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CACILM Multi-country Partnership Framework

Support Project on Sustainable Land Management Research

Sustainable Land Management Research Project 2007-2009

Final Report

Part III - DRAFT

Socio-economic Analysis

Regional Office of ICARDA for Central Asia and the Caucasus (CAC), Tashkent Uzbekistan

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Abbreviations

ADB	Asian Development Bank
Asl	Above sea level
ARD	Agricultural Research for Development
ARP4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
ARI	Advanced Research Institute
AVRDC	The World Vegetable Center
CAC	Central Asia and the Caucasus
CACAARI	Central Asia and the Caucasus Association of Agricultural Research Institutions
CACILM	Central Asian Countries' Initiative for Land Management
CATCN-PGR	Central Asian and Trans-Caucasian Network for Plant Genetic Resources
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CIESIN	Center for International Earth Science Information Network
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center)
CIP	Centro Internacional de la Papa (International Potato Center)
CP	Challenge Program
CSO	Civil Society Organization
ctn	Centners (common agricultural unit; 10 centner = 1 t)
CWANA	Central and Western Asia and North Africa
DSR	Direct Seeding of Rice
EM	Electromagnetic
FAO	Food and Agriculture Organization of the United Nations
FESLM	Framework for Evaluating Sustainable Land Management
FTI	Faculty Training Institute
FDEM	Frequency Domain Electromagnetic
GEF	Global Environmental Facility
GHG	Greenhouse gas
GIS/RS	Geographic Information System and Remote Sensing
GFAR	Global Forum for Agricultural Research
GLP	Good Laboratory Practice
GNI	Gross National Income
GPR	Ground penetrating radar
HQ	headquarters
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
ICM	Integrated Crop Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICRAF	The International Centre for Research in Agroforestry
IIWG	Intercessional Intergovernmental Working Group

IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
ICWC	Inter-State Commission for Water Coordination
IMPACT	International Model for Policy Analysis of Commodities and Trade
IPCC	Intergovernmental Panel for Climate Change
IPGRI	The International Plant Genetic Resources Institute
IPM	Integrated Pest Management
IPTRID	International Program for Technology and Research in Irrigation and Drainage
IRRI	International Rice Research Institute
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
KRII	Kyrgyz Research Institute for Irrigation
MAWMPIK	Ministry of Agriculture and Water Management and Processing Industry of Kyrgyzstan
MDG	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
Mha	Million hectares
MRWF	Medium Range Weather Forecast
MSEC	Multi-Country Secretariat
MTP	Medium Term Plan
NARS	National Agricultural Research System
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organization
NIDFF	National Institute of Deserts, Flora and Fauna, Turkmenistan
NRM	Natural Resource Management
NSRDRI	Natural Resources and Sustainable Development Research Institute, Kazakhstan
NSEC	National Secretariat
PFU	Program Facilitation Unit
PMI	Policies, Markets and Institutions
PGRFA	Plant Genetic Resources for Food and Agriculture
PRIAA	Pri-Aral Research Institute of Agroecology and Agriculture, Kazakhstan
PSC	Program Steering Committee
PSR	Production System Research
RCT	Resource Conserving Technology
R&D	Research and Development
RI	Research Institute
RNA	Research Needs Assessment
RS	Reflectance Spectroscopy
SANIIRI	Central Asian Scientific Research Institute for Irrigation
SASRI	Soil and Agrochemistry Science Research Institute, Kazakhstan
SLM	Sustainable Land Management

SLM-IS	Sustainable Land Management-Information Systems
SLM-CB	Sustainable Land Management – Capacity Building
SLM-KM	Sustainable Land Management – Knowledge Management
SLM-R	Sustainable Land Management Research
SPAOPIF	Scientific Production Association of Ornamental Plant Industry and Forestry, Uzbekistan
SSSARI	State Soil Science and Agrochemistry Research Institute, Uzbekistan
SWEP	System-Wide Eco-regional Program
SWSRPCA	South-Western Scientific Research Production Center for Agriculture, Kazakhstan
TAC	Technical Advisory Committee
TDEM	Time Domain Electromagnetic
ToT	Transfer of Technology
TSSRI	Tajik Soil Science Research Institute
UCRI	Uzbek Cotton Research Institute
UNCCD	The United Nations Convention to Combat Desertification
UNCED	The United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNEP-GEF	United Nations Environment Program-Global Environment Facility
UNESCO	United Nations Educational Scientific and Cultural Organization
UNCCC	United Nations Framework Convention on Climate Change
URIAME	Uzbek Research Institute of Agricultural Mechanization and Electrification
URIKSBDE	Uzbek Research Institute of Karakul Sheep Breeding and Desert Ecology
USDA	United States Department of Agriculture
WUA	Water Users Association
WWF	World Wildlife Fund
ZEF	Zentrum für Entwicklungsforschung (Center for Development Research), University of Bonn, Germany

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Socio-economic analysis of policy, livelihoods and SLM options and their effect on land degradation

Review of literature on drivers of land degradation and their systemic interactions

1 Introduction

1. The present report on Sustainable Land Management Project in Central Asia analyzes the modern condition, use and degradation of the land and water resources in Central Asia and includes research results from five CA countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan).

2. Central Asian countries have experienced the decrease in the area of agricultural pasture land during the last 30-40 years which was due to the range of factors including the use of agricultural land for other needs. Major factors causing soil degradation are wind and water erosion, excessive use of chemicals and pesticides, mixed use of water resources under the condition of frequently repeated draughts, natural disasters, dust-storms, flooding and other dangerous natural disasters. Shortage of water is observed in all of the Central Asian countries but it is especially acute in Turkmenistan. Uzbekistan and Southern Kazakhstan due to the higher water demand for meeting socio-economic and ecological needs of growing population as well as of natural ecosystems.

3. This report consists of three chapters:

4. First chapter is focused on the (i) analysis of the current condition and the use of land resources in CA countries, (ii) water resources and their use in CA countries and (iii) condition of agricultural crop production and livestock breading.

5. Second chapter gives general understanding of the land degradation that includes: (i) land degradation under different agro-ecological conditions of Central Asia, (ii) major types of land degradation and (iii) major reasons of land degradation.

6. The third chapter evaluates the system-based interrelation of causes, ways of development and consequences of land degradation focusing on (i) changes in land use, (ii) quality of land resources, (iii) ecology of dry areas, (iv) living standards of population and markets, (v) institutional policy.

7. The research and preparation of report are based on the use of the state and international programs and plans, results of the field experiments, researches of the international research organizations, statistical data and information from the official sources, ministries and institutions of CA countries .

2 Analysis of the current land resource conditions

2.1 Land resources and their use in Central Asia

2.1.1 Land categories

8. Land is the major factor of the nation's wealth and wellbeing of the population as well as precondition for the development of all sectors of the economy and agriculture, especially in the regions were land is the major factor of production.

9. Central Asian region having its vast areas within deserts and steps has an unfavorable climate conditions for agricultural production due to the low level of precipitation and irregular, drastic fluctuations in temperature. Total land area of the five Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) makes up 351.7 million ha and 294.2 million ha (83.6%) of this area is represented by agricultural land with 220.1 million ha (74.8%) under pastures and hayfields. Land under cultivation comprises 39.975 million ha (13.6%) with the 10.219 million ha (3.5%) under irrigated cultivation.

10. Total area of the cultivated land is not equally distributed between CA countries. Thus. 77.3% of the cultivated land are spread across Kazakhstan with only 7% of irrigated land and huge areas of rainfed land.

11. Irrigated land that constitute only 3.5% (10.219 million ha) out of the total cultivated area spread across CA with the 42.4% in Uzbekistan, 22.7% in Kazakhstan (Southern Kazakhstan which is also included into CA), 17.2% in Turkmenistan, 10.6% in Kyrgyzstan and 7.1% in Tajikistan.

12. Pastures are also unevenly distributed amongst CA countries with the 50% out of the total 36.399 million ha spread in Kazakhstan, 25.3% in Kyrgyzstan, 9.9% in Tajikistan, 8.14% in Turkmenistan and 6.4% in Uzbekistan (Figure 1).

13. The development of the agricultural sectors depends on the available types of land resources. Thus, Kazakhstan is specialized on rainfed cereal crop production, livestock production and partially on irrigation based crop cultivation; Kyrgyzstan specialized on livestock and crop production; Uzbekistan, Turkmenistan and Tajikistan - on irrigated crop production and partially on livestock production.

14. The results of the conducted analysis showed that the areas of agricultural land in CA countries have been shrinking during the years of independence due to the several factors that include:

15. Use of land for non-agricultural purposes (construction of roads, electricity lines, industrial buildings and private housing, extending the city and settlement areas, etc.).

Figure 1. Distribution of land resources across CA countries

16. Land degradation (soil salinity, water logging, depleting of soil fertility, water erosions, irrational use of pastures, anthropogenic effect on soil).

17. Meteorological and hydro-geological draughts specific to the region: Meteorological droughts are connected with the repeated abnormal double or even triple decrease in the level of annual precipitation and usually are permanent or repeatedly occurring up to six times in every ten years. Widely spread in the region hydrological droughts are connected with the shrinking of the glaciers which are the sources of Amu Darya and Syr Darya rivers and have a greater effect on the lower parts of these rivers.

18. Shrinking of the areas under agricultural use due to the drying out of Aral Sea bed – shrinking of the water supplies in the regions situated in the lower parts of Amu Darya and Syr

Darya rivers and spread of the salty sands on the vast areas of pastures, hayfields and arable land.

2.1.1.1 Kazakhstan

19. Out of the total land area of Kazakhstan which has made up to 272.5 million ha as of January 1, 2006 222.5 (81.6%) million ha are occupied with agricultural land that include pastures (185.2 million ha. 83.2%), arable land (21.9 million ha. 9.8%), abandoned fields (10.3 million ha. 4.6%) and hayfields (5.0. 2.2%). Land endowment per person is 13 ha of agricultural land including 2 ha of arable land.

20. The area of irrigated land makes up 2.3 million ha out of which 1.4 million ha are farm land. Agricultural producers possess 106.7 million ha or 39.6% out of the total land area of Kazakhstan. 20.0 million ha (7.4%) are occupied by settlements, 11.1 million ha (4.1%) of the land area is under industrial constructions, transportation, communication, defense and other non-agricultural usage. Forests occupy 21.0 million ha (7.8%) and water resources – 3.1 million ha (1.2%). Specially protected natural landcape areas under national parks occupy 1.2 (0.4%).

21. After Kazakhstan became independent a strategy to convert local economy into market oriented economy has been declared. Consequently after the land reform agricultural land areas decreased from 81.2% in 1990 to 39.6% in 1999 making further drops up to 29% in 2005.

22. In 1991 more than 16.0 million ha of agricultural land have been given for establishment of settlements in order to provide local population with the pastures as a source of fodder for their livestock as well as for the purpose of enhancing their private holdings. However, as some households rejected to accept part of the pastures 10.2 million ha of land primarily in desert and semi-desert areas were returned back and now included into forestry reserves as well as 83.0 million ha la were return to the pastureland reserves.

23. The area under the perennial plantations comprises 138.8 thousand ha including gardens (107.2 thousand ha) and wine yards 18.3 (thousand ha). Half of these land (69.2 thousand ha) are under private property.

Table 1. Category wise land distribution dynamics in Kazakhstan (millionha)

Years	Total land used by land users in the country	Including						
		Agricultural land	Settlements	Industrial land, transportation and under other non-industrial use	National parks	Forests	Groundwater reserves	Land reserves (unused)
1990	271.6	220.7	2.1	19.8	0.8	10.0	0.8	17.5
%	100%	81.2	0.8	7.3	0.3	3.7	0.3	6.4
1995	272.1	194.8	19.2	17.4	0.9	10.9	0.9	28.0
%	100%	71.6	7.1	6.4	0.3	4.0	0.3	10.3
2000	269.8	106.7	20.0	11.1	1.2	21.0	3.1	106.6
%	100%	39.6	7.4	4.1	0.4	7.8	1.2	39.5
2005	261.17	78.0	20.87	11.1	1.2	23.4	3.1	105.5
%	100.0	29.8	8.0	4.2	0.5	9.0	1.2	40.4

24. As result of reforming collective farming holdings, privatization of the state own agricultural enterprises 97.4 thousand households were created that include 90.9 farmer holdings, 2.9 partnership associations, 2.2 thousand production cooperatives and 1.4 other nongovernmental enterprises and organizations.

Table 2. Land use in Kazakhstan

Total area	Cultivated land	Hayfields	Pastures	Perennial plantations	Abandoned land
2000					
222.56/ 100	26.61/12.0	5.03/2.3	184.75/83.0	0.14/0.1	5.94/2.7
2005					
261.17/100	22.0/8.42		180.0/69.0		

Numerator: area of the agricultural land in million ha; denominator: percentage out of the total area of agricultural land.

Table 3. Types of households in agricultural sector of Kazakhstan [1]

Categories of economic agents	1991			2004			2005		
	number	area		number	area		number	area	
		Thousand ha	%		Thousand ha	%		Thousand ha	%
1. Farmer holdings	2 480	1 615.1	0.7	166 236	34 964.4	42.6	18 6844	37 429.0	45.6
2. Nongovernmental agricultural legal entities. Total	548	15 560.5	7.1	16 232	44 553.5	54.2	11 273	42 315.9	51.5
including:									
- collective farms (kolkhozes)	416	15 284.7	7.0						
- partnership associations and joint ventures				4 011	32 594.9	37.9	4 929	33 302.9	40.5
- agricultural production cooperation entities	132	275.8	0.1	1 416	7 863.8	9.6	1 357	6 073.4	7.4
- other nongovernmental organizations				10 805	4 094.8	4.9	4 987	2 939.6	3.6
3. Governmental agricultural organizations. Total	3 640	201 200.2	92.2	1 309	2 614.1	3.2	1 241	2 398.5	2.9
Including									
- state farms	2094	195 322.7	89.4						
- Research institutes and educational institutions	273	2 304.4	1.1	367	1 176.1	1.4	389	1 077.7	1.3
- subsidiary agricultural enterprises	1003	1 911.7	0.9	723	383.1	0.5	646	284.9	0.3
- other governmental organizations	270	1 661.4	0.8	219	1 054.9	1.3	206	1 035.9	1.3
Total	6 668	218 375.8	100.0	183 777	82 132.0	100.0	199 358	82 143.4	100

[1] Statistical Agency of the Republic of Kazakhstan

2.1.1.2 Kyrgyzstan

25. Land resources of Kyrgyzstan comprises 19995.1 thousand ha including agricultural land (28.5%), land under settlements (1.2%), industry, transportation, communication, defense organizations and other non-agricultural use (1.1%), specially protected natural environments with the land area of 2.7%; forests (13.6%), land groundwater resources (3.8%) and unused land reserves (49.0%)2.

26. 12% of the land resources are represented by sandy areas, rocks, slide rocks and other unusable land for agriculture and 4 % of the land is under glaciers and snow fields.

Table 4. Land resources in Kyrgyzstan (thousand ha) [3]

№	Land users and land categories	1995	2000	2005	2006
1.	Agricultural land, Total Including:	11647.1	5788.2	5698.4	5702.9
2.	Land under settlements	137.4	231.7	250.0	252.1
3.	Industrial, transportation, communication, defense and other nonagricultural land	888.8	227.5	221.8	222.3
4.	Specifically protected land areas with protected natural environments	145.4	349.3	447.8	532.2
5.	Forests	1107.1	2634.3	2684.9	2710.6
6.	Land groundwater reservoirs	93.7	767.0	763.7	763.7
7.	Unused reserve land	5975.4	9996.9	9924.7	9807.5
8.	**Total**	**19994.9**	**19994.9**	**19994.9**	**19994.9**

27. During 1995 – 2007 agricultural land have shrunk up to 51.0% or for 5944.2 thousand ha and reserve unused land increased by 1.64% or 3832.1 thousand ha.

[2] Кыргызстан окружающая среда и природные ресурсы для устойчивого развития. Бишкек, 2007 С.20.
[3] Data of the Kyrgyzgiprozem, 2007 г.

Table 5. Land resources of Kyrgyzstan in accordance with the types of agricultural land

№	*Agricultural land*	1995	2000	2005	2006	2007
1.	Arable land	1417.4	1367.5	1284.4	1283.7	1212.6
2.	Perennial plantations	70.6	67.1	72.1	72.0	36.3
3.	Abandoned land	20.1	21.5	35.4	35.3	35.3
4.	Hayfields	170.6	177.0	199.5	199.4	172.5
5.	Pastures	9111.1	9165.2	9189.1	9176.1	9176.1
6.	**Total**	**10781.2**	**10798.3**	**10780.5**	**10766.6**	**12639.8**

28. Agricultural land and forests in Kyrgyzstan experience substantial degradation due to overuse, anthropogenic factor and climate change. Depleted biological productivity of land further triggers the process of deforestation, water logging and accumulation of the soil salinity. In accordance with the scientific calculations, each irrigation washes away from 10 to 20 tons of silt components.

29. Besides, 20% of the land area is represented by stony land and within the arable and previously irrigated land they constitute 4%.

2.1.1.3 Tajikistan

30. Land area of Tajikistan as of January 1, 2008 comprises 14.25 million ha with 4.72 million ha (33.15%) of agricultural land including 0.61 million ha (4.3%) of irrigated land, 710.4 thousand ha of arable land which constitutes 5.0 % out of the total land area or 15.0 % of agricultural land.

31. The total area of the pastures and hayfields is 3898.6 thousand ha (27.35%), perennial plantations make up 105.5 thousand ha (0.74%) and abandoned land have the area of 32.0 thousand ha (0.22%).

32. Pastures and hayfields (3898.6 thousand ha) constitute 82.5% out of the total area of agricultural land (Table 6).

Table 6. Area and dynamics of the agricultural land in Tajikistan[4], thousand ha

Year	Total land area	Agricultural land	Arable land	Hayfields	Pastures
1992	14254.5	4438.8	808.6	26.3	3478.2
1995	14254.5	4577.1	801.8	23.7	3621.2
2000	14060.0	4100.0	860.0	-	3277.0[5]
2005	14300.0	4100.0	800.0	-	3082.0[6]
2007	14255.4	4725.6	710.4	-	3898.6[7]

33. Out of the total land area of Tajikistan (14.25 million ha) 4546.1 thousand ha or 31.2% are used for agricultural production, 65% of agricultural land are used for agricultural production by land users and the remaining area of 292.1 thousand ha (35%) are used by *Goskomfond* (State Land Fund) and *Gosleskhoz* (State Forestry Administration).

34. Arable land constitutes 496.8 thousand ha or 10.5% out of the total area of agricultural land and 81.1% out of total irrigated agricultural land.

35. Forests and shrubs occupy 292.1 thousand ha or 2.1% out of the total land area of Tajikistan and considered as additional land that can be used not only for forestry production but also as pastures.

36. Thus the total land area of Tajikistan used in agriculture including forest and shrub land makes up 4700.1 thousand ha or 33%. The remaining significant land area (67%) is represented by areas groundwater resources (lakes, rivers, reservoirs), glaciers, snow fields rocks, rockslides (*осыпи*), river flood basins (*пойма горных рек*), rock fans (*каменистые конусы выноса*), extremely low productive pastures situated within high mountainous areas on steep not easily accessible slopes. In accordance with the distribution of these two types of land areas across the production zones the area of usable land in Pamir makes up 12% out of the total area. in Garm – 33%, in Leninabad – 43%, in Gissar. Kulyzb and Vakhsh – 61%.

37. The Gorno-Badakhshan autonomic republic is located within the high mountainous areas with the dry climate and 90 % of the territory situated at the height of 3000 m above the sea level predominantly represented by rocks, glaciers, snowfields and steep slows under continuous process of degradation.

38. The *Goszemfond* (State Land Reserves) has 4254.5 thousand ha or 30% of the total territory of Tajikistan and predominantly represented by mountainous regions and high mountains with rocks, glaciers, snowfields and low productive land.

[4] Goskomzem (Tajikistan State Land Committee)
[5] Pastureland and hayfields
[6] Pastureland and hayfields
[7] Pastureland and hayfields

39. Pastures constitutes 3514.8 thousand ha with 1870 thousand ha of supper pastures, 1140 thousand ha of winter pastures, 400 thousand ha of spring-summer-autumn pastures and 105 thousand ha of year-round pastures.

2.1.1.4 Turkmenistan

40. Total land area of Turkmenistan is 49.1 million ha with 40.2 million ha (81.8%) under agricultural land including 38.5 million ha (95.7%) pastures, 2 million ha (4.2%) irrigated land and 0.24% of perennial plantations. Out of the total land area (49.1 million ha) land suitable for irrigated agricultural production make up 7013.3 thousand ha. Highly productive land with the bonitet of 100-80 grades occupy 2941.7 thousand ha (31.9%), low productive land with the bonitet of 60-40 grades make up 2304.3 (32.9%) and land with extremely low productivity (less than 40 grades) – 2467.3 thousand ha (35.2%).

41. Land area included in the first category of land represented by highly productive land spread across the modern irrigation zone with the total area of 2049.3 thousand ha of non-saline and light slightly saline gray soils, takyr-like soils, meadow gray soils, meadow-takyr soils and meadows. Most of this land is under cultivation.

42. Takyr-like soils with the average content of humus, total nitrogen and phosphorus of 0.8-1.2, 0.08-0.10 and 0.15-0.20%, correspondingly, are considered as highly productive as they can be easily reclaimed.

43. The second category of land includes takyr-like soils with takyrs and solonchaks. Reclamation of these soils will require preliminary agro-ameliorative measures. To conduct thorough leaching of these soils drainage channels should be functional at the same time of introducing measures for land reclamation.

44. The third category of land includes low-productive sandy desert soils and solonchaks within the irrigated zone. Reclamation of this land will require substantial soil ameliorative measures as well as drainage net will be required within the zones of solonchak soils.

45. The fourth category of land includes takyr and alluvial soils.

46. Fifth category of land includes solonchaks, sandy desert land, grey-brown soils and takyrs with low fertility.

47. Sixth category includes gray-brown soils and lithogenous solonchaks with extremely low fertility that can be reclaimed only if significant soil ameliorative measures will be conducted.

48. There are also in Turkmenistan the area of 200 thousand ha of light colored highly productive gray soils placed on the height of 300-350 meters above the sea level that require machine assisted water transportation to the height of 100-150 m. Besides this there are protected land with the area of 1986.4 thousand ha including 830.14 thousand ha of sanctuaries and 1156 thousand ha of wildlife areas.

Table 7. Land resources of Turkmenistan given in categories at the beginning of the year[8] (thousand ha)

Land types	1993	2004	Relation of 2004 to 1993 in %	Structure. %	
				1993	1994
Land under agricultural production	34380.7	33875.1	98.5	70	69
Land under state reserves	9711.6	10020.6	103.2	19.8	20.4
Land of forestry enterprises	2172.7	2224	102.4	4.4	4.5
Land under settlements	84.5	137.8	163.1	0.2	0.3
Land under industry, transportation, defense, communication and other	1613	1616.1	100.2	3.2	3.3
Land with protected natural environments, of historical and cultural significance, used for health rehabilitation purposes	733.2	787.6	107.4	1.5	1.6
Land groundwater resources	425.2	459.7	108.1	0.9	0.9
Total area	49120.9	49120.9	100	100	100

2.1.1.5 Uzbekistan

49. During 1990-2007 land area in Uzbekistan has decreased by 2.58% as a result of handing over some portions of the land resources to the neighboring countries. Agricultural land has decreased up to 9.75% as some land was used for other purposes (industrial, road construction, etc.). Dynamics of the changes in the land use is given in Table 8.

[8] Туркменмиллихасабат.

Table 8. Dynamics of the land resources in Uzbekistan (as of 1st January. thousand ha)

Land category	Years								Changes	
	1990	2000	2001	2003	2004	2005	2006	2007	%	+;-
Total land area	45585.0	44410.3	44410.3	44410.3	44410.3	44410.3	44410.3	44410.3	97.42	-1174.7
Including irrigated	4221.8	4277.6	4273.3	4278.0	4275.3	4279.0	4295.3	4303.0	101.9	-81.2
Agricultural land	28080.4	26753.6	36734.5	25841.1	25681.3	25687.4	25683.9	25343.8	90.25	-2737.4
Including irrigated	3425.0	3743.9	3743.9	3722.8	3713.4	3713.6	3718.1	3725.6	108.8	+300.6
Cropland	4176.5	4056.6	4058.4	4052.7	4042.7	4049.0	4057.2	4064.2	97.31	-112.3
Including irrigated	3407.3	3313.6	3308.3	3307.4	3297.7	3296.3	3303.6	3308.5	97.1	-98.8
Perennial plantations	366.8	352.9	346.9	336.4	337.0	338.0	335.8	339.0	92.4	-27.8
Including irrigated	351.5	339.7	332.3	323.1	323.5	325.3	322.7	325.5	92.6	-26.0
Abandoned land	62.1	80.7	82.8	85.0	84.5	83.5	83.6	82.6	133.0	+20.5
Including irrigated	25.9	46.5	48.4	48.4	48.3	48.1	48.4	48.3	1.8 times	+22.4
Hayfields and pastures	23475.0	22263.4	2246.4	21367.0	21217.1	21215.7	21207.3	20858.0	88.8	-2617.0
Including irrigated	37.3	44.1	44.3	43.9	43.9	43.9	43.4	43.3	116.1	+6.0
Forests and shrubs	1410.0	1511.9	1489.5	2375.4	2817.7	2808.1	2811.4	3219.6	2.3 times	+1809.6
Including irrigated	31.3	44.6	46.0	47.2	47.7	47.8	48.8	49.7	1.6 times	+18.4
Land under gardens and grape yards	-	8.5	8.3	8.1	7.8	7.7	7.5	7.7	90.6	-0.8
Land were soil ameliorative measures are applied	-	79.3	-	79.5	79.5	78.8	78.6	77.1	97.2	-2.2
Household plots	437.9	642.9	649.2	667.3	677.3	679.7	691.3	691.6	1.6 times	+253.7
Including irrigated	365.5	481.9	486.8	500.9	507.6	511.1	522.0	521.1	1.4 times	+155.6
Other land	15539.6	15414.1	15446.0	15438.9	15149.7	15148.7	15137.6	15070.5	97.0	-469.1

50. Agricultural land makes up 50.29% out of the total land area. Land under state reserves and used by forestry enterprises increased and now make up 23.46% and 19.28% correspondingly.

51. Dynamics of the land within different categories is given in the Table 9.

Table 9. Land resources of Uzbekistan as divided by categories (as of January 1)[9]

Categories of the land users	1990		2000		2003		2007		Changes	
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%
Agricultural land	33167.8	72.76	25736.0	57.95	22614.0	50.92	22338.3	50.29	-10829.5	67.3
Land under state reserves	7258.6	15.92	7596.1	17.11	10201.5	23.0	104170.9	23.46	+3159.3	143.5
Land used by forestry enterprises	2507.5	5.50	8073.2	18.18	8578.3	19.3	8562.3	19.28	+6054.8	3.4
Land under settlements	197.2	0.43	232.7	0.52	235.0	0.53	236.3	0.53	+39.1	120.0
Land under industrial, transportation, communications, defense, etc.	1821.2	4.00	1883.2	4.24	1885.9	4.34	1955.5	4.40	+134.3	107.4
Land with protected natural environments, of historical and cultural significance, used for health rehabilitation purposes	13.9	0.03	75.3	0.17	72.5	0.16	72.8	0.16	+58.9	5.2
Land under hydro-technical constructions	618.8	1.36	813.8	1.83	822.6	1.84	827.2	1.86	+208.4	1.3
Total land area	45585.0	100.0	44410.3	100.0	44410.3	100.0	44410.3	100.0	-1175.0	97.4

2.1.2 Soil fertility

52. The majority of land in CA is considered to be of low productivity. During 1980-2005 the average value of bonitet of soils in CA region has been decreasing making up to 4 to 15 balls in different countries depending on their location.

53. Major reasons of decreasing in soil fertility within the irrigated area are improper crop rotation systems and crop alternations, decreased amount of applied fertilizers (NPK), improper soil tillage techniques and irrigation methods (anthropogenic influence), increased levels of groundwater and increased areas of saline land. In average the area of saline and highly saline land in the region has increased up to 10 to 20% depending on the area of the irrigated land.

54. Diversification of the farmer holdings (liquidation of the big farmer holdings and creation of the smaller farmer and dekhqan holdings) caused implementation of the improper crop rotations leading to the decrease in the areas under fodder crops especially alfalfa up to 3-7 % out of the total area of cultivated land.

[9] State Committee of Land Resources, Geodesy, Cartography and State Cadastre for the respective years.

55. Though in some countries land is a property of farmers and in some it is rented the farmers are not yet real owners of land which is also negatively effecting on preservation and improving land fertility.

56. Decrease in the productivity of pastures is caused by the irrational use, overgrazing as well as by termination of pastures watering and amelioration.

57. The process of decreasing the humus content was observed on all cultivated land and pastures and is caused by nutrient mining as a result of growing agricultural crops. Within the irrigated land loss of humus is caused by overregulation of the river streams in estuaries and desertification of the surrounding areas as well as by irrigation induced erosion.

2.1.2.1 Kazakhstan

58. In Kazakhstan out of the total area of rainfed fields due to the humus content depletion 4.5 million ha with the slight degree of mineralization, 5.2 million ha of moderate mineralization and 1.5 million ha of high degree of mineralization were subject to desertification. Within the irrigated land the area with depleted humus content makes up 0.7 million ha.

59. Land that can be used for agricultural production without application of the preliminary soil amelioration measures make up 21.8 million ha or 9.7%. The rest of land require application of special measures: amelioration of the solonetz type land, improvement of the ameliorative condition of saline land, prevention of the water and wind erosion. In accordance with the information of the Kazakhstan Land Management Agency saline land and solonetz type land make up 93.7 million ha or 42.1% and land effected by soil erosion make up 29.0 million ha or 13%. The area of overgrazed pastures has increased as result of increased pressure on these land from 14.8 (1990) to 26.0 million ha (1999).

60. Out of 89.9 % of agricultural land pastures make up 69.3 %, cultivated land – 17.7 %, hayfields – 2.8 % and perennial plantations – 0.1%.

61. Another source of land deterioration is the soil disturbance due to the technological measures. During 2000s the area of disturbed and exhausted land has substantially increased making 178.3 and 63.6 thousand ha correspondingly (179.2 and 68.5 thousand ha in 1996). The greatest part of exhausted land is concentrated within the Karaganda region making up 43.2 thousand ha. Kustanay (29.0 thousand ha) and Pavlodar (21.2 thousand ha) regions that are represented by mineral mining fields, rock piles, tailing pounds and ash dumps.

2.1.2.2 Kyrgyzstan

62. In accordance with the Soil map of the Kyrgyzstan SSR 10 following soils were distinguished on the territory of Kyrgyzstan: soils of the sloppy areas of piedmonts; soils of intermountain cavities; soils of highland; sloppy soils of the mountains that also include soils of dry steppe and steppe zones of lowland; soils of the forest-hayfield-steppe zones; soils of the sub-alpine belt of high mountains; soils of alpine belt; soils of the high mountainous wasteland. Mountainous areas of Kyrgyzstan have a colorful soil cover and different level of fertility.

63. In accordance with the Kyrgyzstan Land Cadastre saline land make up 1170.4 thousand ha including 398.6 thousand ha of slightly saline land, 399.1 thousand ha of moderately saline land, 301.1 thousand ha of highly saline land and 70.8 thousand ha of solonchaks. Along with the increase of saline land the increase of water logged land due to the malfunctioning drainages is also observed. The area of alkaline soils makes up 469.0 thousand ha including 1811.3 thousand ha of slightly alkaline soils, 87.8 thousand ha of moderately alkaline soils, 149.0 thousand ha of highly alkaline and 51.4 thousand ha of solonetz soils. Stony land make up 3808.5 thousand ha including 1477.7 thousand ha of slightly stony land, 1494.4 thousand ha of moderately saline soils and 836.4 thousand ha of highly stony soils.11

64. Gray soils with the low humus content are predominant within the soil cover layer of the cultivated land of Kyrgyzstan. Brown and chernozem soils are spread in piedmont and mountainous regions. Productivity of the cultivated land is significantly low in comparison with the virgin soils. The area of cultivated land is decreasing as land areas are being used for nonagricultural purposes and are being shifted to other categories. As a result of granting private property over land, inconsistent land reforms, imperfect legal documents as well as poverty of the population 30% of land are not currently cultivated. 12

65. Moreover, decrease in the investment, broken irrigation and drainage channels led to the increase in the area of land with the poor ameliorative conditions. These tendencies are observed in the Chui and Talas provinces, the Karabury and Batkent districts of the Batkent province, Aravan and Suzak districts of the Jalalabad province and other territories.

66. Within the last 10 years land reforms in agriculture were mainly concentrated on redistribution of land meanwhile works on improving the condition of agricultural land have been ceasing leading to the drastic decrease in soil fertility which is now reached its critical point.

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10 Материалы: Мамытова Б.А. - координатор Центра Горных проблем НАН КР., Таштемиров А. - главный инженер «Кыргызгипрозема», Бекболотов Ж. - начальник отдела «Кыргызгипрозема».
http://www.welcome.kg/ru/kyrgyzstan/region/development/206.html

11 http://www.welcome.kg/ru/kyrgyzstan/region/development/206.html

12 Кыргызстан окружающая среда и природные ресурсы для устойчивого развития. Бишкек, 2007 С.20.

67. Sudden decrease in the amount of work on fertilizer application, especially organic fertilizers, ignoring agro-technical measures protecting soils form erosion and preserving their fertility such as growing legumes, cereals and siderits, use of land with the slopes of more than 10 degrees in irrigated crop cultivation and plowing land with the slopes exceeding 15 degrees on rainfed land, mass destruction of the forest lines, quarrying activities, etc. that encourage erosion processes leading to the land desertification.

68. During the period of land reforms reliable information regarding changes in soil conditions become unavailable as soil related researches become rare due to financial shortages. Besides, resolution of the soil erosion problems is also difficult as the activity of several involved ministries and institutions is not coordinated.

69. In order to resolve current problems the following actions should be undertaken:

70. The inventory of cultivated land in mountainous areas should be created (current conditions of the soils, resistance to erosion, over compaction);

- Soil preserving and resource conserving technologies should be developed;
- Agroecological zoning on soil resistance to different anthropogenic factors should be developed;
- Soil erosion and other types of soil degradation preventing measures should be developed;
- Database on soils within mountainous regions and regulation of their fertility should be developed;
- To create territorial soil erosion maps and unified soil erosion map of the Republic of Kyrgyzstan;
- Creation of forests as an erosion preventing measure;
- Educating population on soil erosion preventing measures; application of the modern soil preserving tillage methods;
- Rational use of water and application of the modern technologies of irrigation for preventing erosion.

2.1.2.3 Tajikistan

71. Seven types of soils were found in Tajikistan: gray soils, brown mountainous soils, hayfield-steppe soils of the high mountains, steppe mountainous soils, desert-steppe soils of high mountains, desert high mountainous soils and soils of nival belt.

72. The description of soil formation process in Tajikistan is given.

73. In accordance with the available data 5380 ha of cultivated land were not used in 2005 in Tajikistan including 2494 ha of irrigated land as a result of unsatisfactory soil ameliorative conditions, drainage channels and pumps.

74. Around 40 thousand ha of land are waterlogged and in accordance with the "*Tojikzaminsoz*" (Table 10) land in some districts of the Khalton province have unsatisfactory conditions.

Table 10. Increase in the area of saline land and groundwater in some of the district in the Khalton province (data of the *Tojikzaminsoz*) [13]

Nr.	Districts	Investigated areas, ha	Of which					
			Saline, ha			Groundwater more than 4 million ha		
			1972-1975	2002	Difference	1972-1984	2002	Difference
1	Vose	24946.93	10508	14621	+4113	6344	4314	-2030
2	Kulob	8751.30	0	781	+781	3553	3011	-542
3	Khamadoni	36537.22	177	411	+234	2301	-	2301
4	Sarband	2222.61	*	239	+239	*	1403	1403

75. The area of the land effected with the secondary salinization make up 16.0 thousand ha (Table 11).

Table 11. Dynamics of land with unsatisfactory soil ameliorative conditions during 1991-2004*14*, thousand ha.

Soil conditions	1991	1993	1995	1997	2000	2002	2004
Soils with unsatisfactory soil ameliorative conditions, total	**64.0**	**69.5**	**61.5**	**75.5**	**85.7**	**80.6**	**55.6**
Including saline and alkaline soils	**18.4**	**22.3**	**21.6**	**22.8**	**22.9**	**21.0**	**15.7**
With unaffordable level of groundwater	**34.6**	**36.8**	**30.9**	**42.5**	**47.0**	**50.2**	**39.9**

76. In accordance with the data of Dr. S. Sanginov the loss in cotton yields on saline land is equal to 50% in comparison with non-saline land15 as well as the area of eroded soils as a result of water erosion makes up 31.88 % and as a result of deflation - 22.34%16 (Table 12). As a result of erosion 7848 thousand ha of land became useless for agricultural production.

[13] The data provided by B. Kholov, the Director of the Tajikistan Soil Research Institute
[14] Сангинов С.Р. Актуальные проблемы повышения плодородия почвы. Труды Таджикского научно-исследовательского института почвоведения. Сборник научных трудов. Душанбе, 2007, С. 9.
[15] Там же, С.9.
[16] Там же С. 14.

Table 12. The degree of land erosion in Tajikistan, thousand ha[17]

Regions	Water erosion			Deflation			Irrigation erosion	
	Slightly washed and unwashed	Moderately washed	Substantially washed	Slightly washed and unwashed	Moderately washed	Substantially washed	Slightly washed and unwashed	Moderately washed
Sugd	155.7	196.3	963.8	22.6	162.4	434.1	150.0	26.3
Gissar	88.1	206.1	580.1	-	-	-	60.0	11.7
Vakhsh	359.9	240.1	110.4	39.6	101.5	192.6	110.0	37.3
Kulyab	124.0	4398.8	379.0	-	-	0.9	40.0	22.4
Garm	52.7	218.1	850.5	-	-	-	-	14.
GBAO	60.0	20.1	1657.2	-	-	2553.0	-	15.5
Total	840.4	1320.5	4541.0	62.2	263.9	3180.6	360.0	127.2

2.1.2.4 Turkmenistan

77. In accordance with the classification of the Turkmenistan desert zone there are gray-brown soils (11.3%), desert sandy soils (38.5%), takyr like soils and takyrs (Table 13).

Table 13. Land resources of Turkmenistan

Major soil types	Thousand ha	%
Brown soils	296.5	0.6
Dark gray and typical gray soils	3327.7	6.7
Light gray soils	3299.0	6.0
Grey-brown soils	5590.7	11.3
Takyr like soils	1963.2	3.9
Takyr soils	1632.2	3.3
Desert sandy soils	19026.0	38.5
Hayfield-grey soils	170.9	0.4
Hayfield-takyr like soils	1544.8	3.2
Hayfield soils	1450.3	3.0
Solonchak soils	2683.9	5.4
Fixed sands and barkhans	4763.5	9.8
Results of soil formations	45748.7	92.6
Over-soil formations	3654.4	7.4
Irrigated land out of the total land area	2000	4.0

[17] Труды Таджикского научно-исследовательского института почвоведения. Сборник научных трудов. Душанбе, 2007, С. 16.

78. Out of 335.8 thousand ha of investigated land 75.5 thousand ha have a high level of groundwater. The rest of the area (206.3 thousand ha) also requires preventive measures on consequences of raised groundwater.

79. Granulometric content of the soils is given in the Table 14.

Table 14. Granulometric content of the soils

Depth, cm	***Fractions (mm)***							
	1-0.25	*0.25-0.1*	*0.1-0.05*	*0.05-0.01*	*0.01-0.005*	*0.005-0.001*	*<0.001*	*% of the physical clay (<0.01)*
0-10	0.02	7.75	20.26	37.05	14.58	8.48	11.88	34.94
40-50	2.23	9.28	27.15	30.55	8.02	13.41	9.36	30.74
80-40	0.39	2.38	11.7	36.4	11.56	26.16	11.41	49.13
160-170	0.13	1.44	11.82	32.56	7.72	19.51	26.82	54.05

Table 15. Granulometric content of gray-meadow soils

Depth, cm	***Fraction (mm)***							
	1-0.25	*0.25-0.1*	*0.1-0.05*	*0.05-0.01*	*0.01-0.005*	*0.005-0.001*	*<0.001*	*% of the physical clay (<0.01)*
0-10	0.34	0.92	41.7	35.07	4.58	7.39	10	21.97
10-21	3.21	0.98	67.38	8.28	4.15	6.38	9.84	20.37
21-39	0.12	1.06	44.74	31.76	5.14	7.95	9.23	22.32
39-54	0.17	0.71	42.04	34.20	6.38	3.26	13.24	22.88
54-79	0.05	4.36	31.93	36.85	5.36	4.16	17.29	26.81
79-102	0.03	0.37	35.78	31.69	8.61	9.62	13.90	32.13

Table 16. Granulometric content of the irrigated light gray soils

Depth, cm	***Fraction (mm)***							
	1-0.25	*0.25-0.1*	*0.1-0.05*	*0.05-0.01*	*0.01-0.005*	*0.005-0.001*	*<0.001*	*% of the physical clay (<0.01)*
0-29	3.70	6.72	21.48	28.64	8.40	12.22	18.84	39.46
29-53	5.85	11.19	24.96	26.24	6.68	10.12	14.96	31.76
53-70	3.67	14.58	31.35	27.40	6.36	6.64	10.00	23.00
70-90	11.21	25.69	27.82	17.28	3.56	5.96	8.48	8.00
90-115	1.69	17.58	31.05	33.24	3.36	6.08	7.00	16.44

Table 17. Granulometric content of the irrigated takyr like soils

Depth, cm	*Fraction (mm)*							
	1-0.25	*0.25-0.1*	*0.1-0.05*	*0.05-0.01*	*0.01-0.005*	*0.005-0.001*	*<0.001*	*% of the physical clay (<0.01)*
0-30	0.88	8.52	11.34	22.94	9.16	19.92	27.24	56.32
30-50	0.53	6.82	15.17	22.44	11.72	16.00	27.32	55.04
50-70	0.54	5.88	14.22	19.40	9.82	20.02	30.12	59.96
70-100	0.66	7.72	26.94	15.88	6.28	16.24	26.28	48.80

2.1.2.5 Uzbekistan

80. Soils spread on the territory of Uzbekistan are presented in the Table 18. The most valuable irrigated land areas of Uzbekistan produce 95% of agricultural crops and experience the continuous decrease in soil fertility due to improper crop rotations and crop alternations, decreased amount of applied organic fertilizers, uncontrolled application of mineral fertilizers (NPK), application of improper soil tillage technologies, inadequate irrigation regimes leading to the raising of the groundwater and soil salinization. Thus, during 1980-2005 the average ball-bonitet of soils in irrigated areas decreased by 4 balls and in some regions by 6-7 balls while in Samarkand this value reached 10 and Surkhandariya 12 balls (Table 19).

Table 18. Soils of Uzbekistan

Soils	Area. thousand ha	% to the total
I. Altitudinal belt		
1. Lightly gray-brown high mountainous soils	540	1.2
2. Brown mountainous soils	1660	3.7
3. Dark gray soils	1050	2.4
4. Typical gray soils	3050	6.9
5. Light gray soils	2590	5.8
6. Meadow-gray soils and gray-meadow soils	780	1.8
7. Meadow-gray soil belts	670	1.5
8. Boggy – meadow soils of the gray soil belt	70	0.2
Total	10410	23.4
II. Desert zone		
9. Gray brown soils	11025	24.9
10. Desert sandy soils	1370	3.1
11. Takyr soils and takyrs	1780	4.1
12. *Лугово-такырные и такыро-луговые*	460	1.0
13. Meadow soils of the desert zone	1790	4.1
14. Swampy-meadow soils of the desert zone	50	0.1
15. Solonchak soils	1270	2.9
16. Sands	12100	27.2
Other land (rocks. rockslides)	4150	1.3
Total	33995	76.6
Total for all land	44405	100.0

81. In accordance with the date during 1990-2001 the area of moderately and highly saline soils has increased (Table 20) while measures applied by government are not all encompassing and are not effective.

Table 19. Irrigated land conditions in Uzbekistan (thousand ha)

	Total	Including										Average ball			
		Worse land		Land with the quality below the average		Land with moderate quality		Land with good quality		Best land					
		I class	II class	III class	IY class	Y class	YI class	YII class	YIII class	IX class	X class				
		BALL OF BONITET													
		0-10	11-20	21-30*	31-40	41-50	51-60	61-70	71-80	81-90	91-100	1980	1990	2001	2005 *
Karakalpakstan Republic	416533		1919	29810	237202	69846	46458	24497	6801			45.00	44.00	41.00	41.00
regions:															
Andijan	224078		311	9593	34322	39801	45187	50547	38267	6015	35	67.00	60.00	57.00	57.00
Bukhara	232696		1038	16521	57391	42070	55294	40843	19456	83		57.00	58.00	53.00	50.00
Jizzakh	276824		105	3607	40717	143261	48533	30379	7413	2809		54.00	53.00	50.00	50.00
Kashkadariya	445379			3455	71977	198976	87416	50375	25003	8177		57.00	54.00	51.00	51.00
Namangan	228712		235	13499	45776	47117	36667	32553	33383	18181	1301	63.00	66.00	59.00	59.00
Navoi	99472		3358	9618	15253	17668	18200	20423	12853	2099		-	55.00	52.00	52.00
Samarkand	306407		41	2044	29478	72263	89756	57187	38321	16770	547	63.00	67.00	57.00	57.00
Surkhandariya	272058		704	11047	43203	59838	79317	50049	20985	6915		72.00	68.00	60.00	56.00

Syrdariya	269092		144	7302	66610	94579	55203	40414	4840			51.00	53.00	49.00	49.0
Tashkent	329021			2631	37586	86361	67968	74385	45380	14600	29	63.00	66.00	59.00	59.00
Fergana	314939		1426	8043	59139	56142	83586	67580	33001	5570	452	65.00	66.00	56.00	56.00
Khorezm	205718		625	8839	46298	34932	32052	49291	11848	102		70.00	54.00	54.00	53.00
Total	**3649115**		**9906**	**126009**	**784950**	**962854**	**795637**	**588523**	**297551**	**81321**	**2364**	**59.00**	**58.00**	**55.00**	**55.00**
2001. 01.01	**3167.39**		**7.66**	**88.23**	**688.81**	**868.38**	**622.11**	**515.92**	**293.49**	**80.01**	**2.78**	**59.00**	**58.00**	**55.00**	**55.00**

Table 20. Dynamics of the conditions of irrigated land in Uzbekistan in terms of salinity during 1990-2001 (thousand ha)

Regions	Years	Total irrigated land	Including saline land						Totals saline land	
			Lightly saline		Moderately saline		Highly saline			
			1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%
Karakalpakstan Republic	1990	432.7	158.3	36.6	173.9	40.2	70.5	16.3	402.7	93.1
	2001	417.2	91.1	21.8	124.9	29.9	117.7	28.2	333.7	80.0
Andijan	1990	214.5	44.6	20.8	18.0	8.4	4.9	2.3	67.5	31.5
	2001	197.9	44.4	22.4	17.3	8.7	4.1	2.1	65.8	33.2
Bukhara	1990	264.4	154.4	58.4	66.4	25.1	19.0	7.2	239.8	90.7
	2001	198.5	101.0	50.9	38.6	19.4	25.0	12.6	164.6	82.9
Jizzakh	1990	245.3	56.6	23.1	18.4	7.5	7.6	3.1	82.6	33.7
	2001	257.9	95.6	37.1	71.9	27.9	36.8	14.3	204.3	79.2
Kashkadariya	1990	414.8	149.9	36.1	70.2	16.9	26.2	6.3	246.3	59.4
	2001	414.8	198.3	47.8	57.8	13.9	28.9	7.0	285.0	68.7
Navoi	1990									
	2001	91.0	38.6	42.4	15.1	16.6	5.2	5.7	58.9	64.7
Namangan	1990	203.2	23.8	11.7	14.8	7.3	5.7	2.8	44.3	21.8
	2001	197.3	41.7	21.1	14.8	7.5	10.6	5.4	67.1	34.0
Samarkand	1990	298.7	32.8	11.0	4.8	1.6	0.1	0.0	37.7	12.6
	2001	260.7	87.1	33.4	16.5	6.3	3.9	1.5	107.5	41.2
Surkhandariya	1990	257.4	58.4	22.7	40.1	15.6	6.4	2.5	104.9	40.8
	2001	242.0	91.7	37.9	40.2	16.6	19.1	7.9	151.0	62.4
Syrdariya	1990	269.5	123.7	45.9	56.6	21.0	36.6	13.6	216.9	80.5
	2001	255.0	108.4	42.5	65.6	25.7	45.8	18.0	219.8	86.2
Tashkent	1990	306.0	25.7	8.4	2.4	0.8	0.3	0.1	28.4	9.3
	2001	298.3	56.0	18.8	10.9	3.7	4.5	1.5	71.4	23.9
Fergana	1990	273.4	29.5	10.8	9.6	3.5	0.3	0.1	39.4	14.4
	2001	254.6	92.1	36.2	57.5	22.6	36.6	14.4	186.2	73.1
Khorezm	1990	216.1	109.8	50.8	32.8	15.2	13.6	6.3	156.2	72.3
	2001	210.3	85.1	40.5	40.3	19.2	18.5	8.8	143.9	68.4
Total	**1990**	**3396.0**	**967.5**	**28.5**	**508.0**	**15.0**	**191.2**	**5.6**	**1666.7**	**49.1**
	2001	**3295.5**	**1131.1**	**34.3**	**571.4**	**17.3**	**356.7**	**10.8**	**2059.2**	**62.5**

3 Water resources and their use in Central Asia

3.1 Major sources of water resources and their use in Central Asia

82. Water resources of the Central Asia are represented by the water resources of the Aral Sea basin that are formed basically within mountainous areas as well as by precipitation. The supply of water in lakes situated within the mountainous areas of the Aral Sea basin makes up 46 m^3 while water resources in lakes situated within the flat land of the Aral Sea basin make up 70 m^3 excluding water resources of the Aral Sea itself. The volume of the Gissar-Alay glaciers is 88 m^3 and of Pamir glaciers – 465 m^3.

83. The basin of the Amu-Darya river constituting a part of the Aral Sea basin provides irrigation water for 3.6 million ha of land. The volume of the drainage water during years with abundant water supply reaches 10 m^3 year-1. While unproductive water loses within this basin increased up to 32-33 m^3 year-1 which is equivalent to the half of the average long-term run off. Figure 2 shows schematically the structure of the water draw-off and water use in the region with the intensive use of water for irrigation.

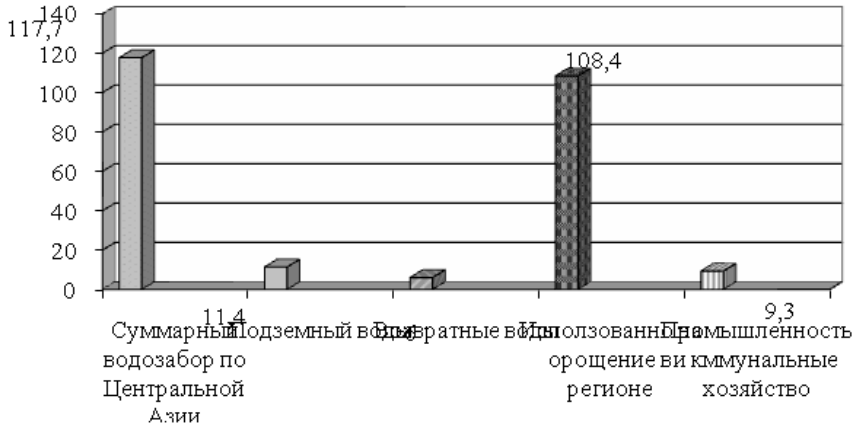

Figure 2. Structure of the water draw-off and water use in CA region (km^3) as of 1990 – the year with the average supply of water resources

84. There are 8900 rivers and 5000 lakes within CA region (Table 21).

Table 21. Distribution of rivers and lakes within the major regions of CA

River basin. region	Rivers		Lakes	
	Total	Length >10 km	Total	Area >1.0 km^3
Amu-Darya	40999	1787	2619	129
Syr-Darya	29790	1907	1405	65
Talas	3632	276	467	23
Chu	5244	491	506	39
Chinese Aksu	4495	214	260	4
Issyk Kul (lake)	1976	134	183	20
Turkmenistan	2972	167	211	42
Total	89018	4979	5961	321

Source: Никитин А.М. Озера Средней Азии. Я. Гидрометиоиздат, 1991-163с. (Nikitin A.M. Lakes of Central Asia. Gydrometeoizdat, 1991-163 p.

Table 22. Water resources of the Aral Sea basin (km^3 year^{-1})

River basin	Average long-term water use, m^3 sec^{-1}	Volume of the annual runoff, km^3 year^{-1}		
		average	maximum	minimum
	Amu-Darya river basin			
Pyanj	1140	35.91	-	
Vakhsh	661	20.8	27.6	16.2
Kafirnigan	187	5.29	9.81	4.09
Surkhandariya and Sherabad	127	4	-	-
Kashkadariya	49	1.156	2.72	0.897
Zerafshan	169	5.32	6.86	3.81
Total	2334	73.5	-	-
Syr Darya river basin				
Naryn	448	13.8	2.34	0.80.81717
Rivers of the Fergana valley	401	12.8	-	-
Rivers of the northern slope of the Turkistan ridge situated to the West from Fergana valley	9.63	0.30	0.446	0.225
Akhangaran	38.5	1.22	3.04	0.557
Chirchik	248	7.82	14.15	4.53
Keles	6.67	0.21	0.507	0.08
Arys	64.2	2.02	-	-
Rivers of the South-Western slope of Karatau ridge	21.1	0.663	-	-
Total	1237	38.83	-	-
Kyrgyzstan				
Talas	68.0	2.14	-	-
Chu	137	4.33	-	-
Issyk Kul (lake)	118	3.72	-	-
Chinese Aksu	225	7.07	-	-
Total	549	17.26	-	-
Turkmenistan				
Atrek	9.85	0.30	-	-
Tejen	27	0.85	0.530	0.093
Mugrab	53.3	1.68	2.60	0.373
Rivers of the Northern slopes of Kopetdag ridge	10.4	0.33	-	-
Total	101	3.16	-	-
Total for CA and Kazakhstan	4219	132.77	-	-

This table does not include water resources of Amu-Darya river's left bank affluxes that are formed on the territory of Afghanistan and approximately make up 13.3 km^3.

Source: Рубинова Ф.Э.. Геткер М.И. К вопросу оценки стока формирующегося ниже опорных гидрологичеких постов в бассейне реки Сырдарья (Треды САНИГИМИ -1975-вып.23 (104). С-59-70. (Rubinova F.E., Getker M.I. To the question of evaluating the runoff formed beneath the major hydrological stations in the Syr-Darya river basin. SANIGIMI-1975. 23rd edition (104). P-59-70).

85. Water resources of the CA region were estimated during 1967, 1969 and 1987 (Table 23). However, this data shows that water supply evaluation by these countries is overestimated and, therefore, requires conducting additional estimations of the water resources in CA.

Table 23. River resources of CA countries in accordance with the data given in different sources, km^3 $year^{-1}$

Countries	Area		Runoff water formed within the state			Runoff water coming from Afghanistan and Iran	
	Thousand km^2	% out of the total area	1967	1969	1987	1967	1987
Turkmenistan	488.0	27.63	1.0	-	1.13	-	2.9
Uzbekistan	447.4	25.34	11.1	10.6	9.50	-	-
Tajikistan	143.0	8.10	51.2	53.4	47.4	20.0	20.7
Kyrgyzstan	198.5	11.24	52.8	49.7	48.7	-	-
Total	**1765.9**	**100**	**126.1**	**-**	**106.73**	**-**	**23.61**

3.1.1.1 Kazakhstan

86. The volume of the total water resources in Kazakhstan is estimated to be 100.5 m^3 during the years with moderate water supply and 46 m^3 represent the usable volume. Water resource deficiency for all regions of Kazakhstan during the years with average long-term water supply is estimated to be 6.6 m^3. During dry years the level of water supply makes up 60% and in some regions (Central Kazakhstan) even 5-10% with the greatest portion of water deficiency observed in irrigated crop land. The situation is even more critical within the basins of trans-boundary rivers of the Syr Darya (1.2-3.4 m^3), Ural (up to 1.7 m^3), Ili, Shu and Talas.

