From monocentric ideal to polycentric pragmatism in the Syr Darya: searching for second best approaches

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Abstract: While best practice in water management typically calls for the use of a basin-level approach, specific guidance in the absence of basin-level management is fairly scant. This paper reviews the experience of the Syr Darya basin to identify insights related to second best practices for water management at scales below the basin level. This paper first presents the causes for the disintegration of river basin management within the Syr Darya, which include both changes in operation of the Toktogul reservoir and rising water demands due to shifts in agricultural production and land ownership. Focus is then devoted specifically to small transboundary tributaries, where bottom-up cooperation has continued or reemerged in recent times. This paper concludes by highlighting the limitations to singular focus on sub-basins and tributaries, suggesting a balance between more intense cooperation and water control on tributaries and a loose overarching framework at the basin level.

Keywords: Central Asia; Syr Darya; Shakhimardan and Khoja-Bakirgan River; water; tributaries; monocentric; polycentric.

Reference to this paper should be made as follows: Wegerich, K., Kazbekov, J., Lautze, J., Platonov, A. and Yakubov, M. (2012) 'From monocentric ideal to polycentric pragmatism in the Syr Darya: searching

for second best approaches', *Int. J. Sustainable Society*, Vol. 4, Nos. 1/2, pp.113–130.

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1 Introduction

Taking a basin-level approach is widely regarded as best practice in water management. While some recent academic literature has highlighted limitations of integrated water resources management (IWRM) and river basin management (RBM) in a southern context (Lankford and Hepworth, 2010; Pigram, 2001; Wester et al., 2005), the volume of this literature is far outweighed by authoritative water management sources (e.g. Global Water Partnership, 2002; UN World Water Assessment Programme, 2009; World Bank, 1995) that advocate adopting a basin-level framework. The proliferation of basin-level transboundary agreements in recent decades[1] is indeed a reflection of the emphasis placed by the global community on the importance of basin-level water management.

Despite widespread acceptance that basin-level approaches are best, the fact remains that many transboundary watersheds are managed at scales below the basin without an overarching framework for basin coordination. The experience of the Syr Darya basin is a case in point and provides interesting examples for use of both basin-level and fragmented approach to water management, i.e. management of rivers crossing the boundaries of individual Central Asian republics was moderated by the central management authority in Moscow, setting a basin-level precedent which continued through 1992. After independence, however, the Soviet river basin framework disintegrated in Central Asia.

This paper recounts the historic development of two small transboundary tributaries (STTs) from a fragmented meso level or polycentric approach to an integrated and central approach during the Soviet Union, and the shift back to a meso level approach to water management. Analysis of the sequence of events reveals that the disintegration of water management within the Syr Darya basin is not solely based on the operation of the Toktogul reservoir but also has local-level reasons that explain why meso level solutions were found. Being within one larger basin, these solutions have negative effects for downstream water users.

Section 2 briefly discusses the monocentric and polycentric models of river management. Section 3 gives a more detailed hydrological and institutional background to the Shakhimardan and Khoja-Bakirgan River and water development in the Ferghana Valley. Section 4 focuses on the evolution from polycentric to monocentric water agreements within the Syr Darya during the Soviet Union and Section 5 gives an overview of the changes in agricultural production and irrigation departments in Kyrgyzstan, Tajikistan and Uzbekistan. Section 6 shows the disintegration of the monocentric water management approach and the reemergence of different water management units. Finally, Section 7 offers some broader conclusions.

2 RBM approaches and scale dimensions

There is a growing distinction between what IWRM means in the South and what it means in the North. Pigram (2001) recognised considerable problems in importing the process oriented, technical approach to water and RBM from the Northern to Southern basins. Hooper (2010a, p.467) points out that "there are fundamental differences in governance, hydrology, demography and levels of economic development and capacity to manage water by governments". Wester et al. (2005) distinguish between a centralised or

monocentric model and a polycentric model. This idea is picked up by Lankford and Hepworth (2010) who distinguish between a regulatory basin-wide model – which they call the cathedral – and a localised polycentric approach which breaks up the larger basins into building blocks or sub-units – which they call the bazaar. Wester et al. (2005, p.3) argue that

> "while possibly appropriate for the construction of water infrastructure, the monocentric model has serious deficiencies when it comes to dealing with the uncertainty, vulnerability and complexity characteristic of water management […] Composed of multiple units at multiple scales of organization, polycentric governance arrangements are less vulnerable to shocks (both biophysical such as floods and droughts and social political upheavals), and more open to experimentation and learning than more centralized systems."

Lankford and Hepworth (2010, p.86) promote the polycentric model in cases where

> "very little or no data and analysis remain the de facto situation [...] water demand and supply fluctuate both intra-seasonally and inter-annually, [...] regulatory organisations, logistics and infrastructure for monitoring demand and supply are generally under-resourced [...] functional and fair judicial system and associated procedural legal capabilities are [not] in place."

It seems that in both cases non-regulatory pragmatic operational solutions and the creation of nested sub-units are promoted.

