"In every drop of water there is a grain of gold." (Uzbek proverb)

1. Introduction

Central Asia makes up part of the arid and semi-arid vegetation zones of the globe. Precipitation and usable ground water resources are insufficient to meet the demands of agriculture and habitation. The majority of water comes from the run-off of the high mountain ranges of Pamir and Tien Shan in the eastern parts of Central Asia. Most of this run-off feeds the two main rivers of the region, Amu Darya and Syr Darya which flow west and north towards the Aral Sea.

Most of the agriculture is made possible only by irrigation demanding sophisticated water distribution systems. The allocation of this precious water could only be realized by developed so-called "hydraulic societies"[1] that have an ancient tradition in Central Asia, especially in the regions of Khiva, Samarkand and Fergana. The "Mesopotamia" of Central Asia, the fertile irrigated land between the two legendary rivers of Oxus (Amu Darya) and Jaxartes (Syr Darya) is an ancient settlement area with a history of approximately 3500 years. Archaeological research has revealed sophisticated irrigation systems that provided water for millions of hectares.

At the end of the 19th century, after the Russians had conquered the Khanats of Turkestan, new irrigation technologies were introduced and cotton was cultivated on a larger scale. With the consolidation of Soviet power in the early 1920s, the irrigated area was extensively developed due to the Soviet Union's most favourable thermal and soil conditions in an arid region with then abundant water resources.

However, the traditional appreciation of the once inexhaustible water resources in Central Asia has diminished since the colonization and the sovietization of the region. Since 1960 the region has witnessed a dramatic increase in the demand for water resources. Water withdrawals for irrigation are enormous. Depletion of river flows and ground water reserves, as well as degradation of water and soil qualities have become widespread. The consumption of water has tripled mainly due to significant extension of irrigated agricultural land and to the rapid population growth which has more than doubled and is expected to reach 50 million by the year 2000.

The desiccation of the Aral Sea is one of the major man-made ecological catastrophes in the world. By 1982 the extreme specialization of cotton monoculture and its irrigation practices had led to an almost total abstraction of the run-off originally reaching the Aral Sea, which has already lost 75% of its volume since 1960. The blowing away of toxic salt and dust due to the exposed sea bottom leads to soil infertility on the once fertile Amu Darya delta. The contamination of drinking water with toxic chemicals from pesticides and fertilizers is believed to be the main cause for high rates of intestinal diseases

1 See Wittfogel, Karl: Oriental Despotism: Cooperative Study of Total Power, New Haven 1957.

like hepatitis, throat cancer, and even typhoid. Infant mortality in the Karakalpakian Autonomous Republic is comparable to some African countries. Furthermore, the falling sea level has caused a micro climate change and a rapid decline in fish productivity. Experts expect that the Aral Sea will evaporate further in the foreseeable future.

The region's productive forces have been focused exclusively on the production of cotton. A big rural labor surplus and the intention of the Soviet central planning authorities to become independent from cotton imports led to a concentration of cotton cultivation. Since 1960 cotton production has doubled and now accounts for almost half of the irrigated sown area. Irrigated arable land has increased by 60% in the last forty years. Cotton monoculture is regarded as the main reason for the depletion of soil and water resources in the central Asian republics. Cotton cultivation is responsible for the exhaustion of nutrients, soil compression, as well as a massive application of herbicides, pesticides, mineral fertilizers and defoliants to ease harvesting. Drainage water from the irrigation fields discharges these toxic substances into the main rivers. Poor water management in the Aral Sea basin is responsible for the decline in agricultural production, and due to salinization it has already taken out of production an area larger than the seize of Belgium.

Furthermore, the ecological crisis in Central Asia overlays and aggravates a structural economic and social crisis found in every former Soviet republic after the disrupture of the Soviet empire.

Central Asia is a developing region, characterized by a high share in agricultural production, low industrialization, mass unemployment and a high population growth. With a standard of living considerably below the Soviet average, it was very dependent on the subsidies from the central government.

With the independence of the Central Asian republics and with the background of economic and social tensions, national hostilities, inexperience in national and international institution-building and peaceful conflict resolution, escalation of conflicts is more than likely to occur. As a process of decolonization and nation-building is beginning in Central Asia, political and social élites must define political and cultural identities not at least to handle internal conflicts once managed from outside.

Many international river basins in the world, such as the Euphrates, the Nile or the Ganges are subject to more or less severe political contention for reasons of access, pollution and flood control. Disputes over such river courses often contribute to existing tensions among different riparians. After the disintegration of the Soviet Union, we see the emergence of a new international river basin in Central Asia: the Aral basin, with all the consequences for the political, ethnic, and economic relations between the not yet fully-fledged Central Asian republics (see Fig. 1). This is the first prominent case since the decolonization wave in the 1960s in which we have the opportunity to follow an international river system in the process of being politically organized.

With the collapse of the Soviet system, water allocation formerly guided by economic ministries in Moscow has become obsolete. All the responsibility for decision-making on natural resources has been returned to the republics, and the political geography of the region has been changed. Rivers have become borders, the division into up- and downstream riparians is now politically relevant: The postulated "sovereignty over own resources" of the different republics is contradictory to the "internationalization" of the Aral hydrological basin. A subsequent solution for the newly internationalized river basins among the six affected republics has not been found.

National hostilities overarch the severe social and economic conditions. Some national groups are accused of benefiting at the expense of others because of better housing or land resources. Violence has generally occurred when economic frustration coincidenced with ethnic tensions. Future conflicts may occur within drainage basins between up- and downstream riparians, mainly because of the degradation of water quality with possible repercussions on a subnational level, aggravating existing ethnic and social cleavages. As many canals divert water from the main rivers to other basins, conflicts will also have inter-basin dimensions.

This study examines the consequences for the political map of former Soviet Central Asia after the political and economic disintegration of the Soviet Union, against the background of a worsening ecological situation. It will focus on the following:[2]

1. Ecological degradation due to water depletion for irrigation purposes and due to the exhaustion of soil fertility;
2. Social effects which emanate from the ecological degradation (loss of productivity, health problems, demographic peculiarities), as well as the transformation of the irrigation culture in Central Asia.
3. Inter-republican water distribution disputes, their potential for violent conflicts against the background of political, economic, demographical and ethno-territorial constraints; identification of possible conflicts induced by ecological factors from local to international levels.
4. Respective conflict management measures for managing the Aral Sea basin's water resources, for alleviating the desiccation of the Aral Sea, and for solving possible conflicts on a subregional and national level.

2 The study follows the analytical framework for examining environmental conflicts proposed by Böge, Volker: Proposal for an Analytical Framework to Grasp "Environmental Conflict", ENCOP Occasional Paper No. 1 (second part), Zurich, Berne 1992.

Fig. 1 The Aral Sea Basin

2. Environmental degradation: The water and soil crisis

2.1. Eco-geographical setting

In this study we define Central Asia geographically as Turkmenistan, Uzbekistan, Tajikistan Kyrgyzstan as well as the southern provinces of Kazakhstan, Kysyl Orda and Chimkent for reasons of unity in terms of cultural lifestyle and physical geography. Politically, Central Asia today encompasses all five former Soviet republics of the region.[3] In examining the water distribution problems in Central Asia, we shall focus on the narrower geographic definition of the region; which is more or less equivalent to the Aral Sea drainage basin, an area of roughly two million square kilometers, approximately the size of Western and Central Europe combined.

Central Asia makes up part of the arid zones of the globe and is dominated by vast, mainly sandy deserts; like the Kysyl Kum (Red Sands) between the two most important rivers Amu Darya and Syr Darya, the Kara Kum (Black Sands) in Turkmenistan, and the Ustyurt Plateau between the Aral and Caspian Sea. Desert regions account for three quarters of the territory of Central Asia. The huge mountain ranges of the Pamir and Tien Shan with peaks up to 7000 meters above sea level, - for example, the Pik Kommunizma in the Pamir range with 7495 m - , form the eastern and southern border of the region. The northern border is characterized by a transition zone from semi-desert to semi-arid grasslands with kastanozems which are soils high in organic matter with associated saline and sodic soils. Also typical are the transitional piedmont areas between the desert lowlands and the mountains with loess-covered foothills and mountain spurs or with alluvial plains often merging with desert lowlands. These are traditional areas of settlement because of the mix of very fertile soils and accessible water resources, for example, the intensively irrigated Fergana Valley which covers an area comparable to that of Austria.

The Aral region has pronounced continental and arid climate characterized by short but cold winters and dry summers with high evapotranspiration[4] and severely arid conditions. Annual precipitation is between less than 100 mm in the desert plains and about 500 mm in the piedmontal zones of the south-eastern mountains. The high mountain areas with precipitation from 800 to 1600 mm are humid and account for the moisture surplus in the

3 According to Soviet terminology, Central Asia comprises parts of Western China besides the former Soviet republics of Turkmenistan, Uzbekistan, Tajikistan Kyrgyzstan and Kazakhstan. The more commonly used Russian term "Middle Asia" (Chtlzfy Fpby_ Srednaya Aziya) incorporates the above-mentioned republics without Kazakhstan. See Sinnott, Peter: The Physical Geography of Soviet Central Asia and the Aral Sea Problem, in: Lewis, Robert A. (ed.): Geographical Perspectives on Soviet Central Asia, London, New York, 1993, p. 74.

4 Evapotranspiration is the total amount of evaporation from the soil's surface and the transpiration of plants. In the arid zones, potential evapotranspiration ranges from 1000 to 2250 mm, which together with the low precipitation results in a small moisture coefficient (precipitation divided by evapotranspiration) of below 0,1.

region.[5] Defining the agronomic aridity limit at 200-300 mm of annual precipitation, almost all agriculture in the plains needs irrigation. In the desert plains, snowfall of very low quantities is possible from November to March in the north and from January to February in the south. The range of noontime temperature in the summer period fluctuates from 20° to 45° C.[6]

The climate is excellent for growing cotton and other heat-loving irrigated crops such as corn, sorghum and rice. Thermal conditions with a growing season of 204 to 288 days[7] were the best of anyplace in the former Soviet Union. With the exception of heavy salinized soils (solontchak and solonets),the thin but mostly fertile soils (calcisoils, sandy soils, alluvial soils and clay-pan "takyr"-soils) are able to support an irrigated agriculture.[8]

2.2. The hydrological basin of the Aral Sea region

The closed limnological system of Central Asia without outlet to the open sea is strongly affected by climatic features. Due to an arid climate with low precipitation and high evapotranspiration in the desert plains, water resources are mainly surface waters that are concentrated in the huge mountains forming the catchment zone of the water cycle in the region. Melting water from extended permanent snow fields and glaciers feed the powerful rivers of Amu Darya and Syr Darya mostly during spring thaw. The Tien Shan and Pamir ridges have together more than 18,000 km^2 of ice cover.[9] The Amu Darya with 2540 km from the confluence of the Pyandzh and Vakhsh to the Aral is the largest river and most important drainage basin in Central Asia. Whereas the second river, the Syr Darya, stretches some 2200 km in length from the Naryn River in Kyrgyzstan through the Fergana Valley, the Hunger Steppe and the Kysyl Kum desert. Other important drainage basins of the Aral Sea are the Zeravshan basin between Tajikistan and Uzbekistan, the basin of the Kashka Darya south of Samarkand, the basins of Tedzhen and Murgab in Turkmenistan and the basins of Surkhan Darya and Vakhsh in Tajikistan (both tributaries to the Amu Darya).

The estimated average river flow of Central Asia is 122 km^3 per year. The two main rivers of the Aral Sea basin account for about 90% of this figure (Amu Darya 73 km^3 and Syr Darya 37 km^3). The rivers have their maximum discharge when they leave the

5 Micklin, Philip: Irrigation and its Future in Soviet Central Asia: A preliminary analysis, in: Holzner, Lutz and Knapp, Jeane M. (eds.): Soviet Geography Studies in Our Time, Festschrift for Paul E. Lyndolph, Wisconsin, Milwaukee 1987, p. 233.

6 Raskin, P./Hansen, E./Zhu, Z./Iwra, M.: Simulation of Water Supply and Demand in the Aral Sea Region, in: Water International 17 (1992), p. 56.

7 Sinnott, Peter, op cit, p. 78.

8 For regional distribution of soils in Central Asia see: Atlas SSSR, Moskva 1984, p. 104 or Food and Agriculture Organization of the United Nations (FAO): World Soil Resources, Rome 1991 (different maps).

9 Gleick, Peter (ed.): Water in Crisis. A Guide to the World Fresh Water Resources, New York, Oxford 1993, p. 127.

mountains, but naturally lose half of their flow through filtration and evaporation while crossing the desert before reaching the Aral Sea.[10] The Aral Sea which is considered to be an unstable water body as a result of natural fluctuations in the river discharge of up to 48% due to glacier melting conditions and river bed displacements received 50-60 km^3 of water per year until the end of the 1950s.[11]

Although surface waters are the main sources for irrigation, there are considerable subterranean water resources fed by the mountain massifs. Usable supplies of ground water are estimated by Micklin at 18 km^3 per year[12] and by Raskin at 12.3 km^3 per year[13] (8.3 km^3 in the Syr Darya basin, 4 km^3 in the Amu Darya basin). Temporary local surface waters (takyry) after occasional rainfalls in the plains are also a source. However, since the Russian colonization they are practically not being used anymore.[14]

Water resources in Central Asia are distributed unevenly. Four-fifths of the water network are situated in the relatively small countries of Kyrgyzstan and Tajikistan; whereas Turkmenistan, Uzbekistan and parts of Kazakhstan, which contain most of the arable land, control only one fifth of the river network.[15]

2.2.1. The exhaustion of the water resources

2.2.1.1. Water diversion for irrigation

Whereas at the beginning of the century only about 5% of the total river flow was used for irrigation[16], the expansion of the irrigation area led to an almost total abstraction of the average annual flow by the end of the 1980s. Indeed, the water use in Central Asia is enormous. In 1988, the water withdrawals in the Aral Sea basin for all purposes were 125 % of the average annual water resources (surface water and ground water = 134 km^3[17]). Withdrawals were more than 100% because the return flows are used repetitively downstream. 22.65% (37.89 km^3) of the withdrawals were return flows to surface waters, mostly drainage water from irrigation fields. Return flows are often lost to evaporation or to desert lakes in natural depressions without any outflow rather than returned to perennial rivers. Withholding much water from the Aral Sea and aggravating the water

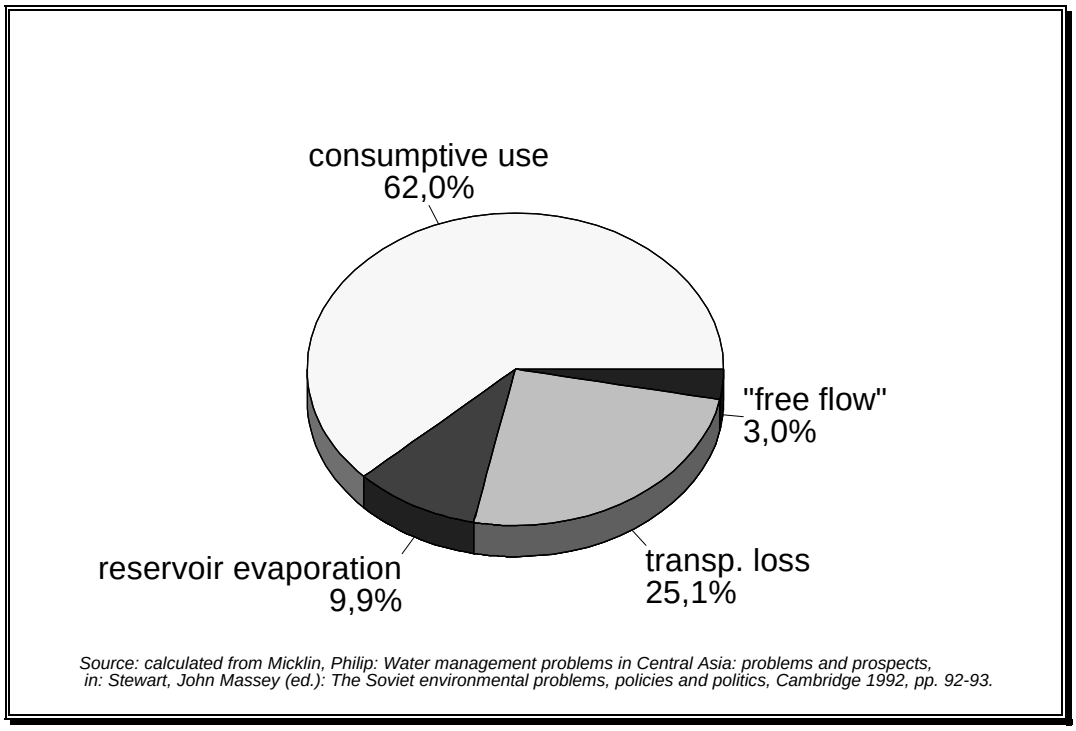
10 Micklin, Philip: Water management problems in Soviet Central Asia: problems and prospects, in: Stewart, John Massey (ed.): The Soviet environment problems, policies and politics, Cambridge, New York 1992, pp. 89/90.
11 Agachanjanc, Okmir E.: Wasserbilanz und wasserwirtschaftliche Probleme der mittleren Region der UdSSR (Mittelasien und Westsibirien), in: Petermanns Geographische Mitteilungen 2/88, p. 111.
12 Micklin, Philip, 1992, op cit, p. 90.
13 Raskin, P. et al., op cit, p. 62.
14 Rumer, Boris: Soviet Central Asia. A Tragic Experiment, Boston etc. 1989, p. 76.
15 Ibid., p. 77.
16 Figures for Amu Dar'ya are: 1917 7% of the river flow, 1955 15% and 1983 more than 50% (see Agachanjanc, Okmir E.:op cit, p. 109).
17 Figures taken and calculated from Micklin, Philip, 1992, op cit, pp. 90-93 and from other sources.

balance an estimated 10 to 20 km^3 per year in return flows, ends in such collector lakes like the Arnasay (~2000 km^2) near Syr Darya or the Sarykamysh in the Aral region.[18]

Only 7.6 km^3 of the 1988 withdrawals were covered by ground water reservoirs. Surface water from the rivers is therefore the most important source for withdrawals.

About 97% (130 km^3) of the annual water resources were consumptively used, i.e. water directly lost to field evaporation, transpiration or incorporated into plants, animals or other products, lost during water transmission from sources like leakage from canals and pipes, reservoir evaporation and discharges of return flows into salt lakes. This calculation leaves about 4 km^3 of "free flow" for the Aral Sea (see Fig. 2). In some dry years, for example 1986, the Aral Sea was partially or totally left without inflow. According to water management experts, the water resources of the Aral Sea basin had already reached full utilization in the early 1980s.[19]

Fig. 2: Water use in Central Asia



Source: calculated from Micklin, Philip: Water management problems in Central Asia: problems and prospects, in: Stewart, John Massey (ed.): The Soviet environmental problems, policies and politics, Cambridge 1992, pp. 92-93.

Water demands are dominated by the needs of the agricultural sector, accounting for 87% of the total use. Municipal use accounts for 3%, industrial production for 10% of the water demand. Irrigation is thus the most important water user in Central Asia accounting for 90% of withdrawals, 95% of consumptive use and 84% of return flows. Irrigation is the paramount cause for the water crisis in Central Asia.[20] Water usage by

18 Agachanjanc, Okmir E., op cit, p. 111 and Konyukhov, Vladimir G., first deputy chairman State Committee for Nature Protection in Uzbekistan (personal communication 1993).

19 See Micklin, Philip: The water crisis in Central Asia, in: Pryde, Philip R.: Environmental management in the Soviet Union, Cambridge 1991, p. 218.

20 Ibid., p. 217.

municipal or industrial use is insignificant. Micklin states that "even small percentage water savings in irrigation could provide enough water to meet future needs of other economic and social sectors"[21].

In the 1980s 44% of the agricultural water use was used for cotton plantations, 23% for fodder and 15% for rice. The residual 28% was used for other cereals, vineyards, orchards and vegetable plantations.[22]

The causes for the immense water use and wastage in Central Asia are to be found in the massive extension of the irrigation area since the 1950s (see Fig. 3), in heavy losses in the distribution and transmission system[23] of irrigation water (an estimated 30-40%[24]), and in the very high on-farm water application rates.

