Ecological and Risk assessment aspects of the Zeravshan Transboundary River Basin water resources management

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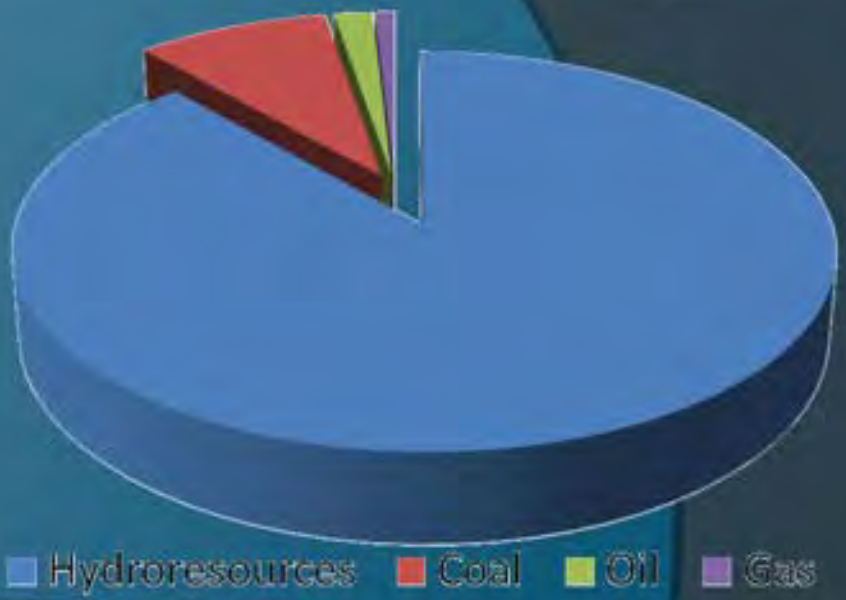
Reservoir → Microclimate → Agriculture



Republic of Tajikistan:

Hydropower resources - 527 Bln. kWt·h

Now used only - 5%

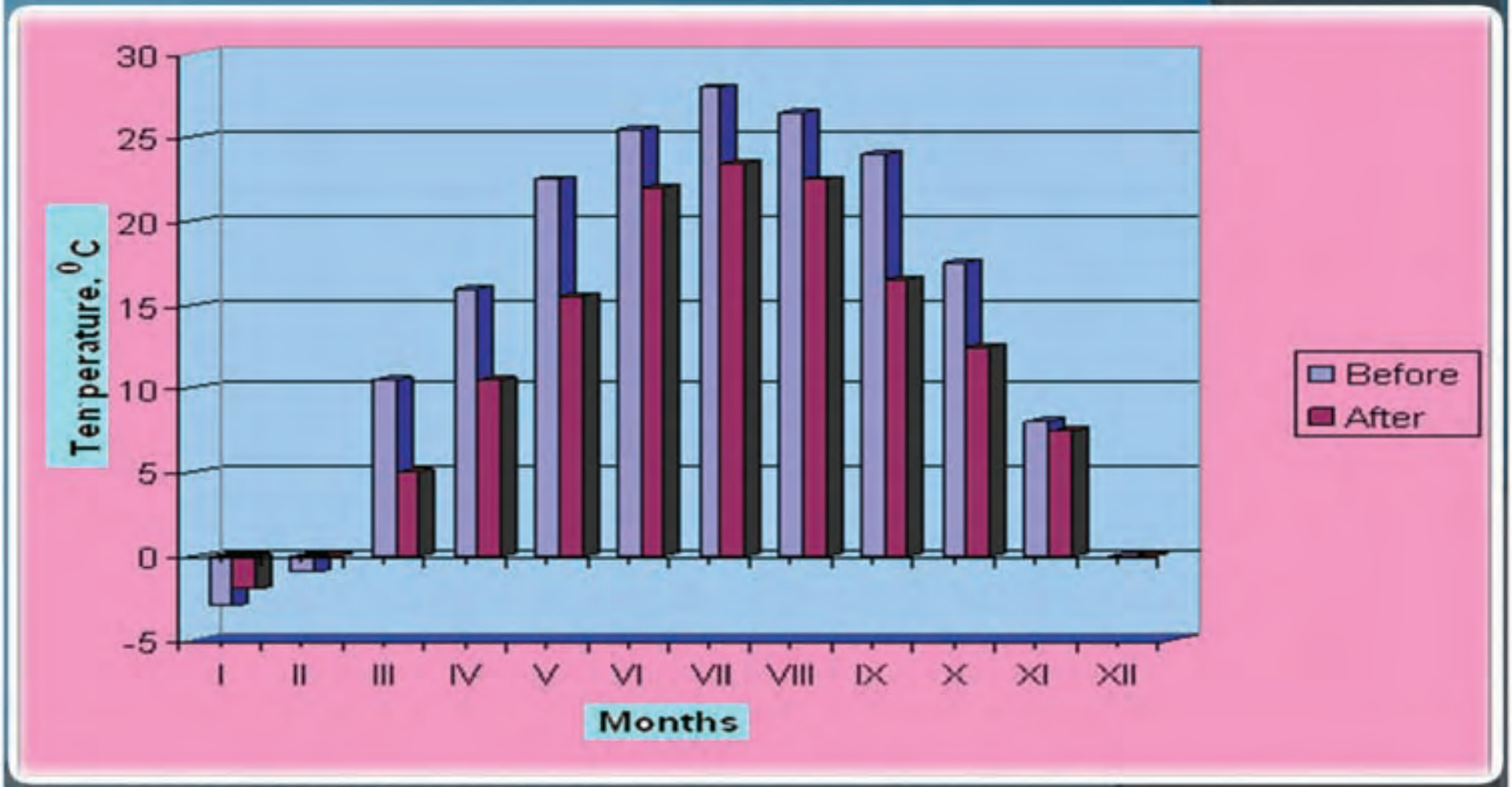
In perspective- construction many middle and large HPS with reservoirs

High potential of hydroenergy resources in Tajikistan and in Zeravshan River Basin indicated about construction in the perspective future a number of HPS with reservoirs.

For establishment influences of Reservoirs on
possible changes of Agroclimatic Resources
we spend the analyses of climatic parameters of three
districts with developed Agricultural branches
(Dangara, Fayzabad and Yavan) adjoined to
Nurek HPS with reservoirs.

District	Index	Years	
		1968-1972	1995-2000
Dangara	Temperature, C	15.3	16.4
	Humidity, %	57.0	56.9
	Precipitation, mm	570.5	598.5
	Evaporation, mm	1196.7	1438.0
Fayzabad	Temperature, C	13.2	15.4
	Humidity, %	61.6	55.2
	Precipitation, mm	709.0	675.4
	Evaporation, mm	1013.0	1258.8
Yavan	Temperature, C	17.2	16.9
	Humidity, %	47.2	50.4
	Precipitation, mm	677.4	677.3
	Evaporation, mm	1630.8	1567.5

MID-MONTHLY TEMPERATURE BEFORE AND AFTER BUILDING OF THE NUREK HPS



Impact of Nurek Reservoir and Microclimate on irrigation norm for 1968-2010

Now for cultivation of agricultural grounds still use old norms of irrigation. For example, in Tajikistan for cultivation of cotton and Lucerne the following norms of irrigation are established

- Cotton - 1100 m^3/ha
- Lucerne - 3000 m^3/ha

However during 1968-2010 meteorological conditions essentially changed

↓ T (°C)	- 0.50
↑ Humidity (%)	- 7.20
↓ Evaporation (%)	- 17.00
↑ Precipitation (%)	- 11.00