Even though there is a conceptual distinction between centralised and polycentric water management, it is questionable whether a basin management approach is actually practiced. In a recent paper on river basin organisational performance, Hooper (2010a, p.467) observes for the USA that the current situation reveals widespread local watershed management efforts rather than whole of basin management. He (Hooper, 2010b, p.8) points out, "while the conceptualization of IRBM is apparent, implementation remains a challenge in many locations in the US. Much of this challenge can be explained by negotiations over issues of sovereignty and power". He (Hooper, 2010a, p.467) highlights the emerging conflicts in the US basins, but he emphasises that "the current US experience demonstrates the federal and State preference for decentralization over federal control and interference". Lautze et al. (submitted) in his analysis of transboundary water treaties states: "what seems clear is that while the majority of transboundary basins with an International River Basin Organisation] IRBO contain just one, more than 25 percent of basins with an IRBO nonetheless contain at least two [IRBOs]." Basins with multiple IRBOs include European rivers such as the Danube and Rhine. Therefore, even though a centralistic approach to RBM may be promoted, one has to question this one-size-fits-all solution as this is often only conceptual. On the other hand, polycentric management is a widespread practice.

One problem with the polycentric model is how to integrate the different sub-units within a larger basin framework, especially if the basin is closed. Rubiano et al. (2006, p.339) reason that "a problem or phenomenon is observed within a level or a scale but either the causes or its consequences might happen in other levels and/or scales". Policies are national or even below the national level. Therefore, policies on the national or meso level can have implications for the river basin. Rubiano et al. (2006, p.339) argue that "policy makers address optimization issues regarding how to improve livelihoods, conditions, societal, economic and environmental benefits within a scale of action" and therefore may not consider other scales. Hooper (2010a, p.467) states: "the Federal

Government has become the facilitator of local action (through funding programs) while States retain strong sovereignty over water".

3 Hydrologic and institutional background

3.1 Hydrology

The Syr Darya rises in the Tien San Mountains of the Kyrgyz Republic. It is the longest river in Central Asia. Its length is 3,019 km with a catchment area of 219,000 km^2. The annual flow in the Syr Darya basin averages 37 km^3 and ranges between 21 and 54 km^3. The river is shared by four Central Asian republics: Kyrgyzstan, Uzbekistan, Tajikistan and Kazakhstan. Up to the confluence with the Kara Darya (also from Kyrgyzstan 3.9 km^3), the Syr Darya is called the Naryn (13.8 km^3), which contributes about 30% of total run-off. Within the Ferghana Valley, STTs[2] have a total annual run-off of 7.8 km^3. Other tributaries are the Chirchik (7.8 km^3) midstream and the Arys (2.0 km^3) and the Ahangaran (1.2 km^3) downstream within Kazakhstan. On its way to the Aral Sea, the Syr Darya crosses international boundaries midstream between Kyrgyzstan and Uzbekistan, then Tajikistan, goes back to Uzbekistan and finally enters Kazakhstan.

The contributions of the STTs within the Ferghana Valley to the Syr Darya basin are quite significant and represent half of the annual flow of the Naryn's 14.5 km^3. The UN SPECA (2003) report distinguishes between three areas of STTs: the rivers between Naryn and Kara Darya (Kyrgyzstan 1.8 km^3 and Uzbekistan 0.3 km^3); the right slope of the Ferghana Valley (Kyrgyzstan 0.8 km^3 and Uzbekistan 0.4 km^3) and the left slope of the Ferghana Valley (Kyrgyzstan 3.5 km^3, Tajikistan 0.9 km^3 and Uzbekistan 0.2 km^3). At the left slope of the Ferghana Valley, there are three small rivers that flow from the Alay mountain ridge in Kyrgyzstan to Uzbekistan. These rivers are Shakhimardan (mean annual flow 0.3 km^3), Isfayram (0.5 km^3) and Sokh (0.6 km^3). Still at the left slope of the Ferghana Valley, the following rivers flow from the Turkestan mountain ridge in Kyrgyzstan into Tajikistan: Khoja-Bakirgan (0.3 km^3), Isfara (0.4 km^3), Isfana (0.1 km^3), Ak-Suu (0.1 km^3) and others (Rysbekov, 2008). Snow and glacier melt make large contributions to the current run-off of the rivers in the Ferghana Valley. Their discharge peaks during the summer months with less flow during the spring and autumn months (Shutz, 1965).

The total length of the Khoja-Bakirgan River (see Figure 1) is 117 km. Its catchment area is 1,740 km^2 and the average annual flow of 0.3 km^3 with a maximum flow of 0.5 km^3 and a minimum flow of 0.2 km^3 (1980–1996). The river starts at an unnamed glacier in the Leylek district (Batken Province) of Kyrgyzstan and is joined on its way by different smaller rivers, all within Kyrgyzstan. Within Tajikistan, the river is utilised by the Jabbar Rasulov and Bobojon Gafurov districts of Sogd Province.

