ISDC

SIC

UNEP

CENTRAL ASIAN INTEGRATED ENVIRONMENTAL ASSESSMENT

ASHGABAT - 2006

International Fund for Saving the Aral Sea
Interstate Sustainable Development Commission
SCIENTIFIC-INFORMATION CENTER
UNEP

SUB-REGIONAL INTEGRATED ENVIRONMENT ASSESSMENT: CENTRAL ASIA

ASHGABAT – 2006

CONTENT

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ABC	Asian Brown Cloud
BAM	Basin of Aral Sea
CA	Central Asia
CAS	Central-Asian Subregion
CAREC	Central Asian Regional Environmental Centre
CDW	Collector-Drainage Waters
DSS	Decision Support System
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GEO	Global Environmental Outlook
GIS	Geographic Information System
GNP	Gross National Product
HPS	Hydroelectric Power Station
IFAS	International Fund for Aral Sea
ICWC	Interstate Commission for Water Coordination
ISDC	Interstate Sustainable Development Commission
MPCs	Maximum Permissible Concentrations
NGO	Non-Governmental Organisation
OECD	Organization for Economic Cooperation and Development
PAs	Protected Areas
PPP	Parity Purchasing Power
REAP	Regional Environmental Action Plan
SIC	Scientific Information Centre
SD	Sustainable Development
UN	United Nations
UNSDC	United Nations Sustainable Development Commission
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP/RRC-AP	UNEP/Regional Resource Centre for Asia and the Pacific
UNDESA	United Nations Department on Economic and Social Aspects
UNESCO	United Nations Educational, Scientific and Cultural Organization
USSR	Union of Soviet Socialist Republics
USA$	Dollar of the United States of America
WHO	World Health Organization

INTRODUCTION

The Central Asian sub-region consists of the following sovereign countries – Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan (Fig. 1).

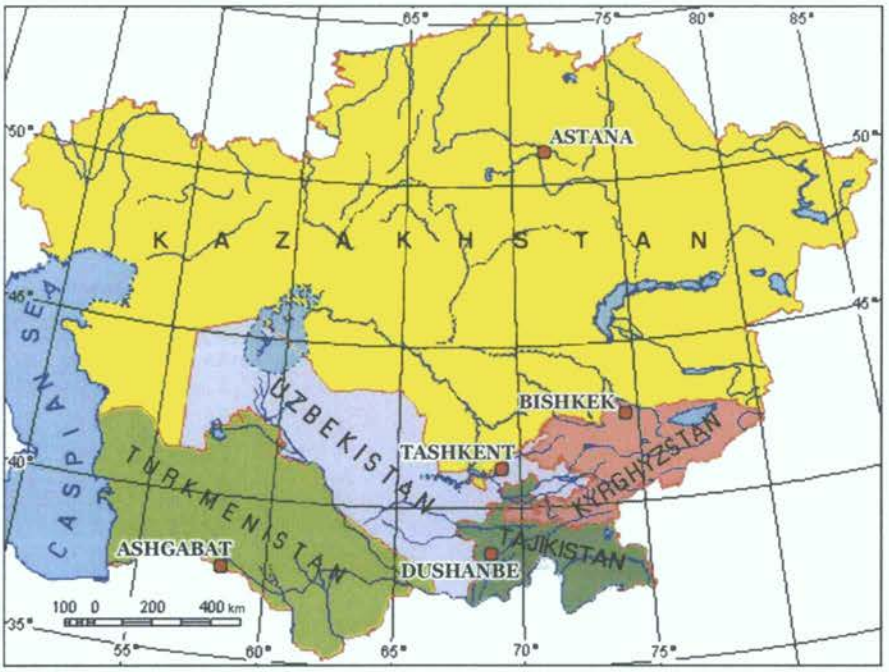

Fig. 1. Central Asia States

Central Asian states have been formed after the demise of the Soviet Union in 1991. Currently they represent a sub-region that is united by economic linkages, historical, social and religious traditions that however face a number of similar, economic and environmental problems.

Common environmental problems in the sub-region have galvanized the regional cooperation among the countries, which consider the move towards environmental security and sustainable development as priority. Taking into consideration the global significance of the Aral Sea shrinking and overall critical environmental situation in Central Asia the heads of the States have concluded an Agreement on mutual actions on solving Aral Sea problems as well as improving socio-economic development of the Aral Sea region. The Agreement is the first of its nature legal document aimed at introduction of sustainable development concept of the Central Asian states.

Heads of the States have several times expressed their commitment to sustainable development having noted that provision of sustainability is a key prerequisite for socio-economic development of the Aral Sea basin.

Considering water as the main trans-boundary issue for the sub-region, the presidents of the States have agreed that water management component should have an eco-system approach and implemented in a harm-free-use considering the interests of all countries.

There were two commissions established under the frame of International Fund for Aral Sea Saving (IFAS): Interstate Sustainable Development Commission (ISDC), and Interstate Coordinating Water Commission (ICWC).

The ISDC is empowered to coordinate and manage regional cooperation in the field of environment protection and sustainable development in CA. The executive body of the ISDC is the Secretariat and the SIC with its branches in each of the states of Central Asia.

Regional cooperation in the field of environment protection and development of common program has become an imperative requirement to solve particular environmental problems that go beyond

the regional scale and have global significance.

To this end, in February 2000 ministries of nature protection agencies of the states agreed to develop a Regional Environment Action Plan with financial support from UNEP, UNDP and ADB and under coordination of ISDC. The document included 5 environmental priorities and was initiated and at the Ministerial Conference and approved by the Steering Committee of IFAS in September 2001. The most important aspect of the REAP is its conformity with the national environment strategies and plans of the States

The Scientific Information Center (SIC) of ISDC as a regional body is assigned to provide expertise and information support as well as develop a Central Asian Decision Making Support System in the field of sustainable development and REAP.

In 2004 the ISDC turned to UNEP soliciting its support for the implementation of REAP and development of Central Asian Convention on Environment for Sustainable Development.

In June 2000 under the ISDC decision SIC was granted a status of the Collaborating Center of UNEP/GRID-Arendal and the Regional Collaborating Center for Global Environmental Outlook (GEO-3). Within this decision, under the support of UNEP, SIC has elaborated subregional CA component for GEO-3, in which Central Asia was included for the first time. In addition, SIC has issued in English and Russian the GEO-3 Regional Outlook and National Reports of the CA countries. The Reports contained retrospective assessment of environmental changes by components for the last 30 years; general information about natural and socio-economic conditions of the countries; strategic steps undertaken for the improvement of reciprocal influence of natural and anthropogenic factors; system of environment management; directions of improvement of international cooperation in the field of environment protection.

Problems of environment protection and resources conservation still remain to be extremely critical and versatile. The earlier published «Global Environmental Outlook – GEO-3" gave a deep allround assessment of the state of environment, determined the most priority trends and proposed recommendations of important measures to keep environment intact and to conserve the nature. However, in spite of the steps taken in this direction, implementation of the relevant conventions, programs and projects progresses everywhere at a slow pace. Apparently, this is the result of underestimation of the danger, in which environment situation happened to be, and low financing of environmental and resource-saving technologies on the regional and national levels. Recently, countries have developed national programs and action plans in this field but they are implemented in different countries in various extents, and often at the lack of the complex regional approach.

It is common knowledge that human society's development is part and parcel of the state of environment, its balance and well-being. Nevertheless, in many regions the excessive pressure of anthropogenic factors on ecosphere turns out to be of enormous dimension and inhibits self-regulative functions of nature that is the prime cause of disturbance of the balanced environmental system and deterioration of economic and social conditions.

Such phenomena, taking place all over the world, are also typical for the Central Asian subregion. For the first time the population of the sub-region faces serious environmental situations, as the nature of Central Asia mainly easily yields to desertification processes. The most active desertification processes are observed in the Aral Sea Zone, the main cause of which has become the excessive use of water for irrigation development in the Amudarya and Syrdarya basins resulted in the drying of the Aral Sea and unexampled in its scales development of negative environmental processes on the territory not only of the Aral Sea Zone but also of the whole sub-region and neighboring states. The beginning of the Aral Sea crisis originated quite long ago, or in 1970s of the former century. After the collapse of the Soviet Union and gaining independence by Central Asian countries the environmental activities have aroused.

Tens of projects, programs and plans were developed, which were implemented only partially. However, the Aral Sea environmental and socio-economic crisis hasn't been sumounted.

As before, soil and vegetation degradation, drinking water quality loss, genetic changes in species composition of flora and fauna, efficiency decrease of irrigated farming and grazing stockbreeding are observed. Environmental situation in the Aral Sea basin as usual has negative direct and indirect impacts on the living conditions of many millions of population, its health and labor activity.

During 1990s countries of Central Asia faced numerous, mainly negative, problems related to the collapse of the Soviet Union and destruction of existing at this time political, economic and social relations between former Soviet Republics. Therefore, new independent countries had to establish new institutes, approaches and working skills for functioning in conditions of the serious economic crisis. Every new sovereign country in situation of emergency searched for its own ways of exit from this difficult situation. It is clear that in these conditions they were not able to pay the appropriate attention at the state and quality of environment. Nevertheless, all five Central Asian countries attach paramount importance to the regional cooperation in solving a number of serious environmental problems arising because of the drying of the Aral Sea and worsening of vital activity of people living in the Aral Sea Zone. The countries prepared and published their own plans and strategies of environmental security and sustainable development, in which they clearly determined the main approaches to the solution of issues of environment protection and nature management.

Solution of economic and social development problems even in conditions of favorable environment requires new approaches to integration and coordination of activity on all governmental, public and local levels. However these goals, unfortunately, often faces indifference and irresponsibility of decision-makers that causes anxiety and concern. Reasons restraining implementation of scheduled environmental measures are known for a long time, but they are not comprehended by many managers on the national and regional levels as well as by overwhelming majority of local population. Naturally, achieved successes of Central Asian countries during the years of independence in the field of environment protection and rational nature management shouldn't be underestimated. However, it is early to say that they are of sustainable nature. Unfortunately, the majority of managers and many groups of the population developed skeptical attitude to the policy of environmental security and sustainable development.

Main environmental problems such as policy of land use improvement, desertification control, conservation of biological and landscape diversity, health care of the population and others impact sustainable development of Central Asian countries.

It should be taken into consideration that sustainable development is not the mere continuation of environmental policy by means of different approaches and techniques; it is the modernization strategy, which contains huge innovative potential for the socio-economic development of the society and environmental prosperity.

To solve these tasks is possible only in the case if all levels of the population from top to bottom and backward will treat these problems as their personal affair. Therefore it is necessary to urge our creative potential to find out new best ways to achieve the set goals.

Established intergovernmental and interdepartmental nature protection agencies and organizations of Central Asia, and first of all International Fund of the Aral Sea (IFAS, 1993), are important subregional mechanisms in solving problems of environment and sustainable development. The Interstate Sustainable Development Commission (ISDC) and the Interstate Coordinative Water-Management Commission (ICWC) supported by scientific-informational centers has been functioning within IFAS. CA countries have ratified all the most important environmental UN Conventions on desertification combat, biodiversity conservation, climate change, etc., for which they developed and passed for realization national action plans financed under the governmental, local and donor sources.

Nature Protection Ministries or governmental committees of each Central Asian country provide scientific and technical support of environmental measures and interdepartmental control of their realization. Scientific-practical and informational support for nature protection ministries and departments is provided by international journal "Problems of Desert Development" established within

ESCAP/UNEP in 1967.

Historically Central Asia is known as a sub-region with quickly growing population. For instance, at the end of 19th century the number of the population here was about 8 million people and now it amounted to 59 million people or during more than 100 years the population of the sub-region has grown up more than 7 times. So, anthropogenic load on environment also steadily grows. Therefore, exactly in this sub-region harmonization of relations of the man and Nature is particularly important.

Having huge natural and economic potential Central Asian sub-region attracts high attention of the world community. Therefore the problems of environmental security and sustainable development are one of the strategical issues for five countries of this sub-region within implementation of the Regional Environmental Action Plan (REAP).

In the given brief review the newest data are presented and objective integrated assessment is given of the present-day state of environment and environment-related sectors of the national economy and social life of the population of central Asia. The assessment focuses special attention to the issues of interaction in the system "Man-Nature", environmental crisis issues and top-priority environmental tasks and nature-saving technologies.

Integrated assessment of the state of environment in Central Asian Sub-region has been prepared by the Scientific-Information Center of the Interstate Sustainable Development Commission Commission – ISDC IFAS in Turkmenistan and its branch offices in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan.

CHAPTER I. GENERAL INFORMATION ABOUT SUB-REGION AND ITS NATURAL CONDITIONS

The Central Asian Sub-region is the territory of about 4 million square kilometers situated at the turn of Europe and Asia, between 35-55° N latitudes and 48-87° E longitudes. As for the administrative-political formation, they are Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, which proclaimed their independence in 1991 after the collapse of the Soviet Union (Fig. 2). The total population of the Central Asian Sub-region is more than 59 million people, average density of which reaches 15 people per square kilometer.

New countries of Central Asia border upon Russian Federation, China, Iran and Afghanistan. They, occupying a buffer area between European east and Asian west, historically experienced in their development their political, economical and cultural influence. The Great Silk Road passed exactly though this region, which was the main connecting link between Europe and Asia.

This huge territory in hypsometric terms is located in the range of 132 m below sea level (depression Karagie in Western Kazakhstan) and 7495 m above sea-level (peak Ismoil Somoni in Tien Shan mountains in Tajikistan) that in its turn predetermines a wide range of original natural complexes.

4/5 of the territory in its structure is characterized by plains and only 1/5 of its territory is occupied mountains (Fig. 3).

Landscape diversity on the main part of the territory of the Central Asian Region, because of its inland location, was formed and developed in conditions of continental climate with insufficient and unstable precipitation that imparted typical aridity to its nature with peculiarities of extra-tropical deserts. Because of the big extent of the territory of Central Asia from North to South the appropriate latitudinal climate change takes place. This resulted in consequent alternation of zone environmental systems from semiarid cold continental steppes and semi-deserts in the North to hot extra-arid deserts in the South. Here landscape zones of steppes, semi-deserts, deserts, and areas of high-density population – oases are clearly distinguished.

Within the desert plains complexes of clay, sandy, brackish and rocky-rubbly deserts form the peculiar landscape category. The ecosystem of oases, which are transformed under the influence of an-

thropogenic factors, is notable against arid piedmont-desert landscapes. Ecosystems of arable lands, occupying vast areas on piedmont inclined plains and slopes of medium-high mountains supplied with weak, medium and abundant precipitation, belong to the man-caused landscapes.

Deserts and semi-deserts occupy more than 80% of the territory of Turkmenistan, 70% of Uzbekistan and 60% of Kazakhstan.

Landscape diversity on mountainous territories complies with vertical zone factor. Here mountainous semi-deserts, mountainous steppes, mountainous forests, alpine meadows and high-level deserts and semi-deserts are clearly prominent.

Every landscape zone occupy: desert and semi-deserts 1,750,000 ha, steppes 1,100,000 ha, mountains – 400,000 ha, oases 300,000 ha, water surface 450,000 ha.

All landscapes of Central Asian Sub-region, without exception, experience the impact of anthropogenic factors of different extent such as irrigation, ploughing up, felling of arbor-bushy

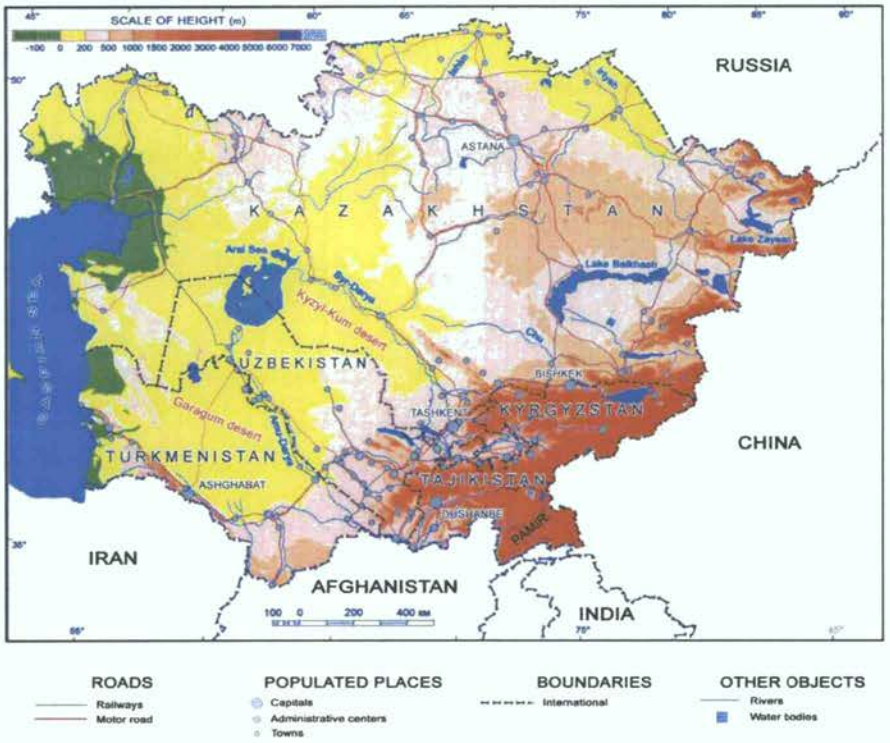

Fig. 2. Physio-geographic map

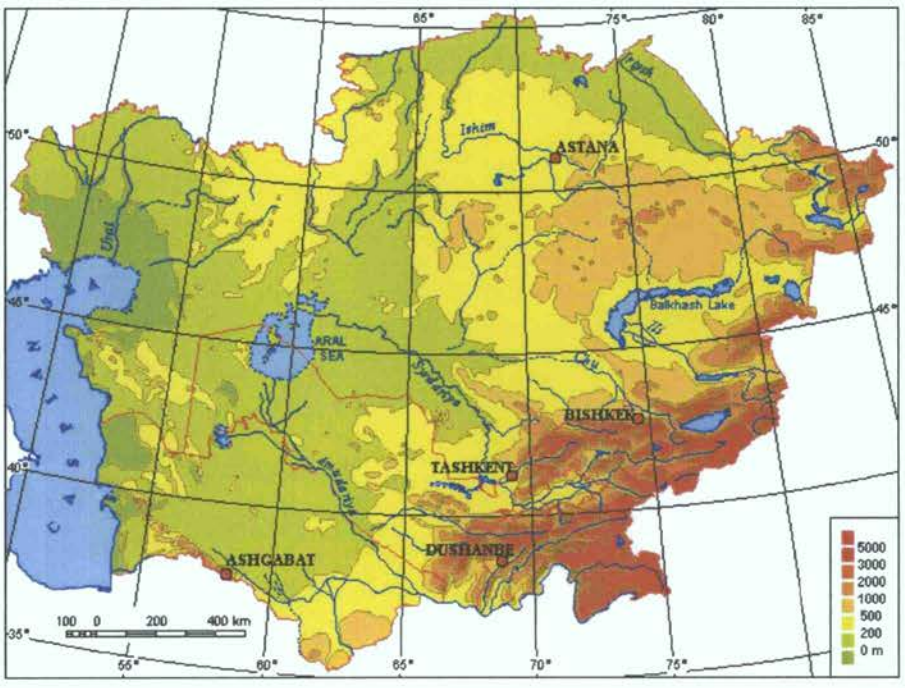

Fig. 3. Central Asia Relief

Fig. 4. 3D Rlief of Central Asia

vegetation, overgrazing, mowing, poaching, road construction and pipelines fitting, power lines and communication lines, mining operations, construction of processing plants, mills, erection of village and city service lines.

Valleys and river deltas as well as piedmont inclined plains, where lands in comparison with original ones have acquired features of cultivated landscapes, are subject to the most active impact of anthropogenic factors.

Conservation of landscape diversity is the basis for optimal ecosystem functioning. Sustainability improvement of natural ecosystems due to the conservation of their landscape diversity reduces the level of exposure to processes of desertification of all kinds. It is particularly important for actual prevention of salinization and deflation in plains, and of processes of erosion and mudflow formation in mountainous regions that cause huge economic damage. Vegetation and natural forests reduction, continuous drying of the Aral Sea and contamination of coastal and shelf zones of the Caspian Sea by oil waste products aggravated the burning problem of desertification in all Central Asian countries. Conservation of the landscape diversity, particularly in vulnerable arid areas, both with natural and artificial vegetation, will play an important role in reduction of desertification processes.

In mountains bordering the Central Asian Sub-region from South and South-east there could be observed the alternation of altitudinal belts – desert – semi-desert, steppe, meadow - steppe, mountain - forest, Alpine and nival landscape diversity (Fig. 5). The overwhelming part of water and hydraulic power resources is formed in CA mountainous territories

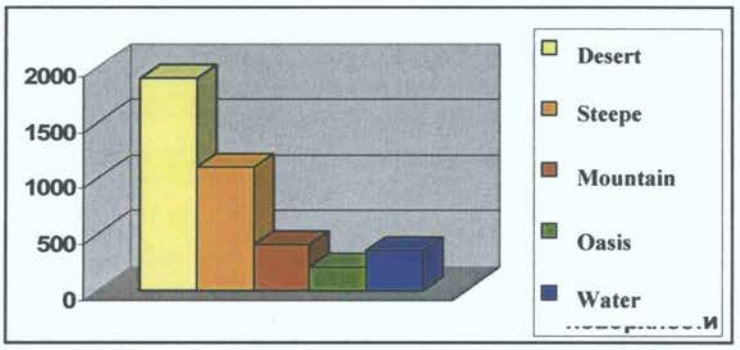

Fig. 5. Landscapes of Central Asia (thousand km^2)

Mountains influence the atmospheric agitation of the major part of plain territories. First of all, precipitation in mountains many times exceeds the relevant precipitation in plains. Annual precipitation here is 500 – 700 mm.