Unproductive losses of water more than

2000 m^3/ha

I. Growth of the population in Central Asia

Present - 64 Mln

2050 - 95 Mln

2075 - 103 Mln

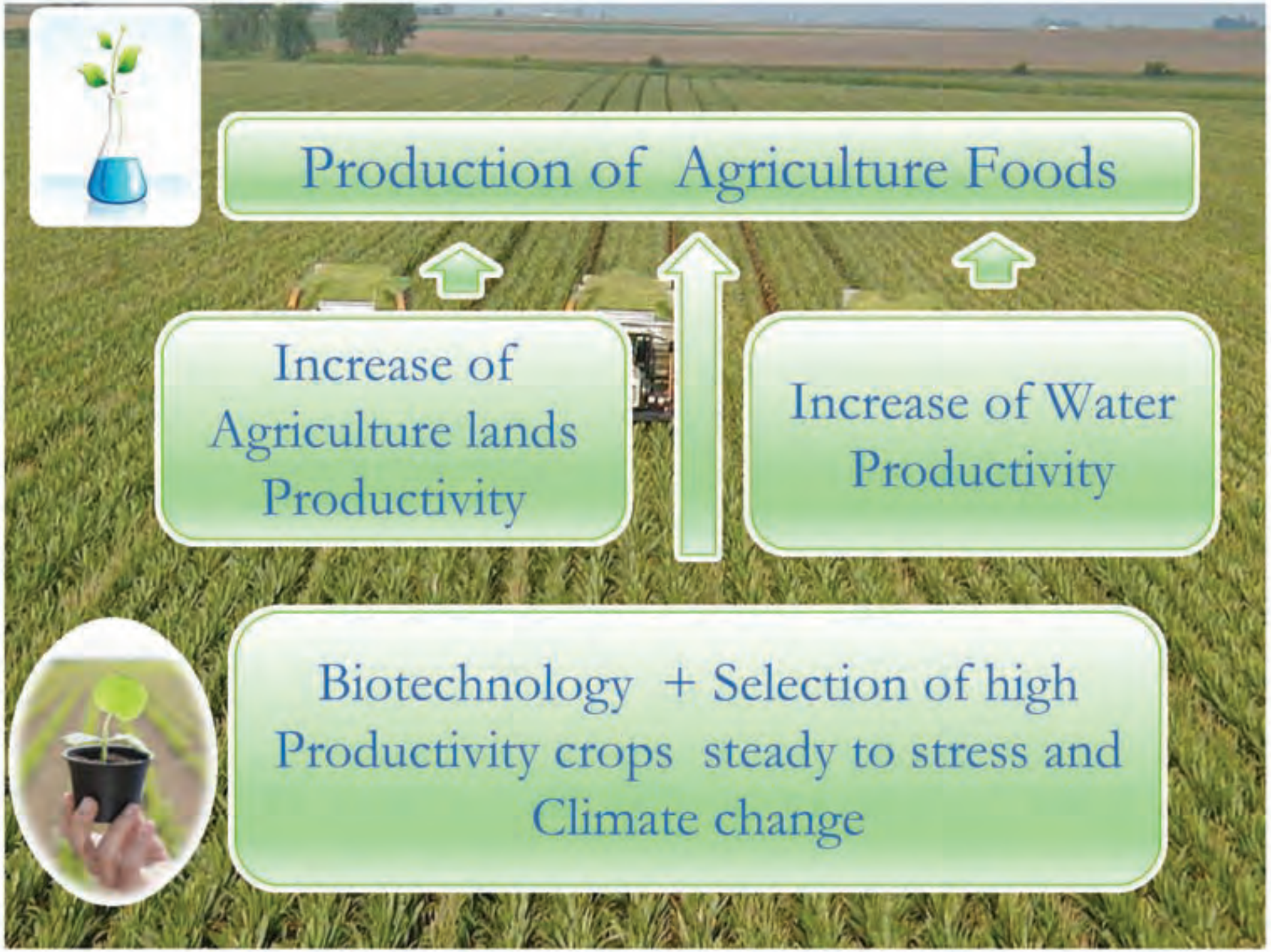
Food Safety

II. Shortage of arable lands

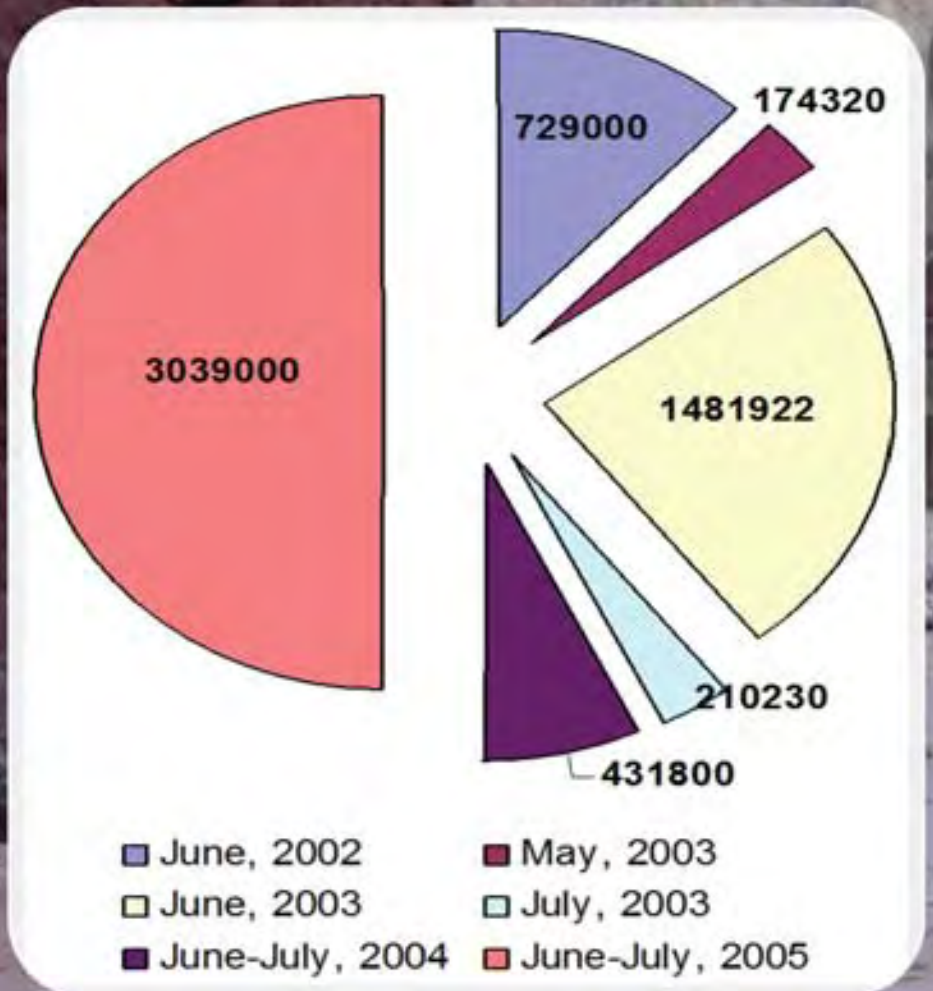
0.14 ha/ pers. -Tajikistan

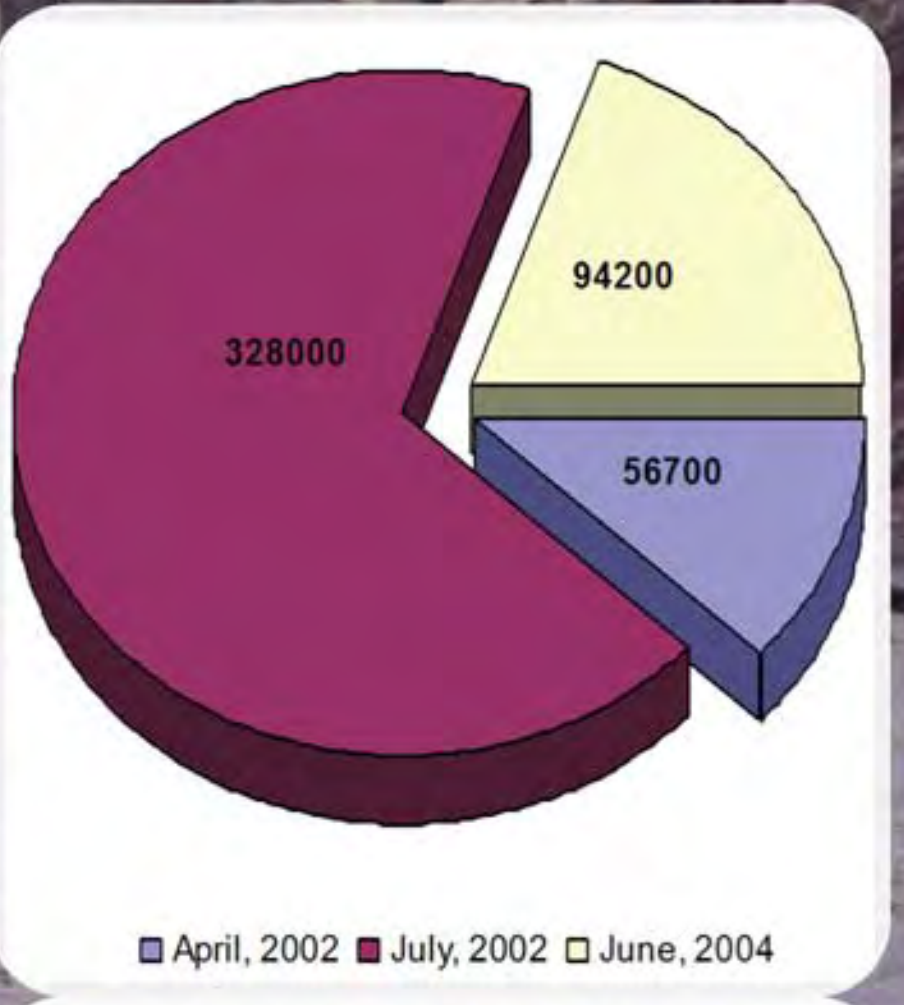
0.26 ha/pers. - Global