The Shakhimardan River (see Figure 2) is formed from the confluence of two mountain rivers: Kuk-say and Ak-Suu, which both have glacier origin. The length of the river is 112 km. The average annual flow of water between 1980 and 2006 was 0.3 km^3 with a maximum flow of 0.5 km^3 and a minimum flow of 0.2 km^3. The river starts its flow in the glaciers of Kadamjay district in Batken Province, Kyrgyzstan. Its stream intersects the state border twice, firstly in Shakhimardan village (an enclave of Uzbek territory in Kyrgyz territory) and secondly at Vuadil district centre

(Kyrgyzstan–Uzbekistan state border). In Uzbekistan, its water is mostly utilised in the territory of Ferghana district in Ferghana Province.

Figure 1 The Khoja-Bakirgan River (see online version for colours)

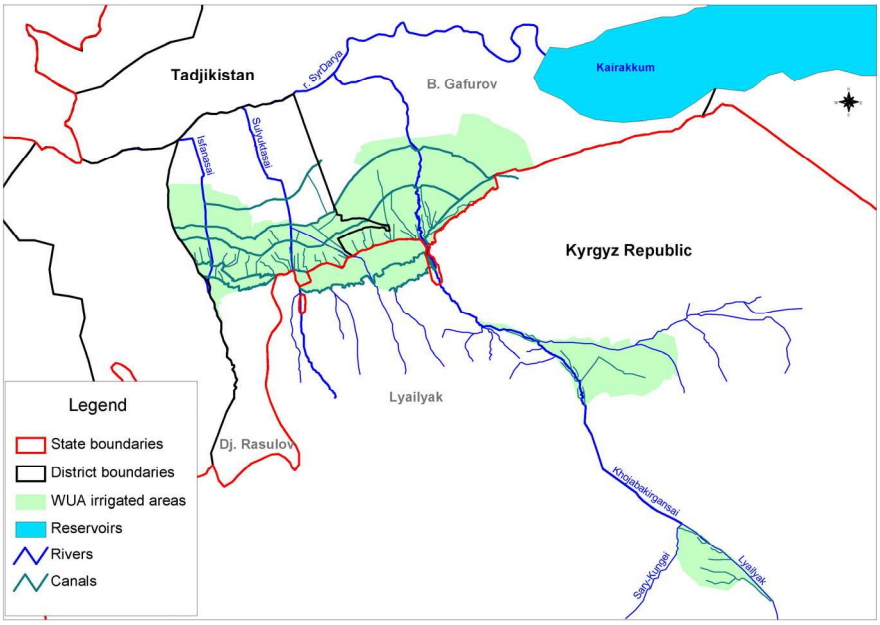
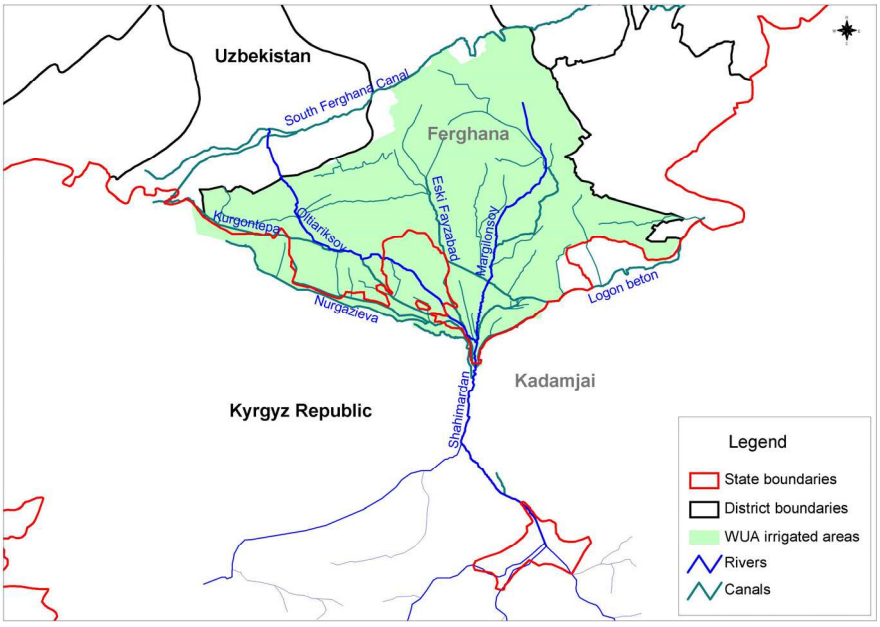


Figure 2 The Shakhimardan River (see online version for colours)