Mountainous territories being of exclusive importance in space-time distribution of water resources represent the area of precipitation accumulation, and glaciers and eternal snow formation, the only sources of renewable fresh water resources. At the same time mountains of Central Asia represent great danger

concerning natural disasters: earthquakes, landslides, avalanches, snow slips, mudflows, etc., which can seriously complicate socio-economic conditions of not only mountain population but also densely populated foothills and desert plains. Though mountains amounts to only less than 20% of the territory of the Central Asian Region, their ecosystems serve as original storage for flora and fauna species diversity, and are the guarantor of conservation and rehabilitation of the landscape and biological diversity.

The main feature of the Central Asian nature is characterized by arid landscapes. Even in mountains there are arid lands, where typical signs of desertification processes can be observed.

. CA territory has experienced difficult geological-geomorphological processes. Results of long-hole drilling show sedimentary rocks complex in plains, which allow to restore paleography picture for a long period of time.

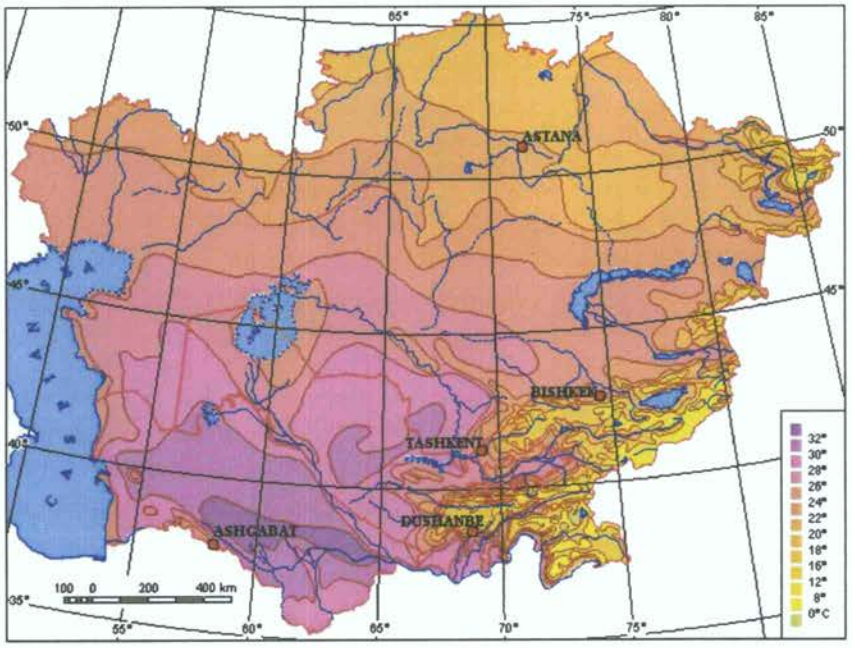

Fig. 6. Average temperature of July

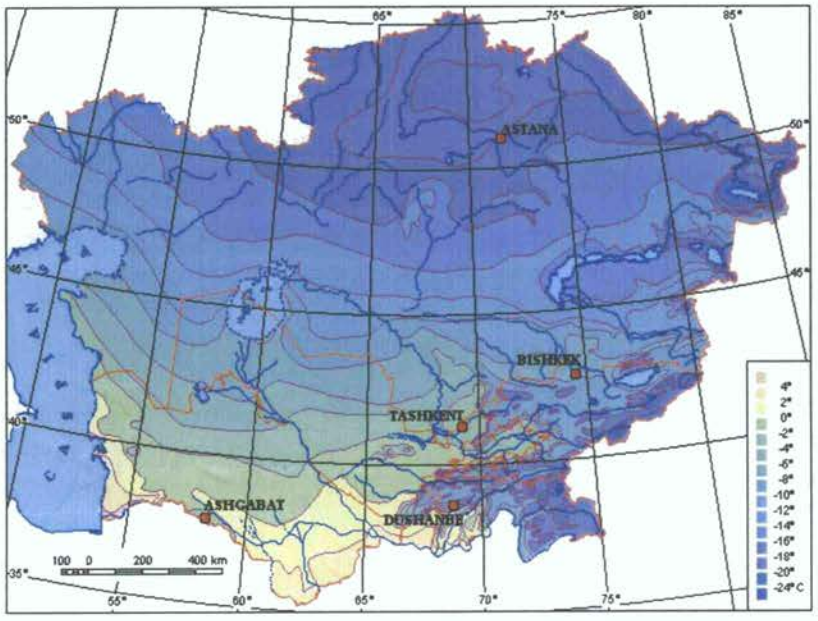

Fig. 7. Average temperature of January

The accumulation of deposits in deserts and semi-deserts in quaternary was related to the influence of ancient, often roaming, rivers coming down from mountains as a result of intensive glaciers' melting. Ancient alluvial sandy-clay deposits in Central Karakums mounted to 500-600 m, and in Kyzylkums – 200-400 m. Henceforth these loose sandy deposits were subject to aeolian processing that resulted in creation of main relief forms of the modern surface of Turan plain.

For CA climate high summer air temperatures are quite typical reaching +50°C in absolute values. The average July temperature varies within the range of +28°C in the North and +32°C in the South (Fig. 6). The absolute minimum reaches -40°C in the North and -26°C in the South (Fig. 7).

Precipitation amounts to 100-200 mm (Fig. 8). High summer-autumn temperature and strong dryness cause soil drought and increase of transpiration in plants. In plains the vegetation period lasts quite long time. It allows in irrigated area to obtain two and in some places three yields of agricultural crops from each hectare. Droughts like "garmseel" and "afghanetz" causing great losses of harvest on irrigated and arable lands belong to the negative features of local climate of Central Asia. Dry air stream "garmseel" last up to two weeks and blows at speed of 12-14 m/sec, in which the air warms up to 43-44°C, and fertile layer of soil almost completely dries up. There were years, when "garmseel" reduced harvest of agricultural crops by 80%.

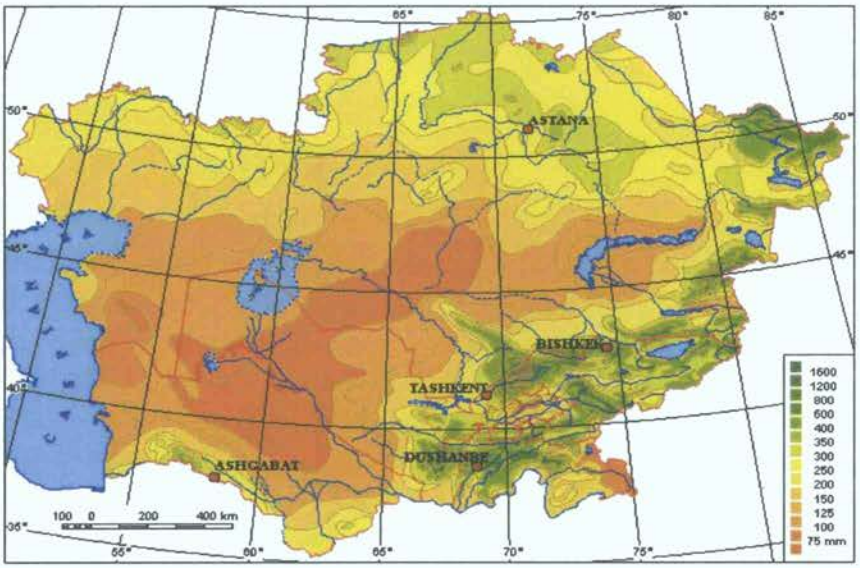

Fig. 8. Annual precipitation

Hot wind "afghanetz" like strong stream bursts through to southern regions of Central Asia. It lasts 2-3 days, and speed reaches 20 m/sec and more. Not only irrigated agricultural crops suffer from droughts but also pasture vegetation. Simultaneous impact of soil and air droughts accelerates the drying out of natural herbaceous vegetation and decreases it yields by 60-65%.

Huge plain part of Central Asia suffers from great deficiency of fresh water. The largest rivers Amudarya and Syrdarya, coming down from high mountains of Pamirs-Altai and Tien Shan, are directed towards the Aral Sea through sandy desert. By present time the discharge of these rivers is almost completely regulated and does not reach the Aral Sea. This resulted in drying of the sea and developing of serious negative socio-economic events, because of which people suffered great socio-economic damage; flora and fauna of the whole Aral Sea zone were impacted. Other smaller rivers such as Zeravshan, Chu, Ilee, Murgab, Tejen and others do not play an important role in the water balance of Central Asia being the river of local importance.

Ground water, which in big amounts is deposited in foothill regions and along rivers, is used mainly for water supply of cities and settlements, as well as for irrigation of neighboring lands. Local source for water supply of small settlements and for small-oasis agriculture from ancient times is local run-off, which is formed on takyr surfaces such as sardobs in deserts, kyariz in inclined foothills valleys, small water reservoirs of mudflow water, etc. However,

this wise folk water engineering is used occasionally.

In plant growing the main culture is cotton, which occupies the overwhelming part of irrigated territory of Central Asian countries. Cereals, fruits, vegetables and melons and gourds are grown on these lands. Vast natural pasture territories allow developing less labor-intense but more profitable branch of stockbreeding such as sheep breeding and camel breeding.

More than 300 million ha (75%) of the total area of CA are agricultural lands, of which pastures occupy 270 million ha, arable lands – 45 million ha, including more than 8 million ha of irrigated lands.

The richest mineral, water and land resources of the sub-region contributed to the development of industrial-agrarian sector of economy. Huge resources of oil and gas, ferrous metals and nonferrous metals, coal, chrome, lead, uranium, water power resources, etc. have been discovered in the Earth's interiors of the Central Asian countries and are being exploited. Weight of fuel-and-energy and mining-and-smelting complex in the total industrial production volume exceeds almost by 12% the relevant indices in countries of the Commonwealth of Independent States (CIS).

Countries of central Asia, besides similar natural-environmental conditions, have deep historical and socio-economic roots. Concerning religion the Central-Asian countries belong to Islamic world. They have much similar in customs, traditions and culture. During the years of independence the Central Asian countries have passed over the period of industry recession, breakup of economic relations, and increase of some production deficiency. Currently certain positive socio-economic shifts are observed in CA countries.

CHAPTER II. SOCIO-ECONOMIC DEVELOPMENT

2.1 Review of the Main Socio-Economic Tendencies

In Central Asian countries socio-economic reforms are successively carried out, however they happen to be antilogous in general with a number of positive shifts, which took place in the society and economy in 1992 - 1999, and negative socio-economic consequences of market transformation. The main macroeconomic indices of the last years being the illustration to this.

In 1996 an increase of the gross domestic product was observed for the first time in the whole sub-region, and this tendency continues till nowadays. The highest rate of economic growth in 1999 was observed in Turkmenistan (116%); in Uzbekistan it was (104.4%), Kyrgyzstan and Tajikistan (103.6), Kazakhstan – 101.7%. Volumes of GDP per capita in 1999 in comparison with 1996 have increased in Kazakhstan by 6%, in Kyrgyzstan –11%, Tajikistan - 7%, in Turkmenistan - 8%, and in Uzbekistan - 9%. . However, in comparison with 1990 the real GDP decreased in all countries of the region. The most significant recession was in Tajikistan – 2.2 times, the least significant in Uzbekistan – 1.1 times.

Average GDP per capita by the purchasing-power parity in CIS in 1999 was on average 5 thousand USD or 21% against the level of this index in the USA. In the Central-Asian subregion the highest value of this index is in Kazakhstan – 5250 USD or 22% against the level of the USA. The lowest value accounts for Tajikistan – 1030 USD (4%). In Turkmenistan, Uzbekistan and Kyrgyzstan this index respectively amounts to: 4210, 2370 and 2990 USD or 14.8, 12.2 and 9% against the level of the USA (Fig. 9).

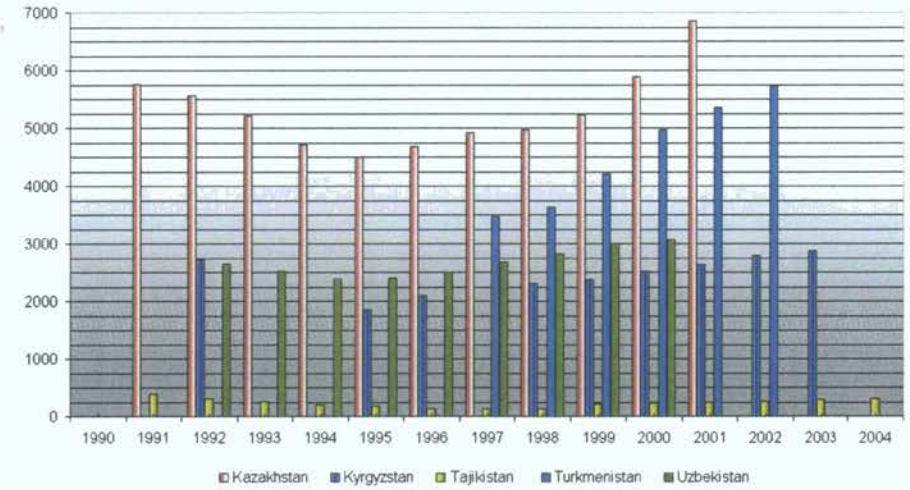

Fig. 9. GPD per capite ($ PPP)

In the agroindustrial complex of CA countries during the last 2 years growth tendency has become outlined. If in CIS production of agricultural products has increased by 2%, then in Kazakhstan is increased by 29%, Kyrgyzstan by 9%, in Tajikistan by 4%, Turkmenistan by 26%, in Uzbekistan – 6.2%. Because of the undertaken policy of diversification of agricultural production the structure of the area under crops is changing – in Turkmenistan areas allotted for grain-crops, in Uzbekistan – for melons and gourds and vegetables. Stable growth of the main productions of the livestock breeding was observed in Kyrgyzstan, Turkmenistan and Uzbekistan (Fig. 10, Fig. 11, Fig. 12, Fig. 13, Fig. 14).

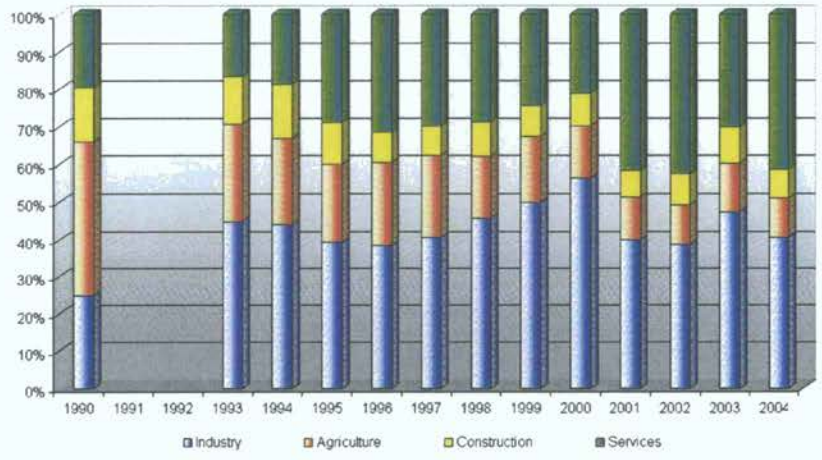

Fig. 10. Kazakhstan. Structure of GDP (%)

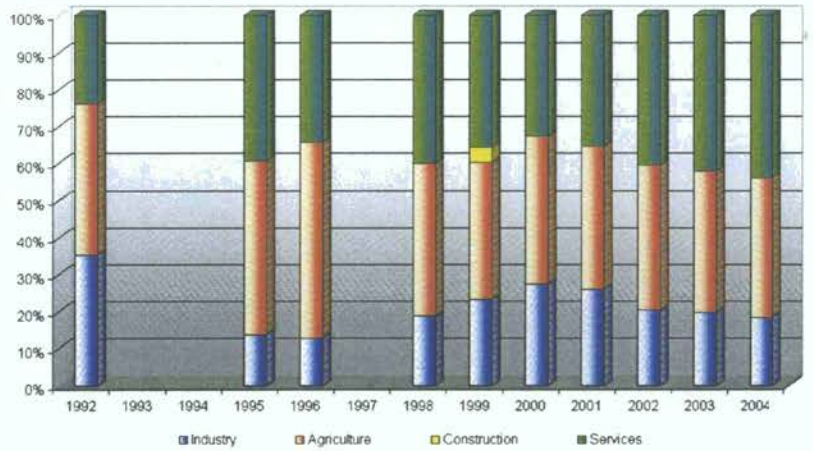

Fig. 11.Kyrgyzstan. Structure of GDP (%)

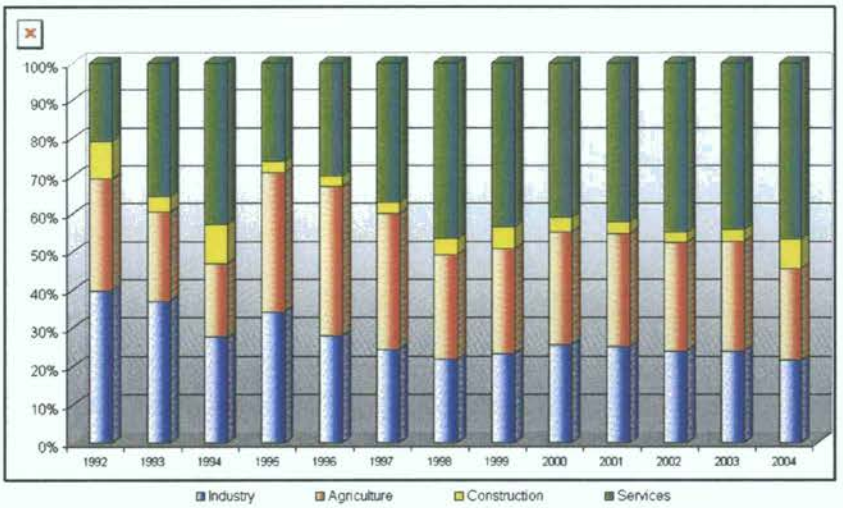

Fig. 12. Tajikistan. Structure of GDP (%)

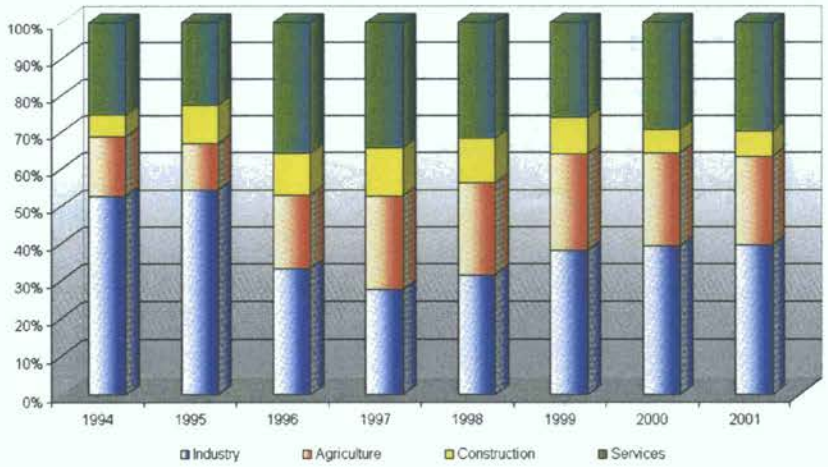

Fig. 13. Turkmenistan. Structure of GDP (%)

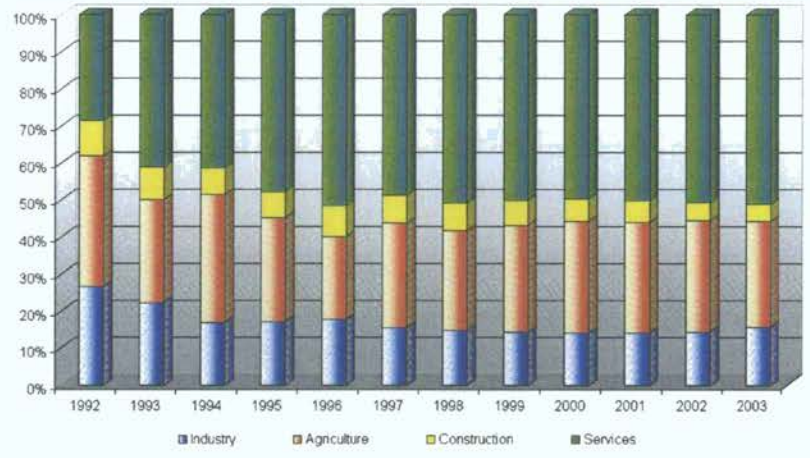

Fig. 14. Uzbekistan. Structure of GDP (%)

The breach of existing interstate relations is still characteristic for economic situation in Central Asia, which causes significant damage to the economies of these countries. Reorientation of external economic links to the world market couldn't alter the situation in production because of the keen competition.

Poverty is the common problem of development of the Central-Asian countries. At the official level poverty is recognized by three countries - Kazakhstan, Kyrgyzstan and Tajikistan, with the relevant programs for overcoming this phenomenon (Fig. 15).