water reservoirs impact

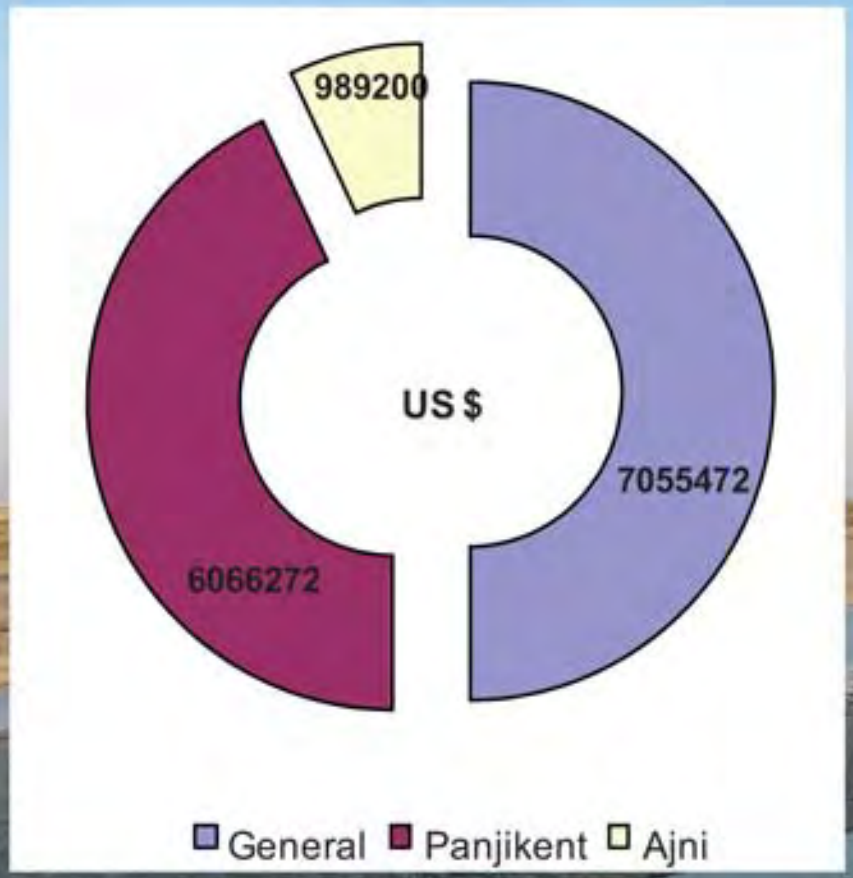

Production of Agriculture Foods
Increase of Agriculture lands Productivity
Increase of Water Productivity
Biotechnology + Selection of high Productivity crops steady to stress and Climate change

Ecological and Social-Economical Estimation of the Flood Impacts in Zeravshan River Basin

