputes over water allocation amongst the riparian states, in recent years attention has focused on the conflicting uses of water upstream and downstream and the interdependence between energy and water. Neither the allocation nor the provision problems have been solved so far. In addition to the problems mentioned, there is the difficulty of establishing legitimate basin management authorities.

## Water management problems

### *Institutional frameworks*

Shortly after independence the Central Asian states agreed to continue with a joint basin shed management. The riparian states decided to establish an organisation, which is responsible for the coordination of the rivers. Already by 1992, the Interstate Coordinating Water Commission (ICWC) had been established. The functions of the ICWC are policy-making, coordination, regulation and execution. The ICWC became responsible for the joint management of the Amu Darya and Syr Darya. The main purpose for ICWC is to enable collective decision making on water-related questions and the implementation of these decisions. However, decisions must be unanimous, although each state has a right to veto. Hence, water management agreements between the riparian states became dependent on the “political will” of the upstream and downstream users. Because of the right to veto, the ICWC was unable to address complaints from the Kyrgyz Republic regarding compensation for operating the reservoirs for the benefit of the lower riparian republics.

There is an absence of “political will” to support the executive bodies of the ICWC and the Water or River Basin Organisations (BVOs). The BVOs do not have the necessary authority and lack binding legal force. This causes two main problems: first, even though the BVOs are responsible for water allocation and the controlling and monitoring of water withdrawals, they are excluded from strategic key water schemes. In addition, although the BVOs are supposed to allocate water seasonally to the different riparians, the withdrawn water share at each intake at province level hardly varies.

The national water ministries are very reluctant to hand over diversion schemes to the BVOs and intervene in water distribution and operation of the water schemes. The BVOs do not have full authority

over the construction of water regulating structures and water reservoirs. Consequently, the BVOs could not prevent Kyrgyzstan using its dams for energy purposes during the winter. Weinthal (2001) argues that the interstate water agreements “excluded mechanisms for dealing with disputes across sectors”. Hence, after independence the mistake was made that the focus was on water allocation, but not on the time scale and different methods of utilisation.

O’Hara argues that the BVOs “are not recognised by national legislatures and therefore lack legitimacy and authority” (quoted in Horsman, 2001). One reason for the lack of “political will” to cooperate could be based on the location of the BVOs. The Amu Darya and Syr Darya BVOs are both located in Uzbekistan. Hodgson (informal interview Bishkek, 17.08.2001) argued that the Syr Darya BVO is not recognised in Kyrgyzstan. According to him it is widely believed in the “water community” in Kyrgyzstan that the Syr Darya BVO in Tashkent is supporting Uzbek’s interests, and therefore tries to get more control over the “Kyrgyz’s” water resources.

The non-cooperative tendency is also reflected in the legal context of water and how the newly independent states regard water in respect to themselves. Kasymova (1999) shows that the laws on water in the Central Asian republics treat water not as a common good of all the riparian states, but as national good. The national approach to water allows utilisation of water for national benefits instead of regional benefits. Chait (no date) argues similarly, “concerned with state building and social-economic transformation, each state is justifying its sovereign right to these waters [the Syr Darya]”.

### *Resource allocation*

Soon after independence, the Central Asians governments initially agreed to continue with the water allocation of the Soviet Union. They agreed to manage the basin water on the basis of the International Water Law. This implies equitable, reasonable and mutually advantageous water resource use (World Bank, 1996). The independent republics acknowledged in the Almaty Agreement in 1992 the joint water management of the water resources. “Under the agreement the states retained their Soviet-period water allocations, refrained from projects infringements on other states and promised an open exchange of information,” (O’Hara quoted in Horsman, 2001).

As Table 1 indicates the current water allocation among the different riparian states is unequal. The allocation is a continuation of the old system. However, while the old system of water allocation continued, other regional approaches disappeared, such as food and energy exchange. This had major consequences for water demand upstream. Because of the upstream–downstream dependence on water, small changes in water policies upstream can disturb the balance of the current agreement. Independence brought large not small changes. After independence all the republics started a national strategy of energy and food security. While downstream countries could divert water away from cash crop production to food crop production (policy of Uzbekistan and Turkmenistan in early and mid-1990s), the small amount of allocated water in upstream countries does not allow any shifts. Any upstream shift in water demands for agriculture reduces the availability of water for downstream users. The following evaluation of Kyrgyzstan’s agricultural reform will emphasise the increasing water demand of the upstream riparian.