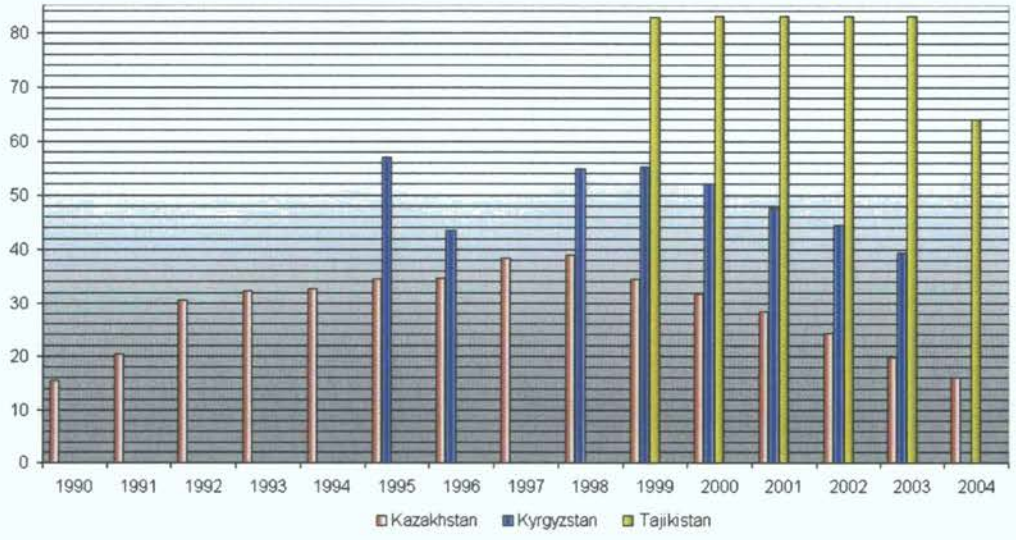

Fig. 15. Population below income poverty line (%)

Gini index, indicating the income gap between the rich and the poor population and characterizing the social stratification of the society, remains very high, and amounts on average to almost 0.350. The income gap between wealthy and the poor increases. For instance, in Kazakhstan before the beginning of the transit period there was four-time gap in cash income between the richest 10% of the population and the poorest 10%. In 1998 this difference exceeded 10-fold dimension (11.3 times). Ten percent of the richest layer of the population received 27% of income, while 10% of the poorest population received only 2.3% of income

(Fig. 16).

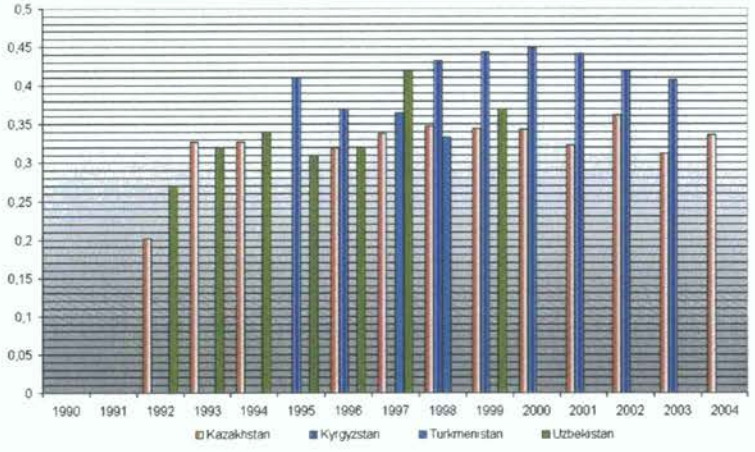

Fig. 16. Gini index- discrepancy in earning

At the same time Turkmenistan had high indices in the world in rates of economic growth during 2000-2002. The growth of gross domestic product (GDP) in 2000 was 118.6%, in 2001 – 120.4%. Gas extraction has grown up 2.3 times during 2000-2002, oil 1.3 times, electric power production 1.2 times. The main indices of agriculture, textile industry, and transport communications, communication development outlined in the program were considerably exceeded. Turkmenistan is the only country in Central Asia, in which for more than 10 years economic reforms have been developed and economic potential of non-governmental sector has been increased.

During the period from 1998 till 2002 there was achieved a significant increase of the total volume of national savings from 11 up to 25% GDP. Direct foreign investments in 1999-2002 totaled on average 9% that is the highest index among CIS countries, though the main share of these investments falls on oil-and-gas industry.

The average GDP growth rate during the last 5 years was 10.3%. In 2005 GDP per capita will be 3,440 USD and it will be 3 times increase in comparison with 1999. According to the data of the World Competitiveness Report of the World Economic Forum, in 2005 Kazakhstan occupies the 61 place of 117 countries included into the report, left behind its CIS neighbors.

Rehabilitation of the agricultural sector in Kazakhstan is going on slowly. That situation when 44% of the population live in rural area and agriculture makes only 9% input in GDP is the evidence of the fact that the given sector reforms should give opportunities for effective employment in order to reduce the poverty and urbanization. Grains production dropped from 30 million tons in 1992 up to 6.5 million tons in 1998 (these figures demonstrate the drop of production on average by 20% per year). The cattle population reduced from 9 million in 1992 to 3.9 million in 1998.

Tendencies for agriculture development appeared in 1998 году, particularly in grains sector. During the period from 1998 till 2002 the grains production increased by 46% on average. Wheat production in 1998 reached 18 million tons.

We can judge about the modern macroeconomic situation by the example of dynamics of the main socio-economic development indices of Kyrgyzstan. During reforms implementation the almost 2-time reduction of gross domestic product in its real terms has made for destabilization of reproductive economic basis; the state investment activity happened to be reduced to zero. For the present moment the real sector cannot actually function without exter-

nal financial assistance, to the share of which fall 90% of all investments in Kyrgyzstan. The share of the gross fixed capital accumulation in the structure of used GDP does not exceed 10%, while the experience of countries, undergone "shock" phase of reforming and achieved positive economic results, shows that it should comprise not less than 30%.

In Kyrgyzstan the ratio of the state and private sectors of economy has significantly changed. During the period from 1999 till 2003 the share of the state sector in economy reduced from 17.3% up to 14.9%, and accordingly the share of the private sector increase from 82.7% up to 8 5.1%.

In Kyrgyzstan the years of reforms were characterized by structure warps in economy, which determined its de-industrializational trend. The main structure-forming spheres in GDP formation has become the agrarian sector with gross value added being 32.9% and service sector 38.1% (according to the data of 2004). Taking into consideration the fact that agricultural production in Kyrgyzstan is highly dependent on unstable climatic conditions, and human services depends on low solvent demand of the population, a significant economic growth is highly unlikely.

The effect of poverty is environmental degradation, which could be observed both in rural areas and in cities of the sub-region. As a result of low standard of living and population growth government of CA countries and people have to make a compromise being tolerant to progressive deterioration of environment to meet their growing needs. People intensely use nature resources leaving nothing to the future generation. In its turn natural resource depletion contributes to impoverishment of the population. It is an urgent problem that should be solved by sub-region governments and international financial institutions by working out appropriate political instruments.

2.2 Human Development

CA countries' differentiation according to the level of human development is determined by the difference in GDP levels per capita. In all countries from the beginning of reforms till mid of 1990s there was a decrease in human development index (HDI) on average by 5% against GDP decrease. By the end of the decade HDI started increasing as far as economy was revived (Fig. 17). At the same time a disturbing tendency appeared in all countries towards reduction of the life span – the "low-weight" component of the Index but very important from the point of view of development. Educational integral part of the Index keeps being stable due to the high literacy level of the population. However closing of kindergartens, low level of labor remuneration of teachers, and decrease in attendance level of educational institutions are the reason to be anxious.

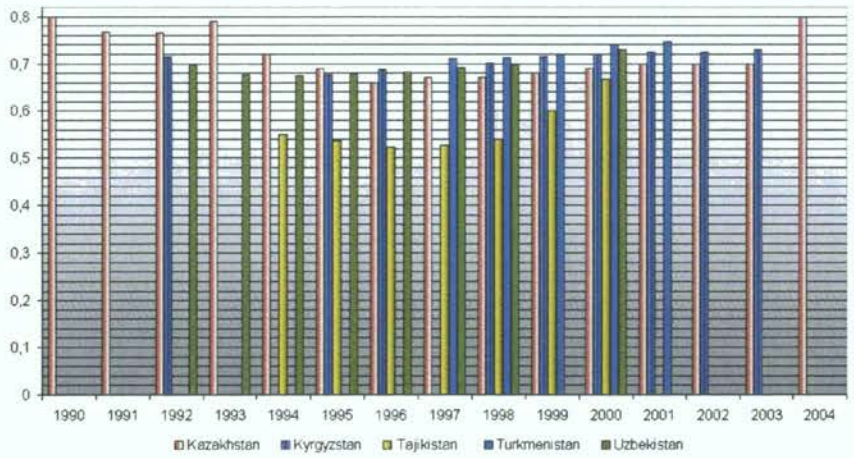

Fig. 17. Human Development Index

According to the yearly UNDP report for 2005 countries of Central Asia occupy the following places by Human Development Index: Kazakhstan — 80th place, Turkmenistan — 97th, Kyrgyzstan — 109th, Uzbekistan — 111th and Tajikistan — 122nd place of 177 countries of the world. These figures are given in Report of the UN Development Program "On Human Development Index". Rating was based on the basis of average life span data analysis in the countries, literacy level, and opportunity to get education and income per capita.

Political and social stability in Turkmenistan and successful economic reforms contributed to the growth of the life standards of the population and favorable demographic situation.

An expanded type of population reproduction with its high natality is characteristic for Turkmenistan. A share of children and able-bodied population is rather high. The population in Turkmenistan as of January 1, 2005 was 6550 thous. people, of them in urban settlements 3082 thous. people lived (47%), in rural area 3468 thous. people (53%). By the data of complete population census, which was held in 1995 in Turkmenistan, the highest number of people in the family observed in Dashoguz velayat – 6.8 people, the lowest – in Balkan velayat (4.9 people) and in Ashgabat city (4.5 people).

Human Settlements. Natural conditions (mountain and desert landscapes, aridity of climate) of Central Asia determine the population concentration mainly in oases, mountainous valleys, along riverbanks.

Though the sub-region does not belong to the most densely populated areas of the Earth, amount of its population is around the environmentally acceptable boundary. Vast desert and semi-desert areas of Kazakhstan, Turkmenistan and Uzbekistan, as well as mountains of Kyrgyzstan and Tajikistan are under-populated. In general here less than 1 person is settled on km2. In Northern and mountainous regions of the sub-region the population density is within the range from 10 to 50 people per km2, and in oasis zone in deltas and valleys of rivers in the South of the sub-region it reaches 100 and more people per km2. All countries of the sub-region are notable for relatively high rate of natural growth of the population (Fig. 18). Against the background of aggravated environmental conditions the population's growth complicates resolution of problems of environment protection, as it forces a part of the population to live and work with their social troubles in environmentally vulnerable areas.

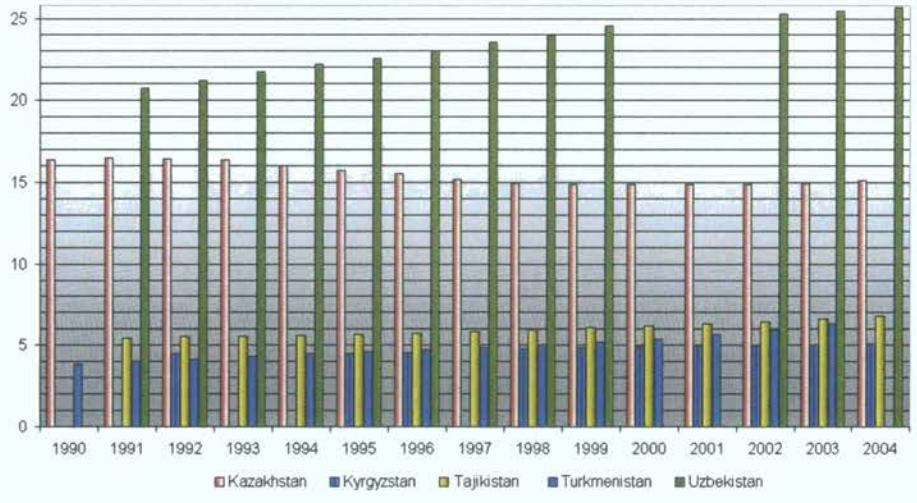

Fig. 18. Number of population (mln.)

At the same time a settling policy was pursued aimed at the increase of cities and large settlements at the expense of disappearance of small kishlaks and auls (villages in Central Asia) and resettlement of mountaineers to valleys. In cities, suburbs and large settlements the population density started exceeding the norms ten times permissible for normal life. During the last decades in majority of Central-Asian republics economic growth rates already did not keep pace with the growth of the population, social development was chronically retarded from established standards.

So, in Kyrgyzstan 15% of lands are located at a height less than 1500 meters above sea level, where almost 85% of population are concentrated, and 13% of citizens separately live at the height from 1500 up to 2000 meters above sea level. And only more than 2% occupy the altitudinal niche, which does not exceed 2500 meters above sea level. North and South of Kyrgyzstan significantly differ from each other by economic growth rates, industry specialization, population's structure and amount. If in the South the natural increase of the population is of critical role in changing amounts of the population, then in the North, and first of all in Chuiskaya Oblast and Bishkek City, it is migration.

The most densely populated areas in Uzbekistan are piedmont and irrigated regions, such as Ferganskaya Valley, Tashkentskaya and Khorezmskaya Oblasts. The population's density in Andizhanskaya, Ferganskaya and Namanganskaya Oblasts, included into Ferganskaya Valley, on average amounts 484.3, 350.3 and 225.3 people per each square kilometer, respectively.

The most urbanized velayat in Turkmenistan is Balkan velayat, the share of urban population there amounts to almost 80%. The biggest share of rural population lives in Mary (over 72%) and Dashoguz (67%) velayats. In those regions, where rural population prevails, the number of children and youths as well as quantitative family composition, is higher than the average index.

Every year in urban and rural settlements of the sub-region the situation with the high-quality drinking water supply worsens. Particularly critical this problem is in Tajikistan, Kyrgyzstan and Kazakhstan. Very often citizens of rural regions do not have water pipelines at all; so, in Kyrgyzstan their number amounts to 40%. The problem of good-quality drinking water supply and in sufficient amounts keeps being complicated that undoubtedly causes the growth of morbidity of the population. In Kazakhstan 25% of the population (about 4 million

people) do not have water pipeline networks, including 16.5% using water from open reservoirs for drinking purpose and 3.2% use drinking water of unsecure quality. Majority of pipelines were placed in operation or overhauled more than 20-25 years ago.

Employment of the Population and Income. In transit period because of the market relation formation the main socio-economic problems have significantly aggravated in countries of Central Asia. Among its main manifestation are as follows: setback in production, increasing scales of unemployment, acute decrease of life standards, transformation of demographic and migration processes. Part of the population couldn't adjust to new economic conditions, became unemployed, without earnings and, as a consequence, a growing property differentiation of the society and scaled increase of poverty became widely spread.

So, for instance, in Kyrgyzstan according to the data of the random integrated study of household budgets in 2003, 39.3% of the population happened to be in the category of poor, at the same time 8.5% were in conditions of extreme poverty. Poverty in rural area was by 19.6% higher than it was in urban area, and reached the level of 46.2%.

An extreme low poverty occurance (11.9%) was typical for households, in which a head of the family had complete higher education. Among those who had high special and high general education, poverty level reached almost 20-40%. The highest level of poor and extremely poor families occurred in those households, where working members were illiterate. At the same time among 2.2% of households headed by illiterate family heads the highest level of poverty intensity and acuteness amounting to 11.2 and 3.7%. The highest percent of poor is concentrated in the group of unemployed – 35.4%, including 38.2% - in families headed by an unemployed man and 29,0% - in families headed by unemployed woman.

In Turkmenistan the scales of structural reforms of economy have ensured the growth of the population employment rate (during 1991-2004 by 37%). Creation of conditions for multistructure economy, realization of the privatization program contributed to redistribution of labor force from the governmental enterprises and organizations to the non-governmental sector. Measures aimed at the stimulation and incentive of entrepreneurship population's activities ensured the 6-time growth of a number of citizens engaged in microbusiness in comparison with 1991. In total labor resources women amount to 49.5%, in those engaged in economy 44.1%.

The share of job seekers in total amount of labor resources is not very high in Turkmenistan, which in 2004 was 5% and during the last years keeps being approximately at the same level (2.7% of registered at the employment exchange).

Governments of Central Asian states undertake actions for income increase of the population, agricultural reforms are implemented, employment and working places establishment, village infrastructure development program is realized. Conditions for accelerated development of small and medium business are formed (Uzbekistan, Tajikistan, Kazakhstan); Programs and Strategy to Combat Poverty and Unemployment are implemented (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan).

To maintain the life standards and population's income at the appropriate level the population in Turkmenistan is provided with free gas, fresh water, electricity and salt, and tariffs for municipal transport, prices for communal services – payment for housing, heating and sewerage remain low and unchanged beginning from January 1993.

Migration of the Population. In mid 1990s the disintegration processes development in countries of Central Asia, as in CIS countries, caused intensification of outflow of the non-

ethnic population of Turkmenistan. Peak periods of external migration of the population were observed in 1992 and 1996. Objective reason for the existing condition was people's desire to go back to their historical Fatherland for uniting with their families.

During this period the size of external migration has increased not only with CIS countries but also with far foreign countries. Countries for emigration were Germany, Greece, Israel and USA. In 1992 of the total amount of people left f or far foreign countries the main migration flow was directed to Germany (47.7%) and Israel (40.8%). This was related to the leaving for these countries of ethnic Germans and Jews. From late 1990s the scales of migration have somehow changed. Departure to Israel has decreased (29%), but increased to Germany (60%). Ethnic composition of emigrants has changed. More than 32% of departed were Russians, 29% Germans, 10% Jews, 3% Ukrainians and 25% representatives of other nationalities.

In Central Asia a new type of migrants appear: environmental refuges. Every year tens thousand people leave zones of desertification every year. So, In Kazakhstan 298 thousand people left areas located in the desert zones in 1994. Particularly high level of outflow of the population is observed from zones of environmental disasters. In 1994 20080 people migrated from Kyzylordynskaya Oblast. Significant part of migrants from this sub-region is settled in large cities. Significant part of family members stays unemployed. This causes social tension, increase of poverty, stimulates growth of law violations.

Decline of the population growth rate in Kyrgyzstan considerably is stipulated by high level of migration of the population. The peak of external migration outflow of the population (1993) was accompanied by sharp decrease of demographic indicators of the republic. During the period of 1999-2003 migration outflow of the population were 103.6 thousand people.

In processes of external migration of the population of Kyrgyzstan its most active capable part is involved. As usual the main part (68%) of emigrants are people of capable age, among whom women prevail - 52%. More than 40% of emigrants it is youths at the age of 14-34 years.

At the same time there are other examples for Central Asia in the issues of the population migration. So, the population of Turkmenistan is characterized with low mobility that is related to several factors. First, ethnic composition of the population, which is represented mainly by native citizens, the national mentality, adherence and observance of traditions and customs of the people, does not ensure migration of the population outside Turkmenistan. Second, family relations are very strong in Turkmen people; often several generations live together and have common household and budget. Close interrelation and mutual aid of older and young members of the family is a restrictive factor of the population's mobility. Third, more than a half of the population live in rural area, where traditional way of life holds true. Nevertheless, events of the last decade, namely, collapse of Soviet Union and creation of independent neutral Turkmenistan had certain impacts on population migration, especially external.

In 1991-2004 external migration in Turkmenistan had a small share in the total amount of territorial resettlements. So, if in 1991 it was around 25%, in 2004 it achieved 30%.

In 1991 migration flows between former Soviet republics (inter-republican resettlements) amounted to approximately about 21-26 thousand people, the migration balance being negative.

Population Policy. In Agenda 21 it is mentioned that all states should develop and im-

plement programs concerning the national policy in the field of population, which would meet national environmental action plans and sustainable development, and corresponded to the principles of respect of people's freedom and dignity and their shared valuables. Moreover, attention is attracted to the fact that policy and programs in the field of population should considered in conditions of complete recognition of women's rights.

It is necessary also to develop the policy, which would allow considering consequences related to the growth of the population as a result of natural movements, and in parallel with this, would envisage measures aimed at the changing of demographic tendencies.

In September 2000 representatives of 191 countries, including Central Asian countries, adopted the Declaration of Millennium. The Declaration reflected the point of view of the world community at the problem of the population, particularly at the problems of peace, security, development, environment, human rights, etc. They are known as Goals of Millennium Development, which are to be achieved by 2015.

In this connection it is necessary to notice that analysis of macroeconomic factors impact on socio-economic development of regions is the evidence of existence of tendencies characterized by maintaining high degree of poverty prevalence on the territory of Central Asia and increase of the income and consumption level differential of the population. At the same time the heterogeneity of poverty indicators becomes apparent in certain socio-demographic features reflecting the state of life conditions of the population. To high extent it is characteristic to families having many children and depends on age and educational level of the household members, the level of their economic activity, etc.

Beginning from 2000 the poverty situation in countries of Central Asia is gradually improving, the economic growth taking place in sectors, where the major part of the population is engaged, being the contribution to this. So, for instance, according to the forecast estimations, by 2015 the level of the abject poverty in Kyrgyzstan should reduce up to 6.7%. Considerable reduction of the poverty level in 2003 was obvious among the urban population (by 8.1 per cent), though in 2001-2002 the rate of its reduction in rural area exceeded the rate of poverty reduction in cities.

One of the important Development Goals of Millenium is incentive of equality of men and women and expansion of women's rights and possibilities. Among unemployed population of Central Asian countries because of their dismissal from working places a number of women is significantly larger. A number of women in public administration is quite small. By 2015 ratio of male and female students should reach 50%. Ratio of women's salary to men's salary should total to 100%.

To achieve Goals of Millennium countries of Central Asia should establish cooperation with international community for countries' potential development; develop and implement strategies allowing to young people finding worthy and productive job; in cooperation with private sector take measures, which allow everyone to benefit form new technologies, especially information and communication.

Education Level of the Population. In all countries of Central Asia literacy of the population is relatively high. So, for instance, in Kazakhstan literacy of the population as of late 2003 amounted to 99.5%, including boys – 98.8% and girls – 99.1%; literacy in the country among people of 15-24 years old is 99.9%.