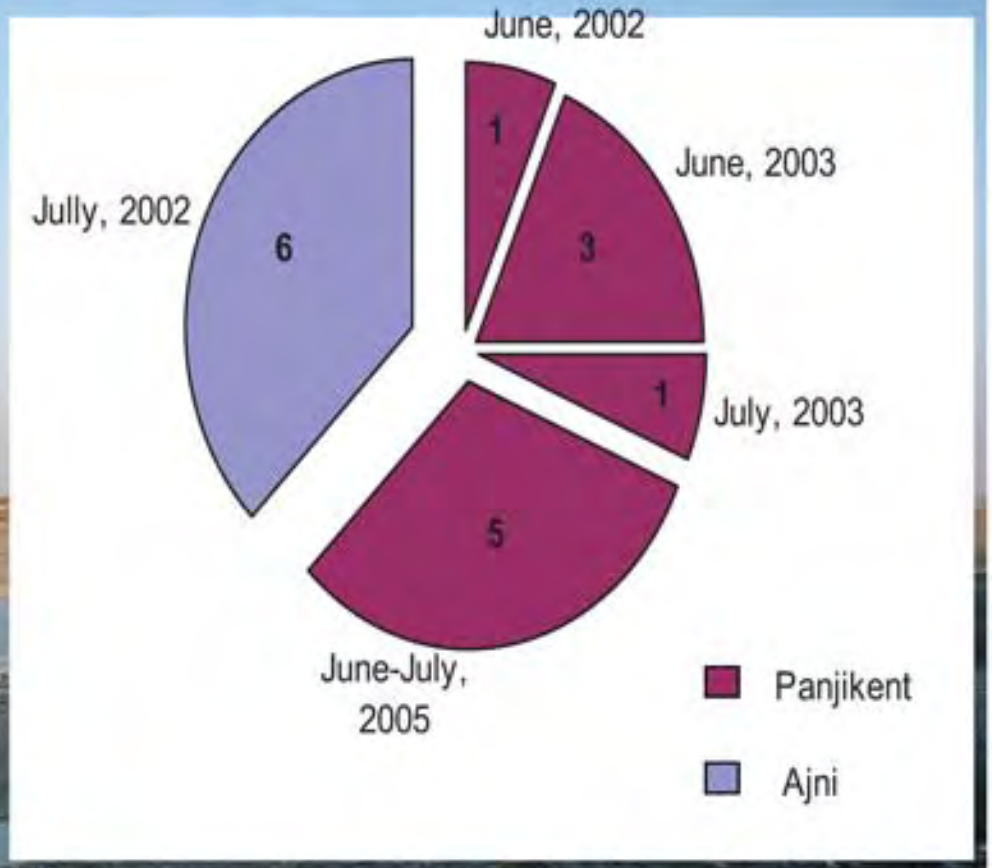




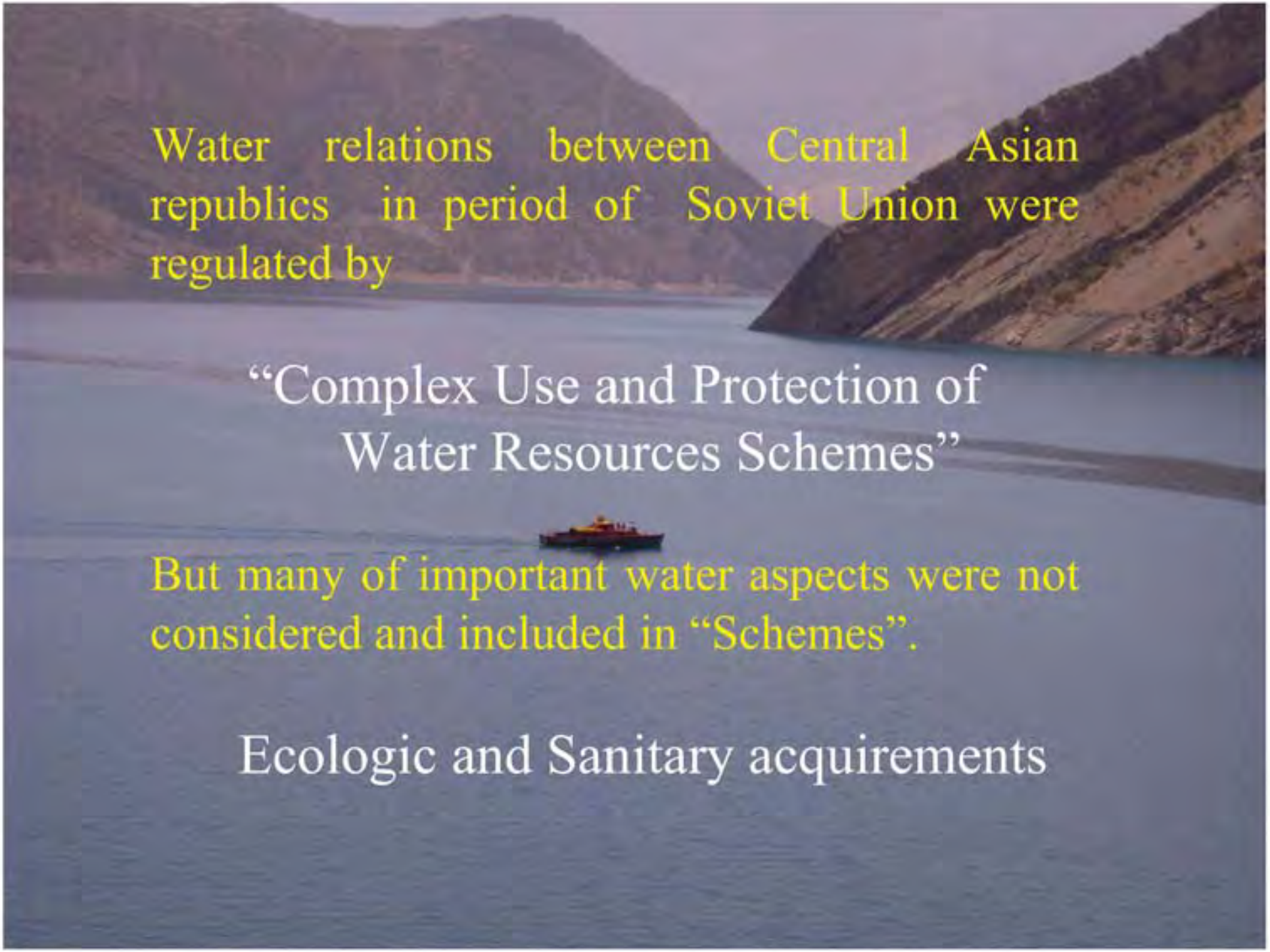
Economical damage of the Floods in Penjikent(a) and Ajni (b) (US Dollars)

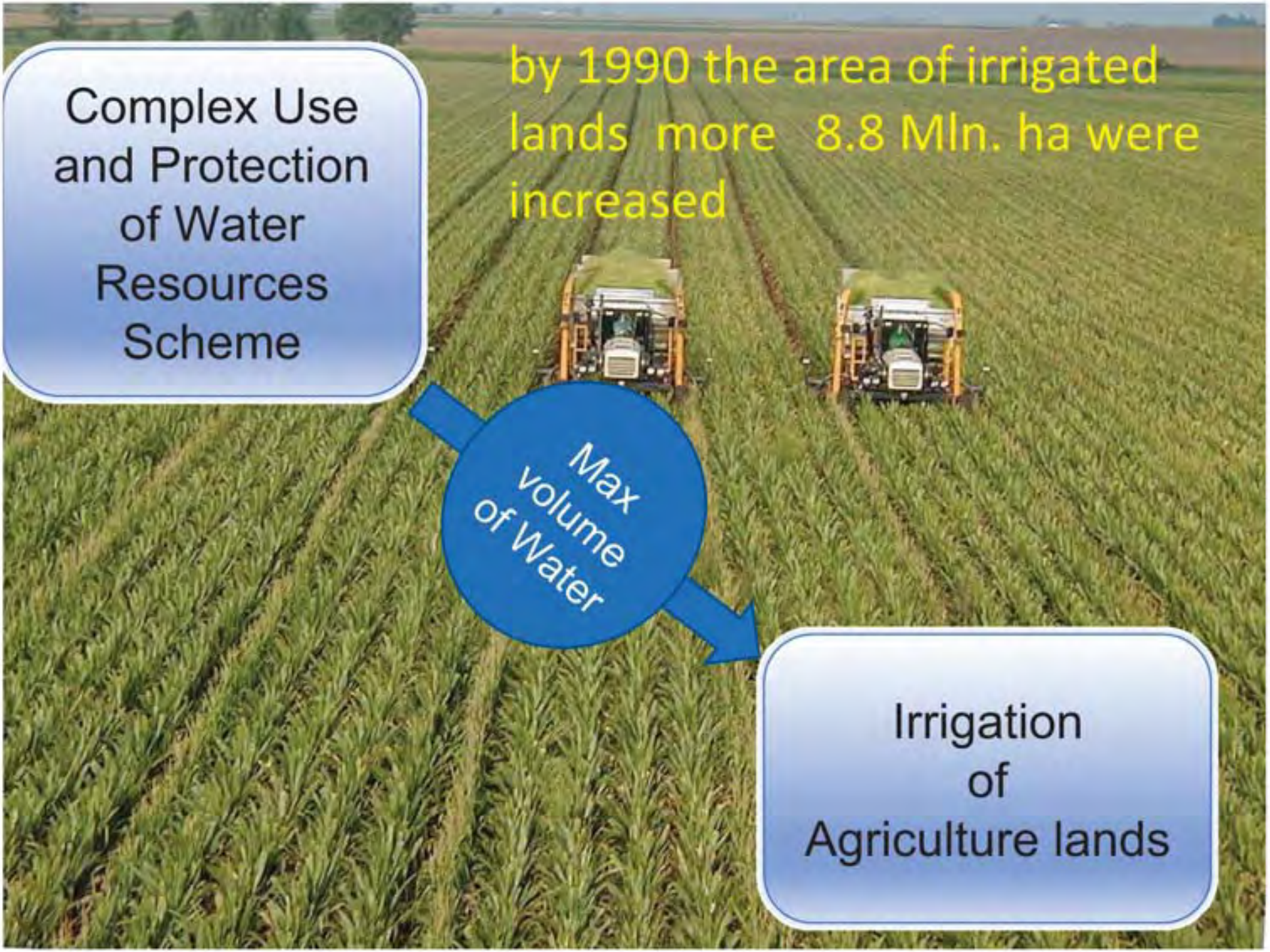


Total economical damage of Ajni and Penjikent districts in result of Floods of 2002-2005