87. The dynamics of water resource use is given within the Table 24.

Table 24. Dynamics of water resource use (million m^3)

Years	Sources	Drinking and other needs	Agricultural water supply	Industry	Fishery co-op	Irrigation	Others	Total
1990	Total	214	147	276	111	10136	437	11320
	Including surface waters (trans-boundary)	20	20	0	61	8500	0	8601
	Surface waters (local)	19	11	154	50	1636	0	1870
	From groundwater	175	116	122	0	0	14	427
	Secondary use of the drainage waters	0	0	0	0	90	423	513
1995	Total	140	130	180	150	10100	60	11300
	Including surface waters (trans-boundary)	0	20	0	100	7960	185	8265
	Surface waters (local)	0	10	60	50	2040	100	2260
	From groundwater	140	100	120	0	0	15	375
	Secondary use of the drainage waters	0	0	0	0	100	300	400

88. Decrease in water supply and deterioration of water quality within the lake systems considered as regulator of the water balance became a problem. Thus the area of lakes in Northern Kazakhstan shrunk up to 12%.

89. Intensive exploitation of the groundwater by the huge water withdrawals and mine drainages led to the decrease in the general level of groundwater in the region. Thus, the area of the major depression funnels in some cases reaches 1000 km^3 and the decrease in the ground level within the center of depression is 100 m (South-Kazakhstan, Jezkazgan, Karaganda, Kustanay, Koshketau, East-Kazakhstan regions).

90. Significant volumes of the groundwater are discharged (0.54 million m^3 per 24 hours or 10.2% out of total water withdrawal) without use via flowing artesian wells within areas near Aral Sea, mining drainages and water transportation.

91. The quality of the surface waters schematically presented in the Figure 3.

Figure 3. Quality of the surface waters

3.1.1.2 Kyrgyzstan

92. Average annual volumes of water resources in Kyrgyzstan make up 2458 m^3 with 50 m^3 of the surface water resources, 13 m^3 potential ground water supply, 1745 m^3 of lake waters and 650 m^3 of glaciers (Figure 4).

Figure 4. Sources of water resources in Kyrgyzstan

93. Only 12-17% of available water resources are used in Kyrgyzstan with substantial portion (nearly 23%) being lost during the use and 75% of water resources flow outside

Kyrgyzstan to the neighboring countries: Uzbekistan, Kazakhstan and Sintzyan-Uygur province of China. The dynamics of water use is given in Table 25.

Table 25. The dynamics of water resource use (millionkm^3)[18]

	1995	2000	2005	2006
Total	**6942**	**4976**	**4485**	**4533**
Including: - for production needs	254	48	59	72
- for irrigation and agricultural water supplies	6410	4749	4135	4215
- for households and drinking	279	182	149	128
- others	-	-	142	116
Water resources per capita, m^3	61	37	29	25

94. Taking into account climate change glaciers will be melting and their total area will shrink by 30-40% by 2025 leading to 25-35% decrease in water supplies.

3.1.1.3 Tajikistan

95. In accordance with the available data 8500 glaciers with the ice volume of 457 km^3 (or 400 km^3 of fresh water supply 8 times greater than annual runoff of all rivers in Tajikistan) cover 6% of the territory of Tajikistan or 8.5 thousand km2 which exceeds the total area of the crop land. Glaciers supply 1/3 of the annual or half of the summer volumes of river runoffs. However, the total area of glaciers in Pamir Alay is shrinking annually by 1.2 km2.

96. Glaciers that feed Amu-Darya and Syr-Darya rivers are the major source of water used for agricultural purposes in Tajikistan. Annually 20—22% of the total water flow is used for agricultural production.

97. Lakes predominantly situated at the height of 3500-5000 m occupy nearly 0.5% of the total territory of Tajikistan and have 46.3 cubic meters of water. The supply of fresh water make up 19.3 cubic meters with the greatest portion (17.3 cubic meters) accumulated in the Sarez lake. Meanwhile 90% of saline lake water is accumulated within the high mountainous lake Karakul.

98. The major characteristics of rivers in Tajikistan are given in Table 26

[18] Охрана окружающей среды в Кыгызской Республики 2000-2006. статистический сборник. Бишкек 2007. с-41.

Table 26. Major rivers in Tajikistan

River	Area of water collection, km^2	Average weighted height, km	Major characteristics of the water flow						
			Average annual water use, m^3 /sec	Annual water layer, mm	Годовой объем стока, млн.$м^3$	Period of high water level	Water outflow during high water level, %	Water spending m^3/sec	
								Maximum	Minimum
Pyandge	13900	4.60	120	272	3780	5-9	88	900	8,90
	113500	3.60	1020	285	32200	4-9	82	5420	281
Kyzylsu (Southern)	1790	1.76	29.4	518	930	3-5	71	625	4.50
	6200	1.21	77.0	390	2430	2-6	63	1310	17.8
Vakhsh	29500	3.43	619	661	19500	4-9	84	4150	120
	38300	-	580	462	17700	3-9	75	3450	39.0
Kafirnigan	3040	2.64	101	1047	3180	3-9	90	800	8.70
	9780	1.84	163	526	5140	2-8	82	1640	32.6
Zerafshan	4300	3.37	80.3	588	25.30	4-9	88	524	9.8
	10200	3.10	155	479	4890	4-10	86	996	24.0
Syrdariya	-	-	485	-	15300	4-8	70	4300	78.0
	136000	-	479	-	15100	5-8	-	2620	37.6

A – formation zone, B – connecting point

99. Major water reservoirs that allow increasing water use efficiency are constructed on the rivers Vakhsh and Syr-Darya and serve a water supply for multiple sectors of economy including energy sector, fishery and agriculture. Meanwhile a lot of smaller water reservoirs serve only for the irrigation needs. Currently used 6 water reservoirs have a supply of water in each of them ranging from 0.02 to 10.5 cubic meters making in total 15 cubic meters.

100. Groundwater is generally widely spread. In the North fresh waters are deposited on the depth of 3 to 60-80 m under the inter mountain depressions. Within the Syrdariya river groundwater is predominantly represented by hydro-carbonate waters and in rare cases by saline sulphate waters with the mineralization up to 5 gram deposited within 1 to 10 meters. Finally, on the greater depth under the layer of water resistant formations there is groundwater of good quality.

101. Within the Gissar valley there are fresh groundwater containing hydro-carbons and potassium with the mineralization up to 1 g l^{-1}. Groundwater are deposited within the depth of 5 to 40 m. Within the southern part of the valley where groundwater lay near the surface there is a narrow stream of groundwater containing sulphates with the mineralization of 1-5 gr l-1. While in the western part of the valley groundwater become sub-artesian in nature.

102. There are also good quality groundwater within the northern part of the Vakhsh valley that on the south become sulphate saline with the mineralization up to 5-50 gr l-1. Groundwater are deposited within the range of several centimeters to several meters.

103. In total the natural ground water resources of Tajikistan were evaluated to make up to 16.2 km^3. While total resources of groundwater that are used for different purposes make up 6.41 km^3 and only 2.69 km^3 represent the amount of ground water resources approved by the State.

3.1.1.4 Turkmenistan

104. Water resources of Turkmenistan formed by surface rivers Amudariya, Murgapa, Tejena, Kashana, Kushki, Atreka, Sumbara and smaller water streams coming from North-Western slopes of Kopetdag as well as groundwater.

105. The total length of Amudariya river is 2620 km. The water intake area of the river Amudariya is 227 thousand km2 with the average water flow calculated for many years making up to 79000 million m^3 per year with the 50% of this volume flowing during summer at the time of active glaciers and snow melting. The lowest volumes of flowing water (4% out of the annual flow) are observed during January-March and November-December. 22 km^3 year-1 or 28% of the Amudariya river water flow is consumed for irrigation needs in Turkmenistan.

106. Murgap river (978 km) is formed in Paropamiz, Afghanistan, where its water used for irrigation of 10-15 thousand ha. The rest of water flow (currently estimated by 1 billion m^3 year-1 is used in Turkmenistan. In accordance with the data received by measuring water flow in Tagtabazar settlement 29% of water flow is observed during May-June while 13% of water flow is observed during July and August at the time of the height water demand for agricultural needs. For the purpose of even water distribution during different seasons flood caused and torrential run-offs are regulated by eight water reservoirs with the total volume of 745 million m^3 established on Murgap river.

107. River Tedjen (1150 km) is formed also within the mountains of Paropamiz, Afghanistan, which is mostly used on the territory of Afghanistan and Iran with remaining 30-35% of the annual flow used by Turkmenistan. 32% of the water flow is observe during May while in July-November Tedjent river dries out. Therefore, in order to regulate water flow three water reservoirs were constructed with the total original volume of 383 million m^3 which is decreasing due to the muddiness of the water flow in the Tedjent river.

108. Atrek river (669 km) has a 27 thousand km2 of water intake area. Average annual water flow of the river is 8.6 m^3 sec-1. During the year more than five flooding events could take place.

109. The supply of the ground water in accordance with the approved data is 3.4 km^3 with 1.2 km^3 under use. More than 130 ground water points are used for satisfaction of the population's water demand: 41% used for drinking and household needs, 36% for irrigation and 23% for stock water development within pastures, balneology and other needs. Total water withdrawal from these sources is 400-470 million m^3 year-1.

110. The volume of the drainage flow in 1997-1999 was 6 km^3 year-1 with subsequent decrease in the year 2000 up to 4.7 and in 2001 up to 3.4 km^3.

111. Total volume of the water resources in Turkmenistan is 23414 million m^3 with 94% coming from the main river of the country – Amudariya, while Murgap river supplies 4.4% and the rest comes from other rivers of Turkmenistan (Table 27).

Table 27. Structure of the surface water resources of Turkmenistan

Rivers	**Volume of the annual water flow, utilization factor is 0.9, million m^3**	**Volume of water flow in total water stream, million m^3**
Amudariya	22000	94.0
Murgap	1044	4.4
Tedjen	232	1.0
Atrek	68	0.03
Small rivers	70	0.3
Total	23414	100.,0

3.1.1.5 Uzbekistan

112. Major water resources of Uzbekistan are formed by surface streams of trans-boundary rivers Amudariya (formed in Tajikistan), Syrdariya (formed in Kyrgyzstan) with effluents Kashkadarya and Zerafshan.

113. Total area of the Syrdariya river (2800 km) basin is 345 thousand km2. Water resources of the Syrdariya river on average make up 41.6 km^3. Total water flow of Syrdariya river entering the Ferghana valley is 25.5 km^3 year-1.

114. Amudariya river (2540) basin occupies 1327 thousand km2 and its water resources on average make up 68.63 km^3.

115. Total area occupied by Zerafshan river (576 km) is 143 thousand km2 with 131 thousand km2 of these area lying within the territory of Uzbekistan. Average water flow measured for many years is 5.91 km^3 and out of this volume 0.76 km^3 is formed within the territory of Uzbekistan. Zerafshan river basin is the region with the lowest water supply.

116. Kashkadariya river (310 km) has 8780 km2 as its water intake area. The average water flow of this river measured for several years is 1.0 km^3.

117. Groundwater constitute the significant part of water resources of Uzbekistan and make up in total 24.35 km^3 with 24.02 km^3 used for the regional needs. Fresh water supply is 8.95 km^3 (Table 28)

Table 28. Ground water resources of Uzbekistan

Basin	Natural resources	Ground water supply used for the regional needs	
		Total	Including up to 1 g l-1
	km^3	km^3	km^3
Amudariya	10.73	9.93	3.11
Syrdariya	13.62	14.09	5.84
Total	24.35	24.02	8.95

Source: Uzbekgidroingeo, 2001

118. Returned waters in accordance with the last estimations were ranging from 28 to 33 km^3 year-1 during 1990-2000. Such huge volumes of return waters are due to high infiltration loses from channels and irrigation fields.

119. Mineralization of the water within drainages is ranging from 1.5-2.5 gr l-1 in Central Ferghana and Southern Surkhandariya up to 5-6 l gr-1 within middle stream of Amudariya river.

120. Average supply of the surface water resources of Uzbekistan is 11.5 km^3 year-1 or 18% out of the total water demand (Table 29).

Table 29. Surface water resources of Uzbekistan

River	Average annual water flow measured for many years, km^3
Amudariya river bassin	4.82
Surkhandariya	3.25
Kashkadariya	1.06
Zarafshan	0.51
Syrdariya river basin	6.65
Rivers of the Ferghana valley	1.50
Midstream rivers	0.36
Chirchik, Angren	4.79
Total	11.47

Source: Glavgidromet, NRG Rep of Uzbekistan, 2001

121. Nearly 82% of the total water demand is supplied by the resources of the trans-boundary waters of Amudariya and Syrdariya that make up 123.08 km^3 of the surface water flow which is used for establishing the limits of water withdrawal by CA countries fixed by the

Intergovernmental Agreement between CA countries. In accordance with this document Uzbekistan is allowed to withdraw 71.69 km^3 of water resources. Out of this volume 13 km^3 comprises marginal waters and water of the underground sources – this volume fluctuates depending on available water supply of a particular year. Total volume of the water resources used in Uzbekistan is 60 km^3. In 2006 this volume was 56.19 km^3 with 38.91 km^3 of used water coming from Amudariya river basin and 17.28 km^3 from Syrdariya river basin. More than 90% of the total water supply is used for agricultural purposes.

Table 30. Volumes of water resources allocated for Uzbekistan, km^3

Rivers	Main stream	Effluents	Total	Ground water	Drainage waters	Total
Syrdariya	10.49	9.2	19.69	1.59	4.21	25.49
Amudariya	26.92	6.98	33.9	1.00	2.63	37.53
Total	37.41	16.18	53.59	2.59	6.84	63.02

Source: KIVR scheme[19] for the rivers Syrdariya (1983) and Amudariya (1984), Sredazgiprovodkhlopok.

3.2 System of water resources

122. Water resources of the Aral sea basin with its major rivers Amudariya and Syrdariya - having respectively 79.5 km^3 and 37.0 km^3 – are the common source of wellbeing for the Central Asian countries and Afghanistan. In order to regulate the water flow of these rivers 60 water reservoirs were constructed in the basin of the Aral sea with 39 of them placed within the territory of Uzbekistan. Coefficient of water flow regulation within the Syrdariya river basin is 0.93 and within Amudariya river basin is 0.8-0.85. Hydrological net of both rivers was equipped by supplementary hydro-technical constructions (water reservoirs, channels, collectors, hydro-electric power stations, etc.) during the second half the last century for the purpose of developing irrigation based agriculture in the region. Therefore, water flow is transformed not only on the level of channel network but also within the irrigated areas and is tightly connected with the metamorphoses of the groundwater.

123. During the former USSR mutual use of water resources by the CA countries was regulated by the application of the water withdrawal limits recommended by the Research Institute of "Sredazgiprovodkhlopok" and approved by USSR Ministry of Water Management. These limits officially are still valid after the Agreement "On Cooperation in the Area of Mutual Management, Use and Preservation of the Intergovernmental Water Resources" was signed by the ministries of the five CA countries in Almaty on February 18, 2009.

[19] Scheme of KIOVR (КИОВР) for Amudariya and Syrdariya rivers was worked out in 1983-1984 by the Ministry of the water management of the former USSR, protocol# 566, 1986, "On distribution of the Amudariya river basin's water resources", and Intergovernmental Agreement between the Central Asian countries, signed by presidents of CA countries in Almaty in February, 1992.

124. Low effectiveness of the water management constructions, huge infiltration rates, low water carrying capacity, difficulties in regulating water delivery, etc., are shortcomings characteristic for all CA countries. Depreciation of the irrigated systems facilities currently is on the level of 30-50%.

3.2.1.1Kazakhstan

[Russian text was unreadable and therefore could not be translated]

3.2.1.2Kyrgyzstan

125. Water resources of Kyrgyzstan comprises one fourth of the water stream of two major rivers of the Aral Sea basin: Syrdariya and Amudariya. 90% of the withdrawn water is used for agricultural purposes, 7% by the industry and 3% for other purposes including supplying population with drinking water.

126. Water system in Kyrgyzstan comprises 6109.45 km long inter-farm channels, 5760 hydro-technical constructions, 3367 hydro-points, 87 pumping stations, 1176 km long drainage channels, 34 water reservoirs with the total volume of 1323.9 million m^3, 60 basins with the regulation of the water during 24 hours that have useful capacity of 21.95 million m^3, 11 basins with the water regulation during every 10 days that have the total capacity of 50.25 million m^3 and 87 pumping points that supply the area of 52.3 thousand ha of irrigated land with the 300 million m^3.

127. The Department of water management supplies water for irrigated area of 1043.2 thousand ha including 873.9 thousand ha (85%) of land with good qualities, 108.84 thousand ha (10%) with unsatisfactory quality and 60.47 thousand ha (5%) with satisfactory quality.

128. Currently there are 461 water use associations (WUA) and 451 of them are registered and are functioning. Total irrigated area covered by WUA is 731 thousand ha or 70.1% of the total irrigated land.

129. Considering the importance of irrigation for Kyrgyzstan government of the country starting from 1996 has been taking measures to receive credits from the International Association for Development (IAD) for maintaining water resource systems that has lead to the realization of several programs during 1996-2006 with the total amount of funding making up 82.6 million USD representing received credits (USD 65.2 ml) and funds from the State Budget (USD 17.4 ml) 20.

130. Water use problems in Kyrgyzstan are connected with inefficient water management in mountainous areas, substantial water losses within the irrigation channels that make up 40% out

[20] Ж.Агропресс. по вопросам АПК КР. Ноябр 2007 г. С. 32-33.

of 90% of water resources used for the irrigation in Kyrgyzstan and other neighboring countries due to the absence of water facility maintenance and repair. Meanwhile the consumption of irrigation water by all water users is lower than this 40%. Currently financial support received by Kyrgyzstan from the neighboring countries for the maintenance of the water distributing system is insignificant.

131. 80% of the watersheds are under erosion resulted from irrigation due to the disproportional land irrigation practices.

3.2.1.3 Tajikstan

132. Irrigation based agricultural production is the main activity within rural areas in Tajikistan that generates more than 95% of the agricultural production in the country constituting 15% of the GDP as well provides employment for 2.5-3.0 million people. Therefore, development and improved efficiency of the irrigated agricultural production directly connected with decreasing the poverty in rural areas.

133. There are 632 irrigation systems with the 25.3 thousand km long permanent channels (6.2 thousand km long major inter-farmer channels and 19.1 thousand km long on-farm channels). Excessive groundwater are discharged from the irrigated areas of 149.4 thousand ha by 636 km long inter-farm collectors and 4.8 thousand km long drainage channels of internal use including 3.1 thousand km of open type and 2.3 thousand km of closed type drainage channels.

134. Technical imperfection of the irrigational system is not only causing substantial water losses but also stimulates water induced land erosion (20% of the area in Yavan valley that brought under cultivation starting form 1968 is under active erosion processes). However, rational water use practices also stimulate land degradation processes 21.

135. 93% of the water resources in Tajikistan is consumed by agricultural sector, 4 % by industry and 3% by households. Industrial sector uses surface and ground water in equal proportions. On average the annual water consumption makes up 12.5 km^3.

136. Highest annual water consumption rates (15 m^3) in Tajikistan were registered during 1977-1984. Currently12-14 m^3 were allocated for Tajikistan. Considering that water withdrawal in 1960 was 8 m^3 during 30 years water consumption in Tajikistan increased by 30%.

137. Due to the low efficiency of irrigation channels (0.55-0.65) transportation loses of water make up 17%. Direct irrigation consumes 14-16 thousand m^3 ha^{-1} that can be reduced by 20-

[21] Хамраев Н.Р., Денисов Ю.М., Давранова Н.Г., Азимбаев С.А. Основы управления местными водными ресурс ha^{-1}ами пустынь (на примере Центрального Кызылкума). Ташкент: АО «агросаноат ахбороти». – 1997. – С.130.

30% if alternative irrigation methods will be applied. Total area of irrigated land in Tajikistan is 700 thousand ha where cotton is the predominant irrigated crop.

138. Annual water withdrawal of groundwater from 5 thousand wells and other facilities on average is 1 km^3. Pollution of the groundwater in the process of irrigational water infiltration within the left bank of the Syrdariya river leads to the drinking water deficit within the northern parts of Tajikistan.

139. Mineral waters are widely spread especially in Pamir and their potential is not fully used yet (30%). Several health resorts were constructed: Yavroz, Khoja Obigarm, Garm-Chashma).

3.2.1.4 Turkmenistan

140. Annual internal water supply per capita in Turkmenistan is 232.0 m^3 – the lowest amongst CA region (Table 31). Water problem in Turkmenistan stemming from its geographical position and climatic conditions is most acute in the northern and north-eastern parts of the country (Dashoguz, Darganatin district of the Lebap region situated within the Aral zone).

Table 31. Internal renewed water resources of CA countries, 1998.

Countries	Ml^3 $capita^{-1}$
Kazakhstan	4484
Kyrgyzstan	10394
Tajikistan	11171
Turkmenistan	232
Uzbekistan	704

141. In accordance with the World Bank assessment soil fertility depletion and soil salinization within the basin of the Aral sea leads to the economic loses equivalent to $2 billion decrease of GDP (5%) while increased mineralization of the drinking water causes deterioration of the population's health conditions.

142. Under the condition of water shortage observed during the last years as well as intensive water withdrawal for irrigation the annual water flow into Aral sea decreased from 60 to 5-15 km^3 and in some years with extreme water shortage up to 2-3 km^3. Surface sea area has decreased two times while sand deflation by wind caused widespread soil and water pollution on big scale leading to the decrease in fish supply, destruction of the ecosystem and recession in tourist activity.

143. Natural hydro-graphical net of Turkmenistan includes major trans-boundary rivers: Amudariya, Murgab, Tedjen, Etrek, - and 20 small rivers flowing from northern slopes of Kopetdag (Table 32).

Table 32. Water resources of Turkmenistan

River/Source	Stage gauge	Average value estimate4d for many years	
		Withdrawal, m^3 sec^{-1}	Water flow, million $m^3 year^{-1}$
Surface waters			
Amudariya	Ata-murat	697.6	22000[22]
Murgab	Takhta-bazar	51.8	1631
Tejen	Aul-ata	27.6	869
Ertek	Chat	11.3	354
Small rivers of Kopetdag and Koytendag, major springs, etc.	-	4.8	150
Total		793.1	25004
Groundwater	-	-	1269
Total	1269		
Gross total	26273		

144. From south to north natural hydrological net is gradually substituted by the artificial net with the 41.2 thousand km long irrigational channel (including 3.2 thousand km of intrafarm irrigational channels) and 35.5 thousand km of drainage channels (including 26.5 thousand km of intrafarm drainages).

145. Length of Amudariya river for the merging point of rivers Vakhsh and Pyandj to the estuary is 1409 km with the 744 km of the river situated within Turkmenistan. Average water flow measured for many years on the hydrological measuring point Ata-murat si 56.57 km^3 year-1.

146. Total surface water resources of Turkmenistan make up 25 km^3 with 88% supplied by Amudariya river.

147. Another river significant for water supply of different southern regions of Turkmenistan is the river Karakum artificially created with the length of 1380 km. Karakum supplies ecologically clean water for irrigating 1 million ha of land.

148. There are 16 water reservoirs in Turkmenistan used for irrigation purposes with the total valume of 3.7 km^3. Five of these reservoirs used for accumulation of the river's winter flow to be later applied for irrigation during spring vegetation are constructed on the river Karakum with the total volume of 2.5 km^3.

[22] Объем водозабора Туркменистана из Амударьи, осуществляемого в соответствии с соглашением пяти государств Центральной Азии (1992 г.) и соглашением Туркменистана с Республикой Узбекистан (1996 г)

149. During 2000-2001 due to the water scarcity limits of water withdrawal from Amudariya river were reduced. Actual water withdrawal from Amudariya river by Turkmenistan is presented in Table 33.

Table 33. Actual water withdrawal from Amudariya river by Turkmenistan under the established limit of 22000 million m^3

Year	Water withdrawal, million m^3	
	Total	Including Karakum river
1997	21146	10687
1998	23024	11931
1999	22045	11118
2000	16748	9003
2001	13519	7171

3.2.1.5 Uzbekistan

150. Irrigated land of Uzbekistan exceeding 4.2 million ha produce 95% of the agricultural production. Due to the water management policy of the former Soviet Union directed to the creation of the major cotton center in Uzbekistan wide scale wild land reclamation (Golodnaya Step, Jizakh, Kashkadariya, etc.) was initiated in 1960 and continued up to 1985-1986. From the engineering point of view irrigational systems constructed at that time were of high standard. As a result of this policy the area of irrigated land increased from 2.57 million ha in 1960 up to 4.22 million ha by mid of 1980s, i.e. 1.6 times. Cotton production increased form 2.95 million to 5.37 million tons. Economic indicators of the constructed systems and water use efficiency was high (0.80-0.85 water use efficiency of the irrigation channels).

151. However, sustainability and ecosystem's balance was most of the time ignored during the process of increasing the area of irrigated land.

152. Starting from 1980-s land reclamation process discontinued. At the same time the area of irrigated land per capita has decreased approximately by 25% (from 0.23 to 0.16 ha).

153. As a result of land degradation and water shortages productivity of one hectare of arable land decreased by 23 % with corresponding increase in input and labor expenses.

154. Currently the water resource system consists of 193 thousand km long channels and irrigational net, 87 thousand water management constructions, 55 water reservoirs, 1500 pumping stations and more than 10420 wells. More than half of the irrigated land are supplied by water using pumps.

155. Depreciation of the irrigated systems makes up 30-50% decreasing the level of security of the provided services by 30-31%. During 1991-2001government investments decreased from 27% to 8% and capital investments in water management decreased by 5 times meanwhile

payment for the electricity consumed by pumping stations increased from 13.6% to 48%. Nearly 20% of the consumed electricity in Uzbekistan and 70% of the Water Management Ministry's Budget is spent for electricity used by pumping stations and drainages. Financial support for maintaining water resource infrastructure decreased from 191 billion Uzbek sum (2000) to 183 billion Uzbek sum (2003).

3.3 Drainage systems

156. Drainage systems in CA countries are divided into State Budget supported inter-farm drainages and farmer holding supported intra-farm drainages that represented by three types of drainages: open drainages, closed horizontal drainages and vertical drainages.

157. Most problems related to the drainage systems are found in Uzbekistan and Turkmenistan where major portion of irrigated land of the region is concentrated. Besides, these two countries are situated within the lower parts of the Amudariya and Syrdariay basins that makes discharge of groundwater difficult.

3.3.1.1 Kazakhstan

158. Kazakhstan in terms of water supply and water distribution is on the last place amongst CA countries. On average annual water flow entering the territory of Kazakhstan is 100.5 km^3 of water and 56.5 km^3 out of this total amount is formed on the territory of the neighboring countries: 18.9 km^3 in China, 14.6 km^3 in Uzbekistan, 7.5 km^3 in Russia and 3.0 km^3 in Kyrgyzstan.

159. Currently due to the lack of financial support drainage systems are deteriorating. Besides, capacity of drainage facility producing industry has decreased. Thus, at the late 1980s and early 1990s the industry produced annually up to 11 thousand tons of polyethylene tubes, 2000 km of drainage ceramic tubes, 6 million m^3 of filtration materials made form sand and gravel, 100 unites of the drainage installing equipment. Meanwhile drainage cleaning machines allowed to clean annually up to 2500 km of drainage channels as well as 600 vertical drainages were constructed annually.

160. At present time the capacity of the amelioration machines decreased by 10 times, drainage tube production decreased by more than 100 times and capacity of the drainage cleaning facilities decreased by 20 times. Previously inter-farm drainage channels were cleaned once in three years while on-farm drainages were cleaned once a year. Currently the frequency of drainage cleaning decreased by 2.5-3 times23. In accordance with assessment the area of highly and mid saline land increased by 600000-800000 ha.

[23] http://sic.icwc-aral.uz/releases/rus/022.htm

3.3.1.2 Kyrgyzstan

161. Drainage net in Kyrgyzstan comprising 4.8 thousand km including 2.5 thousand km of open drainages and 2.3 thousand km of closed drainages is used for discharging exceeding groundwater from the irrigated area of 149.4 thousand ha. Due to unsatisfactory functional conditions of the drainage channels ground water level and salinity is continuously increasing and currently 1068 km of drainage channels should be cleaned.

162. The area of land with poor conditions and high ground water level is increasing. Thus, saline land make up 4.0 million ha, eroded land – 5.6 million ha and water lodged land – 119 thousand ha24 that led to the decrease in the yields of agricultural crops.

3.3.1.3 Tajikistan

163. In Tajikistan out of the 720 thousand ha of irrigated land 55.6 thousand ha are under unsatisfactory conditions.

164. For the purpose of regulating the ground water level and salinity balance on irrigated land the drainage net was constructed on the area of 311.2 thousand ha.

165. More than 90% of the surface water pollution is due to the discharged water from the drainage channels. 4.1 km^3 of returned irrigation and drainage waters are formed on the territory of Tajikistan and 0.35 km^3 is used for irrigation while rest of the water is discharged to the natural water streams.

3.3.1.4 Turkmenistan

166. The volume of the drainage waters from irrigated land of Turkmenistan is more than 7 km^3 year-1. Under the conditions of the natural water resource deficit the government of Turkmenistan has developed several projects and one of them is the project of "Turkmenistan lake" with the capacity of 140 km^3 to be created in the central part of the Karakums in the lower part of Karashor which will be accumulating drainage waters from all irrigational systems of Turkmenistan. 2645 km of drainage channels will be constructed in order to collect drainage waters within the 720 km long main collector. The alternative for creation of the drainage water accumulating reservoir is the intersystem use of drainage waters.

3.3.1.5 Uzbekistan

167. Currently nearly 19 thousand km of the open inter-farm drainages have to be cleaned, 11.5 thousand km of the open and closed drainages need to be repaired and reconstructed and no more than 50% of the closed horizontal drainages are functional25.

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[24] Жумабеков Ж.ЭПочвенно мелиоратиыное состояние земель Кыргызстанаи пути иъх улучшение. Труды Таджикского НИИ почвеведения. Сборник научных трудов. Душанбе, 2007, С. 88-89

168. In the Amu Darya river basin annually on average 1.2 km^3 of saline water with mineralization of 8 g l^{-1} is discharged from collectors Yujnyi and Sichankul collecting drainage waters from irrigated land of Kashkadariya steppe. Up to 1.5 km^3 of drainage waters with mineralization of 4 g l^{-1} are discharged from irrigated land of Bukhara region (Table 34).

Table 34. Mineralization of the drainage waters discharged from the major collectors to the right bank of Amu Darya.

Collectors	Volume of discharged water, million m^3	Mineralization, g l-1	Water collecting unit
Dengizkul	429.8	5.3	ПБДК (current site)
Southern	29.4	8.0	Dengizkul
Major Karakul	75.5	7.1	ПБПК (current site) Amu Darya
Central Bukhara	286.1	3.5	Saline lake, Amu Darya
Western Romitan	80.2	3.0	Saline lake, Amu Darya
Norhtern	343.5	3.4	Karakyr lake
Ayak-achitma	120.8	2.3	Ayak-achitma lowland
Karakulbazar	109.4	9.0	Khadicha low-land
Parsankul	367.9	5.1	Amu Darya
Dul-dul	117	2.5	Ayak-achitma lowland
Central	50	1.9	

169. At present nearly 53% of the land in Uzbekistan are salinity effected with 1 million ha of moderately and highly saline land. 0.8 million ha are effected by irrigation caused erosion and 2.3 million ha – by wind erosion. Loses of humus during one season as a result of erosion make up 80 t ha^{-1}. 7.4 million ha of pastures are degraded as a result of overgrazing and technogenic effect and losses of fodder biomass make up 21%. More than 5 million ha of pastures are effected by sand deflation due to deforestation leading to the loss of 15% of biodiversity. Nearly 54% of the investigated soils are effected by pesticide pollution and more than 80% have high concentration of magnesium chlorate.

[25] Проект государственной стратегии Республики Узбекистан «Совершенствование управления водными ресурсами и водопользованием в условиях реформирования сельского хозяйства и организации ассоциаций водопользователей МСВХ РУз, объединение «водпроект» 2004.).

3.4 Pricing of the water resources

170. Increasing water deficit necessitates the establishment of the pricing for water use. However, there are organizational and technological difficulties such as absence of perfect systems of water measurement that need to be overcome in order to make water pricing as an effective system of water use. The average use of irrigated water per one ha in the region is 13-15 thousand m^3 which is by 30-35% higher than the established norms. While water losses due to infiltration and evaporation is around 36%.

171. At present time there are five types of payments for water in CA countries:

- Payments for drinking water paid by population;
- Payments for water delivery paid by all types of water users: agriculture, industry, etc.;
- Payments for regulation of the water stream paid by water management units of the neighboring countries;
- Fines for water pollution paid by all water users;
- Payments for licenses regulating activity on water management by all of the major water users.

3.4.1.1 Kyrgyzstan

172. In 1999 a decree on tariffs for water delivery services. In accordance with this decree the cost of 1 m^3 is 3 Kyrgyz tyins which is subject to adjustment to the inflation rates. Thus, in 2007 the cost of 1 m^3 was 6 tyins. However, these payments do not cover all the water use related expenses.

3.4.1.2 Tajikistan

173. The issue of introducing new payment for water as a natural resource is being currently considered. In this respect the government has developed "The statute on payments for water resources of the Republic of Tajikistan" and the Ministry of Economy and Trade has prepared an analytical report on "Payments for natural resources".

174. In accordance with the statute of the Government all water users have to charged payments for using water, i.e. including hydro- and heat power industries along with the agricultural sector.

175. At present only 50-60% of all payments are collected. However, even if all 100% payments will be collected they are not sufficient to cover the expenses related to the use of irrigated systems due to the low tariffs: 0.6-1.0 dirham per 1 m^3 of water or 6-10 somon per 1000 m^3 (2-3 USD).

176. Including hydro-power industry into the list of water users charged with the payments is a disputable issue as hydropower stations do not represent ordinary water users and do not have

any effect on water resources – do not withdraw and pollute water resources. Moreover, hydropower stations implement the function of protecting the area from flooding. In addition, hydropower stations help to regulate a river stream which is also done for irrigational purposes.

177. However, the proposed charging of the hydropower industry for the water use is quite justified. This payment is charged to hydropower stations in many countries. Introduction of these payments equalizes hydropower industry and heat-power industry making the heat-power industry competitive which otherwise would be uncompetitive due to the higher expenses for sources of fuel. Introduction of these rates is probably also rational for Tajikistan as it will stimulate the development of the coal industry and to a certain degree the development of the oil and gas industries.

3.4.1.3 Turkmenistan

178. In accordance with the decree of the President of the Turkmenistan "On introduction of the payments on using water for certain categories of the water users and water use on irrigated land exceeding the planned volumes", as of May 5, 1994, payments on using water resources were introduced for industrial enterprises and other water users whose activity is not connected with irrigation. Users in this category are charged for the total volume of the used water while agricultural sector is provided with the free water resources within the planned limits and are charged three times of the established tariffs for the used volumes of water exceeding the planned limits.

179. Factual payments received from water users covers only 10% of the expenses for using water facilities. At present tariff for using water resources is 28 manat 74 tenge per 1 m^3. Under the condition of machine water pumping a coefficient of 1.7 is applied (48.86 manat per 1 m^3) and under the condition of self flowing water e coefficient of 0.8 is applied (23 manat per 1 m^3).

180. Technical maintenance of the inter-farm water infrastructure in accordance with the signed agreements is carried out by the management of the irrigation system using the rents paid by renters and land users in the amount of 3% out of the cost of the gross products produced by them.

181. In 1999 total amount of the payment for using water resources charged to renters in the farmer associations made up 33.3 billion manat and in 2000 – 26.6 billion manat.

3.4.1.4 Uzbekistan

182. Starting from 1999 in accordance with the Decree of the Cabinet of Ministers # 554 as of December 31, 199 taxes were introduced in Uzbekistan for using water resources. For the use of the 1 m^3 of surface waters the tax rate is 9 tiyin (0.09 sum) while for the groundwater is 12 tiyins (0.12 sum). However, these taxes do not cover all expenses of the water management organizations. As farmers are not able to cover all expenses incurred for water delivery all these expenses are covered by the funds from the state budget.

183. It is known that productivity of the agricultural crops depends on the quality of the irrigation waters. Therefore, this factor should be taken into account when establishing prices for water resources.

184. Shift to the system of paid water use should be made in several steps. At the initial stage a mechanism for decreasing the volume of the irrationally used irrigation waters (or used over the excepted norms), as well as a mechanism of measuring the volume of the used water should be developed. Successful resolution of these issues will stimulate launching of the mechanism of the paid water use.

185. At present water use associations are being created and their primary function is to deliver water to the farmer and dekhkan holdings, resolve issues on improvement of the fields ameliorative conditions and maintenance of the irrigation-drainage net. However, the status of these organizations is not clear within the legal frames and there is not clarity of their role and their function within the system of paid water use.

4 Agricultural production in Central Asian countries (plant industry and livestock production)

4.1 Overview of the development in agricultural production of CA countries

186. During the years of independence several practical measures were taken on further improvement of the structural policies within the agricultural sector of CA countries. Major priorities were diversification of agriculture, abandoning orientation towards monoculture (cotton) cultivation, self-production of food products, development of the food processing industry and supplying with the technical and material resources. The economical development strategy was aimed at production of the products for exporting and substituting imported goods.

187. Changes that took place within the agricultural sector of Uzbekistan can be vividly depicted by the comparative analysis of the micro-indicators, production and consumption indicators of CA countries. During the years of independence the role and share of the agricultural sector within the cost of the domestic product of Uzbekistan significantly decreased making in 1991 37.3%, in 2004 – 26.8% and in 2007 – 21.7%. Under the condition of transient economy this tendency can be dually interpreted. On one hand, it shows industrialization and development of other sectors of economy. On the other hand, under the condition of stagnation and slowed down economic growth this show the collapse of the agrarian sector. However, it should be noted that before reforms (1987) the share of agricultural sector in GDP was also 26%.

188. Tendency of unstable share of the agricultural sector within GDP was observed in al CA countries. Thus, in comparison with 1991 this tendency was observed in all countries of CA except Kyrgyzstan. This tendency is supported by the agrarian orientation of Kyrgyzstan and increase of other sectors of economy in other countries of CA (Figure 5).

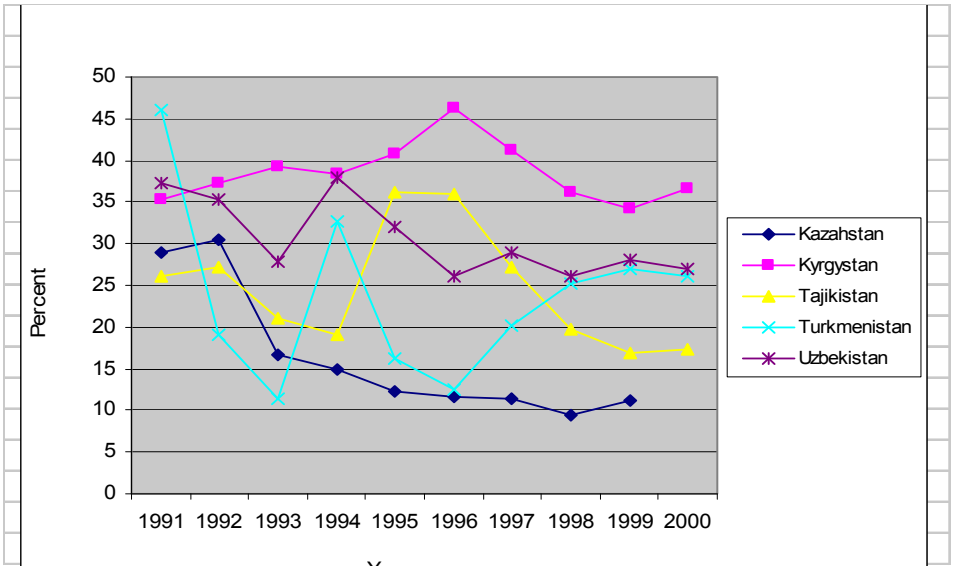

Figure 5. Share of agriculture in GDP in CA countries (%)

Source: Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2004 год. FAO Statistical databese http://appsfao.org/page/collections?subset=agriculture

189. Differences in the tendencies are explained, first of all, by unequal beginning conditions and the speed of introducing reforms within the agrarian sector and economy in general.

190. Kyrgyzstan and Kazakhstan followed the accelerated way by stimulating mass privatization of the processing industry and introducing land reforms, while Uzbekistan and Turkmenistan selected evolutionary way of reforming the agrarian sector. First of all, during the years of independence significant increase in the service industry and small and mid-sized business was observed in three republics. In Kyrgyzstan the annual increase in the share of agriculture within the GDP was 1.2% mainly due to the shrinking industrial production. Smaller rates of decrease in the share of agriculture within the GDP of Uzbekistan is due to the significant orientation to the production of products for export (second cotton producer in the world) that stimulate the flow of freely convertible currency into the state budget and, thus, forms the major source of investment into other sectors of economy.

191. During the years of independence a decrease in the production of the gross agricultural product per capita was observed in Uzbekistan due to changes in the structure of agricultural production, increasing demographic pressure on the economy of the country and decreasing land productivity.

192. Decrease in the agricultural production (except cereals production) was observed in all CA countries starting from the collapse of the USSR (Figure 6).

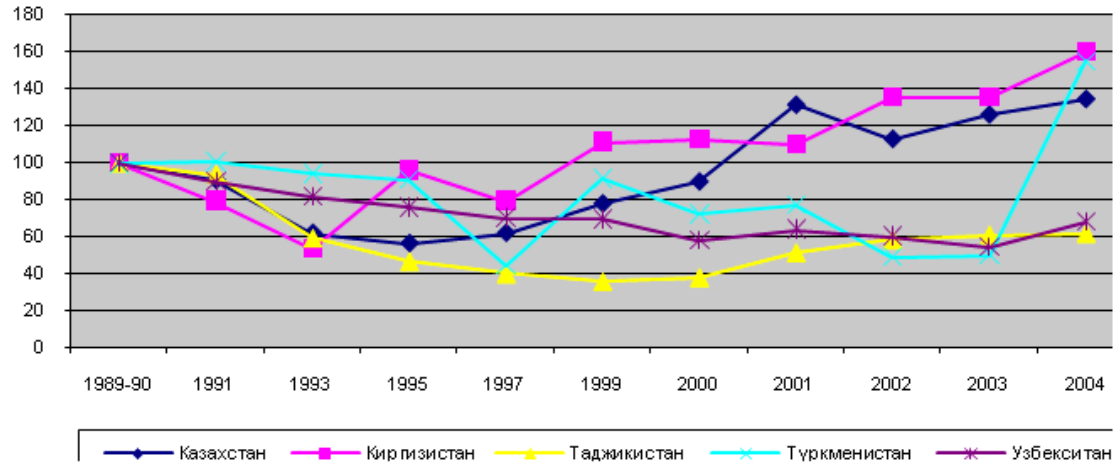

Figure 6. Tendency of cereals production in CA countries during 1990-2004.

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2004 год.(2) FAO Statistical databese http://appsfao.org/page/collections?subset=agriculture

193. The fundamental policy in CA countries except Kazakhstan and Kyrgyzstan was the policy of cereal independence that lead to decrease in the wheat import into the region. In many cases wheat independence was achieved by converting land under cotton production for wheat production.

194. There is a certain dependency between the decrease of arable land and cotton production: 10% decrease in the arable land led to 20-27% decrease in production in all three countries. The negative side of this policy is a decrease in the income from export and income of agricultural producers.

195. On the other hand, countries with more liberalized agrarian markets and favorable conditions for agribusiness have seen increased cotton production. Thus, cotton production in 2004 increased by 34.4% in Kazakhstan, 55% - in Turkmenistan and in Kyrgyzstan this indicator increased after reforms by 60.3% (Figure 7).

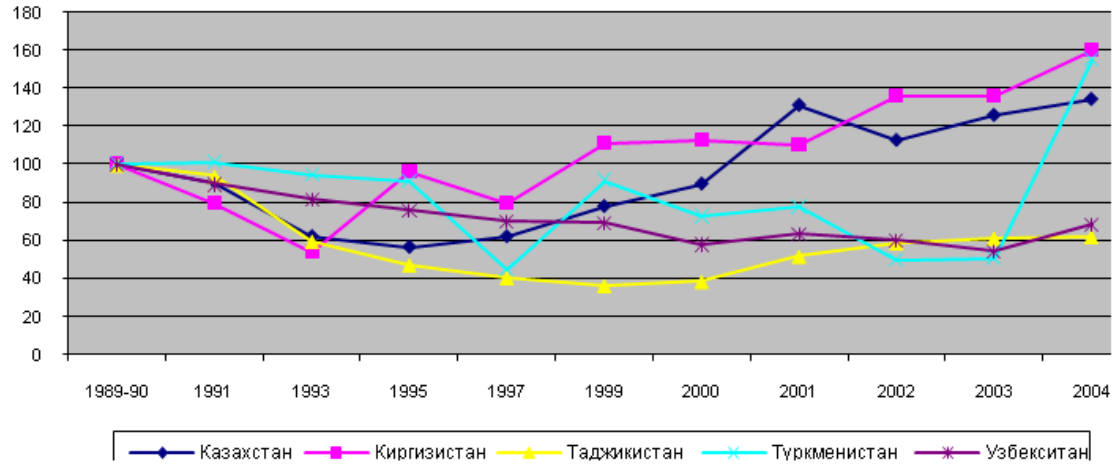

Figure 7. Tendency of cotton production in CA countries during 1990-2004.

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Source: Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

196. Tendency of decreasing share of cotton within the production structure is due to the necessity of eliminating the monopoly of cotton in favor of developing food crop production. However, the major reason is the existing price policy for the products of stately order which is unfavorable for profitable agricultural production.

197. Production of meat decreased in all of the CA countries except in Turkmenistan and Uzbekistan where this indicator increased by 27.5% and 24.3%, respectively (Figure 8). Share of the livestock production within the agricultural production in Turkmenistan make up nearly 60% (livestock population is 15.2 million heads including 15.1 million goats and 127 thousand camels.

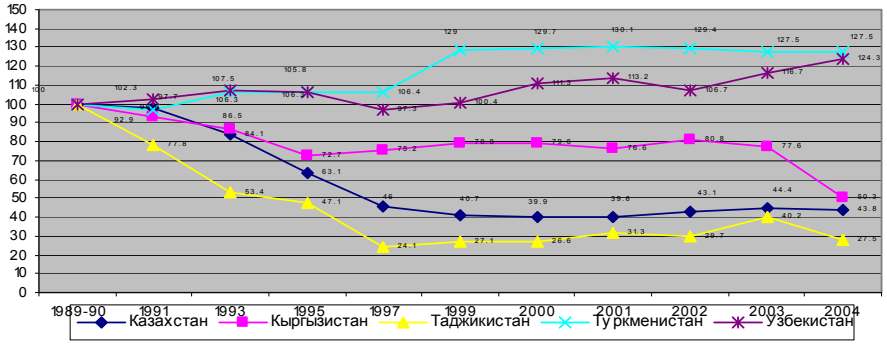

Figure 8. Tendencies of meat production in CA countries.

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

198. Poultry production has decreased in 2004 in comparison with 1990 due to the deficit of special feed-stuff and veterinary services. This tendency directly affected egg production which has decreased 10 times in Tajikistan, more than 3 times in Kyrgyzstan, 2 times in Kazakhstan and by 23.8% in Uzbekistan (Figure 9).

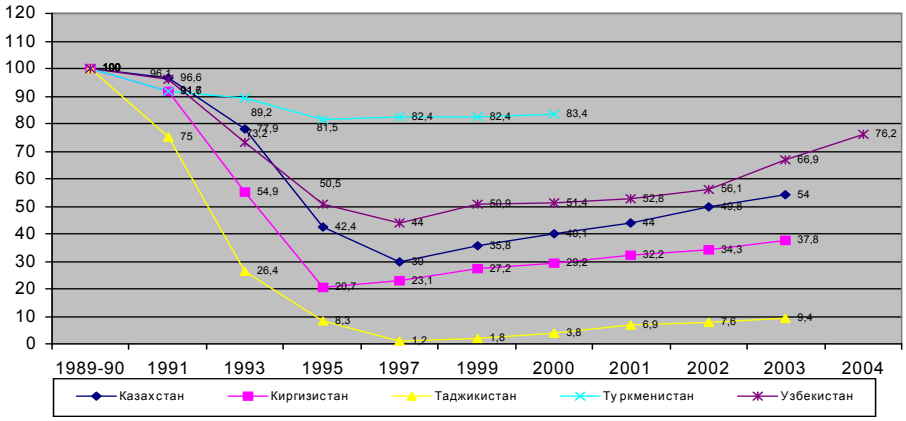

Figure 9. Tendency in egg production within CA counties during 1990-2004 years.

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

199. The situation was observed in milk production as it has decreased in Kazakhstan by 18.7%, in Tajikistan -29.9%, in Kyrgyzstan – 32.4%. Only in Turkmenistan and Uzbekistan milk production increased 1.5-2 times (Figure 10).

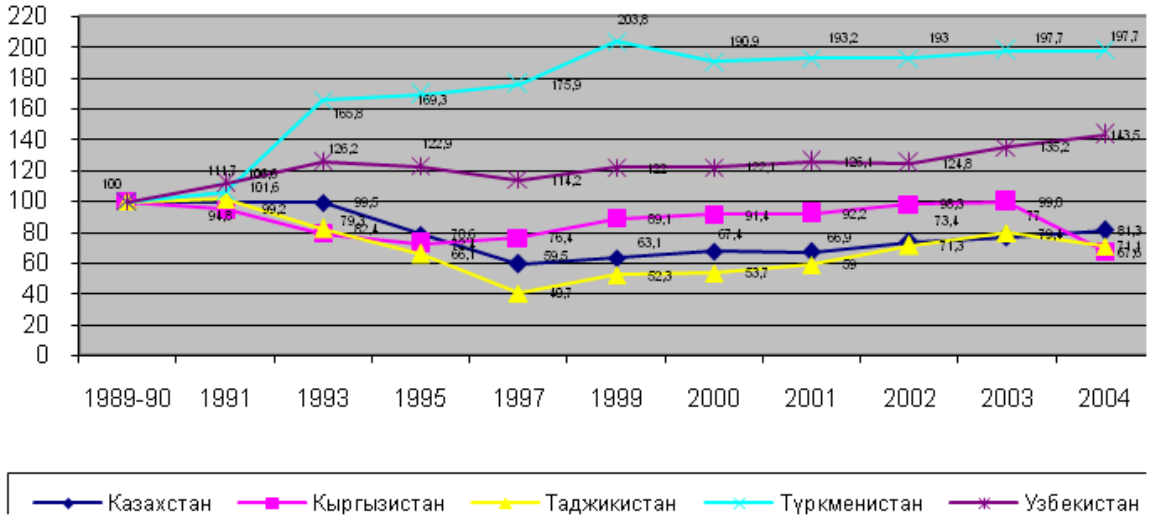

Figure 10. Tendency in milk production within CA countries during 1990-2004 years.

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

200. In Uzbekistan significant increase was observed in the specific weight of livestock population within the private sector. As a result of privatization of the unprofitable livestock farmer holdings 90% of the livestock population was transferred to the private sector since 1992. Livestock population kept within the private sector (dekhkan holdings) continue to increase making the private sector the producer of nearly 95% of meat, milk and eggs.

201. Turkmenistan and Uzbekistan – two countries that chose the way of gradual reformation with significant governmental intervention – could retain the potential of agriculture that was before reforms. While, Kazakhstan and Kyrgyzstan –countries that chose the direction towards more liberalization - have significantly decreased production indicators though in case of cotton production market demand during 1990s led to increase of cotton production in Kyrgyzstan. General tendency for all countries of CA is the sharp decrease in all structural indicators till the year 1994-1995 with the subsequent restoration of the production level that was before reforms.

4.2 Land and water resources used in agriculture

4.2.1.1 Kazakhstan

202. Arable land including land suitable for pastures/animal grazing, especially, steppes make up 222 million ha or 82% out of the total area.

203. Deterioration and decrease in the area of the irrigated land are caused by three types of factors: economical (decrease in the working capital of the farmer holdings), organizational (disintegration of the large farmer holdings required new market based methods of

organization), technical (depreciation of the technical equipment and machinery, constructions, etc.).

Table 35. Dynamics of the area and the use of irrigated land in Kazakhstan during 2000-2006.

Regions of Kazakhstan	Area of irrigated land, as of 01.01.2000, thousand ha	Use of irrigated land during 2000-2006? thousand ha						
		2000	2001	2002	2003	2004	2005	2006
Akmola	46.50	3.55	2.50	1.16	2.17	1.65	1.00	1.00
Aktyubin	48.80	8.57	8.67	8.83	9.10	4.27	9.28	9.50
Almata	635.70	452.80	472.90	471.90	522.40	515.50	512.40	512.40
Atyraus	4.60	3.40	2.95	0.00	2.72	3.76	3.87	3.90
Eastern Kazakhstan	219.10	25.81	30.45	55.60	63.19	56.20	59.56	59.56
Jambul	143.94	118.95	142.02	118.23	117.03	115.57	137.45	165.02
West Kazakhstan	11.10	8.81	8.50	11.10	12.02	5.86	2.18	2.18
Karaganda	87.70	65.20	50.45	40.90	1.66	58.50	53.84	53.84
Kyzylorda	277.68	152.34	141.00	139.80	152.73	145.44	149.45	149.45
Kostanay	145.90	4.30	2.56	1.99	1.02	1.58	3.78	3.80
Mangystaus	1.30	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Pavlodar	12.90	4.80	5.24	6.40	10.30	10.43	7.30	7.30
Northern Kazakhstan	17.70	3.63	1.53	0.48	0.34	0.21	0.28	0.28
Southern Kazakhstan	500.35	404.27	440.17	452.16	455.65	464.73	458.09	458.09
TOTAL	**2153.27**	**1257.17**	**1308.94**	**1308.55**	**1350.33**	**1383.70**	**1398.48**	**1426.32**

204. Ministry of agriculture has been taking measures for maintaining irrigated land starting from 1995 such as realization of the IIDS-1 (first phase of the project on improving irrigation and drainage systems) starting form 1996.

205. Internal surface renewable water resources of Kazakhstan make up 69.32 km^3 year-1 while external water flow coming from neighboring countries make up 34.19 km^3 year-1. Total annual renewable water resources make up 109.61 km^3 year-1. In 1993 total volume of annual water withdrawal was 33.69 km^3 and 80% of this volume was used for agricultural purposes. In 2000 the area equipped for wide scale irrigation made up 2153 million ha or 10% of the total area of arable land. However, in 2006 only 1426 million ha were irrigated in fact.

206. Main irrigated crops are fodder crops (mainly alfalfa), cereals, cotton, fruits, potato and beet-root.

4.2.1.2 Kyrgyzstan

207. The area of agricultural land (arable land, pastures and forests) in Kyrgyzstan make up 10.8 million ha or 75.5% out of the total land area while only 5.72 million ha or 28.6% of total land area is used in agriculture. Pastures have the greatest share (85,2%) within the structure of agricultural land and the share of arable land is 12%. Land resources used in agriculture are not evenly spread across the territory of Kyrgyzstan and most of these land are concentrated in Naryn (26.2%) and Jalalabad (17.2%) provinces.

208. Agricultural sector of Kyrgyzstan uses 1.02 million ha of irrigated land with 0.86 million ha of arable land (Table 36).