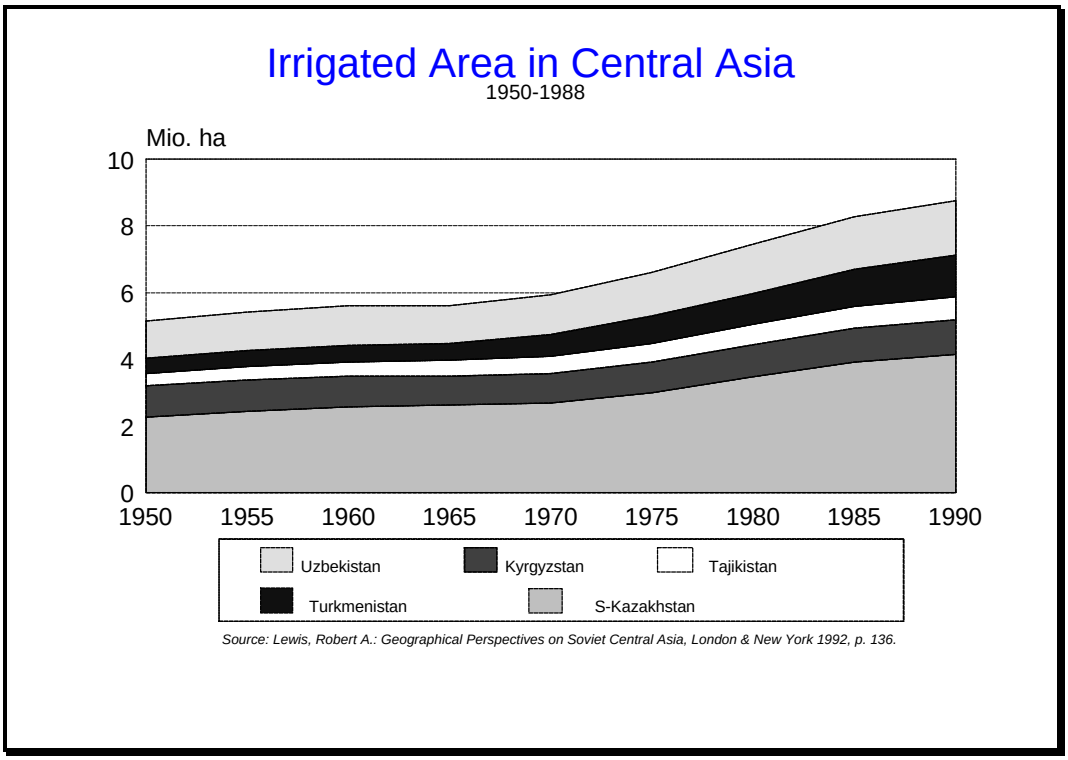
The transmission system with many literally built-on-sand canals accounts for a large portion of water losses in Central Asia. The biggest canal, the 1200 km long Karakum Canal, which diverts ca. 500m^3/s (15 km^3/year) from the middle Amu Darya to Turkmenistan, directly runs on loose sand. Seepage losses are enormous and have led to the creation of a 800 km^2 lake alongside the canal.[25] About one third of the water used for irrigation in Turkmenistan percolates through the sandy soils of the canal.[26]

In 1980, average per hectare withdrawals were 18,700 m^3. Although falling to 13,700 m^3 in 1986[27], withdrawal rates are still considerably higher than the world average. Cotton plants, for example, need 8,000-10,000 m^3 water per ha and year.[28] Israel, the world champion for efficient water use, produces six to seven times more cotton with the same amount of water, although mostly with water-saving drop irrigation.[29] As for rice, it has been estimated that up to 55,000 m^3 water per ha are annually used in the lower Syr Darya.[30] In Central Asia as a whole, the water usage rates are 25-75% higher than the established norm.[31]

21 Ibid.
22 Figures calculated from: Raskin, P. et al., op cit, p. 59.
23 With regards to water losses, Raskin distinguishes between distribution losses (due to field evaporation and deep percolation) and transmissions losses (from evaporation and infiltration in the canals), although the distinction is not operationable due to the lack of data as he himself states (Raskin, P. et al., op cit, p. 60).
24 Irrigation system efficiency measures the percentage of water arriving at the field to that withdrawn from the source. In Uzbekistan it ranged between 50 and 60% in 1985 (see Micklin, Philip, 1987, op cit, p. 242); other estimates are even higher: According to Precoda, it is calculated that 65-70% of the irrigation water is lost before reaching the vegetation (Precoda: Norman: Requiem for the Aral Sea, in: AMBIO, Vol. 20, No.3-4, 1991, p. 112).
25 Precoda, Norman, op cit, p. 224.
26 Mnatsakanian, Ruben A.: Environmental Legacy of the Former Soviet Republics, Edinburgh 1992, p. 110.
27 Micklin, Philip, 1992, op cit, p. 95.
28 Agachanjanc, Okmir E., op cit, p. 109.
29 Müller, Friedemann: Polluted Potential. Ecology and the Economy in Central Asia, in: Harvard Internation Review Vol. XV, No.3 1993, p. 22.
30 Precoda, Norman, op cit, p. 113.
31 Ibid.; see also Rumer, Boris, op cit, p. 79.

Water use is also connected with a tendency for heavy salinization in Central Asia, which requires seasonal and periodic leaching in certain regions. In the Khorezm region of the lower Amu Darya basin, fields are flooded with 3000 - 4000 m^3/hectare in order to leach the soil before planting occurs.[32]

Fig. 3: Irrigated area in Central Asia



2.2.1.2. Water diversion for industrial purposes

Water demands for industrial purposes are still meager compared with agriculture. Industrial production accounts for about 8-10% of the total water demand in the Aral Sea basin. Regionally differentiated, we find that 6% of the water demand in the Amu Darya basin and 12% in the Syr Darya basin are used in this sector.[33] Depending on the economic development, an increasing amount of water will be required by the industrial sector. At present, industrial water demand is dominated by hydropower production. By the end of the 1980s, about 35% of the electricity production in Central Asia came from hydropower (former USSR 14%), thanks to favorable natural conditions such as powerful waterways with big drops.[34]

Since the agricultural sector also claims for the water resources in the reservoirs, which were mainly built for energy production, the results are very contradictory demands on

32 Smith, David, R.: Salinization in Uzbekistan, in: Post Soviet Geography Jan. 1992, p. 25.
33 Raskin, P. et al., op cit, p. 59.
34 Rumer, Boris, op cit, pp. 47-48.

the demands between the two sectors. On the other hand agriculture consumes a high proportion of electricity in Central Asia, an amount that cannot completely be covered by thermal power stations. The fact that most of the reservoirs are located in the now independent water-rich republics of Tajikistan and Kyrgyzstan creates an intricate situation.

Water use for domestic purposes accounts for about 5-6% of the total. Many rural areas are not sufficiently equipped with centralized water distribution systems. Water losses through defective water pipes, a lack of sewage systems, and poor water treatment because of polluted and saline water are problematic especially to the regions adjacent to the Aral Sea. In the Autonomous Republic of Karakalpakia, a long distance water supply system for domestic and industrial use is under construction; in Takhtakupyr on the Amu Darya delta, the German Red Cross has built a reverse osmosis desalination plant for a population of 12,000 inhabitants.[35]

2.2.2. Agrochemical and industrial pollution of the water resources

Water use in Central Asia is not only a question of shortage but also one of poor quality, mainly in the lower reaches of the rivers. Excessive utilization and dumping of herbicides, pesticides, mineral fertilizers, and defoliants to ease harvesting of cotton, and industrial and municipal wastes have seriously deteriorated the water quality of the rivers. Most rural inhabitants, especially along the lower Amu and Syr Darya downstream from other irrigated areas, receive highly polluted water, which contains phenols, nitrogen compounds, pesticides (DDT), organic matter and sulphate up to 10 times the "maximum permissible concentration" (MPC).[36] The local concentration of phenol in the lower Amu Darya is 20 to 30 times the MPC. The local concentration for mineral oil is 5 to 8 times the MPC.[37] Waters of the Amu Darya in Karakalpakia, the region south to the Aral Sea, contain up to 400-500 mg of chlorides and sulphates per liter, up to 160 nanogram per liter Cl-containing pesticides, and up to 22 ng/l of DDT. Local concentrations of pesticides are much higher in small bodies of water like drainage channels and collectors. General mineralization in the downstream of rivers is 1340 mg/l for the Syr Darya and up to 1500 mg/l for the Amu Darya.[38] Drainage water contains as much as 15g of minerals per liter.[39]

35 According to the Supreme Soviet of Karakalpakia (personal communication 1993).

36 MPC (ghtltkmzj ljgecnbvst rjzwtznhfwbq_ GLR= is a rather rigid Soviet standard for the maximal permissible concentration of toxic elements in air, water and soil.

37 Krutov, Anatoly N., Central Asian Research Institute of Irrigation (SANIIRI), Tashkent (personal communication 1993).

38 Mnatsakanian, Ruben, op cit, pp. 84/85 & pp. 102/103 according to a Soviet government report 1989.

39 Agachanjanc, Okmir E., op cit, p. 111. In order to compare the figures; normal mineral water contains 1-1.5g (drinkable) salt; ocean water has an average salinity of about 35g/l.

Ground waters in Central Asia are particularly vulnerable to intoxication because of isolated basins which have no outlet to the major river systems. Drainage water discharged into local lakes also easily percolates through the sandy soils into ground water basins.[40]

2.2.3. The desiccation of the Aral Sea

In recent years the ecological problems in the Aral region have gained international attention.[41] The desiccation of the Aral Sea has become a symbol of man's ravaging attitude towards natural resources and of the extensive and misdirected economic development in the south of the former Soviet Union.

Aral, the "Sea of Islands," is one of the most ancient lakes of our planet and was - with an original area of 69,500 km^2 - the forth largest inland water body on earth. For centuries, the boundaries of this landlocked sea between three deserts - Kara Kum, Kysyl Kum and Ustjurt - remained almost unchanged with a fluctuation of about three meters. High evaporation of about 58 km^3 (a 90 cm water layer!) over the surface was equilibrated by small precipitation (156 mm/year) and surface or subsurface inflow. Until 1960 Amu Darya and Syr Darya, the main water sources, discharged about 55 km^3/a into the Aral Sea. Although the sea has no outlet, the water was only slightly saline (1-1,4%).[42]

Since the early 1960s, the sea has fundamentally changed in area, volume and salinity. The Aral Sea has dropped by 16.5 meters, shrinking by 56% to an area the size of Belgium. It has lost almost three-quarters of its volume, whereas salinity has multiplied to 30g/l, which is comparable to the salinity of the North Sea.[43] In 1992 alone, the Aral Sea level fell another 40 cm. In recent years, the sea received about 5 km^3 of river water annually instead of 55 km^3. In the first half of 1993, Syr Darya fed the Aral with 3.2 km^3, whereas up to 2.5 km^3 ended in the collector lake of Arnasay. For the Aral, this water has been lost forever.[44] It is obvious that human activities played a key role in this radical change. Although a series of dry, naturally low-flow years in the 1970s and 1980s accentuated the Aral crisis.[45]]

If no measures are taken to deliver more water to the sea, it will continue to shrink. The most likely "business-as-usual"-projections with 5 km^3/a on the basis of current water use forecast that the surface will further diminish to meager brine lakes by the year 2015 before stabilizing at about 8000 km^2 (1992: 33,600 km^2). A second scenario with 15 km^3 annual inflow is probably the maximum possible short-term increase and would re-

40 See Mnatsakanian, Ruben, op cit, p. 84.
41 An outstanding and comprehensive study on all the aspects of the Aral Sea problems is: Létolle, René/Mainguet, Monique: Aral, Springer-Verlag Paris 1993.
42 See Precoda, op cit, pp. 109-110; Dech, Stefan Werner/Ressl, Rainer: Die Verlandung des Aralsees. Eine Bestandesaufnahme durch Satellitenfernerkundung, in: Geographische Rundschau 6/1993, p. 345.
43 See Dech, Stefan/Ressl, Rainer, op cit, p. 349.
44 Ekokuryer 22.7.93, p. 3.
45 Micklin, Philip, 1992, op cit, p. 100.

quire enormous water saving measures. Using this scenario, the sea will nevertheless shrink and stabilize at a surface of about 19,000 km^2 by the year 2020.[46]

2.3. The degradation of soils

The degradation of soils is closely interconnected with the exhaustion of the water resources in Central Asia. Massive irrigation has led to large-scale salinization due to saline irrigation water and water logging causing the rising of the ground water table. The excessive application of biocides - mainly due to a low immunity of cotton to diseases - and mineral fertilizers has intoxicated much of the soil resources and polluted the drainage water flowing back to the rivers. The desiccation of the Aral adds an ugly dimension in this respect; deflated salts and toxic dust from the exposed sea bed contribute to the salinization of soils in the adjacent agricultural regions of the Aral Sea.

2.3.1. The intoxication of fertile soils

By the mid-1980s, as much as 300 kg of mineral fertilizers and 50 kg of toxic chemicals were used per hectare. On cotton fields in the Muynak area near the Aral Sea, pesticides were used at ten times the Soviet average. At least 60% of applied pesticides end up in the air, soil and water.[47] The limits were exceeded several times even by Soviet standards. Now, most soils cannot be treated without overdoses of fertilizers. As a Russian environmental expert expressed it, soil has become a "drug addict."[48]

Since the independence of the Central Asian republics, economic constraints have led to a significant decrease in the use of fertilizers and pesticides. According to the leaders of a kolkhoz in the Fergana Valley, in 1993 about $100 had to be paid for one ton of mineral fertilizer, which forced the administration to concentrate on natural fertilizers like manure.[49]

Poorly managed storage for chemicals and fertilizers increases the danger for soil intoxication. An estimated 2100 disposal sites are found mainly in irrigated areas.[50] According to reports only 40% of storage places for pesticides and 11% for fertilizers have even a roof over them.[51]

2.3.2. Salinization

With the extension of the irrigated area, serious salinization problems have occurred mainly along the lower reaches of the Syr Darya and the Amu Darya. Piedmont zones

46 Dech, Stefan Werner/Ressl, Rainer, op cit, p. 350. Compare also projections by Raskin, P. et al., op cit, pp. 62-64 or by Micklin, Philip, 1992, op cit, pp. 103/104.
47 Precoda, op cit, p. 113; Rumer, Boris, op cit, p. 83.
48 According to Konyukhov, V.G. (personal communication 1993).
49 Personal communication in Fergana, Uzbekistan 1993.
50 According to Shermuhamedov, Pirmat (personal communication 1993).
51 Mnatsakanian, Ruben, op cit, p. 106.

and mountain valleys near the sources of mountain streams are much less affected. Especially newly reclaimed irrigation areas are often marginal ones with augmented salt accumulations.[52] In 1985, 42% of Uzbekistan's agricultural land was salinized, of which almost 200,000 hectares (13%) were classified as intensely saline.[53]

In arid and semi-arid regions the primary cause for soil salinization is a high evaporation rate and the lack of precipitation needed to leach salts out. The elevated ground water level, and the high mineral content in the irrigated soil also naturally promote salinization. However, problems with soil salinization do not only occur because of salt already present in the soil (primary salinization), but because of salts dissolved in irrigation or ground water moving upward and accumulating in the upper soil horizon after evaporation (secondary salinization).

Causes for secondary salinization are the use of irrigation water from the increasingly mineralized lower rivers and the rising ground water table with the resultant accumulation of salts.[54] Heavy seepage losses from canals and poor drainage cause widespread water logging and the rising of highly mineralized ground waters carrying salts with them.[55]

To alleviate salinization, irrigated fields are regularly leached with enormous quantities of water. which is often reused. The high mineralization of this water adds additional salt to the soil and requires more irrigation water to flush salts out of the soil resulting in a vicious circle.

2.3.3. Erosion and compaction

Another consequence of the extension of irrigated land is soil erosion both from irrigation and overgrazing.

Overgrazing of pastures in the steppes of Kazakhstan damages the vegetation cover and subsequently causes most of the erosion. In the southern provinces Dzambul and Chimkent, between 17.7 and 21.4% of the pastures are degraded.[56]

Erosion from poorly maintained irrigation systems mainly occurs in the piedmont zone and in the mountain valleys, where irrigated cultures occupy an area of 1.5 million hec-

52 See Craumer, Peter R.: Agricultural Change, Labor Supply, and Rural Out-Migration in Soviet Central Asia, in: Lewis, Robert A. (ed.): Geographical Perspectives on Soviet Central Asia, London, New York, p. 139.

53 Intensely saline means a total soluble salt content from 1.5-2% in the upper soil profile. These soils are completely unsuitable for agriculture (see Smith, David R., op cit, p. 26).

54 Smith, David, R., op cit, pp. 26/30.

55 See Precoda, op cit, p. 113.

56 Mnatsakanian, Ruben, op cit, p. 86.

tares.[57] Erosion is therefore a major problem in mountainous countries. 41% of the arable land in Kyrgyzstan (ca. 7% of total land area) is subject to erosion.[58]

Irrigation erosion affects over 50% of all irrigated cropland in Tajikistan and 7.5% in Uzbekistan.[59] This type of erosion is often due to inadequate irrigation norms of surface watering (up to 15-20,000 m^3/ha) on mountain slopes of the Fergana Valley.[60] On loess soil slopes with cotton cultivation, an estimated 1-2 cm of soil are flushed away with irrigation per year.[61]

Soil compaction occurs mainly on irrigated land when tractors cross the fields up to 30 times a year or because of an inflush of micro soil components. Diminished soil ventilation, decreased nutrient transportation and frequently water logging are the consequences of soil compaction.[62]

2.4. Impoverishment of living space

2.4.1. The consequences of agricultural monoculture

The expansion of cotton monoculture in Central Asia was accompanied by an impoverishment of the diversified agricultural ecosystems on irrigated areas. Other traditional agricultural crops such as fruits, vegetables and pastures were cut back or eliminated (see Fig. 4). Uninterrupted cotton monoculture has violated traditional crop rotation practices using mainly alfalfa[63] and manure, and exhausted the nutrients of the soil.[64] With yield outputs dropping in the 1970s, officials decided to raise cotton even on private plots where peasants grow their own vegetables and fruits and to cut down the few trees which were providing some moisture and coolness for plants and people. By 1987, the tree share on irrigated land in Uzbekistan sank from 15 to 1%.[65]

2.4.2. Habitat destruction in the Amu and Syr Darya deltas

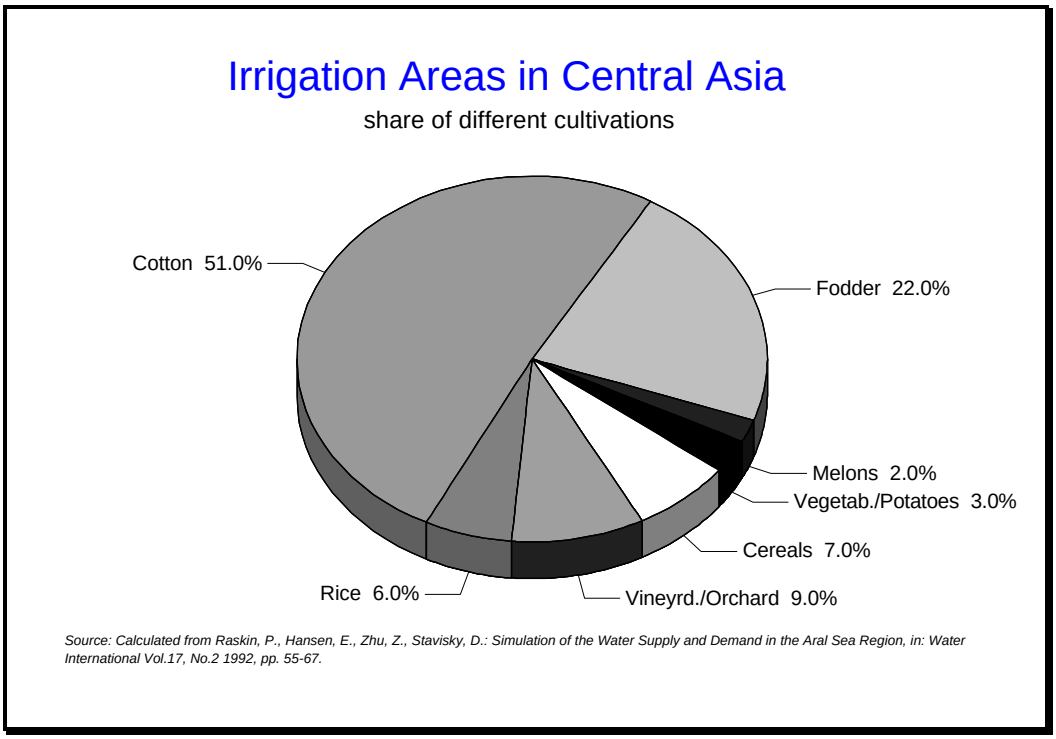
The falling level of the Aral Sea and a drastically reduced inflow of the two main rivers have also devastated the deltas of the Amu Darya and the Syr Darya which not only had a great ecological value but also sustained the livelihood for local inhabitants by provid-

57 Artsibashev, A.N. et al.: Ekologitcheskaya alternativa. Istotchki bedy. Znaki bedy. Ekologitcheskaya alternativa, Moskva 1990, p. 358.
58 Mnatsakanian, Ruben, op cit, p. 92.
59 Mnatsakanian, Ruben, op cit, pp. 97/105.
60 Cf. Dukhovny, V. A.: Melyoratsya i vodnoe khozyaystvo sredney azii: uroki proshlogo i zadatchi nauki, in: Melyoratsya i vodnoe khozyaystvo No.11 1990, p. 7.
61 Artsibashev, A.N. et al., op cit, p. 358.
62 Rumer, Boris, op cit, p. 70; Spitzer, Heinz: Das Ferganabecken - ein bedeutendes Wirtschaftsgebiet Mittelasiens, in: Geographische Berichte 122, Heft 1/1987, p. 40.
63 Alfalfa improves the structure of the soil and enriches it with nitrogen.
64 Rumer, Boris, op cit, pp. 70-71.
65 Feshbach, Murray/Friendly, Alfred, jr., op cit, p. 77.

ing livestock pasturages, spawning-grounds, reeds used for paper-making and house-building as well as hunting and trapping.[66]

A falling ground water level of 3 to 5 meters, locally up to 8 meters, connected with a very high mineralization (from 35 to 100 g/l) and cessation of floodings have led to the drying out of vast areas on the deltas and rivers courses. In the Amu Darya delta about 30,000 hectares of lakes and bogs have nearly dried up.[67] Consequences for biodiversity are gloomy: from the original 178 animal species that once lived in the deltas, only 38 species remain.[68] With desertification of most of the once vast areas of soil-retaining black saxaul woods, tugay forests[69] and reeds, habitats have disappeared and were either followed by salt and drought-resistant plants, or by infertile solontchak soils exposed to deflation. The deltas are not only seriously affected from the surface but also from the air; the million tons of deflated toxic salts from the Aral's dried seabed cover mainly the area of the Amu Darya delta and intoxicate the remaining species.

Fig. 4: Share of different irrigated cultivations by the end of the 1980s



66 Micklin, Philip, 1992, op cit, p. 102.
67 See Precoda, op cit, p. 112. However, in recent times efforts have been made to intentionally flood lakes for water regulation and fishing grounds in the vicinity of human settlements like Muynak.
68 See Precoda, Norman, op cit, p. 112; Dech, Stefan Werner/Ressl, Rainer, op cit, p. 351.
69 Tugay forests are composed of dense groves of phreatophytes (water-loving plants) with shrubs and tall grasses along delta arms and channels with a depth of several kilometers.

2.5. Regional climate change

2.5.1. Climatic consequences from the desiccation of the Aral Sea

Another evident consequence of the Aral's recession is the change of the region's micro climate.

As a barrier against cold winds from the north, the Aral Sea originally had a moderating function in the regional climate system and served as a catalyst for an enforced formation of clouds because of enormous masses of vapor rising from its surface. This moisture replenished the ice and snow caps of distant mountains, completing the region's water cycle. It is assumed that even the precipitation patterns in the mountains of Central Asia will change with a desiccated Aral Sea.