Total human victims of flooding in Ajni and Penjikent districts (person)


Water relations between Central Asian republics in period of Soviet Union were regulated by
"Complex Use and Protection of Water Resources Schemes"
But many of important water aspects were not considered and included in "Schemes".
Ecologic and Sanitary acquirements


Complex Use and Protection of Water Resources Scheme
by 1990 the area of irrigated lands more 8.8 Mln. ha were increased
Max volume of Water
Irrigation of Agriculture lands

Problems

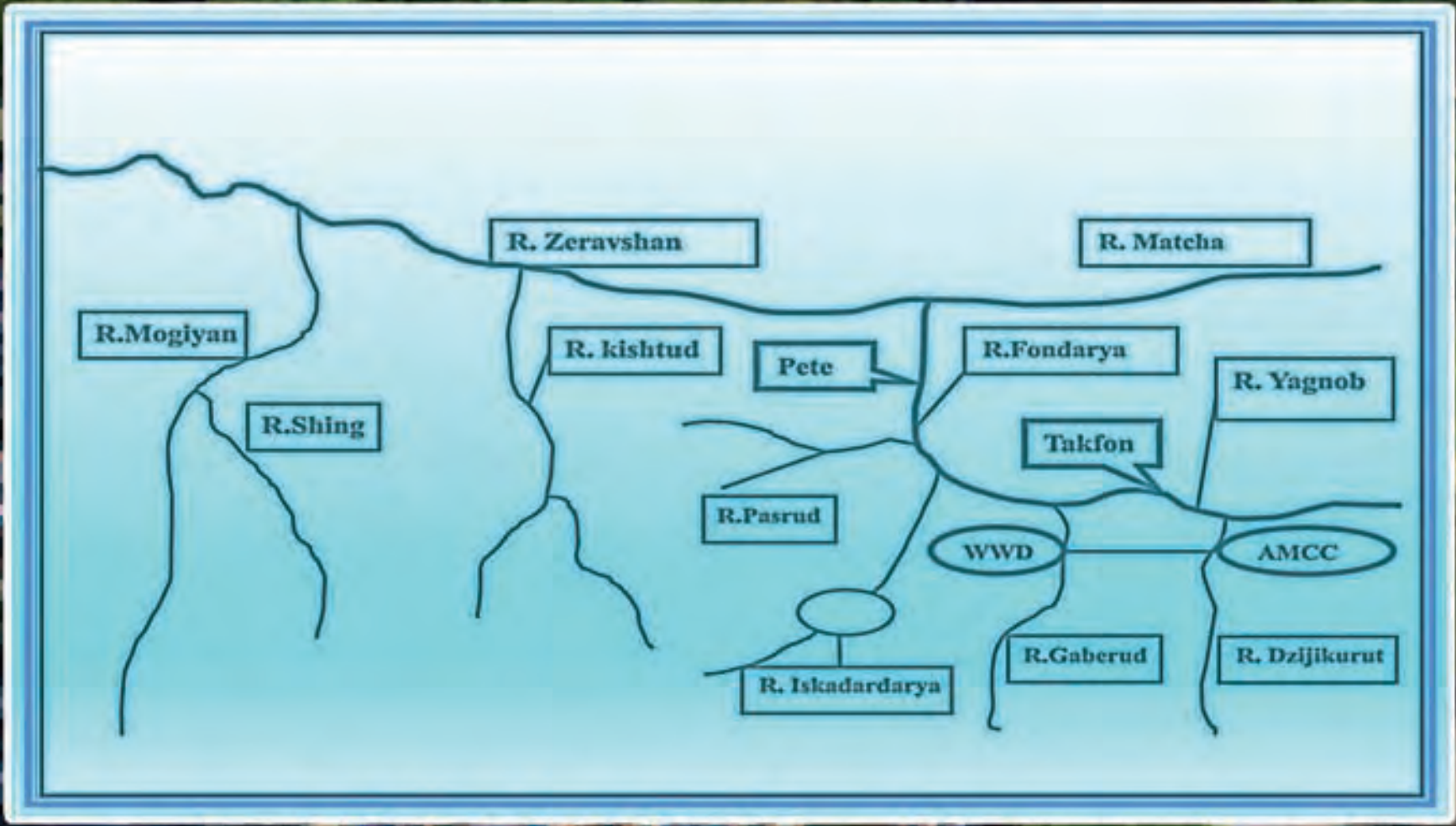
- intensity of processes of the ecological equilibrium
- desertification
- salinization
- deterioration of water quality

Aral Sea Disaster

➢Now after the statement of Republic Tajikistan about the maximum use of hydropower potential of waterways of the Zeravshan River Basin the question of water quality of the Zeravshan River in new coloring began to rise from Uzbekistan.
➢ Many consider a problem of water quality in organic communication with activity of **Anzob Mountain-Concentrating Combine (AMCC)**

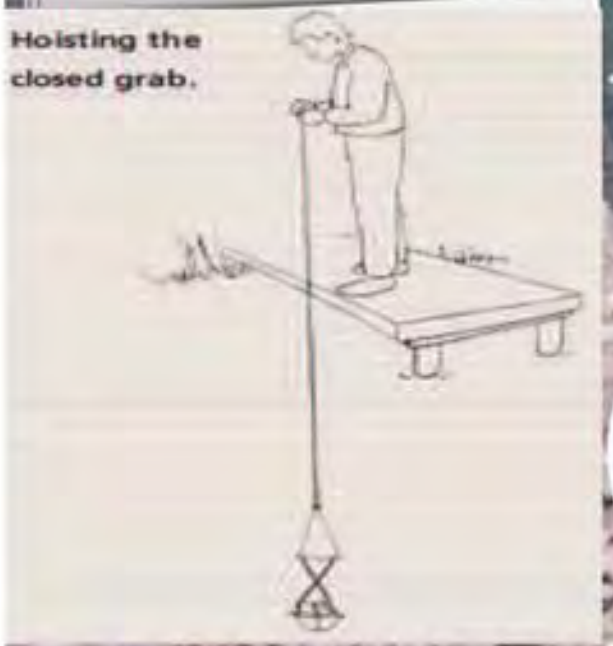
Anzob Mountain-Concentrating Combine (AMCC) the mining enterprise for extraction and enrichment of complex the mercury-antimony ores of the Dzhizhikrut deposit. Waste water dams of Combine is located in village of Ravot (8-10 km from industrial complex) on left to river bank Jagnob**.** In 2009 the industrial complex has completely restored pipelines and now dams in the complete set and works in the established mode.