Kyrgyzstan privatised its state and collective farms. Privatisation had consequences for water management requirements, for example the number of water users increased. While in 1990, 450 state and collective farms existed, in 1996 the number of farms had increased to 40,000. Most of these farms were small-scale. The on-farm irrigation structures became inter-farm structures; however these

structures are not equipped to control the water use of small-scale farms. In addition to the problems of water distribution on the local level, small-scale subsisting farming changed the focus of the agricultural production from livestock to crop production (cf Baumann, 1999). According to FAO data in the time period from 1992 to 2000 the area allocated to cotton, wheat, rice and vegetables increased from 21,500 to 33,764; 284,400 to 443,688; 1,900 to 6,229 and 24,400 to 48,034 ha, respectively (see Figure 1). As a result of the increase in area the production increased as well from 52,400 to 87,884; 679,000 to 1,039,109; 3,500 to 18,991 and 438,600 to 824,000, respectively in the same period (FAO data 25.04.2002). On the other hand, livestock, which was the primary focus of the state and collective farms declined (see Figure 2). The shift from livestock to food and cash crops lead to higher water demands in Kyrgyzstan. Overall the agricultural sector became more important; since independence the agricultural sector dominates the Kyrgyz economy and accounts for 45% of the GDP (UNESCO, 2000). However, the water allocation for Kyrgyzstan did not increase. This could imply that Kyrgyzstan already infringed the current water allocations with its land reforms.

Most authors focus on the allocation of water resources as the main cause for potential conflicts between upstream and downstream riparian states. “The key source of tension between Kyrgyzstan and Tajikistan, and between Kazakhstan, Turkmenistan and Uzbekistan, is [water] allocation,” (Horsman, 2001). Hence, a shift in water consumption and rising demands as happened in Kyrgyzstan should have resulted in a conflict between the riparian states. Gulomova (2001) claims that in Central Asia the “water demand increased by more than 25% during the last decade”. This number seems rather high and is questionable. In addition, Gulomova makes statements on water demand, but not on the actual water use. However, any increase in water demand did not lead to state disputes over water. Disputes in which water played a significant role were not based on allocation issues. On the contrary disputes were related to different uses of water, such as water releases from the Toktogul reservoir for hydropower in winter

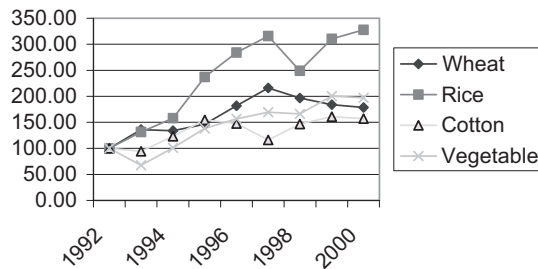


Fig. 1. Area harvested (%).

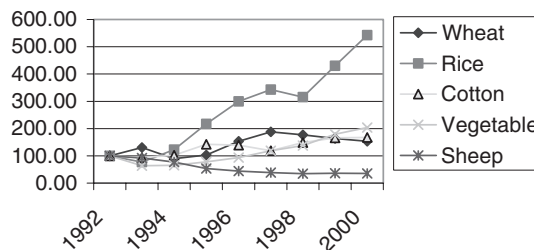


Fig. 2. Production (%).



(see below). Another example in which water played an important role was when gas supplies from Uzbekistan were stopped in order to bargain about border delimitations; the cut in gas supply was followed by water releases (Jumagulov, 2001; Koichiev, 2001). Disputes based on unequal water distribution did not occur. Water scarcity did not lead to interstate disputes. It seems likely that the rising demand for water in agriculture upstream did not have an impact because it was overshadowed by the releases from the dams during the winter. In the future, it will have an impact on the available water downstream. Hence a dynamic approach is necessary which links different uses of water and allocates water away from some sectors to other sectors, and which creates the greatest benefits and on occasions subsidises other sectors.