The climate has become more continental with a shrinking water surface. Warmer summers, cooler winters and lowered humidity have caused a shortened growing season with heat-loving cotton cultivations that have been turned into rice paddies. The temperature extremes reached 47°C in summer and minus 17°C in winter. The quantity of rainfall was reduced by 2.5 times.[70] Within thirty years, the average July temperature in Muynak rose from 25.7 to 28.3°C in the 1980s, whereas relative air humidity sank from 44 to 32% in the same period.[71]

2.5.2. Air pollution caused by salt deflation

Millions of tons of salts and toxic chemicals transported by the rivers ended up in the Aral Sea as the last deposit of the region. But the sea has changed its role from a receiver to a chief supplier of salt. While shrinking, the Aral Sea has accumulated an enormous quantity of salts. On the desertified sea bed area of about 36,000 km^2, solontchak (white alkali soil) develops from which an estimated 75 million tons of toxic salt and dust - mainly sodium chloride and sodium sulphate - are deflated annually.[72] This windborn salty dust - directly deposited or incorporated as aerosols in acid rain - is a serious danger for the plants and soils in the agricultural areas. In the Aral region, an average of over 500 kg of salts and sand fall annually on each hectare of the ecologically and agriculturally important delta of the Amu Darya. They further contaminate crops in the central provinces of Uzbekistan: Bukhara, Navoy and Samarkand. However, the salt-storms carry their toxic load far beyond the Aral region. Dust from the Aral has been found on the top of the Himalayas, in the Ganges and Brahmaputra rivers, and even in the Pacific and Arctic oceans as far as 10,000 km away. Experts think that these soluble

70 Ibid.; Precoda, Norman, op cit, p. 111; ekokur'yer 28/5/92 & 25/3/93.
71 Dech, Stefan Werner/Ressl, Rainer, op cit, p. 351.
72 Precoda, op cit, p. 113; other estimates range from 43 to 140 million tons per year (see Micklin, Philip, 1992, op cit, p. 102).

salts will accelerate glacier thawing especially in the Pamir mountains ultimately, melting the stock of the Amu Darya, the most important waterway of Central Asia.[73]

Observations from satellites indicate that the frequency and magnitude of salt storms is growing with the further shrinking of the Aral.[74] Experts believe that the Aral Sea conceals large quantities of toxic waste originating in the military complex and the Baikonour space center as well as the salt and pesticide charges.[75] With the falling of the sea's level, these wastes will become an increasing danger with incalculable consequences for the biosphere.

2.6. Factors contributing to the environmental crisis in Central Asia

Who or what is to blame for the environmental crisis in Central Asia? In order to avoid simplistic explanations in complex systems, natural, economic, social and cultural factors must be examined. The availability of renewable resources has reached its limits. A further expansion of the current water usage rate is not possible. Further demands for agricultural products, due to a dramatic population increase, are foreseeable and must be covered by the local market. But the ecological legacy of a one-sided export-oriented mono-agriculture has affected all spheres of the society in Central Asia and inhibits a well balanced political, social and economic development for each of the five republics.

2.6.1. The transformation of the irrigation culture in Central Asia

Water resources are almost exhausted in quantity and depleted in quality mainly because of a radical change in land use patterns plus an accelerated transformation of the human environment. Irrigation had already changed the natural environment millennia before the Russian colonization, but only modernization (introduction of hydrotechnology, mechanization of agriculture, application of mineral fertilizers and biocides) has made the diversion of huge amounts of water from the main rivers possible and allowed a far-reaching shift in the proportion of arable land devoted to cotton monoculture. This expansion of agricultural monoculture with its severe impact on the environment can be seen as a clear manifestation of the human-ecological transformation affecting the whole biosphere.[76] The accelerated transformation of the sink and regeneration capacity of renewable resources in the past forty years is reflected by an impoverishment of living

73 Precoda, op cit, p. 111.
74 Micklin, Philip, 1992, op cit, p. 102.
75 Radioactive waste, disposals from the testing ground for biological warfare on the island of Vorozhdenya, stages of rockets/missiles etc. According to Pirmat Shermuhamedov, director of the Committee for the Saving of the Aral Sea, Tashkent (personal communication 1993).
76 "The human-ecological transformation is a category of multi-dimensional processes whose interactions systematize local, regional and global environmental changes." (Bächler, Günther: Conflict and Cooperation in the Light of Global Human-Ecological Transformation, ENCOP Occasional Paper No.9, Zurich, Berne 1993, p. 6).

space especially in sensitive eco-regions of developing countries including arid or semi-arid zones of Central Asia.

The rapid expansion of irrigation in Central Asia began in 1919 with a decree by Lenin stating that irrigation must assure the independence from cotton imports.[77] Due to favorable climate conditions, abundant water and soil resources, the overwhelming share of investments in Central Asia subsequently was concentrated on the cotton industry and away from food production.

After World War II, water projects in Central Asia spread rapidly. Between 1965 and 1986, irrigation fields expanded at an annual rate of 2.3%. Whereas irrigation in the Aral Sea basin expanded from 5.6 to 8.5 million hectares, water use rates doubled. This disproportionate increase in water use resulted mainly from the development of new irrigation areas on marginal land, where huge amounts of water had to saturate dry soils before cultivation.[78]

Manifestations of the human-ecological transformation of Central Asia are firstly the desiccation of the Aral Sea together with the degradation of adjacent ecosystems (deltas), the building of irrigation system with huge canals such as the 1300 km long Kara Kum Canal through the desert of Turkmenistan, and the creation of vast saline lakes in desert depressions due to the diversion of drainage water.

2.6.2. Demographical characteristics

The population of Central Asia more than tripled between 1951 and 1989, reaching 35 million (including the southern provinces of Kazakhstan). The growth rate is actually about 2.5% per year compared to the Soviet average, which was 0.87% in the period of 1979-1989.[79] This is still the most rapid growth within the CIS and exceeds many developing countries, such as Malaysia (2.27%) or Egypt (2.15%). High fertility rates[80], a young age structure and a very small emigration make a further rapid population growth very likely. Even assuming a small slowdown in population growth rates, Central Asia's population will reach 50 million in the year 2010.[81] Preservation of large-family traditions, the gender question in Islamic societies, rejection of abortion and contraception, and a large rural population prevent a reduction of the fertility rate.

Population distribution is very uneven in Central Asia. Whereas the vast desert plains in the western parts and the mountain areas are sparsely populated, many people live in the traditional irrigation areas of the piedmont zones, such as in the Fergana Valley, the

77 Dukhovny, V.A.: Aral: glyadya pravde v glaza, in: Melyoratsya i vodnoe khozyaystvo No. 9 1988, p. 27.
78 Feshbach, Murray/Friendly, Alfred Jr., op cit, p. 76; Micklin, Philip, 1991, op cit, pp. 223-224.
79 Micklin, Philip, 1992, op cit, p. 88.
80 Fertility rates in the mid-1980s were roughly 4 (Kyrgyzstan) to 6 (Tajikistan) childern among the local nationalities.
81 Micklin, Philip, 1992, op cit, p. 89.

Tashkent and Khodzhent (Leninabad) area and the Bukhara-Samarkand region along the Zeravshan River. In 1989, virtually half of the population of Central Asia lived in these regions which comprise only one fifth of the total area.[82] In the Uzbekian parts of the Fergana Valley, population density is 250 inhabitants per km^2 and can reach around 400 inhabitants per km^2 in the Andizhan region.[83]

2.6.3. Environmental consciousness

Social and cultural peculiarities related to the depletion of resources and to the degradation of the environment must be examined under the aspect of the attitude towards water in Islamic societies and the effect of sovietization on traditional attitudes.

Appreciation of water originates in the Islamic religious and customary law. Following the Sharia and the Adat, water is a gift of God and can neither belong to anyone nor be sold. This corresponds to Moslem agrarian law that does not recognize private property. According to the traditional water law, users of irrigation water had to take part in the construction and maintenance of irrigation networks. Even the administration of water was locally institutionalized in the village communities which distributed and controlled water use and also enforced the water laws.[84]

Colonization and later sovietization and collectivization transferred the responsibility for the distribution of water to the highest possible level, to Moscow. The typical attitude towards socialist property became the common one in Central Asia: "what belongs to everybody, belongs to nobody and has therefore no value." Delegating responsibility to the Russian colonizers has led to a lack of concern for the environment, especially for water. In the most affected regions like Karakalpakia near the Aral Sea, one can find a widespread ignorance regarding the worsening of the environmental situation and a passivity to related political questions: "Even the Karakalpakians don't understand the full dimensions of the tragedy. They only expect help from outside."[85] As Central Asian's officials were confident that the Siberian water diversion project would be realized and that their resources would only be temporarily exhausted, they even promoted wasteful water use with the building of new industrial complexes and cities.[86]

The ecological crisis has gained symbolic character in the political fight against Russian predominance and against the local nomenclature whom organizations like "Birlik" in

82 Rowland, Richard H.: Demographic Trends in Soviet Central Asia and Southern Kazakhstan, in: Lewis, Robert A. (ed.): Geographic Perspectives on Soviet Central Asia, London, New York 1992, p. 230.

83 Spitzer, Heinz, op cit, p. 35.

84 See Busse, Walter: Bewässerungswirtschaft in Turan und ihre Anwendung in der Landeskultur, Jena 1915, pp. 55-56.

85 Pirmat Shermuhamedov in a personal communication 1993. See also Bahro, Gundula: Absturz oder take-off. Kasachstan: Vom Atomtestgelände zur grünen Republik? in: blätter des iz3w Nr. 188, 1993, p. 48; turkmenskaya iskra 17.10.91.

86 Rumer, Boris, op cit, p. 101.

Uzbekistan blame for the ecological and social consequences from the cotton monoculture and the desiccation of the Aral Sea.

But since the abandonment of the Siberian project, the partial Soviet withdrawal from Central Asian matters, and the independence of the five republics, the environmental issue has been reduced to no more than an alibi-function on a political agenda.[87]

3. The social effects of environmental degradation

The second step in assessing the contribution of environmental factors to conflicts is to isolate socio-economic problems emanating from the degradation of the environment. The four most serious socio-economic effects in Central Asia are economic decline, decrease in agricultural production, large-scale negative effects on human health and population displacements.

3.1. Economic problems related to environmental degradation

Characterizing the economic potential of Central Asia[88] we find an extraordinary diverse region comprising an explosive mixture of two "haves", two "have-nots" and one "have-a-little".

The first group consists of Kazakhstan and Turkmenistan, countries with a generous base of natural resources including oil, natural gas, and gold. Moreover, Kazakhstan has plenty of coal and non-ferrous minerals (copper and uranium). Nevertheless, the saturated world market for mineral resources will not stimulate high production growth rates. The "have-nots" of Central Asia, Tajikistan and Kyrgyzstan, have a minimal oil and gas production supplying less than 10% of the domestic use. High dependence on fossil energy and food importation make them economically vulnerable. Their advantage is in having fewer ecological problems and abundant water resources in the mountains compared to the desert and steppe countries. With a high hydropower potential, they are electrically self-sufficient and could develop an aluminium production industry. Moreover, there is exploitation of non-ferrous minerals (gold, uranium) in Kyrgyzstan.

The "have-a-little," Uzbekistan, is mainly an agricultural country still dependent on cotton, the rug industry and gold. For energy production, it exploits natural gas for its own consumption; oil has to be imported at market prices. Agricultural products cannot feed the population. Uzbekistan is the key country of the region because it fully suffers from economic decline and ecological devastation: two adverse effects of the Soviet system.

87 Cf. Critchlow, James: Nationalism in Uzbekistan. A Soviet Republic's Road to Sovereignty, Boulder, San Francisco, Oxford 1991, p. 78; Bozdag, Abidin: Zentralasien zwischen Nationalbewegung und Autokratie, in: Aus Politik und Zeitgeschichte. Beilage zur Wochenzeitung Das Parlament, B 38-39, 1993, p. 34; Bahro, Gundula, op cit, p. 48.

88 Compare Müller, Friedemann, op cit, pp. 23-24.

3.1.1. Decrease in agricultural production and other economic consequences

There are 25 million hectares suitable for irrigation in Central Asia of which only 8.5 million are currently being irrigated because of the exorbitant water use rates. In Uzbekistan alone, the potential is as much as 10 million hectares.[89] But the currently available water resources cannot be expanded at reasonable economic and ecological costs.

"King" cotton created a whole network of other industrial branches including construction (irrigation networks, dams), machine-building, chemical industry (pesticides, fertilizers), hydroenergy, cotton-processing plants and scientific research. Because investments subordinated economic development to cotton production, allocations for industry and the social sphere were very low.[90] In intra-soviet economic relations, Central Asia served as a raw material base for an integral part of the Soviet economy. The region's resources such as gold, oil, natural gas and especially cotton were heavily exploited. Cotton was mainly exported to the textile manufacturing industry in the European parts of Russia, only approximately 5% of the cotton remained for the textile industry in the region.

By the 1980s, the "white gold" constituted more than two-third of Uzbekistan's gross output and employed about 40% of the labor force. In 1983, Uzbekistan alone produced almost as much cotton as the entire United States.[91] Although as late as the mid-1960s, half of the sown area in Uzbekistan was still covered by grain, fodder and vegetables,[92] by 1990 the cotton fields covered more than 70% of some areas (Fergana Valley). Important food crops occupied only a marginal share in the Fergana Valley where grain was sown on less than 10% of the area in 1986. However, since 1988 and more decisively with independence in 1992, many regions of Central Asia have changed the agricultural land use patterns mainly in favor of grain and private plots for self-sufficiency (vegetables, fruits, corn etc.).[93]

Philip Micklin states that in spite of possible efficiency measures, irrigation expansion will stop in the 1990s, which may cause severe social and economic disruptions especially in the light of a rapidly increasing population and a subsequently smaller amount of arable land per capita.[94] However, national interests of the newly independent states often do not consider these constraints. Regardless of its water shortage, Turkmenistan

89 According to Makhmud Khamidov, director of Syr Darya river basin agency (BVO), Tashkent (personal communication 1993).
90 Rumer, Boris, op cit, p. 40.
91 Ibid. p. 62.
92 Glantz, Michael H./Rubinstein, Alvin Z./Zonn, Igor: Tragedy in the Aral Sea Basin: Looking back to plan ahead?, in: Global Environmental Change, Vol.3, No.2 1993, p. 176.
93 New reliable figures are not available, however, changes are obvious: In the Fergana valley about 25% of formerly cotton sown area were changed into different (food) crops. In Kyrgyzstan this share is about 75%. Water use rates do not seem to have changed, though. (According to Fergana Canal Adiministration, Kyrgyz Ministry for Agriculture; personal communication 1993).
94 Micklin, Philip, 1992, op cit, p. 110.

recently decided to develop 300,000 hectares of newly irrigated areas to assure grain production.[95]

The decrease in agricultural production is closely related to the excessive use of often highly saline and polluted irrigation water leading to the salinization and water logging of soils or to their intoxication with biocides and fertilizers.[96] Salty topsoils from the exposed sea bed distributed by storms have a damaging effect on thousands of hectares of agricultural land. According to official figures, poor water management had taken an area of more than 3,5 million hectares in the Aral Sea basin out of production by 1988.[97] There is an evident relationship between salinization and declining yields. Uzbekistan has witnessed a 20% decrease in cotton yields per hectare from a peak in 1980 till 1988, which also caused by increasingly salinized soils.[98] Rice production in the Muynak region on the delta of the Amu Darya sank by two thirds within 12 years.[99]

The once important waterborne transportation on the Aral has completely ceased because the sea receded from the main ports of Muynak and Aralsk. Possibilities for navigation up the Amu Darya have been significantly reduced due to the shallow river bed.[100]

Once the annual fish catches were 40-50,000 t and provided employment for many people on the Aral shores. Today there is no fishing in the entire Aral Sea due to salinity and drying out of spawning areas. Fish from the Atlantic are still being processed in some cannery combinates in Muynak.[101] Since 1950, the region has lost around 60,000 jobs related to the fishing industry.[102] Nevertheless, a slight improvement can be observed in the Muynak region. With the completion of a dam in 1989, small ponds with water from the Amu Darya have been created to serve as spawning and fishing grounds for the local population. The annual fish production is 2000 tons.[103]

With the desiccation of the Aral, many other economic opportunities using reed as raw material for cellulose fabrication and the tugay forests as year-round pastures and erosion barriers have disappeared completely.

3.1.2. Insufficient supplies of basic goods for the population

Generally the standard of living in Central Asia was and still is considerably below the Soviet/CIS standard. The monthly wage in 1984 was 88% of the Soviet average. Central

95 According to Pirmat Shermuhamedov (personal comunication 1993).
96 Other reasons are related to the overuse of pesticides, fertilizers and the standardization of agricultural practices such as sowing, watering and harvesting by the command administrative system.
97 Cf. Feshbach, Murray/Friendly, Alfred, op cit, p. 76.
98 Smith, David R., op cit, p. 21. A less moderate estimate of roughly 50% by the year 1986 can be found in Artsibashev, A.N. et al., op cit, p. 363.
99 Agachanjanc, Okmir E., op cit, p. 112.
100 Micklin, Philip, 1987, op cit, p. 250.
101 Precoda, Norman, op cit, p. 112.
102 Micklin, Philip, 1991, op cit, p. 225.
103 According to first deputy mayor (hakim) of Muynak (personal communication 1993).

Asia ranked last in average housing space, medical care, public catering, or was in low ranked positions in other standard of living parameters.[104]

A major role in feeding the population is played by private farming. In 1982, this category occupied only 0.6 to 0.7% of the cultivated land area in Uzbekistan producing 46% of the republic's meat and 40% of its vegetables.[105] The potential for privatization in Central Asia looks promising, although exact figures are not available. According to a local expert the food supply has somewhat improved in certain regions.[106]

Increased cotton production deprived farmers from raising fruits and vegetables on their private plots. In 1917, 70% of the total seeding consisted of grain crops, whose share declined to 26% in 1986.[107] As cotton yields declined by the end of the 1970s, more domestic crop land was converted into cotton fields. In Uzbekistan, food production barely kept pace with the population growth from 1970 to 1987. The per capita consumption of meat, potatoes, and vegetables declined after 1980. In 1987, Uzbeks received only 26% of the meat and 42% of the milk recommended by Soviet medical standards.[108]

As population growth creates rising demands and economic ties, especially with Russia, disintegrate, Central Asia's agriculture is slowly shifting away from cotton to diversified crop production. However, except for fruits and vegetables, Central Asia will remain a large net importer of most food products.[109]

3.2. Large-scale negative effects on human health

The cumulative effects of environmental degradation in Central Asia have led to serious health problems related to poor drinking water quality and airborne toxic salts especially in the lower reaches of the main rivers, although causal relationships between environmental degradation and some illnesses have not yet been proven. Nevertheless, we find a significantly higher level of infant mortality and morbidity in the regions neighboring the Aral than the national average represents. The three main affected areas are the province of Tashauz in Turkmenistan, the autonomous republic of Karakalpakia in Uzbekistan, and the province of Kysyl Orda in Kazakhstan. More than 3.5 million people live in the regions adjacent to the Aral Sea, where rural population is 58% of the total.

Poor drinking water quality is regarded as the most important factor contributing to a whole range of diseases due to a lack of drinking water distribution and water treatment systems. Only 2.3% of the settlements in the area have centralized water systems. The

104 Compare Rumer, Boris, op cit, pp. 128-143.
105 Figures for other republics are similar. See Rumer, Boris, op cit, pp. 125-127.
106 Shermuhamedov, Pirmat (personal communication 1993).
107 Neue Zürcher Zeitung 3.1.94.
108 Cf. Critchlow, James, op cit, p.68; Feshbach, Murray/Friendly, Alfred, op cit, p. 77.
109 Per-capita output in the UdSSR of meat was 2.2 times the Central Asian average. For milk, grain and vegetables the figures were 2.4, 6.5 and 1.9 respectively (See Rumer, Boris, op cit, p. 112; Craumer, Peter R., op cit, p. 148).

majority is forced to take water from frequently contaminated wells or canals. Most of the drinking water samples do not meet to the Soviet bacteriological and chemical standards. In human fat and mothers milk, DDT and other chloride- containing pesticides were detected.[110]

The most serious diseases presumed to be from contaminated drinking water are hepatitis, typhoid, throat cancer, liver ailments, kidney failure, gallstones and birth defects.[111] Diseases of the respiratory tract are attributed to salt storms. Similar illnesses are reported from direct contamination with pesticides or commonly used defoliants (butifos) while harvesting cotton; mainly women and children served as cotton-pickers.[112] In 1990/1991, even endemic cases of pest and cholera were reported in the region.[113] All these illnesses have unprecedentedly increased with the use of toxic chemicals and the pollution of drinking water; e.g. typhoid (25-fold) and hepatitis (7-fold).[114] The poor water quality also contributes to the high infant mortality rates in the region, comparable to those of some African states. In Karakalpakia the rate was 60 per 1000 in 1989, in the Tashauz region 75 per 1000 in 1988.[115]

3.3. Population displacement and large-scale migration

3.3.1. Urbanization and migration

In 1989, only around 40% of the population resided in cities (compared to the CIS average of 65%). The level of urbanization is very low because the growth of urban centers is exceeded by a more rapid rural growth. That means that cities grow rather by natural increase than by net in-migration. The indigenous rural population is traditionally very immobile, so that only little rural out-migration has occurred.[116] Migration therefore has played only a marginal role in the growth of the indigenous population in Central Asia. In recent times even a desurbanization, i.e. a return migration from urban centers to rural areas has taken place; e.g. in Tajikistan.[117]

110 Mnatsakanian, Ruben A., op cit, p. 105.

111 Figures for different diseases at the end of the 1980s are (USSR average in brackets): hepatitis in Uzbekistan 1451 per 100'000 (305), gullet cancer in Uzbekistan 91.3 per 100'000 (5.7), typhoid infection in Karakalpakia 44.5 per 100'000 (not available). All figures from Mnatsakanian, Ruben A., op cit, p. 105.

112 Compare Feshbach, Murray/Friendly, Alfred, op cit, p. 79. According to local experts children no longer serve as field hands cultivating cotton. Moreover, the use of defoliants has been drastically reduced since the beginning of independence (Suleimonov, Khamdam, Kokand, personal communication 1993).

113 Müller, Friedemann, 1993, op cit, p. 26.

114 Precoda, Norman, op cit, p. 114.

115 Other factors contributing to infant mortality are a lamentable health care, inadequate diet and frequent child-bearing. The average rate for the USSR was 25 per 1000 in the same years (see Micklin, Philip, 1992, op cit, p. 103).