For monitoring influence of the AMCIC on qualities of waters of the river Zeravshan were made sampling of water from the river in two points - on Fondarya and Pete Rivers is located accordingly before and after wastewater dams of AMCIC



CABLE OPERATED SEDIMENT SAMPLERS

Van Veen grabs



Chemical analyses of the Zeravshan river waters from point above WWD

T, C	pH	NO3	NH4	PO4	Cr(VI)	Cr(IV)	Hg	Sb	Cd	Zn
14,4	7,96	30,72	0	103,2	0,029	0	0	0	0	0,019
15,5	8,17	12,10	0	146,6	0,014	0	0	0	0	0,017
16,2	8,3	11,17	0	112,0	0,01	0	0	0	0	0,015
16,6	8,19	10,64	0	88,1	0,015	0	0	0	0	0,014
17,0	8,29	7,73	0	129,2	0,029	0	0	0	0	0,021
17,4	8,21	4,21	0	151,3	0,034	0	0	0	0	0,019
17,0	8,34	22,42	0	131,1	0,037	0	0	0	0	0,029

Chemical analyses of the Zeravshan river waters sampling from point down WWD

T, C	pH	NO3	NH4	PO4	Cr(VI)	Cr(IV)	Hg	Sb	Cd	Zn
14,2	7,96	27,68	0	102	0,03	0	0	0	0	0,02
15,3	8,17	11,74	0	147	0	0	0	0	0	0,019
15,9	8,3	10,95	0	110	0,009	0	0	0	0	0,014
16,4	8,19	9,74	0	87,4	0,014	0	0	0	0	0,013
16,8	8,29	8,04	0	127	0,025	0	0	0	0	0,02
17,3	8,21	3,34	0	149	0,031	0	0	0	0	0,015
17,1	8,34	19,3	0	132	0,035	0	0	0	0	0,025

Date	T, C	Ph	NO_3	NH_4	PO_4	HCO_3	SO_4	Date	T, C	Ph	NO_3	NH_4	PO_4	HCO_3	SO_4
16.01. 09	12,4	7,62	2,65	0	0	93,4	36	16.01. 09	12,5	7,62	2,82	0	4,46	94,6	41
13.02. 09	12,9	8,31	2,54	0	48,2	56,7	42,4	13.02. 09	13,1	8,31	2,35	0	54,28	61,3	39,8
26.02. 09	13,1	7,92	3,41	0	72,4	97,6	55,3	26.02. 09	13,2	7,92	3,13	0	69,41	74,5	57,2
14.03. 09	14,1	8,24	15,04	0	92,7	105,4	20,8	14.03. 09	14,3	8,24	14,56	0	94,38	111,3	24,6
28.03. 09	14,8	8,14	11,54	0	120	148	22,6	28.03. 09	15,0	8,14	9,96	0	124,4	136	24,5
17.04. 09	15,7	8,24	9,62	0	112	131,4	69,2	17.04. 09	15,4	8,24	11,2	0	113,2	128,6	71,1
29.04. 09	16,2	8,10	2,73	0	53	159,8	75	29.04. 09	16,3	8,1	4,36	0	57,43	158,3	78,4
26.06. 09	16,8	7,98	3,64	0	61,4	105,9	73,8	26.06. 09	17,0	7,98	5,18	0	63,41	115,7	38,3
06.07. 09	17,4	6,95	8,61	0	84,3	74,6	70,6	06.07. 09	17,6	6,95	9,16	0	79,38	79,1	67,4
31.07. 09	18,2	7,89	7,52	0	136	65,4	55,4	31.07. 09	18,1	7,89	6,62	0	142,4	68,8	51,6
14.08. 09	18,8	7,35	17,36	0	154	56,03	21	14.08. 09	19,0	7,35	21,45	0	155,6	62,47	19,9
29.08. 09	18,4	8,08	14,51	0	152	42,3	24,6	29.08. 09	18,5	8,08	14,51	0	148,1	45,34	23,9
17.09. 09	17,6	8,27	15,06	0	153	31,4	37,8	17.09. 09	17,9	8,27	17,31	0	155,2	33,24	41,8
29.09. 09	16,8	7,95	29,34	0	4,52	56,7	75,3	29.09. 09	17,1	7,95	32,23	0	6,22	53,4	69,6
16.10. 09	14,7	8,30	3,74	0	6,13	26	74,8	16.10. 09	14,9	8,3	6,12	0	8,78	31,75	75
30.10. 09	14,2	8,40	36,8	0	121	131,2	67,5	30.10. 09	14,1	8,4	38,54	0	122,1	130,7	66,3
28.11. 09	13,6	8,21	31,28	0	4,56	101,5	19,3	28.11. 09	13,7	8,21	29,18	0	7,34	102,1	22,6
06.03. 10	14,2	7,96	27,68	0	102	96,4	21,2	06.03. 10	14,4	7,96	30,72	0	103,2	97,4	25,2
17.04. 10	15,3	8,17	11,74	0	147	32,7	47,3	17.04. 10	15,5	8,17	12,1	0	146,6	33	48,1
22.05. 10	15,9	8,30	10,95	0	110	56,8	59,3	22.05. 10	16,2	8,3	11,17	0	112	52,9	56,9
11.06. 10	16,4	8,19	9,74	0	87,4	64,5	66,7	11.06. 10	16,6	8,19	10,64	0	88,1	62,5	71,1
31.07. 10	16,8	8,29	8,04	0	127	127,4	74,9	31.07. 10	17,0	8,29	7,73	0	129,2	134,6	75
12.08. 10	17,3	8,21	3,34	0	149	131,2	38,3	12.08. 10	17,4	8,21	4,21	0	151,3	97,8	33,5
06.09. 10	17,1	8,34	19,3	0	132	47,4	42,8	06.09. 10	17,0	8,34	22,42	0	131,1	49,3	40,8

Date	NO_2	F	Ca	Mg	Al	Fe	Mn
16.01. 09	0,004	0,81	38,4	21,64	0	0,11	0
13.02. 09	0	0,52	39,5	25	0,01	0,13	0
26.02. 09	0,001	0,34	37,8	23,32	0	0,24	0
14.03. 09	0	0,27	49,5	20,72	0,03	0,31	0,017
28.03. 09	0	0,19	49,2	25,1	0,07	0,16	0,03
17.04. 09	0	0,29	48,8	19,98	0,04	0,24	0,006
29.04. 09	0,013	1,1	49,6	24,6	0	0,27	0
26.06. 09	0	1,12	47,4	23,78	0,04	0,19	0
06.07. 09	0,011	0,95	36,8	24,52	0,05	0,21	0,004
31.07. 09	0	1,07	38,2	21,32	0,04	0,17	0
14.08. 09	0	0,6	31,3	19,7	0,08	0,13	0,006
29.08. 09	0,014	0,56	35,1	18,79	0,06	0,14	0
17.09. 09	0,012	0,74	41,7	23,05	0,07	0,08	0,054
29.09. 09	0	0,42	44,5	22,45	0,03	0,11	0,039
16.10. 09	0,013	0,3	36,7	25,04	0,03	0,09	0
30.10. 09	0	0,25	41,6	21,64	0,04	0,12	0,024
28.11. 09	0,011	0,18	33,8	19,58	0,07	0,06	0,017
06.03. 10	0,009	0,11	49,2	17,64	0,05	0,11	0,032
17.04. 10	0	0,009	43,8	16,54	0	0,1	0,037
22.05. 10	0,001	0,13	37,4	24,74	0,03	0,18	0,032
11.06. 10	0,007	0,26	39,6	22,53	0,02	0,24	0,005
31.07. 10	0,013	0,19	40,5	25,2	0,03	0,3	0,044
12.08. 10	0,012	0,21	42,7	23,3	0,03	0,22	0,047
06.09. 10	0,009	0,22	46,4	22,5	0,04	0,16	0,032