3.2 Institutions and management

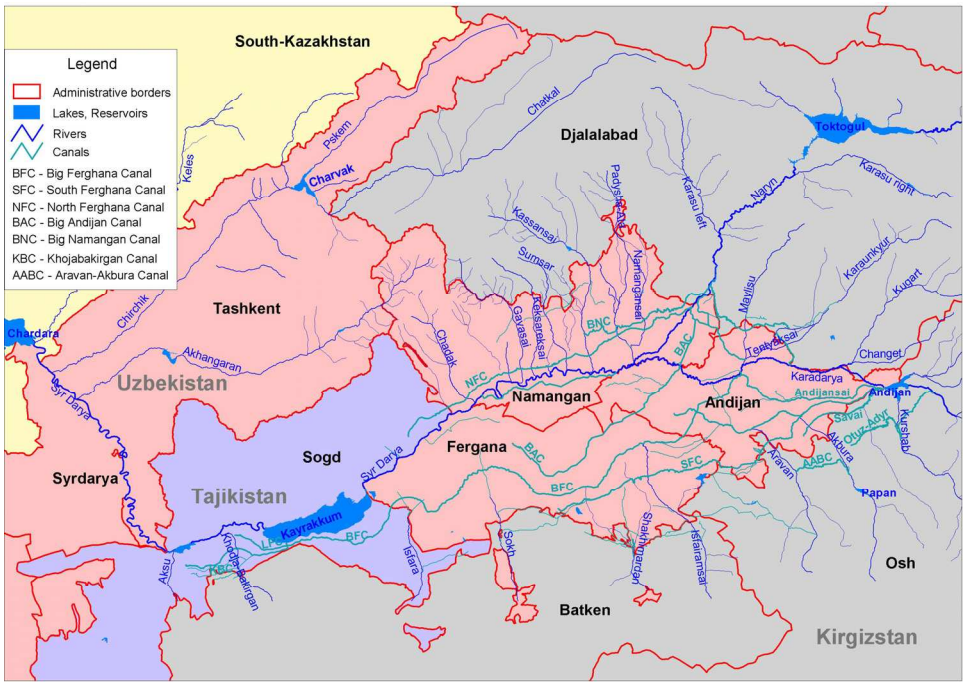
During the period of the Soviet Union, the management of rivers crossing the boundaries of individual Central Asian republics was moderated by the central management authority in Moscow. After 1991, new institutional structures were required to facilitate the sharing of water and water infrastructure between new independent states. In 1992, the five Central Asian states decided to continue with the former water sharing agreements established during the Soviet Union and therefore with all transboundary rivers. Despite the ostensible continuity with the past, the main emphasis was placed on the larger rivers, such as Amu Darya and Syr Darya (see also ICWC Press Release, 2007). Similarly, the donor initiatives focused for about the first 15 years of independence on the larger rivers and did not pay attention to the smaller transboundary tributaries and rivers in Central Asia.

Because of the boundary setting within the Ferghana Valley, with Tajikistan and Kyrgyzstan mainly on the mountain slopes and Uzbekistan mainly within the valley, there is a large concentration of STTs. The waters of these STTs are often utilised for local irrigation. However, these STTs are interwoven within the larger irrigation system of the Ferghana Valley. Even before the Virgin Lands policy of Soviet leader Nikita Khrushchev was initiated, irrigated area was expanded within the Ferghana Valley. Weinthal (2002, p.84) mentions the speed of construction and the extent of the different canals (North (133 km) and South Ferghana Canal (93 km), Great Ferghana Canal (249 km) and Savai Canal (53 km)) constructed in the late 1930s and early 1940s. She links collectivisation and irrigation and states (p.84): "the soviet authorities needed to expand irrigation to support many of these new farms. […] the engineers embarked on the construction of several of the major canals in the Ferghana Valley that would link together the various oases". In this respect, it seems that it was anticipated that the water from the STTs was not enough for further expansion and, therefore, that water was transferred from the Naryn and Kara Darya to support irrigation expansion in the smaller tributary basins. Within the Ferghana Valley, all the STTs to the Syr Darya were linked through a system of canals, designed in a circle around the Ferghana Valley. From the circle, a compartmentation approach (fan) was taken to distribute water equitably between the different administrative units. There is a clear overlap of tributary waters coming from the slopes and the main Naryn flow (see Figure 3).

Although agreements on the use of some STTs in Central Asia were negotiated without the auspices of Moscow, e.g. Khoja-Bakirgan River, other STTs (e.g. the Shakhimardan River) were, like larger rivers, negotiated under the auspices of the Ministry of Water Resources (Minvodkhoz) in Moscow. The sharing agreement on the Khoja-Bakirgan River was negotiated back in 1963. Possibly, at that time the water resources within the Syr Darya basin were not over-allocated. However, the agreement on the Shakhimardan River together with other STTs (mentioned below) were only negotiated in 1980, four years before the overall Syr Darya basin agreement.

Section 4 focuses on the legal agreements for Khoja-Bakirgan and Shakhimardan River from polycentric to monocentric water management in the Syr Darya basin. These agreements also emphasise how interwoven these STTs are within the larger irrigation system of the Ferghana Valley and, therefore, within the Syr Darya basin.

Figure 3 STTs and water infrastructure in the Ferghana Valley (see online version for colours)



4 The development of the water sharing agreements on the STTs

The agreement on the Khoja-Bakirgan River was signed between the Tajik SSR and the Kyrgyz SSR. The agreement was based on the protocol resulting from the meeting between the representatives of the water ministries in Leninabad city (Khojand) on 17–18 May 1962. The interaction between the larger Syr Darya basin (Kara Darya and Naryn Rivers) and the smaller Khoja-Bakirgan River is already evident in the title of the protocol: "On irrigation of parts of the Massiv 'Arka' of Kyrgyz SSR from the Khoja-Bakirgan machine canal and water allocation along the system of the river Khoja-Bakirgan for the year of 1962". At the meeting, the water departments of the benefiting provinces (Osh in Kyrgyzstan and Khoja-Bakirgan in Tajikistan) participated.