The emphasis of water as a national resource, and the usage of the water structures for energy production rather than for irrigation purposes were responsible for the conflicts, not the shift in the water demand for upstream agriculture. The early arrangements for water allocation ceased to function when Kazakhstan and Uzbekistan started to charge for oil and gas supplies to Kyrgyzstan. Kyrgyzstan began to release water during the winter, to produce energy for its population. Even though the use of water for energy production did not change the regional allocation of water, it changed the availability of water at certain periods. Different economic sectors need water in different periods. Kyrgyzstan needs water for energy production during the winter and Uzbekistan for irrigation during the summer. Kyrgyzstan's release during the winter has three consequences. First, it causes floods and therefore destruction and disasters downstream (Lange, 2001; Koichiev, 2001). Second, it leaves the reservoirs dry in the summer, in a period when the downstream countries are dependent on water for irrigation. Third, the discharge to the Arnasai depression reduces the available water for the Aral Sea.

The changes in water utilisation gave rise to disputes between upstream and downstream countries along the Syr Darya. After pressure from the United States Agency for International Development (USAID), the upstream and downstream countries started to agree on a barter trade, which reinforced the Soviet arrangements on energy (Lange, 2001; Weinthal, 2001). On March 17, 1998 the Governments of the Republic of Kazakhstan, the Kyrgyz Republic and the Republic of Uzbekistan adopted the Interstate Agreement "on use of water and energy resources of the Syr Darya River Basin" (Kasymova, 1999) According to this agreement Uzbekistan and Kazakhstan Agreed to buy Kyrgyz electricity during the summer and sell gas, coal and oil to Kyrgyzstan in the winter. The agreement rearranged the old irrigation regime of the Toktogul structure. However, as Chait points out, the agreement "did not provide a means of enforcement". Therefore it had only very limited success.

What could be a win–win solution for all parties seemed to be a zero–sum game for Kyrgyzstan. The price of hydropower is lower than the price of coal and gas. Hence, the energy exchange is not one to one, but leaves the downstream countries with an advantage. In addition to the cheaper energy, Kyrgyzstan provides water at a time when it is needed for the downstream countries. If all countries should have advantages, then the energy should be exchanged one to one and not at the world market prices. However, the barter of energy still does not take into consideration the operation and maintenance of the upstream water management constructions.

### *Service provision*

As pointed out earlier, the water structures were built according to basin shed and not administrative shed management. Consequently, upstream water management structures benefit downstream users, if

they are operated according to the agreements. Article VII of the March 1998 Interstate Agreement states that the operation, maintenance and reconstruction of water and energy facilities shall be covered in accordance with the ownership of the property. Article VII is generally interpreted as “requiring the republic in which the facility lies to finance and conduct O&M of those facilities” (Hutchens, 1999). However, the agreement does not provide for the republic that owns the facilities to recover O&M costs associated with providing water services to other republics.

Based on the agreement, Kyrgyzstan is responsible for the operation and maintenance costs of the dams, reservoirs and trans-boundary canals in Kyrgyzstan. Owing to the high costs of O&M and Kyrgyzstan’s poor economic situation, the water facilities are deteriorating. Berezovsky (2001) states that “most of 34 reservoirs and 6,200 km of irrigation networks are dangerous to operate”. Hutchens (1999) analysing the water management facilities of the Syr Darya Basin comes to the conclusion that “the current level O&M for these facilities is approximately 40% of what is needed”. Reports from the Popan reservoir confirm the deterioration of the water management facilities (Hogan, 2001). The deterioration has consequences for the available water for the basins. Berezovsky (2001), referring to Kyrgyzstan alone, claims that owing to O&M shortfall some “300 million m<sup>3</sup> of water are lost every year”. Water is not only lost for upstream and downstream users, but has wider environmental damaging effects such as rising ground water levels, water logging and floods.