Table 36. Area and use of irrigated land in Kyrgyzstan during 1995-2006, thousand ha[26]

Regions of Kyrgyzstan	1995	2000	2005	2006
Batkent	-	55.5	55.7	55.6
Jalalabad	131.1	129.1	125.7	125.7
Yssykkul	168.8	163.3	155.1	154.1
Narayn	129.3	127.1	119.8	119.8
Osh	198.9	146.2	129.0	128.7
Talas	115.1	114.5	113.2	113.0
Chuy	322.3	322.6	314.0	314.5
Bishkek city	8.8	6.3	6.3	6.3
Osh city	-	-	2.6	2.6
Total	1074.4	1064.7	1021.4	1020.6

209. The total volume of the natural resources of fresh groundwater in the artesian basins exceeds 350 m^3 $year^{-1}$. The volume of exploited underground fresh waters within 44 deposits is 2.2 m^3 year-1that are used for drinking and economic needs (38%), irrigation (45%), industrial needs (15%) and for reclamation of the pasture land (2%).

210. The percentage of using the investigated water supplies is 65%. This volume does not exceed 10% of the natural annual water supply.

211. Major water users in the country are agricultural producers mostly those with irrigated land that supply 90% of the total agricultural products. Kyrgyzstan uses only 12-17% of total water supply in the river stream and 90% of this volume is used for irrigation. More than 70% of the arable land requires artificial irrigation[27].

[26] Охрана окружающей среды в Кыгызской Республики 2000-2006. статистический сборник. Бишкек 2007. с-65.
[27] Кыргызстан окружаюшая среда и природные ресурсы для устойчивого развития. Бишкек 2007., с21-22.

4.2.1.3 Tajikistan

212. Total area of agricultural land in Tajikistan is 4725.6 thousand ha with arable land making 710.4 thousand ha or 15% of the agricultural land. The area of the arable land has decreased during 1990-2007 by 23.6% (219.16 thousand ha).

213. Irrigated land make up 12.8% out of the total arable land. Pastureland has a significant share within the structure of the agricultural land (Table 37).

Table 37. Land use dynamics [28] during 1988-2007, in % to the total

Land category	Years							
	1988	1992	1999	2000	2003	2004	2005	2007
Arable land	20,1	19.2	17.8	16.1	18.2	18.3	17.9	15.0
Perennial plantations	2.4	2.4	2.4	2.2	2.5	2.5	2.5	2.2
Hayfields	0.6	0.5	0.3	0.5	0.4	0.4	0.4	0.5
Pastures	76.3	77.4	79.0	80.6	78.2	78.0	78.5	82.0
Abandoned land	0.5	0.4	0.4	0.5	0.6	0.6	0.6	0.7
Total land	100	100	100	100	100	100	100	100

214. The volume of withdrawn water from all water sources of Tajikistan is within the range of 14.6 – 12.8 km^3 while water consumption is 10.9-12.6 km^3 which is used predominately for irrigation purposes (80-86%) as well as for drinking and other agricultural needs (3.5-6%) and industrial needs (4.35-8.35%).

215. Discharge of water used in agriculture has a negative effect on chemical content of the surface and groundwater (drainage waters has a mineralization of 1.44-1.46 g l^{-1}) and only due to the significant dissolution mineralization of the river stream does not exceed maximally accepted level of concentration, i.e. less than 1 g l^{-1}.

216. Problems of water pollution with the discharged waters used in agriculture are widespread, however, they are more acute in Sogd and Khalton provinces. Miralization of the water in Syr Darya river is 1.2-1.4 higher than the accepted norm of 1000 m g l^{-1} while in all other water basins mineralization is within the range of 150-700 m g l^{-1}.

217. Depending on the index of pollution the quality of the water in the Vakhsh river on all control points in accordance with classification correspondence to the quality of the I class (very clean water) while after the point of discharged waters - to the II class (clean waters).

218. Water in the river Kafirnigan has a neutral pH level (pH6.24-8.34) and mineralization of 242.6-812.6 m g l^{-1} which is less than the accepted maximal level. Water turbidity in some moths reached 2.75 g l^{-1}.

[28] Краткий статистический доклад по сельскому хозяйств: Таджикистан, 2005.

219. Zerafshan river is one of the affluences of Amu Darya river that at present time due to the use of its waters for irrigation in three regions of Uzbekistan does not reach Amu Darya river.

220. Average monthly water flow on Dupuly control post in 1992 was 224.9 m^3 sec-1 and the maximal level of water flow is registered in June-August making up 369 m^3 sec-1. The level of pH in Zerafshan river is 7.25-7.28, mineralization is 141.3-191.5 mg l^{-1}, content of carbonates is 107.4-107.6 mg l^{-1}, chlorides – 1-10.3 mg l^{-1}. Turbidity sometimes exceeds the accepted maximal level (1 g l^{-1}). The quality of water in Zerafshan river is good and in seldom cases classified as satisfactory.

221. Varzob river is the major source of water supply for Dushanbe city. The quality of the water in the Varzob river is 65% of cases are classified as good and in rare cases as satisfactory. The level of pH is 7.1-9.0, the mineralization rate is 438-1240 mg l^{-1}, carbonate content – 65.53-295 mg l^{-1}, and chloride content is 1.4-34 mg l^{-1}.

222. The Syr Darya river is formed by merger of two rivers Kara Darya and Naryn. Total volume of water resources in Syr Darya river is 37.2 km^3 including 27.6 km^3 of trans-border waters.

223. The quality of the water in Syr Darya river near the Karakum water reservoir is lower that the satisfactory level (mineralization exceeds the maximally accepted level by 35-38% as this indicator of the Ajar point makes up 1.38 g l^{-1}). On Kyzyk-kishlak control point mineralization is 0.8-1.0 g l^{-1}, i.e. water reservoir functions as sinker and therefore water flowing to Uzbekistan and Kazakhstan is clean.

4.2.1.4 Turkmenistan

224. Total area of Turkmenistan is 49.1 million ha including 40.2 million ha of agricultural land (2002). Agricultural land includes 95.6% of pastures, 4.1% of arable land and the rest (0.24%) is under perennial plantations and etc.

225. The area of land that can be reclaimed is 17 million ha and situated within the piedmont regions and ancient river estuaries.

226. Total area of irrigated land as of 2005 was 2259.5 thousand ha. Total area under crops in 2004 was 1915.4 thousand ha with 49.6% under cereals and cereal-legume crops (including 94.9% under wheat), 32.5% under technical crops and 1.9% under potato and cucurbit crops.

227. At present time two thirds of the irrigated land require measured on improving their ameliorative conditions.

228. Major water consumers are irrigated agriculture (93.6%), livestock production (0.3%), household consumption (2.7%), industry (3%), pastures (0.3%) and fishing industry (0.1%) (Table 38).

Table 38. Water consumption in Turkmenistan (million m^3)

Water users	2000	2004	2005	2010 (forecasted)
Households	433.1	482.6	934	1353
Irrigation	15496	16949	17592	17555
Livestock	62	70	72	82
Industry	599	761	585	612
Pastures	58	70	76	98
Total excluding infiltration and evaporation losses	16648.1	18339.6	19254	19700
Total including losses on magisterial channels and water reservoirs	25260	25370	25400	25500

Source: НПДООС Туркменсувмиллийтаксимлаш

4.2.1.5 Uzbekistan

229. Agricultural activities in most of the regions of Uzbekistan are not possible without irrigation. Water resources in the Amu Darya and Syr Darya rivers under the current technologies of irrigation are almost exhausted. Therefore, expansion and improvement of the agricultural production via involvement of new land due to the water resource shortages is not possible on a wide scale.

230. Substantial changes in the structure of the crops, liquidation of the monoculture (cotton), widening the area under cereals on the area of more than 1.0 million ha has significant economic and social importance. Thus, water used during the vegetation period per 1 ha for cultivation of cereal crops is 1.4-1.5 times less than for cultivation of cotton as cereal crops use the moisture accumulating during autumn, winter and spring times.

231. In order to change the structure of the agricultural production intercropping and planting of the double crops should be planted on the area of 550 thousand ha in June-August, cereal crops on the area of more than 1 million ha in October. Intercropping and planning of the double crops will require additional 2-3 irrigations in November.

232. During last 45 years specific water consumption per 1 ha increased by 1.3 times and on average make up 13.7 thousand m^3. Khorezm province and Karakalpakstan are greatest water consumers – 25-26 thousand m^3 ha^{-1}.

233. Water consumption for producing 1 centner of cotton is ranging between 350 to 900 m^3 across Uzbekistan. However, researches conducted by the RI of Cotton Growing (Uzbekistan) during many years indicated that current productivity even under the furrow irritation will need only 8-9 thousand m^3 to irrigate 1 ha while 1 centner of cotton depending on the soil type and cotton variety will require 150-450 m^3 of water.

234. High water consumption lead to the increase in overall volume of used water. Currently water withdrawal by all regions of Uzbekistan reached 54-58 km^3 year-1 while supplying water to the irrigation sources is 10 km^3, water flowing beyond irrigation facilities is 7 km^3 and total water disposal is 18 km^3. Consequently, real volumes of water used for irrigation do not exceed 40 km^3. Water losses within the inter-farm and intra-farms channels make up 36%. Calculations have shown that if 35-40% of the irrigation channels of inter-farm net will be concrete made and water will be applied on the fields with the use of plastic chutes 5-6 billion m^3 of water can be saved.

235. In Uzbekistan furrow irrigation is practiced in 99% of the total irrigated land area. Under the current system of furrow irrigation crops can be re-irrigated leading to the increased salinity, water logging, depletion of soil fertility and washing of nutritive components from soil. In accordance with the statistical data the area of irrigated land that require application of soil ameliorative measures has increased by 4.3 times within last 15 years (from 650-700 thousand ha to 2.8 million ha).

236. Researches of Uzbek Cotton Growing Research Institute have shown that land with significant slopes under the condition of furrow irrigation have 50-60 t of soil washed away including 1000 kg of humus, 100-130 kg of nitrogen, 140-150 kg of phosphorus, 150-160 kg of potassium. At the same time chemicals applied to combat weeds and pests are also washed away into the water streams of river polluting the environment.

237. In accordance with the data of the Cotton Growing Research Institute optimal irrigation rate on land with high ground water levels is 700-800 m^3 ha^{-1} and on land with the low ground water level is 1000-1100 m^3 ha^{-1}. However, due to the imperfect irrigation technologies these rates are not applied and water use reaches the level of 1500-2000 m^3 ha^{-1}.

238. Land leveling can significantly contribute to the water saving. Thus, experiments conducted by M.Akhmejanov (Uzbek RI of mechanization) show that land leveling allows decreasing the volume of used water by 37.5-50%. However, insufficient attention is paid to the problem of unleveled land.

239. In Uzbekistan other irrigation methods such as drip irrigation and sprinkler irrigation are also practiced. These methods allow decreasing volumes of water used two times and increase the crop productivity. Experiments conducted by Uzbek Cotton Growing RI in 1968-1973 demonstrated high effectiveness of drip irrigation. Thus, under furrow irrigation cotton productivity was 40.3 centners ha^{-1} and under drip irrigation 50.7 centners ha^{-1}. Water saving was more than 50%.

240. These experiments were conducted on vast areas (500 ha) within the holding named “Fife years of Uzbekistan” situated in Tashkent province in 1993-1995. Average yield of cotton was 43.1 centners ha^{-1} and average water application was 3500 m^3 ha^{-1}.

241. Yield on the experimental site with drip irrigation was 10.5 centners ha^{-1} higher in comparison with the average yields.

242. Drip irrigation also allowed decreasing labor input to 30.5% and material-technical expenses by 38.9%.

4.3 Agricultural crops and crop rotations

4.3.1.1 Kazakhstan

243. In 2006 the volume of the gross agricultural production including services has reached 837.8 billion tenge which is 7% more in comparison with the level of 2005. In 2007 the gross yield of cereal crops was 20.1 million t, of potato – 2.4 million t, vegetables – 2.2 and sweet beets – 0.3 million t (Table 39).

Table 39. Production of the major agricultural crops in Kazakhstan, ml.

Crops	2005	2006	2007
Cereals	12.56	15.67	20.1
Potato	4.49	2.35	2.4
Vegetables	2.15	2.05	2.2
Sweet beet	0.3	0.27	0.3

244. Area under cotton in 2002 was 170.7 thousand ha with the cotton productivity of 22.0 centners ha^{-1}. Area under cotton has increased in comparison with 1991 level 1.5 times. However, the productivity due to the land degradation has decreased by 2.9 centners ha^{-1} or by 11.6% (Table 40).

Table 40. Cotton production in Kazakhstan

Years	Planted area, thousand ha	Productivity	Raw cotton, thousand tons	Lint cotton, thousand tons
1991	116.4	24.9	291.1	100.4
1995	110	16.4	180	68.9
2000	151.8	18.7	287.1	95.5
2001	184.9	22.7	417.4	111.9
2002	170.7	22.0	324	90.4

4.3.1.2 Kyrgyzstan

245. During recent years several programs were accepted for the development of the agrarian sector of Kyrgyzstan that led to the diversification of the planted areas. Total planted area is 1133.6 thousand ha including 625.5 thousand ha under cereals with 65% under wheat, 5.7%

under fodder crops, 20.3% under potato and 11.2% under vegetables and cucurbit crops (Table 41)

Table 41. Dynamics of changes in planted areas under major agricultural crops in Kyrgyzstan during 1997-2006, thousand ha.

Crops	1997	2004	2005	2006
Total planted area	**1147.9**	**1125.4**	**1118.2**	**1133.6**
Cereal crops				**625.5**
including:				
Wheat	537	411.7	425.8	411.8
Barley	80.8	102.8	102.2	105.1
Maize for grain	37.2	73.7	72.6	72.2
Rice	5.9	6.2	5.9	6.3
Cereal-legumes	5	20.3	24.6	35.9
Oat		2.0	1.4	1.2
Technical crops				
including:				
Cotton	24.8	46.3	45.5	45.7
Tobacco	12.1	5.5	5.6	5.6
Sweet beet	11.4	27.1	14.5	13.6
Oil bearing crops - total	**55.1**	**86.9**	**81.5**	**77.5**
Potato	**56.1**	**85.4**	**76.0**	**81.2**
Vegetables	**36.1**	**39.7**	**40.6**	**41.2**
Cucurbit crops	**3.2**	**4.5**	**4.5**	**5.0**
Fodder crops	**281.5**	**212.2**	**216.1**	**230.2**

4.3.1.3 Tajikistan

246. Total planted area in Tajikistan make up 900.2 thousand ha that includes land under cereal crops (44.6%), technical crops – 32.6% (including cotton – 29.1%), potato, vegetables and cucurbit crops – 8.1%, fodder crops – 10.8% (Table 42).

Table 42. Structure of the planted area in Tajikistan within all types of farmer holdings during 2000-2006[29], in % to total

Years	Total planted area	including					
		cereals	Technical crops	Including cotton	Potato, vegetables and cucurbit crops	Including vegetables	Fodder crops
2000	864.3	421.4	277.4	238.61	66.4	30.1	99.2
	100	48.8	32.1	27.6	6.4	3.5	12.0
2001	849.9	389.1	281.1	257.3	65.2	30.5	107.5
	100	45.7	33.9	30.2	6.4	3.6	12.0
2002	822.7	364.2	297.6	269.2	62.3	30.0	98.5
	100	44.3	38.2	32.7	6.3	3.6	12.0
2003	886.9	404.6	319.1	284.36	66.9	30.2	77.8
	100	45.6	36.0	32.1	7.5	3.4	8.8
2004	905.6	403.7	333.1	293.23	71.2	32.0	97.0
	100	44.6	36.8	32.4	7.8	3.5	10.7
2005	901.1	395.6	352.4	313.63	70.2	33.5	97.6
	100	44.0	39.1	34.8	7.8	3.7	10.8
2006	900.2	401.9	294.0	261.66	72.8	35.8	97.6
	100	44.6	32.6	29.1	8.1	4.0	10.8

4.3.1.4 Turkmenistan

247. Total planted area in Turkmenistan in 2004 was 1915.4 thousand ha including 49.6% of land under cereals and cereal-legume crops (with predominance of wheat -94.9%), more than 32.5% under technical crops (including 99.1% under cotton), 16% - under fodder crops, 1.9% under potato, vegetables and cucurbit crops.

248. The share of crop production within the gross value of the agricultural products is 32% and the share of livestock production is 63%.

249. During the years of independence the tendency of increased share of private production in market supplies was observed. Thus, private sector has the share of 96% in milk production, 92% - meat production, 99% - egg production, 86% - vegetables, 87% - cucurbit crop, 85% - fruits and berries production and 67% in grapes production.

250. At the beginning of 2004 nongovernmental sector had a share of 94% in cattle breeding, 99% - poultry, 81% -ship and goat breeding, 73% - camel and 67% of horse breeding.

[29] Государственный комитет по статистике РТ за соответствующие годы.

251. The major direction of agricultural producers is cereal production (41%), cotton growing (38%), animal breeding – 11%, vegetable production – 3%, horticulture and grape production – 1.5%. Out of total number of agricultural producers 5.5% represented by multi-side directed agricultural holdings.

252. In Dashauz and Mary provinces cotton is predominantly grown crop with the share of 67% and 60% in total agricultural production, respectively, while the share of cereal crop production is 20% and 25%, respectively. The share of wheat production in Akhal and Lebab regions is 71% and 63% and in cotton production is 7% and 25%, respectively. Balkan province is mainly specialized on animal breeding (83%) as well as wheat production (17%).

Table 43. Production of the major agricultural products per capita, kg

Products	1993	2000	2004
Cereals and cereal-legumes - total	223	333	465
Potato	7	17	33
Vegetables	65	65	84
Cucurbit crops	40	26	33
Fruits and berries	9	12	17
Grapes	26	37	43
Meat	22	28	36
Молоко	165	187	261
Eggs	62	71	112

Source: data of Turkmenmillikhasabat.

4.3.1.5 Uzbekistan

253. Agricultural reforms in Uzbekistan had to change the structure of agricultural production. In 1992 monoculture cotton was flourishing having negative effect on productivity of other crops, on soil fertility, quality of agricultural production as well as caused the spread of pests affecting cotton plants as well as other plants.

254. In order to overcome widespread cultivation of the monoculture cotton and improve supply of cereals and other crops government has decided to decrease the area under cotton and starting from 1985 to 1996 the area under cotton decreased from 2060 thousand ha to 1500 thousand ha while the area under cereals and rice on irrigated land increased from 240 thousand ha to 1000 thousand ha.

255. In 1990 area under cereal crops was 184 thousand ha and in 1996 – 1334 thousand ha. The area under the fodder crops decreased from 877 to 371 thousand ha including area under alfalfa (from 673 thousand ha to 232 thousand ha) leading to the decrease in the fodder supply from 69% to 41.4%.

256. After 1995 the tendency of decreasing fodder production continued (Table 44).

Table 44. Dynamics of planted areas under different agricultural crops (1995-2006, % to the total planted area)

Crops	Years						
	1996	1998	2000	2002	2004	2005	2006
Cereals-total	43.4	41.8	42.7	43.3	45.1	44.4	44.5
Technical crops	38.0	40.2	40.0	41.3	41.1	41.6	40.7
Including cotton	37.1	38.2	38.2	40.1	39.4	40.6	39.8
Vegetables, cucurbit crops and potato	5.5	5.7	5.9	6.1	6.1	6.1	6.7
Fodder crops	13.1	12.3	11.4	7.3	7.7	7.9	8.1
Total							

257. This method of managing agricultural production has several shortcomings:

258. Decrease in the share of fodder crops including alfalfa and absence of other legume crops such as soy beans and peas lead to the drastic decrease of biological nitrogen and humus in the soil, suppression of the positive biological processes and ultimately to the decrease in soil fertility and crop yields. For example the cotton yield of 1990 (2.7 t ha^{-1}) has not been achieved yet.

259. Insufficient fodder supply lead to the protein deficit causing increased cost of meat, milk production as well as other animal products. For example, average milk yield from one cow decreased by 800 l.

260. Predominant use of cotton and cereals especially on saline land cause deterioration in soil ameliorative and phytosanitary condition.

261. In Uzbekistan all land have low natural soil fertility with the low content of nutritive elements and only 0.7-2.0 % of humus. Therefore, intensive use of irrigated land is possible only under right structure of planted crops with right crop rotations, crop alternation that increase soil fertility.

262. Uzbek Research Production Center of Agriculture developed the optimal variation of crop allocation on irrigated land. In accordance with this variation cereals and rice should be planted on the area of 1185 million ha including 185 thousand ha of rice, cotton – on the area of 1.5 million ha, fodder crops – 555 thousand ha including 400 thousand ha of alfalfa. Also in is important to increase the area under legume crops and use them in intercropping with maize, oat and triticale after harvesting cereals.

263. In this case the area under cereals will be 35.5% of the total planted area, under cotton – 44.5%, fodder crops – 16.6% (including alfalfa 11.9 % and maize for silage - 4%).

264. In accordance with the recommendations summer crops were to be planted after wheat harvesting on the area of 534 thousand ha (250 thousand ha under early maturing and mid-season maize and sorghum preferably together with soy, 150 thousand ha under spring crops (oat, peas, etc.) and 134 thousand ha under winter intermediate crops (triticale, pea).

265. Intercropping of legume crops with second crops (rye, triticale and maize) on the area of 534 thousand ha will allow to annually to plant cereals and cotton after legume crops on the area of 734 thousand ha (534 thousand ha of legumes, 200 thousand ha of alfalfa).

266. Implementation of the recommendations developed by Uzbek Research Production Center will increase the productivity of cereals within coming years up to 60-65 centners per ha, of cotton – up to 29-30 centners per ha, rice – up to 45-50 centners per ha, vegetables and potato – up to 250-300 centners per ha. Gross grain production will be more than 6.0 million tons and cotton production 4.1-4.2 million tons.

267. Ignoring the above mentioned recommendations is one of the major causes of soil degradation, increased soil salinity, low efficiency of livestock breeding and low profitability of farmers.

268. Another problem is allocation of the fodder crops across the regions of Uzbekistan. As majority of farmers do not keep livestock they are not interested in fodder production.

269. Majority of livestock population (90%) is with dekhqan holdings that do not have necessary land area to produce fodder crops.

270. Productivity of pastures in arid zones is also low. Following technology of crop rotation was suggested for rational use of the absinthial pasture land. Pastures should be divided into two fields. First field should be grazed in spring starting from February 16 to May 15 and then this field grazed in autumn starting from October 1 to November 30. On the second field animals are grazed from May 26 to September 30 and in winter from December 1 to February 15. These fields are alternated every 5 years (Table 45).

Table 45. Recommended crop rotation on pastures

Years	**Fields of pasture rotation**			
	First		Second	
	Major season	Repeated season	Major season	Repeated season
1st -5th 6th -10th 11th -15th	Spring Summer Spring	Autumn Autumn Autumn	Summer Spring Summer	Winter Winter Winter

4.4 Productivity of the major agricultural crops

271. Productivity of agricultural crops has decreased in all CA countries after independence.

272. Cotton yields decreased in Kazakhstan by 5% and in Uzbekistan by 1.6% in 2004 in comparison with the yields of 1992.

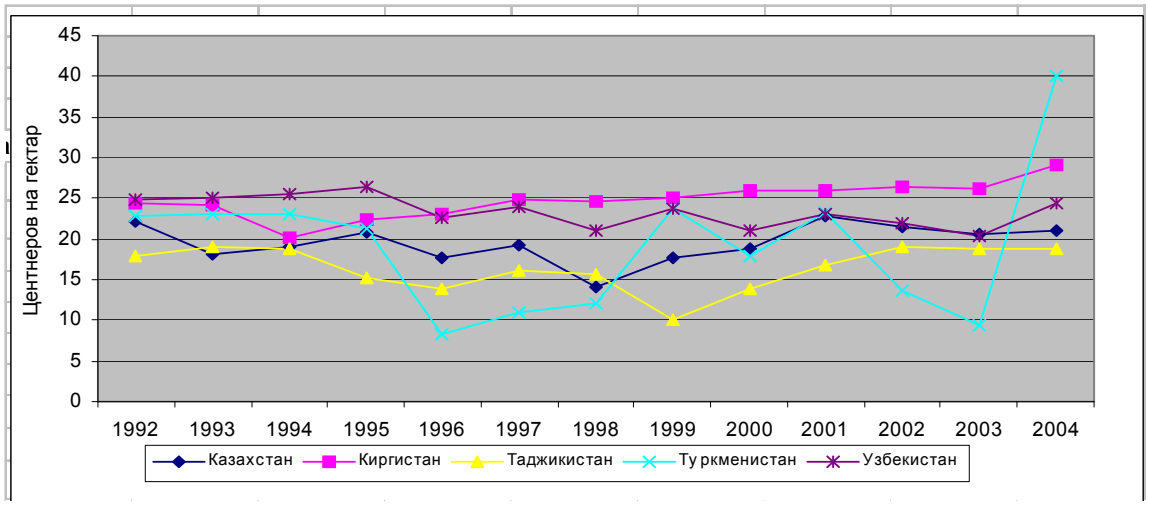

Figure 11. Cotton yield dynamics in CA countries (center per ha)

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

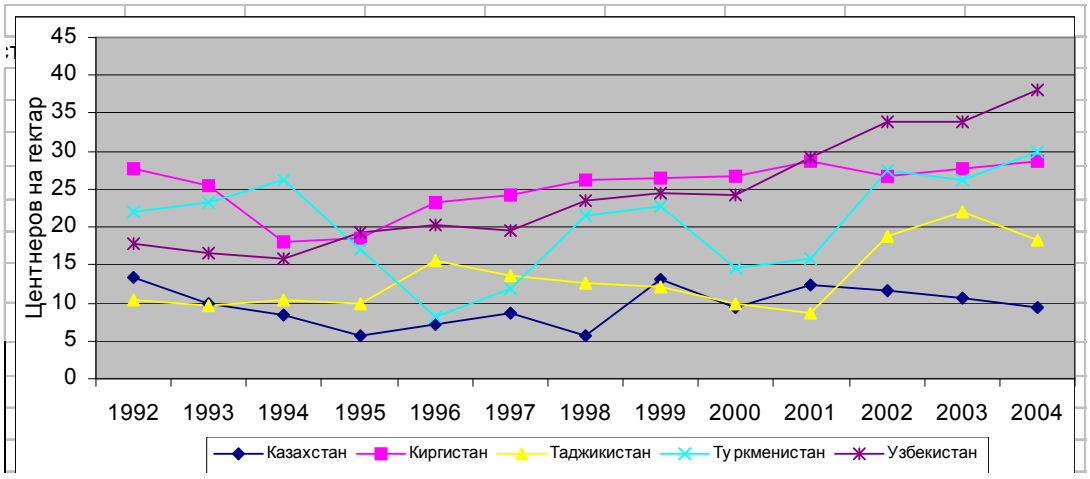

Figure 12. Dynamics of grain yield in CA countries (centners per ha)

Source: (1) Статистический ежегодник Содружества независимых государств за 1999 год. (Statistical yearbook of the CIS countries for the year 1999). Статистический комитет СНГ, Москва 2000 год. (2) Статистический ежегодник Содружества независимых государств за 2003 год. (Statistical yearbook of the CIS countries for the year 2003). Статистический комитет СНГ, Москва 2004 год. (3) FAO Statistical database http://appsfao.org/page/collections?subset=agriculture

4.4.1.1 Kazakhstan

273. Productivity of the agricultural crops in Kazakhstan is lower in comparison with other CA countries. Currently the productivity of cereal crops in Kazakhstan in 9.5 centners per ha, i.e. 3.9 centners per ha less than in 1992. The same tendency is observed in cotton yields – decrease in cotton yields is 4.9%

Table 46. Productivity of the major agricultural crops in Kazakhstan

	1992	1995	2000	2001	2002	2003	2004
Cotton	22.1	20.8	18.7	22.7	21.5	20.5	21.0
Wheat	13.4	5.8	9.4	12.4	11.5	10.7	9.5

4.4.1.2 Kyrgyzstan

274. During recent years a tendency of increased crop productivity was observed in Kyrgyzstan. In 2006 productivity of cereals was 2.5 tons ha^{-1}, of cotton – 2.6 tons ha^{-1}, potato – 15.2 tons ha^{-1}, vegetables – 17.6 tons ha^{-1} and cucurbit crops – 19.3 tons ha^{-1}.

Table 47. Yield of agricultural crops in Kyrgyzstan, tons ha^{-1}

Crops	2000	2004	2005	2006
Cereal crops	2.3	2.8	2.6	2.5
Cotton	2.6	2.6	2.6	2.6
Tobacco beet	2.4	2.4	2.4	2.4
Sweet	19.1	24.3	20.0	16.8
Oil producing crops	1.0	1.1	1.1	1.0
Potato	15.1	15.8	14.8	15.2
Vegetables	15.7	18.2	17.4	17.6
Cucurbit crops	16.4	19.3	19.0	19.3

4.4.1.3 Tajikistan

275. During recent years due to the implemented organizational and economic measures to stimulate agricultural producers and improvement of soil fertility productivity of several crops was at the sustainable level. Productivity of the cereal crops reached 18.8 centners per ha in 2006, i.e. increased by 8.4 centners per ha in comparison with the 1992, Yield of strategically important cotton during this period was fluctuating in the range of 16-18 centners per ha (Table 48).

Table 48. Yield of the major agricultural crops in Tajikistan

	1992	1995	2000	2001	2002	2003	2004	2005	2006
cotton	18.0	15.2	13.8	16.76	19.1	18.9	18.8	15.6	17.0
grain	10.4	9.8	9.9	8.576	18.9	22	18.4	18.6	18.8

4.4.1.4 Turkmenistan

276. Productivity of agricultural crops in Turkmenistan in comparison with the same indicators in other CA countries is low.

Table 49. Productivity of agricultural crops and perennial plantations in Turkmenistan

Crops	**1993.**	**2000**	**2004**	**2004, in % to 1993.**
Cereals and cereal-legume crops, total	2.24	2.31	3.14	140.2
including: Wheat	1.96	2.3	3.15	160.7
Vegetables	14.0	20.6	29.4	210.0
Cucurbit crops	9.46	16.85	26.44	279.5
Fruits and berries	1.78	3.62	7.93	445.5
Grapes	4.71	8.04	12.44	254.1

Source : Data of Turkmenmillikhisabat

277. As it can be seen from the Table 50 productivity of all crops has increased: wheat yields increased 1.6 times while yields of fruits and berries – 4.45 times.

Table 50. Characteristics of the region and corresponding experimental site as exemplified by Akhal region (yields of the major crops)

	Cotton	Wheat	Maize	Vegetables	Grapes
Area under state order	40-45%	50-60%	5% after wheat	1-3%	Planted area, more than 10 thousand ha
Major problems for higher yields	Soil salinity 50-60%	Soil salinity 50-60%	Soil salinity 10-15%	Soil salinity 15-20%	Water shortage
	Weeds 50-60%	Weeds 30-40%	Weeds 20-30%	Weeds 50-60%	Weeds 5%
	Pests 30-40%	Pests 30-35%	Pests 10-15%	Pests 40-50%	Pests 20-25%
	SOM content 0.45-1%	SOM content 0.45-1%	SOM content 0.25-0.71%	SOM content 0.25-1%	-
Major soil mechanical qualities	Sandy 0-5%	Sandy 10-15%	Sandy 10-15%	Sandy 20-30%	Sandy 15%
	Light loam soils 10-15%	Light loam soils 40-50%	Light loam soils 15-20%	Light loam soils 20-30%	Light loam soils 30%
	Moderate loam soils 40-50%	Moderate loam soils 40-50%	Moderate loam soils 40-45%	Moderate loam soils 25-30%	Moderate loam soils 30%
	Heavy loam soils 30-35%	Heavy loam soils 40-50%	Heavy loam soils 20-30%	Heavy loam soils 20-25%	Heavy loam soils 25%
Planting techniques	100 % furrow cutting	100% with planter	100% with planter	50% with planter 50 % by transplants	100% planting with the stalks
Irrigation systems	100% leaching+furrow irrigation	50% leaching 50% furrow irrigation	10-15 % leaching 80% furrow irrigation	100% furrow irrigation	90-100 % furrow irrigation
Field preparation	100 % autumn plowing	50 % autumn plowing 50% summer plowing	40-50 % summer plowing after wheat	60-70% autumn plowing	100% spring plowing after irrigation
	50 % spring chiseling	50 % autumn chiseling	100% spring chiseling	100 % spring chiseling	100 % spring fertilizer application with the use of machines
	100% leveling	100% leveling	100% leveling	100% leveling	100% leveling

	50% furrow cutting after leaching	100% raised beds	100 % furrow cutting after leaching	50% raised beds	100 % furrow cutting after leaching and plantation of stalks
Seed rate	120 kg ha^{-1}	200 kg ha^{-1}, in case of late planting - 250 kg ha^{-1}	30-40 kg ha^{-1} on raised beds and 250 kg ha^{-1} by broadcasting	Depending on the crop seed size	Planting scheme 2.2 x 2.4 m
Method of planting	100% mechanized on 60-90cm	100% raised bed planter	100% with planter	50 % manually, 50 % with planter	70% mechanized. 30% manual
Fertilizer application rate	N 200 kg ha^{-1} P 100-110 kg ha^{-1}	N 180 kg ha^{-1} P 100-110 kg ha^{-1}	N 140 kg ha^{-1} H 80 ru|uf R-60 ru|uf	P 140 kg ha^{-1} Manure 10 t ha^{-1}	N 200-250 kg ha^{-1} P 250-300 kg ha^{-1} K-100 kg ha^{-1}
Applied fertilizers	100% by cultivator	100% broadcasting	100% cultivator	50 % cultivator. 50% manual.	Broadcasting
Herbicide application	20-30%	20-25%	Not applied	Not applied	8 l ha^{-1}
Pesticide application	25-30%	20-30%	10%	Not applied	Not applied
Average yield	2-2.6 t ha^{-1}	3-3.5 t ha^{-1}	7-8 t ha^{-1}	Depending on a crop	70-100 centner ha^{-1}

4.4.1.5 Uzbekistan

278. Major strategic crops in Uzbekistan are cotton and wheat and therefore there are quotas and priorities on supplying with the resources and credits under favorable conditions. Areas under cultivation of these crops as well as grow yields are under the government control. During the years of independence cotton yields decreased and at present time it is lower than the level of 1991 (Table 51).

Table 51. Dynamics of cotton yields in Uzbekistan during 1991-2007.

	Years								
	1991	1995	1998	2000	2003	2004	2005	2006	2007
Cotton yields, centner per ha	27.7	26.4	21.0	21.8	20.3	24.5	25.5	25.5	24.9
In terms of cotton fiber, kg ha^{-1}	858.6	850.1	665.1	688.9	641.5	763.9	822.6	822.6	776.3

279. Decrease in cotton yields is primarily due to the depleted soil fertility, increased areas of saline land, improper crop rotations and decreased material motivation of the producers.

280. Quotas are retained due to the established fixed cotton prices that are significantly lower than the world prices. For most of the producers cotton production is unprofitable that leads to decreased material stimulation. Moreover, farmer rights over rented land are not sufficiently protected therefore they practically do not invest into land amelioration measures.

281. *Productivity of cereal crops in Uzbekistan*. Major cereal crops produced in Uzbekistan are wheat, barley, maize grain, soy beans, mung bean, peas and others. Statistics is not available for all cereals. In general the productivity of cereal crops has increased during independence (Table 52).

Table 52. Dynamics of cereal crop productivity in Uzbekistan during 1991-2006 (including all types of cereals)

	Years					
	Average for 1991-1995	Average for 1996-2000	2000	2004	2005	2006
Yields of cereal crops, centners per ha	14.6	23.1	27.0	35.4	39.8	41.3

282. Yields predominantly increased on irrigated fields while cereal yields produced in rainfed areas remains at the level of 10 centners per ha (Table 53).

Table 53. Cereal productivity in Uzbekistan during 1995-2006 given by each crop (centners per ha)

Cereal crops	Years						2006 in % to 1995
	1995	1998	2000	2004	2005	2006	
Wheat	20.5	26.0	27.8	37.4	41.5	42.7	208
Barley	13.2	15.0	15.1	14.4	15.7	15.6	118.0
Rice	19.5	24.3	24.3	27.7	31.8	33.0	169.2
Maize grain	34.7	30.9	31.5	42.1	44.5	46.6	134.3
Cereal legume crops	7.0	5.9	12.7	11.7	11.5	12.0	171.4

283. Some farmer and dekhqan holdings has increased cereal yields by 2.0-2.5 times indicating that there is potential for increased cereal crop yields.

284. Though yields during the analyzed period of time have increased for all cereal crops these indicators are still low for irrigated land. In comparison with other countries these indicators are low as well that makes cereal production inefficient.

285. *Potato productivity*. During the years of independence Uzbekistan has three times greater potato production as a result of increased productivity. Areas under potato cultivation remain at the level of 50 thousand ha.

286. Nearly 90% of potato yields are produced by dekhqan holdings on small land plots.

Table 54. Dynamics of potato productivity in Uzbekistan during 1995-2006

	Years						2006 г. в % к 1995
	1995	1998	2000	2004	2005	2006	
Potato yields, centners per ha	92.0	121.3	129.3	157.5	173.0	175.2	190

287. Though potato yields have increased during the indicated time span by 1.9 times this increase is still low for this crop. Major reason for low potato productivity is insufficient supply of high yield producing quality seeds for dekhqan holdings, imperfect technologies of cultivation, difficulties in supplying resources (mineral fertilizers, POL) and services. There is no infrastructure of the sub-sectorial potato production.

288. *Productivity of vegetable crops*. In Uzbekistan almost all types of vegetable crops making up to 20 species are cultivated. Tomato and onions have the greatest share in the overall production of vegetables – 54% and 22% respectively. Major vegetable producers are dekhqan holdings (65% of the overall vegetable production) the rest is produced by farmer holdings.

289. Analysis has shown that during the recent years vegetable yields have increased (Table 55).

Table 55. Dynamics of vegetable crop productivity in Uzbekistan during 1995-2006

	Years						2006 in % to 1995
	1995	1998	2000	2004	2005	2006	
Average yield of all vegetables, centner per ha	176.0	175.2	183.8	203.1	215.8	223.0	126.0

290. As it can be seen from the table productivity of vegetable crops has increased 1.26 times. However, productivity of the majority of vegetable crops is below the average potential level. Potential for increasing yields of vegetable crops is quite high. Besides, climatic conditions in Uzbekistan allow harvesting yields two times and in southern parts of the region even three times per year. Vegetable production is region specified depending on soil-climatic conditions. Thus, in Andijan region priority is given to tomato growing and some farmer holdings receive up to 400-450 centners ha^{-1}. Fergana region predominantly grows cucumbers. Cucumber yields in some farmer holdings reach 300-350 centners ha^{-1}.

291. In southern regions (Surkhandariya region) the technology of cultivating early maturing cabbage has been adopted and farmer holdings receive on average 250 centners ha^{-1}.

292. Major reasons for low average yields of vegetable crops are underdeveloped seed production industry, farmers and deckhands are not well supplied with the quality seeds, high losses due to the pests and plant diseases, small sized dekhqan holdings that does not allow to introduce crop rotations, insufficient application of organic and mineral fertilizers lead to soil fertility depletion causing soil degradation.

293. *Cucurbit crop production*. Soil climatic conditions of Uzbekistan are favorable for growing different varieties of cucurbit crops. Major producers of cucurbit crops in Uzbekistan are farmer and dekhqan holdings. More than a half of the cucurbit production is concentrated in four regions of Uzbekistan: Jizzakh, Surkhandariya, Syrdariya and Tashkent region. During the analyzed time span area under cucurbit crops has decreased by 12.4%, however gross yield has increased by 1.57 times. Increase in cucurbit crop production was predominantly due to the increased crop productivity (Table 56).

Table 56. Dynamics of vegetable crop yields in Uzbekistan during 1995-2006

	Yields						2006 г. in % to 1995
	1995	1998	2000	2004	2005	2006	
Average yields of vegetable crops in Uzbekistan	99,0	98,7	132,4	157,0	169,1	178,2	180

294. As it can be seen from the table above productivity of cucurbit crops during 1995-2006 has increased 1.8 times. However, this level of productivity is low for irrigated land. Some

farmers and deckhands in Hungry Steppe and Jizzakh region harvest yields up to 300-350 centners. This fact as well as experiences from other countries indicate that the potential for increasing productivity of vegetable crops is high in Uzbekistan. The major reasons for low yields are the allocation of low productive land for vegetable cultivation, underdeveloped seed production industry, and low levels of resource supply (especially fertilizers).

4.5 Profitability of agricultural production

4.5.1.1 Kazakhstan

295. At the initial stage of economic reforms in agricultural sector of Kazakhstan production of agricultural crops was profitable. This profitability of sun flower production in 1995-1995 was 96.4 and 107.2% despite of the 2.85 times increase in the cost of oil containing seeds in 1995 in comparison with the preceding year. The profitability of potato during this time has decreased from 49.1% to 10.9%, however, its production remained profitable.

296. Other sectors have shown sharp decrease in efficiency of production. Thus, profitability of cereal crop production in 1994 was 8.4% and in 1995 cereal production became unprofitable.

297. Analysis of the dynamics in the cost of cereal crops, channels of their realization suggests that decrease in the efficiency of this sector was the result of strict regulation of the agriculture.

298. Cotton production in 2000-2001 was profitable (18.0% in 2000 and 11.6% in 2001), however, it had a decreasing tendency (Table 57).

Table 57. Profits from cotton production in Kazakhstan

	2000	2001	2001 in terms of 2000, %
Gross income, thousand Kazakh Tenge	1452312.0	1102845.0	75.9
Profit, thousand Tenge	221958.0	114289.0	51.5
Cost of sold products, thousand Tenge	1230354.0	988556.0	80.3
Cost of 1 to, Tenge	33990.0	22880.0	67.3
Factual cost of sold 1 ton, Tenge	40130.0	25520.0	63.6
Level of profitability, %	18.0	11.6	64.4

299. Decrease in profitability was due to the increased prices for material and technical resources including POL and mineral fertilizers. Greater portion of the expenses for production of cotton is represented by expenses for material expenses (56%) and labor costs (25%) (Table 58).

Table 58. Structure of expenses for cotton production in 2001 (%)

Total expenses	100
Material resources	56
Gross payroll	25
Depreciation of the fixed assets	3
300. Other expenses	301. 16

302. In accordance with experts assessments annual increase in consumer demand for milk and milk products that went through thermal processing is 10% in Kazakhstan. In accordance with the statistics of the Kazakhstan Milk Union imported milk products do not exceed 15% of the total market milk supply. In accordance with the data of the Kazakhstan Milk Union the share of processed milk products has been increased 2.8 times during the last four years. Profitability of milk production is 3 to 50% depending on milk product. The volume of milk products produced in 2000 is 251 kg per capita, in 2003 – 282 kg and in 2004 – nearly 300 kg.

4.5.1.2 Kyrgyzstan

303. In accordance with calculations current prices of one kg of wheat in Kyrgyzstan should be 30 Soms. However, as experts indicate farmers cannot sell wheat at this price as it will be too expensive for consumers. Wheat price per 1 kg should not exceed 10-12 Soms. In this case

government should support producers by providing subsidies. Without governmental support farmers producing 0.7-0.8 centners of wheat per ha will turn bankrupt30.

304. Data indicate that current average selling price in Kyrgyzstan is 8.5 thousand some (227.9 USD) per 1 ton (Table 59).

Table 59. Average process of producers for agricultural products in 2007

	Thousand Soms per 1 ton	In USD
Grain	11.4	305.6
Wheat	8.5	227.9
Potato	11.3	302.9
Vegetable	19.8	530.8
Cotton	16.2	434.3
Fruits and berries	20.5	549.6

305. Level of profitability of agricultural production is different depending on the location of the farmer holding. Thus, researches have shown that the share of expenses for material resources involved in cereal production within the farmer holding Daniyar (Sokuluk district of Chui province) is 53% while expenses for mechanized works make up 29.2% and profitability make up +20.9%. Profitability of barley production is 8.4% and that of alfalfa production is 66.7%.

306. Profitability of wheat production in Kenenbay farmer holding (Sokoluk district) is 20.7% and that of alfalfa production is 73.2%.

4.5.1.3 Tajikistan

307. Tajikistan is the agrarian country with the significant potential for growing highly profitable and competitive crops. Profitability of cultivated crops depends on several organizational, economical and agro-technological factors.

308. Research has indicated that expenses for material resources and mechanized works have a great share within the structure of total expenses involved for agricultural production. Wheat production by dekhqan holdings of Vakhsh district involves 50% of expenses for material resources, 28.6% - for mechanized works while profitability makes up 39-42%. Cotton production has a negative profitability (-25.2%): material expenses make up 39.0%, expenses for mechanized works -25.2%, taxes -6.1%. Profitability of potato production is 170.3% and expenses for material resources make up 74.2%, for mechanized works – 6.0% and the share of singly tax is 1.3%. Profitability of vegetable crops is 30-50%. Tomato production involves

[30] URL: http://www.24.kg/parliament/2008/09/17/92705.html

55.0-60.0% of expenses for material resources, 8.3% - for mechanized works and 1.8% of land tax.

4.5.1.4 Turkmenistan

309. Government of Turkmenistan provides support for the development of agrarian sector by providing credits under favorable conditions, exempting from taxes, providing subsidies for cotton and wheat production that covers 50% of expenses for material resources and technical services.

310. Currently agricultural sector is equally managed by governmental and non-governmental sectors with the greater share of the private producers.

311. In 2001 private sector has produced 76% of total agricultural production. Private sector produces 98% of potato, 72% of vegetables, 78% - fruits, 90% of meat, 95% of milk and 93% of eggs.

312. Implementation of the "Grain" program sharply increased the volumes of wheat production that allowed abolishing import of this product.

313. Another strategically important sector is cotton production as this sector influences on development dynamics of agriculture, cotton processing industry, textile and oil producing industry.

314. Significant contribution for development of agriculture is made by livestock production (63% out of total volume of agricultural production). Tax exemption of cattle and poultry keeping farmers and transforming major part of livestock population to the private sector has led to the stabilization and effective development of his sector.

315. Cattle population in the country during 1991-2001 has twice increased while population of ships and goats has increased more than two times, population of camels – by 28% and population of horses – by 45%.

316. The above provided analysis shows that it is difficult to calculate profitability of the agricultural sector. Therefore, decision was made to provide the effect of this sector on macro and micro levels. On macro level agricultural sector is effective due to the following reasons:

- Increased production helps to save funds in hard currency by abandoning the strategy of importing agricultural goods;
- Increased production of the strategically important crops such as cotton as well as livestock products stimulates the flow of hard currency via realization of these products on external markets;
- Continuous supplying of local population by agricultural products with low prices;

- Stimulated the development of processing industry and creates new working places.

317. Thus, agricultural production on macro level is efficient.

318. Since major producers of agricultural products are represented by the private sector profitability on micro level depends on efficiency of dekhqan holdings and renters.

319. Thus, profitability of wheat production has made up 79% with involvement of 50% of expenses for material resources, 2.2% for services, and 50% of governmental subsidies (renter A. Jalliev from dekhqan association Bugdaily).

320. Profitability of cotton production is negative (renter B.Khudoyberdiev, dekhqan association "Bugdaily") without covering of 50% of expenses for resources and 28% of expenses for services. Under the condition that government covers 50% of expenses for material resources and services profitability makes up 30%.

321. Low efficiency of cotton production on micro level is due to the high level of expenditures and low yields (2.37 t ha^{-1}).

4.5.1.5 Uzbekistan

322. Major agricultural crops in Uzbekistan are cotton and wheat that occupy more than 80% of irrigated area. Therefore, profitability of agriculture depends on profitability of cultivating these two crops. There is a governmental order for these two crops: for cotton – 70% and for wheat – 50% out of total production. There are fixed prices for agricultural production ordered by the government. In accordance with the law farmer has the right to sell for market prices the remaining share of the produced products after supplying government with the ordered share. However, in reality all produced cotton is purchased by government in accordance with the fixed prices. The decision was made to increase the price for the cotton produced above the state order by 20%. However, in fact this decision is not being implemented.

323. State order for wheat fluctuates between 45-65% of the total production.

324. In order to support cotton and wheat producers government provides to the farmers credits under favorable conditions with the 3% of bank rate, and for credits taken for 5 years – 5% bank rate. Volume of credits provided under favorable condition at the beginning calculated taking into account covering of the 50% of expenses. Subsequently credits were provided in accordance with the 50% of the cost of products to be purchased by the government. Currently the volume of credits is calculated in accordance with the 60% of the product's cost. Besides, government covers all water expenses from the state budget. Before 2006 government has compensated 25% expenses for mechanized services as well as did not levied VAT for material resources provided to the agricultural sector. From 2006 to present time this order has been abolished.

325. Farmers producing agricultural products in accordance with the state order are supplied by material resources with the decreased prices (by 20% below the stock prices). While other farmers purchase material resources in accordance with the stock prices.

326. During the years of independence the growth in the prices for industrial products was significantly high in comparison with the growth of agricultural product prices.

327. Currently the process of increasing costs for services used by farmers in on the way.

328. Research has indicated that cotton production during 1992-2004 was not profitable (Figure 13). Starting from 2005 cotton production became profitable, however, profitability is still low.

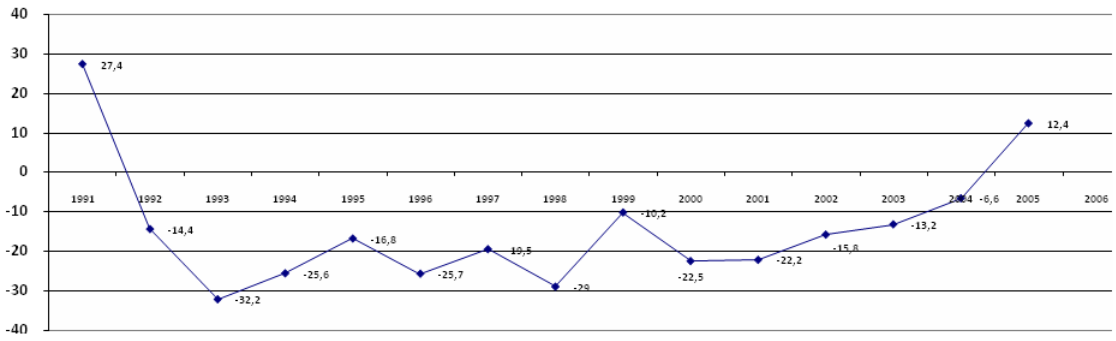

Figure 13. Dynamics of cotton profitability in Uzbekistan during 1991-2006

329. However, on macro level cotton production was profitable during the analyzed period. Efficiency of cotton production on macro level is evaluated by considering macro indexes such as production per capita, export potential, flow of hard currency and employment rate.

330. Profitability of production is influenced by price formation for agricultural and industrial products (price parity), level of subsidies, level of technological production, problems on the local and external markets.

331. *Price formation*. In Uzbekistan there are three types of prices: purchasing prices fixed by the government for cotton and wheat, prices that fixed by processing enterprises (for the products excluding cotton and wheat), contracted prices for the production exceeding the volume of the state order and, finally, market prices.

332. Dynamics of the prices indexes for agricultural and industrial products is given on Figure 14).

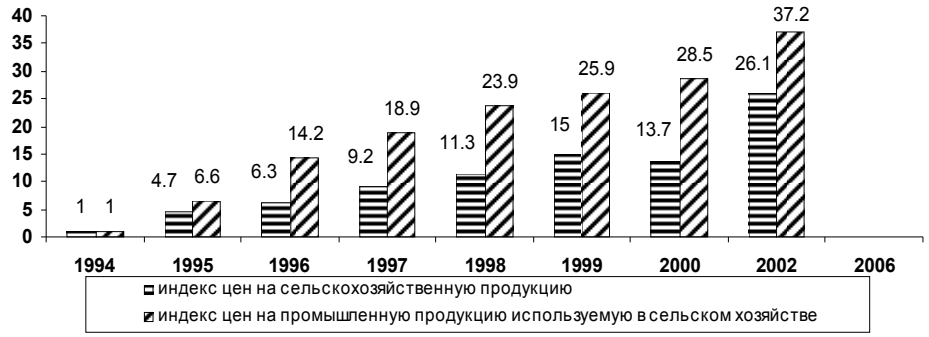

Figure 14 Dynamics of prices indexes for agricultural and industrial products in Uzbekistan during 1994-2006.

333. As it can be seen from the figure above increase in the prices for industrial goods is higher that of agricultural products. Increase in the prices for industrial goods is due to the production of the new types of machines and equipment, fertilizers and chemicals. Meanwhile in agriculture types of products remain the same with the slight improvement of their quality and marketable appearance. Besides, drastic increase in prices for agricultural products will cause the decrease in demand which makes agricultural sector incapable of drastic price increases.

334. During the resent years agricultural sector has seen substitution of mechanized works by manual operations due to the several factors including the increasing number of small farmer holdings, decreasing level of the resource base of agricultural sector, decreasing power capacity of the labor. As a result of high expenses for production the profitability decreases.

Table 60. Comparative analysis of the major industrial and agricultural products based on the equivalent costs in Uzbekistan during 1991-2001.

Inputs	Cost per unit		Equivalent cost per 1 unit of cotton,		Equivalent cost per 1 unit of wheat		Growth in 2001 in comparison with 1991			
	rubles	Thousand sum	in tons		in tons		cotton		wheat	
	1991	2001	1991	2001	1991	2001			ton	times
1. Technical means										
MT 8-80	9000	6320,0	5.7	79.0	38.1	188.1	73.3	13.8	149.8	4.9
Cultivator	2685	983.0	1.1	14.0	11.4	29.3	12.9	12.7	17.9	2.6
Plough	1579	909.0	0.6	11.5	6.7	26.8	10.9	19.2	20.1	4.0
2. Mineral fertilizers										
Ammonium nitrate	163	25.3	0.1	0.4	0.7	0.8	0.3	4.0	0.1	1.1
Ammonium phosphate	379	118.8	0.2	1.5	1.6	3.5	1.3	7.5	1.9	2.2
Potassium	87	50.8	0.01	0.8	0.4	1.9	0.79	80.0	1.5	4.8
Super -phosphate	198	26.0	0.01	0.5	0.8	1.1	0.49	50.0	0.3	1.4
3. POL, tons										
-avtol	557	113.8	0.2	1.7	2.4	4.1	1.5	8.5	1.7	1.7
-diesel	163	80.7	0.1	1.2	0.6	2.9	1.1	12.0	2.3	4.8
-petrol	189	173.3	0.1	2.4	0.8	5.8	2.3	24.0	5.0	7.3

335. Issues of realization. In Uzbekistan the internal market for many products (cotton, wheat) is not developed therefore there is no market infrastructure. Also there are certain barriers to provide products for external markets. These conditions and low competitiveness of the products are reflected on the profitability of production.

4.6 Importance of agriculture in wellbeing of the population

336. Share of agriculture within the economy of CA countries is different: in Kazakhstan – 8.6% of GDP (2006), in Kyrgyzstan – 34.1% of GDP (2006), in Tajikistan – 24.2% 92006), in Turkmenistan – 28.8% of GDP (2004) and in Uzbekistan – 21.7% (2007).

Figure 15. Share of agriculture in GDP given for CA countries

337. Agriculture plays important role in all CA countries due to the several factors: (i) in all of CA countries majority of population live in rural areas, (ii) strategies of food security are based on self provision, (iii) agricultural sector along with providing population with food products also supplies raw materials for industry, (iv) agriculture ensures ecological balance, and (v) finally agriculture stimulates social and demographic development of population.

338. Below the role of agriculture in Turkmenistan is given as an example.

339. During the years of independence agricultural sector of Turkmenistan has undergone significant changes. Production relations, ownership forms are changing, private entrepreneurship is developing.

340. At current stage the government is providing support for developing the agricultural sector by providing credits under favorable conditions, tax exemption, and provision of subsidies for cotton and wheat producers that cover 50% of expenses for material resources and technical services.

341. In 2001 private sector has produced 76%of the total volume of agricultural products with 96% in potato production, 72% in vegetable production, 78% - in fruit production, 90% in meat production, 95% - milk production, 93% of egg production and 83% of wool production.

342. As a result of implementing the President's program "Grain" wheat production has reached the level of 2.3 million tons in 2002 in comparison with 205.6 thousand tons in 1991.