The main points of the protocol are:

1 The management of the Khoja-Bakirgan irrigation system will supply additional water for 250 ha from the Khoja-Bakirgan machine canal to the lands of Kyrgyz SSR. The total area supplied is 550 ha only (the water amount will be determined by the plan for water use and by the actual efficiency of the pumping station).

2 The annual flow of the Khoja-Bakirgan River will be shared between the Tajik SSR and the Kyrgyz SSR in the proportion of 79% and 21%, respectively.

3 Observation at the hydroposts should be carried out by the representatives from both sides – twice a day: at 7 am and 7 pm.

The protocol shows that there is a clear interlinkage between the water resources of the Syr Darya and the Khoja-Bakirgan River. It appears that unequal water limits were set on the Khoja-Bakirgan River, similar to the much later larger basin framework agreements of 1984. This coincides with the Soviet policy of utilising the water resources downstream to facilitate cotton production. An interesting addition is that the protocol determines that the Kyrgyz side is responsible for the construction of the floating pump station and its canal, both of which are located in Tajikistan but bring water to upstream Kyrgyzstan. The protocol does not mention any agreements on operation and maintenance costs.

The protocol on the Shakhimardan River, 10 April 1980, differs substantially from the earlier agreement on the Khoja-Bakirgan River. The protocol on the Shakhimardan River was set in Moscow by representatives from the water ministry of the USSR as well as one representative each from the water ministries of the Kyrgyz SSR and the Uzbek SSR. The protocol, in its annex, determines the shares of nine small transboundary rivers, one of which is the Shakhimardan River (see Table 1).

However, similar to the protocol on the Khoja-Bakirgan River, this protocol makes reference to the total water resources in the Ferghana Valley. Hence, the interlinkages between small rivers and the Syr Dayra are also clearly mentioned. It states:

> Taking into account also that Andijan and Toktogul reservoirs made it possible to increase the water supply of irrigated lands of the Ferghana Valley, including lands under the small rivers, the Commission considers the necessity to conduct clarification of existing water allocation of small rivers of Ferghana Valley. The proposed allocation of water resources is based on the principle of equal water supply to lands of Uzbekistan, Tajikistan and Kyrgyzstan, taking into account all possible sources of irrigation, including surface water of the given source, as well as replenishment from the main canals from supply from Naryn and Karadarya rivers and also current use of groundwater. (Protocol, 1980)

Whereas for the Khoja-Bakirgan River, the protocol determined annual allocations, Protocol (1980) on the nine STTs takes into consideration the hydrological specifics of the STTs and, therefore, determines decadal water allocations (see Table 2).

According to PA Consortium Group and PA Consulting (2002), the previous agreements on the STTs were incorporated into the larger Syr Darya Protocol No. 413. The Protocol of the Meeting of the Scientific-Technical Council of the Ministry of Land Reclamation and Water Management of USSR, held on 7 February 1984 in Moscow, provides water distribution limits for the Syr Darya. These limits assume full use of the internal water resources of the basin (Table 3).

The Syr Darya River was managed during the Soviet Union according to an IWRM framework. The integrated framework did not incorporate the environment (the Aral Sea), but did focus on the problemshed by integrating water, energy resources and food production in an issue-linkage approach (Wegerich, 2004a).

Even though, on 18 February 1992, the presidents of the five Central Asian republics came together and agreed to continue with the set water allocations (Almaty Agreement, 1992), on the national level new treaties have been signed especially for the operation of large infrastructure (agreement on the operation of Toktogul reservoir on the Naryn from 1998). However, the 1998 agreement failed, and Kyrgyzstan continued to release water from Toktogul mainly during the winter months to produce hydropower to meet national electricity demands.

Table 1 Annex 1 of the Protocol of 10 April 1980: proportional water allocation of small rivers of the Ferghana Valley for irrigation (%)

		Share of	
No.	*River, canal*	*Uzbek SSR*	*Kyrgyz SSR*
1	Akbura	18	82
2	Aravansay	23	77
3	Isfayramsay	70	30
4	Shakhimardan	73	27
5	Sokh	90	10
6	Isfara[a]	8	37
7	Maylisay	18	82
8	Padshaata with Chartaksay	64	36
9	Kasansay without tributaries	92	8

[a]Including 55% of share of Tajik SSR.

Source: Protocol (1980).

Table 2 Annex 2 of the Protocol of 10 April 1980: decadal water allocation along the Shakhimardan between Kyrgyzstan and Uzbekistan in cropping season (% from the flow, decadal range[a])

		Cropping season						
No.	*Republic*	*April*	*May*	*June*	*July*	*August*	*September*	*Mean*
1	Kyrgyzstan	21.6–22.2	21.8–22.4	22.3–23.4	23.3–23.8	23.5–23.8	22.9–23.5	22.9
3	Uzbekistan	57.5–58.0	59.0–62.5	62.8–63.5	64.0	62.0–63.0	61.5–62.7	61.7
5	ITN[b]	10.3–10.4	5.1–9.2	3.1–4.2	2.2–2.7	3.5–4.2	3.8–5.5	5.4
7	Stream losses	10.0	10.0	10.0	10.0	10.0	10.0	10.0

[a]Decadal range – maximum and minimum decadal shares of the flow.