Seeing water as national good instead of as common good triggered new demands. Currently in Kyrgyzstan, voices are getting louder demanding that charges are made to “neighbouring republics for the use of water from its reservoirs” (Jumagulov, 2001). According to these voices the resource water has to be seen as the main export good for Kyrgyzstan and is comparable to other natural resources. Sizintsev (informal interview Bishkek, 2001) argued, “water is delivered for free, but Uzbekistan delivers coal and gas at world market prices”. Hence, it is demanded that water should be treated as “any other valuable commodity – something that can be bought and sold, for a real market price” (Mamatkhanov quoted in Feller, 1998). Similar views are picked up by Hogan (2000), who argues that “Kyrgyzstan considers water its new currency”. She states, “President Askar Akayev signed an edict in October 1997 codifying Kyrgyzstan’s right to profit from water resources within its territories” (Hogan, 2000) and interprets the edict as Kyrgyzstan’s intent to sell water to Uzbekistan. However, Kyrgyzstan has not yet charged Uzbekistan for water.

Different from the intention to profit from water resources is the argument that costs of water management occur and that the users should cover the costs equally. The costs could include the operation and maintenance of the hydraulic structures such as dams and reservoirs. The President of Kyrgyzstan signed on July 23 2001 the new law “On the interstate use of water installations, water resources and hydro facilities in the Kyrgyz republic”. The law should support charges on downstream countries for water usage. However, until now the law did not have any impact on downstream users.

## Conclusion

Discussion of the water management problems arising after independence emphasises that the disputes over water are not because of allocation problems resulting from the skewed allocation between upstream and downstream. Unequal allocation is only one issue, which still has not created tension.

The main disputes between upstream and downstream states arose when a win–win situation turned into a zero–sum situation, namely when the energy sector became detached from the water sector. The



evidence suggests that only a combination of water and energy will be profitable for upstream and downstream riparian states. In addition, the hydroelectric power produced from the reservoirs during the summer would have to be more equally priced than gas or oil delivery in the winter.

Also, the recent disputes over O&M of the dams and reservoirs emphasise the need to utilise a joint approach for cost sharing. Already, the decline of reservoir maintenance has led to degradation of the dams and to water losses. Further degradation might have even larger impacts on downstream communities, their economies and the larger environment. Cost sharing according to water utilisation could improve maintenance of the reservoirs and could have greater effects on water utilisation downstream. Transferring the costs to the local level could imply rational and cost effective water use on the farm level and therefore water savings.

The example of the Syr Darya Basin shows that the focus on agreements over water allocations alone has not lead to stability and security. In the case of the riparian states of the Syr Darya a more complex cooperation incorporating water, energy and agriculture is needed. The scope would be similar to that of the Soviet period. But the style would have to be different. The new integration would have to be based on the principle of economic efficiency and environmental sustainability. Water cannot be separated from other sectors. It is part of a larger framework of interdependence. Hence, along the Syr Darya water treaties have to incorporate energy treaties as well as treaties on agricultural production. Only an issue linkage can create stability for the whole basin.

The study showed that complex and comprehensive integrated water management can disintegrate when the political economy disintegrates. Hence, the disintegration of the assumptions and structures in the wider economy can determine water resource allocation. The integration of water allocation will fail if the highest level assumptions and structures disintegrate. The Central Asian case shows that integration of water allocation and management does not necessarily occur and that further disintegration is possible.

## Acknowledgements

I would like to thank Urooj Amjad, Prof Tony Allan and Markus Mueller for their helpful comments and suggestions.

## Abbreviations

BVO	River Basin Organisation
CPR	Common Pool Resource
ICWC	Interstate Commission for Water Coordination
O&M	Operation and Maintenance
SIC	Scientific Information Centre
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development
WB	World Bank