As of the end of 2003 there were 18% of people with higher education among economically active population of Kazakhstan, and 28% of people with high vocational education. At the same time it should be mentioned that the population with higher education happened to

be more competitive. Evidence for this is the fact that the number of unemployed with higher education is less (5%) than the number of unemployed with high vocational education (8%), primary vocational (8%) or high education (12%). Thus, the conclusion can be made that with other things being equal the increase of educational level contributes to the cutting down poverty scales in the country and to formation of middle class.

Of all adult population of Kyrgyzstan 12% have higher education, 11% - high special, 50% - complete high education, 18% - basic general education, 8% - primary education. Illiteracy of the population amounts to 1.3% of the total number of adult population of the republic.

In Turkmenistan the population is completely covered with free primary and high education. The percentage of coverage by high education in total in the country amounted 97.0% in 2004. Ratio of students per one teacher in the country is within the norms. On average in the country in primary forms 22.6 students are per one teacher, and 17.1 students per one teacher in high forms.

By key social indicators Uzbekistan is a developed country. The level of human development is rather high in comparison with the income level. Literacy level of adult population is comparable with the same indicators of the developed countries. Average period of education is 11 years. Average life expectancy is 69 years.

The training of working staff in Turkmenistan is conducted in vocational educational institutions, by working experience during production, and in secondary schools, where vocational education combined with general education.

Accelerated development of economy, rapidly changing technologies is the main criterion, in accordance with which the state priorities in the sphere of education are to be determined.

In the period of market reforms in countries of Central Asia infant schools occurred to be the most socially unprotected. Because of the lack of funds a number of enterprises and organizations had to close many sectoral kindergartens. So, during the last years because of the rise of the cost of maintenance of children in them and inability of many families to pay in for staying of children in them, the number of children in infant schools of Kyrgyzstan has reduced 4.5 times.

Environmental Education. Environment protection in countries of Central Asia is considered from the first days of independence as an integral part of undertaken economic and social reforms. Environmental legislation of these countries is based on common principles of rational use of natural resources. In each of dimensioned economic projects put into practice specific attention is paid to their environmental integral part, environmental security of new industries. Large work is realized in the field of environmental world outlook formation in the population, particularly in the growing-up generation, and in the field of revival of original folk traditions in environment protection.

In many higher educational institutions of Central Asian countries specialists in environmental concepts are trained, including environmental training of pedagogical and scientific staff..

Big input into the development of environmental education in countries of Central Asia was made by non-governmental organizations (NGO). Because of the specificity of their activities NGOs have got much more access to the world experience in the given sphere than representatives of the governmental educational system. Additional sources of financing were of great importance. They were in the form of grants, probations and visits for experience ex-

change to the countries of former Soviet Union and foreign countries, opportunities of getting information by electronic mail, through Internet, participation in NGO forums, and as consequence, experience exchange in this field.

NGOs of Kyrgyzstan possess great experience in environmental education development. About 3019 of officially registered NGOs are in the country. Of them more than 200 are environmental NGOs. In central cities of Kyrgyzstan the civil environmental movement is developing rather actively, what one cannot say about rural regions of the republic.

Analyzing state of the environmental education in CA countries a number of problem can be identified:

- Restraining factors for environmental education development in countries of Central Asia are lack of the model of continuous environmental education and bringing-up at all its stages;
- Weak technical and laboratory equipping of institutes' faculties training specialists-ecologists;
- Weak relations between higher institutions and high schools;
- Weak partnership relations with higher institutions of foreign countries, including teachers' and students' exchange.

Scientific Potential Formation and its Use. From early 1990s a stable tendency to decline of scientific investigations and engineering development was observed. Demand on scientific investigations has discontinued with Soviet Union collapse. Many industrial enterprises, which traditionally were specifiers of scientific products ceased to exist. All this acutely raised a question on reorientation of scientific investigations.

General reduction of governmental investment into the science has changed distribution of funding of investigations and developments. Funds allotted from the state budget are spent mainly for fundamental and applied researches. Therefore last years amounts of scientific investigations and the number of scientists conducting these investigations have considerably reduces in countries of Central Asia.

Reduction of the number of scientific workers occurred mainly in National Academies of Sciences, sectoral research institutes and design departments of industrial enterprises. Part of scientific employees switched to teaching activities in higher educational institutions. This switch should be considered as positive tendency as it corresponds to the world practice of the combining of research and teaching works. Outflow of specialists from science to other spheres of activities is related to significantly low level of remuneration of labor in the sphere of science. In academic scientific institutions the budget supports only wages and financing of researches practically ceased.

Scientific investigations in the field of environment protection and nature use in countries of Central Asia are carried out by scientific and scientific production organizations under the budgetary programs of the Ministry of Nature Protection and other departments of these countries as well as at the expense of nature users and under the international grants.

Health Care and Health of the Population. Changes occurred during the transit period in countries of Central Asia aggravated the life quality for the most part of the population. One of the main indicators of life quality is health. For full-fledged life and satisfaction of needs of the population conditions of recreation are required: its possibility and accessibility allowing envisaging prophylactic measures and health rehabilitation. Regularity and food quality are of great importance. Health of people in many respects depends on environmental situation; sani-

tary conditions of life and housing conditions determine much. Cutting down of governmental investments into the housing construction related to economic difficulties during the transit to the market economy, reduction of the population income in this countries, harshly aggravated the problem of housing provision and sanitary-hygienic conditions of inhabitation for the majority of the population, particularly poor one

Examining problems of Central Asia it is necessary take into consideration that environmental problem of the Aral Sea caused serious deterioration of the health of the Aral Sea zone population due to the water and air pollution, lack of water supply sources, and low level of sanitary. . In the epicenter of this ecological catastrophe can be observed one of the highest indicators like children's and maternity mortality rate, reduction of the average life expectancy, tuberculosis incidence, anemia diffusion, dysfunction of thyroid gland, kidney and liver illnesses among CIS countries. Hemopathy, cancer disease, asthma and cardiac insufficiency are growing progressively worse and there were revealed pesticides in breast milk of women. All these issues lead to destruction of the gene pool.

Majority of the population of irrigated regions of Central Asia uses water from irrigating canals, which contains different salts, residuals of fertilizers, pesticides, nitrites, animals' faeces and other agricultural wastes. Low quality and scarcity of drinking water is the reason of many infectious and non-infectious diseases.

Under the influence of vast complex of negative environmental factors (unsatisfactory condition of sanitary-engineering infrastructure such as water pipeline, sewerage, treatment facilities, etc.) in Kyrgyzstan quite unfavorable sanitary-epidemiological situation continues holding true causing growth of infectious and parasitic diseases. Only in 2003, in comparison with the previous year, morbidity rate of the population with infectious and parasitic diseases increased from 179.5 up to 192.3 cases per 10 thousand of the population or by 3.2%.

The average life expectancy in Kazakhstan is less than that in Europe and Central Asia, in 1998 in increased up to 65 years (Fig. 19). Mortality rate of adult population and morbidity with tuberculosis is considerably higher than in other countries of Central Asia. Water provision fit for drinking is significantly lower than it is on average in Central Asia, particularly in rural area, where 44% of the population inhabits.

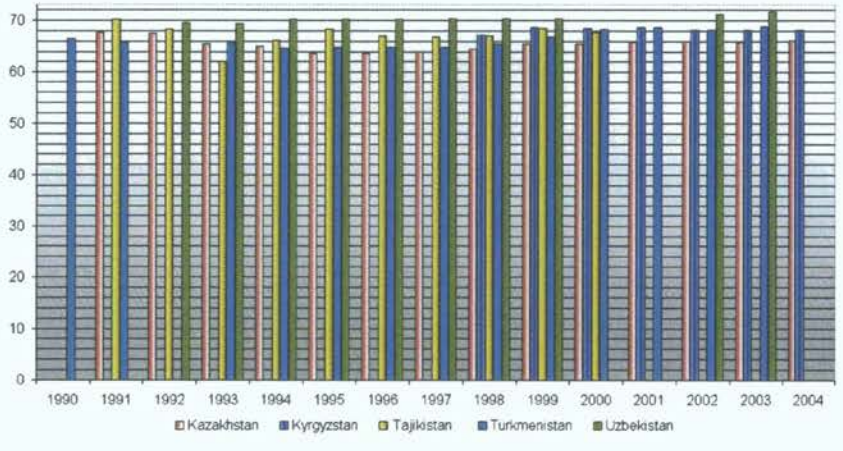

Fig. 19. Average life expectancy

2.3. Industry

Industrial Potential. The main branch of industry of central Asian countries are energy, oil, gas, oil-refining industry, coal, chemical, engineering industry, light, food, flour-milling industry and building materials industry.

The collapse of the USSR and change of social and political status of Central Asian countries, severance of industrial relations in finished and intermediate production distribution cause to the deep economic crisis and negatively reverberated throughout the industrial potential of the countries of the region. As a result acute decline of production has happen. The consequences of all these have become:

- Moral and physical depreciation of main production funds (90%) because of the lack of resources for renovation of productive capacities;
- Reorientation of demand for products earlier supplied to the former Soviet republics;
- Weak economic development of export productions, low competitive ability of domestically produced production;
- Increase of a number of unprofitable enterprises and decline of the production profitability levels;
- Lack of circulating assets for modernization of production.

Central Asia has large industrial potential and richest mineral resources, particularly oil and gas. In 2003 the oil processing volume in Kazakhstan amounted to 8,642.7 thousand tons and exceeded by 16% analogous indicator of 2002.

Realization of the state Program of Developing the Kazakh sector of the Caspian Sea will allow providing volumes of oil production in 2015 up to 100 million tons per year and keep it at this level during 25-30 years. Gas production is supposed to be increased in 2005 at the level of 0.3 billion cubic meters, by 2010 up to 24 billion cubic meters, and by 2015 they will increase it up to 63 billion cubic meters.

In Kazakhstan coal-mining industry provides production of 80% of electric power, almost 100% of charging of by-product-coking production, supplies demands in fuel of the communal sector and the population.

From 1991 Central Asian countries started the new large-scale transformation of theirs economic system. Reforms were aimed at the formation of market economy through competitiveness and private sector development. So, for instance, in Kazakhstan vigorous rehabilitation of the oil and other sectors began in 2000; the real GDP grew up by 13.5% in 2001 and by 9.5% in 2002. Introduction of new capacities in the oil-and-gas sector allowed increasing the oil and gas condensate production from 21 million tons/year in 1995 (423 thousand barrels/day) up to 47 million tons/year (953 thousand barrels/day) in 2002. Growth of world oil prices caused the unprecedented growth of oil industry of the country, which has spread out to the other industries as well.

In countries of Central Asia the ratio of the governmental and private sectors of economy has appreciably changes. For instance, in Kyrgyzstan during the period from 1998 till 2003 the share of the governmental sector in economy reduced from 17.8% (1998) to 15.7% (2002) and to 7.4% (2003), and the share of the private sector has increased from 82.2% (1998) up to 84.3% (2002) and up to 87.2% (2003).

In Kyrgyzstan, in spite of the general decrease of the index of physical volume of industrial production in 2002 (by 10.9%), in certain types of economic activities the volume of output significantly exceeded the level of 2001: in manufacturing of food goods (by 10.8%), tex-

tile and clothing manufacture (by 15.7%), woodworking and wood products production (by 20%), in electrical equipment production, electronic and optic equipment production (by 15.9%).

Industry of Tajikistan at the present-day point is in the final stage of privatization. Taking into consideration the shortage of financial resources in the state for providing the system of post privatization support, the reconsideration of motivating factors is required in the process of privatization of enterprises for the purpose of making them more attractive for the new owners and attracting external investment.

During the last years export possibilities of the Central Asian countries have significantly increased. So, Turkmenistan every year exports about 1.1 billion kW per hour of electrical power, 1.2 million tons of oil, 42 billion cubic meters of gas, 4.5 million tons of oil products, 345 thousand tons of liquefied gas, 84 thousand tons of polypropylene, 9 thousand tons of lubricating oils, 304 tons of technical iodine, 30 thousand tons of cotton yarn, 34.6 million running meters of cotton fabric, 24.2 million items of knitted goods. Oil business remains the main export article and the source of state budget revenue during last years in Kazakhstan. In 2004 about 50.5 million tons of oil and gas condensate were produced.

In Uzbekistan chemical and oil-chemical industries, non-ferrous and ferrous metallurgy, electric power industry, agricultural engineering, motorcar construction, building materials industry, etc. have achieved considerable development. The most priority task is to renovate the transport fleet through both purchasing transport from foreign firms and through the development of its own production of machine building, first of all turnout of motorcars, minibusses, and trolley busses.

For the rise of industrial potential the existing sectoral structure of industry in countries of Central Asia requires fundamental modernization. The main goals of the industry development policy for the long-term period consist in production capabilities of the most prospective industries and productions oriented towards production of finished commodity taking into consideration the internal and external customer demand, in restoration and development of scientific and technological community potential, creation of favorable investment conditions.

Resources Consumption. Asian Bank for Reconstruction (ABR) carries out systemic studies of economics of of Central Asia and according to its forecast, during the next three years the rate of economic growth in countries of Central Asia will amount to 9% per year that will be achieved based on the valuable resources of the region, of which the document distinguishes oil, gas, cotton and gold.

Determining of economic future of the sub-region for the ten-year prospective is a very complicated task, notice experts of ABRD. Very much will depend on prices on the world raw material markets, particularly for the countries exporting raw materials of the Central Asian states - Kazakhstan, Uzbekistan and Turkmenistan.

On the territory of Kazakhstan about 153 oil and gas fields, 300 fields of bituminous and brown coal, 20 deposits of shale oil, several hundreds of ore deposits were revealed. By oil and gas reserves Kazakhstan occupies the second place among CIS countries after Russia.

Currently oil production in Kazakhstan is performed on more than 100 fields. In 2003 they produced 51,389.6 thousand tons of oil and gas condensate, including 45,309.6 thousand tons of oil and 6,080 thousand tons of gas condensate. Growth of cumulative production of oil and gas in comparison with 2002 amounted to 4,150.2 thousand tons or 8.8%, oil production was increased by 8%, and gas condensate by 17%.

According to reports of oil producing companies, gas production amounted to 14.040

than in 2002.

Production of liquefied gas at the oil and gas refineries of Kazakhstan amounted to 1037.6 thousand tons that exceeds 10.2% (941.7 thousand tons) the volume of gross production of the appropriate period in 2002.

As of January 1, 2004 the volume of natural gas reserves in underground gas depositories of Kazakhstan totaled 1,223.6 million cubic meters.

In 2003 gas transit was realized through the territory of Kazakhstan in amount of 105.7 billion cubic meters that is by 8.2% higher than that for the analogous period of 2002.

Amount of investment into the using of mineral and raw material resources in 2003 increased almost 4 times in comparison with 1996 and totaled 6,848.7 million USD or 74% of the total amount of investment into Kazakhstan. Of them the share of foreign investment is 5,576.3 million USD (81% of the total amount of investment into the use of interior of the Earth), share of domestic investment 1,272.4 million USD (19%).

Of the restricting factors for the development of branches of industry in Tajikistan is unstable production of fuel-energy resources.

In Tajikistan in 2001, in comparison with 1990, the more than 2-fold decline of gas production took place, of oil 8.8 times; coal 29 times, electrical power production by 14%. In parallel natural gas consumption reduced 4.5 times, oil and oil products 6 times, coal – more than 70 times. Overcoming of negative tendencies and stabilization in the sphere of Fuel-Energy Complex (FEC) development rests on insolvency of enterprises and population for the consumed electrical and heat energy, natural gas, irrational use of energy resources, obsolescence of technological equipment and supplementary systems, deficiency of investments for the recovery and development of FEC branches, etc.

During the last years in countries of Central Asia the attitude towards the use of natural resources and profound their processing for production of finished materials and establishing additional working places. So, till 1990 enterprises of textile industry of Turkmenistan processed only 3% of the total amount of stored ginned-cotton or 10 thousand tons. Currently this amounts to more than 30% or 135 thousand tons through commissioning of more than twenty textile enterprises.

Uzbekistan possesses the richest reserves of mineral and raw material resources. In gold reserves Uzbekistan occupies the second place among CIS countries; in silver, copper, lead, zinc and tungsten reserves it occupies the third place. It also has significant reserves of gas, coal, oil. The leading branches are those, which deal with processing of the agricultural raw materials: cotton-cleaning, cotton, fruit- and vegetable-growing, fat-and-oil industries.

In Uzbekistan under the governmental support of programs and projects aimed at the expanding of export and import substitution the structural reforms in economy persist. However, because of the slow introduction of market mechanism into agriculture the main branches in cooperation with it suffer from the problem of non-payment. The main task of structural reforms is the transit from agrarian-industrial to industrial-agrarian economy with the prevalence of processing industry able to supply not only the population's needs but also able to export its products.

Impact on Environment. Intensive development of oil-producing branches of industry caused the situation, when the foundation of the present-day industry of the Central Asian countries consist of the most dangerous for environment industries such as fuel, metallurgy, mineral resource industry. And as a result, environment suffers from enormous pressure. Field development is the cause for disturbance and contamination of environment. The main sources

mineral resource industry. And as a result, environment suffers from enormous pressure. Field development is the cause for disturbance and contamination of environment. The main sources of contamination are the oil and drilling cuttings, waste waters, hydrocarbons, nitrogen and sulfur oxides, hydrogen sulphide and gas condensate.

Impact of branches of industry on environment at first time reduced because of the significant drop of production activities in 1990s. However this did not have an effect on the existing situation in resolution of environmental problems. Vice versa, the lack of real possibilities for rehabilitation and maintenance of environmental objects in existing complicated contemporary socio-economic conditions will in the nearest future, along with the rise of economy, contribute to the increase of anthropogenic pressure of environment.

So, in Kazakhstan the increase of emissions during the uranium ore production became noticeable. If in 1999 the industry emitted 1 thousand tons of pollutants, in 2003 20.2 thousand tons were emitted by it.

In Tajikistan the progress achieved in the issues of privatization of enterprises did not have a positive effect on the solution of environmental problems at the enterprises since environment protection conditions and relevant measures are not taken into consideration in programs of privatization. Moreover, privatization procedures do not require environmental expertise to be conducted for determination of appropriate conditions and measures of responsibility before the object privatization.

In Central Asia environmental requirements are not sufficiently taken into consideration in programs of branches of industries' development, which were formed without proper assessment of such indicators and local natural and climatic peculiarities; as a corollary, this caused occurrence of regions with heightened contamination of environment and intensive use of natural resources.

The shortage and in some parameters the absence of official data on quantitative and qualitative indicators reflecting the impact of industries on the state of land and water resources, atmosphere, education and recovery of industrial wastes does not allow to directly determine the dynamics of enterprise impact on environmental objects. In assessments done the data of enterprises, sectoral development programs, design parameters and results of simultaneous inventories are used.

According to the data of inventories of sources of greenhouse gases emissions, the industrial sector of Tajikistan contributes a rather large part to the CO2 emission, and in different years it amounted to from 8 up to 18%. The main sources of CO2 emission are productions of aluminum, cement and ammonia. The largest share to the total amount of CO2 emissions is contributed by aluminum production, which in different years amounted to 43-85%. The amount of emissions from 675 thousand tons in 1990 reduced to 293 thousand tons in 1998. Aluminum production is also a source of 100% emissions of perfluorohydrocarbons in the industry of Tajikistan.

The main cause of high level of air pollution by industrial enterprises consists in the fact that the used dust and gas extracting technological installations are outmoded and inefficient, and at a number of objects they are not used at all. Moreover, technology of production does not meet the contemporary requirements and needs itself to be modernized or replaced.

One of the main environmental problems of oil fields of Central Asian countries is the problem of utilization of associated gas obtained during the oil production. So, only in Kazakhstan more than 800 million m3 per year of associated gas are currently combusted in the flares.

In Turkmenistan in 1990s during exploitation of gas and oil and gas condensate fields up

shlyja fields compressor stations utilize more 1.5 billion cubic meters of associated oil gas, which was earlier combusted on flare installations. All electric power stations in Turkmenistan work at the local natural gas.

In the process of oil field development soil and ground are contaminated by oil leakages, formation and mine water dumping, unregulated movements of machines and transport. In Western Kazakhstan the total area occupied by oil contamination according to the minimum estimations covers about 200 thousand ha, and area of radioactive contamination with the dose rate more than 100 mcr/hour, covers more than 600 ha.

In Uzbekistan the satiety of Ferganskaya Valley and Tashkentskaya Oblast with enterprises of chemical industry, machine-building and other branches of national economy significantly influences the state of both surface and ground water. Ignoring the regulation of economic activities in water protected zones caused partial or sometimes full degradation of natural complexes.

Contemporary level of air contamination in administrative and industrial centers of Uzbekistan is characterized with increased concentrations of solid particles, particularly in comparison with the WHO standards. Of the greatest danger for the people's health are thin solid particles: less than 10 microns in diameter and especially those, which are less than 2.5 microns. It is ascertained that high concentrations of such dust provoke diseases of upper airways, chronic bronchitis and aggravate conditions of pulmonary and cardio-vascular diseases course shortening the life expectancy.

Considerable is the share of the impact of industry of Kazakhstan and Turkmenistan on environment of the Caspian Sea region. So, in Turkmenistan more than 50 sea production wells are the objects contaminating the Caspian Sea. Turkmenbashi Bay is contaminated as a result of leakages of oil products at the oil loading piers, with ground waters containing oil products.

More than 11 million cubic meters of industrial effluents treated to standard quality are discharged annually by TORP into the Soimonov's Bay of the Caspian Sea. Industrial effluents treated to standard quality of the Turkmenbashi HPP are also discharged into it in amount of 470 million cubic meters that causes the breach of hydro-chemical and temperature conditions of the bay.