343. Cotton production in 2001 exceeded the level of the year 2000 by 10%.

344. During the years on independence favorable conditions have been created in Turkmenistan. Population of the cattle has increased two times during 1991-2001, ship and goats – more than two times, camel – by 28% and horses – by 45%.

4.7 Role of agriculture in social sphere

4.7.1.1 Supplying population with food products

345. Nutrition is one of the important factors influencing human health conditions.

346. In accordance with the assessments of FAO only during 10 years (1994-2003) the number of people experiencing inadequate nutrition exceeded 18 million people and reached the level of 852 million people (815 million people in developing countries, 28 million in countries with transition economies (ex-Soviet Union republics) and 9 million in industrialized countries. Annually more than 20 million children are born with weight insufficiency in developing countries. In some countries such as India and Bangladesh 30% of children are born with the weight deficiency. Children with weight deficiency have high risk of neonatal death and inadequate physical and mental development. Annually due to the malnutrition 5 million children die and those who survive have high risk of developing deficiency in iodine, vitamin A and Fe leading to Fe leading to anemia.

347. Economical and material consequences of malnutrition are significant. Decrease in life expectancy and loss of working capacity costs to developing countries more than 220 million years of productive life. In accordance with the FAO evaluation loss of working capacity during the human lifetime due to the low weight at birth, energy and protein insufficiency, vitamin and mineral deficiency cases 5-10% decrease in GDP of developing countries.

348. In accordance with the FAO during 1993-2004 there were decreases in consumption of kilogram calories per capita in CA countries: in Uzbekistan – by 14%, Kazakhstan – by 14.1%, by Tajikistan – 17.8 %, Kyrgyzstan – 29.5% and in Turkmenistan – 10.5%. During 2002-2004 the highest level of consumption was in Kyrgyzstan – 3110 kilogram calories per capita per day. Meanwhile the average world consumption of kilogram calories during 2002-2004 was 2810 kilogram calories per capita per day.

349. After the collapse of Soviet Union bred consumption has increased in all CA countries due to the decreased income of the population as well as due to decreased production of other

types of food products. However, bred consumption has decreased in 1997 in Kazakhstan and Kyrgyzstan while in Uzbekistan it remained on the same level (Figure 16).

Figure 16. Dynamics of bread consumption in CA countries (kg).

Source: Статистический Ежегодник Содружества Независимых государств за 1999 г. Статистический комитет СНГ. Москва 2000г. Данные 2001-2003гг. из FAO Statistics Division

350. The analysis has shown that during 1993-2003 the share of bread in the daily consumption has decreased in Kazakhstan from 50% to 40%, in Tajikistan – from 62% to 57%, in Kyrgyzstan and Uzbekistan this indicator has increased from 56% to 59% and 49% to 53%, respectively.

351. During the considered period there were also changes in meat consumption. In Kazakhstan the share of meat has decreased from 9 to 8%, in Kyrgyzstan- from 9 to 6%, in Uzbekistan – from 6 to 5%. The lowest level was in Tajikistan – 2%. In all countries of CA the share of animal proteins in nutrition is decreasing while the share of carbohydrates is increasing.

Table 61. Share of the major product types in daily nutrition in CA countries (%).

Product types	Countries and years							
	Kazakhstan		Kyrgyzstan		Tajikistan		Uzbekistan	
	1993-1995	2001-2003	1993-1995	2001-2003	1993-1995	2001-2003	1993-1995	2001-2003
Bread and bread products	50	40	56	59	62	57	49	53
Milk	7	13	10	11	5	6	9	10
Sugar	6	9	6	4	5	8	4	3
Sunflower oil	2	5	1	1	0	2	-	-
Potato	4	4	5	8	2	4	2	2
Meat	9	8	9	6	2	2	6	5
Rice	3	3	-	-	2	3	5	3
Cotton oil	1	2	-	-	9	7	12	11
Vegetables	1	1	1	2	-	-	2	2
Eggs	1	1	-	-	-	-	-	-
Maize	-	-	-	-	-	-	3	1

Source: FAOSTAT © FAO Statistics Division 2007. 03 июня 2007.

352. During the USSR time, inter-republican specialization existed and in accordance with this specialization, Uzbekistan, Tajikistan and Turkmenistan were to produce cotton while meat and meat products were imported from other republics. This influences the average level of meat consumption per capita. The highest meat consumption was in 1991 in Kazakhstan – 70.5 kg and Kyrgyzstan – 48 kg, while in other countries the level of meat consumption was low: in Tajikistan – 21 kg, in Uzbekistan – 30 kg and Turkmenistan – 38 kg.

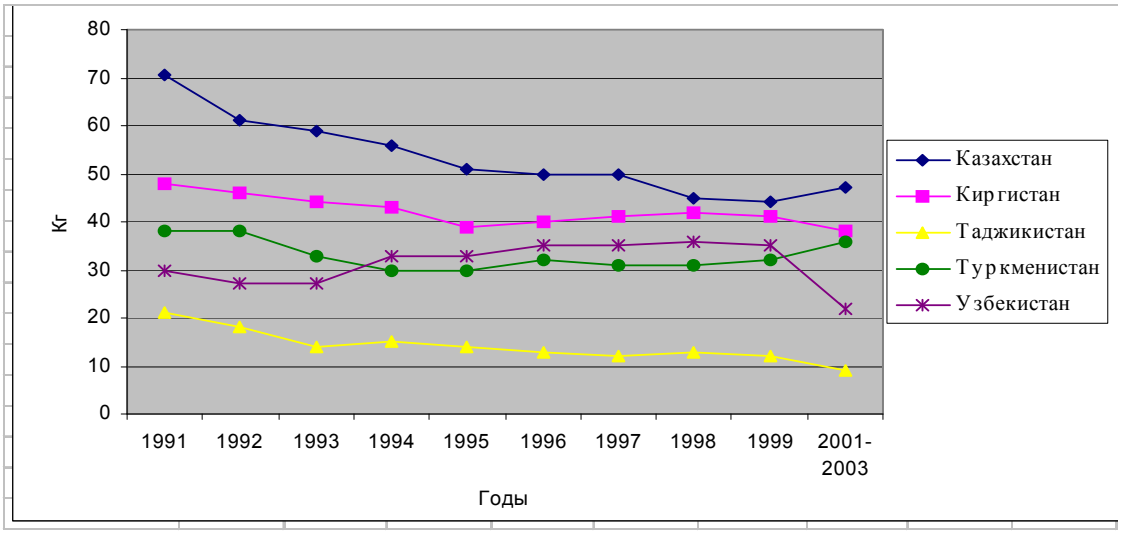

Figure 17. Dynamics of meat consumption in CA countries

Source: Статистический Ежегодник Содружества Независимых государств за 1999 г. Статистический комитет СНГ. Москва 2000. Данные 2001-2003гг. из FAO Statistics Division.

353. In accordance with FAO during 1993-2003 in all countries of CA except Tajikistan and Uzbekistan milk and milk products consumption has increased. In 2001-2003 annual milk and milk products consumption per capita in Kazakhstan made up 223.4 kg, in Kyrgyzstan – 208 kg, in Tajikistan – 67.5 kg, in Turkmenistan – 137.9 kg and in Uzbekistan – 136.8 kg. For comparison, annual milk consumption per capita in developed countries is 350-400 kg.

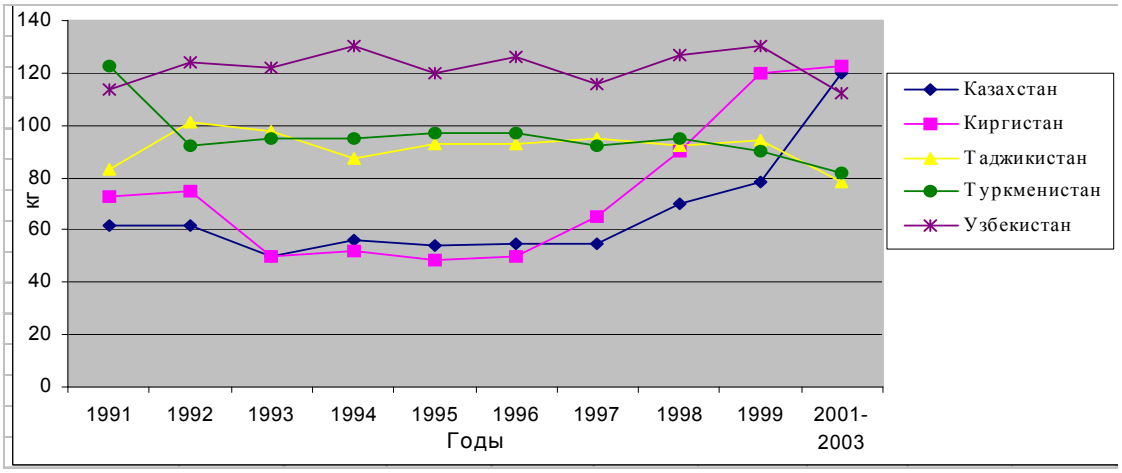

Figure 18. Dynamics of vegetable and cucurbit consumption in CA countries (kg).

Source: Статистический Ежегодник Содружества Независимых государств за 1999 г. Статистический комитет СНГ. Москва 2000. Данные 2001-2003гг. из FAO Statistics Division.

354. Starting from 1997 average consumption of vegetable and cucurbit crops per capita in all CA countries has increased.

355. During 1995-2007 in all CA countries the rate of population growth has significantly decreased. Therefore, rates of increase in production exceed the rates of population growth. Besides, increase in consumption was also due to the migration from CA countries.

4.7.2 Agriculture and population employment

356. In CA countries more than half of population live in rural areas, therefore, the share of population employed in agriculture is higher in comparison with other sectors of economy (except Kazakhstan). In Kazakhstan industry, energy sector, mining are speedily developing therefore the share of population employed in agriculture is significantly low. In 1991 25% of economically active population was employed in agriculture and in 2003 the share of employed population increased up to 36% due to the increased production of fruits and vegetables in southern parts of Kazakhstan.

357. In all CA countries at the beginning of 1990s the share of population employed in agriculture was around 40%. During 1991-2003 in all countries of CA except Uzbekistan the tendency of increased employment in agriculture was observed (Figure 19). Thus, in Tajikistan in 1991 the share of population employed in agriculture was around 45% and in 2003 this indicator increased up to 65% due to the sharp decrease in industrial production. The same tendency was observed in Kyrgyzstan and Turkmenistan where population migrates from cities to rural areas to create self substance oriented farmer holdings.

Figure 19. Share of population employed in agriculture

Source: Статистический Ежегодник Содружества Независимых государств в 2003 г. Статистический комитет СНГ. Москва 2004 FAO Statistical database http://apps.fao.org/page/collections?subset=agriculture

358. In Uzbekistan decrease in the share of population employed in agriculture is caused by changes in the forms of ownership. Thus, as a result of converting collective farmers (kolkhozes) into other forms of ownership 450 thousand people were unemployed. At present time nearly 17 million people directly depend on agriculture. The number of people employed in agriculture is continuously decreasing (Table 62).

359. Decrease in the number of employed people within the agriculture is caused by two major reasons: (1) diversification of the ownership forms (creation of shirkats, independent farmer holdings) and (2) due to the application of different advanced technologies.

360. At present time dekhqan holdings in Uzbekistan produce 18% of wheat and more than 905 of livestock production.

Table 62. Dynamics of the share of population employed in agricultural sector of Uzbekistan during 1995-2006

Years	1995	1998	2000	2004	2005	2006
Employed in agriculture, thousand people	3485	3467	3093	3043	2967	2935
% to the total number of economically active population	41.2	39.4	34.4	30.7	29.1	28.1
Number of workers per 1 ha	0.85	0.84	0.76	0.75	0.73	0.72

4.7.2.1 Agriculture and migration of population

361. Migration connected with agricultural sector is usually due to the climate changes and other factors (draughts, salinity and land water logging, increased level of mechanization, income level, reclamation of new land, etc).

362. In 1960-s a wide scale land reclamation was initiated in Kazakhstan with involvement of working force from all parts of the former Soviet Union. In Uzbekistan, Tajikistan and Turkmenistan wide scale reclamation of new land started in 1970s. Totally 2 million ha of new land were reclaimed in post Soviet Union that involved inter republic migration of population.

363. Drying of Aral Sea caused new migration.

364. Factors causing the migration of agricultural population include the followings:

- Institutional factors – changes in the form of ownership;
- Diversification of the structure of crops – increased areas under less labor consuming crops, decrease in the area of labor consuming high profitable crops;
- Increased level of mechanization;
- Land and water resource degradation.

4.7.2.2 Soil salinity and land water logging

365. Imperfect technologies of crop irrigation, high rates of irrigation water application (10-12 thousand m^3 ha^{-1}), inadequate drainages, untimely cleaning of drainage channels are the major reasons of soil salinity. During 1990-2007 the area of saline land in Uzbekistan has increased from 45 to 64% out of total land area. Annually in Uzbekistan due to the water logging around 20 thousand ha of irrigated land are lost for agricultural production. The same situation is in Turkmenistan. Rural population due to the difficulty of growing agricultural crops on highly saline land migrated to cities in search of employment.

4.7.2.3 Irrigation water pollution

366. High level of groundwater and high infiltration, discharge of used waters with the high content of pesticides, herbicides and other chemicals are the major sources of irrigation water pollution and creation of multiple lakes in the lower stream of Amu Darya and Syr Darya rivers. Level of water mineralization in the lower river streams exceeds the level of 3.5-4.0 g that does not allow reusing these waters.

4.7.2.4 Draughts

367. Periodically repeated water shortages during 2000-2006 and in 2007 led to the increase of land areas with insufficient water supply resulting in exclusion of this land from agricultural production. This, in its turn causes rural population migration.

4.7.2.5 Low incomes

368. In 1990s saw significant socio-economic stresses caused by draughts, soil salinity and low prices for agricultural products with the simultaneous increase in prices for industrial goods leading to increased poverty of population. Poverty predominates in the areas where the share of poor population makes up 40-80% (Table 63). Besides, regions affected with draughts had greater share of poor population. For example, 65% of Tajikistan's poor population live in the Khalton and Sugd provinces of Tajikistan[31].

Table 63. Rural population and poverty in CA (1999)

Countries	Total number of population (x1000)	% of the rural population	% of the poor population
Kazakhstan	15,639	44	46
Kyrgyzstan	4,921	66	70
Tajikistan	6,089	72	85
Turkmenistan	4,644	55	81
Uzbekistan	24,912	63	65

Source: FAOSTAT; различные обследования состояния сельского хозяйства и бедность Всемирного Банка

[31] Всемирный Банк, 200г., оценка бедности в Республике Таджикистан, отчет №202085-тд., стр-20-22.

4.7.3 Role of agriculture in economy

369. Role of agriculture in different countries can significantly differ. As it was correctly noted by D. Meadows et al. (2004) pre-industrial economy was predominantly agrarian, then industrial sector took over the agrarian sector and in recent years the major sector in global economy became serviced.

370. In CA countries agriculture continue to be the major sector of economy. The share of agriculture decreases as GDP per capita increases.

4.7.3.1 Agriculture in world trade

371. From ancient times agricultural products were not only sold on local markets but were objects of international trade as well. Uzbekistan is the exporter of cotton lint, vegetables, fruits, grapes, etc. But at the same time Uzbekistan imports wheat of high quality, vegetable oil, meat and milk products, tea and coffee, etc.). Positive trade balance ensures stability of the country's economy

4.7.4 Role of agriculture in land use

372. In many countries changes in areas under cultivation or under perennial plantation are taking place.

Table 64. Changes in the area under cultivation in Uzbekistan during 1995-2006

Years	1995	1998	2000	2004	2005	2006	2006 in % to 1995
Area	4165	4029.7	3778.3	3695.7	3647.5	3637.4	87.3

373. At the same improper agricultural use of land lead to the range of ecological consequences such as soil erosion and deflation, soil compaction and emergence of secondary salinity, environmental pollution, etc.

374. In accordance with the existing evaluations nearly 2 billion ha of soil or 15% of the land surface has been degraded as a result of human activity (Globalnaya…., 2002).

375. Major types of land degradation:

- Water erosion – 56% out of total area of degraded land;
- Wind erosion – 28%;
- Chemical degradation – 12%;
- Physical degradation – 4%.

376. Soil salinity is also an important factor. At present time 255 million ha of irrigated land as a result of improper irrigation were converted into land affected with secondary salinity and 105-110 million ha are affected by water logging.

377. Improper agricultural management in arid areas has led to environmental degradation as it is exemplified by reclamation of new land in the basin of Aral sea where cotton was predominantly grown leading to the decreased river stream flowing into Aral (from 53 km^3 year-1 to 7-11 km^3 year-1 in 1970s and starting from 1980 river stream reached Aral sea only during the years of abundant water supply). As a result the volume of Aral Sea has decreased three times and salinity of sea water increased from 10 to 40 g l^{-1}. Fishing is now extinct as well as muskrat is not longer inhabit Aral Sea.

4.7.4.1 Agriculture and use of water

378. At present time water withdrawal in CA countries makes up 120 km^3 year-1. 90% of this volume is used for agriculture and in countries like Uzbekistan, Tajikistan and Turkmenistan agriculture consumes more that 90% of water. Areas of irrigated land make up 10212 million ha.

379. Increase in GDP per capita lead to decrease in water consumption by agriculture for production of 1 USD and this decrease is nonlinear.

4.7.4.2 Agriculture and environmental pollution

380. Agriculture affects external environment as it uses mineral fertilizers and pesticides. At present time global consumption of mineral fertilizers is nearly 128 million tons and the average global use per ha is 15.5 kg.

381. Washing of mineral fertilizers from soil as well as fertilizer improper application and storage result in intensive environmental pollution.

382. Greater danger comes from the use of pesticides. The cost of pesticides used worldwide exceeds 34 million USD per year (Wood et al, 2000). However, application of pesticides does not provide the expected results as pests get used to them. In accordance with Brown et al., 1999 at present time around 1000 species of animals and plants that are considered as crop pests have developed immunity against pesticides.

4.7.4.3 Agriculture and changes in biochemical cycles

383. Changes in biodiversity especially changes in the content of plant cover take place during plowing and agricultural operations. This leads to changes in biological cycles. For example, if forest phytocenoses are changed to agricultural phytocenoses biological circles increase. In all zones water stream is increasing (Evdokimova et al., 1976). Unfortunately, there is no global evaluation of biochemical cycles connected with agricultural activity.

4.7.4.4 General evaluation of ecological significance of agricultural land and affect of agriculture on environment

384. At present time the most widely known indicators of influence on environment are biological capacity and ecological footprint. Biological capacity shows hectares of land with average productivity per capita (Living…, 2004). At present time this indicator on average for the entire world makes up 1.8 ha per capita.

385. Ecological footprint means that by affecting external environment we decrease the biological productivity as well as biological capacity. Currently biological footprint is around 2.2 ha per capita.

386. Thus average ecological deficit in the world is around 0.4 ha per capita. Total biological productivity represents the sum of ecological capacity of land with different soil qualities. Agricultural land makes up 0.8 out of total biological capacity including arable land (0.53) and pastures (0.27).

387. On the other hand role of agriculture in formation of the total ecological footprint is evaluated by 0.62 including the results from using arable land – 0.49 and pastures – 0.1432.

388. Thus, contribution of agriculture into productivity of landscapes is greater than the destruction of biosphere as a result of using land for agriculture.

4.7.4.5 Climate change caused by agriculture and global climate change

389. Climate change will result not only on water availability but also will cause changes in concentration of CO2 that will affect differently plants with different photosynthesis.

390. Increased concentration of CO2 will positively influence on growth and productivity of the majority of agricultural crops. Doubling of the content of CO2 in the air under other favorable conditions for vegetation will lead to the increased yields of maize, cotton, millet, sorghum, vegetables, wheat, rice, barley and oats from 0 to 10%. Even under stressful condition increased CO2 will stimulate high productivity. Maximal level of yield increase on average for all agricultural crops can reach the level of 20-40%.

391. It is known that maximal temperatures exceeding 40^{o}C especially during the flowering stage are not favorable for crop cultivation equally for tropical and moderate climate. Temperatures exceeding 25^{o}Centner has negative influence on development of cabbage while temperatures exceeding 27-29^{o}C affect negatively cucurbit and technical crops.

392. Increase in the number of days with the temperatures exceeding 25^{o}C from 10-30 to 50-70 result in decrease of cabbage yields by 15-55%. While increased number of days (from 10 to 50-80) with the temperatures 35-40^{o}C lead to decreased yields of tomato (10-50%) and

[32] Living…., 2004

increased number of days (from 5 to 25) with the temperature 40°C decrease the yields by 9-42%.

393. For cotton planting in Bukhara, Kashkadariya and Surkhandariya provinces increased number of days (from 1.5 to 3.0) with the temperature of 30°C result in decrease of yield by 9-22% and in all other regions of cotton planting – by 0-8%33.

4.7.4.6 Affects of climate change on cotton

394. Possible changes in agro-climatic conditions within the major regions of cotton cultivation will result in extended duration of vegetation and increased summer and autumn temperatures. This will improve in general the conditions for formation, ripening and opening of the cotton balls and ultimately will increase cotton yields and improve quality of cotton.

395. For northern regions of cotton cultivation climate change will cause increased duration of the vegetation period. However, increased number of days with extreme temperatures will decrease yields of cotton in southern regions. Under the condition of low water availability losses due to the ballast temperatures will make up on average 9-15%.

396. Under the optimal condition of water availability increase in the cotton yields will make up 11% in all region.

4.7.4.7 Affect of climate change on cereals

397. Cereal crops in CA countries (except Kazakhstan) are grown predominantly on irrigated land. Growing cereals under irrigated conditions allow to decrease inter year changes of yields. Increased concentration of CO2 will increase the productivity of crops. At present time productivity of winter wheat is 2-8 times higher under the condition of irrigation in comparison with the rainfed conditions.

398. At present time average temperature starting from planting time till tillering stage is below the optimal level and after tillering average temperatures are high34.

399. On rainfed areas with sufficient precipitation and on irrigated land yields will be increasing by 7-15% as a result of climate changes.

4.7.4.8 Affect of climate change on other crops

400. Alfalfa is well adapted for clad winters and hot summers. Under the optimal water availability increased CO2 content and extended vegetation period will increase crop productivity.

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33 Муминов Ф.А. Абдуллаев Х.М. Агроклиматические ресурсы Республики Узбекистан. Ташкент. САНИГМИ, 1997. с.178.

34 Группер С.Р. Агрометеорологическая оценка продуктивности озимой пшеницы в Узбекистане. Ташкент. САНИГМИ, 1998. с.156.

401. Vegetables, cucurbit crops and potato are cultivated in most of the places. Potato and cabbages start vegetation at the temperature of 6°C, while tomato – 12°C, melons and water melons – 15°C.

402. Fruit gardens and grape yards occupy significant area in mountainous areas. Fruit trees and nut nuts are comparatively well adjusted to cool winters while grapes yards are not well adjusted for winters. More mild winter temperatures will decrease the area of grape yards that are covered to protect from low temperature in winter time. Increased summer temperatures will increase the sugar content of grapes.

4.7.4.9 Affect of climate change on pastures and karakul breeding

403. Karakul ships are most adjusted animals for living under hash fodder and climatic conditions of CA deserts. Climate changes will cause decrease in duration of winters on the southern and eastern parts of deserts by 2-3 decades and in central parts of desert by 2 decades while on the north – by 1 decade.

404. Increase in the temperatures up to 2°C will lead to substitution of winter regimes to the regime of "vegetation winters". Vegetation of ephemerous plants started in autumn will continue during winter time. However, winter vegetation does not stimulate the grass growth in spring time; productivity of ephemerous pastures might be decreased[35].

[35] Бабушкин Я.Н. Чуб В.Е.Изменение агроклиматических условий пастбищной территории Узбекистана в связи с возможными изменениями климата Информации от исполнении Узбекистаном своих обязательств по Рамочной Конвенции ООН об изменении климата. Бюллетень№1 Ташкент. САНИГМИ. 1999 с.34-40

5 Dynamics of land degradation

5.1 Land degradation under different agro-ecological conditions of CA

5.1.1 Mountain areas with extensive pastureland based holdings

5.1.1.1 Kazakhstan

405. In accordance with the data of the Kazakhstan Land Management Agency the area of overgrazed pasture land has increased from 14.8 million ha (1990) to 26.0 million ha (2000). In all regions of Kazakhstan the area of overgrazed pasture land exceed 300 thousand ha.

406. The greatest areas of moderately and severely overgrazed pasture land are in Aktubunsk region – 4008.9 thousand ha, Almata region – 2767.0 thousand ha, Atyraysk region – 3870.0 thousand ha, Western Kazakhstan – 2769.9 thousand ha, Kyzylorda region – 1881.8 thousand ha, Mangistau region – 1758.8 thousand ha, Southern Kazakhstan region – 1342.9 thousand ha and Karagaknda – 1246.1 thousand ha.

407. Pastures effected by water erosion are spread in Almata region (705.2 thousand ha), Mangistau region (801.7 thousand ha), Southern Kazakhstan (579.8 thousand ha), Aktubinsk region (374.0 thousand ha) and Jambyl province (236.1 thousand ha).

408. Area of pasture land effected by wind erosion is 24800.6 thousand ha. Areas under highest level of wind erosion are situated within Almata region (5049.8 thousand ha), Atyras region (3278.2 thousand ha), Jambyl region (2653.8 thousand ha), Aktubinsk region (2234.5 thousand ha) Kyzylorda region (2700.5 thousand ha), Southern Kazakhstan (3107.6 thousand ha) and Karaganda region (1272 thousand ha).

Table 65. Major pasture land problems in Kazakhstan

Ecological systems	Major problems
Mountainous	• Lack of necessary legislation for effective pasture management • Low socio-economic level of population • Decreased biodiversity • Decrease in the forest area (deforestation) • Pasture overgrazing near settlements • Insufficient ecological and special education of farmers on livestock and pasture management.
Flat land	In addition to the problems given above: • Irrational use of distant pastures • Water supply system of pasture land is destroyed; pastures are inadequately supplied with water • Mistakes in land privatization • Destroyed pasture rotations • Underdeveloped infrastructure

5.1.1.2 Kyrgyzstan

409. More than 95% of Kyrgyzstan territory is represented by mountains of Tian-Shan and Pamir-Alay that are covered with huge areas of pasture land. High mountainous natural pasture land occupy around 50% of the total land area of the country (200.0 thousand ha) or 90% of all agricultural land that stimulated the development of ship breeding and wool production. In 1980s the population of ship reached 10.0 million heads and produced nearly 40.0 thousand tons of wool and 150.0 thousand tons of meat (lamb). In terms of meat (lamb) and wool production Kyrgyzstan was on the third place after Russia and Kazakhstan during soviet time. In terms of intensiveness of production (population of ship per ha of land area). Kyrgyzstan ranked first.

410. Total area of pastures in Kyrgyzstan is 8459.8 million ha including 1083.2 million ha of rented pastures, 493.1 million ha of intensively used pastures.

5.1.1.3 Tajikistan

411. Natural pastures and hey fields in Tajikistan occupy 3.5 million ha and are the sources of diverse fodder plants. Fodder supply on pastures in accordance with the evaluation of specialists is more than 1.6 million tons of dry mass per year. Pasture land based livestock production is economically profitable as it gives the cheapest product.

5.1.1.4 Turkmenistan

412. More than 20% of the countries land area is represented by mountains. Mountainous areas are characterized by brown and dark gray soils that occupy nearly 5% of the country's land area and used for pastures and in some places for rainfed cultivation of cereal crops.

5.1.1.5 Uzbekistan

413. Piedmont pastures and hayfields of Uzbekistan are mainly situated within the Western Tian Shan ridges on 2500 m above the sea level in the eastern and south-eastern part of Tashkent region and Western part of Namangan region. Pastures in Uzbekistan are mainly used from spring to autumn. Population within this zone is mainly occupied by livestock production, horticulture and crop cultivation. In mountain pasture land goats and ship are main animals that are kept by farmers. Pastures near settlements are overgrazed that along with other factors such as climate change and insufficient precipitation causes pasture degradation. Therefore, most important for mountain regions is the implementation of resource conserving measures based on anti-erosion system that requires differential approach for using each land plot, improvement of the inter farm organizational structure and application of scientific and technological innovations.

5.1.2 Piedmont and forest areas

5.1.2.1 Kazakhstan

414. Total area of forests in Kazakhstan is 26.5 million ha including 11.4 million ha of tree covered area. Forests of Kazakhstan like its population are characterized with low density. Therefore forest area per capita in Kazakhstan is almost on the same level (0.77 ha per capita) as in “forest reach countries” like USA and Malaysia which is high than in majority of European of Central Asian country. Main part of forests and population of Kazakhstan is concentrated within the fertile forest-steppe zone spreading from Russia along the northern border to piedmont areas of Altay, Alatau and Tian-Shan mountains and further to the eastern and south eastern borders and along the Syr Darya and other major rivers in southern deserts. Thus, majority of Kazakhstan population lives within or near the forest zone that gives the opportunity of using forests as a source of fodder for the livestock, source of construction materials, and wood as a fuel. Nearly 300000 people directly depend from forest sector while the population living in forests or that uses forests a source of fuel wood, fodder and other products is estimated to be 2.5 million people.

5.1.2.2 Kyrgyzstan

415. Forests cover 350 thousand ha or 3.4 % of the total territory of Kyrgyzstan. Needle leaved trees cover 53 % of the total forest area. Though forest area in Kyrgyzstan is very small and unevenly spread across the country the world’s major relict walnut and fruit forests are found in Kyrgyzstan and they occupy the total area of 230 thousand ha. There are walnuts, Tian-Shan fir trees, Silver fir trees named after Semyonov, pistachio and almonds. Walnut forests are situated in the place called Arslonbob in south-western Kyrgyzstan within Fergana and Chatcal ridges on the height of 1300-2200 m above the sea level. Besides walnuts trees there are apples, peaches, cherries, currant and raspberry.

5.1.2.3 Tajikistan

416. Total forest area which under governmental control is 1.8 million ha including 1.79 million ha under the state forest management organization. Also there are fragmented forests with the total area of 150-250 thousand ha scattered in the pasture land and in areas that are hard to reach. Total forest area makes up 3% of the total land area of Tajikistan. Total wood supply is estimated to be 12-16 thousand m^3.

5.1.2.4 Turkmenistan

417. In accordance with the data of 1988-1989 total forest area under governmental control is 9.9 million ha or 20.3% of the total territory of Turkmenistan. 6.5 million ha out of the total forest area are given to the livestock production sector for long term.

418. Forest area is categorized in accordance with the following groups:

- -water protective (along the river stream) – 26.2 thousand ha;
- -soil protective – 3081.6 thousand ha;
- - sanitary-hygienic and for recreation – 3.8 thousand ha;
- -specially protected natural territories – 789.2 thousand ha;
- - others.

419. In Turkmenistan there are mountain forests, desert and tugay forests.

420. Mountain forests are predominantly represented by *juniperus turkomanica* which is the major component of biocenosis and mountain ecosystem. Total area of mountain forests with *juniperus turkomanica* is 66.2 thousand ha. Wood supply makes up 1.5 million m^3.

421. Mountain forests have rich biodiversity and include such trees as maple, hawthorn, almonds, barberry, dog rose, jujube, etc.).

422. Desert forests in Turkmenistan is represented by typical xerophile plants with the typical xerophile plants with the substantial biodiversity of endemic species such as white and black saxaul, *Salsola Richteri* and others. Total area under saxaul shrubs is 688.1 thousand ha and the wood supply makes up 9.3 million m^3.

423. Tugay forests are spread along rivers (Amu Darya, Murgap, Tejent, Atrek) within the 50-500 m wide line. During the Soviet times tugay forests were converted into cotton cultivation fields. Currently the total area of tugay forests in Turkmenistan is 38.2 thousand ha with the wood supply of 0.27 million m^3.

Table 66. Turkmenistan forests

Forest types	Total forest area under government control, thousand ha	Area covered with forests, thousand ha	Main forest forming species	Wood supply, million m^3
Mountain forests	524,0	146,2		3,9
			Archa Maple Elm pistachio Christ's-thorn hackberry	1,5 0,203 0,148 1,44, 0,66 Not known
Desert forests	9360.2	3957.9		9.53
			White saxaul Black saxaul Salsola Richteri Grebenshik Grebenshik (*Гребенщик*) Kandym (*Кандым*)	7.5 1.8 0.05 >0.05 0.13
Tugay forests	38.3	26.2		0.27
			Poplar of Efrat Poplar gray-leaved Oleaster Grebenshik (*Гребенщик*) Willow	
Total	9922.5	4126.8		13.7

5.1.2.5 Uzbekistan

424. Within recent times the area under forests in Uzbekistan has increased. Thus, during 1990-2006 the forest area has increased from 2507 million ha to 8526 million ha or from 5.5% to 19.3% out of the country's total land area. Starting from 1991 5.901 million ha were transferred from the category of agricultural land to the category of forests. Drastic increase in the forest area has been seen after 2002 (Table 67). Greater part of forests is situated in deserts (88%). The area under mountain forests makes up 9% of the total forest area.

Table 67. Dynamics of the changes in the area under forest during 1990-2006 in Uzbekistan (million ha)

	1990	% to the total land area	2002	% to the total land area	2006	% to the total land area
Land of forest fund	2.507	5.5	8.409	18.9	8.526	19.3
Including forests			1.490	3.3	2.722	6.16

Source: National report of Uzgoscomzemgeodezkadastr for 2001 and 2006

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425. Piedmont forests are situated in Western Tian Shan, Gissar and Pamir mountains.

5.1.3 Irrigated regions

5.1.3.1 Kazakhstan

426. Total area of agricultural land in Kazakhstan is 222.6 million ha including 2.3 million ha of irrigated land. The area of ploughed land reached 32 million ha, hay fields – 5 million ha and pasture land – 182 million ha.

427. Planted area has decreased by 30% during 1985 to 1996. The area under cereal crops has decreased in 1996 by 3875 thousand ha or 17% in comparison with 1991. But despite of this fact share of the cereal crops within the total volume of produced crops was 59%. Area under potato was equal to 1.1% of the total area under cereals and vegetables were grown on the area of 76 thousand ha or 0.4%.

5.1.3.2 Kyrgyzstan

428. Climatic conditions of Kyrgyzstan stimulate the predominant development of irrigated agriculture. Total area of agricultural land in Kyrgyzstan is 10.6 million ha. The area of ploughed land is 1.3 million ha or 7% of the total territory of Kyrgyzstan. Productivity of more than 70% of ploughed land depends on irrigation. Irrigated agriculture supplies more than 90% of the total volume of the cultivated crops. Total area of irrigated land in Kyrgyzstan is 1020.6 thousand ha.

429. As of 1 January 2007 1232.3 thousand ha are under private ownership, 58.2 thousand ha is under municipal control and 18704.4 thousand ha under governmental control.

430. Due to the insufficient funding and unsatisfactory condition of irrigation system the area of land with poor ameliorative conditions is increasing. In 2006 due to several causes (salinity, water logging, water insufficiency, lack of funding for purchasing seeds, POL, economic reasons) 141.1 thousand ha or 11.0% were not used.

5.1.3.3 Tajikistan

431. Total area of land in Tajikistan is 14.2 million ha. At present time nearly 4/6 million ha are under agricultural use including 3.3-3.6 million ha of pastures, 720-840 thousand ha of ploughed land and 100 thousand ha of perennial plants. Ridge areas occupy 17.5% of the total territory of Tajikistan, glaciers and water reservoirs occupy 9%, forests – 3%, settlements, transportation and industry occupy 2%. At present more than 5 thousand dekhqan (farmer) holdings are created.

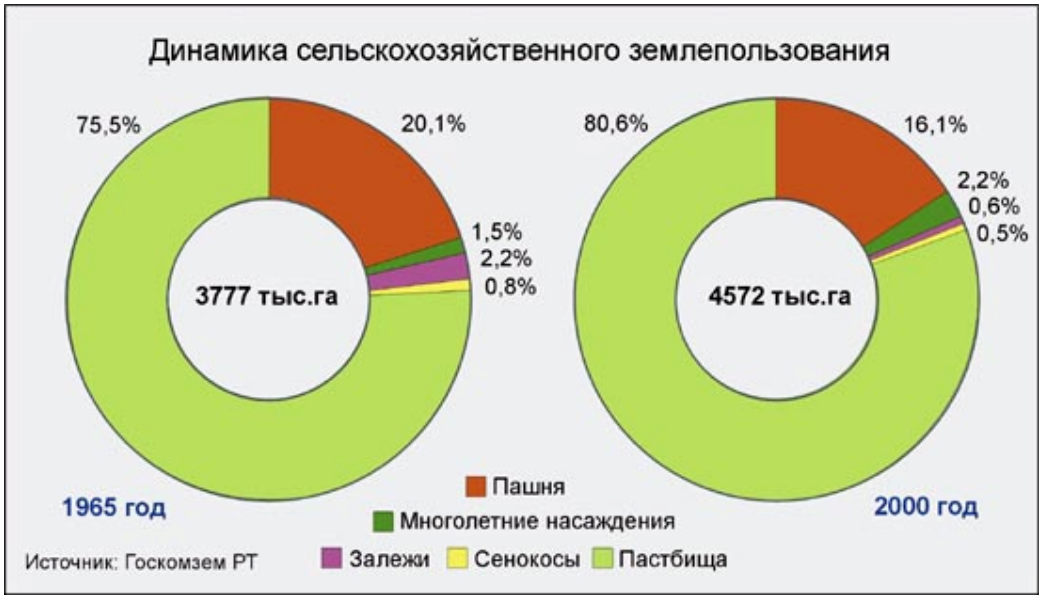

Figure 20. Dynamics of agricultural land

432. During 1930-1950 the area under irrigated land remained constant – 300 thousand ha. As a result of intensive land reclamation in Vakhsh, Syr Darya, Obi-Kiyik, Beshkent, Asht, Dangarin, Gissar, Kyzyl-su-Yakhsuy, Yavan and other valleys the area of irrigated land has significantly increased from 500 thousand ha in 1970 to 720 thousand ha in 2000. As a result of land reclamation significant area has went through deforestation leading in many regions to substantial erosion of sloping land.

Figure 21. Dynamics of irrigated land

433. Changes in the area of irrigated land paralleled with the changes in the area under crops. Thus, in 1940 area under cotton cultivation increased from 100 thousand ha in 1940 to 300 thousand ha in 1980. During 1960-1980 land area under cereal crops has decreased and at resent times as a result of implementing strategy of food self sufficiency this area has increased up to 390-420 thousand ha.

434. The area of irrigated land per capita is decreasing from year to year: in 1970 per capita area of irrigated land was 0.17 ha, in 2000 -0.12 ha. There are expectations that in 2010 this indicator will fall down up to 0.08 ha per capita. Total area of land suitable for irrigation based agriculture in Tajikistan is 1.5 million ha and half of this area is already under irrigated agriculture.

5.1.3.4 Turkmenistan

435. During 1970-1995 the total area of irrigated land in Turkmenistan has increased 1.6 times and during 1992-1994 – by 233.3 thousand ha. This increase in irrigated land was as a result of "Grain" program implementation. 55% of the irrigated land has moderately saline soils that need annual leaching while 12% of the irrigated land area highly saline land. The area under moderately, highly and extremely saline land during considered three years has increased by 147 thousand ha.

5.1.3.5 Uzbekistan

436. During 1996-2007 the area of irrigated land in Uzbekistan has increased from 3339.4 thousand ha to 3308.5 thousand ha (Figure 22). Occupying only 10% out of the total agricultural land area irrigated land produce more than 95% of the gross agricultural products. Most fertile irrigated land is in Fergana valley, Surkhandariya, Samarkand and Tashkent regions.

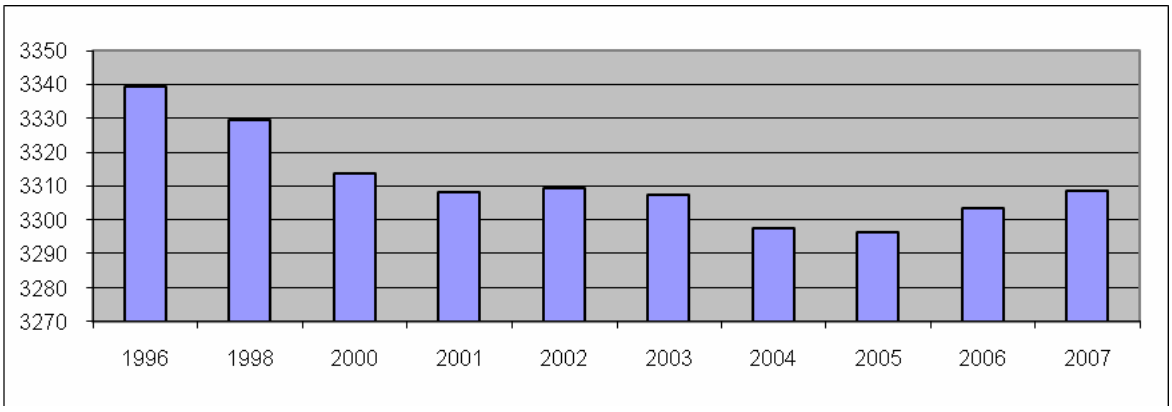

Figure 22. Dynamics of irrigated land in Uzbekistan during 1996-2007 (thousand ha)

Source: National report of Uzgoskomzemgeodezkadastr for 2001 and 2006.

437. Irrigated land is predominantly located in plains and piedmont area. In piedmont areas irrigated agriculture is developed on soils that do not require amelioration measures related to land salinity. However, irrigation and water erosions are the main problems in this area.

438. Within plains irrigated agriculture has problems of accumulated soil salinity. These areas include old irrigated land in Bukhara, Khorezm, Fergana regions as well as newly irrigated land in Hungry steppe, Jizzakh, Sherabad, Karshi steppe, northern Karakalpakstan and central Fergana.

439. Soils with low humus content occupy nearly 40% of the total irrigated land and total area of less productive cultivated land is 0.5 million ha. Nearly 4.5 % of land with low fertility and high susceptibility to wind and water erosion are represented by sandy soils.

440. Total area of abandoned land as of 1 January 2000 made up 80.7 thousand ha including irrigated land 46.5 thousand ha and 34.2 thousand ha of rainfed land.

441. During 1996-2000 total area of abounded land increased by 11.5 thousand ha that are predominantly irrigated land that developed deteriorated soil conditions as a result of ineffective irrigation systems and other factors. Greater share of these land are within Karakalpakstan (7.6 thousand ha), Bukhara (4.9), Kashkadariya (4.8), Navoi (6.8) and Syrdariya (9.4 thousand ha) regions.

Table 68. Dynamics of abandoned land in Uzbekistan during 1995-1999, thousand ha

Years	Total area	Including	
		Irrigated	Non-irrigated
1996	69.2	36.0	33.2
1997	71.7	38.3	33.4
1998	78.0	44.7	33.3
1999	77.8	43.6	34.2
2000	80.7	46.5	34.2
2000 г. in % to 1996	116.6	129.2	103.0

5.1.4 Rainfed areas

5.1.4.1 Kazakhstan

442. Pasture land occupy 182.6 million ha including 151.6 ha in the plains and 31.0 ha in mountain areas. There are nearly 49 million ha of degraded pasture land.

443. Rainfed agriculture in several regions of steppe zone is risky due to the unstable climatic conditions, effects of draughts and winter frosts.

444. In Balkhash region out of total rainfed cultivated area 11.2 million ha were affected by desertification as a result of depleted humus content. The area of land with depleted humus content within the irrigated zone is 0.7 million ha.

445. Land suitable for agricultural cultivation without preliminary amelioration measures make up 23.3 million ha. The rest of the land requires special soil ameliorative measures. In

accordance with the Kazakhstan Land Management Agency saline land make up 94.9 million ha or 42.1% while erosion effected land make up 30.5 million ha or 13.0%.

5.1.4.2 Kyrgyzstan

446. Rainfed land in Kyrgyzstan is spread in valleys and piedmont areas. In accordance with the data for the year 2007 rainfed land made up 569.9 thousand ha or 5.2% of the total agricultural land. During 2000-2006 total area of rainfed land has increased by 4.5 thousand ha (Table 69).

Table 69. Area of rainfed land in Kyrgyzstan

2000		2005		2006	
Thousand ha	% to total agricultural land	Thousand ha	% to total agricultural land	Thousand ha	% to total agricultural land
565.4	5.2	570.0	5.3	569.9	5.3

447. Crop productivity on rainfed land is lower in comparison with crop productivity in irrigated land. For example, productivity of cereal crops on average is 35 centners per ha on irrigated land and up to 15 centners per ha on rainfed land and the difference in income generated on average is 28%.

5.1.4.3 Tajikistan

448. Rein fed areas used for agricultural production are used on piedmont and mountain zones with dry subtropical climate and precipitation during autumn, winter and spring. There are several types of rainfed land in Tajikistan:

- Rainfed land with insufficient level of precipitation – 200-300 million year^{-1}. This type of rainfed land is characteristic for the lower parts of rivers Vakhsh, Kofarnigon, Pyanj which is on the level of 300-800 m above the sea level with the predominant slope of 5o. This land can be used for vegetable and cucurbit crop production if soil amelioration measures will be applied.
- Rainfed land with moderate level of precipitation – 300-500 m above the sea level. These land are spread across plains near mountains on the altitude of 600-1200 m above the sea level with the predominant slopes of 5-15o. These areas are used for cereals, oil containing crops, horticulture and viticulture.
- Rainfed areas with sufficient level of precipitation – 500-800 mm year-1. This land is spread predominantly on mountain slopes on the altitude of 1000-2000 m above the sea level with the slope of 10-30 o. Land are used as pastures.

449. Rainfed area plays an important role in the economy of Tajikistan and is the main part of the agricultural production. Total area of rainfed land in Tajikistan is 4668.5 thousand ha or

32.8% out of the country's total land area. The area under non-irrigated cultivated land is 217.7 thousand ha, under perennial plantations – 101.6 thousand ha, under pastures – 3797.6 thousand ha, abandoned land – 30.1 thousand ha and hay fields – 20.6 thousand ha.

Table 70. Structure of the rainfed land in Tajikistan (01.01.2006, thousand ha) [36]

Region	Non irrigated cultivated land	Perennial plantations	Abandoned land	Pastures	Hay fields	Total
Sugd	65.3	57.8	7.3	95.6	1.1	1105.9
Khalton	102.9	21.1	21.8	1220.5	8.6	1618.3
Mountainous Badakhshan (autonomous region)	0.7	1.8	0.2	757.4	9.2	779.4
Regions of Republican subordination	48.8	20.9	0.8	1024.1	1.7	1164.9
Total	217.7	101.6	30.1	3797.6	20.6	4668.5

5.1.4.4 Turkmenistan

450. Climate in Turkmenistan is extreme continental and dry. Average annual temperature changes in the range of 21-34^{o}C. On plain areas average annual temperature fluctuates between 11 to 13^{o}C in the northern parts and up to 15-18^{o}C in the south-eastern parts. On the mountains with the altitude of 1500-2000 m above the sea level it fluctuates between 7-10^{o}C.

5.1.4.5 Uzbekistan

451. During 2002-2006 the area under rainfed land in Uzbekistan has increased from 746.8 thousand ha to 755.7 thousand ha. This land are predominantly situated in piedmont areas of Kashkadariya (257.2 thousand ha), Jizzakh (220.4 thousand ha) Samarkand (182.7 thousand ha) regions (Table 71). Wheat, legumes and other crops are cultivated on rainfed land.

[36] Земелный фонд Республики Таджикистан (на 01.01.2006г). Госкомзем РТ. Душанбе, 2006.

Table 71. Rainfed land in Uzbekistan (thousand ha)

	Region	01.01.2002	01.01.2002	2007 in % to 2002
1	Jizzakh	217.9	220.4	101.1
2	Kashkadariya	250.8	257.2	102.5
3	Navoi	20.4	20.1	98.5
4	Samarkand	183.4	182.7	99.6
5	Surkhandariya	39.1	38.3	97.9
6	Tashkent	35.2	37.0	105.1
	Total	746.8	755.7	101.2

Source: National report of Uzgoskomgeodezkadastr for 2001 and 2006.

452. In accordance with the date collected in 2002 rainfed areas are predominantly represented by land with moderate level of precipitation (Table 72).

Table 72. Level of precipitation on rainfed land of Uzbekistan

Regions	Total area of rainfed land, thousand ha	Including		
		Land with sufficient level of precipitation	Land with moderate level of precipitation	Land with low level of precipitation
Jizzakh	217.9	17.1	201.4	0.4
Kashkadariya	250.8	94.1	146.0	10.7
Navoi	20.4	0	3.9	16.5
Samarkand	183.4	1.1	174.4	7.9
Surkhandariya	39.1	11.3	18.4	9.4
Tashkent	35.2	6.3	27.7	1.2
Total	746.8	129.9	571.6	45.3

National report of Uzgoskomgeodezkadastr for 2001

5.1.5 Desert pastures

453. CA countries are experiencing desertification process which is classified in accordance with the following groups: (i) degradation of the plant cover, (ii) weathering of sandy deserts, (iii) water erosion of hills, (iv) salinization of the irrigated land, (v) soil salinity due to drying out of Aral Sea, (vi) technogenic desertification and (vii) pastureland water logging within the areas of discharging drainage waters.

5.1.5.1 Kazakhstan

454. Pastures of Kazakhstan are situated in four ecological zones:

- Half desert area spreading across the northern Kazakhstan and is characterized with grassy plant cover with predominance of such plants as *Stipa spp*. and *Festuca spp*.;

- Half-desert area spreading in the central part of Kazakhstan which is covered with shrubs with predominance of *Artemisia spp*.;
- Desert area spreading mainly on the south and west of Kazakhstan with the forest type plant cover including *Haloxylon spp*.), *Artemisia spp*. and *tamarisk*.;
- Southern pastures and desert areas which can be used year around.

455. The conditions of pasture land have deteriorated during 1960-1980s due to use of pasture land for agricultural purposes and excessive overgrazing.

5.1.5.2 Kyrgyzstan

456. Total area of natural pastures in Kyrgyzstan is 8.9 million ha including 3.9 million ha of summer pasture land, 2.7 million ha of spring-autumn pastures and 2.3 million ha of winter pastures. Pastures have a greatest share in the total area of agricultural land – 85%. The most important role pasture land play in ship breeding as fodder provided to ship includes greatest share of natural pasture land grasses (70%).

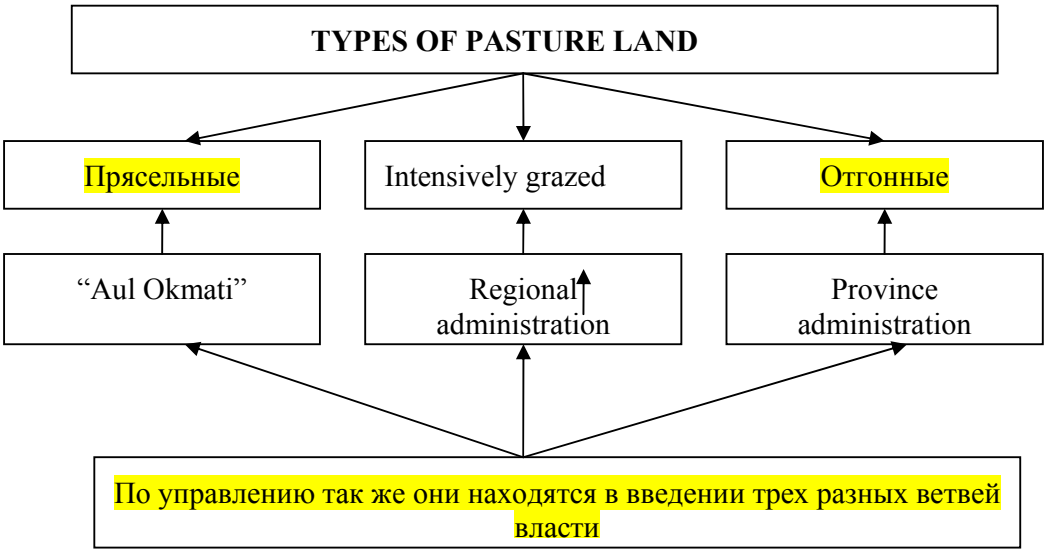

Figure 23. Structure of the pasture land management

457. Moreover, before 1990s pasture land were used in accordance with the annual planned cycle. Starting from 2000 pastures were given to renters that lead to intensive pasture use leading to depletion of pasture land fertility.

458. For the purpose of rational pasture use the government of Kyrgyzstan has accepted Decree “On the procedure on pasture land renting and using”, #360 as of June 4, 2002.

459. During 2000-2004 renting price from 1 ha fluctuated between 4 to 39 Soms ha^{-1} (and even higher on the south of the country). The heist rent was near the settlements. However, the tendency of intensive pasture use and low rents along with underdeveloped infrastructure of dry regions speed up the process of pasture degradation (Table 73).

Table 73. Area under agriculture

Land use	1995		2000		2005		2006	
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%
Pastures	9111.1	84.4	9165.2	84.8	9187.6	85.2	9176.1	85.2
Cultivated land	1417.4	13.4	1367.5	12.7	1284.4	11.9	1283.7	11.9
Hay fields	170.6	1.7	177.0	1.7	199.5	1.9	199.4	1.9
Perennial plantations	70.6	0.6	67.1	0.6	72.1	0.7	72.0	0.7
Abandoned land	20.1	0.2	21.5	0.2	35.4	0.3	35.3	0.3
Total	10781.2	100	10798.3	100	10780.5	100	10766.6	100

460. In recent years due to anthropogenic factors pastureland and hey fields' productivity has significantly decreased. Out of 9.19 million ha of pastures 2.4 million ha are subject to soil erosion, 4.1 million ha are covered by shrubs, 5.1 million ha are covered by unpalatable plants37. In 2006 only 931 thousand ha are officially rented to farmers. The remaining part of pasture land, i.e. 90%, is under governmental control.

[37] Ж.//Агропресс по вопросам АПК КР. Ноябрь, 2007. – 46. – С.

Table 74. Yields and gross fodder supply in Kyrgyzstan across regions, 2006[38]

Regions	Area of pasture land	Including			Yields, centners ha^{-1}			Fodder supply, thousand centers		
		Spring-autumn	summer	winter	Spring-autumn	summer	winter	Spring-autumn	summer	winter
Issyk-Kul	1350	397	591	362	3.4	5.2	2.3	715	1630	474
Naryn	2795	900	1130	765	2.8	3.5	1.9	947	2100	712
Chuy	859	292	48	119	6.9	8.1	3.6	1143	1887	222
Talas	633	252	205	176	3.3	5.5	2.7	420	643	257
Jalalabad	1638	494	852	292	6.4	7.9	3.6	1771	3432	588
Osh	1283	403	799	81	5.4	5.6	2.5	1231	2440	104
Batkent	590	217	104	278	4.2	3.7	1.1	559	232	171
Total	**9188**	**2955**	**4129**	**2063**	**3.9**	**5.5**	**1.7**	**6786**	**12364**	**2528**

461. The number of animals per 1 ha in the areas near settlements is 2.74 which is 3.2 times higher the ecologically justified level.

462. Due to the lack of pasture land amelioration measures pastures currently experience intensive degradation processes (Table 75)

Table 75. Degradation of pastures in Kyrgyzstan

Pastures	Area, thousand ha	%	Degraded area	Degree of degradation, %
Distant pastures	3978.0	43	1432.0	36
Intensively grazed	2756.0	30	1378.0	50
Near settlements	2454.0	27	1718.0	70
Total area	**9188.0**	**100**	**4528.0**	**49**

5.1.5.3 Tajikistan

463. There are following types of pastures in Tajikistan: desert pasture land, desert-steppe pastures and meadow pastures. Productivity of pastures is extremely fluctuating from 7.8 centers ha^{-1} on the south to 0.05-1.20 centners ha^{-1} (Pamir area)[39].

[38] Статданные КР

[39] Х.А.Акназаров. Современное состояние пастбищных угодий Восточного Памира. www. Интернет. khudod@rambler.ru

464. Eastern Pamir (Tajikistan) has nearly 2.5 million ha of pasture land. Major factors limiting the increase in grass productivity is Pamir's arid climate, anthropogenic factors and low fertility of soils.