116 For the reasons of the low mobility among the indigenous population see: Craumer, Peter R., op cit, p. 166.

117 Ibid.

A typical feature of the social structure in Central Asia is the often conflicting cleavage between the traditional unskilled rural population and the urbanized, educated, mainly Slavic population.

Urbanization and industrialization in Central Asia were significantly enforced by the help of Slavic qualified employees and skilled workers. The agricultural sector remained for the mostly indigenous rural population. The modernization of agriculture with the collectivization and expansion of cotton has destroyed the traditional agriculture. The high population growth combined with minimal emigration has led to increasing poverty. Unemployment among young people is increasing because agriculture is not able to employ a rapidly growing work force.

Net emigration out of Central Asia has occurred predominantly among the Russian (Slavic) population. These migrations have reached critical limits regionally because of the brain-drain of skilled workers and employees. These emigrations - 200,000 Russians alone from Uzbekistan in 1990 - will have great impact on the further economic development and also diminish hopes for rapid ecological recovery in Central Asia[118], at least for the technical solutions.

3.3.2. Environmentally-induced migration

In absence of living conditions improvements in the region and with missing opportunities for political articulation to enforce such improvements one would expect that people rationally decide to migrate.

It is quite difficult to distinguish between the motives for migration and the motives for non-migration. Migrations have occurred mainly from lacking employment opportunities; e.g. for fishermen in the former main ports of Muynak and Aralsk. Furthermore, more emigration took place among the young population and among immigrated ethnic groups (Russians, Koreans, Kazakhs from Karakalpakia).[119] But it is hardly possible to identify migrations purely because of ecological reasons. From 45,000 people living in the Muynak region around 1960, about 27,000 are left. In Muynak city, the number decreased in the same period from 20,000 to 12,000. However, for the time being the population remains stable.[120]

Despite Soviet plans to encourage migration to regions outside Central Asia, only a few have opted to leave their homeland, which is a further expression of the low spatial mobility overall found in Central Asia. A new beginning in an alien region would not provide an incentive for people with a low level of education and a strong social rooted-

118 Feshbach, Murray/Friendly, Alfred, op cit, p. 87.

119 According to Ospanov, Medet, vice chairman of the State Committee of Water Resources of the Republic of Kazakhstan (personal communication 1993).

120 Nesterov, E.: V zone ekologitcheskogo bedstviya, in: Melioratsiya i vodnoe khozyaystvo No.4, 1990, p. 13.

ness.[121] According to unanimous opinions from local experts, an enforced migration or even deportation is regarded as unpracticable and unsuitable for solving the problems of the region.[122]

4. Environmentally induced conflicts[123] in Central Asia

In assessing the conflict proneness of environmental degradation, both the natural vulnerability to water shortage and domestic issues, such as ethnic, religious, social and regional cleavages, have to be considered.

4.1. The vulnerability to water shortage in Central Asia

Peter Gleick[124] provides a useful evaluation for a nation's vulnerability to water resource conflicts, giving a rough idea where to identify possible conflict hot spots. The first indicator is the ratio of water demand to supply, where water withdrawals are given as a percentage of internal renewable supplies and river flows from other countries. A critical mark is set at withdrawals exceeding one third of the total renewable supply because of a higher vulnerability to regional or seasonal water shortages. Non-sustainable use of renewable resources is expressed in a ratio higher than 100. As exact figures are not available, only rough estimates are given (Table 1).

A second indicator is the per capita availability of water taking into account a changing population. Water availability in Central Asia per capita decreased from 7500m^3 in 1950 to 2000 m^3 per year in 1980 and will decrease to a meager 700 m^3 by the year 2000, not least due to a rapid population growth.[125] The recommended minimum for an adequate quality of life in a moderately developed country is 1000 m^3.[126]

Table 1: Utilization rate (ratio of water demand to supply) by country

Country	**Utilization rate**
Kyrgyzstan	24
Uzbekistan	58
Aral Basin	99
Stabilized Aral	133[a]

121 According to Shermuhamedov, Pirmat and others.
122 Becker, Petra: Der Fluch des weissen Goldes, in: iz3w Nr. 188, 1993, p. 43.
123 For the theoretical background and definition of environmentally induced conflicts see: Libiszewski, Stephan: What is an environmental conflict?, ENCOP Occasional Paper No. 1 (first part), Zurich, Berne 1992; Bächler, Günther/Böge, Volker/ Klötzli Stefan/ Libiszewski, Stephan: Ökologische Zerstörung: Krieg oder Kooperation? Ökologischer Konflikte im internationalen System und Möglichkeiten der friedlichen Bearbeitung, Münster 1993.
124 Cf. Gleick, Peter H.: Water and Conflict, Occasional Paper Series of the Project on Environmental Change and Acute Conflict, No. 1 1992, pp. 15-20.
125 See Gleick, Peter (ed.), op cit, p. 22.
126 Ibid., p. 105.

Jordan	110
Tunisia	53

Source: Calculated from Gleick, Peter H.: Water and Conflicts, Occasional Paper Series No.1, Toronto 1992, p.15; Mnatsakanian, Ruben A.: Environmental Legacy of the Former Soviet Republics, Edinburgh 1992, and other sources.

(a) Taking into account a required water inflow of 30 km^3 per year into the Aral Sea in order to stabilize the water level. This shows that actual water use rates in Central Asia are far beyond being sustainable.

Third, the dependence on imported surface water (Table 2) is also a vulnerability indicator and measures the extent to which water supplies are shared. Whereas Uzbekistan and Turkmenistan are highly dependent on external water supplies, Kyrgyzstan and Tajikistan have abundant water resources that are generated on their own territory. The dependence on external water supplies can be eased or accentuated by each country's storage capacity in reservoirs allowing regulation of the seasonal river flow. Reservoirs can either reduce the dependence on seasonally changing external water supplies or give the possibility to hold back water from a downstream water requester. This fact is even more important for the Syr Darya than for the much less regulated Amu Darya.

Presently the distribution of the storage capacity in the two river basins rather accentuates the uneven control over water resources between the republics. The water-rich countries Kyrgyzstan and Tajikistan hold the overwhelming share of the usable storage capacity of the reservoirs[127] in both basins. Uzbekistan controls 42% of the storage capacity of Amu Darya and only 16% of the water stored in reservoirs along the Amu Darya. Turkmenistan has no control over the storage capacity of the Amu Darya.[128] With the construction of new dams along the river course these figures will change. Plans for a cascade dam system exist for the Naryn, the main tributary to the Syr Darya, in Kyrgyzstan as well as for the Vaksh in Tajikistan, an important tributary to the Amu Darya. However, economic constraints are likely to slow down these projects.

Table 2: Dependence on imported surface water

Country	**% of external river flow**	**Ratio external/internal supply**	**Usable storage capacity in reservoirs in % of total**
Uzbekistan	>80	10	42 (Amu), 16 (Syr)
Tajikistan	~55	<1	58 (Amu); 9 (Syr)
Kyrgyzstan	<5	<0.1	58 (Syr)

127 The usable storage capacity of the reservoirs is the difference between the maximum and the minimum volume (dead volume) of a reservoir.

128 Cf. Marchand, P.: Géopolitique de l'eau sur le territoire de l'ex-U.R.S.S, in: Révue géographique de l'est 1993, Nr. 1, pp. 66-71.

Turkmenistan	>90	~35	none
Jordan	36	0.6	
Egypt	97	32.3	

Source: Gleick, Peter H.: Water and Conflicts, Occasional Paper Series No.1, Toronto 1992, p.18; Marchand, P.: Géopolitique de l'eau sur le territoire de l'ex-U.R.S.S, in: Révue géographique de l'est 1993, Nr. 1, pp. 66-71; and calculated from Mnatsakanian, Ruben A.: Environmental Legacy of the Former Soviet Republics, Edinburgh 1992; and other sources.

Fourth, the importance of hydroelectric production for a nation's energy supply provides another measure for water vulnerability (see Table 3). Hydropower is important in Kyrgyzstan and Tajikistan with a hydropower share of the total energy production of more than 50%. Significance of hydropower is less important in Kazakhstan and Uzbekistan with a share less than 50%. The importance of hydropower production is closely connected to the control over reservoirs on ones own territory.

These indicators for vulnerability to water scarcity show a distinct difference between the water-rich republics of Kyrgyzstan and Tajikistan and republics not controlling the sources of their water courses like Uzbekistan and to a higher degree Turkmenistan. This shift is accentuated by an uneven control over the storage capacity in reservoirs along the main rivers. The vulnerability indices not only express different access and pollution control opportunities, but also different, often contradictory modes of water utilization (hydropower vs. agriculture).

Table 3: Importance of hydropower in the Aral Sea Basin (number of power plants for different categories of electricity production per year)

Country	Hydro-power $<5x10^6$ KW	Hydro-power $5x10^6$ to 10^7 KW	Hydro-power $>10^7$ KW	Thermic power $<5x10^6$ KW	Thermic power $5x10^6$ to 10^7 kW	Thermic power $> 10^7$ kW
Turkmenistan	- (0.0)[a]	- (0.0)	- (0.0)	2	-	1
Kazakhstan (Syr Darya)	1 (0.25)	- (0.0)	- (0.0)	3	-	-
Uzbekistan	3 (0.5)	1 (0.33)	- (0.0)	3	2	2
Kyrgyzstan	2 (0.5)	1 (0.5)	1 (1.0)	2	1	-

Tajikistan	6 (0.75)	-	1 (1.0)	2	-	-
Ghana		0.98 [b]				
Switzerland		0.6 [b]				

Source: taken from Atlas SSSR, Moskva 1984, pp. 196-199; and Gleick, Peter H.: Water and Conflicts, Occasional Paper Series No.1, Toronto 1992, p.19.

a) Hydroelectric production as ratio of total energy production of the same category. The ratio varies from 0.0 (no dependency) to 1.0 (full dependency)

b) all categories

4.2. Conflict proneness in Central Asia

Central Asia is facing a process of decolonization and nation-building and is often searching violently for national, religious and subnational identities, although the similarities are more evident than the differences. All the people of Central Asia profess Sunni Islam and all - with the exception of Tajiks - speak a Turkish language.

4.2.1. Ethnicity and Nationalism - the ethnic dimension

When the Soviets came to power in Central Asia, they drew boundaries in order to impede the emergence of a Turan nation, respecting neither the history nor ethnic composition of the Turkish and Persian population. However, a correct delimitation would not have been possible because of nomadic migration and a lack of national self-awareness in pre-revolutionary times. The modern boundaries, as well as the major ethnic and national groups, are therefore an artificial creation of the Soviet period.

Since the dissolution of the Soviet Union, most of the republics rank the ethno-territorial issue as a top priority. As the borders became international, large alien populations were left in areas adjacent to their home republics. This incongruence between the borders of the republics and the perceived dimensions of the homelands can produce territorial conflicts, especially when they are exacerbated by economic, demographic and ecological stress.[129] Uzbekistan is a representative example of the heterogeneous ethnic composition of Central Asia (see Fig. 5).

Within the Soviet Union, these boundaries had no political relevance and were meant only for administrative purposes. This changed radically after independence, as the boundaries became international.

All ethnically mixed areas are potential hotbeds for conflicts, as the claim for a national homeland by a minority is threatening the national integrity of the titular nation. A study by Kolossov, Glezer and Petrov has defined 26 potential ethno-territorial conflicts in the

129 Kaiser, Robert J., op cit, p. 290.

territory of Central Asia.[130] Until now it has been possible to contain most of the conflicts in the earliest stages. The potential conflicts enumerated in the study concern boundary changes, changes in the status of territorial units (secession or autonomous status), or resettlements of ethnic groups (flight, migration).

Tab. 5: Ethnic composition of Uzbekistan

Source: redrafted from Sellier, Jean/Sellier, André: Atlas des peuples d'orient, Moyen-Orient, Caucase et Asie Centrale, Paris 1993, p.161.

Ethnic tensions have also appeared between the indigenous (autochthon) population and other ethnic groups who settled there either by free migration or by deportation mainly during and after World War II; for example, the Meskhetian Turks or the Krimean Tatars. The relations are especially strained between Russian immigrants and the indigenous population in Kazakhstan, where the former constitute 38% of the population. Northern Kazakhstan, regarded as an old colonial settlement area by the Russian population, is subject to boundary disputes between the two neighbors. In other republics of Central Asia, the Russian population share is much smaller. These minorities, under the pressure of discrimination (language, employment opportunities), are often forced to migrate.

130 Cf. Kolossov, Vladimir A./Glezer Olge/Petrov, Nikolai: Ethno-Territorial Conflicts and Boundaries in the Former Soviet Union (Territory Briefing No.2) Durham 1992.

Social and cultural reasons, mass unemployment, and the shortage of housing and agricultural land, contributed to the outbreak of recent inter-ethnic conflicts; e.g. in the Fergana Valley 1989 (Uzbekistan) and 1990 in Osh (Kyrgyzstan).[131] Other ethnic clashes occurred in the same period between Turkmenians and Armenians in Ashgabat and Nebit-Dag in Turkmenistan (May 1989), between Kazakhs and immigrated Caucasians in Novy-Uzen' in Western Kazakhstan (June 1990), between Tajiks and Kyrgyz in the Isfara region of Tajikistan (July 1989), and between Tajik and Armenians in Dushanbe (February 1990).[132] The reasons for the outbreak are subject to contradictory speculations. There is some evidence that the riots were "sparked off" from the Republican Communist Party, internal troops (MVD) and KGB organizations.[133] Others blame nationalistic hotheads of both sides for having fanned the flames of underprivileged people.[134]

4.2.2. The reawakening of Islamism - the religious dimension

In the Western press Islamism has often been erroneously identified as a main catalyst for conflicts. Islamic revival in Central Asia is an indigenous movement with limited promotion by Islamic forces from abroad and little transnational significance.[135] Given the missing ideological confrontation with the West, Islamic fundamentalism of the Iranian type does not fall on fertile ground in Central Asia.[136]

Moreover, the current development shows the primacy of social and economic interests over religious ones in the national movements.[137] Islam is much more a cultural than a political movement. Indeed, the most violent conflicts have all taken place among Moslem believers, demonstrating the prevalence of ethnicity and sub regional or tribal identity fighting out a conflict.

Despite an overall reawakening of suppressed beliefs and traditions in the Moslem communities, the unifying force of Islamism is weak. First, the return to traditional ideas and Islamic institutions takes place at the neighborhood level, the *mahalla*. Second, there are major differences between the animistic syncretism of formerly nomadic people and the more rigid beliefs of the farmers for example the Uzbeks.[138]

131 As a result of mass unemployment around 40% of the Uzbek population were said to be dependent on relatives or the state by the end of the 1980s (cf. Critchlow, James, op cit, p.68).

132 Ro'i, Yaacov: Central Asian Riots and Disturbances, 1989-1990: Causes and Context, in: Central Asian Survey, Vol. 10, No.3, 1991, pp. 33-34.

133 Ibid., p. 21; Shermuhamedov, Pirmat and Suleimonov, Khamdam (personal communication 1993).

134 As e.g. Razakov, Talant: Ozhskye sobytiya na materialakh KGB, Bishkek 1993 (view from a former KGB official).

135 Rupert, James, op cit, p. 180. Saudi Arabia, Pakistan and Iran made some efforts to influence the revival by donating cash to buy Korans or to build mosques and Islamic schools.

136 Halbach, Uwe: Islam und Politik in den Nachfolgestaaten der Sowjetunion, in: Evangelische Verantwortung, April 1993, p. 11.

137 Saidbaev, Talib, op cit, p. 168.

138 Halbach, Uwe: Islam und Nationalstaat in Zentralasien, in: Aus Politik und Zeitgeschichte. Beilage zur Wochenzeitung Das Parlament, B38-39/93, 1993, p. 14.

Nevertheless, there is a tendency to use religion as an instrument of national integration. Even in republics where Islamic fundamentalists are persecuted, as, e.g. in Uzbekistan, the state doctrine refers to Islamic symbols.[139] It is not unlikely that Islamism becomes a political determinant profiting from different factors of an overall crisis and disseminating the social doctrine of Islam with its egalitarian ideas. Rupert thinks that under the banner of Islam, political movements could recruit the underprivileged if the governments of Central Asia fail to meet basic needs.[140] But Islamic movements in some parts of Central Asia do not necessarily follow the Iranian model. The Party of Islamic Rebirth, the most successful Islamic movement of the Muslims of the former Soviet Union, is directed against ex-communist establishment and against secular opportunism of the spiritual leadership.[141] The party is especially active and successful in Tajikistan, where regional and tribal opponents struggle for political power. This leads us to a further conflict dimension - the quest for a subnational or regional identity.

4.2.3. Subnational identity and the question of power - the "tribal" dimension

After inter-ethnic and cultural conflict types, we may identify another conflict pattern in Central Asia, characterized by the struggle for power among subnational groups because of a lack of national unity.

Political power in Central Asia is largely dependent on "political patron machines" which were already consolidated in Soviet times and have essentially remained in power since independence. Loyalties to tribes, clans and regions still define the composition of new-old power élites.[142] In Turkmenistan, for example, power is concentrated in the hands of the Teke, one of the three main contentious tribes in the country.[143] Local party bosses prefer to rely on members of the same region, tribe or clan rather than on formal contacts within the party structure. Under the cover of a Soviet egalitarian system, segmented societies and subnational groups were therefore conserved endangering a national integration of the newly independent states today. According to the 1959 All-Soviet census Kaiser identified about 85 affiliated subnational groups within Central Asia's nationalities, 19 alone for Tajikistan.[144]

The rivalrous competition between subnational groups has triggered a ruthless civil war in Tajikistan between nationalistic ex-communist and Islamist forces under the banner of different ideological labels. The consequences of the civil war for the population and the economy are enormous. In 1992 alone, over 20,000 people were killed, about 120,000

139 Halbach, Uwe: Islam und Nationalstaat ... op cit, p. 15.
140 Rupert, James, op cit, p. 181.
141 See Halbach, Uwe: Islam und Nationalstaat ... ,op cit, pp. 15-16.
142 Rupert, James, op cit, p. 182; Halbach, Uwe: Islam und Nationalstaat ..., op cit, p. 12.
143 Rupert, James, op cit, p. 190.
144 Kaiser, Robert J., op cit, p. 306.

families were left homeless and 800,000 people were displaced. Agricultural output sank by 40% in the same period causing famines in some regions.[145]

It is a conflict characterized by the struggle of previously politically and economically destituted regional groups, disputing the monopoly of power of the old (communist) power élite that recruited its representatives mainly from the more developed industrial region in the north of the country. Halbach distinguishes among three antagonisms in the conflict of Tajikistan: firstly a political one between supporters and enemies of president Nabiyev, secondly a cultural one between Islamism and secularism and thirdly, as the most important, the regional antagonism between at least four regions of the country.[146] A strong opposition with a secessionist movement is found in the autonomous province of Badakhshan, the eastern part of the country, where many little Pamir peoples live in poor conditions and isolation.

The conflict is closely interwoven with the unconsolidated civil war in Afghanistan. The Russian intention is to maintain its military hegemony in the region along with the policies of the neighboring countries. Uzbekistan, fearing a "Tajikistan syndrome" in their own country, keeps democratic and Islamic opposition on a tight reign not least because of a strong Tajik minority in the economically important region of Samarkand and Bukhara.

Kyrgyzstan is another example of conflicting regional disparities. Beside the inter-ethnic conflict lines between Uzbeks, Russians and Kyrgyz, we find strong cultural and socio-economic disparities within the Kyrgyz people due to historical reasons and unequal economic development. Nevertheless national self-awareness of the Kyrgyz people seems to be more cohesive than "local patriotism".[147]

Given the different levels of integration, a person living in Central Asia has much stronger affiliation to his local clan than to a national or international identity as a Moslem or a Turk.[148]

4.3. Water conflict dimensions in the Aral Sea basin

The new border situation in Central Asia created classical clear-cut upstream-downstream situations between different independent countries, but also between a whole series of now politically separated irrigation networks that withdraw water from the same source, as well as political borders that follow the river course.

145 Halbach, Uwe: Islam und Nationalstaat ..., op cit, p. 12; a comprehensive analysis of the civil war in Tajikistan is given by: Hottinger, Arnold: Der Sieg der Apparatschiks, in: Europa-Archiv, Folge 11/1993, pp. 317-326.

146 Halbach, Uwe: Islam und Nationalstaat ... , op cit, pp. 16-18.

147 See Naumkin, Vitaly: Active Leadership: Russia's Role in Central Asia, in: Harvard International Review, Vol. XV, No. 3, 1993, p. 59; Halbach, Uwe: Islam und Nationalstaat ... , op cit, p. 13.

148 See Rupert, James, op cit, p. 178.

4.3.1. The water issue from Soviet rule to independence

Before going into details of possible water-related conflicts in Central Asia some historical prerequisites for the present water management system have to be examined.

In the Soviet law system, water resources[149] were an exclusive state property and therefore provided as a free good. Costs for the utilization of water appeared only as charges for the development and maintenance of water supply schemes and not for the amount of water consumed which reduced the efficiency of water use considerably.[150]

Moreover, water law is strictly bound to land law because the utilization of water sources is not possible without a direct or indirect utilization of surface land (irrigable land, embankments etc.).[151]

Water was based on the "Fundamentals of Water Legislation of the USSR and the Union Republics" of 1970, regulating the utilization and conservation of water bodies. On the basis of the "Fundamentals", water codes for the union republics were adopted.[152]

Caponera[153] divides the administrative authorities responsible for the utilization and conservation of water resources into three categories:

1. General state administration (councils of ministries, local authorities). These agencies administrate water as an integral part of the economic planning.

2. Special state administration (i.e. Ministry for Land Reclamation and Water Resources, the *Minvodkhos* [Vbzbcnthcndj djlzjuj üjpyqcndf ´ Vbzdjlüjp]) that are entrusted with the regulation of water use and with its conservation.

3. Agencies of branch administrations managing sectors of the national economy which utilize water resources (ministries of fishery, agriculture, electrification and others).