Emissions of heat and power plants mainly consist of carbon dioxide, which cause greenhouse effect that leads to the climate changes and drought. Other emissions are sulfur and nitrogen oxides change into sulfuric and nitric acids in the atmosphere and come back to earth with snow and in a form of acidic rains. Increased acidity of water causes the reduction of soil fertility, decrease of fish reserves and forests drying, damage of building units and constructions. Toxic heavy metals such as cadmium, mercury and lead are dissolved by acids and get into the drinking water and agricultural products.

In Tajikistan the most waste-productive are mineral resources and non-ferrous branches of industry. More than 90% of the total amount of formed industrial wastes falls to their share. The main formed amount of wastes are technological wastes in the form of tail pulp of the base ore, etc., which are stored in more than 20 specially established storage placed being on the balance of enterprises. Because of unprofitability of their development they are currently are not supposed to be processed. At the same time the contents of useful components in the wastes make them prospective for the further processing.

Particularly serious problems could be provoked by the lack of special grounds to place the toxic wastes. Because of this lack industrial enterprises accumulate toxic wastes on their territory, and if it is impossible to store them there further, they wouldn't be able to escape a

the toxic wastes. Because of this lack industrial enterprises accumulate toxic wastes on their territory, and if it is impossible to store them there further, they wouldn't be able to escape a temptation for their unauthorized replacement. In spite of amount reduction there are cases when toxic wastes are taken out to places, which are not assigned for these wastes storage. The chemical composition of the wastes has not been determined because of the lack of distinct reporting procedure and because enterprises do not submit data about the character of wastes.

In Kyrgyzstan the low-waste and nonwaste technologies are practically not used for utilization and recycling of wastes.

During the long period of extraction and processing of mineral resources in Uzbekistan rather significant amounts of industrial wastes have been accumulated. By nowadays in the mining complex at the dumps of deposits more than 1.25 billion cubic meters of stripping rocks have been stacked. In tailing dumps more than 1.3 million tons of ore-dressing wastes are stored, and in special dumps huge amount of slag of metallurgic production are bunched. Annual accumulation of mentioned wastes in the complex amounts, respectively, to 25 million cubic meters of stripping rocks, 42 million tons of ore-dressing wastes and 300 thousand tons of slag of metallurgic production.

In Uzbekistan about 30 million cubic meters of domestic wastes are generated in addition to industrial wastes, which mainly stored at the urban and rural dumps. At that with each million of domestic wastes 360 thousand tons of food wastes, 160 thousand of paper and cardboard, up to 55 thousand tons of textile, up to 45 thousand tons of plastic and many other valuable components are got lost.

In countries of Central Asia the works are being conducted for outfitting manufactures with up-to-date technologies. So, from 2003 at the oil and gas field Goturdepe in Turkmenistan the restoration of electric bottom-hole drilling began, which was introduced here for the first time in 1961. This drilling technique is more environmentally appropriate. Also the inclined hole drilling with horizontal location of well bore in the producing formation is conducted that reduces the number of boreholes and correspondingly decreases the volume of hazardous emissions into environment.

At the new Kelyata cement plant with the capacity of 1 million tons of cement per year the complete automation of production is envisaged, which provides high norms of products output as well as environment protection, cleanliness of environmental space at the plant and its neighborhoods.

To reduce the impact on environment of the Central Asian industry it is necessary to introduce energy-saving technologies or to involve the second raw materials and wastes into production;

2.4. Agriculture

The area of agricultural lands in Central Asia in 2004 was more than 150 million ha that means that during the last 15 years it shrank almost 2 times. The area of irrigated arable land in 2004 constituted more than 9 million ha, having increased against the level of 1991 by 5.8%. Lands of the total area of 37.6 million ha are subject to salinization and flooding to a different extent.

The most significant conditions of the rational land use in CA countries include as follows: reclamation; application of crop rotation; substantiation of agricultural enterprises of optimal sizes (including farming) taking into consideration of complex mechanization of the field works and observance of rational irrigation regime; stage-by-stage and all-round intro-

duction of paid land use based on the rent concept with the purpose of economic stimulation of the farming to rational use of potential fertility of soil.

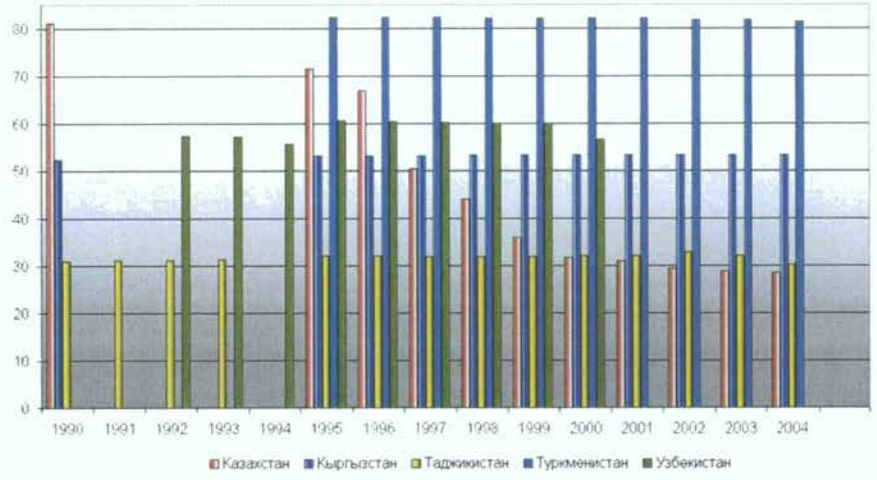

Fig. 20. Share of arable land to total area (%)

Complex approach to the rational use of land resources considerably depends on the system of water use and organization of agricultural production.

One of the most important trends is the development of desert soils, predominantly in combination with the strengthening of fodder basis of the outrun livestock-breeding.

The Aral Sea crisis, which covers in the Aral Sea sub-region the territories of Kyzyl-Ordynskaya Oblast of Kazakhstan, Dashoguz Velayat of Turkmenistan, Khorezmskaya Oblast and Republic of Karakalpakistan of Uzbekistan, is aggravated by irrational use of land-water resources, by existing system of agriculture and methods to combat salinization of lands resulting in the raise of the ground water levels, salinization and degradation of fertile soils of the delta of Amudarya and Syrdarya rivers. In this zone the following events take place:

- Intensification of desertification of lands because of the unregulated decrease of the Aral Sea level, natural-climatic changes, intensification of aeolian processes of salt-dust transfer from the dried bottom of the sea and other solonchaks (alkali soil);
- Existing practice of agriculture and irrigation, state of meliorative systems, crop rotation structure resulted in the raise of the ground water level and land salinization. Accepted practice of land flushing with the absence of the adequate drainage only aggravates the situation;
- Soil overpacking because of the movements of agricultural machines;
- Waterlogging and salinization of neighboring territories of rice-growing farms;
- Lack of guaranteed water supply for irrigation of agricultural crops.

In connection with the mentioned above causes, significant areas of land in the Aral Sea sub-region dropped out of agricultural rotation. In 2001 because of the water and climatic drought in the lower stream of the Amudarya River, 600 thousand ha of irrigated lands were left out of crop.

The existing water management system in states of Central Asia – in the main part of the Aral Sea basin – was established mainly for the irrigation water supply for the agricultural production of the Central Asian republics of the former Soviet Union, at the same time administrative borders of those republics were not taken into considerations. As it is know, the main water arteries of the Aral Sea basin are the Amudarya and Syrdarya Rivers.

The largest consumers of water in the basin of the Syrdarya River are the irrigation systems of Feganskaya Valley, Golodnaya and Dalverzinskaya Steppes, irrigation lands of Chimkentskaya and Kyzyl-Ordinskaya Oblasts of Kazakhstan.

The largest consumers of water from the Amudarya River are Karshinsky and Amu-Bukharsky Canals, Karakum-Darya in Turkmenistan, irrigated agriculture of Republic of Karakalpakistan, Surkhandaryinskaya and Khorezmskaya Oblasts of Uzbekistan, Dashoguz Velayat in Turkmenistan.

For the Aral Sea basin, as practice shows, water resources are the basis of life-support for the population and economic development of the society. Agricultural production being the main industry in the sub-region and functioning only in conditions of development of irrigated agriculture, consumes up to 70-80% of the rivers' run-off. As of current period of the total area of lands of 155.4 million ha, suit for the development of irrigated agriculture are considered to be 32.6 million ha, 7 million ha are actually irrigated, and the scarcity water resources is quite obvious already. The predominant agricultural crop is cotton, then grain-crops and fodders. During the last 35 years a powerful system of irrigation-and-drainage and hydraulic-engineering constructions has been built:

- Main and interfarm irrigation canals with the length of 47,748 km, and with the coefficient of efficiency (COE) of 0.82;
- Irrigation canals of intrafarm network with the length of 268,480 km, and with the coefficient of efficiency of 0.73;
- The system of water reservoirs of the long-term and seasonal regulation, which allowed regulating flow by 93% along the Syrdarya River with its tributaries and by 21% along the Amudarya River with its tributaries.

During the years of low-volume river flow or high percentage of supply (75–100%), irrigated lands suffer from the sharp scarcity of water.

Impact of agriculture on environment. At the achieved level of agriculture the anthropogenic pressure of economic activities on environment become stronger. This is particularly obvious in irrigated agriculture. Impact of agriculture on environmental situation is considered from the point of view of elimination and prevention of negative consequences of the given impact and stimulation of rational nature management.

In the use of land and irrigation water as peculiar types of natural resources an adequate approach is developed to their efficient management. In this case an issue consists in provision of stable functioning of operational systems, including resources-rehabilitating works, with regular improvement of engineering-technological, organizational, economic and legal bases of incitement to the resource saving. In this point the issue of paid use of land-water resources is of great importance.

Taking into consideration the rent essence of the land-tax, the following methodological principles should be based in its development:

- usage of the given type of taxation as a means for regulating the natural monopolism in the land management;
- differentiation of tax rates according to the soil fertility and land plots location;
- creation of the equal concernment in the use of land of different quality;
- target use of tax incomes;
- keeping of a certain part of incomes from the land tax into disposal of the local authorities;
- setting of periodical revision of land tax rates.

Monopolism in agricultural land use has its specificity. This is vividly obvious in irri-

the payment for water is considered as a specific variety of differential ground rent. The statement that water rent is a variety of a ground rent is concerned with their common origin. Water rent can't be formed in isolation from the land and finally it is realized in the cost of agricultural production. At the same time water rent should be differentiated from ground rent because it should be used for a specific purpose – for water-economy construction, reconstruction of irrigation network, agricultural and environmental needs. While funds obtained by water rent, concerning financing of nature conservation and resource-rehabilitation measures, have limited designation in comparison with the rent formed for exhaustible natural resources. The main task here consists in economic stimulation of the introduction of water-saving technologies of irrigation in farms – water consumers.

While choosing irrigation technology it is important to substantiate the criterion of efficiency taking into consideration such realities of market economy as paid natural resources, and regional peculiarities as irrigation water scarcity with the availability of reserves for new lands development.

A new criterion of efficiency of water-saving technology of irrigation consists in minimization of irrigation norm with the observance of one of two conditions. The first condition consists in the fact that expenditures on introduction of the water-saving technology of irrigation should be covered by the cost of saved water. The second condition consists in the covering of these expenditures with additional profit, which would be formed if new lands were developed at the expense of water savings. The second condition takes into consideration the peculiarities of the region, where there are reserves for the land development in the parallel with the scarcity of irrigation water. Depending on the certain circumstances both conditions can be laid down simultaneously.

From this, the price of a unit of water is defined as a ratio of expenditures on the introduction of the water-saving technology of irrigation and a volume of saved water due to the introduction of this technology. In case of the excess of operational expenditures for water delivery and differential water rent over the value calculated in compliance to the indicated rule, the price of water could be set at the level of a sum of expenditures and the rent. In this case undifferentiated water rent won't form.

With the market economy the distribution of any rent incomes can be regulated predominantly through taxation.

It should be emphasized that because of the stimulating purpose of paid irrigation water the given procedure can be only related to the system of water use within certain countries. Interstate issues of water problem, including environmental aspects, are to be solved at the completely different principles of international cooperation, in particular – equal partnership of countries – parts of the given water basin.

Development potential. In agriculture based on the irrigated farming four main factors of production are functioning: land, irrigation water, labor resources, material means of production.

During the last years institutional reforms and restructuring of the industry were made in agriculture of the region. As a result the number of private farms and their significance in the products manufacturing has grown. At the same time because of disaggregation of enterprises, particularly in plant growing, problems happened with the use of highly productive machines on the small in size land plots, organization of crop rotations, rational use of irrigation water, etc. This, in particular, resulted in some increase of labor-output ratio of agricultural production.

Development of potential of agriculture in total in the sub-region emphasizes the neces-

etc. This, in particular, resulted in some increase of labor-output ratio of agricultural production.

Development of potential of agriculture in total in the sub-region emphasizes the necessity of agro-industrial integration, development of processing capacities in zones of intensive agriculture. In this connection the national socio-economic programs of CA states include tasks of complex development of productive forces of micro-regions, mainly through combination of agriculture, industry and infrastructural industries.

At the same time some temporary negative events can be observed. For instance, because of discoordination of supplies of materials and machinery in agriculture the used systems of fertilizers are not balanced in nitrogen-phosphor-potassium components. Amounts of organic fertilizers against the crops areas are insignificant. The latter circumstance is typical in almost all countries of the sub-region.

More common for CA objectives of more efficient use of industrial potential of agriculture are as follows:

- production intensification oriented on the increase of agricultural crops capacity, finally providing irrigation water productivity increase;
- systemic management of agriculture and livestock-breeding;
- strengthening of mutual relations between agrarian economy and environment;
- development of mutual cooperation between countries of the sub-region in the field of rational use of land-water resources.

The existing at present structure of agricultural production and the system of its management have the following main disadvantages, which can be eliminated by institutional measures:

а) the lack of clearly defined specialization in manufacturing of agricultural production both between the regions and inside them, and in agricultural enterprise as well. This particularly concerns the production of spiked grains, productivity of which on average in republic two times and more is lower its potential capability. This became the result of the scattering grain-crops as the distribution of the state order among all farms with different capabilities and skills in cultivation of this crop. This can be considered defensible as a first step in ensuring grains independence, however now it is necessary to improve the given approach;

б) environmentally intensive crops structure, in which Lucerne, leguminous plants and other fodder crops have a very small share. Such structure does not provide the reproduction of soil fertility that inevitably results in land degradation, as well as does not allow establishing the reliable forage reserve for the development of livestock breeding;

в) a large gap in prices for agricultural production, which with the system of state order is not of significant importance, divides crops in "profitable" (for instance, cotton) and "unprofitable" (for instance, grain-crops) that finally influences the level of profitability of irrigated hectare.

This is quite a big disadvantage restraining development of production specialization and way out to the environmentally-sound crops structure. A mechanism regulating obtaining of a unit of irrigated land areas of approximately equal profitability, irrespective of the type of cultivated crops, is of great necessity.

2.5. Power Engineering

Energy Resources Production and Consumption. Energy relations in Central Asia always were and still are being one of the stumbling blocks between states after the collapse of the Soviet Union. Regulated in Soviet times system of mutual deliveries and mutual clear-

ing-off for energy resources was damaged, and this drastically aggravated cooperation between countries of the sub-region.

In Central Asia market reforms, rupture of economic relations, economic crisis, having struck particularly production complex; decrease of demand and volumes of fuel and energy consumption stipulated by shutting down and breaking of a number of large enterprises, liquidation of kolkhozes and sovkhozes, increase of the energy carriers costs up to the level of world prices, called forth significant drop of production of their own energy resources.

Vast territory of Central Asia, particularly of Kazakhstan, low population density, concentration of generating capacities, mainly in the North of the country, determine the necessity of transportation of electric power to considerable distance that causes significant losses amounting to about 30% (Fig. 21). In this connection, centralized electric power supply of remote regions becomes economically inexpedient. Development of small and alternative power engineering will help to solve some of existing problems.

Total capacity of generating sources of Central Asia is more than 40, including about 18 thousand MW of Kazakhstan and 10 thousand MW of Uzbekistan. Central Asian states produce more than 150 billion KWH of electric power, including 58.2 billion KWH of electric power produced in Kazakhstan in 2002. From that amount the energy was produced by: coal-fired stations – 80%, coal-black-oil-fired stations - 5% and electric power stations - 15%. At present energy sector of the most CA countries is characterized by significant depreciation of the main equipment, power lines and heat networks. The age of equipment constitutes 25-40 years, and depreciation of capital assets achieves 60%. This causes diseconomy of the work of equipment and overexpenditure of fuel. According to the data of estimation the fuel overexpenditure for electric power supply can constitute 10-15%, of heat – 15-20%. Losses for transportation of electric power amount to 13-14%.

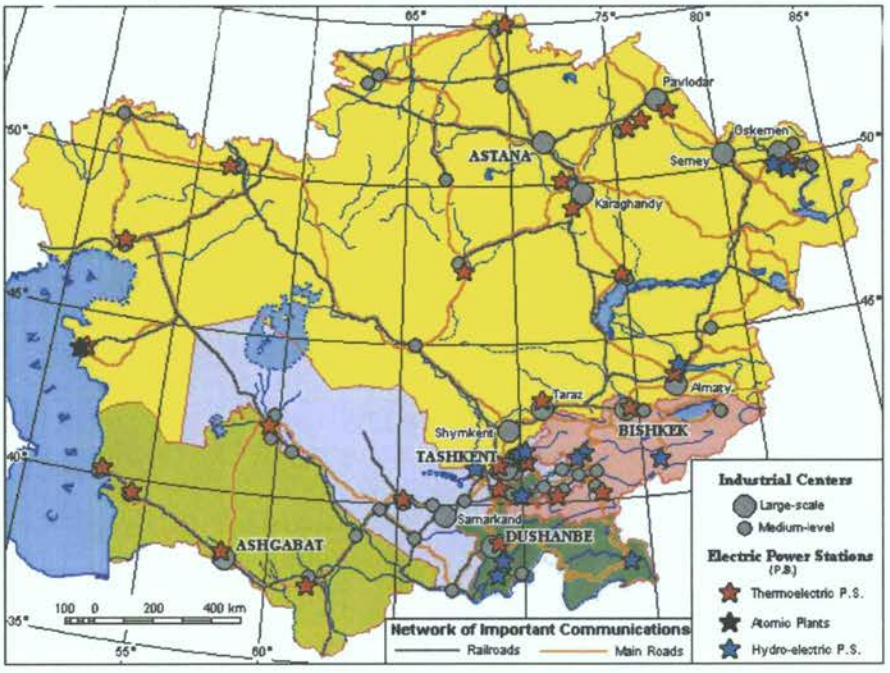

Fig. 21 Industrial centers. Electric power stations.

Complex solution of sub-regional water and energetic problems is a priority for the sub-region. Program, which forms energy policy of the sub-region, should be based on the mutually beneficial trade and economic cooperation.

Tajikistan possesses huge reserves of hydroelectric power resources. In their total reserves Tajikistan occupies the eighth place in the world. About 4% of hydroelectric power potential of the Earth falls on its share. In Tajikistan practically the whole industrial energy engineering is based on hydro-power engineering. 92% of the total capacity of energy system falls on the share of hydroelectric power stations, at which 98% of the total electric power is generated in the republic. With this Tajikistan significantly differs from other countries of the region.

Fig. 22. Nurekskaya HPS, dam height 300 m

At the same time all power stations of Turkmenistan work using local natural gas. Energy system of Turkmenistan is excessive in its established capacity. With the established capacity of 2,652 thousand KW its own capacity demand is 1,500 thousand KW. Capacity excess can be exported to other countries.

There are electric couplings with the voltage of 220 KV for export of the spare capacity to Iran or by transit through Iran to third countries. In prospective the growing of generating capacities at the electric power stations is planned with the help of installation of up-to-date gas and steam-gas facilities for increasing of the electric power export and for enhancement of reliability and sustainability of the work of energy system of the country.

As the main fuel natural gas is used at power stations in Uzbekistan, constituting 95% and more of the whole consumed fuel. The amount of the consumed natural gas is changed depending on the season of the year, increasing in winter because of the enhancement in households in comparison with summer, therefore there are restrictions for consuming of natural gas as a fuel at HPSs. Sometimes HPSs have to use black oil as a alternative source of energy, however coal and black oil should be used as fuel much less if possible because of the high degree of air pollution with sulfur dioxide, nitrogen oxides, etc., which are contained in the products of their combustion.

Potential possibilities of small rivers of Central Asia for generation of electrical power on the micro-HPSs are estimated to be 30 million KWH per year. For instance, development of this resource can solve the problem of reliable energy supply for Tajikistan, unallocating resources of the major HPSs for exporting. Wide use of micro-HPSs will allow resolving the problem of energy supply of certain consumers in regions difficult to access, shepherds, beekeepers, farmers, etc., who are engaged in seasonal works.

Most of the electric power stations of Central Asia are interconnected with the high-voltage transmission lines into the power grid and can work in parallel. So, the Turkmen power supply system has electric couplings with the voltage of 220-500 KV with the power

supply system of Uzbekistan, is the member of the Consolidated Power System of Central Asian states.

Parallel work of the Power Grid (PG) of Kazakhstan with the Consolidated Power System (CPS) of Central Asia creates necessary conditions for receiving electric power in the summer period from Kyrgyzstan. At that, the resolution of the problem is possible for water supply to Yuzhno-Kazakhstanskaya Oblast and Kyzykordynskaya Oblast of Kazakhstan from Toktogul water reservoir in Kyrgyzstan...