465. Productivity of all types of pastures has decreased in recent years from 20 to 12.5%.

466. Desert-steppe type pastures have a plant cover with the low fodder value and therefore are used in supper and autumn. While meadow type pastures are used in winter time.

5.1.5.4 Turkmenistan

467. Out of the total area of pastures (38.5 million ha) sandy deserts occupy up to 90%.

468. Pastures of desert areas occupy 26 million ha (productivity of fodder plants is 100-400 kg ha^{-1}), pastures of gypsoid deserts – 5 million ha (with productivity of fodder plants making up 60-280 kg ha^{-1}), pastures of the loam deserts – 4 million ha (with productivity of 80-400 kg ha^{-1}), pastures of the piedmont deserts – 4 million ha (with fluctuating productivity of 50-300 kg ha^{-1} under the condition of 200 mm precipitation per year, 150-600 kg ha^{-1} under precipitation level exceeding 300 mm per year).

Table 76. Degradation of pastures in Turkmenistan, km^{-3}

Region	Degree of degradation			Total
	Slight	Moderate	Severe	
Akhalsk	41433	42401	2412	86246
Balkansk	43116	43583	6470	93169
Dashauz	20336	39905	3	61144
Lebap	44428	26766	2007	73201
Mary	46982	22153	5461	74596
Total	**196295**	**174808**	**17253**	**388356**
%	**50.5**	**45.0**	**4.5**	**100.0**

Source: НПДООС

5.1.5.5 Uzbekistan

469. Substantial area of the country is represented by pastures considered as a major fodder source for ship breeding. In comparison with 01.01.2000 the area under natural pastures made up 22151.3 thousand ha (Table 77).

Table 77. Distribution of pastures in Uzbekistan (01.01.2000), thousand ha

Total area	Including		
	Chul area	Adyr area	Tau area
22151.3	18050.9	3162.6	937.8

470. Desert pastures occupy north-western parts of Uzbekistan (Karakalpakstan, Bukhara province Navoi province and Kashkadariya province) on the altitude of 500 m above the sea level and are used around the year for karakul ship grazing. Desert pastures have the greatest share 980%) in the total area of pastures.

471. Currently under the productivity at the level of 1.5-3.5 centners ha^{-1} fodder availability makes up 50-55%. It should be noted that fodder plants growing in desert areas have low level edibility (15-30%), digestion (50-55%) and nutritive value (0.3-0.5 fodder units and 30-35 g of protein per kg).

5.2 Major forms of land degradation in Uzbekistan

5.2.1 Depletion of soil fertility

5.2.1.1 Kazakhstan

472. Land effected by desertification and salinity occupy more than 50 thousand km-2 within the basin of Aral Sea and Balkhash. The problem of land degradation is more prominent in the northern Kazakhstan – the area of cereal crop production. During many years of agricultural activity humus content has decreased by more than 5-20 %. Out of 4.3 billion tons of hummus supply 0-25 cm layer has been irrevocably lost due to the mineralization of the organic matter, nutrient mining, water and wind erosion. Regions producing cereal crops are effected by wind erosion (2.6 million ha) and soil deflation 917.8 million ha).

5.2.1.2 Kyrgyzstan

473. Major problems of land management in Kyrgyzstan are soil fertility depletion and soil pollution. Irrigation in the areas with high level of groundwater under the condition of dry areas causes secondary soil salinity. The area affected by soil salinity makes up 3.8 million ha. Due to the imperfect irrigation and unevenness of the land surface, fields area affected by water logging. 60% of the cultivated land are affected by water and wind erosion.

474. Out of the total 10.7 million ha of agricultural land more than 88% are degraded and affected by desertification. Areas affected by secondary salinity during 1995-2006 have increased and at present time 75% of the arable land are affected by water and wind erosion. Nearly 50% of the pastures are classified as degraded pastures.

475. The area of stony land makes up 4.0 million ha (Table 78).

Table 78. Dynamics of land degradation, thousand ha

Types of degradation	1985	1990	2000	2005
Saline soils	666.3	1170.3	1180.8	1180.8
Solonchak soils	243.4	469.3	471.2	471.2
Water logged land	28.9	89.2	90.9	118.6
Story land	2397.4	3808.8	3808.8	4021.2
Effected by wind erosion	616.2	5475.3	5475.3	5689.8
Effected by water erosion	725.7	4544.8	5626.8	5626.8

5.2.1.3 Tajikistan

476. Soils in Tajikistan have 6-9 % of humus. 31.8% of land area is considered to be washed out soils as a result of water erosion and 22.34% of land is affected by soil deflation. Total area of land effected by erosion make up 7848 thousand ha (Table 79).

Table 79. Soil erosion in Tajikistan[40], thousand ha (%)

Region	Water erosion			Soil deflation			Irrigation caused erosion	
	Lightly washed out soils	Moderately washed out soils	Highly washed out soils	Lightly washed out soils	Moderately washed out soils	Highly washed out soils	Lightly washed out soils	Moderately washed out soils
Sugd	115.7 5.96	196.3 7.52	963.8 36.94	22.6 0.86	162.4 6.22	434.1 16.63	150.0 5.76	26.3 1.00
Gissar	88.1 7.40	206.1 17.40	580.1 57.60	-	-	-	60.0 5.0	11.7 1.05
Vakhsh	359.9 29.07	240.1 19.49	110.4 9.03	39.6 3.22	101.5 8.24	192.6 15.44	110.0 8.90	37.3 3.03
Kulyab	124.0 10.39	439.8 36.70	379.0 31.72	-	-	0.9 0.07	40.0 3.45	22.4 1.85
GArm	52.7 3.03	218.1 12.72	850.5 50.32	-	-	-	-	14.0 0.80
GBAO	60.0 0.94	20.1 0.33	1657.2 26.00	-	-	2553.0 39.89	-	15.5 0.26
Total	840.4 5.90	1320.5 9.27	4541.0 31.88	62.2 0.43	263.9 1.85	3180.6 22.34	360.0 2.52	127.2 0.89

[40] Сангинов С.Р. Актуальные проблемы повышение плодородия почв. Путы повышение плодородия почв Таджикистана. Сборник научных трудов 39 том. НИИПТАСХН. С 14

5.2.1.4 Turkmenistan

477. One of the major land management problems in Turkmenistan is irrigation caused soil salinity. Almost 90% of the irrigated area at present time is affected by salinity.

478. High level of groundwater is the major cause of soil salinity. Total losses of water in irrigation systems are nearly 12 km^3. In accordance with the evaluations reparation of irrigation system will cost 1.2 billion USD.

479. Water of the major left bank collector has chloride-sulphate-sodium type mineralization of 2.8 g l^{-1} and Dargantine collector – 3.39 g l^{-1}. Maximal levels of mineralization on the right bank are observed on Surkhin collector – 13.0 g l^{-1}, Geoktepin district – 8.8 g l^{-1}, Kaakhin district – 19.8-26.2 g l^{-1}.

5.2.1.5 Uzbekistan

480. During 1990-2000 soil fertility in Uzbekistan has decreased from bonitet with 58 balls to 55 balls. Soil fertility in Fergana and Surkhandariya regions have decreased by 10 balls, in Tashkent, Navoi and Namangan regions – by 7 balls and in Bukhara by 5 balls (Figure 24).

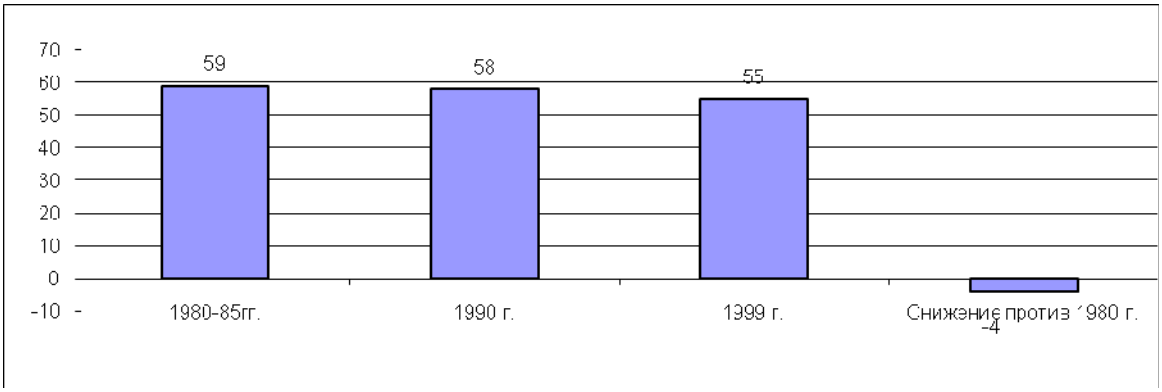

Figure 24. Dynamics of soil fertility on irrigated land in Uzbekistan during 1980-1999 (ball bonitet is measured on scale of 100 balls)

Source: data of Uzgoscomzemgeodezkadastr.

481. At present time average bonitet of soils in Uzbekistan is 55 balls ranging from 41 balls in Karakalpakstan to 60 balls in Andijan and Surkhandariya.

482. Soil humus content has decreased by 30-50%. Currently soils with low and very low humus content occupy nearly 40% of the total area of irrigated land while the total area of arable land with low fertility makes up more than 0.5 million ha.

483. The results of researches conducted during 2000-2002 in Pakhtakor farmer holding situated in Saykhunabad district of Syrdariya province showed that the rate of soil nutrient mining during these years overtook the rate of nitrogen application (Table 80)

Table 80. Indicators of factual nitrogen application and mining of NPK for cotton production in Pakhtakor farmer holding (Saykhunabad district of Syrdariya region) during 2000-2002

	2000			2001			2002		
	N	P	K	N	P	K	N	P	K
Factual fertilizer application, kg	43.4	43.2	19.5	46.8	44.2	18.2	43.6	44.2	19.8
Factual mining, kg	54.6	49.5	19.1	52.9	49.6	18.4	54.6	47.5	19.1
% of application to mining	125.8	114.6	97.9	113.0	112.2	101.0	125.8	113.0	97.9

Source: Research report on problems of effective land and water resource use under the conditions of market econoty, 2002(Научный отчет «Проблемы эффективного использования земельно-водных ресурсов в условиях рыночной экономики», 2002).

5.2.2 Erosion

5.2.2.1 Kazakhstan

484. 2.48 million ha of pastures in Kazakhstan are affected by wind erosion. Significant infiltration rates and inefficient irrigation are the major reasons of secondary salinity, water logging and water erosion.

5.2.2.2 Kyrgyzstan

485. All land area in Kyrgyzstan is potentially susceptible to soil erosion. Total area of erosion effected land is 6435.0 thousand ha including 770 thousand ha of arable land and 4546.7 thousand ha of pastures. Area of land effected by water and wind erosion is nearly 5 million ha or 45.7% out of total area of agricultural land. The area of land with slopes that stimulated water caused erosion is 614 thousand ha.

486. Areas susceptible to wind erosion with the wind speed reaching 20 m sec-1 in Kyrgyzstan make up 5386.0 thousand ha.

5.2.2.3 Tajikistan

487. At present time 97.7% of the total agricultural land in Tajikistan is subject to erosion in comparison with 68% in 1973. Erosion processes intensively progressed in piedmont regions. Major causes of land degradation in Tajikistan are water induced soil erosion and intensive agricultural activity. Soil cover is being washed out and increasing area of gullies reduces the area of arable land. In Fergana, Gissar, Vakhsh and Kabodin valleys arable land are scattered on the hilly landscape making land on hilly areas suffer from insufficient irrigation and land in valley areas suffer from over irrigation – both factors decreasing crop productivity. Crop cultivation is widely used on sloping land with the 25o slopes without application of erosion preventive agro-technical measures. Most of the pastures in Tajikistan are subject to severe soil erosion: 89 % of summer pastures and 97% of winter pastures.

5.2.2.4 Turkmenistan

488. Karakum desert occupies nearly 80% of the country's total territory. High dryness of the climate, mobility of the soil base and scattered type of plant cover sensible even to the slight changes in the wind speed stimulate soil weathering. Therefore major problems of land management in Turkmenistan are soil weathering and deflation.

489. 50.5% of desert pastures are slightly susceptible to wind erosion, 45% -susceptible to moderate erosion and 4.5% - to severe erosions[41].

490. Water erosion is the main problem on the mountain slopes in Kopetdag, Big and Small Balkhan and on piedmont sloping plains. Total area of land susceptible to water erosion is 690 thousand ha. These areas are mainly spread within the sloping land of Balkan, Mary and Akhal regions.

491. In mountainous areas 87% of land is affected by soil erosion. In Eastern and Western Kopetdag and in Kaytendage mudflows are very common.

492. Irrigation caused erosion are more characteristic for Akhal region (300 thousand ha).

493. Negative consequence of water erosion is the development of gullies. The length of the natural gulley net in Balkan region is 3025 km, in Mary – 686 km and in Akhal – 497 km.

5.2.2.5 Uzbekistan

494. Natural conditions of Uzbekistan potentially can trigger all types of soils erosion if soil protective measures will not be implemented.

495. Land of Uzbekistan is subject to water and irrigation erosions, destructive mudflows and wind erosion. In accordance of date collected in 2002 out of 26.73 million ha of agricultural land only 1551 thousand ha or 5.8% are not affected by erosion (Table 81)

[41] Национальный план действий Президента Туркменистана Сапармурада Туркменбаши по охране окружающей среды. 1 Туркменистан: Краткий обзор. Ашхабад 2002. с.235.

Table 81. Types of erosion in Uzbekistan, thousand ha (2001)

Land category	Total	Including			
		Not effected by erosion	Subject to water erosion (irrigation erosion)	Subject to wind erosion	Subject to water and wind erosion
Agricultural land	26734	1551	2700	20487	2005
Including:					
Irrigated	3733	791	341	2262	341
а) ploughed field	3308	569	341	2057	341
б) others	425	212	-	213	-
Non-irrigated (including pastures)	23001	760	2359	18218	1664

Source: National report of Uzgoskomzemkadastr as of 2001.

496. More than 4 million ha, or 20% of non-irrigated land (and in some regions such as Kashkadariya, Surkhandariya and Samarkand 50-80%) are susceptible to water erosion.

497. The areas effected with water erosion on irrigated zones is 628.4 thousand ha, 14% of irrigated land. Out of these land 4.5% have moderate and high erosion. Irrigated areas most effected by water erosion are spread across Tashkent region (138.6 thousand ha), Samarkand (121.9 thousand ha) and Kashkadariya (159.7 thousand ha) regions.

498. Total area of land affected by wind erosion makes up 50%. These areas are predominantly in steppe and grays soil zones in Fergana valley, north-eastern Bukhara, Hungry steppe, Kashkadariya, Sherabad, Karakalpakstan and Khorezm.

499. In terms of wind activity there are three regions:

- -region with insignificant wind activity with the wind speed up to 6 m sec-1 with the total area of 6.66 million ha;
- -regions with moderate wind activity with the wind speed up to 6-12 m sec-1 on the area of 35.08 million ha;
- -regions with high wind activity with the wind speed exceeding 12 m sec-1 on the total area of 2.67 million ha.

5.2.3 Accumulation of salts

5.2.3.1 Kazakhstan

500. Process of decreasing humus is observed on all arable land and pastures due to nutrient mining.

501. Out of the total area of non-irrigated land areas affected by desertification due to decreasing humus content make up 4.5 million ha with slight desertification, 5.2 with moderate

desertification and 1.5 million ha with high level of desertification. On irrigated land the area of land with depleted humus content is 0.7 million ha.

502. Areas that do not require preliminary soil amelioration measures for agricultural production make up 23.3 million ha. In accordance with the Kazakhstan Land Management agency the areas affected by salinity make up 94.9 million ha, or 42.1% and areas under erosion make up 30.5 million ha, or 13.0 %.

503. Due to the factors depleting the quality of irrigated land gross production of agricultural crops has decreased 1.6-1.8 times.

5.2.3.2 Kyrgyzstan

504. The total area of land effected by salinity in Kyrgyzstan is 1170.4 thousand ha including slightly saline land (398.6 thousand ha), moderately saline land (399.1 thousand ha), highly saline land (301.1 thousand ha) and solonchaks – 70.8 thousand ha. Due to inefficient work of drainage nets the area of water logged land is also increasing.

505. The area of land with stony soils is 3808.5 thousand ha including 1477.7 thousand ha of land with slightly stony soils, 1494.4 thousand ha of moderately saline soils and 836.4 thousand ha of highly stony soils.

5.2.3.3 Tajikistan

506. Total area of saline land in Tajikistan is 16.0 thousand ha[42] (Table 82.

Table 82. Dynamics of land area with unsatisfactory soil ameliorative conditions

Soil condition	1991	1995	2000	2004
Soils with unsatisfactory ameliorative conditions	64	61,5	85,7	55,6
Including:				
Saline soils	18.4	21.6	22.9	15.7
Soils with exceedingly high level of groundwater	34.6	30.9	47.0	39.9

507. Yield losses due to salinity on cotton fields are 50% in comparison with non-saline soils.

5.2.3.4 Turkmenistan

508. Though total area of irrigated land is only 4% they play important role in the country's economy and environment.

[42] Минводхоз РТ, за 2004 г.

509. More than 68 % of irrigated land area affected by salinity to the moderate and high degree. Nearly 28% of land have high level of groundwater (up to 2 m), therefore, are subject to secondary salinity (Figure 25; Figure 26).

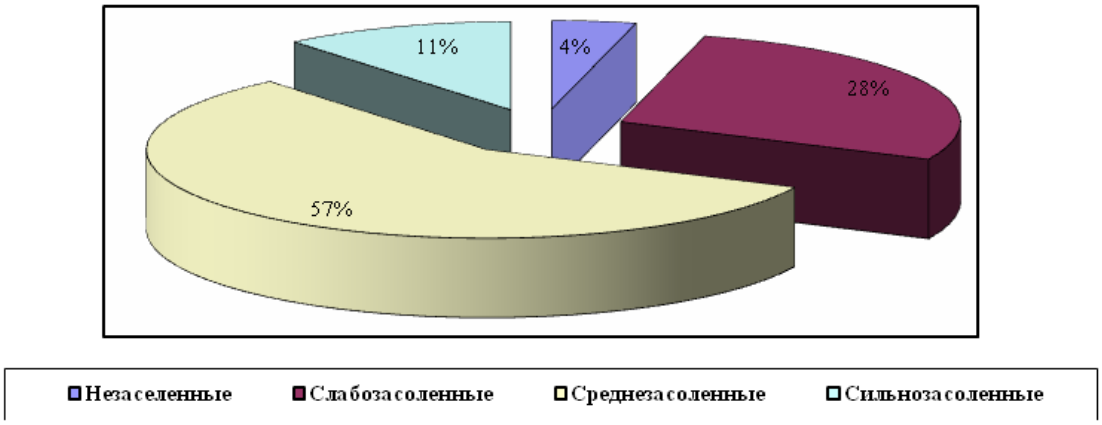

Figure 25. land salinity in irrigated areas of Turkmenistan (1998)

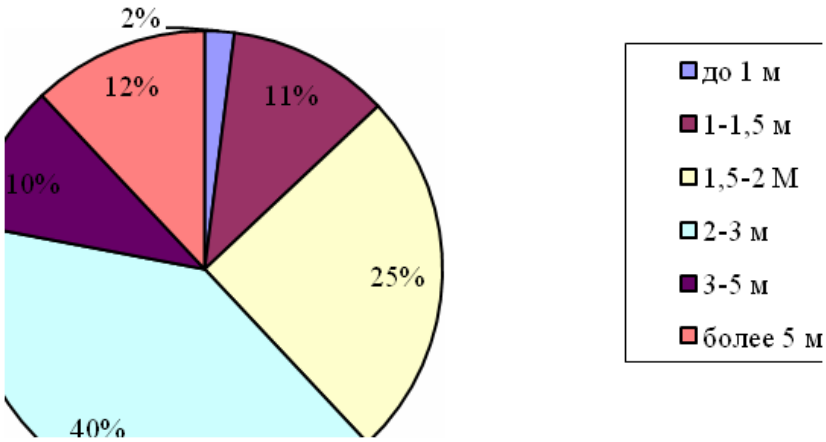

Figure 26. Groundwater level on irrigated land of Turkmenistan (2001)

510. In Dashauz region representing the area near Aral Sea consequences of the ecological crises area manifested in deterioration of the irrigational water quality which is flowing from Amu Darya river, intensive salt accumulation on irrigated land, increased volumes of transit drainage waters flowing from Uzbekistan. More than 65% of the drainage waters discharged into Sarakamysh lake are formed in Khorezm (Uzbekistan) – 3.5-4.0 km^3 (which is 2.3-3.3 times higher the drainage volumes formed in Dashauz region. As a result the volume of drainage waters discharged into collectors is 1.5-2.2 times higher than the projected capacity. This in turn leads to increased groundwater and accelerated secondary salinization.

511. Depending on the degree of land degradation there are slightly degraded land - 0.3-0.5% of dissolved solids, moderately degraded – 0.5-0.8% of dissolved solids and highly degraded – 0.8-1.0% of dissolved solids.

512. Area of land effected by salinity makes up 1145.2 thousand ha (66.9%). If slightly saline land will be taken into account then nearly 80% of Turkmenistan's arable land is affected by salinity.

Table 83. Salinity of irrigated land in Turkmenistan

Regions	Irrigated	Degree of soil salinity			
	Area, thousand ha, %	Non-saline	Slightly saline	Moderately saline	Highly saline
Akhal	497,8 100,0	9,3 1,9	107,8 21,6	311.2 62,5	69,5 14,0
Mary	440,1 100,0	43,1 9,8	183,2 11,6	160.1 36,4	53,7 12,2
Lebap	285,2 100,0	17,7 6,2	132,3 46,4	125,4 44,0	9,8 3,4
Dashauz	407,3 100,0	0,00 0,00	47,5 11,7	299,7 73,6	60,1 14,8

Note: Areas of saline land in Balkan region are not calculated.

513. In accordance with approximated calculations annual decrease of cotton yields in Turkmenistan makes up 200-300 thousand tons while in CA region as a whole – 2 million tons. Cotton yields on slightly saline land decreases by 15%, on moderately saline land – by 30% and on highly saline land – more than 50%.

5.2.3.5 Uzbekistan

514. Total area of saline land within the irrigated zone has increased during 1991-2000 by 561.5 thousand ha (16.2%) including highly saline land by 210 thousand ha (more than two times), moderately saline soils by 63.3 thousand ha (by 10.5%) and slightly saline land by 288 thousand ha (by 10.5%) (Table 84).

Table 84. Dynamics of changes in the area of saline land in Uzbekistan during 1990-2001, thousand ha

Years	Total agricultural land	Including:							
		Total saline area	%	Slightly saline	%	Moderately saline		Highly saline	%
1990	3811.6	1838.2	48.2	1029.4	27.0	602.0	15.8	206.5	5.4
2000	3726.9	2399.7	64.0	1317.6	35.0	665.6	17.8	416.5	11.2
2001	3711.3	2446.3	65.9	1258.7	33.9	720.2	19.4	467.5	12.6

Source: National report of Uzgoscomzemgeodezkadastr for 2006.

515. Major reasons for soil salinity are:

- - imperfect irrigation technologies;
- - untimely cleaning of drainage system and collectors;
- -poor quality of soil leaching, etc.

5.2.4 Water logging

5.2.4.1 Kazakhstan

516. 20.5 million ha of arable land and 25.0 million ha of pastures are subject to wind erosion and 19.2 million ha are affected by water erosion. On the area of 11.2 million ha of irrigated land erosion causes depletion of the soil humus content, 181.3 thousand ha are affected by desertification due to technogenic factors, 376.7 thousand ha are affected by salinity. Out of the 1.4 million ha of land suitable for irrigated agriculture 0.5 million ha are not used due to the secondary salinity. Areas of land affected by desertification as a result of petrol and gas pipe constructions make up 21 thousand ha, as a result of settling electricity lines – 458 thousand ha.

5.2.4.2 Kyrgyzstan

517. At present time total area of water logged land makes up 0.8 % of the total country's area. Along with the processes of water logging Kyrgyzstan also faces the problem of flooding. In 2005 133 settlements were flowed including 79 settlements in Chuy region.

5.2.4.3 Tajikistan

518. 40.0 thousand ha of land area in Tajikistan is affected by water logging. In order to prevent water logging biological drainages should be created by planting trees as well as salt resistant crops should be planted.

519. Ground water level in Tajikistan fluctuated between 1 to 3 and more meters. 67% of the total area has groundwater at the depth of more than 3 m, 18% of land – up to 2-3 m, 13% of land- up to 1-2 m and 2% of land – up to 1 m43.

5.2.4.4 Turkmenistan

520. The area of land with the extremely high level of groundwater (1-2 m) in Turkmenistan makes up 60% (Table 85).

Table 85. Depth of groundwater irrigated areas of Turkmenistan, ha/%

Regions	Ground water level, m				
	Less then 1	**1-2**	**2-3**	**3-5**	**More than 5**
Balkan	608/0.98	2513/4.03	4414/7.09	1834/2.95	52884/84.94
Akhal					
-Near Kopetdag area	624/0.24	52698/20.61	86784/33.94	41830/16.34	73775/28.85
- Tejen area	115/0.06	46789/19.75	160095/67.53	26363/11.10	3596/1.56
Mary					
- Khauzkhan area	217/0.15	14402/10.17	109156/77.18	17673/12.50	-
- Murgap area	3560/1.08	149283/45.50	132519/40.39	38680/11.80	4026/1.23
Lebap	13307/4.66	157139/55.04	65418/22.92	33286/11.66	16337/5.72
Dashauz	23863/5.94	226486/56.35	83071/20.67	19811/4.93	48693/12.11

521. 10 % of the irrigated area (Lebap and Dashauz regions) is subject to water flooding.

5.2.4.5 Uzbekistan

522. Land reclamation in the desert area without proper discharge of drainage and ground water led to land water logging.

523. During 2000-2004 increased flooding have been observed in Uzbekistan. Thus, 35% of the total area of Navoi region, in Syrdariya and Kashkadariya regions more than 50% of irrigated land, in Bukhara and Khorezm – more than 40% and in Andijan, Fergana and Namangan – 25-35%.

5.2.5 Pasture overgrazing

5.2.5.1 Kazakhstan

524. Total area of pastures in Kazakhstan as of 01.01.1998 was 184.75 million ha. Land suitable for agricultural use without preliminary soil amelioration measures make up 21.8 million ha or 9.7%. Saline land make up 93.7 million ha or 42.1% and erosion affected soils –

[43] Госкомзем РТ.

29.o million ha or 13.0%. Are of overgrazed pastures has been increased and made up 26.0 million ha in 1999.

525. Water erosion affects mainly pastures in Almaty region (705.2 thousand ha), Mangstau (801.7 thousand ha), Southern Kazakhstan (579.8 thousand ha), Aktubinsk (374.0 thousand ha) and Jambyl (236.1 thousand ha) regions (Table 86).

Table 86. Structure and area of degraded land in Kazakhstan

Total area	Area of pastures	Including Cultivated pastures	Overgrazed		Including					
			Moderate degree	High degree	With secondary plant cover					
					With annual salt resistant and ephemerons plants		Artemisia pastures		Other	
					Moderate	High	Moderate	High	Moderate	High
272490.2	182454.3	6288.3	16316.1	7761.4	4220.3	3036.5	5973.8	876.3	1284.6	456.6

526. 24800.6 thousand ha of pastures are subject to wind erosion. Thus in Almaty region the area of pastures effected by wind erosion makes up 5049.8 thousand ha, in Atyrask -3278.2 thousand ha, in Jambyl -2653.8 thousand ha, in Aktubinsk – 2234.5 thousand ha, in Kyzylorda 2700.5 thousand ha, in Southern Kazakhstan – 3107.6 thousand ha and in Karaganda – 1272.0 thousand ha.

5.2.5.2 Kyrgyzstan

527. Total area of pastures in Kyrgyzstan is 8.9 million ha. In accordance with the data of *Kyrgyzgyprozem* pasture land productivity has decreased during 1970s-90s by 14 %. Nearly 25% of the pasture land is degraded.

5.2.5.3 Tajikistan

528. Major indicator of pasture land degradation is changes in the plant cover. Substitution of the perennial fodder crops with strong root system by annual quickly growing plants with shallow roots led to increased water and wind erosion.

Table 87. Area, productivity and degree of erosion on pastures in Tajikistan

Pastures	**Area, thousand ha**	**Yield of the dry mass, centners ha^{-1}**	**Land erosion, % to the total area**
Autumn-winter-spring pastures			
Short-grass semi-savanna	450	2.5-5.0 / 2.0-3.5	98.0
Tall grass cereal semi savanna	260	10.0-18.0 / 8.0-12.0	96.0
Semi-desert with *Artemisia spp*. And salt tolerant plants in piedmont regions and low mountains	300	5.0-7.5 / 1.5-2.5	100.0
Ephemerous and Artemisia pastures in high Pamir areas	170	0.5-0.7 / 0.2-0.5	100.0
Xerophile forests	600	5.0-7.0/ 3.0-4.5	98.0
Summer pastures			
Tall grass semi-savanna	500	16.6-10.0/ 2.5-8.0	97.0
Steppe pastures	760	5.0-9.0/ 2.5-5.0	97.0
Hay fields (with tall and short grasses)	170	6.0-12.0/ 3.5-7.0	96.0
Ephemerous and Artemisia pastures of high Pamir	360	0.5-0.9/ 0.3-0.5	100.0
Total	**3570,0**		

5.2.5.4 Turkmenistan

529. In accordance with the data for the period of 1972-88 the area of moderately and strongly degraded pastures make up 19 million ha or 46% of the total pastures.

Table 88. Distribution of pastures in Turkmenistan depending on the degree of anthropogenic degradation (2001)

	Area of pasture land		**Including pastures with different degree of degradation**					
			Slight degradation		moderate		High level of degradation	
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%
In Turkmenistan	38835.6	100	19629.5	50.5	17480.8	45.0	1725.3	4.5

5.2.5.5 Uzbekistan

530. During 1994-2004 1566.3 thousand ha of pastures in Karakalpakstan were subject to degradation, 4093.6 thousand ha in Navoi, 1019.0 thousand ha – in Bukhara, 168.4 thousand ha – in Jizzakh, 185.7 thousand ha in Kashkadariya, 117.3 thousand ha - in Samarkand, 205.7 thousand ha - in Surkhandariya. Productivity of pastures has decreased by 23.3% on average: in Karakalpakstan by 27.0%, in Bukhara by 18.5%, in Jizzakh -16.9%, in Kashkadariya by 6.2%, in Navoi by 26.5%, in Samarkand – 10.9%, in Surkhandariya – 17.4%.

531. Nearly 10 million ha of pastures require substantial amelioration measures.

Table 89. Area and share of pastures in Uzbekistan affected by degradation (2001, thousand ha)

	Area researched rangeland	Subject to degradation		Degradation levels					
		total	%	weak	%	middle	%	strong	%
Total	18073.3	7356	40.7	1857.8	10.3	5142.5	28.5	355.7	1.9

5.2.6 Decreased reforestation activity

5.2.6.1 Kazakhstan

532. Forest area in Kazakhstan makes up 2.3%. This area can be extended to 4.6% if saxaul forests will be included.

533. Forest degradation is most prominent in the forests of Southern Altay where productivity of the conifer forests has decreased by 7%, area covered with fir trees has decreased by 13%. Area of apple forests in Djungar and Zailiy Alatau has decreased by 24%.

5.2.6.2 Kyrgyzstan

534. During 1995-2006 the area under forests in Kyrgyzstan has increased from 1107.1 thousand ha to 2710.6 thousand ha, or by 1602.5 thousand ha (2.4 times). Share of forests in the total land area increased from 5.5% to 13.5%.

535. Though Kyrgyzstan has small land area this country is included into 200 priority ecological regions of the planet with 2% of the world's flora and 3% of worlds fauna.

5.2.6.3 Tajikistan

536. Total area of forests in Tajikistan made up 291.1 thousand ha in 2008 or 2.1% out of the country's total land area. Since development of agricultural sector the area under forest has shrunk 2-3 times that lead to increased natural disasters especially during 1992-1999. Starting from 1970 the area under forest has not changed while average wood supply has decreased and at present time it makes up 70-80% out of the previous volumes.

5.2.6.4 Turkmenistan

537. Area under forests in Turkmenistan made up 2204.6 thousand ha in 2007 or 4.5% out of the county's total area. In comparison with other CA countries the area under forests in Turkmenistan during 1993-2006 has not changed and remained at the level of 4.4-4.5%.

538. Importance of forests for arid Turkmenistan is stipulated in the Forest Code (1993) and other legislation accepted in Turkmenistan.

5.2.6.5 Uzbekistan

539. Total area of forests in Uzbekistan make up 8526 million ha including the 2.72 million ha of planted forests (2006). In comparison with 1996 forest area has decreased by more than 1 million ha. Area of tugay forests decreased by 1/10. Clearance of saxaul forests, juniper and other trees causes desertification of nearly 6.5 million ha of land earlier covered with plants.

5.3 Major causes of land degradation

540. Majority of population in Central Asia lives in rural area and occupied predominantly with agricultural production activity. Therefore, population's livelihood directly depends on soil production capacity. Some factors effecting land productivity and agricultural economy are provided below:

541. Major causes of land degradation are (i) land reclamation as starting from the middle of the last century huge areas of pasture land were converted into wheat fields; (ii) changes in the land use such converting them into irrigated land, hunting areas, construction of wells; (iii) overuse of groundwater; (iv) intensive use of shrubs by population as wood fire leading to fast deforestation and development of sandy dunes; (v) overgrazing; (vi) soil salinity caused by excessive irrigation and discharge of drainage waters in pasture land areas; (vii) use of land for nuclear testing and space programs.

542. Land degradation can be group in two categories: first is caused by natural and climatic factors such as global warming, relief (steep slopes, lowland without natural ground water discharging), arid climate, etc.; and second is caused by human activity related to use of land and water resources.

5.3.1 Biophysical factors of degradation

543. Major biophysical factors of degradation are (i) use and reclamation of new land without necessary soil ameliorative measures; (ii) insufficient use of crop rotation within cotton and wheat cultivation systems; (iii) extensive use of land in irrigated land; (iv) inefficient use of irrigation water; (v) insufficient application of water saving technologies; (vi) discharge of drainage water into surface water streams; (vii) water logging of the irrigated and pasture land; (viii) imbalanced application of NPK containing fertilizers; (ix) irrational use of chemicals and mineral fertilizers and (x) use of highly mineralized water for irrigation.

5.3.2 Socio-economic factors

544. Major social factors effecting land degradations include (i) low income level in rural, mountainous and steppe areas and (ii) underdeveloped social infrastructure in rural areas. These factors cause excessive use of natural resources. At present time forest clearing for wood fire

during winter time, excessive collection of medical plants and fruits, overgrazing of pastures in piedmont and steppe areas near settlements are accelerating degradation processes.

545. Economic causes of land degradations include comparatively low profitability of farmer holdings, insecure renting rights and imperfect mechanism for stimulating land users to preserve soil fertility.

5.3.3 Strategic and institutional factors

546. Strategic and institutional factors causing land degradation include strict administrative control over the structure of the planted crops, low governmental prices for the agricultural products purchased by the government; insufficient security of the agricultural producers against price disparity.

547. Institutional factors effecting land degradation include inefficient agriculture management; excessive regulation of the agricultural enterprises activity.

548. After independence in all CA countries measures for food self sufficiency were taken without consideration of issues related to soil fertility preservation. Institutional reforms such as converting large farms into small farms lead to inappropriate crop rotations.

6 Interconnection of reasons, ways of development and consequences of land degradation

6.1 Changes in land use

549. Changes in land' utilization took place during the years of independence in all Central Asian countries, mainly a reduction of land allocated for agriculture including arable land.

550. The main reasons of agricultural land' share reduction are as follows:

- land transfer to the balance of other land users (forestry, state reserve, centers of population, hydro technical and hydroeconomic structures);
- speeding up of initial and repeated salinity;
- water supply worsening for irrigated land;
- intensity of industrial land development for agriculture, in particular pasture land;
- industrial growth in suburban territory and urban area without taking into account conditions of eco systems;
- domination of extensive methods and ways of land utilization;
- utilizing the agricultural land for needs, construction of roads, houses, industrial and economic objects and communications;
- capacity of infrastructure providing the realization of agro technological policy;
- not perfection of regularly - legal and organizational - economic mechanisms and stimulus for land utilization;
- increasing of the areas subjected to water and wind erosion.

551. All these led to the reduction of cropland and arable land areas in calculation per one inhabitant of Central Asian country (Figure 27).

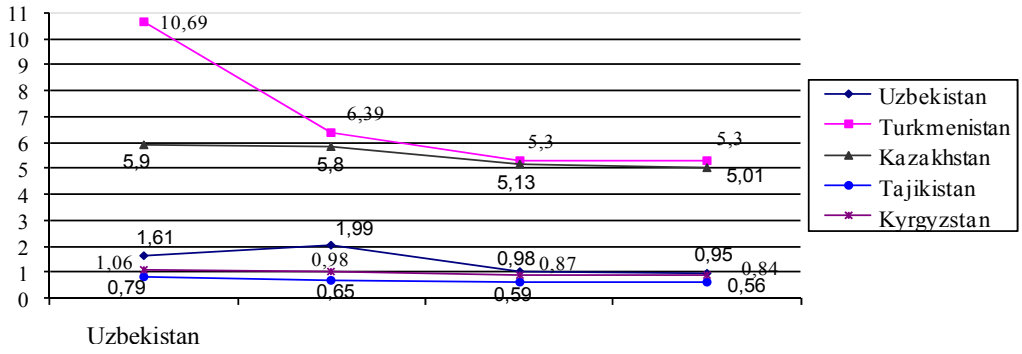

Figure 27. Changing of cropland area in calculation per one inhabitant of Central Asian countries for 1990 - 2007

552. As can be seen from given data cropland' area in all Central Asian countries for analyzed period was reduced, in particular sharp reduction was observed in Turkmenistan and Uzbekistan.

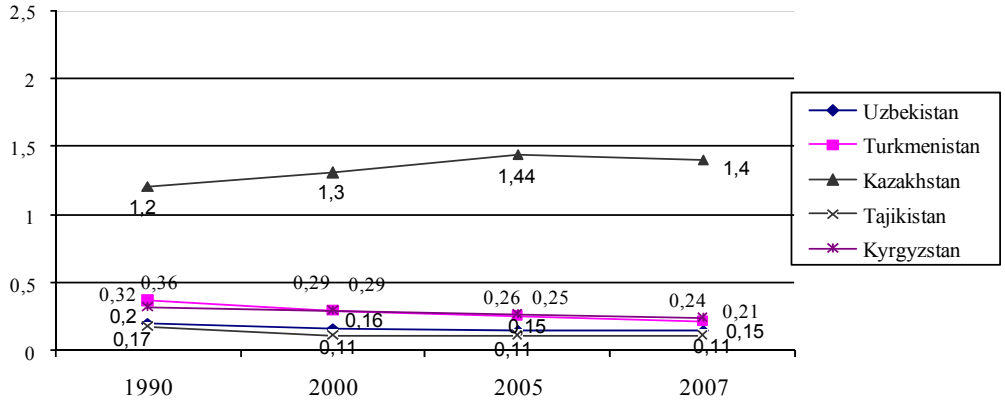

Figure 28. Changing of arable land' area in calculation per one inhabitant of Central Asian countries for 1990 - 2007

553. Area of arable land was reduced in calculation per one inhabitant in all Central Asian countries except Kazakhstan, where a bit increasing was observed. (Figure 28)

554. Together with reduction of crop and arable land general phenomena for all Central Asian countries is a reduction of crop and arable land' productivity. It is explained by changes of economic management form and property form for the land. In general it was expected that together with property form changing land utilization will be increased, but efficiency of land' utilization did not occur.

555. Main reasons are creation of small landowners and farmers instead of big farms that led to the breaching of crop rotation, investment's reduction for the land, worsening of technical

base of land owners and land users, worsening of mineral fertilizers' supply, and quality reduction of land tillage.

556. Besides that took place the structure diversification of planted area. In all the countries policy of agriculture sphere after obtaining the independence was aimed for self supply (area for grains sharply increased, in irrigated zone grain and cotton became dominated crops).

557. As it is known grain-cereals and cotton are soil exhausting crops, they were not mixed with soil enriching crops and this led to the reduction of soil fertility. Together with this share reduction of high-yielding crops negatively impact on the yields of farm and dekhqan farm as well as on investment for the land.

6.1.1.1 Kazakhstan

558. By January 1st 2007 Land Fund of the Republic of Kazakhstan was made 2724.9 thousand km2. from them 78.0 million ha cropland (81.7%) and 22.0 million arable land.

559. In 1994 in the republic approximately 77 million hectares were subjected to deflation, more than 50 million hectares are erosion harmful land, 17.7 million from them are in the arable land, more then 75 million ha are saline soils, 8 million ha from them were in crop rotation110. Area of chernozems (black earth) in the republic did not exceed 15 million ha.

560. Intensive cropland utilization without proper fertility rehabilitation, breaching the crop rotation system led to the land waste in the republic. As a result area of suitable land for agriculture has been reducing from year to year. Thus, for 2000-2007 shares of agricultural land reduced for 9.8% or for 8400.0 thousand hectares. However area of arable land increased from 19400.0 thousand ha to 22000.0 thousand ha, i.e. for 13.4% or for 2600.0 thousand ha. For this time area of cropland has reduced in calculation per one person from 5.8 ha to 5.01 ha (Figure 27), and area of arable land from 1.2 ha to 1.4 ha. (Figure 28).

561. Forms of land users also have been changed, the main land users are agricultural enterprises, peasant farms and farms of population.

562. At present time the main part of cropland are focused on farms. Their specific weight for producing agricultural products intensively increases.

563. Kazakhstan takes the 6th place in the world for the size of its grassland resources and arable land are made approximately 186.0 million ha or 70% of land resources of the republic.

564. Considerable structural changes have taken place for the years of independence as a result of implemented economic reforms in the structure of republic's land fund. Thus, for 1991-2005 area of cropland reduced for 37.65 or for 136.0 thousand ha. And land which was

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110 Conceptual development program of agro industrial complex of the Republic of Kazakhstan for 1993-1995 and till 2000. «BASTAU», 1994. – p. 30.

used by population was increased in 5.6 times, land occupied by hydro technical and other hydro economic structures were increased in 4.7 times.

565. As a result of privatization and development of various forms of property for considered period land of forestry enterprises had increased for 6.6 times or for 106.65 thousand ha, at the same time were increased the land for nature protective, health and historical - cultural purposes as well as land for industry, transportation, communication, defense and others. Structures have been reduced for the indicated period in 3.6 times or for 12.9% respectively.

566. With development of forms of property staff of economic subjects has also been changed in agrarian sector (Table 90).

Table 90. Structure of planted area of the Republic of Kazakhstan according to the forms of land users for 2000-2007[111], *thousand ha/ in% to total*

Years	Total for planted areas	From them							
		Grain	Technical	From them		Oil - yielding	From them sunflower	Potato	Vegetables
				Cotton	Sugar beet				
	All categories of farm								
2000	16195.6	12438.2	631.1	151.8	22.5	448.2	313.9	160.3	102.6
	100	76.8	3.9	0.9	0.14	2.8	1.9	1.0	0.6
2001	16785.2	13208.7	560.8	184.9	19.9	347.5	253.5	164.6	107.7
	100	78.7	3.3	1.1	0.11	2.1	1.5	1.0	0.6
2002	17756.3	14022.7	609.2	170.9	19.8	409.6	321.2	163.0	108.7
	100	79.0	3.4	1.0	0.11	2.3	1.8	0.9	1.6
2003	17454.2	13872.6	862.9	199.9	22.2	631.9	446.0	168.9	110.2
	100	79.5	4.9	1.1	0.13	3.6	2.5	0.96	0.6
2004	18036.4	14278.0	918.5	223.7	22.3	665.0	457.6	168.2	111.3
	100	79.2	5.5	1.2	0.12	3.7	2.5	0.9	0.6
2005	18445.2	14841.9	900.0	204.2	17.5	669.7	454.5	168.2	110.6
	100	80.5	4.96	1.1	0.10	3.6	2.4	0.9	0.6
2006	18369.1	14839.8	974.1	200.1	14.4	751.4	492.6	153.9	102.2
	100	80.8	5.3	1.1	0.01	4.1	2.6	0.8	0.5
2007	18954.5	15427.0	899.9	199.9	12.4	672.8	365.7	154.7	103.7
	100	84.4	4.7	1.0	0.06	3.5	1.9	0.8	0.5

[111] Statistic agency of the Republic of Kazakhstan.

Table 91. Structure of agriculture gross products according to the farm's categories in the Republic of Kazakhstan[112], *(comparable prices in %)*

Categories of farms	1995	2000	2003	2004
Agriculture				
All farms' categories	100	100	100	100
Agricultural enterprises	50.8	20.9	22.6	24.3
Peasant farms	3.2	19	27	25.6
Farms of population	46	60.1	50.4	50.1
Plant cultivation				
All farms' categories	100	100	100	100
Agricultural enterprises	60.3	33	33.3	…
Peasant farms	3.6	32.3	43.1	…
Farms of population	36.1	34.7	23.6	…
Livestock farming				
All farms' categories	100	100	100	100
Agricultural enterprises	32.8	8.4	8	…
Peasant farms	2.3	5.1	5.3	…
Farms of population	64.9	86.5	86.7	…

567. As in other Central Asian countries changes in land' utilization in the Republic of Kazakhstan have taken place according to the following main directions:

- - agricultural land' allocation for other needs (for 1991-2005 - 136.0 thousand ha);
- - changing of land users' forms (in 2005 - 45.6% of land area belonged to peasant farms, in 1991 – 0.7%);
- - changing of planting structure and breaching of crop rotation (for grain, technical and oil-yielding - 89% of planted area in the republic, in 2000 - 83.5%);
- - worsening of soil fertility (salinity, water and wind erosion, breaking of discharge and filling balance); for 1991 -2005 - land required reclamation and ecological conditions and compulsory referred to the category of state land reserves increased in 6.6 time or for 106.65 thousand ha;
- - reduction of crops' productivity.

[112] Statistic agency of the Republic of Kazakhstan, 2007

6.1.1.2 Kyrgyzstan

568. By January 1st 2007 Land fund of the Republic of Kyrgyzstan was made 19.9 million ha, including agricultural land - 28.5%; irrigated land were made 1020.6 thousand ha that is made 5.1% of total land area.

569. Intensive cropland utilization without proper fertility rehabilitation, breaching the crop rotation system led to the land waste in the republic. As a result area of suitable land for agriculture has been reducing from year to year. Thus, for 1990-2007 cropland' area in calculation per one person has been reduced from 1.06 ha to 0.84 ha, and area of arable land from 0.32 ha to 0.24 ha.

6.1.1.3 Tajikistan

570. By January 1st 2006 Land fund of the Republic of Tajikistan was made 14.31 million ha, including agricultural cropland - 28.67 % (4.1 million ha), area of arable crop – 5.5 % (800 thousand ha), pastures – 21.5% (3.1 million ha), perennial plantings – 0.7 % (more than 98.6 thousand ha), rocks and slide-rocks occupy 17.5% of the republic's territory, glaciers and reservoirs are to 9%, forestry area is 3%, land of population's centers, transports and industry are about 2%. Irrigated land had been made 703.81 thousand ha or 4.9% of total land area.

571. Quite active modern and many-sided tectonic processes are carried out at the territory of Tajikistan. 93% of Tajikistan's territory is occupied by mountains which refer to the highest mountain system of Central Asia - Tian-Shan and Pamir. About half of country's territory is situated at more than 3 thousand meters height, and difference between minimal and maximal height point is more then 7 thousand meters. This territorial-geographical peculiarity in many cases defines the character of land usage in the country.

572. Cropland utilization without proper fertility rehabilitation, breaching an agro technical; methods and techniques for crops' cultivation and non-observance of crop rotation systems led to the land waste in the republic. As a result of which by years area of cropland was reduced as well as area arable land used in agricultural crop rotation. Thus, for 1990-2007 share of agricultural land was reduced from 29.73% to 28.6%, i.e. for 1.13 p.p. or for 81.5 thousand ha, and area of irrigated arable land from 719.0 thousand ha to 500.0 thousand ha, or for 219.0 thousand ha. For this period area of cropland in calculation per one person had been reduced from 0.79 ha to 0.56 ha and the area of arable land from 0.17 ha to 0.11 ha113. This process accompanies by structure diversification of cropland, structure of land users and planted areas.

573. Agricultural land' reduction took place due to the following reasons:

[113] State Land Committee of the Republic of Tadjikistan for necessary years; State statistic committee RT: Informational bulletin for industrial security and poverty in RT. №1/2005, www. stat.tj.

- - land transfer to the balance of other land users (forestry enterprises, land of President's fund, centers of population, hydro technical and other hydroeconomic structures, land of new economic farms - joint-stock companies and others);
- - reduction of water supply level of irrigated land;
- - intensity of agricultural land' development, in particular pasturages by mining enterprises; speeding up of initial and repeated salinity;
- - land' allocation for construction of transport and communication networks, houses and housing infrastructure, industrial organization and economic communications;
- water supply worsening of irrigated land;
- - not perfection of regularly - legal and organizational - economic mechanisms and stimulus for land utilization.

574. For 2000-2005 for non agricultural needs were allocated more then 60 thousand ha of arable land, 219 thousand ha of irrigated land. This process has been continuing, only for 2000-2005 were allocated 195.0 thousand ha of pasturages. For the same years more than 20.0 thousand ha of forest plantings were cut for constructing of new and reconstruction of existing highways.

575. Land users also were changed. By the beginning of 2006 of kolkhozes and sovkhozes were reorganized and dekhkan and farms become the main land users. By that time 27.1 thousand units of dekhqan and 19.4 thousand units of farms were operating in the republic. At present time more then 60% of cropland and more then 80% of arable land were focused in dekhqan farms (Table 92).

Table 92. Dynamics of land' changing in the Republic of Tajikistan[114] (by January 1st, thousand ha)

Land' category	Years							
	1990	2000	2001	2002	2003	2004	2005	2007
Total land' area	14060.0	14060.0	14060.0	14000.0	14300.0	14300.0	14300.	14255. 4
From them under irrigation								
Cropland	4181.0	4100.0	4200.0	42000	4100.0	4100.0	4100.0	4725.6
From under the irrigation	719.0	719.0	x	x	722.22	735.41	703.81	607.6
-Arable land	930.0	860.0	860.0	850.0	800.0	800.0	800.0	710.4
-From them under irrigation	719.0	719.0	x	x	502.80	503.92	500.0	496.8
-Perennial plantings	101.0	98.0	98.0	98.0	98.0	98.6	98.6	105.5
-From them under irrigation	x	x	x	x	78.99	79.52	77.08	81.7
-Abandoned fields	22.0	19.0	17.0	19.0	23.0	23.0	22.3	32.0
-From them under irrigation	x	x	x	x	13.64	16.57	15.94	24,.3
-Hayfields and pasturages	3256.0	3277.0	3438.0	3600.0	3065.0	3082.0	3082.0	3898.6
-From them under irrigation	x	x	x	x	4.1	4.1	3.2	4.6
-Forests and shrubs	x	x	x	x	x	x	x	292.1
-From them under irrigation	x	x	x	x	5.66	5.7	3.47	5.4
-Private subsidiary farms	x	x	x	X	36.89	36.50	32.21	63.0
-Land where reclamation conditions are have been improving	x	x	x	X	2.88	7.35	7.0	-
-Sites adjoining the farms	x	x	x	x	x	x	x	167,9
-From them under irrigation	x	x	x	X	80,15	86,11	71,98	93,8
Other land	x	x	x	x	x	x	x	8321,7

[114] State Land Committee of the Republic of Tadjikistan for necessary years; State statistic committee RT: Informational bulletin for industrial security and poverty in RT. №1/2005, www. stat.tj; Commonwealth of Independent States in 2005. Brief manual/ State committee of CIS. – M., 2006 . p. 383

Figure 29. Allocation of cropland according to the land' type for 2005

Table 93. Land' allocation according to the types of property[115]

Types of property	2006		2007	
	Thousand ha	**%**	**Thousand ha**	**%**
Land of kolkhoz	604.9	7.74	299.0	
Land of sovkhoz	1445.4	18.57	303.9	
Land of dekhqan farms	4865.4	60.21	5116.6	
Land of houses and subsidized land (house sites and land of President's Fund)	91.6	1.18	105.5	
Land for agricultural usage for enterprises and organizations (factories, social organizations, ministries)	387.8	4.98	8.6	
Land of new forms of agriculture (joint-stock companies and others)	452.4	5.81	425.5	
Land of "jamoats"	117.5	1.51	403.0	

[115] State land committee RT.

Table 94. Dynamics of arable land' utilization[116], for 1988-2007 /in % to total

Land' category	Years							
	1988	1992	1999	2000	2003	2004	2005	2007
Arable land	20.1	19.2	17.8	16.1	18.2	18.3	17.9	15.0
Perennial plantings	2.4	2.4	2.4	2.2	2.5	2.5	2.5	2.2
Hayfields	0.6	0.5	0.3	0.5	0.4	0.4	0.4	82.5
Pasturages	76.3	77.4	79.0	80.6	78.2	78.0	78.5	
Fallows	0.5	0.4	0.4	0.5	0.6	0.6	0.6	0.7
Total of arable land	100	100	100	100	100	100	100	100

Table 95. Dynamics of irrigated land' utilization[117], for 2003-2007

Land' category	2003		2004		2005		2007	
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%
Total irrigated land	722.22	100	735.41	100	703.21	100	769.6	100
From them								
Arable land	502.79	69.6	503.92	68.5	499.99	71.1	496.8	64.6
Perennial plantings	78.99	10.9	79.52	10.8	77.07	10.9	81.7	10.6
Fallows	13.64	1.9	16.57	2.2	15.94	2.2	24.3	3.2
Hayfields	0.85	0.12	0.84	0.11	0.67	0.1	4.6	0.6
Pasturages	3.23	0.4	3.24	0.4	2.51	0.3		
Sites adjoined to the farm	80.15	11.1	86.10	11.7	71.92	10.2	93.8	12.2
Private subsidiary sites	36.89	5.1	36.50	4.9	32.21	4.6	63.0	8.2
Forests	5.66	0.8	5.70	0.7	3.46	0.5	5.4	0.7

576. Dekhqan farms occupy 70.5% of planting areas including 78.6 % of grains and 59.7% of technical crops, from them 57.8% of raw-cotton, 90.0% of potato, vegetables and watermelons and 68.6% of forage crops.

577. Producing efficiency is characterized by reduction of producing the product per resource unit as a whole. Cotton productivity for 1990-2006 reduced from 27.7 centner ha^{-1} to 15.4 centner ha^{-1}. For the last decades in general in the republic point-bonitet of agricultural soils has been reduced.

[116] Brief statistic report on agriculture: Tadjikistan, 2005.

[117] State Land Committee of the Republic of Tadjikistan for necessary years; State statistic committee RT: Informational bulletin for industrial security and poverty in RT. №1/2005, www. stat.tj;

578. Plants' cover of desert zones due to the critical conditions of growing, ecologically not stable to the influence of anthropogenic factors and quickly damages, and irrational usage of pastures speeds up the process and degradation.

579. Thus, changes in land utilization in the republic take place according to the following directions:

- -agricultural land' allocation for other needs;
- -changing the form of land users;
- -changing of planting's structure;
- -worsening of soil fertility (salinity, water and wind erosion, breaching of discharge and filling balance);
- - reduction of agricultural crops' productivity.

Table 96. Land' allocation for non agricultural needs for 2007[118].

Категория земель	2007	
	Thousand ha	%
For construction of housing and communal services, industrial objects and others, introductions were submitted to the ministry of defence.	2.01	3.7
For construction of hydro technical and hydro economic structures.	0.3	0.6
State land' reserves	51.5	95.7
Total land	**53.81**	**100**

6.1.1.4 Turkmenistan

580. Turkmenistan is the most flat republic of Central Asia. Almost 1/5 of its territory lies in the borders of Turan lowland mainly occupied by the Karakum desert. 10 natural districts which are combined in 3 groups are singled out in Turkmenistan. Territory of the republic as the other Central Asian countries is characterized by sharp continental climate.