The "compartmentalization"[154] of water resource management in the USSR caused innumerable conflicting interests which each government body claiming as much water as it needed "without regard to the requirements of others".[155] Nevertheless, it was the Ministry for Reclamation and Water Resources who had primary operational responsibility in determining water withdrawal.[156]

149 A distinction is drawn between "water" and "water resources". Water is a dynamic substance and may become subject to individual appropriation, while water resources constitute a seperate state-owned material wealth as in natural reserves (seas, lakes, underground reservoirs etc.), (Caponera, Dante A.: Principles of water law and administration. National and international, Rotterdam, Brookfield 1992, p. 85).

150 Cf. Hollis, G.E.: The falling levels of the Caspian and Aral Seas, in: The Geographical Journal Vol. 144, part 1 1978, p. 77.

151 Caponera, Dante A., op cit, p. 85.

152 Ibid.

153 Ibid., p. 88.

154 Hollis, G.E., op cit, p. 78.

155 L'vovich, M.I. quoted in: Hollis, G.E., op cit, p. 78.

156 Gleason, Gregory: The Struggle for Control over Water in Central Asia: Republican Sovereignty and Collective Action, in: Radio Liberty Research, June 21 1991, p. 17.

Already in 1923, the Soviet government issued a decree to take "this central feature of social and community organization out of the hands of the traditional elders and councils with whom it has resided."[157] The Soviet power abolished the local institutions for water allocation in order to impose their own over the local interests. Local administration was deprived of the ability to solve water management problems between up- and downstream riparians. Moreover, the Soviet water managers created extensive large scale irrigation systems that linked different drainage basins as well as upstream- and downstream users through canals and collectors. Water allocation has therefore become much more complex on a supra-regional level than it was before in traditional water administration.[158]

In 1986, a plan to divert water over a stretch of 2500 km from Siberian rivers, the "Sibaral project," was stopped because of practical and environmental concerns.

The omnipotence of the centrally guided Minvodkhos began to decrease in 1988, when its authority to control water use and allocation in Central Asia was removed and replaced by the State Planing Agency (Gosplan), in order to settle water distribution conflicts and to enforce the limits on water withdrawals established by Gosplan. The Councils of People's Deputies of the Union Republics were granted the right to control water use within their territories. Moreover, with the implementation of automatized and computerized irrigation systems in the same year, two centralized water management authorities (basin water management agencies, ;fcctqzjt Djlzjt J,+tlbztzbt_ Basseynoe Vodnoe Ob'edinenie [BVO]) were established for the river basins of the Amu Darya and the Syr Darya in order to improve the efficiency of water use. They still have the responsibility to allocate and control the inter-republican river flow for irrigation purposes and to operate the hydrotechnical nodes (reservoirs, canals, pumping stations) on the basis of data transmitted by water measurement and regulation devices along the rivers and main canals.[159]

All the republics declared sovereignty in 1990, asserting their right to control land, water and other natural resources within their territories. With new laws on property, the republics reserved the right to ownership of water for the republican governments. The responsibility for the water management at the Union level was given to the republic-level ministries.[160] The water allocation is therefore still centrally-commanded from the national Ministry for Water Management down to several canal and reservoir administrations and further down to district water officers. Administration officials control the

157 Black, Cyrill E. et al.: The Modernization of Inner Asia, New York 1991, p. 281.
158 Ibid., p. 16.
159 Micklin, Philip, 1992, op cit, p. 97.
160 Some of the former Ministries for Reclamation and Water Resources (Minvodkhos) have been renamed in order to split the often contradictory tasks of reclamation (irrigation development) and (economic) use of water resources. For example in Kazakhstan, the name of the ministry responsible for water is "State Committee of Water Resources".

water use of the kolkhozes and may impose sanctions. Water quality is checked by a river basin inspection.

The transition to independence totally transferred the management of natural resources to the republics which is complicated by the fact that water bodies are now found within several jurisdictions. For the time being, intergovernmental agreements based on the former Soviet quotas regulate interrepublican[161] water distribution among the new Central Asian republics.

Indeed, the formerly rather administrative borders of the Soviet republics became international frontiers and therefore politically relevant. Unsettled minority problems are manifested above all in boundary disputes and territorial claims between the new republics of Central Asia.

4.3.2. Conflicts within international river basins

The cause for conflicts between up- and downstream riparians seems to be clear; "Measures taken by upstream countries influencing the river flow diminish the possibilities of downstream countries to use the river for their development."[162] Water storage for hydropower production or a deterioration of the water quality has severe consequences for water-dependent activities (agriculture, industry, fresh water supply) in the lower reaches of a river. Especially in arid regions, usable water in river flows is progressively scarce and rivalrous because drainage run-off degrades the quality and river diversion reduces the amount of water. While the upstream users may not be affected by poor water quality, the users downstream face a different set of constraints.[163]

So, hydrological conditions make it possible to externalize costs for the utilization or deterioration of the water, harming the lower riparians. Users upstream try to abstract water needed for their own purposes with no respect to possible salinization and/or pollution for the downstream riparians.[164] Obviously, upstream users have fewer incentives to alleviate their adverse actions.

On the local scale, most of the upstream-downstream conflicts have repercussions on irrigation systems. They are described in the following chapter.

4.3.2.1. Upstream - downstream conflicts in the Syr Darya basin

All the Central Asian republics own a greater or lesser portion of the Aral Sea basin. Uzbekistan and Kazakhstan share the Aral Sea itself. The two main basins of the Syr

161 Interrepublican refers to the relations between the Central Asian republics to distinguish them from the international relations.
162 Falkenmark, Malin et al.: Water and Society. Conflicts in Development, Part 2, Oxford u.a. 1980, p. 124.
163 Cf. Gleason, Gregory, op cit, p. 15.
164 Ibid., p. 13.

Darya and the Amu Darya are shared by several states and in the case of Uzbekistan even shared twice because both rivers cross another country between two stretches situated in Uzbekistan.

The Syr Darya is divided by four countries. It leaves Kyrgyzstan as the upper riparian in the eastern Fergana Valley; passes the Uzbekian part of the valley, then crosses the small but important Tajik stretch in the Western Fergana Valley before pouring again into Uzbekistan. After crossing the Hunger Steppe the Syr Darya runs into Kazakhstan.

Especially complicated is the upstream-downstream situation in the densely populated and ethnically mixed Fergana Valley where three countries; Kyrgystan, Tajikistan and Uzbekistan, have common borders similar to gear teeth. Especially in this region each republic maintains mostly ethnically based territorial claims against its neighbors.

Uzbekistan, the most populous republic in the region, does not control the sources of the three main rivers - Amu Darya, Syr Darya and Zeravshan- that are so essential for the life in the irrigation areas of the country.[165] This republic, in contrast to most of the Central Asian states, is completely dependent on the water resources of the Aral Sea basin. As a matter of fact, Uzbekistan's possibilities to control hydrotechnical installations along the course of the Syr Darya are restricted.[166] Most of the reservoirs regulating the river flow lie beyond the borders. Although most of the reservoirs are officially under control of the interrepublican water agency (BVO), they represent a potential lever for exerting pressure onto downstream neighbors.

In the recent past, there have been conflicts about the amount of water released by Kyrgyzstan for the downstream users of Uzbekistan, Tajikistan and Kazakhstan. Since independence, especially Kyrgyzstan faces serious economic problems, mainly because of a shortage of energy supply from Russia and the neighboring countries. As energy production is actually the major income source for this country, it wants to take the maximum profit from its abundant water resources. The primacy of energy production over the needs for irrigation in the middle and lower courses of the rivers has already created a major discord between Uzbekistan and Kyrgyzstan.

Needs for irrigation often do not correspond to the needs for maximum energy use. In summer, when much water is demanded by irrigation, the water is stored in the reservoirs to be released in winter time when energy demand is at a maximum.[167] The big reservoirs in the mountain countries, such as the Toktogul on the Naryn in the Tien Shan range were constructed mainly for hydropower production. The use of the reservoirs had already been controlled by the energy demand schedule of the former Soviet Union.

165 Compare also Fig. 5, p. 32, for the two river courses in relation to the international borders and ethnic composition of Uzbekistan.
166 Cf. Marchand, P., op cit, p. 68ff.
167 Cf. Rumer, Boris, op cit, p. 77.

In summer 1993, Kyrgyzstan retained about 50% of the water allocation granted to Uzbekistan in the Toktogul dam.[168] Since the introduction of a national currency in Kyrgyzstan, the "Som," Uzbekistan raised the prices for gas and oil for its neighbor. Producing electricity for export also, Kyrgyzstan tried to prevail upon Uzbekistan to purchase hydroenergy as a recompense for the usually free amount of water flowing into Uzbekistan. Uzbekistan, who is interested only in getting the necessary water, accused Kyrgyzstan of intending to sell water to its neighbors. Moreover, Uzbekistan is not dependent on electricity from Kyrgyzstan as it can produce it more cheaply with its own fossil resources.[169]

Kyrgyzstan was blamed for releasing *too much* water from the Toktogul dam down the Syr Darya in winter 1993. According to a petition of the Aral Committee of Tashkent to the presidents of the five Central Asian republics, the extra water did not reach the Aral Sea because of the winter freezing of the lower Syr Darya, but was dumped into the Aydarkul depression.[170] The Toktogul case illustrates the ability of an upstream country to control the river flow and to cause contentions with its downstream neighbors.

Moreover, Uzbekistan does not control the important stretch of the Syr Darya with the Kayrakum reservoir due to the Tajik "appendix", the Khodzhent region which protrudes into the Fergana Valley. The storage capacity of this reservoir gives Tajikistan 9% of the total usable water for regulation in the Syr Darya basin.[171] This situation is worsened by territorial claims of Uzbekistan for parts of the Tajik section of the Fergana basin, perhaps because one third of the population of the Khodzhent region are Uzbeks.[172]

Kazakhstan, who also receives water from the Syr Darya after Uzbekistan has claims against its upper riparian. The control of water resources is not only a question of pure quantity, but also of water quality along the rivers. Out of 143 major drainage channels to the Syr Darya, only three are directly controlled by Kazakhstan.[173] The artificial lake of Chardara in the province of Chimkent is the last big reservoir of the Syr Darya before it crosses the desert. It enables Kazakhstan to control almost one fifth of the usable storage capacity in the basin.[174] The control over water resources in this region could also

168 According to Khamidov, Makhmud, director of the BVO Syrdarja 1993. He stated that Kyrgyzstan wanted to dictate the water allocation to profit from hydropower production. A "scandal" could be avoided because in the rainy year of 1993 enough water was stored in other reservoirs of the BVO administration to compensate the deficit from the Toktogul dam.

169 According to Alik Bekenov, director of irrigation system administration in Kyrgyzstan from the national Minvodkhos, 1993.

170 Obrashtchenie utchastnikov ekspedicii "Syrdary'a-93" organizovannoy Obshtchestvennym Komitetom po sashtchite Arala i Priaral'ja, Tashkent 1993.

171 Marchand, P., op cit, p.70.

172 Cf. Kolossov et al, op cit, p. 49.

173 Cf. Kazakhstanskaya Pravda 22.1.92 and Lashenov, V.Ya.: Problemy mezhrepublikanskogo raspredeleniya vodnykh resursov r. Syrdar'i, in: Melioratsiya i vodnoe khozyaystvo No.1, 1990, p. 4.

174 Cf. Marchand, P., p. 70.

become a point of contention because of territorial claims from the Uzbekian side on parts of the province of Chimkent, where a large Uzbek minority lives.[175]

4.3.2.2. Upstream-downstream conflicts in the Amu Darya basin

The Amu Darya passes through three states - Tajikistan as the upper riparian, Uzbekistan and Turkmenistan - as the middle and lower riparians - and forms the border in some stretches between Tajikistan, Uzbekistan and Afghanistan, and between Turkmenistan and Uzbekistan. Finally the Zeravshan river, belonging to the basin of the Amu Darya is shared by Tajikistan and Uzbekistan.

A point of contention concerning the water distribution among the five republics is the handing over of hydrotechnical installations (mainly reservoirs) from the joint river basin agency of the Amu Darya (BVO Amu Darya) to the republican water ministry of Tajikistan. The suspension of joint control of a part of Tajik water resources was vehemently debated at a water minister meeting in 1993.[176] The mountainous terrain of Tajikistan (like Kyrgyzstan) would make it easy to exploit hydropower resources, for example with its large dam on the river Vakhsh, a main tributary to the Amu Darya. But, because of its civil war, Tajikistan has other problems than the water concerns of the lower riparians.

There are serious water disputes not only between the upper and lower riparians, but also between the middle and lower riparians; for example, between Uzbekistan and Turkmenistan along the course of the middle and lower Amu Darya. Both countries are confronted with territorial claims from the other side. Especially irrigated territories on both sides of the Amu Darya with strong minorities from the neighboring country are disputed.

Like Tajikistan, Uzbekistan wants to keep control over the storage capacity on its own territory. The Tuyamuyun reservoir on the border between Turkmenistan and Uzbekistan is under the exclusive control of the latter. The reservoir was presumably built only for political reasons in order to increase Uzbekistan's storage capacity because a reservoir in the middle of the desert with enormous evaporation does not make sense. Turkmenistan, adjacent to the reservoir, actually plans to build a canal to the water body, in order to improve water delivery for the oasis in the lower reaches of the Amu Darya.[177]

Uzbekistan blames its western neighbor for excessive water use. Indeed, water use per capita is about twice as much in Turkmenistan as in Uzbekistan because of poor water administration. There are many unrecorded canals in the lower reaches of the Amu Darya. But most of the water gets lost by inter-basin water transfers on Turkmen territory. The large scale irrigation systems often linking different drainage basins by canals

175 Kolossov et al, op cit, p. 50.

176 Sovety Kazakhstana 15.7.93. As the joint river agencies for the Syr Darya and the Amu Darya were not created before 1988, many hydrotechnical installations remained under republican control which also diminished the effectivity of the agencies' work.

177 Marchand, P., op cit, p. 69.

further complicate the water management. Such inter-basin water transfers are also disputed, because they diminish the amount of water for the downstream users. But in contrast with classical upstream-downstream conflicts, the water users are located in different drainage basins. Inter-basin water transfers of international relevance are the Kara Kum, the Bukhara-Amu, and the Kashkadar-Amu canals. The most contentious inter-basin transfer is the Kara Kum Canal diverting more than double the amount of water annually from the Amu Darya, instead of the 6 km^3 that were fixed in the old Soviet water quotas for Turkmenistan.[178] These withdrawals substantially reduce the river flow for the downstream users mainly in Karakalpakia in the west of Uzbekistan.[179]

New irrigation schemes of Turkmenistan envisaging an additional 1.6 million hectares of cultivated land are likely to strain the relations with Uzbekistan. With regard to the demands of a growing population, it is a declared national priority of the country to achieve self-sufficiency in grain and other crops without reducing the output of cotton; the country's main cash crop. Turkmenistan, officially considering the Aral Sea as doomed, is not supporting regional efforts for its stabilization.[180] As Turkmen officials assert, the new irrigated area would use water saved through conservation rather than drained from the Amu Darya.[181] This might be an illusion, as the development of virgin land is likely to go faster than the conservation of water especially in Turkmenistan.

4.3.3. Internal conflicts within shared irrigation systems

A thorough conflict analysis concerning the water distribution on a internal level has not yet been undertaken for the case of Central Asia.[182] Nevertheless, this local dimension may have the greatest potential for an escalation of water disputes into violent conflicts. Ethnic minorities could use ecological problems as a vehicle for imposing their interests against the titular nation, as has happened in the disintegration of the Soviet Union in many different regions.

As many irrigation systems in Central Asia are shared by two or more national groups, low-intensity conflicts are likely when a particular ethnic population is effectively or allegedly discriminated in the allocation of land and water resources. This could happen, for example, through an externally induced water shortage caused by the activities of the upper-riparian in the same river basin. A conflict of this type will become more likely since large-scale "privatization" in the form of lease holding multiplies the number of private farmers and water allocation gets more complicated.

178 According to Pirmat Shermuhamedov (personal communication 1993).
179 Ibid., p. 16.
180 Arab News 2.4.93
181 Ibid.
182 A thorough analysis of several irrigation systems (Spain, Philippines) from the collective action theory approach is given by: Ostrom, Elinor: Governing the Commons. The Evolution of Institutions for Collective Action, Cambridge 1992, pp. 69-88.

Raskin has identified 23 major irrigation systems for the Amu Darya and 9 for the Syr Darya.[183] The most contentious irrigation systems are located in ethnically mixed regions of Kyrgyzstan, Uzbekistan and Tajikistan. Hotbeds of ethno-territorial strife with a high probability of water-related disputes are located in the Fergana Valley between Kyrgyz and Uzbek populations, where all the most recent conflicts broke out, and in the districts of Samarkand and Bukhara between Uzbek and Tajik populations, where conflicts have been contained at an early stage and the irrigation systems within the ethnically mixed provinces of Khorezm (Uzbekistan) and Tashauz (Turkmenistan) in the lower reaches of the Amu Darya.

The Fergana Valley with 45% of the irrigation area in the Syr Darya basin is one of the most ethnically mixed regions of Central Asia. All countries making up parts of the valley have territorial claims against each other mainly because of large minorities living in districts bordering their own republic. As far as the most populous republic is concerned, around 90% of the Uzbek foreign community live in districts bordering Uzbekistan. So Uzbeks living in Kyrgyzstan reside mainly in the Osh district bordering the Uzbek part of the Fergana Valley.

The strained relations between Kyrgyz and Uzbek communities in Osh are historical. Over 20 such inter-ethnic clashes are reported from the 19th century.[184] In 1990 Uzbeks and Kyrgyz people fought over land rights in the Fergana Valley city of Osh, resulting in at least 300 deaths. The immediate cause for the clashes was the official permission for a Kyrgyz cooperation to use irrigated land of an Uzbek kolkhoz to build residential buildings on it.[185] After the clashes, the Uzbek minority in Kyrgyzstan claimed an autonomy status in the Osh region. In the eastern Fergana Valley, skirmishes are reported between Tajiks and Kyrgyz along the tributary of Syr Darya, Isfara, which crosses three countries, Kyrgyzstan, Tajikistan and Uzbekistan, in less than 150 km.[186]

Moreover, minorities deported to the Fergana Valley during the Stalin period are complicating ethnic relations. In June 1989, Uzbeks clashed with Meskhetians Turks - a deported people from Georgia - in the Fergana Valley. At least 100 people were killed and more than 16,000 were evacuated. The economic frustration of one group, the Uzbeks, is reflected by a coincidence of socio-economic stratification with national or ethnic divisions, leading to conflicts between the indigenous and economically privileged immigrated Meskhtian Turks, often having better income opportunities as little traders. This

183 Raskin, P. et al., op cit, p. 57.
184 Kamilov, Abdulaziz, op cit, p. 144.
185 Rupert, James: Dateline Tashkent: Post-Soviet Central Asia, in: Foreign Policy No.87, 1992, p. 181. For the riots in Osh see: Bozdag, Abidin: Demokratie - oder Chauvinismus? Kirgisien im Wandel, in: der überblick, Zeitschrift ofür ökumenische Begegnung in internationale Zusammenarbeit, 2/1992, p. 39.
186 Cf. Nezavysymaya Gazeta 9.11.91.

cleavage is not only obvious on the countryside but also in the cities, where a mostly Slavic immigrant population have the qualified jobs.[187]

In a socio-economic crisis, the "scapegoat"-syndrome is widespread, i.e., the search for the culprit in the neighborhood that threatens the "sense of exclusiveness"[188] of the majority. The share of young people out of work is 40% in some regions and represents a virulent aggression potential of desperate men with no qualified skills and no possibility for maintaining a family, which is regarded as humiliating in the traditional society.[189] So it was not surprising that a lot of young people and even teenagers took part in the clashes in the Fergana Valley: "The indigenous youth has turned its anger against those who have jobs, high wages and decent material and living conditions, i.e., against those who are doing well."[190]

Ethnic tensions are also reported between Uzbeks and the Tajik minority in the Zeravshan valley. Tajikistan has territorial claims for parts of the Zeravshan valley with its traditional Persian centers of Bukhara and Samarkand, regarded by many Tajiks as their genuine capital. These claims play an important role in the Tajik nationalist movement.[191] In rural areas, water distribution problems in the ethnically mixed irrigation systems in the southern Zeravshan River may therefore erupt.

An irrigation system can also lie on both sides of a joint border river; e.g. between Uzbekistan and Turkmenistan in the middle and lower Amu Darya, where the two countries have the river as a joint border for some 200 km. People of both republics live as minorities in the adjacent regions of the neighboring republics. Some 120,000 Turkmens live in Uzbekistan, mostly in the irrigation area of Khorezm in the lower Amu Darya. On the other side, over 300,000 people of Uzbek nationality live in Turkmenistan, concentrated in the province of Tashauz bordering Karalkalpakia and along the middle course of the Amu Darya in the very south-east of the country. Confronted with water shortage, Uzbeks and Turkmens already send raiding parties across the common Amu Darya in order to destroy pumping stations and canals.[192] The claims from both sides for territories with strong respective minorities could be strengthened by such water disputes.

Violent water-related conflicts may arise where they coincide with socio-economic constraints and impoverishment which does not affect all people to the same degree. Al-

187 Ibid., p. 148. An alleged coincidence, however, can also be percepted as such and serve as a pretext for the triggering of a conflict, which could have been the case in the Osh riots.

188 Kaiser, Robert J., op cit, p. 305.

189 See Gussejnov, Gassan: Alte Machthaber im neuen Gewand. Mittelasien nach dem Zerfall der UdSSR, in: der überblick, Zeitschrift für ökumenische Begegnung und internationale Zusammenarbeit, 2/1992, p. 7.

190 Saidbaev, Talib: Inter-Ethnic Conflicts in Central Asia: Social and Religious Perspectives, in: Rupesinghe, Kumar/King, Peter/Vorkunova, Olga (eds.): Ethnicity and Conflict in a Post-Communist World. The Soviet Union, Eastern Europe and China, London, New York 1992, p. 167.

191 Götz, Roland/Halbach, Uwe: Politisches Lexikon GUS, Beck'sche Reihe 852, München 1992, p. 225.

192 Hyde-Price, Adrian: Eurasia, in: Thomas, Caroline & Howlett, Darryl (eds.): Resource Politics, Freshwater and regional relations, Buckingham, Philadelphia 1993, p.166.

though the contribution of environmental factors to the conflicts in the Fergana Valley and elsewhere is not easy to weigh, water and soil pollution surely exacerbate the deplorable economic conditions in certain regions and may even serve to stress the rights of an ethnic minority; e.g. for the Tajik minority in the Zeravshan valley, or for the Usbek minority in Kyrgyzstan.