Renewal Energy Sources. Central Asia possesses significant reserves of renewal sources of energy in the form of water, wind and sun, which successfully could be used for satisfying the needs of energy supply of small consumers in remote regions. Unconventional renewable power sources (RPS) due to their potentialities sometimes can compete with traditional sources of energy, particularly in remote desert and mountainous regions.

According to the data of investigation "Kazakhstan and Kyrgyzstan: Opportunities for the Development of Renewable Power Sources" conducted within the ESMAP Technical Assistance Program in 1997, about 5,100 remote inhabited localities in Kazakhstan are not connected to the power transmission lines. In these conditions utilization of RPS as local sources of power is economically sound.

In Central Asia the development of energy potential of small rivers is considered to be prospective. Only in Kazakhstan the potential production of electric power at these small HPSs can reach about 6.3 billion KWH annually. Studies showed that hydroelectric power potential of small rivers of Kyrgyzstan gives the possibility to construct 92 new small HPSs with the total power of about 178 MW and average annual production up to 1.0 billion KWH of electric power. Besides, it would be possible to restore 39 earlier existing small HPSs with the total capacity of 22 MW and average annual production up to 100 million KWH of electric power and in prospective it would be possible to construct 7 HPSs at the irrigation water reservoirs with the established capacity of 75 MW and average annual electric power output of about 200 million KWH. Realization of these plans in Kyrgyzstan allows increasing the share of electric power output at the small HPSs up to 10%.

Due to its geographical situation Central Asia is extremely rich in wind resources. According to the assessment data, the wind potential density in CA countries amounts to approximately 10 MW/km2. So, in Kazakhstan wind potential is investigated best of all in Djungarskiye Vorota and Sheleksky Corridor of Almatinskaya Oblast. Average annual wind velocity at a height of 10 meters in Djungarskiye Vorota amounted to 7.5 m/sec, in Sheleksky Corridor 5.8 m/sec. At present time, at the station "Druzhba" in Djungarskiye Vorota the Company "Almatyavtomatika" has installed the first in Kazakhstan wind facility with the capacity of 500 kW. The Program of Power Engineering Development of Kazakhstan till 2030 foresees construction of large wind-driven power plants (WPP) of the total capacity of 520 MW. Potential annual electric power output at these WPP can amount to 1-1.5 billion KWH.

Utilization of renewable power sources (RPS) in practice in Central Asia currently is quite insignificant and, for instance, in the energy balance of Kyrgyzstan they amount only to 0.15%, the established capacity of solar collectors being 1.300 kW, wind installations -25 kW, micro-HPS – 1,000 kW. Utilization of wind energy in Kyrgyzstan is supposed to take place through installation of wind-driven power plants of small capacity (1-5 kW), efficiently working in conditions of wind flow of 3-5 m/sec that is characteristic for valley regions.

In all countries of Central Asia scientific and technical works, as well as experimental development, are conducted. In Turkmenistan the map of quantitative assessment of wind-

energy distribution of resources on the territory of the country was made. Using it in prospective makes it possible to calculate energy resources of pasture regions, which amount to 40 million ha. The annual economic efficiency of combining helio-wind-energy systems in heat-cold-supply of houses with the total area of 150 m2 in rural area will amount to 0.4 thousand US dollars annually and will save 180-200 kg of equivalent fuel per year. Due to the utilization of wind facility it is possible to cover from 40% up to 85% of energy consumption in remote areas.

In Uzbekistan the economic potential of wind energy is recommended to realize on the basis of serially produced wind electric generating plants with the unit capacity of 60-250 kW for electric power supply of remote consumers: inhabited localities, water-lifting pumping facilities for irrigation and melioration; geological prospecting crews, etc.

In Kyrgyzstan the Center for Problems of Renewable Power Sources Utilization was established on the basis of the Business Project "Koon". Besides, KSTC "Energiya" and the Institute of Automation of the NAS of Kyrgyzstan are working on this problem. At present the most prepared in the sub-region for utilization of RPS are heating and hot water supply sectors using solar energy by installing solar collectors for hot water, drying of agricultural production and installation of aerial heating systems. Assessment of potentials of the power production from RPS shows that from 1 square meter of the surface of solar collector 5,700 MJ of heat energy could be generated annually.

A number of scientific research works have been done on utilization of solar energy as well as on applying them into practice. Different constructions of helio-based greenhouses, helio-based drying machines, helio-hot-water generators, helio-water demineralization installations, helio-installation for production of manure gas, helio-installation for growing of micro algae and many other installations were designed to be introduced into practice.

In Uzbekistan the development of photo-power engineering is supposed to be implemented through organization of production of silicon solar cells with the annual production capacity of 1 MW based on the technology and equipment of the US «Spire» company: «Spi-Line TM 500C 500 kW» and organization technological base for production of photovoltaic modules based on the technological line of the US «Spire» company «Spi-Line TM 500C 500 kW», providing 90% output of non-defective solar cells with the performance index not less 18%; the output percentage of non-defective photovoltaic modules is 95%, with the commencement of product output not later than 2003.

The most prospective is the construction of solar-heat electric power stations in southern regions of Central Asia for electric power supply of large pumping facilities of irrigation systems. For instance, in Uzbekistan the conditions are favorable for construction of solar electric power stations in zones of location of pumping facilities' cascades of Karshinsky, Shirabadsky, Amu-Bukharsky main irrigation canals, and Djizakskaya parent pumping facility as well as in the region of Talimarjanskaya GRES, which is under construction.

For ensuring the large-scale consumption of renewable sources of energy in sub-region countries contacts and partners with foreign countries and companies are searched for the development and realization of joint demonstrational projects, in which the combination of solar energy and wind is used; small HPSs for industrial purpose, establishing of productions for manufacturing equipment for solar systems of heat supply; photo-power engineering; wind-electric facilities. In resolution of these issues the necessity of international collaboration and cooperation is obvious, as well as support of appropriate international structures and programs.

Also for sub-region countries biomass energy can be valuable source of energy, which

tons of fuel equivalent . or 10.32 million tons of black oil.

Practical experience shows that using of the installation giving 15 m3 manure gas per 24 hours (efficiency of the installation is 1 ton of manure during 4 months of work) provides heat supply of the room of 60 m2, and cooking food for a family consisting of 4-5 people.

Power Engineering Development Potential. In countries of Central Asia action programs for further development of power engineering have been elaborated. So in Kazakhstan in 1999 the "Program of Power engineering Development till 2030", in Kyrgyzstan "National Power Engineering Program for the Period till 2005", in Tajikistan "Program of Development of Fuel-and-energy complex for the period of 2005 – 2010".

The mentioned above Programs envisage construction of large RPS of the total capacity of 520 Mw in Kazakhstan,. Potential annual output of electric power at this RPS may amount to 1-1.5 billion KWH, the prospective GRES with the capacity 1,200 MW based on the coals of Kavaksky lignite basin (Kavakskaya GRES) is supposed to be build in Kyrgyzstan, in Tajikistan Ragunskaya HPS, Sanktudinskaya HPS-1 and Sanktudinskaya HPS-2 are being built. The term for putting into operation of all three HPSs is defined to be 2009-2010. The second power-generating unit at the Seidi HPP with the capacity of 80 MW, gas-turbine units at the Anadan GRES with the capacity of 123 MW and Balkanabad GRES with the capacity 126.4 MW were put into operation in Turkmenistan in 2004.

Uzbekistan possesses 28 hydro-power stations (HPS) with 67 hydro-turbines at 8 cascades. The most high-capacity hydro-power station is Charvakskaya HPS located on the Chirchik River with the maximum output capacity of 620 MW. On the Syrdarya River the Farkhadskaya HPS is located with the capacity of 126 MW. Charvakskaya and Farkhadskaya HPSs being the simultaneous electric power storages serve as regulators of supply-line voltage in power supply. Analysis shows that the productivity and reliability at the majority of hydroelectric power stations is decreasing.

Impact on Environment. In the total volume of economic activities power engineering sector is the most important source of greenhouse gases (GHG) emissions in all countries of the world. Countries of Central Asia are no exception. For instance, power engineering sector in Kazakhstan, Uzbekistan and Kyrgyzstan is the main source of pollutants emissions into the atmosphere in the form of ash, sulfur and nitrogen oxides, and carbon oxide. Significant amounts of contamination of the atmosphere by power engineering sector are explained: first, by utilization in power industry of low-quality coals as a main type of fuel; second, by weak equipping of heat and power stations and boiler houses with systems of refining of effluent gases.

According to the greenhouse gases emissions per unit of GDP and per capita Kazakhstan occupies the leading place in the world and is in the third place according to the absolute value among CIS countries after Russia and Ukraine. In 1990 enterprises of the energy sector of Kazakhstan emitted into the atmosphere about 2.3 million tons of pollutants that constituted 35% of the total amount of emissions into the atmosphere.

Nature protective measures in the states of Central Asia have covered all main environmental problems of present day, attaching significance to techniques of their resolution in the order of their priority. Some of these measures have been already realized, most of them are still in the phase of implementation. However, the policy of national economy development, its restructuring and extreme necessity of resolving environmental problems have created a requirement in setting new political goals and priorities in the field of environment protection, choosing the most efficient way of their achieving.

its restructuring and extreme necessity of resolving environmental problems have created a requirement in setting new political goals and priorities in the field of environment protection, choosing the most efficient way of their achieving.

As a result, all countries of the sub-region have accepted laws "About Environment Protection", and National Power engineering Development Programs for the period till 2020 envisage activities on environment protection against impacts of objects of energy complex.

Encouragement of energy saving, utilization of renewable power resources, reduction of environment pollution by heat and power stations and boiler houses through improvement the process of combustion and transit to the new types of fuel as well as dissemination of other special measures for preventing of atmosphere and soil pollution, which are represented in the National Energy Programs of the Central Asian states.

New objects of power engineering in countries of Central Asia should be constructed only based on the thorough studies of demand for power, availability of production capacities, types of fuel and its deliveries, as well as acceptability, reliability and safety from the point of view of ecology. Kyrgyzstan is a potential country – seller of greenhouse gases emission quota. Consequently, it is important to prepare mechanisms for obtaining and utilization of investment envisaged by UNFCCC realization. Otherwise the threat of political influence on measures for further sustainable development of heat energy in Kyrgyzstan is unavoidable.

Besides, for realization of projects on reduction of greenhouse gases emissions in the sub-region and attraction of investment flows into modernization, reconstruction of power engineering, energy saving in spheres of production and municipal economy related to the energy sector, it is necessary to establish special funds. So, for instance, in Kyrgyzstan it is supposed to establish a non-commercial investment environmental organization "Energy Hydrocarbon Fund", which should provide efficient mechanisms of Kyoto Protocol in order to increase efficiency of power industry

Situation of negative influence of power engineering on environment in Tajikistan during the last decade has considerably improved. Emission of greenhouse gases as a result of forced sharp reduction of utilization of organic types of fuel during the last ten years has reduced more than 10 times.

Analysis shows that the share of hydro-electric engineering in Tajikistan, from the point of view of environment pollution and impact on climate, should not be less than 70%. If its share is less, emission of greenhouse gases in the republic will exceed the level of 1990-1991 or 22 thousand tons per year.

The total amount of emissions of hazardous substances into environment from the large enterprises of energy sector of CA countries amounted to more than 3.0 billion tons, including 2.3 billion tons of Kazakhstan emission. In Turkmenistan the total amount of emissions into environment in 2004 amounted to 17,308.423 tons Amount of hazardous emissions into the atmosphere in 2004 in comparison with 2003 reduced by 4.1%, whereas electric power production increased by 10.5%. Reduction of emissions took place due to the commissioning into operation in November 2003 of three gas-turbine generators with the capacity of 3x42 MW at the Balkanaabad GRES and in November 2003 gas turbine with the capacity of 126 MW at the Abadan GRES.

In Uzbekistan more than 200 thousand tons pollutants are annually emitted into the atmosphere by large enterprises (HPS and HPP). Incipient recently total reduction of emissions into the atmosphere can be explained by changes in fuel balance towards decreasing the share of black oil combustion and increasing of the gas share.

The problem of impact on environment by coal combusted in the fire-chambers of HPS

according to the data of Novo-Angrenskaya HPS the actual dry ash percentage in 2004-2005 amounted to 42.57% (working 26.4%).

When assessing emissions to the atmosphere, it should be mentioned that one small HPS with the capacity of 1 MW and productivity of 6000 MWH is equal to the reduction approximately by 5,000 tons annually of carbon dioxide emissions by fuel-based electric power stations, not taking into consideration other hazardous impacts on environment as a result of using fuel in production of electric power, transportation, storing, combustion, etc.

2.6. Transport

State of the Problem. Transport complex of the Central Asian countries is represented by railway, river, air, road and pipeline type of transportation.

Road transport, the most widely spread, and mobile means of passengers' and cargo delivery, are of great importance in the production infrastructure of Central Asian countries. For instance, the total length of motor roads constitutes about 90 thousand km in Kazakhstan, to the share of which fall 70% of passengers' and cargo traffic flows.

All types of motor transport use gasoline, diesel oil, liquefied oil gas and compressed natural gas as a motor fuel. For instance, in Kazakhstan 61% of auto trucks, 79% buses, 96% passenger cars and 78% special vehicles worked on gasoline in 2001. The share of vehicles working on gas is still very small (2.4%), and has a tendency to reduce.

Age structure of stock of cars of Kazakhstan up to 1993 remained rather stable – about 70% of transport was within the range of depreciation terms (under 8 years), 19% of transport was within the range of age group of "over 10 years". Beginning from 1994 a tendency to ageing of vehicle fleet (about 80% auto trucks in 2003 have the age over 8 years, passenger vehicles this indicator equals 34.6%).

In Kyrgyzstan and Tajikistan because of the peculiarities of the geographical position and relief the freight and passengers transportation is executed mainly by motorcar transport. The length of motor roads is about 3,000 km. Of them only the highway Bishkek – Osh is quite close to international standards in its quality. The total length of motor roads is more than 26 thousand km, but from 1997 to 2001 under the influence of extreme natural phenomena about 3.6 thousand km of motor roads, more than 500 bridges and other constructions were ruined and damaged.

To the share of motor roads more than 95.8% of all transported freight and more than 99.2% passengers fall in Turkmenistan. Today share of the non-governmental sector in the total amount of motor vehicles constitute: auto trucks 51.5%, buses 69.7%. The share of the volume of work done is 29.8% of the total volume of transported freight within the state and 30.1% of passengers.

An important place in the national economy complex of Uzbekistan also belongs to the motorcar transport, to the share of which more than 85.7% of total amount of transportations fall. During 2004 714.9 million tons of freight and 3,479.2 million passengers were transported by all types of the transport industry of Uzbekistan that is higher than the level of the appropriate period of the previous year, respectively, by 1.0% and 3.9%. At this the work has been fulfilled at the rate of 64.5 billion tons-km and 40.1 billion pass.-km that is in comparison with the appropriate period of the last year is higher by 3.7% and by 10.7%, respectively.

The total length of motor roads in Uzbekistan constitutes 84.4 thousand km, including roads of general use – 43.3 thousand km, of them: 3,243 km are of international importance, 18,582 km – of state importance, 21,493 km – of local importance. Existing roads allow providing uninterrupted transit through the territory of the republic of transit freight and passen-

roads of general use – 43.3 thousand km, of them: 3,243 km are of international importance, 18,582 km – of state importance, 21,493 km – of local importance. Existing roads allow providing uninterrupted transit through the territory of the republic of transit freight and passengers to Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan and Afghanistan, and through these countries the way out to motor roads of Russia, China, Pakistan, India, Iran and countries of South-East Asia.

The transport facility fleet used in the countries of Central Asia is by 10-20 years behind by all indicators of effectiveness, reliability and safety from motorcars exploited in industrially developed countries. The analysis made showed that the biggest input into the contamination of environment is made by motorcar transport. Negative influence of the motor transport is obvious first of all in large cities of sub-region.

The transition to the market relations has aggravated environmental problems caused by motor transport. Change in the form of ownership for the majority of transport facilities has got them out of hand, reduced amount of fund invested into the development and maintenance of the required road quality, as well as the amount and condition of the public transportation. Destruction of the centralized system of transport fuel supply has practically eliminated control of its quality during importing and realization.

Transport Development Potential. In countries of Central Asia during the development of transport projects the issues of transport servicing of economic and social demands, increase of efficiency of transport work, ensuring of traffic safety and environment protection.

In Kazakhstan the share of transport in gross domestic product in 2003 amounted to 10.2%. In the beginning of 1990s the passenger motor transport in republic amounted to about 60% of all transport facilities, and in 2003 this indicator increased up to 78%. In 2003 the citizens of Kazakhstan had in their private property 86.5% of all transport facilities (auto trucks, buses, and motor cars), 11% - in private property of legal entities of all types of economic activities, and less than 4% - in state property. In 2003 provision of citizens of Kazakhstan with motor cars constituted 7.3 units of vehicles per 100 people of the permanent population.

In Kyrgyzstan annual import of overland, air and water transport facilities, their spare parts and gear amounts to 31.5 – 41.5 million US dollars. In import structure the vehicles, predominantly motor cars and passenger busses constitute the lion's share. As of the year 2003 the number of vehicles has reached 300 thousand units. In Kyrgyzstan, in total amount of public conveyance in republic the main share falls on buses and micro-buses, number of which increased from 74% on 1997 up to 86.4% in 2002 and up to 88.8% in 2003.

In Central Asia the railway transport occupies the next place after the motor transport by its significance. The possibility to traffic high levels of freight for far distances, high carrying capacity of a unit of the rolling-stock and low costs of traffic is the most attractive feature of the railway transport. And this stipulates for the fact that more than 80% of all export – import and transit freights are trafficked by the railway transport.

Due to the putting the section Serakhs – Tejen – Mshkhed into operation in 1996, which connected the railway networks of Turkmenistan and Iran, the new "Silver Road" turned to be completely composed. It connected the Pacific ports of China with Europe through Central Asia, Iran and Turkey.

The railway network of Central Asia exceeded 20 thousand km, including 14.3 thousand km in Kazakhstan. Turkmenistan is realizing national program of railway network development. It envisages construction of more than 2000 km of new lines, increasing of locomotive fleet, passenger and freight stock, enhancement of sectoral infrastructure and its integration

Dashoguz with the length of about 540 km was completed.

Aviation transport also was dynamically developed. National airlines of CA countries carry out regular flights to more than 25 countries of the world. So, for instance, Tashkent is connected with direct airlines with New York, London, Frankfurt-on-Main, Beijing, Seoul and other cities of the world. At the same time aviation transport of the region has problems too. So, for instance, air traffic during the last decade has sharply reduced because of the high exploitation costs and unsatisfactory state of the aviation complex. For instance,. air fleet of Tajikistan numbers 41 planes, the newest of which was purchased in 1992. The average age of airplanes amounts to 21 years.

Considerable part of exploited airplanes in the sub-region countries does not meet the present-day requirements. For instance, emissions of hazardous substances into the atmosphere of the airport of Dushanbe are estimated in approximately 270 tons annually, of which emissions from air transport amount to about 120 tons. The quartering on the territory of Kyrgyzstan of two large air bases: US "Gansi" and Russian air base, contributes to the total contamination of the atmosphere with emissions from mobile sources.

The transport system of Central Asia includes pipelines, through which oil and natural gas is exported to the external markets. For instance, Turkmenistan today exports through the gas pipeline "Middle Asia – Center" 50 billion cubic meters of natural gas per year. As the analysis of tendencies taking place at the Russia's and European gas markets shows, the northern direction has all chances to become the most priority for the Central Asian exporters of natural gas in the nearest future.

Oil and natural gas are strategically very important goods for the states of Central Asia, and not for a while yet their reserves are large they should be used with the maximum profit in order to provide full entrance into the global energy market for the Central Asian countries and serve as an incentive for further development of economies.

European Union, pursuing their strategic goals in Central Asia is to great extent interested in the development of transport infrastructure for connecting Central Asian markets with the European one. For this it is particularly important to complete the works on the unfinished sites, to improve the legal basis of Central Asian countries, to unify the norms and standards of tariff regulation and transit development. In this direction a great work has been already done within EEC and ESCAP. Transport policy within the framework of SPECA is based on the development of three transport corridors connecting Central Asia with Europe: through Russia; TRACECA (Program of Euro-Asian Transport Corridor Development): through Iran and Turkey.

For simplification of border crossing all Central Asian states have acceded to seven UN international conventions relative to the overland transport. The strategy of SPECA Program implementation in the field of transport in the present-day stage has the following orientations: detection of the main overland transport corridors; estimation of conditions on the routes, revelation of physically and operatively bottle-necks on the routes, increase of their efficiency; development of unified tariffs between the main points of dispatching and destination; improvement of safety on the transport; improvement of the management and maintenance of road networks and rolling stock; introduction of monitoring of movements of cargo/containers by rail train; realization of the principle of "precisely in time" delivery, which is the compulsory condition of efficient international trade.

Impact on Environment. The most considerable impact on environment is caused by the motor transport. The main reasons of high content of hazardous substances in emissions

Impact on Environment. The most considerable impact on environment is caused by the motor transport. The main reasons of high content of hazardous substances in emissions are the obsolete motorcar fleet, untimely and low-quality technical maintenance of vehicles as well as low quality of motor fuel. So, ecological and geochemical investigation of Almaty City in 2000 showed the high level of soil contamination with heavy metals. To different extent soils in the large cities of the sub-region are contaminated with copper, nickel, cobalt, cadmium, lead and zinc.

Impact of transport on environment in many respects is determined by intensity of traffics, technical conditions of the vehicle fleet, quality of the used fuel as well as development of one or other kinds of transport services. Impact of the municipal motor transport, which accounts for the main share of passengers' traffic, on the quality of the air in large cities, gives rise to anxiety. Toxic substances emissions on the territory of Tashkent, Almaty and Bishkek Cities and other large cities remain high that is stipulated by extension of the motor fleet as well as by transition of the municipal transport to vehicles with small amount of seats.