581. Turkmenistan is desert and semi-desert country, therefore agriculture production depends on irrigation. Rainfed farming and pasturable livestock production also play an important role in the economy of Turkmenistan. Desert plantings prevail where shrubs grow such as: white and black saxaul, kandym, saltwort, acacia sandy, locoweed with inflated sedge in the grass cover.

582. Considerable part of soils in the republic are moisture keeping vertisols (of different depth and horizons), alternated by subclasses of such soils. Ardisols can be met at majority part of Turkmenistan's territory. Up to 80% of Turkmenistan's territory does not have surface flow,

[118] Source: State Land Committee of the Republic of Tadjikistan for given years.

rivers are only in southern and eastern peripheral districts. The only river abounding with water is Amu-Darya which runs along the eastern outlying districts and has 2 flash floods: in spring and in summer.

583. One-side agriculture development has worsened the agro ecological conditions - diversity of cultivated crops has reduced.

584. In Turkmenistan like in Tajikistan and Uzbekistan wheat ejected nitrogen-fixing fodder crops and crop rotation system was broken.

585. On condition by January 1st 2006 Land Fund of Turkmenistan has been made 491.2 thousand sq.km. From them agricultural land are made 338.93 thousand km2 (69%), land of state reserve and forest fund are made 122.8 thousand km2. (25%) and land of other land users are made 29.47 thousand km2 (6%).

586. Total area of Turkmenistan is 488.1 thousand km2, from them 73% is occupied by flats, 15% - mountains and foothills, 12% - water surfaces and non soil formations (slide-rocks, rocks, precipices). It should be pointed out that northern and central parts of the territory in the country occupy sandy deserts of Turan lowland - Central, Zaunguz and south-eastern Karakums (about 80% of the territory).

587. Intensive cropland utilization without proper fertility rehabilitation, breaching the system of crop rotation led to the land waste in the republic. As a result of which by years cropland which are appropriate for agriculture were reduced. Thus, for 1990-2005 share of agricultural land was reduced from 76.25% to 69.48%, i.e. for 6.77 p.p. or for 3205.2 thousand ha. However area of irrigated arable land was increased from 1448.1 thousand ha to 1808.4 thousand ha or for 360.3 thousand ha. For this period area of cropland in ratio per one person reduced from 10.69 ha to 5.3 ha, and area of arable land from 0.36 ha to 0.21 ha.

588. Agricultural land' reduction occurred due to the following reasons:

- - speeding up of initial and repeated salinity;
- - land transfer to the balance of other land users (forestry enterprises, state reserves, centers of population, hydro technical and other hydroeconomic structures);
- - reduction of water supply level of irrigated land;
- - intensity of agricultural land' development, in particular pasturages;
- - land' allocation for construction of roads and housings, industrial enterprises and economic communications;
- - not perfection of regularly - legal and organizational - economic mechanisms and stimulus for land utilization.

589. For 1992-2001 for non agricultural needs were allocated more than 3541.6 thousand ha of agricultural land119.

590. Distinctive feature is that in the structure of allocated land, 91.7 percents are made land which are transferred to the state land reserves, and small share has the land with are allocated for forest farming (Figure 30).

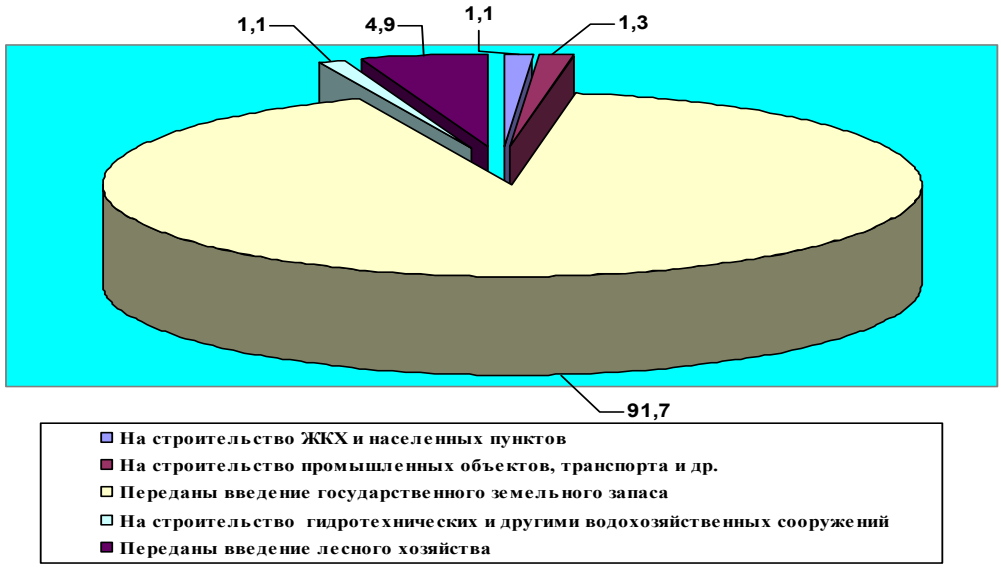

Figure 30. Land allocation for non agricultural needs,[120] 1992-2001, in %.

591. Land allocated for agriculture are made more then 70 percents of total land are of Turkmenistan (2002). In the structure of total land area land of State land's reserve are constitute 20.1%, land of forest farming organizations - 4.5%, land of industry and transport – 3.3%, land of nature protective zones - 1.6%, land occupied by hydro technical and hydro economical objects – 1.0%, land occupied by population – 0.2%.

592. Process of transformation, changing and re-allocation of land fund took place in course of reform. According to the research the given process during first years of independence was more dynamic than in 2003-2007.

593. Analyses of changing tendencies in using the resources of Turkmenistan indicate that areas allocated for agriculture have slowly, gradually reallocated and reduced (table 34), transforming to other land' categories. Thus, only for 1998-2002 area of land for agriculture was reduced for 162.6 thousand ha.

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[119] Data of Ministry of Agriculture of Turkmenistan for given years; About land availability and their allocation according to the categories, cropland, land owners and land users 1 January 1993, - Collection of decrees of Turkmenistan's President and decision of the Government of Turkmenistan, part II, 1993, №8, p. 18-21; Stachin I., Lerman Ts. Agrarian reform in Turkmenistan. Israel - Rekhovot. 2003, p. 88-90: Data of Scientific-Industrial Center of Ecological Monitoring of Nature usage Ministry and Environmental Protection of Turkmenistan. Development of human being. Turkmenistan. 1995, 1996, 1997.

[120] The same.

594. In cropland' structure irrigated land constitute 4.4% (2001) and at these land 41.5% of plant growing and 50% of livestock sector products have been produced.

595. Complex of activities related to "Grain" program realization enabled to expand the areas of irrigated arable land. It should be pointed out that only for 1992-1999 more than 2.0 billion USD were allocated for realization of this program, 55% of which were spent for land' development and rehabilitation. During these years more than 476.8 thousand ha were developed and rehabilitated.

596. Pastures are very important for the agriculture of Turkmenistan. In general pasture's territory of Turkmenistan is divided into 7 natural-geographical districts[121]. Total area of pastures in sandy desert constitutes 26.0 million ha, productivity of which is made 1-3 centner ha^{-1}.

597. Pasture's area in the structure of used cropland is made 95.3% or 38.91 million ha (2002). For 1972-2002 pasture's area of Turkmenistan reduced for 884.1 thousand ha. This means that pastures in Turkmenistan serve as the main reserve for development and extension of the area of irrigated land.

Suggestions:

598. In order to provide a stable development of the branches in agro industrial complex is necessary:

- - to introduce water saving technology which helps to reduce the water rate for leaching irrigations;
- - to reduce irrigation rates and liquidate or bring to minimum water losses.

599. Form of land users also has been changed for analyzed period. By 2002 the main land users were users adjoining the farm where 0.4% of cropland and 8.0% of arable land are focused the sites adjoining the farms of citizens.

600. For the share of dekhkan farms falls 0.2% of cropland and 2.9% of arable land. Lawn and garden sites have a small share in cropland' structure.

601. Plants' cover of desert zones due to the critical conditions of growing ecologically is not stable to the impact of anthropogenic factors and quickly damages. And irrational utilization of pastures speeds up the process and degradation.

602. Changes in using the land resources of Turkmenistan can occur according to the following directions:

- -allocation of agricultural land for other needs;

[121] Necheva N.T., Mardvinov N.A., Mosolova N.A. Pastures of Karakums and their utilization. Ashgabat: TFAN USSR, 1943.

- -changing of land users;
- -changing of planting structure and breaking the crop rotation;
- - worsening of soil fertility (salinity, water and wind erosion, breaking the balance of discharge and filling);
- -reduction of crops' productivity;
- -desertification growth;
- -increasing of state land reserves and others.

Table 97. Dynamics of changes in land resources of Turkmenistan[122] (on condition by January 1st, thousand ha)

Land' category	Years					
	1991	1995	2000	2001	2003	2006
Total land area	49403.0	49403.0	49603.0	49603.0	49603.0	49120.9
Cropland	37669.2	34524.8	34507.2	34464.0	34413.9	39933.5
Arable land	1287.0	1622.2	1636.5	1652.0	1652.0	11777.8
Perennial plantings	59.6	52.3	44.4	41.6	41.6	32.0
Fallow	14.0	11.2	50.7	62.1	62.1	13.2
Hayfields and pastures	39525.3	38848.4	38934.2	38915.9	38915.9	38110.3
Forests and shrubs						2204.6
Land of lawn and garden sites	4.5	5.1	3.7	3.7	3.7	3.7
Land where its reclamation condition is improving	6.1	62.9	49.1	46.8	46.9	46.9
Sites adjoining the farms	88.3	123.2	133.0	132.8	132.8	119.7
Other land	8517.1	8868.9	8937.2	8931.4	8931.4	8931.4

603. For 1993-2002 in dynamics of land areas of lawn and garden sites took place not so clear transformation which reflected the changes in disproportional way. For investigated period area of lawn and garden sites reduced for 35.1%, but average size of the vacation garden increased for 3.3%.

6.1.1.5 Uzbekistan

604. On condition by January 1st 2007 Land Fund of the Republic of Uzbekistan has been made 44410.3 thousand ha, land allocated for agriculture have been made 50.92%, land of state reserve - 23.46%, land of forestry enterprises - 19.28%, land for industry, transport,

[122] Source: Ministry of agriculture of Turkmenistan.

communication, defence and others - 4.4%. Irrigated land have been made 4303.0 thousand ha, that is made 9.69% of total land area.

605. Intensive utilization of cropland without proper fertility rehabilitation as well as breaching the system of crop rotation led to land waste of the republic. As a result area of suitable land for agriculture has been reducing by years. Thus, for 1990-2007 share of agricultural land reduced from 72.76% to 50.29%, i.e. for 32.7 p.p. or for 10829.5 thousand ha, and area of irrigated arable land from 3407.3 thousand ha to 3308.5 thousand ha or for 98.8 thousand ha. For this period area of cropland in calculation per one person reduced from 1.61 ha to 0.95 ha, and area of arable land from 0.2 ha to 0.15 ha[123].

606. Agricultural land' reduction occurred due to the following reasons:

- - speeding up of initial and repeated salinity;
- - land transfer to the balance of other land users (forestry enterprises, state reserves, centers of population, hydro technical and other hydroeconomic structures);
- - reduction of water supply level of irrigated land;
- - intensity of agricultural land' development, in particular pasturages;
- - industry growth in suburban territories and rural areas without ecosystems;
- - prevailing of extensive methods and ways of cropland' utilization;
- - land' allocation for construction of roads and housings, industrial enterprises and economic communications;
- - infrastructure capacity which provides the realization of agro technological policy;
- - not perfection of regularly - legal and organizational - economic mechanisms and stimulus for land utilization.

607. During 1998-2002 more than 8212.9 ha of irrigated land were allocated for non agricultural needs[124]. This process has been continuing, only for 2003-2007 were allocated 75.0 thousand ha of irrigated land.

608. Land users also have changed (agricultural enterprises (shirkats), farmers and dekhkan farms). By the beginning of 2007 all shirkat farms were reformed and main land users were farmer and dekhkans. At present time 18% of cropland and 80% of arable land are focused at farms.

[123] Calculated on the basis of statistic materials of the Republic of Uzbekistan.
[124] Decree of Cabinet of Ministers of the Republic of Uzbekistan № 248 on 27 May 1992.

Figure 31. Land' allocation for non agricultural needs, in %.

609. For the share of dekhkan farms falls 12.5 % of planted area, including 13.3% of grain and 0.7% of technical crops, 67.7% of potato, vegetable, watermelons and 21.4% of fodder crops.

610. According to the researches products' production per resource unit in general for the last years has reduced125. Cotton productivity for 1991-2006 was reduced from 27.0 centner ha^{-1} to 25.0 centner ha^{-1}. For the last 10 years point-bonitet of agricultural soils in average has 3 points and in some provinces 7-10 points.

611. Plant cover of desert zones due to critical conditions of growing ecologically is not stable to the impact of anthropogenic factors and quickly damages and irrational utilization of pastures speeds up the process and degradation.

[125] Stability theory in modern system of agriculture management. UzNIIRR, Tashkent, 2007, p. 173.

Table 98. Dynamics of changes in land' utilization in the Republic of Uzbekistan [60](by January 1st, thousand ha)

Land' category	Years								Changes	
	1990	2000	2001	2003	2004	2005	2006	2007	%	+;-
Total land' area	45585.0	44410.3	44410.3	44410.3	44410.3	44410.3	44410.3	44410.3	97.42	-1174.7
From them irrigated	4221.8	4277.6	4273.3	4278.0	4275.3	4279.0	4295.3	4303.0	101.9	+81.2
Cropland	28080.4	26753.6	36734.5	25841.1	25681.3	25687.4	25683.9	25343.8	90.25	-2737.4
From the irrigated	3425.0	3743.9	3743.9	3722.8	3713.4	3713.6	3718.1	3725.6	108.8	+300.6
Arable land	4176.5	4056.6	4058.4	4052.7	4042.7	4049.0	4057.2	4064.2	97.31	-112.3
From the under irrigation	3407.3	3313.6	3308.3	3307.4	3297.7	3296.3	3303.6	3308.5	97.1	-98.8
Perennial plantings	366.8	352.9	346.9	336.4	337.0	338.0	335.8	339.0	92.4	-27.8
From the under irrigation	351.5	339.7	332.3	323.1	323.5	325.3	322.7	325.5	92.6	-26.0
Fallow	62.1	80.7	82.8	85.0	84.5	83.5	83.6	82.6	133.0	+20.5
From the under irrigation	25.9	46.5	48.4	48.4	48.3	48.1	48.4	48.3	1.8 times	+22.4
Hayfields and pastures	23475.0	22263.4	2246.4	21367.0	21217.1	21215.7	21207.3	20858.0	88.8	+22617.0
From the under irrigation	37.3	44.1	44.3	43.9	43.9	43.9	43.4	43.3	116.1	+6.0
Forests and shrubs	1410.0	1511.9	1489.5	2375.4	2817.7	2808.1	2811.4	3219.6	2.3 times	+1809.6
From the under irrigation	31.3	44.6	46.0	47.2	47.7	47.8	48.8	49.7	1.6 times	+18.4
Land of garden-vineyard's Associations	-	8.5	8.3	8.1	7.8	7.7	7.5	7.7	90.6	-0.8
Land where their reclamation condition has been improving	-	79.3	-	79.5	79.5	78.8	78.6	77.1	97.2	-2.2
Sites adjoining the farms	437.9	642.9	649.2	667.3	677.3	679.7	691.3	691.6	1.6 times	+253.7
From the under irrigation	365.5	481.9	486.8	500.9	507.6	511.1	522.0	521.1	1.4 times	+155.6
Other land	15539.6	15414.1	15446.0	15438.9	15149.7	15148.7	15137.6	15070.5	97.0	-469.1

[60] Source: State Committee for land resources, geodesy, cartography and state cadastre of the Republic of Uzbekistan for corresponding years.

Table 99. Land' allocation for non agricultural needs for 1998-2007[61].

Category of land	1998		1999		2000		2001		2002		2003-2007	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
For housing constructions	132	4.5	256.0	14.9	383.1	33.4	41.0	3.6	68.6	5.2	1300	1.7
For construction of industrial objects etc.	842	29.0	93.4	5.4	33.4	2.9	27.0	2.4	25.5	2.0	69600	92.8
Transferred to the ministry of defence	1594	55.0	673.5	39.3	198	17.3	357.0	31.3	287.9	22.0		
For construction of hydro technical and other hydro economical structures	161	5.5	176.3	10.3	33.0	2.9	481.0	42.1	678.3	51.8	4600	6.1
For pit-run works	16	0.6	10	0.6	13.0	1.1	13.0	1.1	33.1	2.5		
For other purposes	157	5.4	503.8	29.4	485.5	42.4	223.0	19.5	216.5	16.5		
Total land	**2902**	**100**	**1713,0**	**100**	**1146**	**100**	**1142**	**100**	**1309,9**	**100**	**75000[62]**	**100**

[61] Source: State Committee for land resources, geodesy, cartography and state cadastre of the Republic of Uzbekistan for corresponding years.
[62] Designed - provisory data.

Table 100. Structure of planting area of the Republic of Uzbekistan according to the form of land users for 2000-2006[63] *in % to total*

Years	Total planting area	From them					
		Grain	Technical	From them cotton	Potato and vegetable - watermelons	From them vegetables	Fodders
1	2	3	4	5	6	7	8
	All farm categories						
2000	3778.3	1614.0	1512.5	1444.5	222.8	129.9	429.0
	100	42.7	35.9	40.0	38.2	5.9	3.4
2001	3444.5	1393.7	1500.3	1452.1	219.3	131.2	331.2
	100	40.5	43.5	42.1	6.5	3.8	9.6
2002	3540.8	1533.4	1462.2	1421.0	213.1	127.5	329.1
	100	43.3	41.3	40.1	6.0	3.6	9.3
2003	3790.1	1790.9	1445.0	1392.9	236.1	145.6	316.5
	100	47.2	38.1	36.7	6.2	3.8	8.3
2004	3695.7	1667.1	1518.5	1456.3	225.9	137.6	284.4
	100	45.1	41.1	39.4	6.1	3.7	7.7
2005	3647.5	1616.1	1518.4	1472.3	222.7	137.7	290.3
	100	44.3	41.6	40.4	6.1	3.8	7.9
2006	3637.4	1618.5	1476.9	1448.2	244.8	154.4	296.4
	100	44.5	40.6	39.8	6.7	4.2	8.1
	In farms						
2000	632.2	255.0	307.0	299.2	17.9	8.4	52.4

[63] *State Committee for land resources, geodesy, cartography and state cadastre of the Republic of Uzbekistan for corresponding years. «Agriculture of the Republic of Uzbekistan for 2000, 2001, 2003, 2004, 2005. Statistical collection, State Statistics Committee, Tashkent.*

	100	40.3	48.6	4.7	2.8	1.3	8.3
2001	696.3	277.3	340.7	333.9	19.6	10.3	58.7
	100	39.8	48.9	47.8	2.8	1.5	8.4
2002	991.6	414.0	473.4	473.4	21.4	10.5	82.8
	100	41.7	47.7	47.7	2.1	1.0	8.3
2003	1401.9	680.3	590.0	573.0	36.7	17.5	94.9
	100	48.5	42.1	40.3	2.6	1.2	6.8
2004	1762.6	805.3	816.6	793.2	36.8	19.0	104.0
	100	45.7	46.3	45.0	2.1	1.0	5.9
2005	2140.7	932.0	1034.9	1015.4	39.5	21.7	134.3
	100	43.5	43.5	47.4	1.8	1.0	6.2
2006	2710.6	1181.5	1280.1	1267.8	69.5	44.2	179.4
	100	43.6	47.2	46.8	2.6	1.6	6.6
	In dekhkan farms						
2000	401.5	195.4	7.0	-	143.0	86.7	56.1
	100	48.7	1.7		35.6	21.5	14.0
2001	386.8	180.2	7.4	-	145.8	90.1	53.5
	100	46.6	1.9		3.8	23.3	13.9
2002	404.1	188.6	7.1	-	149.4	91.2	59.0
	100	46.7	1.8		37.0	22.6	14.6
2003	493.3	198.5	7.8	-	153.4	94.0	61.4
	100	40.2	1.6		31.1	19.0	1.3
2004	676.2	200.0	10.4	-	157.9	97.4	64.9
	100	29.6	1.5		23.3	14.4	9.6

2005	441.9	208.2	10.0	-	160.1	99.5	63.2
	100	47.1	2.2		36.2	22.5	14.3
2006	454.8	215.8	9.7	-	165.7	103.5	63.6
	100	47.4	2.1	-	36.4	22.7	14.0

612. In sandy zone of Kyzylkums due to irrational utilization of pastures spices composition was reduced in 4 times, shrubs and semi-shrubs in 2 times, fodder plants in 2.5 times, sands' overgrown with moss is observed (about 1.0% of the territory), sands' mobility is fore then 1 million hectares. Territories of waste pastures near kishlaks and wells' sites (35-40%) also extends that led to the process of desertification are also extend. Moreover more then 0.54 million ha of pastures are flooded by Aydarkul64.

613. All these require the deeper investigation of interaction and inter conditionality of all factors and reasons of land waste by monitoring the degradation consequences that would help to regulate the level of soil fertility.

614. It is necessary to review the legislative base aimed for maintaining agricultural land, in particular irrigated ones.

615. Thus, changes in utilization of republic's land can take place according to the following direction:

- -allocation of agricultural land for other needs;
- -changing the form of land users;
- -changing of planting structure and breaching the crop rotation;
- -soil fertility worsening (salinity, water and wind erosion, discharge and filling balance breaking);
- -reduction of crops' productivity.

6.2 Quality of land resources

616. In general low land' fertility with small humus content is typical for Central Asian countries. Point - bonitet of the soil at the major part of agricultural land is made less than 40 m.

617. Only small part of land in Kazakhstan (about 15 million ha) is chernozems.

618. Worsening of land' quality is observed for the analyzed period in all Central Asian countries. In irrigated area this takes place due to low and moderate salted areas.

619. Thus, in Uzbekistan where is focused the main part of land, area of low and high salted land for years 1990-2005 had increased in 1.6 times and had been made more then 62% to the total area of irrigated arable land. For this period total point - bonitet of soil in the republic was reduced for 3 points and in specific provinces for 8-10 points.

[64] Web site. www.virtualcentre.org/ru.

620. In Uzbekistan humus content was reduced approximately for 45% of the area. Soils with low and very low humus content constitute about 40% of irrigated land and total area of low productive arable land constitutes more than 0.5 million ha.

621. In Turkmenistan areas of low and high salted land constitute 40% to the total volume of irrigated arable land. Areas of such land have systematically increased.

622. A similar phenomenon is observed in the south zone of Kazakhstan where arable land are focused.

623. The main reasons of soil fertility worsening are:

- Bad drainage of irrigated land;
- Worsening of technical conditions of collector-drainage network;
- Development of low productive land and land difficult for reclamation;
- Utilization of collector-drainage waters for irrigation;
- Breaching the irrigation regime of agricultural crops;
- Not qualitative and irregular carrying out of leaching irrigations;
- Sharp lifting of ground water's level.

624. In Turkmenistan average provision by drainage network is made 40% to scientific-special standards. At 38% of area level of groundwater is higher than 2.0 m that leads to the repeated soil salinity.

625. Area increasing of winter wheat planting does not allow making leaching irrigation at the area due to the limitation of water resources in autumn and the planting dates do not allow checking leaching soils before planting the grains.

626. Quick damaging of plants' cover due to irrigation pastures' utilization is typical for pastures and desert zones.

6.2.1.1 Kazakhstan

627. Worsening of land' quality takes place in the republic. The main reasons of soil fertility reduction are: worsening of technical conditions of collector-drainage; development of low productive land and land difficult for reclamation; utilization of collector-drainage waters for irrigation; fertile land' allocation for extending the population's centers and for other needs.

628. Land with unsatisfactory reclamation conditions in the provinces of the republic.

Soil characteristic of desert zone

629. As in other Central Asian countries in Kazakhstan soil peculiarities of desert zone are low humus content, high content of carbonates and high salinity.

630. High point-bonitet have the soils of northern grain provinces of the republic, i.e. in Akmonsliy (38 points), Kostanay (32 points), Severniy Kazakhstan (34 points) and eastern Kazakhstan (31 points).

631. One of the reasons of land' quality worsening is effect of human factor.

632. Analysis of analytical materials shows that 3 factors mostly impact on the worsening of land' quality:

- -land' spoiling;
- -irrational utilization or not utilization of agricultural land;
- -land' utilization for other purposes.

633. For these 3 factors fall more then 31 percents of breaking land' legislation in the republic which same to light in 200765.

634. According to the fertility and quality, land' area of Kazakhstan is divided for the following zones.

Table 101. Zoning of the territory of Kazakhstan[66] (2007)

Category of land	Totally land, million ha,	%	Cropland	%
1. Forestry prairie zone	**0.8**	**0.3**	**0.5**	**0.2**
2. Prairie zone	**26.5**	**9.7**	**23.5**	**10.6**
3. Dry prairie zone	**62.4**	**22.9**	**55.5**	**24.9**
4. Semi-desert zone	**37.2**	**13.7**	**33.9**	**15.2**
5. Desert zone	**11.2**	**41.1**	**83.6**	**37.6**
6. Pre- mountain-desert-prairie zone	**12.3**	**4.5**	**10.2**	**4.6**
7. Subtropical desert zone	**4.4**	**1.6**	**3.8**	**1.7**
8. Subtropical pre-mountain-desert zone	**3.5**	**1.3**	**3.1**	**1.4**
9. Central Asian mountain region	**10.1**	**3.7**	**7.1**	**3.2**
10. South-Siberian mountain region	**3.23**	**1.4**	**1.4**	
Total land	**272.5**	**100**	**222.6**	**100**

635. According to the Table's data, main part of cropland is focused in the desert zone (37.6%), this is mainly the territory of provinces located in the southern part of the republic.

[65] From information from State Department of control for land' utilization and protection, 2007. www.auzr.kz/faq/view.php.
[66] On the basis of data from Statistic Agency of the Republic of Kazakhstan.

6.2.1.2 Kyrgyzstan

636. *Soil cover of the Republic is diversified*. Soils of foothills are represented by Turin sierozems - light - typical - dark, sierzems light and simple, meadow - sierozem and sierozem - meadow soils.

637. Soils of intermountain troughs are light-brown, gray-brown, light and dark chestnut soils and sierozems.

638. *Почвы сыртовых нагорий*- takyr-like desert, brown desert-prairie and chestnut prairie.

639. Soils of mountain slopes are mountain dark sierozems, mountain gray-brown, brown, mountain light-brown, mountain light and dark, chestnut, mountain chernozems, mountain-forestry, subalpine meadow-prairie, alpine meadow-prairie and other soils.

640. Soil degradation processes are the product as of anthropogenic so of nature factors and their combination. Main processes of degradation in Kyrgyzstan include the soil erosion, land' salinity, under flooding, chemical pollution and plants' extinction. Degradation of natural resources is explained by geophysical and climatic peculiarities of each zone aggravated by extra and irrelevant exploitation of frail nature base. Erosion intensity first of all is caused by cover washout, sedimentation of irrigation systems and agricultural works at the slope land that badly impact on the land. Mountain zones, in particular in south regions (Tien Shan and Pamir-Alay) are more vulnerable and less tolerant to extra anthropogenic impacts in comparison with flat territories. Main groups of population are communities on whom degradation of land impacts directly: farmer and peasant farms, land users, women and unemployed people. However at present time land' degradation in Kyrgyzstan is not limited by only some zones of poverty and vulnerable communities. Today it is a serious and widely spread problem in Kyrgyzstan at which 88% of total agricultural land is classified as land subjected to degradation and desertification.

641. More than 40% of cropland (9.6 million hectares of pastures and 1.36 million ha of arable land) have already been wasted. Area of arable land is made 1.36 million hectares including almost 60% of the territories subjected to water and wind erosion. As for the territories which are mainly used as pastures (about 9 million ha is occupied by 11 million of cattle), approximately 30% are at the stage of real desertification, 27% - in moderate stage and 17% at initial stage of desertification. Almost 2 hectares of land are polluted by harmful radioactive matters which have a long term of half-decay and the areas with residual chemicals in the soils are made 200 thousand hectares. Area of potentially erosion land reaches 85% of the territory that is result of mountain topography. In majority of republic's provinces humus content in plowing soils reduced for 20-45 percents in comparison with virgin land. In the flat irrigated zones areas of saline and under flooded land increase. Current tendencies according to main types of land degradation are given in Table 102.

Table 102. Tendencies in degradation of irrigated arable land in Kyrgyzstan[67], thousand ha.

	2004
Saline	220.6
Alkaline*	84.0
Water logged	31.1
Rocky	196.1
Subjected to wind erosion	551.1
Subjected to water erosion	764.8

* with high salt content.

6.2.1.3 Tajikistan

642. Land resources of Tajikistan are the main basis of rainfed and irrigation agriculture, horticulture and pasturable farming. Major part of country's territory constitute low productive rocky and desert soils, rocks and glaciers. Main part of the land is low productive that assumes intensive usage of plowing land, intensive usage of which leads to further worsening of their condition. In this relation impact factors and ecological load per territory unit here is higher then in other Central Asian countries.

643. Tajikistan as a typical mountain country has high zonality of soil cover. Low-lying regions of the country mostly consist of sandy desert and gray-brown soils, in foothills - seirozems. Alluvial soils are formed in bottomland and low terraces of the rivers. Salted and alkali soils are formed in relief's depression at close groundwater occurrence. Mountain brown, mountain light-brown and forest soils are formed in middle mountain zone depending on moisture conditions. Highland meadow-prairie, desert-prairie and desert soils with alkali fragments are formed in highland also depending on moisture conditions. Upper part of high zone almost does not have soil cover or it has weak developed forms.

644. According to the researches qualitative indexes of land resources gradual reduce in the republic. For instance, in 1998 one percent of irrigated land were referred to high saline soils, 4% to moderate saline, 10% to low saline and 85% of irrigated land were referred to non saline soils. Specific feature is that at 67% of irrigated land depth of ground water has been made more then 3 m, at 18% from 2 to 3 m[68].

645. In 1999 73% (509.9 thousand ha) of land under the agricultural crops were in good condition; 14% (101.6 thousand ha) were in satisfactory condition and 12% (85 thousand ha) were in unsatisfactory condition69

[67] Data of soil-agro chemical station of Kyrgyzstan.
[68] Source is Gomkomzem RT for given years.
[69] Water resources of Tajikistan. – Dushanbe, 2003, p. 69.

646. Unsatisfactory condition of irrigated land led to the following consequences:

- - not possible occurrence of ground water's level in 1999 – 45.6 thousand ha, in 2000 – 46.4 thousand ha;
- -soil salinity in 1999 – 27.0 thousand ha, in 2000 – 28.8 thousand ha;
- -combined effect of both factors mentioned above in 1999 – 18.8 thousand ha, in 2000 – 12.9 thousand ha.

647. At present time in the republic 1% of land refer to high saline, 4% to moderate saline, 1% to low saline and 85% to non saline soils.

648. Reasons of unsatisfactory reclamation condition of irrigated land are: high occurrence of groundwater (55%), soil salinity (28%) and impact of both factors (17%).

649. One of the reasons of worsening of the land' qualitative characteristics in the republic is irrational and not effective utilization of not only old-irrigated but of new-irrigated land. Thus, in new irrigated Yavin valley process of ravine formation has increased from 2 unit/km2 to 33 unit/km2 and this process has growing tendency[70].

650. As in other Central Asian countries land of the republic are mainly subjected to two erosion types: water – 41% and wind 24%.71 Areas of land damaged by wind and water erosion constantly increase.

Table 103. Type of wasteland in the Republic of Tadjikistan[72]

Type of waste	1990-1999		2000-2005	
	million ha	% from total area	thousand ha	% from total area
Water	8.3	58	10.3	72
Wind	3.7	26	3.7	26

651. Desertification factors in different provinces of the republic reveal distinctively mainly depending on location and lay of land. That is why depending on factors and regions of desertification territory of the republic is characterized by the following features:

- -first, highland' regions (higher than 2000 m), zone of active physical weathering, water erosion processes - delayed and feebly marked, moderate mud activity. Central and North-southern parts of the territory refer to this (except Khodjant, along the river Zaravshan and Syrdarya);

[70] Data from Ministry of nature protection RT for 1998-2000.
[71] NPJRT for fighting against desertification.
[72] State Committee of the Republic of Tadjikistan on land management. "National report of the Republic of Tajikistan on KBOOON implementation, Dushanbe, 2006.

- -second, regions of active shower and mud activity; marked water-erosion processes and flat soil washout. Mainly Western part of the republic refers to this (districts of Dushanbe, Vaksh and Sukhrob river);
- -region of combined impact of desertification factors, which is characterized by the lack of rainfalls, wind erosion and formation of alkali soils. To this territory refer Eastern part (Pamir, Oksu - borders with China and Afghanistan), South-western part (Kurgan-Tyube, along Amudarya and Panj rivers) and also Northern-western part of the territory (Khodjand).

652. It should be pointed out that the following negative factors that speed up land' degradation are observed in Eastern and North-western parts of the territory: excessive deforestation and degradation of trees and shrubs; excessive exploitation of pastures; soils dehumification73.

653. Irrigation agriculture is the main activity of the population in rural area. About 15% of country's GDP is formed in the irrigation agriculture and more then 95% of agricultural products are produced. Together with this about 2.5-3.0 million people have work. For this reason development and efficiency increasing of irrigation agriculture directly effect on reduction of poverty in rural area.

654. Technical imperfection of irrigation systems leads not only to considerable water losses while transporting but also to the development of irrigational erosion. Example can be the development of Yavan valley which has begun in 1968 where 20% of areas are subjected to active processes of ravine formation. One of the reasons of ravine formation in the valley was irrational water management. It should be pointed out that not only irrational management but also irrational arrangement of using the water resources as in irrigated zone so in the deserts lead to the activization of land waste[74].

655. For the last 10-15 years process of land' degradation have changed the qualitative structure of land' areas in the republic. For this reason in the north of the republic processes of clay deserts' formation - takyrs speeded up and it is almost impossible to rehabilitate due to the high costs of such works. Withdrawal construction for irrigation from the Vaksh river led to the lowering of ground water for 3-4 meters from the surface in the area of protected woodland "Tygrovaya Balka" and this was the reason of soil, plants' degradation and of frequent fires.

656. For the last years process of land' quality worsening also speeds up because 90% of agricultural enterprises do not have a plan for reclamative soil improvement and do not take measures for preventing erosion[75].

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[73] Data of the Ministry of nature protection RT.
[74] Khamraev N.R., Denisov Yu.M., Davranova N.G., Azimbaev S.A. Basis of local water management in deserts (example of Central Kyzylkun). Tashkent: AO «Agrosanoat akhboroty». – 1997. – p.130.
[75] Ministry of reclamation and water resources of the Republic of Tajikistan. http://www.cawater-info.net/5wwf/national_report_tajikistan.ht

657. Though means allocated from all sources for reclamative soil improvement and irrigational systems' rehabilitation have been increasing by years. Just for the last years about 200 million USD was allocated for rehabilitation of irrigational systems76.

658. Only about 33% of total area has been handled in the republic and the amount almost have not increased from year 1960. As it was pointed out one of the factors that causes land waste is the impact of anthropogenic factors.

659. The main anthropogenic impact on the land is observed from agriculture side. Wide-scaled pesticides' application from the period of 1960 to 1990 led to toxic soil pollution. Thus pesticides' content of groups DDT and ГХЦГ in the soils of some farms exceeded allowable concentration in 21 times for DDT and in 3 times for ГХЦГ. Besides that due to the active application of pesticides their content in the meat of agricultural animals was high.

660. Together with the impact on agricultural production, serious influence on degradation process and worsening of land' productivity makes such anthropogenic factors as deforestation of forestry lines which serve as the main protective mean against wind erosion. Deforestation of mountain forests and impoverishment of plants' cover lead to washout increasing of upper fertile soil level, losses of moisture in the cover, increasing the process of mud and landlide formation, worsening of slopes' steadiness, general degradation of land forms around.

661. Mine workings in the carrier damage a fertile cover soil level and can lead to the total land waste. Sizes of the territories subjected to harmful impact of open mine workings in 7-8 times more then the areas of carriers' themselves77. Especially detrimental the influence of mine workings and exploitation of unauthorized and not allowed carriers with minerals.

662. It should be pointed out that formation of artificial reservoirs, waste discharge of industrial enterprises, unfavorable nature-climatic phenomena - flood and flash flood, landlides, drought, dry sandy storms etc. also impact on increasing of degradation areas.

663. All these and other factors negatively impact on land' productivity and reduce the productivity of agricultural crops.

664. Specific feature is that in Tajikistan process of dehumucification is observed in irrigated soils. As a result of which degrading processes are getting worse - compaction, reduction of porosity and others. In irrigated cotton zone of Tajikistan contains 110-120 thousand ha of stone and sandy soils that requires reclamation. 30-70% of arable land in middle mountain districts are also stony soils.

665. Forests - forest fund constitute considerable part in the structure of land' area. Total area of state forest fund of the Republic of Tajikistan is made 1.8 million ha, 99.4% of which are

[76] Yokubzod S. Minister of reclamation and water resources of the Republic of Tajikistan http://www.cawater-info.net/5wwf/national_report_tajikistan.ht

[77] Data from Ministry Nature protection RT for 1998-2000, and also Report on environment of Tajikistan in electronic bearers. Ministry of nature protection of Tajikistan, Dushanbe, 1996.

controlled by the authorities of forest farming. From this territory plantings occupy 410 thousand hectares or 23% of state forest fund area. Outside the land of state forest fund there are fragmentary forest areas of pastures and territories difficult of access of 150-250 thousand ha. Almost all the forests of the republic belong to the country. Percentage of forest land is made about 3%[78].

666. In the structure of forest fund certain share has sandy-desert forests (saxauls) that mainly grow in the south of the republic. The mian forest rocks are white and black saxauls.

667. Area of saxaul forests in Tajikistan constitutes 10-12 thousand ha. Height of saxail trees and shrubs can reach 12 m and to the age of 100 years. Average stand density is made 0.3 - 0.5, annual growth of wood is 0.3-1 m^3 ha^{-1}. Saxaul forests play an important soil protective and sand fixing role, and frequently used as spring-autumn pastures. Having fixed the mass of sandy soils they protect oases, canals, transportation ways against sand and increase productivity of pastures.

668. Specific weight of state forest funds' area assigned to agricultural enterprises for long-term usage as pastures exceeds 70% of total and covered by forest area.

669. Other factor that promotes the area growth of land not used in agriculture is construction of new and reconstruction of existing roads of international value and zone highways. Only for 2000-2007 as a result of construction of new and reconstruction of existing highways more than 20.0 thousand ha of forest plantings were deforested.

670. Factors and reasons impacting on worsening of land' quality:

- -incompleteness of land and water reforms;
- -necessity of economic mutual relations improvement between water resources' consumers and operatives of reclamation systems;
- -low level of technical equipment as in irrigational systems and WUA so in agriculture and commodity producers;
- -poor introduction of progressive methods and ways of irrigation and watering;
- -absence of economic responsibility for breaking water usage rules and as a result increasing the volume of drainage-discharge waters;
- -increased water rates in the collectors and deferent canals as losses and discharges of irrigation waters from the fields and from the canals for the reasons mentioned above;
- -worsening of irrigation water's quality at direct or indirect repeated utilization of drainage-discharge water;

[78] Sources: State statistics committee RT, ЛХПО RT, Ministry of Nature RT

- -aggravated ecological problems and desertification.

6.2.1.4 Turkmenistan

671. Quality worsening of land resources intensively takes place in Turkmenistan. Thus, in 1994 are of low and high saline land was made about 650.0 thousand ha that is made 40% of arable land's area.

672. For the period from 1970 to 1995 area of irrigation land in Turkmenistan increased in 1.6 times, and for the period of 1991-2003 for 360.3 thousand ha. Main reason of such considerable growth of irrigation land was realization of program "Zerno" and new land' development under this program.

673. One of the main factors stipulating the formation of reclamative condition of irrigation land is water supply for irrigation and discharge of drainage flow.

674. Level of drainage flow is made 30 and more percents at 40 percents drainage supply, i.e. part of irrigation water, passing through the field falls into collector network.

Figure 32. Area of low and high saline land in Turkmenistan.[79]

675. Level of irrigation land supply by collector-drainage network is very low and in sections of provinces varies from 31% to 68% and more, at average value around the country - 42% from scientifically proved recommendations. Due to unsatisfactory condition construction of collector-drainage network and organization of repair rehabilitation works of horizontal drainage more then 80% of horizontal drainage does not function.

[79] Data of the Ministry of Nature utilization and environment protection of Turkmenistan. Data of scientific industrial center of ecological monitoring under the Ministry of Nature utilization and environment protection of Turkmenistan.

676. 38% of irrigated territory groundwater occurred to 2 m that is the reason of repeated salinity process development at low level of agro techniques. Land's share with ground water's level from 2 to 3 meters has considerably increased (almost for 160 thousand ha).

677. At the area of 55% of irrigation land (1992-1994) moderate saline soils are spread which require yearly exploitation leaching, and at the area of 12% - high and very high saline soils which require substantial leaching. Area of moderate-, high-, and very high saline land only for 1992-1994 increased for 147 thousand ha[80] .

Table 104. Dynamics of changing the level of irrigation land salinity in Turkmenistan for 1991-2007.[81] *(by January 1st, thous* ha^{-1}*)*

Rates	1991	1995	2005	2007
Total irrigated arable land	1287.0	1622.2	1652.0	
Total area of saline land	908.0	1090.2		
To all irrigation areas in %	70.5	67.3		
Including				
Low saline land				
To all irrigation areas in %				
Moderate saline land	708.0	890.2		
To all irrigation areas in %	55.0	55.0		
High saline land	200.0	200.0		
To all irrigation areas in %	15.5	12.3		

678. From total irrigated area only 15.6% is referred to the category with good reclamation condition, 47.9% is referred to satisfactory and 36.5% to unsatisfactory.

679. Particularly difficult reclamation condition is in Dashkhovuz province where more than 60% of irrigated area constitute the land where ground water level is to 2 meters.

680. As in other Central Asian countries the main reasons of reduction of soil fertility and reclamative condition of irrigation land in Turkmenistan are: worsening of technical condition of collector-drainage network; development of low productive land and land difficult for reclamation; usage of collector-drainage waters for irrigation; fertile land' allocation for extending population centers and other needs; relatively low drainage for irrigation land; poor natural drain; unsatisfactory level of inter-farm collector-drainage network's operation due to lack of reclamation techniques and qualified technical specialists; continuously breaking of regimes and irrigation techniques and other reasons.

Soil characteristic of desert zone

[80] The same.
[81] The same

681. Soils of Turkmenistan are characterized by the following features:

- -gray-brown soils (with humus content less then 1%, sharp alkaline and gypsum accumulation) occupy plateau Ustyurt, Krasnovodsk and Zaunguz; seirozems (with humus content from 1% to 3-4% and high carbonate content) - mainly occupy foot and down slopes of mountains;
- -light seirozems are spread at the foothill flat; in the down mountain zone - typical seirozems, upper - dark seirozems;
- -at the highest parts of mountain plateau and ridge of Kopetdag and Kugitangtay - mountain brown soils.
- -in Karakums at considerable areas — fixed sands. In lower parts — alkali soils, takyrs and takyr-like soils;
- -in rivers valleys — meadow-seirozems and alluvial-meadow soils.

682. About 2% of Turkmenistan area constitutes irrigation soils - the main agricultural fund of the country.

6.2.1.5 Uzbekistan

683. Worsening of land' quality takes place in the republic. Thus, for 1990-2001 area of saline land increased from 1666.7 thousand ha to 2059.2 thousand ha that is made 62.5% of arable land' area. Areas of low and high saline land increased for more then 1.6 times.

Table 105. Dynamics of changing of irrigation land' salinity level in the Republic of Uzbekistan for 1990-2001 *(for January 1st/ thousand ha)*

Rates	1990	2001	2001 to 1991 +;-
Total area of irrigation arable land	3407.3	3308.3	-99.0
Total area of saline land	1666.7	2059.2	+392.5
To all irrigation areas in %	49.1	62.5	+13.4 p.p.
Including			
Low saline land	967.5	1131.1	+163.6
To all irrigation areas in %	28.4	34.3	+5.9 p.p.
Moderate saline land	508.0	571.4	+63.4
To all irrigation areas in %	15.0	17.3	2.3 p.p.
High saline land	191.2	356.7	+165.5
To all irrigation areas in %	5.6	10.8	+5.2 p.p.

Source. Data from state committee of land resources of the Republic of Uzbekistan.

684. In republic's regions salinity level of irrigation land varies from 80.0 % (Republic of Karakalpakstan and Syrdarya province) to 23.9 % (Tashkent province). According to other data 97% of land subjected to salinity in the Republic of Karakalpakstan82, 30 thousand ha in Namangan province83, and 97% in Syrdarya province84.

685. According to the quality land that are lower from middle (I-V class, from 0 to 40 points) have been made 3.0%, middle land (VI - VII class, from 41 to 60 points - 47%, good land (VII - VIII class, from 61 to 80 points) - 25.55% of irrigation arable land.

686. Due to the worsening of ecological reclamation conditions, soil fertility (point bonitet) in average reduced from 58 points (1990) to 55 points (2001). In Samarkand and Fergana provinces bonitet-point reduced for 10 points, in Surkhandarya province for 8 points, in Navoi, Namangan and Tashkent provinces for 7 points, in Syrdarya province for 4 points.

687. According to the quality average bonitet-point of soils in the provinces varies from 41 points in the Republic of Karakalpakstan to 60 points in Andijan and Surkhandarya provinces.

688. Humus content in the soils reduced for 30-50 %. Soils with low and very low humuc content occupy for about 40% of irrigation land and total area of low productive arable land is made more then 0.5 million ha.

Area of low productive land with bonitet-points lower 40 is made 22%, and in the Republic of Karakalpakstan such land are made 63%.

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[82] Aybergenov B., Koshekov R. Some ecologic aspects of agriculture in Karakalpakstan. M.// «Agro science of agriculture in Uzbekistan, №3, 2007, p.32-33.

[83] "Khalk sozi" newspaper, 5 January 2007.

[84] Mamatkulov A.V. «Кишлок хужалигида сугориладиган шурхок ерлардан самарали фойдаланиш», Publishing house named after "Cholpon:, Tsherlute, 2007, p.22.

Table 106. Dynamics of class changing and assessment of irrigation land in the Republic of Uzbekistan[85] *(by 01.01.2001, /thousand ha)*

Provinces	Years	Total irrigation land	According to the class					
			1-2	3-4	5-6	7-8	9-10	Average point
Republic of Karakalpakstan	1990	472.3	-	54.6	37.7	7.0	0.9	44
	2000	463.2	6.4	61.2	25.6	6.8	-	41
Andijan	1990	233.7	0.4	14.6	40.7	40.6	3.7	60
	2000	228.3	0.43	14.97	40.4	40.4	3.8	60
Bukhara	1990	227.3	0.14	28.2	22.96	42.2	0.5	58
	2000	229.3	0.14	28.8	29.96	40.0	0.2	53
Djizzak	1990	270.8	4.6	21.4	40.8	30.1	2.9	53
	2000	255.8	0.03	16.0	69.27	13.7	1.0	50
Kashkadarya	1990	450.7	-	14.8	59.1	22.7	3.4	54
	2000	452.3	-	19.5	62.1	16.4	2.0	51
Navoi	1990	107.9	-	23.1	32.9	40.5	3.5	59
	2000	108.1	6.6	27.1	34.1	30.8	2.0	52
Namangan	1990	234.6	0.5	20.6	29.4	33.3	16.2	66
	2000	236.1	0.09	28.21	35.5	28.0	8.2	59
Samarkand	1990	2840	0.02	6.18	37.3	41.3	14.4	67
	2000	279.3	0.013	11.08	51.7	31.4	5.8	57
Surkhandarya	1990	284.0	0.06	10.2	24.84	40.5	24.4	68
	2000	279.3	0.7	22.8	39.5	30.7	6.3	60

[85] Data from state committee of land resources of the Republic of Uzbekistan

Syrdarya	1990	275.7	0.02	257	40.1	33.8	0.5	53
	2000	2739	0.05	29.7	54.75	16.5	-	49
Tashkent	1990	369.6	-	23	35.3	35.5	6.2	66
	2000	337.5	-	31.8	45.6	17.9	4.7	59
Fergana	1990	296.6	0.06	5.5	28.4	35.4	30.7	66
	2000	296.0	0.5	24.8	38.7	34	2.0	56
Khorezm	1990	216.8	0.6	17.1	30.0	30.2	32.1	54
	2000	240.2	0.7	17.5	32.5	32.3	17.0	54
Republic of Uzbekistan	1990	3709.4	0.2	20.8	34.8	34.9	9.3	58
	2000	3729.5	0.3	26.4	44.5	26.0	2.78	55

Table 107. Quality of irrigation cropland of the Republic of Uzbekistan[86] *(thousand ha)*

	Total	including:										Average point			
		worst land		worse land		middle land		good land		the best land					
		I class	II class	III class	IY class	Y class	YI class	YII class	YIII class	IX class	X class				
		Bonitet													
		0-10	11-20	21-30*	31-40	41-50	51-60	61-70	71-80	81-90	91-100	1980	1990	2001	2005 *
Karakalpakstan	416533		1919	29810	237202	69846	46458	24497	6801			45.00	44.00	41.00	41.00
provinces:															
Andijan	224078		311	9593	34322	39801	45187	50547	38267	6015	35	67.00	60.00	57.00	57.00
Bukhara	232696		1038	16521	57391	42070	55294	40843	19456	83		57.00	58.00	53.00	50.00
Djizzak	276824		105	3607	40717	143261	48533	30379	7413	2809		54.00	53.00	50.00	50.00
Kashkadarya	445379			3455	71977	198976	87416	50375	25003	8177		57.00	54.00	51.00	51.00
Namangan	228712		235	13499	45776	47117	36667	32553	33383	18181	1301	63.00	66.00	59.00	59.00
Navoi	99472		3358	9618	15253	17668	18200	20423	12853	2099		-	55.00	52.00	52.00
Samarkand	306407		41	2044	29478	72263	89756	57187	38321	16770	547	63.00	67.00	57.00	57.00
Surkhandarya	272058		704	11047	43203	59838	79317	50049	20985	6915		72.00	68.00	60.00	56.00
Syrdarya	269092		144	7302	66610	94579	55203	40414	4840			51.00	53.00	49.00	49.0
Tashkent	329021			2631	37586	86361	67968	74385	45380	14600	29	63.00	66.00	59.00	59.00
Fergana	314939		1426	8043	59139	56142	83586	67580	33001	5570	452	65.00	66.00	56.00	56.00

[86] Source: State Committee of land, geodesy, cartography and state cadastre of the Republic of Uzbekistan for necessary years.

Khorezm	205718		625	8839	46298	34932	32052	49291	11848	102		70.00	54.00	54.00	63.00
Total	**3649115**		**9906**	**126009**	**784950**	**962854**	**795637**	**588523**	**297551**	**81321**	**2364**	**59.00**	**58.00**	**55.00**	**55.00**
01.01. 2001	**3167.39**		**7.66**	**88.23**	**688.81**	**868.38**	**622.11**	**515.92**	**293.49**	**80.01**	**2.78**	**59.00**	**58.00**	**55.00**	**55.00**

Note: 1. Data for Andijan province for 2002.
2. Data for Surkhandarya for 2003.
3. Data for Bukhara for 2004.
4. Data for Khorazm for 2005.
5. Data for other provinces for 2001.

Table 108. Dynamics of changing the area of irrigation arable land of the Republic of Uzbekistan according to salinity degree for 1990-2001[87] (thousand ha)

Territories	Years	Total irrigated arable land	Including salinity degree						Total amount of saline land	
			low		moderate		high			
			ha	%	ha	%	ha	%	ha	%
Republic of Karakalpakstan	1990	432.7	158.3	36.6	173.9	40.2	70.5	16.3	402.7	93.1
	2001	417.2	91.1	21.8	124.9	29.9	117.7	28.2	333.7	80.0
Andijan	1990	214.5	44.6	20.8	18.0	8.4	4.9	2.3	67.5	31.5
	2001	197.9	44.4	22.4	17.3	8.7	4.1	2.1	65.8	33.2
Bukhara	1990	264.4	154.4	58.4	66.4	25.1	19.0	7.2	239.8	90.7
	2001	198.5	101.0	50.9	38.6	19.4	25.0	12.6	164.6	82.9
Djizzak	1990	245.3	56.6	23.1	18.4	7.5	7.6	3.1	82.6	33.7
	2001	257.9	95.6	37.1	71.9	27.9	36.8	14.3	204.3	79.2
Kashkadarya	1990	414.8	149.9	36.1	70.2	16.9	26.2	6.3	246.3	59.4
	2001	414.8	198.3	47.8	57.8	13.9	28.9	7.0	285.0	68.7
Navoi	1990									
	2001	91.0	38.6	42.4	15.1	16.6	5.2	5.7	58.9	64.7
Namangan	1990	203.2	23.8	11.7	14.8	7.3	5.7	2.8	44.3	21.8
	2001	197.3	41.7	21.1	14.8	7.5	10.6	5.4	67.1	34.0
Samarkand	1990	298.7	32.8	11.0	4.8	1.6	0.1	0.0	37.7	12.6
	2001	260.7	87.1	33.4	16.5	6.3	3.9	1.5	107.5	41.2
Surkhandarya	1990	257.4	58.4	22.7	40.1	15.6	6.4	2.5	104.9	40.8
	2001	242.0	91.7	37.9	40.2	16.6	19.1	7.9	151.0	62.4

[87] Source. Data from state land committee of the Republic of Uzbekistan.

Syrdarya	1990	269.5	123.7	45.9	56.6	21.0	36.6	13.6	216.9	80.5
	2001	255.0	108.4	42.5	65.6	25.7	45.8	18.0	219.8	86.2
Tashkent	1990	306.0	25.7	8.4	2.4	0.8	0.3	0.1	28.4	9.3
	2001	298.3	56.0	18.8	10.9	3.7	4.5	1.5	71.4	23.9
Fergana	1990	273.4	29.5	10.8	9.6	3.5	0.3	0.1	39.4	14.4
	2001	254.6	92.1	36.2	57.5	22.6	36.6	14.4	186.2	73.1
Khorezm	1990	216.1	109.8	50.8	32.8	15.2	13.6	6.3	156.2	72.3
	2001	210.3	85.1	40.5	40.3	19.2	18.5	8.8	143.9	68.4
Total	**1990**	**3396.0**	**967.5**	**28.5**	**508.0**	**15.0**	**191.2**	**5.6**	**1666.7**	**49.1**
	2001	**3295.5**	**1131.1**	**34.3**	**571.4**	**17.3**	**356.7**	**10.8**	**2059.2**	**62.5**

689. In Syrdarya – 27%, in Navoi - 25% and in Bukhara – 24%. Crops' cultivation at such land requires considerable expenses and connected to production inefficiency.

690. Main reasons of soils fertility reduction are: worsening of technical condition of collector-drainage network; development of low productive land and land difficult for reclamation; usage of collector-drainage waters for irrigation; fertile land' allocation for extending population centers and other needs.

691. Land with unsatisfactory reclamative conditions in the republic's provinces are as follows: Tashkent province - 2%, Andijan, Namangan and Djizzak - 5%, Fergana - 7% and big specific weight of such land in Surkhandarya - 22%.

692. Quality of irrigation land is characterized as follows:

- -1st cadastre group: land of 1st and 2nd class are made 0.3% of irrigated cropland' area;
- -2nd cadastre group: land of 3rd and 4th class are made 24.9% of irrigated cropland;
- -3rd cadastre group: land of 5th and 6th class are made 48.2% of irrigated cropland;
- -4th cadastre group: land of 7th and 8th class are made 24.3% of irrigated cropland;
- -5th cadastre group: land of 9th and 10th class are made 2.3% of irrigated cropland.