Tab. 4: Water-related conflicts in the Aral Sea basin

Hydrological system	Control of sources	Main user(s)	Type of dispute	Related ethno-territorial or sub-national conflicts	Severity of conflict
Naryn and Toktogul resv.	Kyrgyzstan	Kyrgyzstan Uzbekistan	up-down-stream	ethnic tensions between Uzbek and Kyrgyz population in the Fergana Valley	high
Kayrakum resv	Tajikistan	Uzbekistan Tajikistan	up-down-stream	transfer of the Tajik section of the Fergana Valley to Uzbekistan	medium
Tributaries to Fergana Valley-c)	Kyrgyzstan	Uzbekistan Tajikistan	shared irrig. system	ethnic tensions between Uzbek and Tajik population	high
Chardara resv.	Kazakhstan	Kazakhstan, Uzbek minority	up-down-stream; shared irrig. system	transfer of lands between the Syr Darya and the Arys rivers (province of Chimkent) from Kazakhstan to Uzbekistan	low
Vakhsh/ Pyandsh	Tajikistan	Tajikistan	up-down-stream (potential)	factional divides along the course of the Amu Darya between Gorno Badakhshan and the region of Kurgan Tyube	high
Zeravshan	Tajikistan	Uzbekistan	shared irrigation system up-down-stream	ethnic tensions between Uzbek and Tajik population; transfer of the upper reaches of the Zeravshan to Uzbekistan	medium
Lower Amu Darya	Turkmenistan Uzbekistan	Turkmenistan Uzbekistan	shared irrig. system/up-downstream	territorial claims concerning parts of the Tazhaus Oasis, the Khorezm province, and Cardzhou at the middle Amu Darya	medium
Kara Kum Canal	Turkmenistan	Turkmenistan	transbasin	overregional significance, repercussions for downstream users	medium
Aral Sea	Kazakhstan Uzbekistan	Karakalpakia, Turkmenistan, Kazakhstan, international	regional common/ sacrifice area	low potential for a secession of Karakalpakia from Uzbekistan; overregional conflict	low

Severity of conflicts:

high: ongoing violent conflict or outbreaks in the recent past

medium: conflict at an early stage with probability of conflict escalation

low: conflict at an early stage with probably peaceful conflict settlement

In view of the virulence of subnational and factional divisions in different regions of Central Asia; for example, in Tajikistan, one must also keep in mind the dimension of regional economic disparities between the impoverished mountainous region of Gorno-Badakhshan and the more industrialized regions of Dushanbe and Khodzhent. The contribution of environmental factors to the ongoing civil war in Tajikistan is probably very low, at least for the moment. In case of a changed balance of power in Tajikistan, a supposedly unreliable and uncoordinated water management with hydrotechnical installa-

tions under the control of different warlords in this important upstream country would have serious repercussions for the downstream users Uzbekistan and Turkmenistan. Along the upper course of the Amu Darya, we find different ethnic and subnational groups that support either the government of the old nomenclature or the Islamic opposition forces. Presently, the most important river stretches with reservoirs and dams on Tajik ground are under the control of government forces.

Table 4 shows the ongoing and potential water-related conflicts summarizing the different water-related disputes, while overlapping them spatially with ethno-territorial conflicts when it is possible. Some of the water-related conflicts have both an international dimension as well as an internal dimension.

4.3.4. The Aral Sea region: a "sacrifice area" or a regional common ?

An attempt has been made to distinguish "national sacrifice areas."[193] These are peripheral areas of states where economic interests (mining, for example) endanger the traditional way of life of a marginalized indigenous population bearing the environmental costs but not the economic profits. In economic cost/benefit assessments, such regions are "sacrificed" for the good of the national economy, while the profits are realized elsewhere by multinational companies or national élites. Ecological degradation is often planned or at least taken into account for unsustainable short-term benefits. The human-ecological transformation of such areas often tends to induce acute conflicts, if the parties involved are capable and willing to fight out such a dispute.

There is much evidence that this happened at least partially with the Aral region. At the latest by the end of the 1960s, Soviet scientists were aware of the looming catastrophe: The desiccation was indeed deliberately undertaken, the Aral was doomed to die.[194] Prominent politicians, scientists and engineers considered that drying up the Aral was far more advantageous than preserving it and pointed out that the increased agricultural output would benefit a local economy.[195] As the adverse consequences of the desiccation became known, no measures were taken into account to alleviate the situation in the Aral region. For good reason; the monopoly over the cotton industry was very profitable, filling the coffers of the central bureaucracy and the local nomenclature through bribery and corruption.[196] While the local population - mainly Karakalpakians, Kazakhs and some Turkmens - had to bear the ecological costs of the "modernization" of irrigated agriculture.

193 Cf. Böge, Volker: Large-scale strip-mining and environmentally induced conflicts, working paper, 1993.

194 See Precoda, Norman, op cit, p. 111; Glantz, Michael H. et al.,op cit, pp. 185-190. Also Artsibashev et al., op cit, p. 357.

195 See e.g. Chernenko, I.M.: The Aral Sea problem and its solution, in: Problemy osvoyeniya pustyn', No.1 1968, pp. 31-34.

196 For example the money for local "cotton lords" came from embezzlement of state funds, inflated harvest claims, protection payment and narcotics trafficking (see Feshbach, Murray/Friendly, Alfred, op cit, pp. 79-80).

After the independence of the Central Asian republics, it has become difficult to identify who is responsible for the ecologically ravaged Aral region. The Soviet empire does not exist anymore, the former decision makers tried to get themselves out of it. Russia doesn't want to take over a never-ending and unpayable legacy. The new Russian leaders do not seem to feel a moral obligation to clean up the mess that their predecessors have created.[197] An "intergenerational inequity" has been created within a few generations:

"In retrospect, one generation of decision makers has doomed a later generation of decision makers in the newly independent states of the former Soviet Union to cope with the environmental mess it had set in motion a few decades earlier."[198]

The sacrifice area is still there but the state that has provoked and promoted the environmental mess no longer exists. The economic decline, the health problems, and the uprooting of people demonstrate how the cotton monopoly has developed into "a principal source of social misfortune in the region."[199]

As far as the adjacent regions of the Aral Sea are concerned, such as Karakalpakia, the Turkmen province of Tazhaus or the Kazakh province of Kysyl Orda, one would expect a high potential for environmentally induced conflicts. The appearance of "ecological stress" among the population is indeed complicating the local political leadership.[200] But as a matter of fact, the Autonomous Republic of Karakalpakstan, suffering more than any other region in Central Asia from the cumulative effects of the water crisis, is politically stable with low inter-ethnic conflict potential and small emigration. A low environmental consciousness and a widespread fatalism concerning the impoverishment of the living conditions, combined with a rather stable society and a modest food supply network, do not create the "critical mass" of social upheaval taking the form of violent separatist movements. A secession of Karakalpakia from Uzbekistan is theoretically possible and is even foreseen in the constitution but, for the moment, there is no serious alternative to staying in the present union with Uzbekistan. Furthermore, the local political leadership denies environmentally induced migration from the Aral region to other republics. The emotional ties of the local population to their native country are so strong that enforced resettlement is regarded as inhuman.

What is the potential for an regional conflict regarding the Aral Sea? The water body has no outlet into the open sea. Reduced river flows not only affect the immediate riparians of the water body but often the regions not directly adjoining it as well. Even the mountain riparians, Tajikistan and Kyrgyzstan, suffer from salt loads transported by wind from the Aral Sea. These factors create conflicts in efforts to save the "Blue Sea". As a matter

197 Glantz, Michael H., Rubinstein, Alvin Z., Zonn, Igor, op cit, p. 197.
198 Ibid., p. 193.
199 Kamilov, Abdulaziz: Internal Conflicts in Soviet Central Asia: Causes and Consequences, in: Rupesinghe, Kumar/King, Peter/Vorkunova, Olga (eds.): Ethnicity and Conflict in a Post-Communist World. The Soviet Union, Eastern Europe and China, London, New York 1992, p. 146.
200 Cf. Pravda Vostoka, 31.10.90.

of fact, all proposals to alleviate the water crisis in Central Asia emphasize the need to "save" the Aral Sea. However, since the problems do not affect all the republics to the same degree, determining priorities and clear financial commitments becomes complicated. National development plans of some countries sharing the Aral Sea basin (e.g., Turkmenistan) may be contradictory to commitments of other countries in favor of the common resource.

4.2.5. Geopolitical implications

4.2.5.1. The role of Russia as a regional military power

Military forces in Central Asia still depend to a high degree on the presence of Russian troops that succeeded the former Soviet Army. The events in Tajikistan have not only demonstrated Russia's stabilizing role in the region but also its will to assert its national interests on the southern borders.

A lack of consensus with different views on foreign policy and unresolved ethno-territorial questions hinders the formation of a regional collective security system. Even direct bilateral military ties - with the exception of an intended military collaboration between Kyrgyzstan and Uzbekistan - are lacking.[201] The Tashkent collective security treaty among the CIS of 1992 is limited to defence against threats originating from outside the CIS.

On the other hand, the republics concluded bilateral agreements with Russia to settle the status of the former Soviet military units that were "nationalized". Nevertheless, these forces remain - above all in the officer cadre - predominantly Russians and do not deny their roots in the Russian army. Although these troops (11 divisions) now fall under local budgets, it is unclear who has the authority over these forces. Even the role of the Russian troops in the region was not defined in the bilateral agreements.[202] To express their sovereignty, some republics created national guards with a small number of troops. Their limited tasks allow them to protect government establishments and to maintain social order, but they can hardly intervene in conflicts like the one going on in Tajikistan.

Military presence of Russians in Central Asia remains unavoidable for several reasons:

1. Difficulties in recruiting enough personnel to build up an army with national cadres.

2. Dependency by agreement on Russia's peacekeeping role in the region.

3. Overreliance on arms suppliers or on maintenance and repair contracts with enterprises in Russia.[203]

201 Allison, Roy: Military Forces in Soviet Successor States (Adelphi Paper 280), IISS London 1993, p. 54.
202 Lubin, N., op cit, p. 8.
203 Cf. Allison, Roy, op cit, pp. 58-59.

The perceived military threats influence plans to develop military structures in the successor states, although the high dependency on Russian forces in case of aggression does not allow the development of national military doctrines. The internal threats to regime stability are seen as more challenging than direct external threats, although internal threats are often perceived as externally induced. The external threats in Central Asia concern mainly the defence of "ethnic Russians" and ethnically-based territorial demands between Russia and Kazakhstan as well as between Central Asia's republics.[204]

For the near future, Allison[205] thinks that states like Kazakhstan, Uzbekistan and probably Turkmenistan should be able to develop powerful semi-professional armed forces, although these troops would remain partly dependent on Russian assistance to be fully operational. The poorer countries like Kyrgyzstan and Tajikistan have to choose strong dependency on Russian aid or to confine themselves to territorial defence concepts such as, utilizing the mountainous terrain suitable for guerrilla tactics. The crucial question of maintaining close military ties with Russia will remain for all the republics:

"The dilemma of Central Asian CIS states is how to benefit from continued military and military-financial patronage from Russia without surrendering national control over their emerging fledgling military structures or their defence priorities."[206]

How would Russia intervene of in case of "hydroconflicts?" Russia is not hydrologically linked with the Aral Sea basin, so it cannot rightly ask for water resources in the region. It would not do so, anyway, because Russia's water resources are more than abundant. Since the project of a transbasin diversion of Siberian rivers to the Aral basin was abolished in 1986, the water resources of Russia and the Aral basin will remain separate. So far, only Kazakhstan has concluded an agreement with Russia concerning common transboundary water resources in the north of Kazakhstan (e.g. the rivers of Ural and Irtysh).[207]

On the other hand, every military escalation of possible environmentally induced conflicts (e.g. aggressions due to water shortage in Central Asia) must be seen in the context of Russian security needs. The participation of Russian troops -- be they "nationalized" or deployed as "peacekeeping" forces -- could then become necessary.

4.2.5.2. The role of the regional "co-riparians"

the regional powers that may question water resources of the Aral Sea basin are Afghanistan and to a lesser degree China and Iran.

The water question is serious for Afghanistan, which is draining significant amounts of water into the Amu Darya and into the Karakum Canal in Turkmenistan via the Murgab

204 Ibid., pp. 72-73.
205 Ibid.
206 Ibid., p. 62.
207 According to Ospanov, Medet, Deputy Director of the State Committee for Water Resources of Kazakhstan (personal communication 1993).

and Tedzhen rivers. The country withdraws water for irrigation from tributaries to the Amu Darya (Kunduz or Kotcha rivers) and shares a large portion of the Pyandsh and the Amu Darya with Tajikistan and Uzbekistan. The southern riparian could claim historically guaranteed water rights for half of the water of the Amu Darya, as soon as it would start exploiting the water resources for its own purposes be it for hydropower generation or for the development of irrigation cultures.[208] The realization of such claims could affect the water balance of the whole Amu Darya basin.[209]

The watershed of the Tien Shan range diverts the water resources between the Aral basin and the much smaller portion of rivers flowing to the Takla Makan desert in the province of Sinkiang in western China. Rivers, such as the Kysyl Su, the Taushkandarya or the Ak Su are certainly of local importance for irrigation cultures in the piedmont zones on the Chinese side of the Tien Shan with the towns of Kashgar, Aksu or Kutcha. However, they are not likely to become a source of contention between Kyrgyzstan and China in the near future. Kazakhstan is preparing an agreement with China concerning common water resources that are mainly concentrated on the river Ili, feeding the second largest lake of Kazakhstan, the Balkhash. These resources, though, do not make up part of the Aral Sea basin.

Finally, Iran has some smaller shared water resources with Turkmenistan, mainly feeding the Kara Kum Canal. The larger part of this in the bordering mountains of Kopet Dag flows into the Caspian Sea. Turkmenistan is reported to negotiate with Iran on the issue of building river dams in the border zone.[210]

5. Approaches to peaceful conflict management

5.1. General state of relations between conflicting parties

After independence, the points of departure for an economic and political development are quite disparate for the Central Asian states, although all the countries have inherited a low standard of living, a small industrial production base, and heavy ecological problems from the Soviet Union. The development of multilateral relations between the newly independent states of Central Asia has proceeded at a rather slow pace because of diverging intentions. The differences regarding unresolved territorial disputes, geopolitical orientations, and economic perspectives are too big. The mechanisms of the CIS treaty

208 According to Pirmat Shermuhamedov (personal communication 1993), this right was fixed in a decree by Lenin. Exact figures for water run-off and demand are not available.

209 The fear of such claims is expressed by the Turkmen minister for water economy and supply: "Our concern is that Afghanistan might make a claim on the water of the Amu, and we would not be able to do anything about it, because they are upstream from us." (Arab News 2.4.93).

210 Cf. Müller, Friedemann: Islamischer Wirtschaftsriese? Die mittelasiatischen Republiken gehören zu den armen Ländern der Welt, in: der überblick, Zeitschrift für ökumenische Begegnung und internationale Zusammenarbeit Nr. 2/1992, p. 23.

turned out to be ineffective, so that they are successively being replaced by bilateral agreements among the member countries.

The relations between the countries of Central Asia depend on their very different conditions for development. According to Müller, they concern the fields of fossil energy resources, willingness to reforms and the availability of water.[211] Kazakhstan, Turkmenistan and to a lesser degree Uzbekistan are well endowed with fossil energy resources, whereas Tajikistan and Kyrgyzstan are not. Looking at the water resources, we may state exactly the opposite. Economic boycotts in the context of water distribution conflicts are therefore conceivable. As the water-poor countries, like Turkmenistan or Kazakhstan, have in general larger stocks of fossil energy resources than the upstream countries, they could demand a bargain of oil or gas for water from Kyrgyzstan or Tajikistan. Until now, the economic dimension has played a role only in the Toktogul question between Uzbekistan and Kyrgyzstan, although, in the reverse sense. Other possibilities are the blockade of transit oil and gas pipelines or railway lines as has already happened in the Nagorny Karabakh conflict between Armenia and Azerbeijan.

Furthermore, the relations concerning the water resources between the conflicting parties depend on their internal political power structure and their readiness for political and economic reforms. Kazakhstan and Kyrgyzstan have chosen a moderate opening to democratization and market-oriented economy, whereas in Uzbekistan and Turkmenistan political power remains in the hands of the traditional clans. In Tajikistan the old nomenclature regained power after a short interregnum of the nationalistic-islamistic opposition. The relations of the political leadership in Tajikistan with its northern neighbors Uzbekistan and Kyrgyzstan are directed towards the containment of opposition forces, in order to prevent a spill-over into their own territory. In Uzbekistan, the threat of "Tajikistan conditions" facilitates the control over the internal opposition. Due to the ongoing civil war in Tajikistan, the water problem does not have first priority on the political agenda of the Pamir state.

Another missing link in the chain for effective water management is that Turkmenistan has no political opposition and a low potential for inter-ethnic strife. It therefore tries to isolate itself from the Central Asian neighbors. Due to its overwhelming natural wealth, Turkmenistan can afford such a single-handed effort, although this desert state remains dependent on the availability of external water resources. Nevertheless, the country participated at a summit of the Central Asian leaders in January 1993, at which the establishment of a "common market" and further steps to integrate the region were proclaimed.[212] After the crumbling of the rouble zone in autumn 1993, efforts in the Central Asian republics to create an economic subzone less dependent on Russian relations have gained much more importance.

211 Cf Müller, Friedemann, 1993, op cit, pp. 23-25.
212 Cf. Naumkin, Vitaly, op cit, p. 59.

Integrative efforts were also made under the leadership of Turkey and to a lesser degree of Iran. On the basis of a regional economic cooperation, the Economic Cooperative Organization (ECO) was revived with the entry of the Central Asian republics. However, the possibilities of this organization should not be over estimated because of the constant rivalry for political and economic influence between Turkey and Iran.

5.2. Possible approaches for alleviating the water crisis in the Aral Sea basin

Solutions for alleviating water shortage and quality problems are being broadly discussed in the community of specialists in the region and in Western countries. Solutions are often well-known, with the most promising ones sometimes even having been evaluated. The problem, however, lies mostly in the setting of priorities, in the coordination of contradictory demands, and in the implementation itself: "Yet, there is still considerable dissension in the basin as to *what* the problem really is and *how* best to resolve it."[213]

The proposed solutions concern the environmental problems in connection with water misuse in the whole region, encompassing the particular problems of the Aral Sea which are climate change and desertification). The Aral Sea region cumulates all the negative impacts of the water crisis in Central Asia.

We may differentiate between technical solutions (improving efficiency of water use and management, or development of additional non-local water resources) and economic solutions changing the demand patterns (water price, structural reforms). A separate chapter deals with the comprehensive protection of the Aral ecosystems. As water use for agriculture has the far and away the biggest potential for saving water, I will concentrate on this sector.

5.2.1. Technical solutions for an ecologically sound water management

5.2.1.1. Improving efficiency

Technical solutions concerning water management are innumerable. In fact sarcastic comments in local newspapers complain that with all the propositions to save the Aral Sea, a new sea was created - a sea of paper.[214]

The potential for water saving measures is subject to controversy. Water management specialists present a rather cautious view and think that the amount of water that can be saved is much less than optimists believe. Estimates vary between 10 to 20 km^3 and 35 to 50 km^3 per year, demanding corresponding large-scale measures that "will be lengthy, costly and complicated."[215] In order to stabilize the actual water level of the Aral Sea, 35-40 km^3 of water have to be freed.

213 Glantz, Michael H., Rubinstein, Alvin Z., Zonn, Igor, op cit, p. 196.
214 See Kazakhstanskaya Pravda 23.1.93.
215 Micklin, Philip, 1992, op cit, p. 95.

Water efficiency improvements may alleviate the water crisis in the Aral Sea basin but not necessarily solve it nor deliver more water to the Aral. With the requirements of a growing population, saved water resources are likely to be used for irrigation of new lands or for industrial development.[216] The modernization of older irrigation systems; e.g. Fergana and oasis of Khorezm or Taushauz, is regarded as crucial.[217] Measures to improve water efficiency include the amelioration of the water storage system, the distribution system (transport and drainage), and the irrigation systems themselves:

- Reconstruction of irrigation canals and drainage ditches, such as the lining of canals with concrete, or shortening their length, and construction of concrete channels on supports and additional collectors, in order to prevent highly saline or polluted water from re-entering into the irrigation water supply of rivers and to alleviate salinization and water logging. As a matter of fact, in Kazakhstan, return flow to rivers is officially not regarded as a resource suitable for irrigation. Water is allocated in such a way that as little water as possible re-enters the rivers.[218] The construction of a 1147 km long collector paralleling the Amu Darya is underway and will lead about 4 km^3 drainage water annually directly to the Aral instead of conveying it to the stream or to drainage lakes. The huge canal is likely to replace one evil with another: the additional poisoned and saline load to the Aral will further deteriorate the regional environment. Moreover, this measure will dry up the largest lake supported from drainage water in the Amu Darya basin, the Sarykamysh, with its important wildlife and fishery habitats.[219]
- Redesign and reconstruction of reservoirs to minimize evaporation and to allow seasonal and multiyear regulation in low flow years. The storage capacity in reservoirs in the Aral Sea basin is estimated at 50 km^3, half of it could be used with full development of existing reservoirs in low flow years.[220]
- Improving water management: A major improvement to controlling water distribution is computerization, telemechanization and automation of water distribution facilities. A basin-wide automated water management system (ASUB)[221] is being implemented along the Syr Darya under control of the BVO Syr Darya.

216 Micklin, Philip, 1987, op cit, p. 251.
217 More recent systems as e.g., the Hunger Steppe or Vakhsh irrigation systems utilize up to three times less water than the traditional ones. (Cf. Agachanjanc, O., op cit, p. 113).
218 According to Ospanov, Medet, (personal communication 1993).
219 Micklin, Philip, 1992, op cit, p. 104; Golos Uzbekistana No.28 1993, p. 4 and No. 27, 1993, p. 3.
220 Nevertheless there are a number of disadvantages to developing reservoirs (evaporation, rising of ground water level of surrounding land, reduction of water, sediment and nutrient flow). Cf. Micklin, Philip, 1987, op cit, p. 247.
221 ASUB = avtomatisirovannye sistemy upravleniya vodnymi resursami basseynov rek, fdnjvfnbpbhjdfzzst cbcntvs eghfdktzby djlzsvb htcehcfvb- According to Mahmud Khamidov, till 1993 about 750 km have been automatized (personal communication 1993). Cf. also Micklin, Philip, 1987, op cit, p. 244.