Tens of pollutants are emitted in CA countries by motorcar transport, with total amount of more than 3,300 thousand tons per year, including 1,100 thousand tons in Kazakhstan and 1,540 thousand tons per year in Uzbekistan. In majority of large cities the input into the urban-industrial environment reaches during the last years 60% and more, and in Almaty and Tashkent it reaches up to 90% of total emissions.

By 2004 in Bishkek the total amount of motor transport mounted to 86.9 thousand units, and emission volume from motor transport ran up to approximately 70 thousand tons. In regions with intensive traffic of motor transport the largest contents of pollutants are observed: carbon oxide 1.7 – 3.3 MPC, nitrogen oxides 1.5 MPC, formaldehyde 7 MPC, benzpyrene 25-35 MPC. Concentration of lead in the air mounted up to 3.9 mcg/m^3 with the norm of 1 mcg/m^3.

In the sub-region countries the shift towards the use of transport with high level of contamination took place. Setback in production and drop in the income of the population resulted in reduction of volume of passengers' and freight traffics in 2004 in comparison with 1990.

The percentage of using compressed and liquefied gas as a motor transport fuel in CA comes to about 4%. Exception is Sogdiiskaya Oblast of Tajikistan, in which the use of compressed and liquefied gas amounts to about 80%.

Transport is an important source of emissions of one of the main greenhouse gases – CO2. According to the data of the National Action Plan of Tajikistan for the Mitigation of Consequences of Climate Change (2002), emissions of CO2 from transport amounted to 533.4 thousand tons. However regulation of greenhouse gases emissions in the transport sector is not implemented and account of hazardous substances emissions from mobile sources in total in the industry is carried out mainly based on the fuel consumption.

Decisions made to prohibit the selling of motor fuel directly from mobile refueling points significantly improved the environmental situation. During the last years the number of motor transport refueling points has increased. Motor transport refueling stations are located in zones of green plantations, near residential houses, in water protection zones of rivers and water reservoirs without any necessary cleaning systems of rain drainage and without necessary protection of ground waters. Almost at 20% of stations the environment protective constructions are not available (gasoline-oil collectors), and water-proof coatings.

Meteorological conditions of Turkmenistan stipulate quick dispersion of pollutants in the atmosphere of all populated areas of the country except large cities. Therefore the main part of

hydrocarbons 39%. In Ashgabat City more than 100 thousand motorcars are used.

In Uzbekistan emissions of pollutants into the atmosphere from stationary sources of contamination and emissions from mobile sources during the period beginning from 1997 till 2002 are observed to be increased up to 1.54 million tons that is related to the growth of the number of vehicles and increase in the volume of freight traffic. The main pollutants and their contents in the total volume of emissions in Uzbekistan are given in the Figure 29.

During the last years the growth of emissions from motor transport, which contain such highly toxic for the man and environment compounds as nitrogen oxides, lead, heavy metals, polyaromatic hydrocarbons, etc., has been noticed in CA countries. Pollutants from motor transport emissions in contrast to the stationary sources are accumulated in the surface air directly in the zone of breathing.

Analysis of tendencies in motorcar fleet development of countries of Central Asia and its impact on environment shows that environment-oriented transport policy should be based on the strict environmental norms corresponding to the existing international requirements, and on the efficient control system of their observance.

In order to improve environmental situation in Central Asia n sub-region it is necessary in the first place to undertake the following environmental measures related to the transport sector:

- step-by-step modernization of oil refinery plants with gradual shift to the production of lead-free-gasoline;
- organization of complex control of the contents of exhaust gases with the simultaneous regulation of internal-combustion engine;
- reduction of volume of import and exploitation of vehicles with long service life;
- organization of two-level multi-row planting of greenery in highways with the most intensive traffic of motor transport;
- development of environmentally appropriate types of transport;
- prohibition of import and production of ethylized types of gasoline;
- organization of the system of environmental monitoring of roadside territories.

2.7. Natural phenomena

Natural phenomena such as earthquakes, flash floods, ground subsidence, landslides, mudflows, soil erosion, etc., constitute a menace to the whole sub-region of Central Asia. The Aral Sea crisis is the largest environmental and humanitarian disaster in the newest history of the mankind. About 30 million people living in its basin suffer from its consequences. Nowadays the dried bottom of the Aral Sea stretches for 28,000 square kilometers. Two thirds of this territory is occupied by alkali soils (solonchaks) and saline sands. 75 million tons of salt-dusty mass rises annually from this territory to the atmosphere and then are spread by winds and accumulated at the distance of thousands kilometers. Dried bottom of the Aral Sea becomes one of the main sources of emissions of aerosols, pesticides and herbicides into the atmosphere. Facts of pernicious influence of salts and aerosols from the bottom of the Aral Sea on the health of the population and environment became widely known and even on the process of accelerated melting of mountain glaciers, where Central Asian rivers Syrdarya and Amudarya spring from.

The sub-region is characterized with high seismicity. Earthquakes can cause landslides into the artificial water reservoirs and also destruction of natural dams. Strong and weak earthquakes contribute to the formation of other catastrophic phenomena: impoundment of

The sub-region is characterized with high seismicity. Earthquakes can cause landslides into the artificial water reservoirs and also destruction of natural dams. Strong and weak earthquakes contribute to the formation of other catastrophic phenomena: impoundment of rivers, debacle of lakes, mountain avalanches, ground depressions, etc. In 1911 in the Murgab River valley a 9-10 grade earthquake stroke the area. Giant rock masses came down from the mountains completely covered the populated Usoi kishlak (settlement): according to some data about a thousand people died. Usoi obstruction formed during the earthquake blocked the Murgab River that caused the formation of huge Sarez Lake (Tajikistan), the volume of fresh water in its amounts to 17 km3. The water level in the lake constantly rises. Therefore, in case of debacle the catastrophic flash flood will occur, which can cover the territory of more than 70 thousand square kilometers with the population of about 6 million people, in Tajikistan, Uzbekistan and Turkmenistan.

Fig. 23. Usoi obstruction, formation of Sarez Lake

To solve the issues of safety providing of Sarez Lake and for the prospects of utilization of its water resources, the government of Tajikistan has established the "Sarez" Agency; the projects of international programs are under implementation for the purpose of warning and preparation of the population living in the vulnerable regions to the actions in case of disaster.

Processes of desertification are also referred to the serious natural factors; their development is caused by such natural phenomena as: climate aridity, water scarcity, high evaporation, recurring droughts and irrational people's activities.

During the last 25-30 years as a result of soil erosion, overgrazing and other anthropogenic impacts as well as the lack of phytomeliration the pasture digression is observed manifested in the loss of their forage capacity. More than 70% of pasturelands are subject to the processes of digression. Load increase on the mountainous pastures also caused the degradation of vegetation and soils that results in strengthening of the storm discharge and enhancing of mud flow recurrence.

Impact of Natural Phenomena on Environment State. Environmental disbalance in the sub-region of the Aral Sea affects first of all the changes in air temperature and precipitation distribution. Reduction of the water area and volume of the Aral Sea has changed the thermal regime of the region, which in their turn serves as a reason of the abnormal changes in the atmosphere.

In high-mountain regions of Central Asia snow-glacier avalanches often occur in spring months. During abundant precipitation powerful friable detritus-gravel-pebble masses formed as a result of weathering on slopes of mountain ridges are saturated with water and turn into the thick rock-mud mass. At that time landslips often occur and movements of moraine-glacier mass intensify, which fill the valley and cut-off rivers.

In mountains and foothills mudflows represent impetuous mountain flows with the mass of semi-liquid mud, crushed stones, gravel, pebble and boulders destroying and flooding on their way all populated settlements, industrial facilities, roads, crops, pastures, etc. Mudflows specially cause strong damage to flora and fauna of the region.

In foothills, low mountains and medium mountains of Central Asia mudflows occur every year, but sometimes during a year they reoccur several times. In Turkmenistan because of the extremely dryness of climate mudflows are quite rare, and often occur in springs and autumns. Of the total amount of registered mudflows in Central Asia more than 70% of them fall to the share of Uzbekistan. The most dangerous are mudflows on the mountain slope of Fergana Valley.

In mountain and foothill regions of Central Asia landslides often occur, which are specifically frequent on mountainous territories of Kyrgyzstan, Tajikistan and Kazakhstan.

Fig. 24. Flood

Erosion processes and river floods represent a great danger. Big inclination of riverbed contributes to the intensive development of ground erosion, particularly in places, where river cross the easily washing out rocks (in piedmont zone, in the intermountain troughs). During the high water side erosion intensely takes place (deigishi). Catastrophic erosive processes often occur in the Amudarya River valley.

On the territory of Tajikistan there are 8,492 glaciers with the total area of 8,476 km2 and ice volume of 567 km3 that constitutes more than 60% of the total area of glaciers in states of Central Asia. 845 km3 of water is concentrated in glaciers and this exceeds 13 times the average annual run-off of all rivers of Tajikistan and 7 times the run-off of all rivers of the Aral Sea basin.

Because of the global climate changes the process of glaciers and snowfields reduction is observed during the last 50 years. This affects only water content of rivers with high share (40% - 50%) of glacier feeding. The problem of glaciers monitoring requires attracting attention of the world community to organize regular observations, particularly for forecasting of water content of rivers.

Specific natural phenomena are characteristic for platform-plain territory of Central Asia, formation of which mainly connected with physical erosion and aeolian processes. During the hot season (5-6 months) soil surface becomes badly warm under the influence of solar radiation. Moisture evaporates and upper layer of soil turns into the loose mass, which the wind can blow out and transfer fine material from the surface. When winds are strong, particularly in summertime, they often form dust storms. If shors are subject to the intensive evaporation, in this case dust-salty storms are formed. During summer period, when the surface of sandy deposits becomes very warm, intensive transfer of sands takes place.

Fluctuations of the Caspian Sea level influence environment of Kazakhstan and Turkmenistan. The main factors causing frequent fluctuation of the sea level are hydro-climatic changes, tectonic processes and economic activity of man. During the fall of the sea level,

which was registered in 1930-1977, on the dried territory the processes of sand deflation or wind erosion and soil salinization, offshore motion of sediments and accumulation of the coastline were formed.

In 1980 because of the fall of the Caspian Sea level the strait connecting it with the Karabogazgol Bay was blocked with blind dam, and by the end of 1983 the bay completely dried out and turned out into giant salt depression. In this connection the salt-dust carry-over to the neighboring territory intensified, the microclimate and radiation balance in the subregion of the bay has changed. In 1992 in connection with the beginning of the sea level raise the blind dam was dismantled and the bay was completely filled up with water.

For all states of Central Asia frequent earthquakes and strong winds are rather characteristic, which sensibly affect the state of environment. So, annually the seismic stations of Kyrgyzstan register more than 3000 earthquakes, of them tens are perceptible, and some of them as a rule cause tangible damage of environment of the region.

In Turkmenistan the winds achieve their maximum velocity values in spring and summer. Strong winds are observed in western regions of the country with velocity of more than 6 m/sec. Here the amount of days with active winds (more than 4-6 m/sec) totals 280 days. Number of days with strong winds (more than 15 m/sec) in Central Karakums amounts to 5-10 days, in south-east Karakums 3-8 days per year. In northwestern Turkmenistan the number of days with strong winds has increased up to 40, and in the west of foothills of the Kopetdag and in the Amudarya River valley up to 54 days per year. Strong winds cause the development of deflation processes in the sandy desert. More than 11,5% of sandy surface is subject to the deflation processes.

Probability of drought occurring amounts to 75-95% (Kovda, 1977). Droughts of mild extensity are observed every year almost on whole territory of Turkmenistan. Strong droughts are observed in the regions Nichka (80%) and Tagta-Bazar (67%), which cause discomfort of the climate and negatively influence on productivity not only of agricultural cultures but also on pasture vegetation and contribute to occurrence and development of desertification processes. During strong droughts productivity of agricultural crops reduces by 30%, and productivity of pasture vegetation by 30-65%.

Impact of Natural Phenomena on Socio-Economic Development. During the last years natural disasters and catastrophes have been often observed in Central Asia, scale of damage of which was excessively grave. It can be explained first of all by the increase of the population density, progressive urbanization of the territory, global climate change on the Earth, enhancement of the seismic activity.

For Central Asia the most dangerous natural phenomena is earthquakes. So, for instance, on the territory of Turkmenistan more than 1000 earthquakes take place, which are registered by seismic stations. Maximum amount of earthquakes - 2381 – was registered in 1984. Strong and medium earthquakes have destructive impact on environment and the man. The most destructive earthquake in Central Asia happed to be in Ashgabat and its suburbs in 1948, as a result of which the city was completely destroyed. Few building left after the earthquake also required major repairs. Population losses were huge and amounted to more than 40%. Complete destruction of the city and death of people, often in whole families, and the necessity of undertaking the urgent sanitary measures did not allow making an account of the death roll. That's why in different period after the earthquake different figures were mentioned.

Catastrophic grade 10 earthquake occurred in 1949 in Garma and its outskirts (Tajikistan). Destructive grade 8 earthquakes struck in April 1966 in Tashkent and in March 1983 in

exposed to the severe drought because of the shortage of water resources. Significant part of the yield of rice, cotton and fodder crops have gone. Incorrect distribution of existing water resources and unstable character of agricultural crops production aggravated the drought consequences. As a result in Republic of Karakalpakistan rice crops were lost on the area of 48 thousand ha and cotton crops on the area of 126 thousand ha, which were not ever watered. Also crops of fodders and vegetables were damaged. In northern regions of Kara-Kalpak there was no any possibility to provide the population and animals with drinking water.

The socio-economic conditions are negatively impacted by fluctuations of the Caspian Sea level. In 1979 - 1995 the 2.5-meter rise of the Caspian Sea level was observed, which resulted in flooding of vast low-lying territories of the coastal zone and industrial-economic objects located there. It became the reason for development of such processes as flooding, waterlogging, salinization, abrasion of the coastal line, degradation of the vegetation cover. More than 60% of the area of the coastal zone (at 100 km width) is subject to the desertification processes.

Typical for Central Asia example of natural phenomena impact on socio-economic development is further development of desertification processes in the region. The following main economic problems could be singled out, which are stipulated by desertification processes:

- Loss of agricultural lands;
- Decrease of crop capacity, total yield of crop production, reduction of export potential;
- Reduction of the livestock population and productivity;
- Decrease of the manufacturing of agricultural products and light industry products.
- After the economic consequences desertification causes a number of serious social problems, such as:
- Intensification of unemployment, particularly among the rural population;
- Decrease of the population's income from selling agricultural products;
- Aggravation of the health of population;
- Intensification of migration of the population from regions subject to the wide-scale desertification.

Among states of Central Asia Kazakhstan is on the first place according to the area included into the desertification process (179.9 million ha). About 66% of the territory is subject to degradation. Hotbeds of degradation are observed around the whole territory of republic that is caused by the negative anthropogenic impacts against the background of unfavorable phenomena.

Development of desertification processes resulted in reduction of agricultural lands proportion from 220.7 million ha in 1991 to 90.9 million ha in 2001.

Comparative analysis of the qualitative land status for 1990 and 2000 in Kazakhstan testifies to the fact that during 10 years the areas subject to wind erosion have extended to almost 5 million ha or 22%. Display of erosion processes in the first place is related to the fact that the carrying out of anti-erosion measures stipulating the interconnected utilization of organizational-economic, agricultural, forest-amelioration, hydraulic engineering measures and techniques ensuring liquidation, prevention or diminishing of erosion processes as well as rehabilitation of erosive land fertility, currently is virtually discontinued.

Frequent dust storms are also typical for Central Asia. Dust, salt and sand storms cause great socio-economic damage to industrial objects, roads, populated areas and cities. A dense dust storm was observed over Ashgabat and its outskirts on December 19, 1985. It lasted 7

tation of erosive land fertility, currently is virtually discontinued.

Frequent dust storms are also typical for Central Asia. Dust, salt and sand storms cause great socio-economic damage to industrial objects, roads, populated areas and cities. A dense dust storm was observed over Ashgabat and its outskirts on December 19, 1985. It lasted 7 hours. The thickness of sand-loess-like deposits within the city borders reached 5-6 cm.

In countries of the sub-region a complicated situation occurs in the case if in the mouth of mud flows settlements or industrial-economic objects are located. So, mud flows and floods, which took place in 1998 cause damage to the economy of Tajikistan to the amount of about 70 million US dollars, during the period from 2000 till 2005 – to the amount of 202.9 million US dollars. During these years 36,998 houses were wrecked, of which 4,212 were destroyed completely, 111, 292 people were injured, 121 people died.

In August 1990 mudflows formed after abundant showery rain in Western Kopetdag; the sound of floating water was heard at the distance of 5 km. The height of the water flows exceeded 3.0 m. About 200 cubic meters of water and mud per one second flew along the riverbed. At the end of the flow or on the basis of erosion the width of the flow ran up to 5 m. The 2-km section of Ashgabat – Turkmenbashi highway was broken down, in the town of Serdar 20 houses and a number of industrial-economic objects were submerged, Janakhir settlement was hard hit by the flow: tens of houses and household buildings submerged.

Freshets sometimes cause catastrophic floods, particularly in valleys of large rivers. In July 1998 the Amudarya River flooded agricultural lands and economic objects located in its flood-lands and at low terraces.

It should be mentioned that floods on river usually occur in warm seasons, when abundant runoff takes place because of precipitation and water from melted snow. Floods can take place also in cold time, when a river is in low-flow period. In winter 1968-1969 on the Amudarya River near the railway bridge an ice jam was generated, which blocked the river flow. As a result the river submerged the city of Chardjow and urban-type settlement.

In April 1991 after the abundant rain the flood happened on the Murgab Riverr. (Turkmenistan), resulted in the flooding of a large territory of crops, a number of economic and hydraulic structures, built-up areas. Bairach settlement was hard bit most of all. About six hundred families were left without a roof over their heads. In April 1998 the flood on the Murgab River repeated, as a result of which the railway station Takhtabazar was submerged.

Underestimation of objective laws in manifestation of earthquake load and other of exogenous processes during the economic activities, particularly in the combination results in unfavorable consequences and human deaths.

Often earthquakes initiate appearing of landslides, landslips and mudflows. In 1989 quite light Gissar earthquake caused the effect of the ground liquefaction and, as a consequence, the landslide appearing. As a result 270 people died.

Construction of large water reservoirs also causes the risk of natural disasters occurring in mountains and appearing of induced seismicity. In the complex and with the course of time these processes can result in changes in behavior of dangerous modern geological processes and enhancing of the risk of natural disasters occurrence

Moving sands formed mainly through irrational nature management in Turkmenistan and Uzbekistan have a certain negative impact on rhythmic work of roads, industrial enterprises, electricity transmission and communications lines.

Interrelation Between Anthropogenic Loads and Natural Phenomena. Independent states of Central Asia - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan,

have inherited environmental cataclysm from the former irrational nature management. Environmental damage was caused to the sub-region during the decades of intensive development of natural resources, insufficiently considered constructions of hydraulic structures, unwarrantably wasteful use of water, cultivation of cotton monoculture, etc. All these resulted in environmental crisis, the tendency of further aggravation of which still remains. (the Aral Sea, Balkhash Lake, Caspian Sea, etc.)

For Central Asia desertification and drought are the transboundary problem. With the present-day scarcity of water resources the drought forecasting is the primary measure for the mitigation of drought consequences and choosing the response strategy to the prospective shortage of water with the purpose of decreasing of possible damage to the national economy. Establishment of the early warning system of droughts in the Aral Sea basin can become the foundation of a complex of measures to reduce consequences of droughts arisen as a result of climatic changes and anthropogenic impact.

Anthropogenic factors most of all influencing environment of Central Asia are as follows:

- Impact of industrial complexes (development of natural resources, their processing, accumulation of industrial wastes, construction of line structures);
- Overgrazing of cattle on pastures with poor fodder capacity;
- Imperfection of the system of agriculture;
- Regulation if river flow;
- Intensive timber cutting;
- Fires and burnings.

During the last years the situation has also aggravated by unregulated anthropogenic impact on vulnerable mountainous and desert ecosystems. In connection with the overpopulation of certain areas of mountainous territories and river valleys, as well as incorrect choose of places, where objects of economic activity should be located, and violation of technologies of existing enterprises the man-caused landslides, landslips, deep depressions, soil salinization, desertification and other phenomena take place. Construction of large water reservoirs impacts the seismic conditions of the area intensifying the tectonic activity that can be observed in the area of Nurek and Toktogul water reservoirs. The problem of safe storage of wastes of mining production is aggravated by a large number of natural disasters, particularly on the territory of Kyrgyzstan and Tajikistan. It is obviously appear in the increased concentration of dangerous for the health of people pollutants: heavy metals, pesticides, arsenic compounds and chlorine in the water of majority of rivers of the region.

During the last 10 years the development of hillside territories with the steepness of more than 10 degree has noticeably activated in Tajikistan. This in its turn resulted in active development of soil erosion and creation of favorable conditions for landslides. Moreover, because of the financial inability of the population to buy for their domestic needs fuel such as coal, firewood, gas and because of the instability of electricity transmission forests are cut down and shrub-herbaceous vegetation is annihilated that also increases the extent of erosion processes under the influence of such natural phenomena as mud flows, avalanches, floods and landslides.

Extensive way of development of irrigated agriculture, use of pesticides, salinization, waterlogging, erosion, livestock overgrazing, forests and vegetation cutting down, etc., results in the aggravation of environmental situation in Central Asia. Inevitable consequences of these processes are the exhaustion of renewable water resources and the increase of probability of dangerous natural disasters occurrence. High degree of vulnerability of Kyrgyz Republic from natural disasters is explained, from one side, by the complex of geo-climatic conditions

of the country and, from the other side, by its economic difficulties during the transition period. In mountainous regions forests felling, ploughing works, livestock grazing on the slopes of mountains cause intensive degradation of soil cover, formation of mudflows, landslides and avalanches.