[b]INT – industrial technical needs in water supply.

Source: Protocol (1980).

Table 3 Water use limits in the Syr Darya basin following Protocol No. 413 of 7 February 1984

	Water use in year of availability of 90% of annual average flow (km^3)			
	From surface water sources		*From ground water and return flows*	*Irrigated areas in basin development plan (ha)*
Republics	*Total*	*From Naryn to Syr Darya*		
Uzbekistan	19.7	10.5	5.8	1,982
Kazakhstan	12.3	10.0	3.0	780

Table 3 Water use limits in the Syr Darya basin following Protocol No. 413 of 7 February 1984 (continued)

	Water use in year of availability of 90% of annual average flow (km^3)			
	From surface water sources			
Republics	*Total*	*From Naryn to Syr Darya*	*From ground water and return flows*	*Irrigated areas in basin development plan (ha)*
Kyrgyz Republic	4.0	0.4	0.9	456
Tajikistan	2.5	1.8	1.2	262
Total for Basin	38.5	22.7	10.9	3,480

Source: PA Consortium Group and PA Consulting (2002).

While the analysis of the disintegration within the Syr Darya focuses mainly on the large-scale infrastructure, the operation of the Toktogul reservoir in upstream Kyrgyzstan (O'Hara, 2000; Wegerich, 2004a; Weinthal, 2001), recent studies indicate that the disintegration cannot only be attributed to the change in operation of the Toktogul reservoir. These studies suggest that water utilisation in STTs within the Syr Darya basin has also changed (Abdullaev et al., 2006; Ul Hassan et al., 2004). An ICWC press release confirms this, stating that water resource management on transboundary small rivers (TSR):

> has become highly complicated over the last 10 years as a result of population growth and new land development in upper reaches of small rivers. Earlier reached agreements on TSR water resources use are not complied with in some periods, the situation with water allocation becomes complicated in low-water years. In general, non-compliance with established interstate water allocation from TSR results in aggravation of social tension in border areas located in TSR basins, which can easily develop into international conflicts. (ICWC Press Release, 2007)

Section 5 tries to explain how the agricultural sector changed after independence and how water management reforms failed to cope with these changes.

5 Changes in agricultural production in Kyrgyzstan, Tajikistan and Uzbekistan

The centralised Soviet state order system in Central Asia determined the production of certain crops on state and collective farms (average size of about 2,000 ha). Depending on the planned production, water was allocated from top to bottom within a strict administrative hierarchy (Wegerich, 2005). The state production plan allowed emphasis mainly on metering water intake at the state farm gate, rather than constructing water control infrastructure.

Wegerich (2004a) shows that, because of land reforms in upstream Kyrgyzstan, water utilisation has increased. Whereas in 1990 there were some 450 state and collective farms, by 2002 the number of farms had increased to some 84,700, most of which were small in size (Spoor, 2004). On-farm irrigation structures became interfarm structures; however, these structures were not equipped to control the water use of small-scale

farms. In addition to the problems of water distribution at the local level, small-scale subsistence farming changed the focus of agricultural production from livestock to crops. This shift from livestock to food and cash crops led to increased water demands in Kyrgyzstan. Lerman and Sedik (2009) show cropping structure changes for Tajikistan (Table 4). They argue (2009, p.39) that "the restructuring or dissolution of collective and state farms and the establishment of individual farms necessarily entails the loss of a degree of control by the government over crop production and the mix of crops". Munoz (no date) shows an increase in wheat and rice production for Tajikistan. According to Lerman and Sedik (2009), within Tajikistan the production of rice is highest in Sogd Province, which is in the Ferghana Valley. The national food self-sufficiency strategy in Uzbekistan, which reallocated irrigated areas from cotton to wheat production, could have led to water savings (Abdullaev et al., 2009; Spoor and Krutov, 2003). However, Conrad (2006) and Wegerich (2009) emphasise the expansion of a second crop after winter wheat in Uzbekistan.

Within the STTs, the competition between upstream and downstream riparian states is highest during the spring and autumn period; this is the period in which winter wheat needs to be irrigated (Table 5). However, during this period the flow of the STTs is still limited.

Table 4 Cropping structure changes in Tajikistan 1980–2006

	Total sown ('000 ha)	*Grains (%)*	*Cotton (%)*	*Horticultural crops (%)*	*Feed crops (%)*
1980	763.6	25.5	40.4	4.3	28.5
1985	802.8	26.1	38.8	4.7	29.2
1990	824.2	27.9	36.8	5.9	28.0
1995	758.0	35.0	35.4	6.1	21.3
1998	827.6	49.2	29.4	6.7	10.8
2000	864.3	48.8	27.6	7.7	11.5
2003	886.9	45.6	32.1	7.6	10.8
2006	900.2	44.6	29.2	8.1	14.6

Source: Lerman and Sedik (2009, p.39).