693. Coming out from nature-climatic features of the territory three nature - climatic zones are differed: desert, foothills semi-desert and mountain, which are divided for 9 sub-zones taking into account agrarian potential.

694. In the system of latitudinal soil-climatic belts, flat part of Uzbekistan refer to the south zone - zone of desert with gray-brown, desert sandy and takyr soils. In the system of vertical zones (altitudinal belt) in the eastern part of the republic prevail seirozems of foothills and low land, brown mountain-forest soils of middle high mountain belt and light-brown meadow-prairie soils of highland.

695. 23.4% of territory (or 43% of total irrigation land) refer to altitudinal belt and 76.6% (or 57% of total irrigation land) refer to desert zone of the republic.

696. Soil characteristic of altitudinal belts is: humus layer capacity is from 30 to 100 cm, humus content is from 2-3% to 4-8% (brown soils).

Soil characteristic of desert zone.

697. Main soil feature of desert zone is low humus content, high carbonate content, widely spread salinity, alkali soils in some places.

698. Gray-brown soils. Humus content varies from 0.3-0.6%, mainly used under year-round pastures, not so much used under irrigation due to insufficient capacity of small-earthy soil. Capacity of gypsum layers reaches 10 m.

699. Desert sandy soils are spread in Kyzylkums, in old delta flat of Amudarya. Humus content is from 0.3 to 0.6%, used under year-round pastures. Absence of soils connectivity leads to soil spraying even at weak wind. Irrigated desert sandy soils are characterized by unfavourable agronomic features. Humus content is low (0.3-0.4%), easily deform, require much water for irrigation and fertilizers. Soils transfer to hydromorphic stage at ground water rising.

700. Takyrs soils and takyrs are spread in the valleys and delta of Amudarya, Zeravshan, Kashkadarya and Surkhandarya, and to the flats of Kyzylkum and Ustyurt. Plants' cover on these soils is much cut, this indicates about low level of organic matters. Humus content is 0.4-1.0 %, permeability is low. However can be quickly cultivated and give good yields.

701. Meadow-takyr soils are spread in flats in the zone of takyr and meadow soils' combination. Depth of groundwater is 3-5 m, humus content is 0.7 – 2.0 %. Almost all meadow-takyr soils are saline in this or that degree, during irrigation this process is strengthening.

702. Meadow soils of desert zone are developed in the rivers' valleys and delta in conditions of moistening by high level groundwater (1-3 m). Humus content varies from 0.5 to 2.0%.

703. Paludal-meadow soils of desert zone are developed in the same zones as meadow soils, but at redundant moistening due to higher level of groundwater. Area of paludal-meadow soils is small and mainly used as year-round pastures.

704. Alkali soils are formed in river valleys and delta in the valleys under mountains. After necessary activities they can be developed for irrigation. Salt content in the upper layer varies from 3 to 20-30%.

Specific features of soil's types.

705. Brown soils are mainly spread in foothill's flats, rainfalls amount is from 500 mm to 1000 mm, humus content is 1.5-3.0 %, mechanical composition is middle loams, nitrogen content is 0.12-0.25%.

706. Dark sierozems occupy the territory of upper part of foothill's flat, amount of rainfalls is from 400-500 to 750-1000 mm. Mechanical composition is middle loams, humus content is 0.08—0.15 %, carbonate content is 2-8%.

707. Typical seirozems are mainly spread in the middle part of foothill's flat at 450-750 m height above sea level 450-750 m, amount of rainfalls is 300 - 400 mm, humus content is 0.04-0.06 %, carbonate content is 5-10 %.

708. Light seirozems are mainly spread in the down part of foothill's at 450 m height above sea level, amount of rainfalls is 300 mm. humuc content is 0.5-10 %, nitrogen content is 0.04-0.06 %.

Factors and reasons impacting on land' quality worsening:

- -existing hydroeconomic condition and hydro reclamation system in Uzbekistan. This negative factor has been caused by: firstly, imperfection of economic mutual relations between water resources' consumers and operatives of reclamation systems; secondly, by low technical equipment for irrigation systems and by low level of irrigation methods.
- - high water intake in the head parts of system due to low level of technical equipment and irrigation system's operation, irrigation techniques, absence of economic responsibility for breaking water usage rules and as a result volume increasing of drainage-discharge waters;
- - increased water rates in the collectors and deferent canals as losses and discharges of irrigation waters from the fields and from the canals due to the reasons mentioned above;
- - water shortage in the middle and down parts of the system due to mentioned above;
- -worsening of irrigation water's quality at direct or indirect (through coming back to the sources) repeated utilization of drainage-discharge water (takes salts from one fields and direct to the others);
- - aggravated ecological problems;
- - absence of mechanism stimulating the improvement of irrigation methods, irrigation networks reconstruction, using modern means for irrigation;
- - usage of old open drain system88.

709. As a result of these groundwater come to the surface and for the second, third etc. times salt the irrigation waters.

Measures for improving the quality of land resources:

- -using a bio-drainage system - rehabilitating an ecological reclamation background of damaged saline soils89;
- - increasing the funds for reconstruction and modernization of reclamation system and for exploitation and technical maintenance of highways;
- -creation the stimulus for effective usage of funds;
- -creation the stimulus for rational water usage;
- -using modern irrigation methods techniques.

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88 Internet: International Eurasian institute of economic and political researches. A.A. Bogdanov, V.I. Klochkov. Ecological situation in Priaral. www.htt.iicas@iicas.org

89 Internet. www.bareev_et_ru. Baraev F.A. and others. Ecological condition improvement of irrigation land on the basis of bio-drainage system's introduction to the farms. Uzbekistan, TIIM.

710. It should be pointed out that about 40 - 50 % of total irrigation water in Uzbekistan, i.e. 24-30³ km is taken by pumps and each saved cubic meter of water in the field is two cubic meters of saved water in the system's head, i.e. of water resources and almost one cubic meter of prevented return flow![90]. Moreover for about 20% of consumed power energy in the republic and 70% of the budget of Ministry of agriculture falls to irrigation water supply.

711. New water management system should be designed in order to implement all measures listed above[91].

6.2.2 Ecology of dry zones

712. Big volume of water intake for irrigation and accumulation in the reservoirs has a contrary effect - desertification effect, water quality worsening. In the process of new irrigation land' development which was carried out in big scales in Central Asia a leading role belonged not to turbulent heat flux but to evaporation costs (70% from radiation balance). Considerable part of old dry desert territories of prairie had oasis features with corresponding reduction of summer temperature and increasing of air moisture[92].

713. Desertification takes place in Priaral due to much water taking for irrigation where as a result of considerable water level reduction ecology of dry neighbor areas worsens.

714. Soils of Priaral zone for 43% are polluted by chemical fertilizers, pesticides and phenols.

715. Cropland' quality worsens; air pollution increases and water resources become more limited due to the Aral Sea drying.

716. Analysis of qualitative indexes of land in the dry areas shows that under the influence of different factors in particular erosion, takes place the process of productive land' reduction.

717. In Uzbekistan cropland' share damaged by water erosion is made 10.1%, by wind erosion - 76.6%.

718. At the irrigated land damages by water erosion is made 10.2%, by wind erosion - 78.8%.

719. According to the specialists' calculations every year only in Uzbekistan for about 20 thousand ha of land become not suitable for agriculture under the influence of salinity and soil erosion growth, water mineralization and other factors.

720. Territories located in foothills and low mountain zones are strongly subjected to water erosion.

721. Wind erosion and deflation are spread in the zones of active wind activity.

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[90] Morozov A.N. How do we see hydro reclamation systems (HRS) in future. Web site: www.water-salt.nm.ru.htm.
[91] General Report (volume i): Existing situation and perspectives of agricultural sector. Prepared for Asian Development Bank and Ministry of Economic of the republic of Uzbekistan (tar: uzb 37148), 12 March, 2005, p. 26.
[92] Chub V.E. Climate changing and its influence on nature-resource potential of the Republic of Uzbekistan. Geagydromet RU, Tashkent, 2000, p. 115.

722. Imperfect production technology and structure of crops' allocation also make a great influence on ecological situation worsening.

723. In Turkmenistan anthropogenic activity has led to a quite unfortunate consequences as the part of Turkmenistan's territory (Dahkhaus province) was acknowledged as a zone of ecological disaster by international community.

724. Together with subjective reasons which caused the nature environment's degradation there are a number of objective reasons, including the lack of finance and material-technical means, which are required for realization ecologically safe hydro economic and other projects, difficult demographic condition, which is the reason for necessity of yearly increasing of agricultural products' production.

725. Desertification is the main problem in Turkmenistan because of waterless climate. According to the specialists' assessment approximately 70% of Turkmenistan's territories are subjected to desertification. The main reason of desertification speeding up is intensive agriculture, construction projects, and oil and gas designs.

726. The main sources of water pollution in Turkmenistan are: collector-drainage system (70-80%); fuel and energy complex (8-12%); communal services (2-3%)93.

727. In Kazakhstan anthropogenic human activity is the main reason of ecological condition's worsening, soil and plant' cover changing, land pollution not only in dry but in all territory of the republic.

728. There are some regions with unfavorable ecological condition in the republic: Prikaspiyskiy region; Semipalatinskiy polygon; Kazakhstan part of Priaral.

729. In Tajikistan main factors of ecological condition worsening are: climate changing, deforestation, breaking an irrigation regime, intensive usage of irrigation land and cattle grazing, intensive development of nature resources, ravine strengthening and landlide formation, development of road-communicational and irrigational network, grasshopper plague. Kyrgyzstan is a mountain country with big potential for pastures' development.

730. According to the analyses for last years pastures' productivity have worsen due to bad ecological conditions in dry areas.

731. This is caused by big load on the pastures near mud, reduction of pastures' watering.

[93]Data of scientific-industrial center of ecological monitoring of the Ministry of Nature usage and environment protection of Turkmenistan.

6.2.2.1 Kazakhstan

732. According to the rate of river flow Kazakhstan is considered to be a less water supplied Central Asian country.

733. At the beginning of new century for about 100.0 million ha of pastures were watered by irrigational structures. According to the specialists' assessments condition of almost all water objects was estimated as unsatisfactory94.

734. The main reasons of water supply worsening to population in dry areas are breaking of water supply system and high level of surface and ground water's pollution.

735. As in other Central Asian countries in Kazakhstan anthropogenic human activity is the main reason of ecological condition's worsening, changing of soil and plant's cover, land' pollution not only in dry areas but in all territory of the republic. There are some regions with unfavourable ecological condition.

736. *Prikaspian region*, where for about 77% of hayfields and pastures of Atyrausk province have signs of anthropogenic impact - different breaking degree (49%), polluted by poor eaten and not eaten (36.3%), and by noxious plants (1.1%)95. Reasons of soil pollution are oil products blowout. High and low degradation degree of pasturable plantings is observed at 68% of province's area.

737. *Semipalatinskiy polygon*, where from 1949 to 1989 were made 470 nuclear explosions: 90 air, 26 surface, 354 underground. Radioactive precipitations were spread at 304 thousand sq/ km, area of ecological disaster zone is made 7 million ha. Cropland in the effect zone of Semipalatinskiy polygon are equal to 27.4 million ha that is made 88.3% from total region's area96.

738. *Kazakhstan part of Priaral covers* 59.6 million ha of land or 22% from total area of the republic. This region is the centre of ecological disaster and pastures at 8% of the territory are subjected to high, moderate (22%) and low degradation degree. Process of cropland' transformation from one category to the other speeds up - from hayfields category to pastures. Sandy - alkaline waste ground is formed at the dry bottom of Aral Sea. Area of spreading zone and dust sedimentation is made about 25 million ha.

739. For the last years the following processes have strengthen: plants' degradation and replacement by weeds; salinity and desertification; repeated salinity and pollution by toxic and chemical matters and heavy metals.

[94] State program for development of rural territories of the Republic of Kazakhstan for 2004-2010. Astana, 2003, p. 244.
[95] At the same place, p. 250
[96] At the same place, p. 250.

740. In the republic 36 rural population centers are considered to be high saline (salinity level is from 4-6%), in 354 rural centers soils are moderate saline (salinity level is 2-4%) and in 7268 (94,9%) soils are low saline (to 2%).

741. As a result in more than 8.0% of rural population centers not potable water of not corresponded standards is used, i.e. maximum acceptable concentration of mineral salts is more then 1.5 g l^{-1}.

742. More then 42% of cropland is subjected to wind erosion. According to the data of National Report on desertification problem, grass stand worsening in major part of pastures due to over grazing can lead to the losses of nature potential with the rate of gross national income.

743. Desertification processes appear at more then 60% of country's territory97.

744. Broken pastures, arable land, which lost their fertility, saline and damaged soils as a result of industrial pollution, refer to the waste territories.98.

745. Pastures are the main nutritive base in the country. But condition of pastures causes anxiety. Even in 1993-1994 63 million ha of pastures were subjected to desertification. Main reasons of this are: over grazing for 47 million ha; desertification of 6 million ha due to anthropogenic factors etc. Pastures' degradation increases by years.

746. Huge pasturable resources of Kazakhstan are not enough used that strengths the process of ecological condition's worsening in dry territories and worsen environmental problems. Though in Kazakhstan pastures give more then 70% of forage for livestock production, only 60-70 million ha of pastures are used99, and the territory of not used and wasteland is made for about 100 million ha100.

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97 htt: //enrin. drida.no/aral/aral sea/ Russian/land/land.htm#kazah

98 SoE of Kazakhstan. Report on Human development. Kazakhstan, Alma-Ata, UNDP.

99 Tchaar Shilkhorn Van Vin, I. Alimaev, B. Utkelov, Kazakhstan: Pastures in transition period: resources, users, rational utilization. Report of World Bank. www. worldbank.org .

100 At the same place.

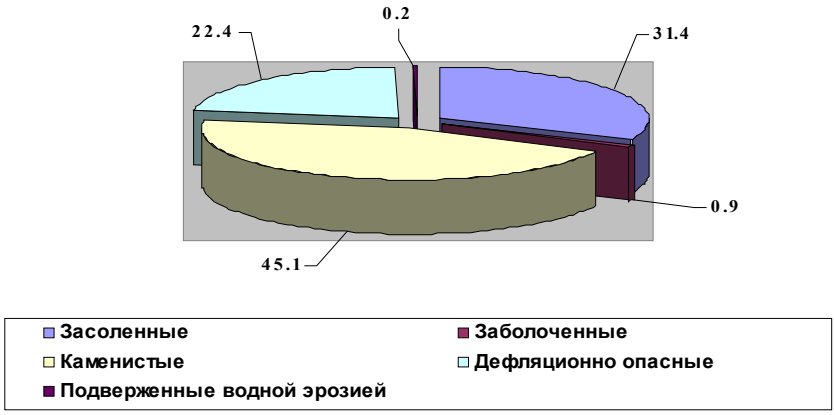

Figure 33. Cropland' characteristics according to the signs which effect on soil fertility in the Republic of Kazakhstan101

747. Only 64% of planting are in the basin of Aral (southern) is irrigated at the territory of Kazakhstan102 .

748. The first and the main reason of environment degradation is human activity which constantly damages condition of soils, water and air.

749. Soil quality worsens due to urbanization and erosion.

750. It should be pointed out that 98% of all food is given by land, and according to some assessments from the second half of 20th century for about 17% (more than 1.2 billion. ha) of fertile land were subjected to considerable waste in the whole world, and approximately 9 million ha were totally wasted.

751. In course of urban growth more area began to occupy roads, dumps, places of waste disposal, industrial enterprises, reservoirs, recreational complexes and houses themselves. Considerable areas turned out to impenetrable surfaces (covered with asphalt for example); as a result rainy and melt waters instead of soaking into the soil and filling underground water bearing layers, were taken aside where quickly evaporated.

752. At present time the main and everywhere existing factor of soil waste is erosion which occurs as a result of human mistakes while land' exploitation. As a result of water erosion upper soil layer is washed in 25 times faster than not touched nature areas. Organic matters which define land' fertility are accumulated exactly in this layer. Erosion leads not only to fertility losses: small silt particles taken away by water fill reservoirs, rivers, lakes and bays that absolutely changes the character of locality. Practice of merciless land' cultivation, cattle overgrazing, deforestation, salinity and direct pollution by chemicals promote erosion.

[101] SoE of Kazakhstan.
[102] 2000-2001. Drought, p. 20

753. For 1999-2006 ecology of dry and other land of the Republic of Kazakhstan in spite of taken measures improves very slowly. For indicated period contaminants emissions per head increased for 22 percent and in 2006 for 191 kg. Formation of industrial toxic waste for indicated period increased in more than 2.8 times, and emission of liquid and gaseous contaminants in more than 1.3 times.

754. Though for 1999-2006 costs for environment increased in 4.2 times, investment rate allocated to environment protection and nature resources usage in 24 times.

755. From the other side quantity of constant pollution sources increased in more than 2.2 times. Such ratio indicates about ineffective usage of targeted resources directed to ecological condition improvement in the Republic of Kazakhstan.

756. Factors that strength pastures' waste:

- - excessive pasturing and consequent risk of damaging of biological balance;
- - waste disposal of livestock production and industrial production;
- - weeds' planting or animals' disease which can bad impact on diversity of flora and fauna;
- -irrational burning of animal fertilizers that cause impoverishment of land' soils' resources;
- -natural disaster, weather cataclysms; fires etc.

6.2.2.2 Kyrgyzstan

757. On ecology of dry regions of Kyrgyzstan influence the geographical location and climatic conditions effect. Main part of republic's territory is located in the zone of moderate climate and only south part refers to subtropical zone. Location of Kyrgyzstan towards Eurasia, remoteness from oceans and seas and desert closeness are the factors that determine its climate both dry and continental. Thank to considerable difference in relief and availability of such a big lack as Issik-Kul, climate changes from sharp continental to marine climate.

758. In the republic major part of the territory is occupied by prairie zones which differ for lowland (1000-1600 m), middle mountain (1600-2500 m) and highland (to 3500 m) depending on the sea level's height.

759. In prairie together with numerous ephemers and wormwood also grow wheat-grass, desert-candle tanned, hay plant, East Indies bluestem and many other interesting plants, for example saryndyz (Inula), Ferula, milfoil, burning bush. In prairie rarely can be met trees and shrubs as almond pistachio and separate trees of archa.

760. Major part of land in dry regions is subjected to desertification, degradation of plant cover, sand deflation, water erosion, soil salinity, process of anthropogenic desertification, soil pollution by industrial disposal, pesticides etc.

761. Pastures are one of the main components of dry regions. Pasturable ecological system at present time is pressed by direct impact of human activity. The highest population density (33.85 thousand head per km2.) which is typical for lowland prairie led to their full damage.

762. From the other side, constant population is almost absent in alpine and sub alpine meadows (0.09-0.94 head km2.) Cattle grazing is the leading effect factor on the pastures.

763. At present time pastures' overload has led to productivity reduction, to overgrowing by weed and noxious plants. As a result degradation degree of pastures in Chuyskaya valley of Issik-Kul trench is estimated as a strong degree. In general up to 50% of dry regions' territories are wasted[103], this tells about bad ecological condition of these territories. Worsening of ecological condition has a tendency for growing. It should be pointed out that for last years processes for rehabilitating pastures have grown but their speed is very far from demand. Complexity of this process is that funds' reduction for ecological situation rehabilitation in dry areas has led to considerable reduction of different chemicals' application and this reduced pollution of soils and surface water resources. From the other side efficiency of irrigation system has worsened. Both positive and negative tendencies in conditions of land resources in dry areas are consequences of economical principals' changing.

764. Hydro ecosystems play an important rope in ecological and economical stability of Kyrgyzstan. Hydro ecosystems help to clean polluted flows, carry out water transportation, and provide landcape's watering. Total annual flow of Kyrgyzstan's rivers is made 45³ km of water on which depends the prosperity of not only Kyrgyzstan population but also population of Central Asia.

6.2.2.3 Tajikistan

765. Problem of land waste and ecological situation worsening in dry areas of Tajikistan becomes more actual by years. As in other Central Asian countries land degradation in dry and half-dry regions of Tajikistan is caused by climate change, anthropogenic factor and result of grasshopper plague.

766. Pastures and hayfields are made more than 3.08 million ha or 20.91% (2005) of total land area of the republic. Pastures are the sources for fodder base of desert livestock production, forage reserves according to the specialists are made more than 1.6 million tons of dry mass per year 104.

[103] http://trek-kyrgyzstan.com/ru/kyrgyzstan/flora
[104] Akhmadov Kh.M. Pasturable waste in Tajikistan. www. Internet. ahmadov@yahoo.com

767. Pastures' flora considerably changes due to extensive usage of pastures (mainly in south regions of the republic) and under the influence of excessive cattle grazing. As a result grass stand productivity reduced in 5-10 times for the last 10 years105.

768. For the last 40 years productivity of all pastures' types has reduced in average from 12.5 to 20% under the influence of human being - uprooting of eurotia an wormwood, unsystematic cattle grazing106.

769. Activities for replacing perennial fodder plants with strong roots by not deep root system led to strengthening of wind and water erosion in the pastures. From the other side cattle over grazing leads to soil packing and hydro-physical and salt regime changing. Salinity processes develop when moisten soils are packed.

770. According to data of Kh. M. Akhmadov in some provinces of the republic (territories of Gissar ridge) at the sites of extensive cattle grazing in 15029 times less in comparison with rehabilitated grass stand and rate of forage reserves is made only 0.4 centner ha^{-1} 107.

771. The main factors of these negative phenomena are: climate changing, deforestation, wrong irrigation methods, excessive cropland' exploitation, intensive grazing, intensive development of nature resources, strengthening of ravine and landlide formation, development of road-communicational and irrigational networks, grasshopper plague and others.

772. In spite of water resources richness and high moistening of a number of districts, part of Tajikistan is occupied by the deserts. Here refer the eastern Pamir up to 40-50%, small areas (30-40 thousand ha) of south and north Tajikistan in the mouth of Pyandj, Vakhsh, Kafirnigan and Syrdarya rivers[108].

773. Negative tendencies of land waste are observed due to the absence of pasturable rotation at the territory of all winter and 80% of summer pastures. Pastures waste strengthening comes out in reduction of their productivity.

Main anthropogenic factors which impacts and strengthen the process of land waste and desertification in Tajikistan are:

- -destroying of flood tugai forests at the territory of Kulyabskiy and Kurgan-tyube oases in 1930-1940;
- -wide scaled deforestation of mountain wide-leaved and archa forests for fuel and construction materials;
- -plowing area extension from 200 thousand ha to 800 thousand ha, together with instead of local agriculture was used heavy techniques and mono crops;

[105] At the same place.
[106] At the same place.
[107] At the same place.
[108] http://enrin.grida.no/htmls/tadjik/soe zon/rus

- -irrigational development of valleys consisting of loess like and sandy-rocky soils in south and north Tajikistan;
- -intensive usage of pesticides and mineral fertilizers in all agricultural zones and farms' categories;
- -irregular cattle grazing, in particular at winter pastures;
- -absence of biotechnical activities in all grazing types;
- -fast population growth;
- -irrational planning and usage of the land for construction of housing, industrial and other economic objects;
- -intensive development of highways, irrigation and communication networks;
- -overregulation of rivers' flow;
- -area and scales' extension of mining workings and others.

774. Drought that took place during 2000-2001 made a bad influence on land waste and desertification. As a result more than 300 thousand ha were destroyed, loss had been made up to 100 million USD. Losses caused by drought only in 2001 were made 4.8% of GDP or 16.8%[109].

775. And the frosts of 2007 according to the minister of agriculture of the Republic of Tajikistan K. Kosimov caused the losses at a rate of more than 130 million USD[110].

776. As a result of Moroccan grasshopper plague agriculture of the republic received income of 2 million USD less[111].

777. During last yeas big damage is caused by pests, in particular grasshopper, after plague of which pastures' degradation sharply strengthens.

Ways for overcoming the waste of pastures

778. Scientists of Tajik scientific-research institute of forest farm headed by professor Kh.M. Akhmadov designed the methods of stable usage and rehabilitation of pastures and creation of rangeland.

779. This method is designed both for autumn-winter-spring pastures and for summer pastures and cover more then 3570.0 thousand ha of pastures. Wide-scaled application of this method promotes the reduction of pasturable digression and cattle provision by pasturable forage.

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[109] Drought. Management assessment and effects' softening for Central Asian countries and Caucasus. World Bank Report. № 31998 ECA, 11 March 2005. – p. 11.
[110] Agriculture of Tajikistan - if there is no flour we will eat wild root crops. D. Dinorshoev. Web site. dinorshoev_d@mail.ru 11.08.2008.
[111] At the same place.

780. Government makes many efforts for preventing land' degradation but serious lack of finance does not allow realizing all the complex of planned measures. International targeted investments and increasing of budget financing are required.

781. Only on the basis of projects of TASIS program of European Union in 1991-2006, 69.25 million euro were allocated for the development of various economic sectors, including an improvement of ecological and reclamative condition of land. Totally, more then 499.75 million Euro was invested for economics development by donor countries of EU[112].

782. At present time for about 4000 pollutants are registered in the republic.

783. Monitoring over water resources condition is carried out by 6 different departments and monitoring over land' utilization and condition is mainly carried out by 3 departments: State land management committee Rt; Glavtajikhydromet and GKOOS and LH RT[113].

784. Though in the republic observation over ecology in dry areas is carried out by the "Observation Center over nature protection", but its activity requires further improvements. Thus, till 1990 observations over surface waters' pollution were carried out in 46 rivers, 6 lakes and in 1 reservoir. Content up to 40 organic and inorganic contaminants was determined. However from 1994 to 1997 observations over surface waters' pollution were not done. From 1998 such observations were carried out only in 21 rivers for 20 contaminants. It should be pointed out that in 1990 radiometric observations were carried out in 27 stations and at present time in 16.

785. In 2004, 1.9% (2003 – 4.2%) of republic's irrigation land were subjected to salinity and logging114.

786. One of the reasons of ecological situation worsening is continuous disposal growth from the enterprises of chemical and mining industry.

787. Wastes of mining enterprises contain the compounds of mercury, antimony, lead, zinc and due to unsatisfactory conditions of transportation and storage sometimes can be leading factors of water pollution. According to 2002 data, 8 from 22 "tail" storages are in unsatisfactory condition[115].

788. Te biggest sources of toxic industrial waste formation is TadAz, PO "Tajikkhimprom", PO "Tajikcement", Vakhsh nitrogen-fertilizer plant, yavan electric chemical plant and others. From 400 names of industrial wastes from 5 to 50% of wastes are processed. Polygon of

[112] www.evrostst.
[113] Ministry of agriculture and nature protection of the Republic of Tajikistan. Sector strategy "Rehabilitation of ecological monitoring system in the Republic of Tajikistan", Dushanbe, 2007. p. 5, 12
[114] State statistics committee RT. Informational bulletin for food security and poverty. №1/2005. www.stst.tj.
[115] Information sources: State statistics committee RT, LPHO RT, Ministry of nature RT.

radioactive waste disposal in Fayzabad district for last years became unsatisfactory due to unsufficient financing[116].

789. In near future strengthening of glaciation waste processes will considerably impact on ecological situation of dry areas of Tajikistan.

790. According to the specialists' assessments, air temperature increasing for 2-3°C in medium-term perspective will strengthen the process of glaciation degradation that promotes a disappearance of thousands small glaciers in the mountain part of Tajikistan's territory.

791. As a result area of total glaciation in the country can be reduced for 20%, ice volume - for 25-30%. In initial period ice ablation will promote the flow increasing of separate rivers and partly compensate flow of other rivers, and then disastrous fall of water will take place in many rivers[117]. This worsens an ecological situation in the country, strengthens the processes of desertification, lack of water, land' degradation, reduces crops' yields and pastures' productivity, and reduces the speed of social-economical development of the territory.

792. As a result of ice waste, water resources of the republic in middle-term perspective will increase in one regions (Western Pamir) and reduce in others (basin of Zaravshan river, Kafirnigan etc.). For this reason nature disasters can increase, in particular mud flows and floods as well as drought and desertification.

793. Consequences of climate warming to the ecology of territory: icy winter reserves reduce, many years icy area will reduce that leads to water resources reduction; water flow from winter reserves will reduce; summer flow of ice ablation will increase during initial period and will reduce during following years.

794. According to the specialists as a result of warming, risk of infectious - parasitic diseases spread, including malaria will increase in particular in low stream of the Vakhsh, Kafirnigan, Pyandj and other rivers.

795. Analysis of qualitative indexes of land in dry areas shows that under the influence of different factors, in particular erosion takes place the process of share reduction of productive land.

6.2.2.4 Turkmenistan

796. Degradation of land and water resources of the republic's territory, changing of climate had serious consequences both for agriculture and environment and for social-economic conditions of rural population.

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116 The same.

117 http://enrin.grida.no/htmals/tadjik/soe2001/rus;

797. Drought that took place in 2000-2001 in Central Asian countries caused ecology worsening in dry areas of the republic,118 as a result of which:

- - during these years rainfall's level reached only 40-60% of standard;
- - river flows reduced for 35-40% from average level;
- - lack of irrigation water became more;
- - water level in underground sources reduced that led to organization of potable water for population;
- -desertification and deforestation processes were intensified;
- -drought-stricken people of rural area lost almost 80% income;
- -poverty level increased;
- -cases of malnutrition and disease became frequent caused by infected water.

798. Water resource of Turkmenistan is mainly formed for the account of Amudarya flow as well as of Mugrub River's flow, stream of which starts from Afghanistan and the Aenjen River which starts from Iran.

799. *Surface of water resources in the republic* is made 24.4 km^3, that is made 12.4% of water surface of Central Asian countries. Groundwater are made 3.4 km^3 and 4.4% respectively. Water resources per head are made 6.739 m3/year that is for 28.5 more than average rate of Central Asian countries.

800. Results of anthropogenic activity turned out to be very sad and at present time part of Turkmenistan's territory (Dashkhovuz province) has been already acknowledged by international community as a zone of ecological disaster.

801. Together with subjective reasons which caused the nature environment's degradation there are a number of objective reasons, including the lack of finance and material-technical means, which are required for realization ecologically safe hydroeconomic and other projects, complicated demographic condition, which is the reason for necessity of yearly increasing of agricultural products' production.

802. Relatively low supply of irrigation land by drainage, poor natural drain, extremely unsatisfactory level of inter-farm collector-drainage network's exploitation due to the lack of reclamation techniques in the farms and qualified technical specialists, breaking irrigation regime and techniques are the main reasons of bad reclamative condition of irrigation land in Turkmenistan.

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118 World Bank Report. Drought: Assessment of management and effects' softening for Central Asian countries nd Caucuses. 11 March 2005. p. 11.

803. An additional problem is Aral Sea drying and huge territories formation of former sea bottom which are subjected to wind erosion. Dust consisting of salts, fertilizers and pesticides is a strong mixture which is dangerous for human being and environments. Every year 43 million tons of salts are taken from the basin of Aral Sea and silt at the area of 1.5 - 2.0 million cubic km, badly impacting on neighbor agrarian regions119.

804. Due to waterless climate desertification is the main problem in Turkmenistan. According to some assessments, desertification covers approximately 70% of Turkmenistan's territory. The main reason of desertification speeding up is intensive agriculture, construction projects, oil and gas designs.

805. Area of yearly losing plowing land due to desertification has increased from 11 thousand ha in 1959 to more than 40 thousand ha in 1970 and this index left without changes at least till the end of 1980s.

806. Main reasons of desertification development in this republic are intensive agriculture without proper reclamation - technical measures, construction, oil and gas surveys.

807. Desertification first of all connected to degradation of plant's cover, wind and water erosion and salinity. Secondary processes also can be pointed out, in particular anthropogenic and zoogenic desertification. Regional land using system improvement closely connected to the removal of negative phenomena caused by soil erosion.

808. From total Turkmenistan area of 49.4 million ha about 20 percent refer to erosion subjected, mountain and foothill territories; 80 % of deserts in this or that extent are subjected to deflation. Erosion from rainy water more intensively appears at the mountain slope soils, at foothills and flat relieves. For example, in interfluve of Tedjen and Atrek area of differently eroded land reaches one and half million hectares. Due to increased surface flow at some low land of Kopetdag capacity of humus layer hardly reaches 10-15 cm. Along the process of surface washout on the main soil types, can be observed the formation of small streamed washouts, gully and ravines. Wrong irrigation planning with high water rates causes irrigational erosion which leads to 2.5-3 t ha^{-1} soil mass losses every year.

809. Researches of scientists who carried out monitoring for cropland' quality condition during 1985-1990 indicate that for given years area of saline soils increased in 0.3 times and logged soils in 0.2 times[120].

[119] SoE of Turkmenistan. http://enrin.grida.no/enrin/htmjs/turkmen/soe2/index.thm; Statistic collection "Environment protection and rational usage of nature resources in Turkmenistan". National Institute of Statistics and Prognostification of Turkmenistan, Ashgatat, 1990, 1994, 1995; Atamoradov Kh and others "Preservation of biological diversity of central Asia", Turkmenistan, Ashgabat, 1997.; Intergovernmental statistics committee of CIS countries, Moscow, 1996.

[120] At the same place

810. Application of pesticides leads to soil pollution. According to the observations over condition of soil pollution in 1997 kolkhozs and farms of Akhalk, Mariy, Lebap and Dashkhovuz provinces were considered as the most polluted.

811. Lebap province refers to the regions of less polluted in 1997.

812. It should be pointed out that for the last years number of observations over the condition of soil pollution by pesticides sharply reduced. This does not give chance to make a detailed assessment of soil pollution in Turkmenistan.

813. According to the observation in 1997 traces of pesticides - DDT and their metabolites as well as ГХЦГ were found in all Turkmenistan regions. The most polluted soils contained alfa ГХЦГ, content of which has been made 0.0013 - 0.0047 mku/kg.[121]

814. Everyday and industrial waste waters in Turkmenistan discharge to the desert in such a way that they effect on groundwater but do not pollute surface waters. Agricultural drainage waters which fall into the river without control have increased content of mineral salts, phenols, pesticides and other harmful compounds in the water. As a result, dangerously high concentration of salts and toxic matters accumulated along the whole length of rivers, in particular in mouths.

815. Dashkhovuz province was acknowledged by international community as a zone of ecologic disaster where social-economic development of region should be carried out in unity with solving the problems of nature usage and environment protection.

816. Ecological condition of water resources in dry regions.

817. More than 90% of consumed water in Turkmenistan is used for irrigation, watering and agricultural water supply. From total volume of consumed water 8% is used for industrial needs and 1.5% for economic - potable needs. Water consumption per head has constantly increasing. Specific indexes of water consumption per head are made: in cities - 160 l/per day, in villages of urban type - 57, in rural areas 0 34 l/day[122].

818. Together with natural shortage of water resources difficult hydro economic situation partially can be explained by high rates for fields' irrigation and leaching, low efficiency of irrigational systems, considerable losses for filtration, evaporation, leakage etc.

819. Amudarya River is a main water arteries of Turkmenistan. For Lebap and Dashkhovuz provinces this river is the main source for crops' irrigation. All industrial enterprises located along the river's bed use its waters in technical purposes.

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[121] SoE of Turkmenistan. Statistic collection "Environment protection and rational usage of natural resources in Turkmenistan". National Institute of statistic and prediction of Turkmenistan, Ashgabat,1990,1994,1995. Atamoradov Kh and others "preservation of biological diversity of Central Asia", Turkmenistan, Ashgabat, 1997. // Intergovernmental statistics committee of CIS country, Moscow, 1996.

[122] Data of Ministry of Nature using and Environment protection of Turkmenistan. Data of scientific-productive center of ecological monitoring of the Ministry of Nature using and Environment protection of Turkmenistan.

820. Ecological load on this water system was increased as a result of economic activities and led to water quality worsening. Water balance also was destroyed.

821. Monitoring results of qualitative composition of Amudarya waters revealed the changes of average mineralization and hardness and their gradual increasing has been observed. Initial mineralization in 1962 was made 327 mg l^{-1}, in 1967 - 779 mg l^{-1}, in 1990 and at present time in certain withdrawal points (Dargan-Aga village) it is equal to 2-4 g l^{-1}. Such data spread is connected to waste economic-everyday waters' discharge in indicated points. If in 1940 it was equal to 4.2 mg. eqv l-1, then in 1991 this rate was made 8.1-9.0 mg. eqv l-1 at MPC of 7.0 mg. eqv l-1. Observations showed that concentration of SO4-ions, Cl-ions, NO3, phenols is higher than MPC. Together with this concentration of main components varies depending on the season[123].

Factors impacting on ecological condition of water resources

- - anthropogenic factors: discharge of industrial and economic waste waters into the river, using the water by industrial enterprises in technical purposes.
- - not organized discharge of collector-drainage waters, surface flows during rain and snow melting periods;
- - natural factors such as natural evaporation and water filtration.

822. Main sources of water pollution in the republic are as follows: collector-drainage system (70-80%); fuel and energy complex (8-12%); communal services (2-3%).[124]

823. The most spread pollution types are: NO3-N - 1.7-7.0 MPC; oil products - 1.8-9.0 MPC; phenols (volatile) 12-16 MPC; pesticides (choroorganic) - 2-13 MPC; SO4 - 1.8-7.5 MPC.

Measures for improving the quality of water resources:

- -to tight the control over water intake for potable, economic, industrial purposes and irrigation;
- -to strengthen monitoring of waste waters' volume and quality;
- -modernization and construction of water cleaning structures;
- - to prohibit a discharge of collector-drainage waters;
- - to reduce the crops' areas in the region of tugai forests;
- - to improve an activity of Ministry of nature using and environment protection of Turkmenistan and their structure;

[123] The same
[124] The same

- - to improve the activities of Scientific-productive center of ecological monitoring and National institute of deserts, flora and fauna and also regional nature protection management.

Water management

824. Due to ineffective water using system and systematic ecological condition's worsening more and more rural population started to feel water supply shortage. Absence of coordination system and inter-branch integration both in national and regional levels has worsened the land and water waste process. Main reasons of this situation are: big specific weight of water consumption in agriculture; non development of hydro economic infrastructure; ineffective operation of hydro economic structures; low level of main canal maintenance; big specific weight of losses (from 25 to 48%)[125] of water in main canals of inter-farm systems.

Proposals

825. 97% of cultivated land in the republic depend on irrigation. In order to prevent land and water waste it is necessary:

- - to improve the management of irrigation and drainage waters' usage;
- - to rehabilitate and modernize hydro economic infrastructure;
- - to concentrate foreign and domestic financial resources for preservation of marginal meadow pastures against further erosion and desertification;
- - diversification of crops (safflower, millet, sunflower) adapted to local nature-climatic conditions and integrated agriculture system;
- -water and soil conservation: increasing of salt and drought-resistant plantings as saxaul example.

826. Due to Aral Sea drying crops' quality worsens, air pollution increases, limitation of water resources is felt more and more. Analysis of qualitative indexes of the land in dry areas shows that under the influence of various factors, in particular erosion share of productive land reduces.

827. Factors that worsen land' ecology are as follows: water erosion; erosion during irrigation; erosion as a result of mineral fertilizers and pesticides application; deflation (wind erosion).

828. Territories located in foothills and lowland zones are strongly subjected to water erosion.

829. Wind erosion or deflation is spread in the zones of active wind activity.

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[125] World Bank Report. Drought: Management assessment and effects' softening for Central Asia and Caucauses. 11 March 2005. p.25; Royal Haskonings, 2001. Water and environment management Project, regional report, №2; «Regional hydro economic system for the countries of Aral Sea basin», Water and environment management Project, 2003; «Strategic ways of the Program for Aral Sea basin», political report ECSSD, August 2003.

830. One of the reasons of this situation is imperfect structure of crops' allocation and cultivation technology of cotton and grain which occupy more than 80% of planting areas (in some farms more than 90%).

6.2.2.5 Uzbekistan

831. Anthropogenic climate changing has mesoscale character and mainly connected to intensive land development. When irrigation land' area in Hungry prairie has reached 60% leading role in heat exchange processes started to belong not to turbulent heat flux but to costs for evaporation (70% from radiation balance)[126]. Thus, considerable part of earlier dry desert territory of Hungry prairie has obtained the features of oasis with corresponding reduction of summer temperatures and air moisture increasing. The same climate changes took place in Fergana valley.

832. Because of too much water spent for irrigation desertification took place in Priaral where as a result of considerable water level reduction, ecology of dry areas adjoining to it has worsening.

833. Soils of Priaral zone for 43% are polluted by chemical fertilizers, pesticides and phenols. In Khorezm province huge area is strongly polluted in the line from Urgench to Mangyt where DDP content in the soils has reached 24-28 MPC. In the republic of Karakalpakstan at the left-bank of Amudarya, in Khodjaliyskiy, Shumanayskiy, Konlikul'skiy districts MPC is made 15.

834. Due to Aral Sea drying crops' quality worsens, air pollution increases, limitation of water resources is felt more and more. Analysis of qualitative indexes of the land in dry areas shows that under the influence of various factors, in particular erosion share of productive land reduces.

[126] Chub V.E. Climate changing and its influence on nature-resource potential of the Republic of Uzbekistan. Glavgidromet of RU, Tashkent, 2000. p. 115.

Table 109. Area of agricultural crops subjected to erosion in the Republic of Uzbekistan, (2001)

Land' category	Total land, thousand ha	Including			
		Not damaged by erosion	Damaged by erosion	Damaged by wind erosion	Damaged by water and wind erosion
Cropland	26734	1551	2700	20478	2005
Specific weight, %	100	5.8	10.1	76.6	7.5
Including irrigated					
A) Arable land	3308	569	341	2057	341
Specific weight, %	100	17.2	10.3	62.2	10.3
B) Other land	425	212	-	213	-
Specific weight, %	100	49.9	-	50.1	-
Irrigated land	23001	851	2346	18125	1679
Specific weight, %	100	3.7	10.2	78.8	7.3

835. According to specialists' calculations under the influence of salinity and soil erosion, water mineralization and other symptoms every year for about 20'000 hectares become not suitable for agriculture.

836. Erosion negatively impacts on the soil's condition and worsens an ecological situation. As a result of erosion humus is washed out from plowing layer, energy and nutrients reserves exhaust in the soil that leads to soil fertility reduction. Factors that worsen land' ecology are as follows: water erosion; erosion during irrigation; erosion as a result of mineral fertilizers and pesticides application; deflation (wind erosion).

837. Territories located in foothills and lowland zones are strongly subjected to water erosion. 624.4 thousand ha of land that is made 14% of all irrigation land are subjected to water erosion. From them 4.5% refer to moderate and strongly subjected land. Especially subjected to water erosion the land of Tashkent (138.6 thousand ha), Samarkand (121.9 thousand ha) and Kashkadarya (159.7 thousand ha), Navoi (Nurata and Khatyrch districts) provinces.

838. Wind erosion or deflation is spread in the zones of active wind activity. All the districts of Karakalpakstan, Khorezm, bukhara, Surkhandarya (except Sariasiyo and Baysun districts), Navoi and also Arnasay and Farij districts of Djizzak province, Khavass, Mekhnatabad districts of Syrdarya provinces are subjected to wind erosion. Totally 50% of desert zones' area is subjected to wind erosion.

839. Small specific weight of cropland subjected to wind erosion is located in Syrdarya (88% of territory), Bukhara (78%) and Khorezm provinces 73%) and in the Republic of Karakalpakstan as well (71%).

840. One of the reasons of this situation is imperfect structure of crops' allocation and cultivation technology of cotton and grain which occupy more than 80% of planting areas (in some farms more than 90%).

841. At present time traditional technology negatively impacts on ecological situation and productivity efficiency of agricultural crops.

842. As a result of using the technology of saline land hydro reclamation which is based on salts' dissolving by big flow of irrigated water took place the mineralization of river water in the mouth of Amudarya to 1.502.9 g l^{-1}. Development of irrigation agriculture led to the formation of big volumes of drainage waters (30-35 km^3 year-1), which are polluted by mineral fertilizers and soil salts washed out from the fields. All this led to soil fertility reduction for 30-50%[127].

843. Too much water spent for irrigation and bad drainage systems' condition led to groundwater lifting. Population that lives along the beds of Amudarya and Syrdarya rivers are unfavorably influenced by ground water's level lifting. More then five million people or 20% of total amount of population live in the regions where level of groundwater is less then 2 m.

844. Water quality of Syrdarya and Amudarya rivers sharply worsens in all the sites from from head till mouth. In upstream water mineralization increased for 0.2-0.3 g l^{-1}, in middle streams - for 0.5-0.7 g l^{-1}, in downstream - for 1.0-1.5 g l^{-1}[128].

845. In the republic area of pastures constitutes for about 17.5 million ha where more than million people lives, for about 4.2 million karakul sheep breeds, all karakul breeding production produces, half of plant production (mainly rainfed, grain, different types of legumes and oil crops).

846. In the republic 84.6% (20858.0 thousand ha, by January 1st 2007) of land in dry areas are focused in Karakalpakstan, Bukhara, Karshi and Navoi provinces. From them about 42% falls on Navoi province.

847. Joint venture for minerals mining works at the territory of Kenimekh district of Navoi province. This and other mining enterprises in course of their work use groundwater. Used water is taken to the fields (pastures), this leads to creation of artificial reservoirs with polluted water - land logging by water erosion.

[127] «Agro ilm», №1, 2007, p.30.

[128] **General Report:** existing situation and perspective of agricultural sector. Prepared for Asian Development Bank and Ministry of Economy of the Republic of Uzbekistan (tar: uzb 37148), 12 March, 2005; Project of Government's proposals for Market Principles introduction into water management.

Figure 34. "Korakota" territoty of Kenimekh district of navoi province. Water ravine, December, 2007.

Figure 35. "Korakota" territory of Kenimekh district of Navoi province. Water logging, December, 2007.

Figure 36. "Korakota" territory of Kenimekh district of Navoi province. Deposits of salt, December 2007.

848. Thus, more than 15 ravines with area of 1.5-8 hectares were formed at the territory of shirkat farms “Madaniyat” and “Korakota”.

849. Salinity has become a global problem in dry regions. Redundant content of water dissolved mineral salts in ecological niche as a result of osmotic and toxic impact holds back the growth and development of plants, reduces their productivity and technical features. In the Republic of Karakalpakstan, in Khorezm and other dry zones even in winter salinity process is continued by the influence of dry sold winds[129].

850. Ecology of dry regions worsens in parallel with land’ salinity, which speeds up the process of pastures’ productivity reduction, in particular in sandy zone. By the researches of UzNIIKEP’s scientists was determined130 that due to irrational usage of pastures and other factors, sands are overgrow by mosses (about 1.0% of territory), sands’ mobility for more than 1 million ha of land. Territories of waste pastures close to villages and wells (35-40%) extend causing the process of desertification. Productivity of pastures is made 1.5-3.5 centner ha^{-1}. Fodder plants of the desert are eaten less (15-30 %), digestion (50-55 %) and nutritious value (0.3 -0.5 fodder units and 30-35 g of protein and 1 kg of forage). As a result of infrastructure non-development in dry regions - desert livestock production (41.7 % of water sources needs repair), load increases almost in 2 times on grazing territories.

851. Various factors can be the reasons of desert zones and pastures waste: i) cattle overgrazing (44%); ii) plants cutting for oil (25 %); iii) reduction of water sources (15 %); iv) mobile sands’ coming (10 %); v) land’ plowing under the crops (5%); vi) destroying the plants’ cover construction of roads, lines of energy-industrial complex; vii) mines and carriers (1.0 %).

852. Consequences of these are: uncovering of land’ surface, degradation of pasture sites near villages and wells, appearance of mobile sands, industrial waste bank (spoil bank). As a result biological productivity of pastures and their fodder capacity reduce and it should be considered as beginning of desertification process development.

853. Measures for preventing pastures’ waste:

854. i) designing of new system of rational and effective pastures’ usage; ii) usage of resource saving and nature protective technologies; iii) construction of new and reconstruction of soil water sources; iv) implementation of special activities and technologies for fixing mobile sands; v) re-cultivation of land allocated for industrial complexes and others.

855. Measures for preventing water and wind erosion:

856. i) irrigation techniques improvement and observance of irrigation norms; ii) application of chemical protection means against water erosion - synthetic polymers , policomplexes (K-4, K-9, THM-1), and humin; iii) application of biological means (biohumus, chlorella etc.); iv)

[129] M//Agriculture of Uzbekistan, №4, 2007, p.38
[130] Web site: www.virtualcentre.org

usage of advance technologies (raised-bed planting, bentonite application and others); v) planting of protective trees; vi) taking agrotechnical and chemical measures against wind erosion and others.

6.3 Living standards

857. In 1990s in Central Asia was strengthened the subjection to social-economic effect, caused by diversification of property and management forms, by planting structure and drought that led to poverty increasing.

858. Poverty prevailed in rural area where share of poor population was made 40-80%.

Table 110. Rural population and poverty in Central Asia (1999)

Countries	Total population (x1000)	Percentage share of rural population	Percentage share of poor rural population
Kazakhstan	15,639	44	49
Kyrgyzstan	4,921	66	70
Tajikistan	6,089	72	85
Turkmenistan	4,644	55	81
Uzbekistan	24,912	63	н/д

Source: FAOSTAT; various investigations of agriculture condition and poverty, World Bank.

859. For the last years in all Central Asian countries damage caused to economics in 1980s of Soviet power and during first ten years after obtaining independence has been gradually overcoming which

860. Population amount and food volume was increased in all countries; process of increasing the income of rural population is going on. Though the poverty level has reduced it still remains high.

861. Reduction of rural families' income is typical for Central Asian countries. Low salary is the main reason of high poverty level in the village. Salary increasing in the village is in 2-3 times less in comparison with other branches of economic.

862. Low income level of rural population forces them to search for additional sources for improving family budget. Big amount of rural people in Central Asian countries, except Kazakhstan and Turkmenistan, mainly youth leaves rural area in order to search for a job abroad.

863. More than 50% in some cases 60 and more percents of income is spent for food.

6.3.1.1 Kazakhstan

864. Popluation amount of the Republic of Kazakhstan by January 1st 2008 was made 15571.5 thousand people, including urban - 8265.9 thousand (53.1%), rural - 7305.6 thousand (46.9%) people. In average 5.7 people come per 1 km2[131].

865. There are 14 provinces, 86 cities, 2 republican cities, 160 districts, 174 settlements, 7660 auls (villages).

866. 46.9% population of the country lives in the rural area, 32.6% from them has income lower then minimum living wage. Such population categories in Mangistau province was made 83.6% and in Kyzylorda province - 52.1%132. It should be pointed out that in 1996, 39.0% of rural population of Kazakhstan lived behind poverty line.133 In general around the country shares of population who has lower income than minimum living wage were made: 46.7%,in 2001, 31.6% in 2005, 12.7% in 2007.[134]

867. In general in the republic as a result of bad social-ecologic situation, due to the crisis in agrarian sector and broken system of population's life support only in 2000-2002 about 300 population's center were self liquidated and there are 136 rural population centers from which all population moved and at present time nobody lives there.

868. Elemental process of internal migration has continued in which during the years 1995-2006 participated for about one million people and more than 60% moved from village to cities.

869. One of the reasons of worsening the life level of rural population is social infrastructure of rural territories.

870. In particular, 72.4% of villages did not have water supply system. Moreover more than 63% of villages in the republic use the water for drinking from decentralized water supply sources, i.e. from wells, springs, artesian wells without distributing network. Quality of this water does not correspond to the standards on micro biological and sanitation chemical indicators of the republic. For about 9% of villages is supplied by imported water. Population share supplied by water supply system in 2006 was made 78.7%, in comparison with 75.1% in 1999 135. About 18% of villages are not supplied by health services.

871. Agrarian sector has remained as low profitable economic sphere.

872. Social-demographic processes directly impact on the development rate and proportions of macro-economic indicators.

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[131] Statistic Agency of the Republic of Kazakhstan, 2008.
[132] State program on development of rural territory of the Republic of Kazakhstan for 2004-2010. Astana, 2003. p. 234, 242 -243.
[133] Report on World Development in 2000/2001. Stepping on poverty. M.: Publishing house «Whole world», World Bank, 2001. p.302.
[134] Statistic Agency of the Republic of Kazakhstan.
[135] Statistic Agency of the Republic of Kazakhstan.

873. About 42% of rural population is represented at the age of 15. Labor sources of the republic for 2/3 are formed for the account of rural population, rate of growth of population and labor resources of the village leaves behind an average republican indicator.

874. Population of the republic for the last 37 years have increased in 1.2 times, but average annual rates of growth reduced in 1.3 times and such tendency has been continuing: in 1970-1979 - 1.4%, in 1980 - 1989 – 1.2%, in 1990-1999 - 0.9%, in 2000-2007 - 1.1%. At death rate reduction for 1997–2007 from 14.8 per thousand to 10.2 per thousand was observed the tendency of death rate increasing due to the disease of blood circulation system (51.7% of total number of dead) and malignant neoplasms in particular in rural area (11.5%) and also because of accidents, poisoning and injures (14.2%)[136].

875. As a result of ecological situation worsening in Kazakhstan, rates of maternal mortality (48.9 per 100 thousand of live-born) and infant mortality (15.1 per 1000 of live-born) have still remained high especially in such ecologically unfavorable provinces as Mangistau, Atyrau, Pavlodar, Akmol and South-Kazakhstan[137].

876. For 2000-2007 natality increased from 4.86 per thousand to 10.81 per thousand. But decrease in population (in average from 1.0 to 1.5 per thousand) is observed in Kustanay, Northern and Eastern-Kazakhstan provinces.

877. The main reasons of infant mortality are: worsening of mother's health condition; not appropriate care after newborns; worsening of prenatal care.

878. Expected lifetime of men in 2007 was made 66.69 years, women - 72.32 years138.

879. Economically active population for 2001-2006 increased from 7479.1 thousand till 8028.9 thousand people or for 7.3%.

880. Employment rate of economically active population in 2006 was made 92.1% (in 2001 - 89.6%). Unemployment rate was made 7.8%, total number of unemployed was 625.4 thousand people. And rate of youth unemployment is 12.1% and in rural area is even higher139.

881. In 2006 average monthly salary of one employee was made 53.23 thousand tenge. For 1995-2006 average monthly salary increased in 8.5 times. In agriculture this rates is much lower in comparison with average republican rate.

882. Cost per one labor force for 2000-2006 increased approximately in 2 times and in 2006 was made 556.7 thousand tenge, in comparison with 283.3 thousand tenge in 2000.

883. It should be pointed out that in rural area cost per one labor force for 35-45 % lower than in average in the republic and in 2.5-2.9 times less than in urban area.

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[136] Web site. www.arba.ru, news; http://go.worldbank.org; Kazakhstan Today, 28.06.2007,
[137] Web site www.arba.ru,; news; http://go.worldbank.org; Kazakhstan Today, 28.06.2007
[138] Statistic Agency of the Republic of Kazakhstan. Express information. N05-3a / 7-13., 2008.
[139] At the same place.

884. 24.1% of GDP was created in agriculture in 2006 (2005 - 26.3%), where 2406.0 thousand or 33.2% of people had been working including the employees working in forest and fish sectors, i.e. 30.5% of labor resources of the country.

Table 111. Rates of social-economic development in the Republic of Kazakhstan for 1995-2006[140].

Rates	2000	2003	2005	2006
Share of agriculture in GDP of the country, in %	10.0	7.6	7.7	7.6
Specific weight of employees in agriculture sector, in %	31.41	35.24	33.21	н/д
Average monthly salary, thousand tenge	14.37	23.12	33.81	40.79
GDP per 1 person, thousand tenge	174.50	307.47	468.68	634.0
Rate of national currency, per 1 USD/tenge	144.50	144.22	133.77	131.0
GDP per 1 person, in USD	1207.61	2131.95	3503.62	4839.7
Including per day per 1 person, in USD	3.31	5.8	9.60	13.26
Unemployment rate, in %	10.4	8.8	8.1	7.8
Specific weight of costs for food in the structure of population expenses, in %	46.4	46.4	40.0	40.0

885. Ecological situation worsening and land' waste caused the reduction of families' income, especially of rural families where the main part of incomes is formed in private farms and sites adjoining the farms.