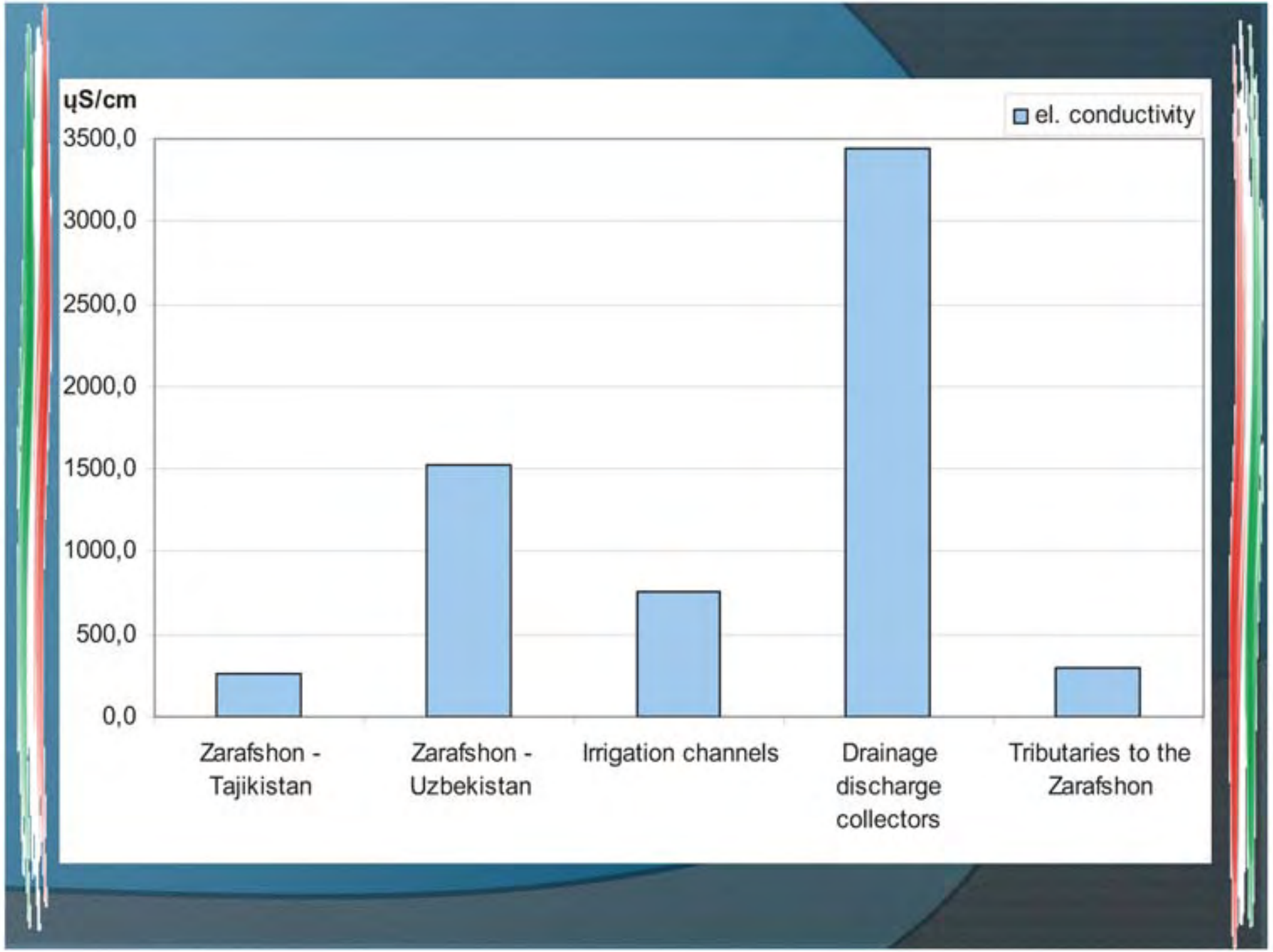
Date	NO_2	F	Ca	Mg	Al	Fe	Mn
16.01. 09	0,006	0,77	39,1	20,72	0	0,13	0,011
13.02. 09	0,002	0,62	36,5	23,43	0	0,15	0,01
26.02. 09	0	0,26	38,2	13,64	0,02	0,27	0
14.03. 09	0	0,31	46,8	16,73	0,03	0,19	0
28.03. 09	0	0,24	45,3	17,41	0,04	0,17	0
17.04. 09	0,013	0,19	47,3	21,83	0,03	0,26	0,009
29.04. 09	0	0,29	44,6	23,82	0	0,25	0,004
26.06. 09	0	1,02	48,2	22,65	0,04	0,22	0,001
06.07. 09	0,012	1,15	35,6	23,74	0,04	0,24	0,008
31.07. 09	0,001	1,12	36,1	13,91	0,04	0,16	0,001
14.08. 09	0	0,69	29,6	17,81	0,08	0,14	0,042
29.08. 09	0	0,61	33,8	19,92	0,07	0,13	0,041
17.09. 09	0,009	0,79	40,3	22,83	0,08	0,09	0
29.09. 09	0	0,58	42,4	21,75	0,03	0,15	0
16.10. 09	0	0,28	35,8	26,31	0,03	0,11	0,021
30.10. 09	0	0,18	43,7	23,43	0,02	0,1	0,034
28.11. 09	0	0,21	36,7	21,54	0,04	0,1	0,019
06.03. 10	0	0,17	49,8	13,71	0,06	0,13	0,034
17.04. 10	0,009	0,01	42,3	16,92	0,02	0,12	0,032
22.05. 10	0,0014	0,14	38,6	25,13	0,03	0,22	0,036
11.06. 10	0,008	0,28	39,9	23,09	0,02	0,26	0,037
31.07. 10	0	0,23	41,3	26,11	0,03	0,29	0,005
12.08. 10	0,011	0,2	43,7	24,1	0,03	0,21	0,049
06.09. 10	0,001	0,24	47,2	21,9	0,05	0,18	0,034

Date	Cu	Cr(IV)	Cr(VI)	Hg	Cd	Zn
16.01. 09	0	0	0	0	0	0
13.02. 09	0,09	0	0	0	0	0,07
26.02. 09	0,01	0	0,024	0	0	0,04
14.03. 09	0	0	0,032	0	0	0,06
28.03. 09	0,08	0	0	0	0	0,01
17.04. 09	0,09	0	0	0	0	0,02
29.04. 09	0,11	0	0	0	0	0,03
26.06. 09	0,08	0	0,02	0	0	0,04
06.07. 09	0,078	0	0,018	0	0	0,09
31.07. 09	0,062	0	0,021	0	0	0,08
14.08. 09	0,013	0	0	0	0	0,06
29.08. 09	0,064	0	0,016	0	0	0
17.09. 09	0,057	0	0,03	0	0	0,05
29.09. 09	0	0	0	0	0	0,03
16.10. 09	0	0	0,04	0	0	8
30.10. 09	0	0	0,017	0	0	0
28.11. 09	0	0	0,027	0	0	0
06.03. 10	0,075	0	0,03	0	0	0,02
17.04. 10	0,064	0	0	0	0	0,019
22.05. 10	0	0	0,009	0	0	0,014
11.06. 10	0,059	0	0,014	0	0	0,013
31.07. 10	0,043	0	0,025	0	0	0,02
12.08. 10	0,073	0	0,031	0	0	0,015
06.09. 10	0,054	0	0,035	0	0	0,025