Table 5 Cropping patterns in the two STTs

	Irrigated land (ha)	*Cotton*	*Wheat*	*Maize*	*Vegetables*	*Orchards*	*Tobacco*	*Alfalfa*	*Sunflower*	*Kitchen garden*	*Other*
Shakhimardan Kyrgyz part											
2004	4,405	0	1,820	662	188	401	188	0	0	1,177	30
2005	4,405	0	1,820	662	188	326	40	0	0	1,177	30
2007	4,539	0	1,630	738	202	336	40	0	0	1,376	135
Shakhimardan Uzbek part[a]											
1980	11,995	6,214	1,454	412	155	1,125	0	0	0	1,689	312
1985	12,012	5,425	1,862	416	133	1,366	0	0	0	1,825	414

Table 5 Cropping patterns in the two STTs (continued)

	Irrigated land (ha)	*Cotton*	*Wheat*	*Maize*	*Vegetables*	*Orchards*	*Tobacco*	*Alfalfa*	*Sunflower*	*Kitchen garden*	*Other*
1990	12,081	5,126	2,123	355	125	1,594	0	0	0	2,004	314
1995	12,156	4,956	2,612	240	86	1,655	0	0	0	2,113	183
2000	12,142	4,367	2,833	259	79	1,739	0	0	0	2,425	190
2007	12,142	3,524	2,830	28	102	2,372	0	0	0	3,093	160
Khoja-Bakirgan Kyrgyz part											
2004	5,708	755	1,064	773	253	815	0	0	237	1,452	359
2005	5,708	760	720	643	249	491	0	0	659	1,225	398
Khoja-Bakirgan Tajik part											
2005	11,641	6,065	1,751	0	1,282	347	0	1,056	0	986	154
2006	11,337	5,967	1,890	0	634	667	0	1,034	0	989	156
2007	13,470	6,814	2,536	0	930	629	0	1,428	0	818	315
2008	14,604	7,085	3,142	0	1,249	769	0	1,245	0	821	293
2009	16,153	6,888	3,890	0	1,823	915	0	1,401	0	929	307

[a]The data for 2000 and 2007 do not include the second crop after winter wheat.

Sehring (2009) shows for Kyrgyzstan and Tajikistan how national water reforms are created in a vacuum and under donor pressure. She (2009, p.75) states: "despite the importance of water administration for overall reform (the central level of bureaucracy is involved in rule formulation, the meso level in implementation), the importance of these inter-institutional linkages was not adequately considered in the reform program". Wegerich (2004b) shows for Khorezm Province in Uzbekistan that the irrigation departments cannot control water utilisation anymore in the changing social and economical environment. He (Wegerich, 2005, 2009) shows how pure organisational changes in the irrigation department failed to adapt the weakening of social and economic control in the agricultural sector. Although these observations relate to the meso and local level, these changes have consequences for the national level or have even transboundary implications. Abdullaev et al. (2006) and Ul Hassan et al. (2004) reveal that small changes upstream within the STTs have implication for downstreamers within the same tributaries. However, in the case of Ferghana, the extensive existing control infrastructure allows additional water to be brought from other sources (Syr Darya or groundwater) and therefore compensate for these locally experienced water deficits. Since these are transboundary tributaries within the larger Syr Darya basin, compensating from other sources entails implications for downstream farmers not only in Uzbekistan but also in other riparian states.

6 Operational and pragmatic polycentric solutions

With the failure of the 1998 agreement on the operation of Toktogul and its increased operation during the winter, the midstream and downstream states had to find operational and pragmatic solutions.

In reaction, the midstream state Uzbekistan is attempting to increase its independence from the upstream water control infrastructure by constructing its own reservoirs. On the right side of the Ferghana Valley, Uzbekistan is considering the construction of the Kenkylsay reservoir (0.7 km^3) which would be supplied with water from the Big Namangan Canal and has started the construction of the Rezaksay reservoir (0.2 km^3) which will also be supplied by the Big Namangan Canal and, by pumping, from the North Ferghana Canal. With these two smaller reservoirs, Uzbekistan will increase its independence on the right slope of the Ferghana Valley from the operation regime of the Toktogul reservoir.

On the left side of the Ferghana Valley, the reaction to the increased competition within the STTs led to different solutions. A key person from the Dispatch Centre of the Ministry of Agriculture and Water Resources of Uzbekistan (personal communication, Ferghana City, 19 May 2010) stated that in 2001, the ministries of Uzbekistan and Kyrgyzstan met and agreed orally to share equally all the STTs on the left side the Ferghana Valley (including Shakhimardan River). With this bilateral agreement, the larger water sharing agreement of 1984 on the Syr Darya was discarded.

Regarding the water allocation in the Khoja-Bakirgan River, representatives from Kyrgyzstan and Tajikistan held a meeting in Bishkek in 2008. The protocol of the meeting highlights the fact that both countries were aware of the possible conflict situations and therefore organised the meeting to avoid these conflict situations in the future. The meeting in Bishkek resulted in an agreement to establish a joint interstate working group for solving allocation problems between Kyrgyzstan and Tajikistan (Protocol, 2008).