## References

- Baumann, P. (1999). Kyrgyz Republic, Agriculture Area Development Project, Social Diagnosis (unpublished).
- Berezovsky, V. (2001). Central Asian unearths water war axe. *Rossiyskaya Biznes Gazeta*, in *Kyrgyzstan Review* [http://www.kind.net.kg/eng/2001/42/agriculture\\_and\\_water.html](http://www.kind.net.kg/eng/2001/42/agriculture_and_water.html).
- Chait, E.A. (no date). *Water Politics of Syr Darya Basin, Central Asia: Question of State Interests*. <http://www.iwra.siu.edu/pdf/Chait.pdf>.
- Elwert, G. (2002). Conflict. In: *International Encyclopaedia of the Social and Behavioural Sciences*, Baltes, P.B. & Smelser, N.J. (Eds). Elsevier Science Ltd., pp. 2542–2547.
- Falkenmark, M. (2001). Water related human security and catchment hydrosolidarity. *Analytical Summary from the Proceedings of the SIWI Seminar*. Stockholm, Sweden.
- Feller, G. (1998). Between Kyrgyzstan and Uzbekistan: the politics of Water. *Washington Report*. <http://www.washington-report.org/backissues/0198/9801045.htm>.
- Gulomova, L. (2001). Water: the future apple of discourse in Central Asia. *Central Asia Caucasus Analyst*, 25/4/2001.
- Hogan, B. (2000). *Central Asian States Wrangle Over Water*. Eurasianet.org. <http://www.eurasianet.org/departments/environment/articles/eav040500.shtml>.
- Hogan, B. (2001). *Kyrgyz Authorities Concerned about Retaliatory Raids against Central Asian Reservoirs*. Eurasianet.org. <http://www.eurasianet.org/departments/environment/articles/eav101601.shtml>
- Horsman, S. (2001). Water in Central Asia: regional cooperation or conflict? In: *Central Asian Security: The New International Context*. Allison, R. & Jonson, L. (Eds.). (2001). Washington/London: Brookings Institute/RIIA.
- Hutchens, A.O. (1999). *Principles of sharing costs associated with operation and maintenance of the water facilities of interstate joint use*. USAID-EPIQ [http://www.dec.org/pdf\\_docs/PNACJ888.pdf](http://www.dec.org/pdf_docs/PNACJ888.pdf).
- International Conference on Freshwater (2001). *Water – Key to Sustainable Development: Recommendations for Action*. Bonn, Germany [http://www.water-2001.de/outcome/bonn\\_recommendations.asp](http://www.water-2001.de/outcome/bonn_recommendations.asp)
- Jumagulov, S. (2001). *Uzbek Gas for Land Bid Fails*. Institute for War and Peace Reporting. <http://www.1worldcommunication.org/gasforland.htm>
- Kasymova, V. (1999). *National constraining factors to the agreement on water and energy use in the Syr Darya Basin*. USAID-EPIQ. [http://www.dec.org/pdf\\_docs/PNACH123.pdf](http://www.dec.org/pdf_docs/PNACH123.pdf)
- Koichiev, A. (2001). *Water Games Could Leave Central Asia High And Dry This Summer*. Eurasianet.org. <http://www.eurasianet.org/departments/environment/articles/eav031901.shtml>
- Lange, K. (2001). *Energy and Environmental Security in Central Asia: the Syr Darya*. Centre for Strategic and International Studies (CSIS). <http://www.csis.org/ruseura/cs010220lange.htm>
- Ostrom, E., Gardener, R. & Walker, J. (1994). *Rules, Games, and Common-Pool Resources*. Ann Arbor: University of Michigan Press.
- Renger, J. (1998). *The Institutional Framework of Water Management in the Aral Sea Basin and Uzbekistan*. European Union – TACIS Programme
- Rumer, B. Z. (1989). *Soviet Central Asia: “A tragic experiment”*. London: Unwin Hyman.
- SIC ICWC (1999). Institutional, technical and financial issues facing the irrigation sector in the Central Asian Republics, *Consultant Report*.
- Smith, D. R. (1995). Environmental security and shared water resources in post-Soviet Central Asia. *Post Soviet Geography*, 36(6), 351–370.
- UNESCO (2000). Water related vision for the Aral Sea Basin. *Report*. Imprimerie des Presses Universitaires de France, Paris, France.
- Weinthal, E. (2001). Sins of omission: constructing negotiating sets in the Aral Sea Basin. *Journal of Environment and Development*, 10, March, 50–79
- World Bank (1996). Fundamental provision of water management strategy in the Aral Sea Basin. *Report*.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.