886. Income rate of rural population of Kazakhstan has been made 456.6 USD per person per year against 2500 USD in general in the country.

887. Share of population with incomes lower than minimum living wage has been made 31% against 19.8% in general in the country.

888. Nominal cash income in average per head per month has been made: in 2001 – 7.6 thousand tenge, in 2005 – 15.78 and in 2007 – 25.22 thousand tenge.

889. 80-82% is made incomes from working activity of family members in the structure of household's cash incomes. At present time in general in the republic "Poverty depth" in average is made 3.9%141. In the structure of cash expenses share of consumers' expenditures is made 93.6% (2007) and this rate has decreasing tendency (in 2001 - 96.6%).

890. At present time the rates of minimum living wage in average in the republic of Kazakhstan is made 11927 tenge per month.

[140] Commonwealth of Independent States in 2005. Brief manual/ Statistic committee of CIS – M., 2006. – p. 306-310; Report on World Development of 2000/2001. Stepping on poverty. M.: Publishing house «Whole world», World Bank, 2001. – p. 296; http://www.cisstat.com/rus/index.htm MSK CIS

[141] Statistics Agency of the Republic of Kazakhstan, 2007. This rate is determined on the basis of minimum living wage. Minimum living wage is determined by 43 names of food (methodic was introduced from 1 January 2006) and percentage of food basket in it is made 60%.

Analysis shows that growth rate of salary in agriculture for 1991-2006 is behind the average growth rate of other economic branches and average republican rate.

891. Distinctive feature is that in desert livestock production in the structure of households' incomes from villages and farmers, big specific weight has the incomes from salaries and casual earnings: households - 33.83%, rural farmers 0 28.46%[142].

892. In agriculture in the income farm structure cost of sold animals (24.61%) and cost of sold meat, cheese and butter of home production (51.72%) totally is made 76.33%.[143]

893. Products of livestock production prevail in the structure of foodstuff consumption in dry areas, though during first ten years of independence products of livestock production have reduced almost for 40%[144].

Table 112. Agricultural structure of Kazakhstan,[145] in 2002.

Legal status	Number of units	Total territory of plowing land, thousand ha	Average size, ha	Share of market product, in %
Agricultural enterprises	9368	12.876	1374.5	22
Peasant farms	141328	8.311	58.8	26
Small farms	2154791	481	0.2	51
Total	2305487	21.668	9.4	100

6.3.1.2 Kyrgyzstan

894. Social - demographic development of the republicentner has its own features: more than 64% of population lives in rural area; about 31.0% of rural population is represented at the age of 15; about 80% of labor resources is formed in rural area; growth rate of population and labor resources of the villages are much more higher than republican rate and as a result of this main labor activity of republic's population is formed in rural area.

895. Analysis of macroeconomic rates shows that for the last ten years development rate of the branches of national economics reduced very much. This tendency especially was activated when Kyrgyzstan became a member of WTO.

896. In spite of some stability and in some years even growth of macro economic rates, Kyrgyzstan remains to be one of the poorest countries in Central Asia. In 2005 GDP per head was made 475 USD.

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[142] Source: HBC, Livestock production of Kazakhstan – support of branch revival. Program of combined economic researches. World bank Report, Washington, June 2004.
[143] At the same place, and review of households' budget.
[144] World Bank: Investigation of livestock production branch of Kazakhstan. Brief note: Support of livestock production's products distribution.
[145] Livestock production of Kazakhstan – support of branch revival. Program of combined economic researches. World bank Report, Washington, June 2004

897. Poor development of market infrastructure and imperfection of institutional base limits the development of agro food production distribution as inside the country so for export. It should be pointed out that at the background of poverty problems exploitation level of natural resources is observed, anthropogenic press on natural and artificial ecosystems increases.

898. By January 1st 2008 population of the Republic of Kyrgyzstan was made 5.22 million people146. With total territory of 199.9 thousand km2, 26.1 persons fall per 1 km2. Typical feature is that 54.1% of territory in the republic is made cropland, 5.4% of land is covered by forests, other land constitute 36.4%.

899. 5% of the territories are focused here, 8.6% including 9.4% of rural population of Central Asian republics147. Social-demographic development of the republicentner has its own features: more than 64% of population lives in rural area; about 31.0% of rural population is represented at the age of 15; about 80% of labor resources is formed in rural area; growth rates of population and labor resources of the villages are much more higher than republican rate and as a result of this main labor activity of republic's population is formed in rural area. Population of the republic during 1979-2008 increased in 1.5 times, but average annual growth rates have decreasing tendency: if natality coefficient in 1988 was made 23.8, then in 2005 it was made 15.0.

[146] Web site. www.stat.kg

[147] Report on World Development, 2008. Review. Agriculture in the course of development. International Bank of Reconstruction and Development/, Washington, Columbia county. www.world bank.org. p.1.

Table 113. General macroeconomic rates of the Republic of Kyrgyzstan[148] *(in % to previous year)*

	YEARS												
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Gross domestic product	94.6	107.1	109.9	102.1	103.7	105.4	105.3	100.0	107.0	107.0	99.8	102.7	108.2
Industrial product	75.0	104.0	140.0	105.0	96.0	106.0	105.0	89.0	117.0	105.0	88.0	90.0	107.3
Продукция сельского хозяйства	98.0	115.0	112.0	103.0	108.0	103.0	107.0	103.0	103.0	104.0	96.0	102.0	101.6
Investments to the main fund	182.0	119.0	96.0	64.0	122.0	137.0	86.0	90.0	93.0	102.0	106.0	155.0	103.7
Freight	70.0	108.0	94.0	99.0	115.0	105.0	97.0	105.0	109.0	104.0	91.0	99.6	115.5
Retail turnover	94.0	102.0	109.0	111.0	100.8	107.0	106.0	109.0	111.0	117.0	114.0	116.0	109.4
Consumer price index	143.0	132.0	123.0	110.0	136.0	119.0	107.0	102.0	103.0*	104.0*	104.0*	106.0	110.2
Export to other countries	1019.0	80.0	254.0	99.0	96.0	110.0	104.0	103.0	120.0	117.0	83.0	113.0	136.6
Import from other countries	157.0	208.0	78.0	147.0	85.0	75.0	82.0	126.0	116.0	117.0	117.0	172.0	122.8

***** *According to the classifier of individual consume in purposes (ICIN)*

[148] Intergovernmental statistics committee of CIS, 2008. Commonwealth of Independent States in 2005. Brief manual./ Statistics committee of CIS. –M., 2006. – p.440;

900. Mortality coefficient for 2000-2007 has tendency of growth, also tendency of mortality share increasing due to the disease of blood circulation system and malignant neoplasms in particular in rural area.

901. The longest rivers are: Naryn -535 km, Chu – 221 km, Kyzyl-Suu and Talas by 210 km, Chatkal - 205 km and Sary-Djae - 198 km.

902. The biggest lakes: Issyk-Kul – 6.2 thousand km2., Sonkul – 0.3, Chatyr-Kul - 0.2 thousand km2. The heights point is Pobeda peak - 74 m.

903. Analysis of macroeconomic rates shows that for the last ten years development rate of the branches of national economics reduced very much. This tendency in particular was activated when Kyrgyzstan became a member of WTO.

904. 34.1% of GDP was created in agriculture in 2006 (1995 - 44%), where 938.0 thousand or 45.4% of people (in 2000 - 49.0%) had been working including the employees working in forest and fish sectors, i.e. 50% (in 2000 - 53.0%) of labor resources of the country.

Table 114. Rate of social-demographic development of the Republic of Kyrgyzstan[149] *for 1989-2007.*

Rates	Years				
	2003	**2004**	**2005**	**2006**	**2007**
Total number of population, thousand people	5037.0	5065.0	5166.0	5190.0	5224.0
Including					
Rural population, thousand people	3300.0	3272.2	3358	3350.0	3374.0
Specific weight of rural population, %	65,.6	64.6	65.0	64.5	64.7
Expected lifetime at birth (years)	65.0	65.0	65.6	65.6	65.6
Infant mortality (per 1000 of live-born)	20.9	25.7	29.7	29.2	30.6
Natality coefficient	13.1	14.7	15.0	15.9	16.2
Birth rate (per 1000 population)	20.9	21.6	21.4	23.3	23.5
Mortality coefficient (per 1000 population)	7.1	6.9	7.2	7.4	7.3
Doctors availability (for 10 000 population)	27.0	27	26	25	25
Availability of hospital beds (per 10 000 population)	56	54	54	54	54

905. In spite of some stability and in some years even growth of macro economic rates, Kyrgyzstan remains to be one of the poorest countries in Central Asia. In 2005 GDP per head was made 475 USD.

[149] State statistics committee for given years www.stat.kg; Report of Human Development. Fighting against climate changing, human solidarity in divided world. UN development program (UNDP). Publishing house «the whole World», 2007 p. 231.

906. According to this rate republic is at 116th place in the world, and at 4th place among Central Asian countries after Kazakhstan (3772 USD), Turkmenistan (1669 USD) and Uzbekistan (533 USD).[150]

907. As in other developing countries of low income in Kyrgyzstan import share of food products in total volume of goods selling is relatively high and is made 12-13%.

908. In Kyrgyzstan 45.7% of population live in poverty. The following factors negatively impact on the poverty in rural area:

- -domination of small commodity producers;
- -relatively complicated access to credits;
- -problems in selling of some products' types and others.

909. Poor development of market infrastructure and imperfection of institutional base limits the development of agro food production distribution as inside the country so for export. It should be pointed out that at the background of poverty problems exploitation level of natural resources is observed, anthropogenic press on natural and artificial ecosystems increases.

Table 115. Rates of social-demographic development of the Republic of Kyrgyzstan for 2005-2007[151].

Rates	2005	2006	2007
Share of agriculture in GDP of the country, in %	39.2	34.1	30.0
Specific weight of employees in agriculture sector, in %	48.5	-	75.0 [152]
Average monthly salary, soum	2572	3270	3836.8
Average monthly salary in agriculture, soum	1041	1259.	1788.0
Proportion of average monthly salary in agriculture to average republican level, in %.	40.5	38.5	46.6
GDP per 1 person, in soum	19617	21918	26696
GDP per 1 person in USD	561.4	587.6	500[153]
Including per day per 1 person, in USD.	1.53	1.61	1.37
Expenditures of state budget for education, in % to GDP	4.4	5.2	5.3
Expenditures of state budget for public health, in % to GDP	2.3	2.3	2.3
Rate of unemployment, in %.	3.3	-	8.3[154]

[150] Report of Human Development, 2007/2008. Fighting against climate changing: human solidarity in divided world. UN development program (UNDP). Publishing house «the whole World», 2007, - p. 278-279.; www.stat.kg.
[151] Commonwealth of Independent States in 2005. Brief manual./ Statistics committee of CIS –M., 2006. – p. 440; Report of Human Development., 2007/2008. Fighting against climate changing; human solidarity in divided world. Publishing house «the whole World», p. 278-279. www.stat.kg.
152 Agro press on APK KR issues.//Ж: КР МСВХиПП. Bishkek, 2007. p. 8.
153 At the same place, p. 8.
[154] www. CIS statistics for MOT methodology (i.e. including a number of people searching for a job independently).

910. Development of social infrastructure is poor in Kyrgyzstan. Due to this, only 42.1% of villages in average has centralized water supply system. From 1750 villages where live about 700 thousand people 737 villages do not have water supply system at all155. However to the system of centralized water supply of rural population included: 667 water supply systems with 9604 km length of distributing networks, 830 main water intake structures, 212 reservoirs accumulating potable water, about 27 thousand of standpipes, pump stations, devices for water disinfection and others. But due to the lack of finance for system operation, technical maintenance and repair of hydro economic structures about 50% of water supply networks are in extremely bad condition and 40% require a complete overhaul156. As a result, majority of rural population use the water from irrigational canals, aryks and other surface sources subjected to pollution, that led to the growth of infectious diseases with consequences (in average 40-60% of children of 1-4 forms were infected by intestinal worms)[157].

911. Project realization for the total amount of 69.5 million USD has begun in 2000 in order to develop the infrastructure of population centers and to improve water supply for rural population. At present time, water supply of 508 population centers has been improved instead of planned 1000 centers.

912. Law “About potable water” was accepted in the republic in 2006 taking into account an importance of water supply to population for improving health condition and reducing the sickness rate. For 2000-2007 water supply systems were rehabilitated in 367 villages where 614 thousand people live.

913. At present time 624 territorial units - Rural public communities of potable water consumers (RPCPWC) deal with the issues of rural water supply.

914. Analysis shows that salaries in agriculture for 2006-2007 are behind average salary of other branches of economics and average republican level.

[155] M.// Agro press on APK KR issues, November, 2007. p.50.
[156] M.// Agro press on APK KR issues, November, 2007. p.50.
[157] Там же, с. 53.

Table 116. Salaries according to the branches of economics of the Republic of Kyrgyzstan for 2006-2007[158].

Branches of economics	Years	
	2006	2007
In average in the republic	3270	3836.8
Industry	5100	4500
Agriculture	1259.1	1732.0
Construction	2886.6	4220.0
Transportation and communication	5141.2	6265.5
Communal services	5339.6	5898.7
Public health and social security	1750.6	2479.9
Public education	1955.4	2671
Finance. Credit, social insurance	10669.4	12061.5
Management	3753.4	4245.4

6.3.1.3 Tajikistan

915. By January 1st 2008 population of the Republic of Tajikistan has made 7.215 million people. 49 people come per 1 km2.

916. By its social-demographic development Tajikistan differs from other Central Asian countries. Social-demographic development of the republicentner has its own features: more than 74% of population lives in rural area; about 45% of rural population is represented at the age of 15; number of population for 85% is formed by rural population; growth rates of population and labor resources of the villages are much higher than republican rate and as a result of this main labor activity of republic's population is formed in rural area. Population of the republic for the last 30 years has increased in 1.7 times, but average annual growth rates reduced in 1.4-2 times and this tendency have been continuing: if natality in 1980-1985 was made 33 per thousand, then in 1993-1999 it was 27.3 and in 2007 – 25.1 per thousand. At death rate reduction during 2000-2007 the tendency of death rate increasing was observed due to the disease of blood circulation system and malignant neoplasms in particular in rural area.

917. 24.2% of GDP was created in agriculture in 2007 (1995 - 15.3%), where 1432.0 thousand (in 1995 - 1095 thousand people) or 65.6% of people (in 1995 - 58.0%) had been working including the employees working in forest and fish sectors, i.e. 35.4% (in 1995 - 39.0%) of labor resources of the country.

158 www.stat.kg

918. In spite of intensive growth Tajikistan remains to be one of the poorest countries in Central Asia. Total GDP in 2006 was made 2.8 billion USD and GDP per head was made 390 USD.

919. According to this rate republics Tajikistan is at 122nd place in the world, and at the last place among Central Asian countries after Kazakhstan (3772 USD), Turkmenistan (1669 USD) and Uzbekistan (533 USD) and Kyrgyzstan (475 USD).[159]

6.3.1.4 Turkmenistan

920. Starting from 1997 in Turkmenistan the state order for milk and meat production, vegetables, cucurbit crops, potato, fruits and grape production has been abolished. State order has been retained only for cotton, wheat and rice production. These led to some liberalization in price formation. Starting from 2002 free prices were also introduced for cotton, wheat and rice.

921. Though agricultural production volumes are not significant in farmer (dekhkan) holdings the quality is high, therefore, 100% of produced cotton, 85% of produced wheat, 90% of grapes, 62% of produced milk, 60% of produced meat and 55% of produced eggs are usually sold.

922. Major channels for cotton and wheat trade are governmental organizations and therefore access of the farmers to the external markets is limited and dekhkans sell 70% of their production to the government organizations. 1/5 of the produced wheat, 2/3 of produced vegetables and meat products, 80-100% of produced potato dekhkan (farmer) holdings sell to population.

923. Share of the livestock products within the total volume of agricultural production is 25-30% and that of crop production is 65-70%.

924. Cotton and wheat in Turkmenistan as in any other CA countries are strategic crops. Besides these two crops export items include animals, phytognous products (0.2%), mineral products (81.0-85.0%), textile materials and goods (8.0-11.0%), etc.

6.3.1.5 Uzbekistan

925. Uzbekistan predominantly exports cotton fiber, vegetables, fruits, grapes, cucurbit crops, potato and others. Cotton and wheat are strategic crops. Cotton exports contribute nearly 17% of the convertible (hard) currency inflows.

[159] Report of Human Development, 2007/2008. Fighting against climate changing: human solidarity in divided world. Publishing house «the whole World», p. 278-279.

926. Within the total volume of exported goods 40.29% is represented by cotton and cotton products, 8.67% of precious metals, 8.23% colour metals, petrol and petrol products – 21.27%160.

927. Farmers and dekhkans sell their cotton and wheat to government.

928. Incomes of farmers are negatively influenced by price disparity. Price growth for industrial products is always ahead the rates of increase in agricultural product prices. Thus, in 1991 for purchasing one tractor the cost of 5.1 tons of cotton was sufficient while in 2006 more than 89 tons of cotton required for the same purpose.

929. In 1996 the share of exported fruits and vegetables has increased by 3.2% and in 2002 by 6.4%. Major market for agricultural products from Uzbekistan is Russia (share of Uzbekistan on Russian market is 11%).

930. In accordance with estimations currently nearly 20-22% of the cucurbit crops and vegetables , 23-26% of potato, fruits and grapes are being sold via whole sale market. In 2006 80% of the produced vegetables, 47.2% of grapes, 86.5% of cucurbit crops and 79.5 % of potatoes were sold on internal markets. The rest of the products except seeds and planting materials were exported.

931. In 2006 production capacity is 5.5 million tons of fruit and vegetable products and 1.02 million tons of potatoes[161.]

932. Karakul breeding, camel and horse breeding is managed by shirkat holdings that are united under Uzbekkarakuli company. Major part of produced karakul pelts are sold to processing enterprises within the company as well as private entrepreneurs. Ready goods are predominantly exported and partially sold on internal markets.

6.4 Institutional changes

6.4.1.1 Kazakhstan

933. In Kazakhstan as in other CA countries agricultural reforms started with land reform oriented on retaining large farmer holdings. However, in accordance with the opinion of international experts land reforms and restructuring of the farmer holdings had shortcomings:

- Almost half of the corporate holdings are not efficient;
- Government supports corporate holdings by subsidies and credits.
- Business community predominantly supported large farmer holdings.162

[160] Бюллетень Таможенной статистики Республики Узбекистан 2002 г.

[161] Основные экономические и социальные покупатели РУз. в 2006 году.

934. Several legeislative documents have been excepted to regulate different aspects of agricultural sector that include legislation „On veterinary“, “On plant protection”, “On seed production”, “On credit unions”, “On grain”, “Land Code”, “On obligatory insurance of plant production”, “On state regulation of the agricultural development”.

935. State policy in agrarian issues is implemented via State Land Cadastre and Decree of the Republic of Kazakhstan as on June 6, 1996, # 710, “On approving the procedures of Land cadastre in Kazakhstan”.

6.4.1.2 Kyrgyzstan

936. During 1991-2006 the structure of agricultural holdings has been changed. In 1991 major agricultural producers were represented by 518 big enterprises that had 60 % share in the gross agricultural production while in 2006 their share has decreased by 4% and the share of private holdings has reached in 2006 41-55% (Table 117).

Table 117. Number and the structure of the agricultural production units in Kyrgyzstan

Years	Collective farms	State farms	Farmer holdings	Agricultural cooperatives	Joint ventures	Collective farmer holdings
1991	195	323	4567	-	-	-
1995	37	49	23180	608	74	227
2000	-	61	71163	292	45	236
2002	-	47	244404	464	39	176
2006	-	111	300162	1662		

937. During 2000-2002 495 thousand ha of land were redistributed and 200 ha of land were sold.

6.4.1.3 Tajikistan

938. In 2000 Government of Tajikistan has accepted Program on increasing yields of cereal crops and in 2001-2005 Program on increased grain production. After independence agricultural production has decreased due to the following reasons:

- loss of traditional markets;
- civil war and its socio-economic consequences;
- inefficient systems of agricultural management;
- deterioration of the irrigation systems;

[162] Нора дадвик, Кэрин Фок, Дэвид Седик, Аграрная реформа в постсоциалистичекком пространстве: Опыт Болгарии, Молдавии, Азербайджана и Казахстана. Рабочий доклад Всемирного Банка N94. Отчет Всемирного Банка – 39977. С. XX, 53.

- depleted soil productivity;
- imperfect economic and legal basis of agricultural structures;
- land degradation;
- high increases in prices for petrol and other material resources;
- insufficient credit resources, etc.

939. As a result of agrarian reforms different agricultural production units emerged (Table 118).

Table 118. Dynamics of the economic indicators of different agricultural enterprises in Tajikistan

Indicators	Years					
	1990	**1997**	**1998**	**1999**	**2000**	**2001**
Agricultural enterprises						
Number of enterprises	501	572	586	594	594	582
On average one enterprise have:						
Total agricultural land, ha	68525	55166	53651	52920	52807	53990
Arable land, ha	2310	2503	2419	2402	2421	2485
Cattle, heads	750	390	250	260	252	247
Ship and goats, heads	7590	5480	3820	4260	4710	5120
Cos t of the agricultural production, million mantas	4942[163]	2328	2558	3318	3402	4513
Cost of agricultural products per 1 ha, million mantas	2,1[164]	0,93	1,06	1,38	1,41	1,82
Dekhkan (farmer) holdings						
Number of enterprises	337,3	480,1	491,4	498,3	510,3	510,6
On average one enterprise have:						
Total agricultural land, ha	0,11	0,37	0,38	0,39	0,38	0,33
Arable land, ha	0,08	0,27	0,28	0,29	0,29	0,26
Cattle, heads	1,3	1,9	2,6	2,8	2,8	3,3
Ship and goats, heads	4,9	5,9	7,7	9,3	11,8	17,6
Cos t of the agricultural production, million mantas	1050 руб	3,0	6,3	9,2	11,5	16,7
Cost of agricultural products per 1 ha, million mantas	12,1[165]	11,1	22,5	28,8	39,6	64,2

940. During 1991-2001 private sector has speedily developed. During this period the arable land used in private sector has increased from 2.3% in 1990 to 8.5% in 2001.

[163] тыс. руб
[164] тыс. руб.
[165] тыс. руб

Table 119. Rates of social-demographic development of the Republic of Tajikistan for [166] 1970-2006 .

Rates	Years							2007 to 2000
	1980–85	1993–99	2000	2003	2005	2006	2007	
Total number of population, thousand people	4216.0	5812.7	6250.0	6640.0	6780.0	7064.0	7215.0	115.4
Including								
Rural population, thousand people	2816.3	4227.7	4590.0	4882.0	5095.0	5206.0	5339.1	116.3
Specific weight of rural population, %	66.8	72.5	73.4	73.5	73.6	73.7	74.0	+0.6 п.п.
Expected lifetime at birth (years)	69.7	66.9	68.2	70.1	70.6	70.6	70.6	+2.4
Infant mortality (per 1000 of live-born)	46.8	47	89	68.1	65.1	65.1	65.1	-23.9
Birth rate (per 1000 population)	40.0	32.6	28.6	29.9	31.4	29.4	29.4	+0.8
Mortality coefficient (per 1000 population)	7.0	5.3	4.2	5.0	4.4	4.3	4.3	+0.1
Fertility rate (number of birth per 1 woman)	5.598	3.931	3.493	3.42	3.274	3.266	3.200	-0.293
Immunization against measles (in % from a number of children younger than one year)	…	90	98.9	97.7	96.7	96.7	96.7	-2.2
Doctors availability (for 10 000 population)	25.2	21.5	51.5	43.1	42.2	42.2	42.2	-9.3
Availability of hospital beds (per 10 000 population)	102.2	79.0	65.8	61.2	58.6	58.6	58.6	-7.2

[166] State Statistics committee for given years. www.stat.tj

Table 120. Rates of social-economic development of the Republic of Tajikistan for 1995-2006.[167]

Rates	1995	1999	2000	2005	2006	2007	Changes (2007 to 2000) +;-
Share of agriculture in GDP of the country, in %	15.3	27.6	25.6	24.2	24.2	-	-1.4 p.p
Specific weight of employees in agriculture sector, in %	65.0	64.4	66.6	67.5	67.0	69.4	+2.8 p.p
Average monthly salary, thousand somoni	0.92	11.61	15.57	89.59	116.26	227.0	+21.43
Average monthly salary in agriculture, thousand somoni	0.81	5.38	7.78	38.89	42.99	87.52	+79.74
Proportion of average monthly salary in agriculture to average republican level, in %.	88.0	46.34	50.0	46.53	37.00	38.6	-11.4 p.p
GDP per 1 person, in somoni	12.2	219.5	285.87	1041.42	1339.91	1802.13	+1516.26
GDP per 1 person in USD	-		153.1	355.0	390.0	-	+236.9
Including per day per 1 person, in USD.			0.36	0.92	1.07	-	+0.71
Expenditures of state budget for education, in % to GDP	-	2.1	2.41	3.5	3.5	3.6	+1.19 p.p.
Expenditures of state budget for public health, in % to GDP	-	1.0	0.9	0.9	1.1	1.1	+0.02 p.p.
Rate of unemployment, in %.		3.0	2.6	2.2	2.4	2.4	-0.2 p.p.
Average monthly cash income per head (households), somoni	7.25 (1998)	11.3	16.9	55.48	75.86	-	-58.96
Specific rate of expenditures for foodstuff in expense structure of population, in %.	79.3 (1998)	87.3	86.5	72.1	72.1	65.6	-20.9 p.p.

[167] Commonwealth of Independent States in 2005. Brief manual/ Statistics committee of CIS –M., 2006. – p. 440; www.stat.tj; State statistics committee RT; Republic of Tajikistan: Priorities for stable growth: strategies for agriculture development. Joint report of MB and SECO. 2006. – p. 9-10; Report of Human Development, 2007/2008. Fighting against climate changing: human solidarity in divided world. Publishing house «the whole World», 2007, p. 278-279.

941. In general in the country poverty level reduced during 1999 - 2003 from 81% to 64%, i.e. for 17% p.p. For this period rural poverty reduced for 20%, i.e from 80% in 1999 to 35% in 2003. And the index of human potential development is made 0.673 (in 1995 – 0.638)[168].

942. Reduction of rural poverty starting from 1999 is the result of organizational-economic activities of government aimed for economic growth and poverty reduction in the country. From 38 million of poor people 80% (3 million people) live in rural areas.

943. Poverty level of rural population has specific features and zonal specific character. Zonal specific feature is that the highest and deepest rural poverty level and the lowest rates of poverty reduction are mainly observed in cotton planting provinces - Khatlon and Sogd. In 1999-2003 rural poverty reduced for 6.9% in Khatlon and for 12.8% on Sogd province in comparison with general reduction of this rate for 15.9%[169].

944. Though in many rural areas and zones of the republic rates of average daily calories' consumption per head has exceeded minimal needs (2170 kkal), it was truly stated by international experts that this fact contradicts to more general rates of rural poverty, and in households with lower incomes protein demand for 80% is satisfied by bread and croups170. This fact shows that in reality absence of food security is one of the main problems of the poorest rural households.

945. About 2.9 million people in the republic do not have constant access to advanced water sources, 2.8 million people from them live in rural area. At present time 49% of rural population has a centralized water supply system. All infrastructures are worn for more than 70% and requires rehabilitation and reconstruction[171].

946. Objects of social infrastructure are poorly developed in Tajikistan. Thus, only 63% of republic's population has water supply system, in rural area this rate is made 40%. Moreover more than 1.3% of population uses the water from boreholes, 9.6% - from springs, 1.8% - from wells and 2.5% is supplied by imported water. About 22% of republic's population takes water from open reservoirs and irrigational networks which absolutely do not correspond to the standards. In general in the republic central water supply is carried out from 661 water pipelines and groundwater serve as water supply source for 90.6% of population. In Kurgan-Tyube zone of Khatlon province and in the districts of republican subordination water supply from pipelines is made 38.5 and 42% respectively.

947. Such rates in Kumsangir and Gozimalik districts are made 19.2 and 21.1% and in Yavan, Djilikul, Khojamaston, Pendjikent districts potable water supply is much lower.

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[168] Report on Human Development, 2007/2008. Fighting against climate changing: human solidarity in divided world. Publishing house «the whole World», 2007, p. 231, 236.
[169] State statistics committee RT; Republic of Tajikistan: Priorities for stable growth: strategies for agriculture development. Joint report of MB and SECO, 2006. p. 9-10.
[170] The same. P. 11-13.
[171] info.net/5wwf/national_report_tajikistan. http://www.cawater-ht

948. In Tajikistan one of the features of rural poverty as in other Central Asian countries is its gender manifestation. The following conclusions can be done on the basis of existing information and our researches and results of pool, private interviews and observations:

- -rural women constitute the majority part of poor population;
- -a number and proportional share of women increases among poor population;
- -households leaded by women are more subjected to poverty and share of households leaded by women has growing tendency;
- -women's share has been increasing at domestic labor market, but this tendency does not accompanied by quality improvement of working places.

949. At present time labor migration is one of the ways for fighting against poverty, shortage of work places and is the main family income. According to various assessments for 1991-1995, about 285 thousand of able-bodied population left Tajikistan for searching the work abroad. According to the assessments of International Migration Organization in average from 600 to 800 thousand people work abroad, that is made about 17% of total economically active population (EIU, 2005), and only in 2004 money transfers of people working abroad were made about 20% of GDP172. For 2000-2005 total amount of transfers were made 618.5 million USD.

950. People mainly go to work to Russian, Uzbekistan, Kyrgyzstan and Kazakhstan. That is why income from migration is an important source for rural and urban families. In 1997-2007 more than 77.2 thousand people went abroad to search for a job that is made 3.5-4.0% of economically active population of the country.[173]

951. Strategy efficiency of productive employment supply for rural population mostly depends on agriculture.

952. It should be pointed out that three-fourth of poor population of developing countries lives in rural area and agriculture is main sources of living means. [174]

953. Worsening of ecological situation and land waste brought to reduction of families' incomes, especially rural ones where main part of incomes is formed in private farms and sites adjoining the farms.

954. Analysis shows that growth rates of salaries in agriculture for 1991-2006 are behind the average growth rate in other economic branches and average republican rate.

172 Investment center FAO/ Seria of reports - № 11 - August 2006, Cooperation Program of IBRD: Tajikistan. Financial enhancement in rural areas.

173 Commonwealth of Independent States in 2005. Brief manual/ Statistics committee of CIS –M., 2006. – p. 440; www.stat.tj; State statistics committee RT; www.stat.tj

174 Report on World Development, 2008. Review. Agriculture in the course of development. International Bank of Reconstruction and Development/, Washington, Columbia county. www.worldbank.org. p.1.

955. Low salary is the main reason of rural poverty. Besides that, price increasing in agricultural and industrial products also negatively impacts on the incomes of rural employees.

956. Tajikistan is the country with low income, gross domestic product (GDP) per head in 2005 was made 390 USD. In 2005-2006 day income of population according to different calculations varied from 0.92 to 1.07 USD.

957. Main part of incomes is spent for food stuff, but this rate can be reduced, i.e. from 86.5% in 2000 to 65.6% in 2007. In dry regions this rates is made for about 75%.

Table 121. Salary growth rate in the economic branches of the Republic of Tajikistan for 1991-2005.[175]

Economic branches	YEARS					
	1991	1996	2000	2004	2005	2006
In average in the republic	100	100	100	100	100	100
Industry	109.4	284.7	302.6	245.6	229.2	197.4
Agriculture	108.4	59.6	50.0	57.6	46.0	37.0
Construction	120.3	165.4	249.9	250.6	237.8	274.3
Transport	90.0	151.9	199.0	233.2	216.5	119.8
Communication	91.6	190.5	247.0	360.4	345.5	478.1
Informational services	82.1	89.5	108.3	96.3	94.4	92.0
Communal services	75.7	115.9	117.7	110.3	120.3	109.1
Public health and social maintenance	73.2	42.0	43.2	37.4	48.9	48.2
Public education	79.7	53.2	74.2	73.8	90.2	87.8
Culture and art	67.5	60.0	74.0	67.5	71.2	72.5
Science and research works	126.2	76.6	105.1	109.8	126.5	113.7
Finance, credit, social insurance	207.0	246.8	492.7	376.6	420.0	480.7
Management	117.6	165.1	153.2	138.5	171.4	179.2

6.4.1.4 Turkmenistan

958. At the beginning of 2006 number of population in Turkmenistan has been made 6.746 million people, 14 people fall per 1 km2 (13.7 people).176 More than 55.5 % of population lives in rural area.

959. Share of population with income less than 1 USD is made 20.4 %, and share of population with income less than 2 USD per day is made 59.0%.177 81% of rural area is

[175] Commonwealth of Independent States in 2005. Brief manual/ Statistics committee of CIS. –M., 2006. – p. 440; www.stat.tj; State statistics committee RT; www.stat.tj; Statistics collection of the Republic of Tajikistan in 2004, Dushanbe, 2005. p. 88. In 1991 in the economy of Tajikistan were used Soviet rubles; Statistic yearbook of the Republic of Tajikistan for 2004. Dushanbe, 2005. p. 209.

[176] Commonwealth of Independent States in 2005. Brief manual/ Statistics committee of CIS – M., 2005. p.395

[177] Report on World Development in 2000/2001. Stepping on poverty. M.: Publishing house «Whole world», World Bank, 2001, p. 303

poor178, and 60% of population has an access to potable water. Demographic processes are characterized by the following rates: mortality per 1000 live-born is made 33 (in 1980 - 54), total birth coefficient is 2.9 (in 1980 – 4.9), birth rate per 1000 population was made 18.5, mortality rate – 5.4 and natality rate – 13.1. Average lifetime of men is 63.4 years, of women is 70.8 years. Main part of population and labor resources of Turkmenistan is focused in rural area. Two thirds of population in Turkmenistan is formed for the account of rural population, growth rates of population and labor resources began to pass ahead the average rate of the country and as a result the main working part of population is formed in rural area.

960. Unlike other Central Asian countries population of Turkmenistan for 1970-2006 increased in 3.1 times and average annual growth rates increased in 1.5 times, such tendency is still going on: in 1970-1979 - 2.75%, in 1987-1997 - 3.3%, in 1997-2006 - 4.25%.

961. In 2006 cost of GDP was made 26.8 trillion mantas that are in 3.4 times more than in 2000.

962. Worsening of ecological situation and land waste brought to reduction of families' incomes, especially rural ones where main part of incomes is formed in private farms and sites adjoining the farms.

963. Analysis shows that growth rates of salaries in agriculture for 1991-2006 are behind the average growth rate in other economic branches and average republican rate.

964. In 2005 average monthly nominal salary was made 17500 thousand manats (336.54 USD) that is in 2.9 times more than in 1999.

965. Disparitet's price growth between agricultural and industrial products, low salaries, underdevelopment of social-territorial infrastructure in village, lack of working spheres in rural area and high level of unemployed population are the main reasons for poverty increasing in the village.

966. Unlike other Central Asian countries in Turkmenistan increasing rate of rural poverty to a considerable degree is explained by high demographic processes from the beginning of new century. This created and will continue to create an additional load on labor market in particular on rural. As a result local and foreign migration increases.

967. Turkmenistan is a country of low income, gross domestic product (GDP) per soul in 2000 was made 720 USD. In 1999-2000 daily income of population according to various calculations varies from 1.81 to 2.06 USD.

968. Main part (2/3) of rural population's income is spent for food stuff. In dry areas this rates is even higher. According to different assessments, rate of rural population's poverty

[178] World Bank Report. Drought: Assessment of management and effects softening for Central Asia and Caucasus. 11 March 2005, p. 11.

varies from 59.0% to 81.0%179. This rate is one of the highest in comparison with other Central Asian countries. 180.

969. Geography of poverty has the differentiation between provinces and etraps of the country. The highest poverty risk is observed in Dashkhovuz province which was acknowledged by international community as zone of ecological disaster.

970. Poverty risk has especially high tendency for people living in dry areas where access for potable water as well as for irrigation water is limited.

971. At the beginning of 2000 number of population centers having water pipelines or separate water supply networks in Turkmenistan has been made: cities - 16 (79.9% supplied), villages of urban type - 53 (75.8% supplied), rural population centers - 656 (39% supplied). From total number of cities in 15 cities and in 71 settlements more than 80% of population used water intake pump. 23% of rural population had central water supply including the houses with inside water pipelines and canalization where 3% lived.

972. About 80% of rural population uses the water from local sources (wells and others), quality and mineralization level do not correspond the standards.

973. Water supplied to population not always meets the demands for potable water: according to microbiological rates - 34.1% of investigated samples, according to sanitation-chemical rates – 27,31% of investigated sample[181].

974. In the territory of Turkmenistan 107 water pipelines take water from surface sources. The main sources are: Amudarya river, Garagum canal, Murgap river, Tedjen ans small rivers.

975. Potable water quality does not worsen so much while transporting to long distance by water conduit in comparison with water supplied to the population through distributing networks. This mainly takes place due to long-term exploitation of damaged water supply network and self break of water pipeline. Thus, about tens of thousands cases of water pipelines damages take place every year.

976. Water from pipelines supplied to population from surface sources does not meet the demands of potable water due to the absence of sanitation protection, complex of cleaning structures and disinfectant installations at the water intake.

977. At the territory of Turkmenistan there are 188 pipelines which take water from underground sources, 103 (54.79%) from them do not meet sanitation standards and rules also

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179 Azizur Rakhmankhan. System of land utilization, agriculture and poverty in Uzbekistan. California University, Riverside, April 2005, p. 7. Internet site Land.Ref_1Draft._rus, Report on World Development in 2000/2001. Stepping on poverty. M.: Publishing house «Whole world», World Bank, 2001, p.303; JICA Alumni Association in Uzbekistan. Alumni Publication, volume 2, 2006. “Sustainable Development Studies Program”. Tashkent, 2006, 35-36 p.

180 World Bank Report. Drought: Assessment of management and effects softening for Central Asia and Caucasus. № 31998-ECA, 11 March 2005. p. 28.

181 Data of Ministry of Nature Utilization and Environment Protection of Turkmenistan. Data of scientific-production center of ecological monitoring of Ministry of Nature Utilization and Environment Protection of Turkmenistan.

due to the absence of sanitation protection - 97 (51.6%), necessary complex of cleaning structures - 3 (1.60%), disinfectant installations - 63 (33.51%).

978. At present time the complex program on water supply development of Turkmenistan is carried out till 2010, the main purpose of which is to supply the population by centralized water supply system.

6.4.1.5 Uzbekistan

979. As of 1.01.2007 population of Uzbekistan has reached 26.66 million people. Population density is 59.4 people.

980. More than 64% of the population of Uzbekistan live in rural areas and nearly 40% of the rural population is under 15 years. Population growth rate in rural areas exceeds the average rate of population growth in Uzbekistan. During the last 35 years population of Uzbekistan has increased 2.3 times. However, average annual population growth has decreased 3 times. This tendency continued in 1970-1979 (3.3%), in 1980-1989 (2.9%), in 1990-1999 (1.03%) and in 2000-2006 (0.95%).

981. In 2006 24.1% of GDP was generated by agricultural sector (26.3% in 2005) while 19.81% of labor resources were involved in agricultural production activities (Table 122).

Table 122. Indicators of the sorio-economic development during 1995-2006 in Uzbekistan

Indicators	1995	1999	2000	2005	2006.	Changes
Share of the agricultural production in GDP, %	28.0	28.0	30.1	25.0	24.1	-3.9 пп.
Percentage of employed population in agriculture, %	41.2	36.2	33.5	30.0	28.1	-13.1 пп.
Average monthly payment, thousand sum	1.067	8.823	11.387	108.619	183.94	172.4 times
Average salary in agriculture, thousand sums	0.777	4.106	4.875	57.564	99.33	127.8 times
Percentage of the average salary in agriculture to the average salary level across the country, %	72.82	45.54	42.32	53.0	54.00	-18.82 пп.
GDP per capita, thousand sums	13.222	86.929	131.245	606.20	778.58	58.8 times
GDP per capita, USD	442.82	698.22	554.71	512.84	648.81	1.46 times
Including GDP per capita per day, USD	1.22	1.91	1.52	1.40	1.77	1.45 times
State budget spending for education, % of GDP	7.6	7.9	6.7	7.1	8.7	+1.1 пп.
State budget spending for public health services, % to GDP	3.6	2.8	2.5	2.6	2.4	-1.2 пп.
Unemployment rate, %	0.4	0.5	0.4	0.3	0.3	-0.1 пп.
Average per capita monthly income, (households) thousand sums	1.1	8.8	11.6	28.60	37.94	34.5 times
Share of food related spending within the total spending of population, %	72.0[1823]	70.0[1832]	65.2[184]	48.5	46.1	-25.9 times

982. Deterioration of the ecological situation in the region and increased land degradation caused the decrease in incomes of the families living in the rural areas.Analysis has shown that rates of salary increase in agriculture during 1991-2006 far below the same indicators in other sectors of economy (Table 123).

182 За 1997 г.
183 За 2002 г
184 За 2001 г.

Table 123. Rates of increase in salary within different sectors of economy in Uzbekistan during 1991-2005

Sectors of economy	Years				
	1991	1996	2000	2004	2005
Average in Uzbekistan	100	100	100	100	100
Industry	113	139,1	198,3	183,0	151,9
Agriculture	109,5	76,6	47,3	24,8	53,2
Construction	121,9	152,0	169,9	157,0	180,1
Transportation	113,4	137,7	166,9	148,9	167,9
Communication	97,5	142,2	182,2	153,3	121,5
Information services	106,3	144,6	316,2	308,2	105,1
Community services	79,2	90,7	121,3	92,1	55,4
Public health and social welfare	73,4	64,6	74,3	53,9	61,9
Public education	78,2	64,5	89,7	60,8	70,7
Culture	65,5	65,9	82,0	58,9	82,1
Arts	74,6	80,0	100,7	71,6	111,0
Science and research	111,9	121,9	143,1	103,9	146,8
Finance, credits and social insurance	178,2	182,9	204,5	217,5	283,0
Management	108,0	99,0	127,7	72,8	92,7

983. Uzbekistan has a low level of income: GDP in 2005 made up 512.84 USD. In 2005-2006 daily income of the population fluctuated between 0.81 to 1.05 USD. While nearly 50% of the population's income is spent for purchasing food products (in dry areas this value makes up 70%). Level of poverty in the rural areas is between 28.7% to 30.5%185. Greatest risk of poverty is in Karakalpakstan (44.0%), Kashkadarya (41%), Namangan, Surkhandarya and Syrdarya (32.6-33.4%).

984. 50% of the rural population is represented by women including 36% below 18 years. 43% of the working force employed in agricultural sector is represented by women. Insignificant share of women succeeds in making career on administrative or technical positions. Percentage of women involved in farm management is low: in Bukhara, Kashkadarya and Syrdarya – 2%, in Khorezm – 44% while average in Uzbekistan is 5%.

[185] Азизур Рахманхан. Система землепользования, сельское хозяйство и бедность в Узбекистане. Университет Калифорнии, Риверсайд, Апрель, 2005, стр 7. Интернет. Сайт. Land.Ref_1Draft._rus

6.5 Markets in CA countries

985. Due to the disintegration of the previous soviet trading system and lack of the currency supply governments of CA counties give high priority to creation of the food supplies (especially wheat supply) via internal production.

6.5.1.1 Kazakhstan

986. Despite of the measures prices for food products increased during 2000-2008 on average by 27.1%. During this period process for flour have increased by 67%, for bread – by 42.4%, cereals – by 12.6%, oil products – by 60%, milk products and eggs – by 32.7%, fruits – by 30%, vegetables – by 23.7%, fish and sea products – by 20.5%, patisserie – by 13.7%, meat and meat products – by 24.8% (poultry – by 36.6%, horse meat – 33.3%, lamb – 23.7%, pork – 17.1% , sausages – by 20%).

Table 124. Average prices for main food products in Kazakhstan (March, 2008)[186]

	Prices in tenge per kg						Average in march, 2007.
	average	minimum		maximum		Difference, times	
		city	price	city	price		
Wheat flour, I quality	77	Kokshetau	61	Astana	110	1,8	46
Bread form first quality wheat flower	75	Aktobe	52	Aktay	103	2,0	53
Beaf	566	Uralsk	445	Almaty	799	1,8	435
Butter	608	Uralsk	435	Almaty	962	2,2	426
Sunflower oil, litr	313	Ust-Kamenogorsk	272	Almaty	351	1,3	164
Milk, 1 litr	92	Kokshetau	62	Atyrau	137	2,2	67
Eggs, 10 units	193	Kostanay	165	Almaty	237	1,4	149
Potato	75	Taraz	51	Atyrau	102	2,0	67
Sugar	105	Petropavlovsk	85	Almaty	137	1,6	100
Tea	865	Pavlodar	701	Astana	1013	1,4	755

987. Major factors hindering the development of agricultural sector include expensiveness and underdevelopment of transportation systems, lack of special transportation vehicles and technologies for keeping agricultural products, underdeveloped information market and underdeveloped logistics in agriculture, insufficient know-how and small assortment of agricultural products.

[186] Директор Департамента макроэкономической статистики Н.Кривко www.old.stat.kz/index.php?lang=rus&uin

988. Analysis of the logistics in agrarian sector has shown that some farmers overcome distances of 100 km to sell their products (45% of farms have to travel 50 km, 20% - up to 100 km and 8 % - more than 200 km187). Livestock products most of the time is transported via use of lorries (48.1%) and automobiles (36.4%). For 80% of tradesmen this distance takes less than 3 hours while 6% of tradesmen spend more than 6 hours.

989. Only 11% of farmers use credits. 37% of farmers and 17% of agricultural enterprises sell their products directly to the processing companies[188].

6.5.1.2 Kyrgyzstan

990. During the years of independence Kyrgyzstan has developed legislation regulating export and import of agricultural products. In 2007 Kyrgyzstan had trade relations with 71 countries (118 in 2008) and external turnover made up 3551.2 million USD, or 2.7 times higher in comparison with 2003. Export has increased 2 times and import – 3.4 times. 12.3% of the exported goods and 11.6% of imported goods are represented by food products.

991. Among the items exported by Kyrgyzstan are milk products (33.1 thousand tons), wheat (1.1 thousand ton), vegetables (118.6 thousand tons), fruits (59.4 thousand tons), cotton 925.2 thousand tons) and others.

992. Hard currency income generated by export of cotton make up 2%, milk products – 2.3%, vegetables – 3.7%, and fruits – 1.6%.

993. Import of wheat in 2007 made up 273.6 thousand tons (47.24 million USD), or 2% of the total imported goods.

Table 125. Average selling prices for agricultural products[189]

Products	1997	2000	2003	2007
Wheat	2.93	5.47	4.2	8.5
Potato	3.05	4.35	6.30	11.3
Meat	30.0	58.0	86.0	130.0
Milk	3.95	6.20	7.70	11.7

[187] Отчет Всемирного банка. Пастбищные угодья а переходной период. Ресурсы, использователи и рациональное использование. Всемирный Банк, 2004.

[188] Животноводства Казахстана – поддержка возрождения отрасли. Программа совместных экономических исследований. Отчет Всемирного Банка. Вашингтон. Июнь 2004 г.

[189] Ж. АГРОПРЕСС. №9, январь 2004. с 73-74.; Социально-экономической положения Кыргызской республики. Годовая публикация, Бишкек 2008.,с 27.

6.5.1.3 Tajikistan

994. Tajikistan is one of the producer and exporter of the vegetables and fruits in CA. Annual fruit export by Tajikistan makes up 100 thousand tones and export of vegetables – 50-60 thousand tons. More than 99% of vegetables and fruits is exported to Russia.

995. Most of the produced agicultural products (more than 70%) is grown on farmland on average 0.13 ha that in total make up the area of 700 thousand ha. Most of these products is consumed by households.

996. Due to the insufficient organization of marketing chains prices increase. 75% of the retail trade belongs to the soviet type cooperatives.

997. Out of 32 canning factories in Tajikistan only 4 have the capacity exceeding 10 million l, 6 factories – 1-10 million l and the rest of cunning factories – less than 1 million l. Due to the insufficient funding and low efficiency on 30-40% of the capacity is used.

998. Despite of the positive changes in microeconomic indicators Tajikistan economy still depends on external factors especially export of cotton and aluminum 190 – two major sources of export income that constitute 80.3%. . In accordance with the evaluation of the International Monetary Fund currency flow from money transfers in 2004 made up 20% of GDP (in 2000 – 3.5 million USD, in 2004 – 312.7 million USD). 191 During 2005-2007 and eight months of 2008 via banking sector of Tajikistan5.58 million USD were received by the economy of the country, namely 663.97 million USD in 2005, 1.12 billion USD in 2006, 1.77 billion USD in 2007 and 2.01 billion USD during eight months of 2008. During 10 months of 2008 600 thousand workers migrated to other countries predominantly to Russia (482.1 thousand people) for finding employment including 77.1 thousand women (16%).[192]

999. Cotton is the most important exported product. One third of the arable land are used for cotton cultivation. About 85% of total volume of applied fertilizers is used for cotton production. However, during years of independence planted area under cotton has decreased from 303.0 thousand ha to 262.88 thousand ha in 2006. Yields decreased during these years from 27.7 centners per ha to 17.0 centners per ha in 2006. Total volumes of produced cotton has decreased from 842.0 thousand ha to 438.0 thousand ha, or 1.9 times. Total capacity of the 41 cotton processing factories is 1.1 million tons. Due to the obsolete equipment fiver yield makes up only 24-32% while in Western countries this indicator makes up 36%. Long process of cotton cleaning also causes low profitability of the farmer holdings. Cotton cleaning factories in Tajikistan on average cleans cotton within 200 days while in Western countries it takes 110 – 120 days.

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[190] Таджикистан: Расширение возможностей финансирования в сельской местности Инвестиционный Центр ФАО / Серия отчетов - № 11 - август 2006 Программа по Сотрудничеству ЕБРР. С. 20.

[191] Там же; Хемоникс [Chemonics], 2003, ПТ 2005.; Всемирный Банк (2005a), основанный на данных Госкомстат, Министерства финансов, оценки сотрудников МВФ и Всемирного Банка, ПТ, (2005)

[192] Там же, С. A|10

6.5.1.4 Turkmenistan

1000. In 1997 state order for production of milk, meat and other meat and poultry products, vegetables, cucurbit crops, potato, fruits and grapes has been abolished. As a result price formation has been more liberalized. State order was only retained for cotton production. This changes stimulated liberalization in the price formation. State order has been retained only for cotton, wheat and rice production. Starting from 2002 prices for cotton, wheat and rice were also liberalized.

1001. Despite of the small producing capacity the quality of produced agricultural products is high. Therefore, all produced products have high selling potential.

1002. Major channels of cotton and wheat trade are governmental organizations. Therefore, access of the farmer organizations to the external markets is limited. 70% of the produced products farmer holdings sell to the government. 65-70% of the produced agricultural products are represented by crop production and 25-30% by livestock production.

1003. As in other CA countries cotton and wheat are strategic crops in Turkmenistan. Amongst other exported goods there are animals, phytogenic products (0.2%), mineral products (81-85%), textile materials and goods (8-11%).

6.5.1.5 Uzbekistan

1004. Major exporting items in Uzbekistan are cotton fiber, vegetables, fruits, grapes, cucurbit crops, potato and others. Cotton and wheat are strategic crops. 17% of the hard currency income is generated by cotton fiber exports. The share of cotton and cotton products within the exported goods make up 40.29%, precious metals – 8.67%, color metals – 8.23%, petrol and petrol products – 21.27%.

1005. Price disparity negatively affects farmers' income. Rates of increase in the prices for industrial products are ahead of increase in prices for agricultural products. Thus, in 1991 for purchasing one tractor the cost of 5.1 tons of cotton was enough while in 2006 this value made up the cost of 89 tons of cotton.

1006. After 1996 the share of exported fruits and vegetables has increased by 3.2% and by 6.4% in 2002. In accordance with current estimations 20-22% of the cucurbit crops and vegetables, 23-26% of potatoes, fruits and grapes are sold via whole sale.

1007. Major market for fruits and vegetables produced in Uzbekistan is Russia. Currently share of Uzbekistan on Russian market is more than 11%.

1008. In 2005 80% of the produced vegetables, 61.5% of fruits, 47.2% of grapes, 86.5% of cucurbit crops and 29.5% of potatoes were sold on internal market. The rest of the product agricultural products excluding seed and planting materials was exported.

1009. Potential for increasing production of fruits and vegetables in Uzbekistan is huge. In 2006 production capacity made up 5.5 million tons of fruits and vegetables and 1.02 million tons of potatoes.

1010. Another item for export is karakul pelts that are produced predominantly by government own enterprises united under Uzbek Karakul Company.

7 Conclusions

1011. Population of CA countries is over 55 million people leaving on the vast area of 3.9 million km2. Out of the total volume of land resources arable land make up 9.8%. Countries have similar agro-ecological conditions and are situated in the basin of the Aral Sea. On the bases of income level CA countries are divided to countries with average level of income and countries with low level on income. Agricultural development has always plaid an important role in ensuring food security and economical development in CA countries. Cultivation of the irrigated and rainfed land, use of semi-desert, desert and mountain pastures is the major components of land management in CA countries. Productivity of agricultural crops and of livestock is low.

1012. In all countries of CA during the years of independence the area of agricultural land has decreased due to the use of these land for other non-agricultural purposes, water and wind erosion, increased soil salinity and water logging, draughts and desertification of pastures. Agricultural land in CA includes irrigated and rainfed arable land, pastures, hay fields, land groundwater resources, semi-desert areas, piedmonts and mountains.

1013. Soil fertility is being depleted due to the destruction or liquidation of the crop rotations, decreased areas under fodder crops, legumes and other more profitable crops, insufficient attention to the second crops, winter crops and intercropping in cotton and wheat cropping systems, increased soil salinity, inefficient drainages, pasture overgrazing and other factors. As a result of depleted soil fertility farmers get low yields and, therefore, generate low income causing poverty in rural areas. One of the reasons of farm's low profitability is the purchase of the greater part of their products by the government on the basis of the fixed governmental prices while farmers buy production inputs on the market for market prices. Therefore, farmers have no incentives to increase the production.

1014. Land reforms and land relations are regulated in accordance with the specific political and economic conditions in each of CA countries. In some of the countries the share of private land ownership has increased (Kazakhstan, Kyrgyzstan and Turkmenistan) and on others land has been given for long term renting (Uzbekistan and Tajikistan).

1015. The major sources of water resources for all CA countries are rivers Amu Darya and Syr Darya. Water resources between CA countries are distributed in accordance with the signed multilateral agreements. However, water resources used inefficiently as the rate of infiltration on major channels and irrigation nets is high (30-35% of the total applied water). There is a need to shift to the system of water pricing. In some countries work has been done in this direction. However, till now there is no well developed mechanism of shifting to system of using water on paid basis.

1016. Ensuring long term food security will require not only increased productivity of agricultural production but also restoration of the regional trade and development of policy options for better stimulation of agricultural production. However, till the present reformation process has been concentrated on land reforms, changing the types of farming holdings without attention to the institutional mechanisms of supporting farmers.

1017. In all CA countries land and water resources are under degradation due to the insufficient measures to prevent depletion of soil fertility, to decrease amount of wind and water caused erosions, pasture overgrazing and deforestation. Water resource degradation is caused by application of high amounts of chemicals, fertilizers as well as by high rates of irrigation.

1018. Other reasons of land degradation include biophysical factors, changes in the flora and fauna, decreased plant cover, mining for extraction of mineral resources, socio-economic factors (farmers have insufficient resources to conduct soil amelioration measures, lack of long term credits, and state budget subsidies), political and institutional factors (imperfect policies).

1019. In all CA countries agrarian reforms are conducted in accordance with the specific conditions of agricultural production and are oriented towards securing self sufficiency and substitution of imported goods. This policy is not always justified as it does not allow using water and land resources efficiently, decrease the level of specialization and the product quality, increases production expenses and the cost of final products, ultimately decreases the compatibility of the product on the external and internal markets.

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