On 18 June 2009, representatives of the two countries met again in Isfara in Tajikistan. Some prepared documents highlight the difference of opinion between the two sides. Whereas the Kyrgyz proposed to share the water equally (Batken BWMD, 2009), the Tajik proposed to continue with the 1962 sharing agreement (79% for Tajikistan and 21% for Kyrgyzstan) but to calculate the 79/21 share from the daily instead of from the annual flow (Sogd PDWR, 2009). The final outcome of the meeting was that both sides agreed to continue with the annual allocations determined in the Protocol of 1962. Furthermore, the Khoja-Bakirgan canal management organisation and the Leylek district water management department were authorised to take all means to arrive at solutions to emerging water questions on the Khoja-Bakirgan River (Protocol, 2009). Even though Tajikistan and Kyrgyzstan agreed to continue with the 1962 allocations, it is significant that, like the Kyrgyz and Uzbek bilateral informal agreement, this agreement is also only bilateral and hence does not take into consideration that the Khoja-Bakirgan River is only a tributary of the larger Syr Darya basin and that, therefore, all riparian basins should have been consulted.

Since the lower basins have access to different water resources, either groundwater in the Shakhimardan River or lift irrigation in the Khoja-Bakirgan River, the lower basins can compensate. However, since in both cases the water has to be lifted, the costs of the alternative water resources are higher. During the summer period, the periods of higher flows, the competition between upstream and downstream riparian states within the basin is lower and mainly only occurs in periods of low average flow. Nevertheless, since all the water resources are used within the irrigated area, utilising more water upstream for summer crops naturally implies that less water is available for the summer crops in the irrigated areas within the downstream parts of the basin, and that water users downstream

have to depend on alternative water resources. In this respect, the area using two different water resources varies throughout the year.

The downstream riparian in the Syr Darya, Kazakhstan, is most negatively affected by the water strategies of the upstream and midstream riparian states. Ryabtsev (2008) and Libert et al. (2008) point out that within the Syr Darya basin, the water agreed upon in a bilateral protocol between Kazakhstan and Kyrgyzstan did not reach Kazakhstan in 2008 but was partly used in Uzbekistan and Tajikistan. To increase its independence, Kazakhstan has started to construct a reservoir at Koksarai, 140 km downstream from the Chardara reservoir. The reservoir will be able to store 3 km^3. In addition, Kazakhstan has started the construction of a pump station at the Chardarya reservoir to lift water to Makhtaaral district, which is currently supplied through the transboundary Dustlik canal. With these two constructions, Kazakhstan will be independent from the operation regime of the upstream Toktogul reservoir.

7 Conclusion

The attempts of the midstream and downstream riparian states to build new water control infrastructure highlights the establishment of polycentric solutions to the change in operation of the upstream reservoir. On the left slope of the Ferghana Valley, the attempts of the three riparian states to come to bilateral agreements (either informal or formal) on the STTs also show the emergence of polycentric solutions. All of these solutions highlight how the larger Syr Darya basin framework is being further disintegrated.

The study on the STTs shows that the disintegration or fragmentation within the Syr Darya basin is not only based on the operation of the Toktogul reservoir. It emphasises that privatisation in Kyrgyzstan and to a lesser extent in Tajikistan led to a loss of control over agricultural production and, therefore, also a loss of control over water demand and utilisation during all seasons. The shift in Uzbekistan has mainly resulted in a loss of control for the few months after the winter wheat harvest in which farmers grow their second and most profitable crop, which is outside of the state order system. However, particularly the shift to food security and the production of winter wheat caused the main competition in an already more water-scarce period within the STTs. The problems within the STTs represent on the micro level; the current problems of water sharing on the Amu Darya and the Syr Darya. Extrapolating from this, using the water control approach, one could argue that an irrigation system in Central Asia is a microcosm of the larger basin. In this respect, it appears to be a priority to focus on water control on the micro scale first before riparian agreements on water sharing can be negotiated.

The study highlighted the shift from the monocentric ideal to a polycentric pragmatism in the Syr Darya. One could distinguish between different units such as Toktogul reservoir (Kyrgyzstan), the left as well as the right banks of the Ferghana Valley (mainly Kyrgyzstan and Uzbekistan), the small part at the Kairakum reservoir (including Khoja-Bakirgan River), the Uzbek' agricultural area between Kairakum and Chardara as well as Kazakhstan below the Chardara reservoir and finally the northern part of the Aral Sea. Even though these pragmatic second best solutions are partly already operational, the fragmentation has not been formally acknowledged. Acknowledging the polycentric pragmatism might ease the current deadlock on annual water sharing negotiations, and therefore might ease the current tension.

Having stated this in the case of the Syr Darya, polycentric pragmatism is only a second best solution, since the Syr Darya is a closed basin. The loser of the polycentric approach could be as it was before in the monocentric approach the Aral Sea.

Acknowledgement

This paper has greatly benefited from the comments of two external reviewers.

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Notes

[1] See, e.g. Lautze and Giordano (2005) for a description of this in Africa.

[2] Also called transboundary small rivers (TSRs).