- Improving water application:[222] a) By implementation of water saving irrigation facilities as, for example, trickle-down irrigation[223] or sprinkling systems. 98% of the irrigation area in Central Asia is irrigated by inefficient surface methods through furrows. Regarding the high investments and other limitations for sophisticated irrigation techniques in Central Asia, surface irrigation will remain the most important water application technology.[224] b) By amelioration of arable land (land levelling, contouring).

5.2.1.2. Development of new water resources

The development of new non-local water resources has been heatedly discussed in Central Asia. Traditionally, the credo of the local leadership was that considerable additional water resources from water-rich river basins were indispensable to cope with the water crisis in Central Asia. Politicians and water engineers were long confident of the realization of the famous "Sibaral project." Even after the suspension of the project many specialists keep urging for additional water resources. The development of such resources is also officially envisaged in the Aral document signed by the heads of states of the Central Asian republics in March 1993. The search for water has produced some more or less sensible proposals to enhance the water supply. Most of them are costly and have met with considerable environmental concern.

The first set of concepts concerns the acceleration of the run-off. Artificially increased rainfall would only be possible in the piedmont zones or on the surface of the Aral Sea, where the cloud formation takes place. According to specialists, such a proposal is technically not feasible and would have catastrophic effects on precipitation patterns.[225] Increasing the rates of glacial melting is tempting because of the large glacier areas in the Pamir and Tien Shan mountains. Melting water from ice and snow contributes up to 90% of the run-off of the Aral Sea basin. In order to significantly increase the run-off one would have to blacken the ice fields with coal dust, which is not practicable for a larger area.[226] Many of these proposals are rightly dismissed as impractical.

A second set of proposals deals with the exploitation of under-utilized water resources. There are still opportunities for developing new or currently under-utilized water resources in Central Asia. Water resources in the four largest aquifers in the region - the basins of Amu Darya, Syr Darya, Ustyurt and Turgay - are reported to be enormous.[227] However, ground water development in Central Asia is a delicate matter facing problems such as high mineralization, the great depth of the resources, slow recharge rates with

222 Micklin, Philip, 1991, op cit, p. 220; Micklin, Philip, 1992, op cit, pp. 96-97).
223 Modern trickle-down irrigation systems are being implemented on a trial basis in Turkmenistan and Kazakhstan in cooperation with Israel (Christian Science Monitor 23 September 1992; Ospanov, Medet, personal communication 1993; cf. also Dukhovny, V., 1990, op cit., p. 8).
224 Cf. Micklin, Philip, 1992, op cit, p. 97.
225 See Ekokur'yer 28.5.92, p. 4.
226 Cf. Agachanjanc, O., op cit, p. 112.
227 Cf. Pravda Vostoka, 20.6.91.

the danger of lowering of the ground water table and of a reduction of (hydrologically linked) river flows.[228] Ground water utilization could however be expanded to 18 km^3 per year without adverse effects on the surface flow.[229] In Kazakhstan, an extended exploitation of the rich ground water resources is out of the question due to technical problems and adverse effects on surface waters.[230]

Another possibility is to utilize periodic run-off collection more intensively in ephemeral streams and clay-pan basins for small-scale irrigation.[231] This traditional method was widespread before the development of large irrigation systems with perennial water supply via canals but is, of course, less reliable because of a lack of storage capacities to hold back the periodical flows for the dry season.

The third set of proposals finally includes transbasin water transfers. The best-known "project of the century", the diversion of Siberian rivers to the south of the former Soviet Union, has raised general questions of cost-effectiveness of large-scale projects, of politics of interrepublic and later international water transfer, and, last but not least, the questions of strong ecological impacts and consequences for local cultures.

The water in the Sibaral Project was to come from the confluence of the Ob and the Irtysh River and to be directed over a 2500 km long canal through the Turan lowlands to the Amu Darya. The plan was to use 27 km^3 (~20% of annual water resources in the Aral Sea basin) annually to provide more water for irrigation. The dominant factor for the cancellation of the technically feasible project seems to be the excessive costs compared to the expected benefits.[232] After the Russian retreat from the project, pleas for a revival of the project have not fallen silent. Political leaders and many specialists in Central Asia still think that regional water resources are likely to prove inadequate in meeting future economic and social needs and to save the Aral.

The following proposals for a transbasin water transfer are concentrated on the necessity to save the Aral.[233] The aim of a scaled-down "Sibaral" Project would be to divert water exclusively for the Aral and not for irrigation expansion, transferring the water to the northern parts of the sea. This would substantially reduce costs by a shortening of the route. The question is, whether a delivery of 10 to 15 km^3 per year to the Aral would outweigh the environmental harms in Western Siberia.[234] With independence of the Central Asian republics and the collapse of the economic ties, Russia does not seem susceptible even for a scaled-downed version of the Sibaral Project - at least not for the mo-

228 Cf. Micklin, Philip, 1987, op cit, p. 246.
229 Micklin, Philip, 1992, op cit, p. 98.
230 According to Ospanov, Medet (personal communication 1993).
231 Micklin, Philip, 1992, op cit, p. 98.
232 Details of the project are not discussed here. For the background see: Rumer, Boris, op cit, pp. 85-103 and Micklin, Philip, 1992, op cit, pp. 105-109.
233 Some of the projects are too peculiar and far-fetched to be seriously discussed; e.g., a water transfer from the Indus River by tunnels through the Hindukush range to the Amu Darya (Novy Den' No.2 1993, p. 3).
234 Cf. Micklin, Philip, 1992, op cit, p. 107.

ment. On the other hand, the realization of such a project would raise questions of possible political blackmail from the Russian side towards Central Asia.

The currently most discussed project is a water transfer from the Caspian Sea to the Aral Sea.[235] The realization of the project would require the construction of a 450 km long canal (instead of 2500 km with the Sibaral), transferring about 40 km^3 low saline water (4-6 g/l) per year from the Caspian Sea to the Aral. As the Caspian Sea lies below sea level and therefore below the level of the Aral, such a delivery would require electric energy input perhaps from solar or wind power stations that would make sense in desert conditions. The actual sea level rise of the Caspian Sea, causing the flooding of the coastal zone, could be offset by the transfer of water. Critics argue that the level of the Caspian Sea is fluctuating considerably due to the changing precipitation pattern in the river catchment area. Till the 1980s, the largest inland water body on Earth suffered from a falling sea level.[236] Supporters of the "Kaspi-Aral"- canal stress also the impetus of such a project for the socioeconomic development in the Ustjurt region (construction of power stations, better drinking water supply, exploitation of natural gas etc.).

5.2.2. Comprehensive protection of water and soil resources

A more comprehensive approach is to focus on improving the ecological situation in the deltas of Amu and Syr Darya and on the former sea bottom. A first group of actions seeks to stop desertification in both deltas by rehabilitating former ecosystems. Another package of measures deals with the problem of renaturation of the exposed sea bed.

Many attempts have been made to fight against desertification in the Amu Darya delta. There are plans to construct a dike on the dried sea bottom on the former southern coast in order to withhold water in a reservoir. This would raise water levels in the deltas, allowing partial restoration of its former ecological and economic value and preserving low salinity in those areas which receive river inflows.[237] Such dikes would allow the stabilization of the water level, creating a network of artificial lakes. Periodic floodings would additionally inundate the delta, because the Amu Darya is not regulated.[238] A small dam has already been constructed near Muynak providing little ponds for fish breeding and water supply. Nevertheless, the water of these artificial lakes comes from the Amu Darya river and is of poor quality. The "irrigation" of the delta furthermore prevents the Aral Sea level from stabilizing.

Another possibility is to use drainage water through the construction of new drainage collector canals to lead water to the delta instead of to Lake Sarykamysh.[239] On the

235 See Ekokur'yer 28.5.92, p. 4; Zeleny Mir No. 22-23, 1992, p. 5; Novy Den' No. 2, 1993, p. 3.
236 Cf. Hollis, G.E., op cit., p. 62-80.
237 Cf. Dukhovny, V. A., 1988, op cit, pp. 30-32; Micklin, Philip, 1991, op cit, p. 227; Micklin, Philip, 1992, op cit, pp. 104-105.
238 According to Krutov, A.N. (personal communication 1993).
239 Cf. Rafikov, A.A.: Borba s opustynivaniem v nizov'yakh Amudar'i, in: Melioratsiya i vodnoe khozyaystvo 9/1988, p. 32-35.

Kazakhstan side, the stabilization of the smaller northern part of the Aral Sea would be possible with the inflow of Syr Darya even without the construction of dams. Some success can be observed; plantations with reed, saksaul or tamarisk are growing, even supporting cattle breeding. Tugay forests along the Amu Darya are recovering. Camels, wild horses and some of the aviafauna are returning to their original places.

Planting of halophytes stabilizes the former sea bottom and holds back salinized soil from aeolian erosion although these measures are difficult to implement and require a long time period. Such cultivations are possible on the sea bed which has already been exposed 15-20 years. Even a natural conquest of the former sea bottom with salt- and heat-loving plants is reported.[240] Anyhow, the younger the exposed sea bottom is, the more saline and intoxicated are the soils, which makes a renaturation difficult or even impossible.

5.3. Possible approaches to alleviate social effects of the environmental problems

5.3.1. Improving the living conditions in the disaster areas

Improving water quality and the water supply for human consumption are the most important prerequisites for the alleviation of environmentally induced illnesses among the local population in the most affected areas as the Turkmen district of Tazhaus, the Kazakh district of Kysyl Orda, and Karakalpakia. Almost all the statements of experts and politicians focus on the question regarding the social effects of the environmental crisis in Central Asia.

Such measures require improved sewage works, an effective potable water supply net with the construction of large-scale pipelines[241], and desalination facilities to re-utilize drainage water especially in the lower reaches of the rivers. The construction of reverse osmosis plants is under way with foreign help (Germany) in the Autonomous Republic of Karakalpakia. Small-scale and solar-driven desalination facilities are very appropriate for this region.[242] Such desalination plants transforming little quantities of water would of course be suitable for human consumption or for small-scale industry only and not for irrigation. A legitimate question is, who will pay for such wide-ranging measures in the region.[243]

Other measures are direct medical help, improvement of the social infrastructure and food supply, the creation of employment opportunities, and the restricted application of pesticides and defoliants.[244] Especially important are hygienic and ecological information

240 Cf. Novy Den' 2/1993 or Aziya 11/1993.
241 As e.g. an existing water pipeline from the Tujamujun reservoir to Nukus over a distance of 260 km, the prolongation of the pipeline till Muynak is underway.
242 Cf. Agachanjanc, O., op cit, p. 113; Kazakhstanskaya Pravda 20.9.92.
243 Glantz, Michael H./Rubinstein, Alvin Z./ Zonn, Igor, op cit, p. 196.
244 Ekokur'yer 29.5.92, p. 6; Ospanov, Medet (personal communication 1993).

campaigns directed to people who are barely aware of the complex relatedness of ecological degradation and their health situation.

Enforced emigration is not an appropriate means to solve the situation. The local people have a strong tie to their native country. So, for the time being the government is not likely to take more rigorous measures to encourage emigration to areas with better water supply.[245]

5.3.2. Economic solutions

5.3.2.1. Structural reform in agriculture

A restructurization of the agriculture in Central Asia is oriented towards water-saving crops as well as to the improvement of the regional food supply.[246] These measures may include a restriction of high water-consuming rice and cotton production as for example in Kazakhstan, where the reduction of rice paddies has been under way since 1989. The development towards a diversified, food-oriented and low water-consuming agriculture (food crops, fruits, vegetables) can also be observed in Uzbekistan and Kyrgyzstan. The share of the cotton-sown area has been reduced by 25% in the Syr Darya Basin and by 75% in Kyrgyzstan since the 1980s already but is more pronounced since independence.[247] Even a re-structuring of the total cash crop agriculture away from water intensive irrigation toward low water-use industry (textiles, clothing, electronics) can be seen.[248] Other restructuring measures in order to use less water and protect soil resources are the inter-cropping of trees with seasonal crops, the utilization of natural fertilizer (dung) instead of mineral fertilizer, and the reasonable application of pesticides and defoliants.

Nevertheless, cotton will remain an important good for export, as long as alternative product possibilities are not realized on a large scale. Furthermore, the transformation of cotton sown area into food crop area is limited due to large scale salinization.[249] Opium poppy, an "alternative" cash crop promising quick profits, increased substantially in the past few years. Central Asia with an estimated 120,000 hectares is regarded as one of the largest producers in the world. As the cultivation has been partially legalized in Kazakhstan and Kyrgyzstan, it is a sheer impossibility to control illegal production.[250]

Since independence, many land plots for house building and agriculture have been farmed out. This measure, mainly undertaken in Kazakhstan and Uzbekistan has somewhat taken

245 Cf. Micklin, Philip, 1987, p. 255; government representative of Karakalpakia and Shermuhamedov, Pirmat (personal communication 1993).
246 Micklin, Philip, 1992, op cit, p. 97; Rumer, Boris, op cit, p. 84.
247 Guldarshev, Director Fergana Canal Administration, Section IV, Fergana City; Ministry of Agriculture of Kyrgyzstan (personal communication 1993).
248 Micklin, Philip, 1992, p. 109.
249 The salinized arable land can better be transformed into pastures with an intensification of cattle breeding, in order to improve the regional food supply (Kazakhstanskaya Pravda 20.9.90).
250 Lubin, N., op cit, p. 7.

the sting out of social unrest on the basis of land shortages. Furthermore, the private peasants have an increased interest in the results of their farming, as they now have the possibility to grow their own food (vegetables and fruits). Nevertheless, governments hesitate to achieve a complete privatization of land for the time being, since the competition for land and housing space is especially virulent along ethnic fault lines.[251]

A structural reform of agriculture including privatization will be intricately linked with the success of the introduction of a water pricing system. Water must be regarded as a commercial good.[252]

5.3.2.2. The implementation of water pricing

Traditionally, water allocation for agricultural purposes in Central Asia has been provided "free", promoting inefficiency and waste. A mere symbolic price under Soviet rule was abolished in 1953. It is commonly recognized that water pricing is principally beneficial, because water waste will continue until its value is fixed in a pricing structure.[253] Furthermore, water payment would give the users a sense of ownership and would have some educational effect on the population.[254] Water pricing would act as an incentive for innovations and investments in irrigation technologies. Thus, the water tax could serve as a lever for the modernization of irrigation systems.

The implementation faces problems, such as lack of water-delivery measurement facilities and the still existing out-dated system of agricultural prices. The agricultural lobby fears that increased water costs will consume the meager profits of small farmers.[255] Furthermore, such a price reform would require expensive installations of new equipment (measurement facilities) and would encourage poaching, which raises the costs for monitoring and enforcement.[256]

Water pricing would force collective and private farms in Central Asia to pay for the water delivered by the different water management authorities and would require a differential tariff approach according to sectoral demands, regional supplies and periodic availability.[257] A sectoral differentiation is reported from Kazakhstan, where prices are different for agriculture, industry, domestic use, fishing industry and hydropower. Fur-

251 Cf. Neue Zürcher Zeitung 3.1.94.

252 Zolotarev, E.: Agrarnaya reforma: novoe otnosheniye k vode i zemle, in: Tchelovek i demokratiya, (Tashkent) mart-aprel' 1993, p. 14.

253 For example: " The sooner we acknowledge that water is an economic resource that should be valued in the same manner as any other resource (e.g. oil), the faster we go for a really rational water usage." or "the new water distribution network should not differ at all from analogue networks for the distribution of natural gas, electricity or information." Both quotations from Zolotarev, E., op cit, p. 13.

254 " The population is somehow an accomplice for the water waste, it has therefore to be brought up for a water-saving utilization." (Shermuhamedov, Pirmat, personal communication 1993).

255 The minister for agriculture in Uzbekistan is against such measures because a water pricing would charge too much for the budget of farmers (according to Guldarshev, A. personal communication 1993).

256 Micklin, Philip, 1992, op cit, p. 98; Gleason, Gregory, op cit, p. 18.

257 Ekonomitcheskaya Gazeta 6.8.87.

thermore, water pricing takes into account a) administrative costs and b) costs for water protection measures, reconstruction and maintenance of dams and canals.[258] From the regional point of view, the chairman of the "Save-the-Aral" Committee, Shermuhamedov, thinks that introducing a price on water is inappropriate for regions with generally poor water quality as in the Aral region but suitable for water-abundant regions like Tashkent.

Irrigation water pricing has been introduced only on an experimental basis until now. In Kyrgyzstan, the introduction of water pricing on some farms resulted in a 1.5 times decrease in irrigation withdrawals without a decline in yields.[259] In 1993, a water price was introduced in Kyrgyzstan not for the resource itself but for the services of water distribution for irrigation systems.[260] In Uzbekistan, experiments are reported for the Samarkand oblast; however, no results are available yet.[261] Kazakhstan partially introduced water pricing in 1992 and fixed the measure in a national legal water code, stating that water does have its price. A positive impact has been reported on water usage behaviour (renunciation of allocation quotas, irrigation during the night). In Kazakhstan, even the cut in former water allocation quotas for agricultural users has turned out to be an incentive for a more efficient water use.[262]

5.4. Possibilities and prerequisites for solving environmental conflicts

5.4.1. Water conflict management in Central Asia

The possible conflict settlement measures for water disputes must be differentiated by the possible hierarchical levels on which they take place. Disputes among settlers in an irrigation system need solutions other than interrepublican water distribution conflicts. Nevertheless, these measures must fit into a broader concept of environmental conflict resolution.

Despite independence from the central decision-making in the former Soviet Union, the weaknesses of the current water management system are still manifest through:[263]

1) the "foreign" control by Moscow that tolerated no independent water management depriving local authorities of the experience in resolving water conflicts;

2) the "foreign" (Soviet) priority setting for the economic development that continues to have an effect;

258 According to Ospanov, Medet (personal communication 1993).
259 Ekonomitcheskaya Gazeta 9.4.87.
260 According to Bekenov, Alik (personal communication 1993).
261 According to Guldarshev, A. (personal communication 1993).
262 According to Ospanov, Medet (personal communication 1993).
263 Cf. Gleason, Gregory, op cit, pp. 18-19.

3) contradictory administrative competencies and indecisiveness. According to Falkenmark much inequity may be alleviated by clear decisions about who is responsible for what in the water allocation process;[264]

4) the insufficient resources for monitoring and control.

Since independence, there is an overall tendency for centralization and nationalization of water resource management on the national level in Central Asia. No differentiation is made between local and republican monitoring and control. As a Kazakh water official states: *"Water resources should be available for the whole republic. If somewhere in the republic water is lacking we should have the right to allocate water where it is needed. Every water withdrawal must be controlled."* Institutions are therefore likely to demand a more effective administrative system with extensive monitoring capabilities and the ability to impose greater sanctions.

The motivation of this development is somewhat understandable: Central Asia faces a severe water crisis and has consequently also to cope with interrepublican claims. But the centralization at national level may be as unfortunate as at the former union level. Such centralized agencies are not likely to be successful in solving the water management problems in Central Asia, as they do not cope with questions of monitoring and control at a local level.[265]

Although the monopolized state water management has proven to be ineffective and destructive, a complete demonopolization of the centrally guided water management might not be a successful alternative. All in all, there is no tradition in Central Asia to privatize water resources and expose them to the "arbitrary market forces."[266] Following Zolotarev, a possible approach could be a partial demonopolization where the principle of free competition between state, cooperative and private structures has to be complied with. Every party should be treated equally, and the state should guarantee the rational use of these resources on the basis of a well-conceived system of issuing licenses and quotas for cooperative and private water enterprises.[267] However, the Zolotarev does not specify how the structure of an overall water management from the regional to the local level would function and which of the institutions would be private or state enterprises.

Gleason suggests that successful water management institutions "combine local and central decision-making institutions in such a way as to maintain incentives among appropriators while encouraging interregional integration."[268] Following such a differentiated approach solutions to water management in Central Asia consider different "independent institutions that are organized in multiple levels of nested enterprises".[269] This approach

264 Falkenmark, Malin et al., op cit, p. 171.
265 Gleason, Gregory, op cit, p. 19.
266 Zolotarev, E., op cit, p. 14.
267 Ibid.
268 Gleason, Gregory, op cit, p. 19.
269 Ibid.

is based on the fact that institutions managing irrigation systems on a local level face other problems than water distribution agencies on the interrepublican level. Irrigation administration, for example, is concerned with the monitoring of commitments of the water appropriators (farmers), whereas on a higher level water administration deals with the river basin water balance. [270]

On the lowest level, there would be a system of management based on diverse (more or less) independent local institutions, solving the problems of monitoring, enforcement and local governance. This would mean a more autonomous canal administration and water district (irrigation system) administration with local participation in order to manage conflicts within irrigation systems. On an intermediate national level, water committees would provide the legal framework for water use and distribution (e.g. standard water pricing system).

On a second level, these institutions need to be nested into larger organizations that serve a whole river basin independent of particular state interests. Such organizations already exist in the form of the already mentioned river basin water agencies (BVO), although without all the necessary competencies for monitoring and enforcement. Such institutions would also be appropriate to manage river basin conflicts between up- and downstream users.

On the third level, we would find an interrepublican water distribution institution with

a) the Intergovernmental Coordination Committee for Water Supply (ICCWS) for the two BVO's to solve transbasin conflicts and interrepublican up/downstream conflicts;

b) a coordination committee for the specific problems in connection with the desiccation of the Aral Sea (as proposed by the World Bank), and

c) an agency setting sectoral priorities in order to maintain the balance between agricultural and industrial development, crop diversification, and farm employment.

5.4.2. Institutional arrangements on a local level

Traditional water institutions in Central Asia were largely successful in monitoring and maintaining water distribution systems on a local level.[271] Before the sovietization of Central Asia in the 1920s, every clan had its water master (*mirab*) elected from the most honorable comrades. In every district, elders discussed water distribution and settled conflicts. The office of the water master was highly regarded and vested with considerable political power. The mirabs were independent from state institutions.[272]

270 Cf. Ostrom, Ellinor, op cit, p. 102.
271 Cf. Gleason, Gregory, op cit, pp. 11-12.
272 Cf. Ibid.; Moser, Henri: L' Irrigation en Asie Centrale. Etude géographique et économique, Paris 1894, pp. 185-189.