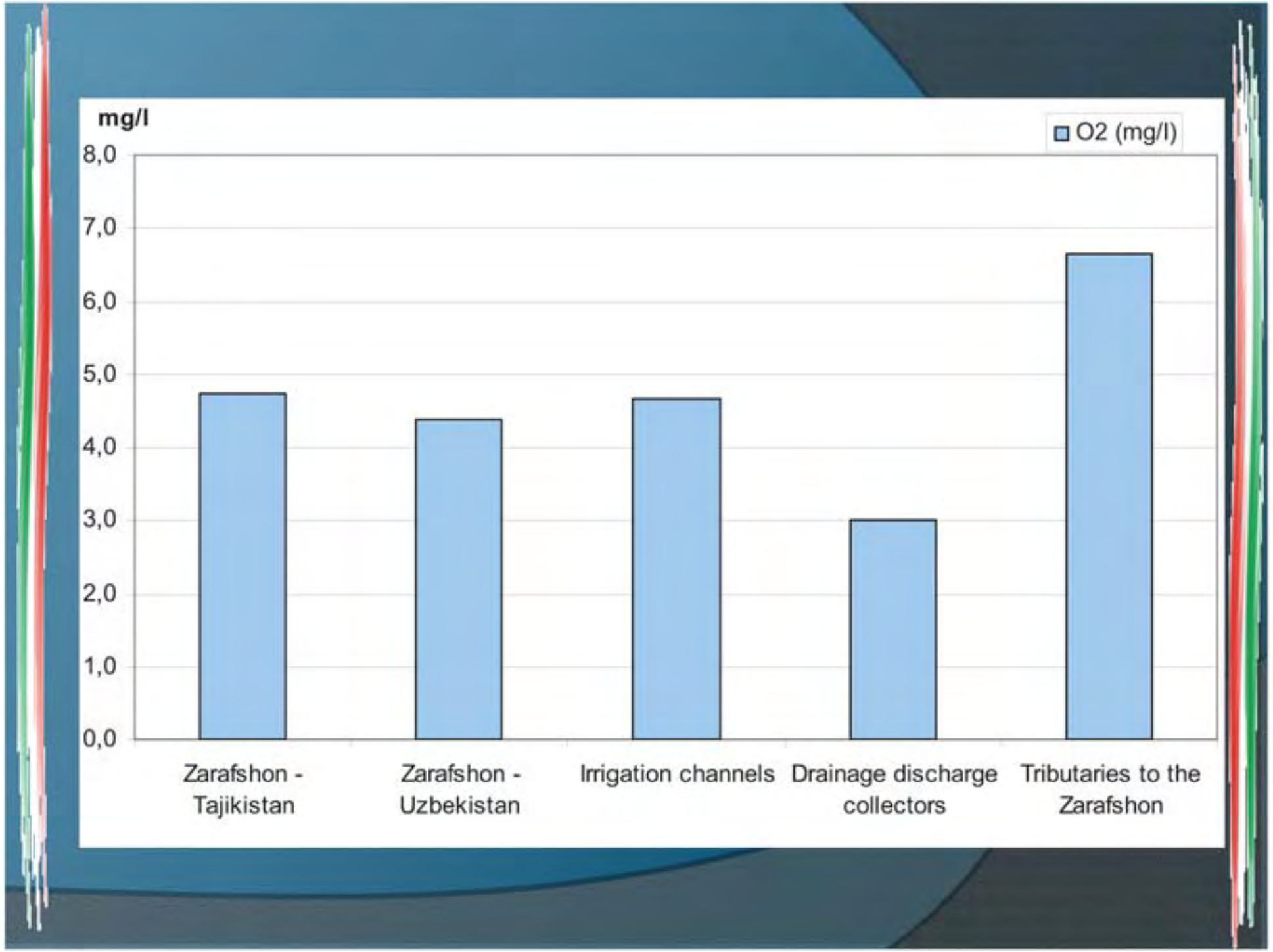
Date	Cu	Cr(IV)	Cr(VI)	Hg	Cd	Zn
16.01. 09	0,003	0	0	0	0	0,012
13.02. 09	0,008	0	0	0	0	0,05
26.02. 09	0,011	0	0	0	0	0,005
14.03. 09	0,01	0	0,028	0	0	0,005
28.03. 09	0,09	0	0,015	0	0	0,009
17.04. 09	0,1	0	0,01	0	0	0,022
29.04. 09	0,032	0	0,009	0	0	0,032
26.06. 09	0,01	0	0,019	0	0	0,041
06.07. 09	0,078	0	0,02	0	0	0,007
31.07. 09	0,074	0	0,022	0	0	0,083
14.08. 09	0,015	0	0,017	0	0	0,071
29.08. 09	0,071	0	0,019	0	0	0,007
17.09. 09	0,062	0	0,033	0	0	0,054
29.09. 09	0,013	0	0,012	0	0	0,034
16.10. 09	0,01	0	0,037	0	0	0,013
30.10. 09	0	0	0,02	0	0	0
28.11. 09	0,01	0	0,031	0	0	0
06.03. 10	0,081	0	0,029	0	0	0,019
17.04. 10	0,069	0	0,014	0	0	0,017
22.05. 10	0	0	0,01	0	0	0,015
11.06. 10	0,061	0	0,015	0	0	0,014
31.07. 10	0,046	0	0,029	0	0	0,021
12.08. 10	0,078	0	0,034	0	0	0,019
06.09. 10	0,06	0	0,037	0	0	0,029

Date	Sb	Na+K	SiO_2	Si	As
16.01. 09	0	51,24	3,92	1,74	0
13.02. 09	0	50,94	4,01	1,82	0
26.02. 09	0	48,41	3,86	1,91	0
14.03. 09	0	52,1	3,24	1,68	0
28.03. 09	0	50,76	3,96	1,79	0
17.04. 09	0	48,76	4,12	1,86	0
29.04. 09	0	50,2	4	1,95	0
26.06. 09	0	51,62	4,2	1,9	0
06.07. 09	0	50,96	4,4	1,5	0
31.07. 09	0	52,01	3,46	1,62	0
14.08. 09	0	52,41	3,3	1,54	0
29.08. 09	0	48,68	4,34	1,71	0
17.09. 09	0	52,12	4,61	1,68	0
29.09. 09	0	49,21	4,84	1,73	0
16.10. 09	0	51,68	4,9	1,89	0
30.10. 09	0	50,92	3,84	1,47	0
28.11. 09	0	48,34	2,51	1,91	0
06.03. 10	0	32,86	4,52	1,84	0
17.04. 10	0	47,64	3,27	1,64	0
22.05. 10	0	42,65	4,59	1,51	0
11.06. 10	0	37,62	3,84	1,71	0
31.07. 10	0	50,3	3,32	1,69	0
12.08. 10	0	49,7	2,87	1,89	0
06.09. 10	0	48,8	3,44	1,32	0

Date	Sb	Na+K	SiO_2	Si	As
16.01. 09	0	52,31	4,01	1,97	0
13.02. 09	0	51,43	4,27	1,89	0
26.02. 09	0	49,34	4,12	2,01	0
14.03. 09	0	51,87	3,43	1,74	0
28.03. 09	0	50,9	3,86	1,83	0
17.04. 09	0	49,86	3,93	1,92	0
29.04. 09	0	52,03	3,95	1,97	0
26.06. 09	0	50,93	4,15	1,93	0
06.07. 09	0	49,74	4,44	1,48	0
31.07. 09	0	51,73	3,49	1,56	0
14.08. 09	0	51,88	3,35	1,55	0
29.08. 09	0	46,64	4,37	1,73	0
17.09. 09	0	50,14	4,65	1,71	0
29.09. 09	0	48,73	4,91	1,75	0
16.10. 09	0	50,78	4,88	1,92	0
30.10. 09	0	49,37	3,79	1,39	0
28.11. 09	0	49,68	2,56	1,89	0
06.03. 10	0	35,32	4,37	1,82	0
17.04. 10	0	45,56	3,12	1,61	0
22.05. 10	0	43,73	4,17	1,49	0
11.06. 10	0	39,02	3,92	1,73	0
31.07. 10	0	49,93	3,34	1,7	0
12.08. 10	0	48,89	2,9	1,87	0
06.09. 10	0	49,02	3,41	1,34	0


µS/cm
el. conductivity
3500,0
3000,0
2500,0
2000,0
1500,0
1000,0
500,0
0,0
Zarafshon - Tajikistan
Zarafshon - Uzbekistan
Irrigation channels
Drainage discharge collectors
Tributaries to the Zarafshon

mg/l
NO3
PO4
NH4
140,0
120,0
100,0
80,0
60,0
40,0
20,0
0,0
5,6
81,3
0,0
37,7
72,7
0,1
26,7
66,7
1,8
83,8
121,9
2,7
8,7
89,6
0,0
Zarafshon - Tajikistan
Zarafshon - Uzbekistan
Irrigation channels
Drainage discharge collectors
Tributaries to the Zarafshon


mg/l
O2 (mg/l)
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
Zarafshon - Tajikistan
Zarafshon - Uzbekistan
Irrigation channels
Drainage discharge collectors
Tributaries to the Zarafshon

Thank You for Yours Attention

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