There is some informal social organization of the local water distribution within the canal administration in the Fergana Valley, where mirabashis or water chiefs control the water distribution on a local scale and act in an advisory capacity for the local water administration.[273]. They are often recruited from former collaborators of the canal agency but have no official representative organization, although they are socially well-accepted.[274]

Could one imagine a renewal of this old tradition? Although a more sophisticated management coordinating the interrepublican water allocation is now necessary, nevertheless, some of the ancient principles of common water law are quite remarkable.[275]

The privatization of water rights would require relatively autonomous irrigation agencies to operate in a generally recognized legal framework.[276] Moreover, the centralized republican authorities have been responsible for local monitoring, distribution and enforcement for a long time, burying the knowledge of traditional water administration and depriving people of the possibility for local participation. However, the new "old" administration must understand how to use local forms of collective behaviour for the benefit of all and that communal participation is more than the mere provision of manual labor.[277]

The traditional reverent attitude of Central Asian population towards water was not only a "resource fulfilling human needs but was sacred by its nature."[278] Informal moral authorities in the form of supra-economic organs could be created that would not have institutional power, but through force of their moral authority would have the capacity to regulate the functioning of new water management structures. A council of the eldest (Areopagus), recruited not only from professionals, but from the most respected and honored people, could give recommendations and thereby influence the public opinion. Zolotarev[279] imagines that such an informal lobbying could be more effective than institutional decrees. This, however, presupposes a favorable moral climate within the population.

5.4.3. Legal measures on a national level

According to Falkenmark, a functioning legal system is a necessary background for the management of water. However, water laws require time consuming and complex research in order to be adapted from the former Soviet legal system and suited for the cul-

273 According to Guldarshev, A. (personal communication 1993).
274 Ibid.
275 For example water can neither be sold nor purchased. Water appropriators are committed to irrigation systems maintenance and to helping their neighbors with the dikes and channel construction. In case of water shortage, water must be equally distributed. Every water theft is considered to be a crime and is subject to heavy sanctions. (From the customary law for water use in Russian-Turkestan by the end of the 19th century, in: Busse, Walter, op cit, pp. 55-56.)
276 Gleason, Gregory, op cit, p. 18.
277 Falkenmark, Malin et al, pp. 171-172.
278 Zolotarev, E., op cit, p. 14.
279 Ibid., p. 15.

tural and political climate of the countries.[280] A new water codex, recently adopted in Kazakhstan, and expressing a re-centralization of water administration under state authority, has been criticized for being just a copy of the old one.[281] Among the regulative functions of this codex, we can emphasize the rational utilization for the needs of the population, the economy and the environment; water protection measures from pollution and the prevention of harmful effects of intoxicated waters; as well as the improvement of the legal structure and the legal protection of citizens, enterprises, administrative institutions and organizations in the field of water relations. The water resources in Kazakhstan (and also in the other republics) are an exclusive state property. The purchase and sale of water are strictly forbidden. The right of ownership of water resources of Kazakhstan is realized by the Supreme Council and the local councils in the framework of the national water codex.[282]

5.4.4. Intraregional cooperation with neighboring states

5.4.4.1. Central Asia and international water law

A possible approach on a regional level is the reinforcement, respectively the introduction, of international river law with the fundamental principle of equitable utilization of shared water resources among different states. This "fair-share" concept of equitable utilization of water resources implies that "benefits are balanced by cost or damage incurred on other co-basin states."[283] The goal of this principle is to satisfy the needs of riparians of the same river basins to the greatest extent possible and to minimize their damages. This doctrine is expressed by the Helsinki Rules on the Uses of the Waters of International Rivers, elaborated by the International Law Association (ILA) and adopted in 1966. Article IV of the Helsinki Rules says that states are entitled "to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin".[284] What equitable means in each individual case must be determined in the light of all relevant facts and circumstances.[285] Consequently, there is no blueprint of existing joint river commissions or treaties that could be simply transferred to Central Asia.

The principle of equitable utilization does not necessarily fix a status quo, but may also change an existing apportionment of the water resources. According to the commentary to the Helsinki Rules, an existing use may be replaced by a new use in order to achieve an equitable utilization of shared water resources. This may be the case, if a co-riparian wants to amplify its water utilization (e.g. for hydropower), requiring other states to modify their own water utilization (e.g. through a modernization of irrigation practices).

280 Falkenmark, Malin et al, op cit, p. 172.
281 See Ecokur'yer 24.9.92, p.6.
282 Soviety Kazakhstana 7.8.93, full text of the codex (draft) in: Kazakhstanskaya Pravda 13.8.92.
283 Falkenmark, Malin et al, op cit, p. 127.
284 Cited from Gleick, Peter H. (ed.), 1993, p. 98.
285 Ibid.

Another basic rule referring to river pollution declares that a state may not, through its actions affecting an international watercourse, significantly harm other states. This principle is often subsumed to the equitable use principle, though.

5.4.4.2. The River Basin Enterprises (BVO)

In order to cooperate on the basis of the fundamental river law principles, the co-basin states often establish an international joint river-basin commission.[286] With independence and the emergence of an international river basin, the need to implement internationally approved law principles is also recognized in Central Asia itself.[287] In 1992, the Central Asian states signed a water agreement creating a joint coordination committee consisting of the water ministers of the five republics. This committee controls the activities of the river basin enterprises (BVO). These institutions show a considerable lack of compulsory jurisdiction and centralized enforcement unlike many international agreements in the world. The World Bank states in a strategy paper that "despite the water agreements signed after the independence of the republics, the potential for future water disputes cannot be ignored. Comprehensive planning and management of water resources of Amu and Syr Rivers should receive high priority, both for using the resources efficiently and for improving regional cooperation in sharing the resources."[288]

The Central Asian states particularly need a know-how transfer concerning the legal basis of international river basins, the organization of water management on different levels, the relationship between state and water resources (privatization of water administration) and between water and appropriators (water pricing).

Since the independence at the end of August 1991, the Central Asian republics have tried to find an equitable water distribution system to replace the defunct Soviet system. Already in February 1992, the five republics came to a water distribution agreement "for the cooperation in the field of water management to use and protect water resources from international sources," including the creation of an intergovernmental coordination committee controlling the water use and monitoring water pollution.[289]

The first article of the agreement determines the equitable use of the water resources, as well as the mutual responsibility for a rational utilization and protection based on the common feature and unity of the region's water resources. It is remarkable that the Aral Sea is admitted as the sixth water recipient in the region - after the five republics - and is granted a defined minimum inflow (Art. 4).

The joint coordination committee (Art. 7 and 8) consisting of the water ministers of the five republics, meets four times a year or when disputes or claims among the republics

286 Falkenmark, Malin et al, op cit, p. 126.
287 Novy Den' 1/1993 p. 3.
288 The World Bank: The Aral Sea Crisis. Proposed Framework of Activities, 1993, p. ii.
289 Russian version of the agreement in : Ekokur'yer 26.3.93, p. 2.

arise. The BVO (Art. 9) is the operative organ of the committee and puts the joint decisions into action.

The share of water allocation is based on Soviet quotas that are still in force. The quotas are defined by country, total area, period, time of allocation, canals, and irrigation systems. On the basis of the quotas, an allocation plan is elaborated every year by the BVO. The plan allows deviations of +/- 10% from the plan. This makes it possible for a state to claim less than the guaranteed quota in one year while getting more another year according to its needs.[290]

The European Bank for Reconstruction and Development (EBRD) criticized the agreement, for not reflecting the interests of countries like Afghanistan, China and Iran, since they are linked with the river basins of Central Asia.[291] Furthermore, the agreement has no binding legal value. An increasing nationalization of water distribution facilities already demonstrates its ineffectiveness.

Nevertheless, the water agreement could encourage cooperation in the field of water distribution. The preamble, referring to the common interest of the republics to solve the water questions and the related ecological devastations, shows that this agreement is not only a technical one. It states that only unification and coordination of actions allow the creation of favorable conditions to solve socioeconomic problems and to relieve ecological stress in the consequences of water misuse.

One of the most promising approaches for improving interrepublican water distribution and coordination of macro and sector policies of the republics would be the reformation of the existing Intergovernmental Coordination Committee for Water Supply (ICCWS) toward a permanent interrepublican organ analogous to existing joint river commissions by a state treaty, and secondly a reinforcement of its operational agencies, the river basin enterprises (BVO), regulating the water distribution of the basins of Syr Darya and Amu Darya.[292] The BVOs were created in 1988 in order to supervise the limitations of interrepublican and intersectoral water distribution and to control the rational use of the water appropriators.

The success of regional cooperation in the field of water management depends on the effectiveness of the ICCWS and the BVOs, their technical excellence, reliable forecasting and comprehensive water management, their abilities to build consensus and resolve disputes, and also on the republics' confidence in their objectivity and independence. However, the BVOs are at present not adequately equipped to fulfil these tasks effectively.[293] For example, not even all of the hydrotechnical installations are under their supervision and control; some remain under national control. Furthermore, the BVO's lack a

290 According to the director of BVO Syr Darya, Makhmud Khamidov (personal communication 1993).
291 Novy Den', zero number March 1993, p. 3.
292 Cf. Dukhovny, V., 1990, op cit, p. 5.
293 The World Bank, op cit, p. iv.

hydrometeorological network in their basin (the official State Committee for Hydrometeorology [Goskomgidromet] is often not reliable).[294] Therefore, their technical and institutional capacities have to be strengthened.

Technical investments have to focus on the modernization of systems, facilities, and equipment: completion of the automatized system of water distribution and monitoring, computer centers, laboratories for monitoring water quality and hydrological measurement networks, as well as technical assistance and staff training.

Institution-building should concentrate on the reformation of the BVOs from an interrepublican to an international organization based on a state treaty between the five republics.[295] The creation of further BVOs (e.g. for the Zeravshan River which is also an international river)[296] and the full integration of the Aral Sea as an international water body into the distributional concept of the BVOs[297] are also essential for an effective functioning of a comprehensive water management.

5.4.4.3. Regional and international cooperation to save the Aral

Over 300 resolutions and agreements - partly with foreign contribution - have been signed since the end of the 1980s without reaching any major improvement in the Aral region

In March 1993, the heads of state of the five republics convened in the Kazakh town of Kysyl Orda to sign a non-binding agreement on "common actions to solve the problems of the Aral Sea and the adjacent territories, on the sanitary recovery and the socioeconomic development of the Aral region".[298]

In the preamble, the agreement not only acknowledges the ecological danger for the local population, but also the negative consequences for other regions in the Aral basin, especially due to changed air circulation patterns.

The arrangement "recognizes" common tasks such as, the rational utilization of limited water resources to assure the socioeconomic development in the Aral region, the renaturation of complex ecosystems on the deltas of Amu and Syr Darya, and the improvement of water quality and the health situation of the local population. It urges the need for a guaranteed minimum inflow into to the Aral Sea which was already required in the water distribution document mentioned above. It is noteworthy is that the delivery of additional water resources to the Aral is still regarded as feasible.[299]

294 Lashenov, V.Ya., op cit, p. 5.
295 Chamidov, M., Director BVO Syr Darya (personal communication 1993).
296 Dukhovny, V., 1990, op cit, p. 5.
297 Cf. Pravda Vostoka 25.8.92.
298 Russian version of the agreement in: Ekokur'yer No. 8 (59) 1993, p. 1.
299 In the original text:"Renewal of projects for the delivery of additional water resources to the Aral Sea basin on the basis of newly elaborated mutually accepted conditions." Some of these new projects after the rejection of the "Sibaral" are discussed in chapter 5.2.1.2.

To coordinate the activities, the conference participants decided to create an Interrepublican Council for the Problems of the Aral Basin. The Russian Federation will have an observer status in the council and will cooperate in the field of technical and scientific assistance.

In a resolution "On the International Fund to Save the Aral"[300], the republics were asked to allocate 1% of their state budgets annually for the alleviation of the consequences of the desiccation of the Aral Sea.

A follow-up conference took place in August 1993 in the Karakalpakian capital of Nukus to arrange the financial questions of the agreement. The effectiveness of this new agreement is in question because Turkmenistan signed neither the accord nor participated in the second conference because it is unwilling to make financial contributions. Tajikistan is not in the position to make financial commitments, either. Furthermore, the financial commitment is probably too large for some of the poorer countries like Kyrgyzstan. Additionally, the five republics count on the assistance of the world community expressed in a message to the UN secretary general.

International approaches to alleviate the water crisis in Central Asia have to date focused on the epicenter of the ecological catastrophe: the Aral Sea.

Since 1990, several international organizations have started evaluation of projects in the region. The United Nations Environmental Program (UNEP) signed an agreement with the then Soviet government in 1990 for assistance in preparing an action plan for the rehabilitation of the sea. The organization created an international experts working group to provide information about the ecological, epidemiological and socio-economic situation in the Aral Sea basin. The goal of the working group was to develop an action plan for the basin's rehabilitation.[301] In September 1992, UNEP presented its recommendations with estimated costs of $212 Mio.:[302]

- Short-term actions: Improvement of sanitation and health services, end of direct discharge of polluted water into rivers.
- Medium-term actions (2-10 years): Rebuilding of the irrigation and water supply systems, new agricultural technologies and methods.
- Long-term actions: Radical change in attitudes to farming and land use in the entire area.

In 1993, the European Bank for Reconstruction and Development (EBRD) sent a fact-finding mission to the Aral region. The Bank favors a regional approach, while developing the region and not encouraging migration. EBRD is also ready to give financial assis-

300 Full text in: Ekokur'yer No. 8 (59) 1993, p. 2.
301 Micklin, Philip, 1992, op cit, p. 108; Glantz, Michael H./Rubinstein, Alvin Z./Zonn, Igor, op cit, p. 190.
302 Perera, Judith: A sea turns into dust, in: New Scientist 23. October 1993, p. 27.

tance to the completion of the work of river basin enterprises. Its program focuses on the stabilization of the Aral Sea and the development of the Aral region (health, water supply, labor opportunities, restoration of the deltas' environment).[303]

Fundings may also come from the World Bank through its Global Environment Fund (GEF). In a recent report, the World Bank proposed a regional program for possible international support:

A) Stabilization of the Aral Sea on a sustainable level.

B) Rehabilitation and development of the Aral Sea disaster zone.

C) Strategic planning and comprehensive management of the water resources of the Amu and Syr Darya.

D) Building of institutions for planning and implementing the above program.[304]

The stabilization of the Aral Sea (point A) would include undertaking hydrological studies for simulating current and future water balances and evaluating their impact on the dimensions of the Aral Sea and its water quality, on the environment and the productivity of the sea; the identification and preparation of projects necessary to improve the productivity and the environment of the sea.

The second issue (point B) focuses on improving the depressed economy and the living conditions of the people through the rehabilitation of existing infrastructure facilities (water pipelines, sewerage works, pumping stations, drainage works for salt water lakes within the zone, etc.), development of community water purification systems, health programs, and improvement of the environment. The requirements for points C) and D) are already been discussed in chapter 5.4.4.2.

To implement the program, the World Bank suggests a 3 phase Aral Sea Environment Assistance Plan (ASEAP) that would be realized over 15-20 years. According to the World Bank, ASEAP is not a relief plan but a development plan and will be designed to meet the normal criteria for economic justification. This limitation has been criticized by UNEP, reproaching the World Bank for seeking investment opportunities instead of developing an environmentally sound action plan. UNEP fears that the republics may not commit themselves to such a loan.[305]

The existing organizations of the ICCSW and the BVOs will be responsible for the planning and implementing of the programs A (without physical work) and C. A new regional organization will be established for planning and implementing program B and the physical work of program A. (Intergovernmental Coordinating Committee for the Aral

303 Novy Den' Nr. 0/1993.
304 The World Bank, op cit, p. ii.
305 Perera, Judith, op cit, p. 27.

Sea [ICCAS] and the Aral Sea Environment Commission [ASEC] analogous to ICCSW and BVO).[306]

The implementation of the first phase of ASEAP would require $50 million from bank loans and grants financed by GEF, UNDP, EU, EBRD and eventually UNEP.[307]

Other research projects are currently carried out by the Russian Academy of Science, Moscow; the Aral Research Coordination Center, Moscow; (sponsored by UNEP); the Kyoto University, Japan; Unesco and many others.

The degradation of the environment is too serious to delay action. According to the World Bank, there is sufficient information to proceed with identification and preparation of programs. The urgency of undelayed action requires a clear priority setting regarding temporal (short-, medium- and long-term measures), sectoral (agriculture, industrial development), and regional priorities (directly affected regions, regions with corollary impacts). Furthermore, foreign aid should differentiate between the problems that require coordinated actions at the regional level, and those that are country specific and should be carried out by the republics as national programs.[308]

Another difficulty in implementing programs is the multiplication of partners. Before the breakup of the Soviet Union, programs were arranged between the organizations and Moscow.[309] Today substantial commitments by the five republics are necessary (1% of the budgets to the Aral fund as adopted at the Aral conference in Kysyl Orda in March 1993) and will probably promote the assistance from outside donor countries or international organizations.

Non-governmental organizations such as the "Committee to Save the Aral" in Tashkent founded by the Uzbek Writers' Union, could play an important role in coordinating foreign assistance, defining the needs, and informing the local population. Reliable organizations should be promoted and empowered, in order to fulfil their important tasks.

6. Conclusions and prospects

The water crisis in Central Asia is mainly a direct consequence of the massive expansion of irrigated cotton monocultures under the directives of the Soviet centralized economy. The desiccation of the Aral Sea is only the most obvious manifestation of the overall degradation of the traditional living space of the rural population and natural ecosystems along the main rivers.

Water resources were "nationalized" by the five successor republics which shows that independence is no guarantee for an improved ecological situation. The social and eco-

306 The World Bank, op cit, p. v.
307 The mission report of the World Bank urges for a joint sponsoring of ASEAP together with UNEP (The World Bank, op cit, p. v).
308 The World Bank, op cit, p. ii.
309 Perera, Judith, op cit, p. 24.

nomic crisis facing all the republics is not likely to foster respect for their own environment, let alone for the ecological problems in the Aral Sea region. In the foreseeable future, the republics will increasingly focus on their national development program including water management, reclamation of new irrigation lands, crop diversification, optimization of hydropower production and food requirements for their growing population. Their water demands may then differ significantly from the current allocation based on the former Soviet quotas. If no equitable water utilization plan can be found, different national water priorities will lead to conflicts of interests and water disputes. The competition for scarce water resources will then become a key factor in carrying out conflicts and shaping interrepublican cooperation in Central Asia.

Where can we expect environmentally induced conflicts in Central Asia? Prospects for environmental conflicts are based on general assumptions of the possible interrelatedness between the environmental situation and the main conflict fault lines. So shortly after independence from a closed political system, the data base of water disputes in Central Asia is still too small for a clear analysis of all the mechanisms between environment, society and conflict. Nevertheless, some conclusions can be drawn from the actual environmental (especially water) management problems between the newly independent states of Central Asia.

Conflicts with a contributing environmental factor may occur on different political levels. Water disputes on the interrepublican level are probably controllable, as long as the demographic and economic pressures do not become unbearable. In such a case, political leadership could be tempted to take violent control over water resources or to utilize a water dispute as a pretext for ethno-territorial claims triggering clashes between different ethnic groups. Especially susceptible is Uzbekistan which has no control over water resources but has large minorities in the countries which wield the water power.

Rapid population growth will require an expansion of the regional economy in order to provide employment opportunities and food crops mainly for the rural population. Given the deplorable economic situation in most of the countries arable land will become even more precious. The Turkmenistan example shows that an extension of the current irrigation area can become a national development strategy even regardless of the overall water scarcity.

Acute conflicts over the distribution of water and soil resources are likely to occur on the subnational level within irrigation systems existing along conflicting ethnic or tribal fault lines, together with other stress factors like economic depression, high rural population density, and unemployment. Conflicts could arise in regions with a latent susceptibility for ethnic and social strife, like most of the densely populated piedmontal regions from Bukhara to Fergana, and not necessarily in the most affected regions like Karakalpakia.

However, the classical up-downstream situation could be tempered by the Aral Sea as a common regional resource, whose degradation affects all countries to some degree. The

legacy of the Aral Sea problem could also be a chance for an enforced regional cooperation and serve as a confidence-building measure for other contentious questions.

In seeking for solutions, small and simple solutions that are adapted to the social and ecological needs of the region are preferable to huge projects such as the diversion of Siberian rivers or the pumping of waters from the Caspian Sea.

Short-term foreign assistance should concentrate on improving the living conditions of the directly affected population and the environment in the deltas of the Aral Sea. Foreign experience with international river and water management should allow a know-how and technology transfer to reinforce the work of already existing interrepublican water distribution and monitoring organs and to promote the activities of NGOs in the fields of aid coordination and public relations.

Medium and long-term measures should cover the entire region. Such a development would include measures for crop diversification, land-use reforms, privatization, water pricing system, and reduction of the birth rate. Since after the abolition of the Sibaral Project one way to alleviate the menacing water shortage is to improve water utilization efficiency. This can be done by introducing economic incentives like water pricing or by technical means like improving collector-drainage and reducing losses from canals. Efficiency can also be improved by growing crops that require less water. This would also improve the regional food supplies. However, implementing the necessary water saving measures will be costly and complicated. The perspectives for land reform with privatization are gloomy because of political and social obstacles. Moreover, cotton is likely to remain the main cash crop in the region because of its persisting economic importance.

Politically, water management will be confronted with the dichotomy of re-centralization versus the revival of local participation in the monitoring of irrigation systems. Such diverging interests could be surmounted with a system of "encapsulated" enterprises on different political levels, stretching from autonomous local irrigation system administration to interrepublican directive organs for strategic water distribution. The re-introduction of local responsibility for monitoring and control of water distribution could promote social control over the distribution of water and the respect for the precious resource.

For these solutions to become reality is not necessarily a question of know-how and finance, but one of political will of the five republics. The interrepublican obstacles for cooperation cannot be ignored. Ethnic and nationalist rivalries as well as the economic crisis after the disintegration of the USSR jeopardize the search for a collective water management. But the Aral Sea syndrome is not only a matter of Central Asia: it is an alarming signal of the human-ecological transformation taking place on the entire planet.

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