Irrigated agriculture also has the negative impact on environment. During the last 30 - 35 years irrational land utilization resulted in gradual worsening of environmental situation practically in all irrigated regions of Central Asia. This is particularly obvious in contamination of surface and ground water. The main pollutant of water objects is irrigated agriculture. Drainage water rich in mineral fertilizers, pesticides and insecticides is of particular danger. The most contamination with collector-drainage water is observed in small rivers and lower course of Amudarya and Syrdarya Rivers.

Central Asia is an arid sub-region and the problem of water supply always existed beginning from the second half of 19th century, when many nomadic tribes turned to the settled way of life. The problem became more important during our days. The reason for this became the deprivation of the management of once united water-economic complex of the Central Asian region, when each country of the sub-region started pursuing their own water policy, often not coordinating it with the neighbors. Besides, the problem of water scarcity became the result of severe drought lasting for several successive years that lead to the critical situation in the lower course of Amudarya and Syrdarya Rivers.

One of the sources of water resources contamination is a livestock-breeding complex. At the overwhelming majority of livestock-breeding enterprises the water-protective situation is unsatisfactory. Without any techniques of decontamination manure-containing effluent is discharged to the accumulating device of absorbing type, to relief depression, directly to the collector-drainage network or the nearest water sources

The existing system of return water consumption based on the repeated putting into circulation of a significant portion of CDW has predetermined the process of growing salt pressure on irrigated territories and water sources. The most keenly perceptible negative consequences of this process are in medium and low course of river basins.

Potentially dangerous for environment is a complex of tailing dumps at diggings and uranium mines themselves, including entombments of radioactive wastes in the Mailuu-Suu River basin, is located in mountainous area and is subject to landslides during floods and possible earthquakes.

In case of radioactive and toxic wastes of uranium industry get into water arteries of Kyrgyzstan and Tajikistan the contamination can spread to the territory of Uzbekistan, Kazakhstan and Uzbekistan.

Such a situation can result in irreversible changes in environment in local and regional scale, to political tension, economic destabilization, withdrawal from use of vast agricultural lands, which will during many decades contain radioactive nuclides and toxic impurity.

On the dried seabed of the Aral Sea a sandy-saline desert Aralkums is forming. It is ascertained according to the space images that dust-salty flows are spread to 150-300 km, sometimes to 500 km. The area of dust distribution and deposition zone is about 25 million ha. In conditions of high content of chlorides and sulfates in irrigation water the irrigated land becomes saline, and with unsystematic utilization of pesticides the soil contaminates with pesticide residues.

Cosmodrome (spaceport) Baikonur and changes of weather conditions in some regions of Kazakhstan, particularly when space rockets are launched in spring and summer months, can serve as an example of anthropogenic pressures impact on natural phenomena.

The cosmodrome running in commercial and other purposes causing extreme damage to the safety of the sub-region puts an alternative forward: conservation of regional safety due to the reduction and international control of space rockets launches otherwise there will be the acceleration of imminent environmental catastrophe. In this connection it is urgently necessary to make a wide-scale international assessment of impact cosmodrome Baikonur and space rocket launching, in the first place carrier-rocket "Proton" and others with particularly poisonous fuel reagents, on environment of Central Asia.

At present time in states of Central Asia the laws were passed for nature and its certain elements protection, for which target programs and projects are developed and being realized. In the works undertaken the specific importance is attributed to measures against natural disasters and liquidation of their consequences.

Systematization of information about dangerous phenomena, mudflows and dangerously flushable lakes using GIS and entering it into the system of forecasting methods of mudflow risk for certain regions highly subject to mudflows, is a measure of preparation, adaptation and mitigation of these dangerous phenomena consequences.

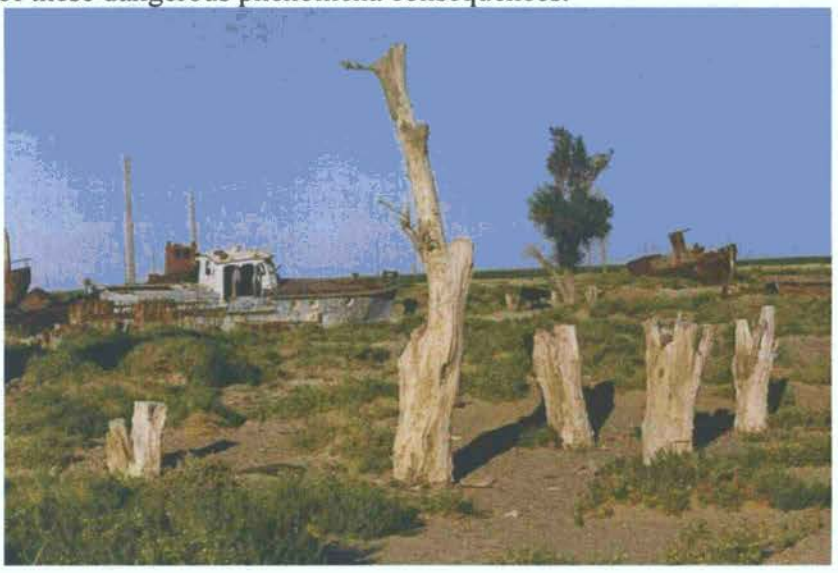

Fig. 25. Dried Aral Sea bed

CHAPTER III. ENVIRONMENTAL POLICY

Coincidence of natural, environmental and socio-economic conditions is objectively existing incentive for uniting of effort of Central Asian countries (CA) in the sphere of environmental policy implementation and ensuring of sustainable development of the subregion.

Analysis of the modern state of environmental policy carried out by CA countries shows that all conditions are created for the further consolidation of political and institutional basis for Subregional cooperation.

In total number of political statements CA countries undertook obligations for the complete cooperation at the regional level and verified their adherence to the principles of sustainable development, that clearly was expressed in Nukus Declaration of States of Central Asia and International Organizations on Problems of Sustainable Development of the Aral Sea Basin (1995) and Ashkhabad Declaration of Presidents of Central Asian States (1999).

In Almaty Declaration of Presidents of Central Asian States (1997) and Tashkent Decla-

ration on special UN Program for the states of Central Asia (1998) time and again a desire was expressed to expand the environmental cooperation with the competent organizations and agencies.

All countries of CA acceded to the UN Environmental Conventions being in global scales the guarantor of environment conservation, prevention of environmental disasters. They include:

- UN Framework Convention on Climate Change;
- Convention on Biological Diversity;
- Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer;
- United Nations Convention to Combat Desertification;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal;
- Convention of Migratory Species of Wild Animals;
- Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, etc.

Cooperation of CA countries in sokution of the most urgent problems of the sub-region was very vivid during the development of the Program for the Aral Sea Basin (PASB). The Program consists of four priority trends:

- Stabilization of environmental situation in the Aral Sea basin;
- Rehabilitation of the crisis zone around the Aral Sea;
- Improvement of management of international waters in the Aral Sea basin;
- Capacity building of the regional bodies in the planning and PASB implementation.

Solution of the given problem resulted in establishment of specific institutes in the person of the International Fund of the Aral Sea (IFAS), including the IFAS Managing Committee, Interstate Coordinative Commission for Water Management (ICWC), Interstate Sustainable Development Commission (ISDC) and assigned to the commissions Scientific-Informational Centers (SIC). IFAS activities, which is financed by CA states, was significantly strengthened by foreign financial assistance through projects of the UN Development Program and Global Environmental Facility (GEF).

Moreover, each of the CA countries adopted the "National Environmental Action Plan" (NEAP), and for the purpose of the regional integration and activity coordination in the sphere of environmental policy the Regional Environmental Action Plan (REAP) was developed and approved, which currently is introduced and regulated by the Interstate Sustainable Development Commission (ISDC).

The determining factors of efficiency of environmental policy implementation are:

- Management and regulating of issues of environment protection;
- Improvement of legislation in the field of environment protection;
- Efficiency of economic techniques and mechanisms of management of environment protection.

The common and most important for countries of Central Asia (CA) is the fact that Presidents and Governments of all five countries support and realize the policy ensuring environmental security. Besides the developed "National Environmental Action Plans" (NEAP), the main laws are introduced and successfully function, assuring realization of environmental policy, and mainly similar economic mechanisms of environment management.

Furthermore, in all countries special Commissions have been established, which control

the implementation of UN Conventions and Programs related to the issues of environment protection.

Depreciation of technical means for observations and measurements results in reduction of amount and reliability of obtained information. Insufficient interdepartmental coordination of monitoring systems of different ministries and departments does not allow to fully making objective estimation of the state of environment and obtaining timely operative information.

The distinctive factor in the environmental policy is some outstripping of separate countries in laws adoption. So, for instance, in Kazakhstan the Law on Environmental Audit is in operation. An issue of introduction of the Law "On Mandatory Ecological Insurance" is to be considered. In other countries there are no such Laws

3.1. Efficiency of Management and Regulation of Issues of Environment Protection

Efficiency of Management and Regulation of Issues of Environment Protection in countries of Central Asia (CA) depends on the perfection of their legislation. In general in CA countries the laws related to many issues of nature conservation have been developed and successfully are functioning.

In Kazakhstan the meeting of Security Council in 2003 has become the starting point, where the issues of environmental security were actualized and the "Concept of Environmental Security of Republic of Kazakhstan for 2004-2015" was developed.

Realization of environmental policy is achieved through improvement and systematization of legislation. The Law on Industrial Wastes and Consumption, the Law on Environmental Audit have been adopted. The draft Law "On Mandatory Ecological Insurance" is in the phase of adjustment.

Amendments were introduced into the Code of Kazakhstan on Administrative Breaches aimed at efficiency enhancement of administrative sanctions against violation of environmental requirements. Strict requirements to prohibit industrial development of oil and gas fields without utilization of associated and natural gas, prohibition of their combustion, prohibition for waste discharge and burial in the sea were included into the Law on Oil.

The step-by-step improvement of the quality of environment has been planned, including measures for radical improvement of the system of management of environment protection, for the purpose of which the Program "Environment Protection of Kazakhstan for 2005-2007" and the Program to Combat Desertification for 2005-2015 were developed.

Within the Ministry of Environment Protection the Committee for Environmental Control was established. The Governmental Decree was adopted determining "The List of Specially Authorized Bodies Realizing Functions of Environment Protection, Nature Use Management and State Control in this field and Rules of Their Activity Organization". The Regional Center for Monitoring the Aral Sea Zone and the Center of Environmental Monitoring of the Caspian Sea were established in Atyrau. In 2005 the Second Conference of the Parties for the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, on which the Almaty amendments to the Convention were adopted, related to the genetically modified organisms.

In Kyrgyzstan "The Concept of Environmental Security of Kyrgyz Republic" was developed and approved at the Security Council of Kyrgyz Republic in 1997.

On the basis of the Bishkek Administration for Nature Protection the experts on sustainable development approved a new instrumental mechanism of efficient management of environment – Stakeholders Group Organization for decision-making in the issues of sustainable environmental development of Bishkek.

In Tajikistan the State Committee for Environment Protection and Forestry implements coordination of nature protection activities and realization of decisions in the field of environment protection.

The Ministry for Emergency Situations and Civil D makes monitoring of natural and man-caused accidental situations and natural disasters, the Academy of Science of Tajikistan takes account f all biological diversity and compiling of the Red Data Book.

The Interdepartmental Coordination Committee coordinates the work in environment protection.

The system of state environmental expertise includes environmental impact assessment (EIA).

Environment management cannot function efficiently without necessary system of monitoring. The lack of legal mechanisms in activity coordination in the system of observation, assessment and forecasting of components of environment, as well as environment data and information management results in inadequate assessments of its state and decision making.

In Turkmenistan the Ministry of Nature Protection is entrusted with implementation of environmental policy, decisions of which are considered to be obligatory for all ministries, departments, associations, enterprises and organizations irrespective of their departmental subordination and property forms, citizens and foreign legal and natural persons.

The control of water resources protection is passed to the Ministry of Nature Protection of Turkmenistan, and the Ministry of Water Economy controls only the rational use of water as well as rules of exploitation of water-management systems, water reservoirs and other hydraulic engineering constructions.

The Ministry of Public Health realizes the policy in the sphere of human health and sanitary.

In 1999 under the Decree of the President of Turkmenistan the State Commission for Implementation securing of commitments subsequent from UN Environmental Conventions and Programs.

In Uzbekistan the work for improvement and development of organizational structure of management of environment quality and nature use is done. In conditions of the going economic reforms, transit to market economy, growth of the population and cities, increase of amounts of transportation, intensification of agricultural and industrial production, solution of environmental problems and related to them issues of rational use and reproduction of natural resources has become the most important state objective.

Reforms implemented in Uzbekistan promote resolving of objective of overcoming economic difficulties on the way from the centralized planning system with the administrative-command principles of management to the market economy, achievement of economic and financial stability.

3.2. Environmental Legislation

Currently in all countries of the CA there is already the legislative basis, which mainly ensures efficient management of nature protection.

At present in Kazakhstan more than 20 laws are functioning, in which issues of environment protection are considered, as well as more than 200 special by-laws. Kazakhstan has ratified 19 international environmental conventions, which are also of legislative force. The Concept of reforming of environmental law was developed with its maximum approach to the international standards. Currently the Environmental Code is under the development.

At present the level of development of environmental monitoring in Kazakhstan does not

correspond to the present-day requirements. The state network of observation points amounts to only 20% of the optimal their amount with the equipping with measuring apparatuses from 40 up to 80% of the necessary level.

In the national legislation of Kyrgyzstan during the last 10 years a new normative legal basis has been created in the sphere of environment protection and rational nature management.

The Law "On Nature Protection" it is said that the nature and its components are the national property, one of the main factors of its sustainable socio-economic development. It is noticed in the Law "On Air Protection" that the air represents a vitally important component of the nature providing the natural environment for human life and other living organisms on the Earth, and is subject to the state protection.

The Law "On Environmental Expertise" is aimed at the realization of the constitutional right of citizens for the favorable environment and envisages providing of environmental security. The state policy in the sphere of handling the solid wastes of industry and consumption is defined in the "Law on Wastes of Industry and Consumption.

In al laws and codes of Kyrgyzstan related to the nature protection and rational use of natural resources the ways and methods of Ministries and departments of nature management are clearly defined and their responsibilities are emphasized.

By present time a relatively developed environmental legislation basis is created in Tajikistan.

During the years of independence about 70 legislative and normative acts were adopted in Tajikistan as well as Decrees of the Government concerning environment protection and natural resources, including 16 environmental Laws.

The key place in the hierarchy of legislative acts in nature management regulation and environment protection is occupied by the Law of Republic of Tajikistan "On Nature Protection". The Law secures the legislative frameworks for preventing destruction of the natural ecological systems and irreversible changes in environment, observance the normatives of maximum permissible impact on environment, ecological normalization of environment quality, etc.

In Turkmenistan as far back as the first years of independent development the legislative basis providing the efficient nature management was established.

The main legislative act in the field of nature conservation and rational nature management is the Law "On Nature Conservation of Turkmenistan", which assigned the juridical basis for environmental expertise , defined environmental measures, normative-technical and metrological provision, environmental requirements to the economic and other activity. The law envisages the state measures during the emergency environmental situations, control in nature conservation, right of citizens to the favorable environment for life and responsibility for the breach of environmental legislation.

Establishment of the legal foundation for nature conservation is under way: in 2005 the Code of Turkmenistan "On Land" and Code of Turkmenistan "On Water" were adopted, the preparation of draft laws on fishing, wastes, on soil conservation and on continental shelf goes on.

In Uzbekistan a good legal basis stipulates the efficient implementation of reforms.

Amendments and additions were made, which reinforced the Laws and Decrees "On Nature Conservation", "On Water and Water Management", "On Products and Services Certification", "On Interior of the Earth", "On State Committee of Republic of Uzbekistan for Nature Conservation", "On Fauna Conservation and Management" and "On Flora Conservation

and Management".

3.3. Economic Methods and Mechanisms of Environment Protection Management

The arising rates of economic development of the Central Asian countries can negatively influence the environmental situation of the territory that contributes to the necessity of implementation of preventive measures, in which the development of methodological approaches and economic instruments is of extreme importance.

According to the classification of the Organization of Economic Cooperation and Development the economic instruments can be represented in 12 groups (types). In all CA countries a part of these economic instruments (EI) has been developed and is used in practice, and some of them have not been developed and are not used.

As a central element of economic regulation in Kazakhstan the system of payments for environment contamination is used that are integrated into the general fiscal policy of the state. The payment for environment contamination is taken from physical and juridical persons for the activity of the territory of Republic of Kazakhstan related to the special nature management. The products cost price of enterprises-polluters the share of the payments for contamination does not exceed 5 – 6%.

The Ministry of Environment Protection of Kazakhstan approves the basic tariffs of payments for contamination of environment.

The draft Law "On Environmental Insurance" stipulates that the juridical persons and citizens engaged in environmentally dangerous economic activities are subject to the obligatory environmental insurance.

In Kyrgyzstan the economic instruments of the first and second blocks have been developed and are in use. Here all types of wastes placed by nature user in environment are subject to payment. But the paid in payment does not exempt the nature users from liquidation of consequences related to environmental misdeeds

Payments for the natural resources use in Kyrgyzstan are used for covering losses for complex services in the sphere of nature management. The payers can be both physical and juridical persons.

The polluters are charged with the payment for environmental misdeeds, who do not fulfill the requirements of environmental regulation and natural resources management. All penalties obtained for the caused damage are transferred to the state budget, from which then the environmental measures are financed. Incomes from claims imposed from law infringers enter the local funds for nature conservation and are spent in accordance with the estimates of incomes and expenditures, in which 32% of obtained funds are directed for the environmental measures.

In Tajikistan the system of paid nature management is used, which is the main economic mechanism in providing conservation of environment and rational nature management.

Economic mechanisms in environment protection are based on the common approaches of paid nature management. They include land- and interiors management taxes, payments for collection, disposal and placement of wastes, utilization of sewage system, water supply; calculation of losses for infringement of water legislation, pollution of air, scale of penalties for damage caused to the forestry because of illegal cutting, injury and collection of vegetation resources, extinguishment and illegal collection of plants and capture of animals listed in the Red Data Book.

A system of payments for environment pollution has been introduced.

In 1996 the Government of Republic of Tajikistan introduced the payment for services

related to the accumulation, transportation to consumers, distribution and purification of water in agriculture.

The main economic instrument for environment management in Turkmenistan is the system of payments for environment pollution and damage causing. The payment for environment pollution is imposed on physical and juridical persons.

Currently "Rates for Calculation of the Size of Collection of Claims against Damages Caused by Illegal Prey, Extermination of Animals' Species Listed in the Red Data Book" are in action.

In 1995 the Law "On Renting Land by Foreign States" was adopted in Turkmenistan, in compliance with which the certain tariffs are fixed.

From 1994 the Decree of the President of Turkmenistan "On Introduction of Payment for Water Consumption by Separate Categories of Consumers and Excess Water Consumption for Land Irrigation" has been functioning.

.In Uzbekistan a special attention is paid to the pursuing of the policy aimed at the introduction of resource-saving and low-waste (clean) technologies, new types of services, entrepreneurship, etc., with wide range of using economic instruments.

In accordance with the Concept "Introduction of Scientifically Grounded Economic and Legal Mechanisms of Nature Use in Republic of Uzbekistan" approved by the Cabinet of Ministers the introduction of economic methods of management of environmental activities and regulating of nature management based on principles of paid nature management: "polluter pays" and "consumer pays" is being implemented.

CHAPTER IV: INTEGRATED ASSESSMENT OF THE PRIORITY ENVIRONMENTAL PROBLEMS

4.1. Water resources pollution

State of the problem. The level of contamination of the surface and ground water sources is estimated in different ways depending on geographical position. The water sources are less polluted in the zone of the run-off formation and more polluted in the zone of intensive run-off consumption. As it is known, the main volume of the natural river run-off is formed on the territory of Kyrgyzstan, Tajikistan and Afghanistan, and the biggest water consumption falls on the territory of Kazakhstan, Uzbekistan and Turkmenistan. Correspondingly, the greatest anthropogenic pressure the water flows experience in the middle and low river flow.

The quality of natural river water near the urban, agricultural and industrial centers worsens. In water near the settlements of the Chu, Kara-Darya basins and Charyk tributary in Osh and Djasabaz Oblasts the high concentration of nitrates (more than 3 mg/l), nitrites (0.7 mg/l), oil and grease (0.5 mg/l) phenols (more than 0.001 mg/l) and pesticides were discovered. In some places contamination of surface water by mountainous burrow and tailing dumps also takes place, for instance, radioactive contamination of the Maili-Moo River, cadmium contamination (320 times high than the MPC) of the Sumsar River and other heavy metals (copper, zinc, lead) in Djalal-Abad Oblast.

Water flows of Uzbekistan according to the quality of water belong to the moderately contaminated ones. Insignificant amount of water flows located in the mountainous part of the territory belong to the clean category.

Aggravation of the river water quality in the middle and lower flow impacted also the quality of ground water. So, for instance, lenses of fresh ground water formed along the Amu-

darya River flow and used as the main source of water supply of Khorezm Oblast and Karakalpakia during the last 10-15 years, because of the growth of mineralization and hardness ceased to meet the requirements of the national quality standards.

Contamination of water sources on the territory of certain states of the sub-region is also non-uniform and depends on relief conditions, intensity of agriculture development, level of the territory urbanization, availability and conditions of the water treating facilities and other factors.

Return water of anthropogenic origin, amounts of which regularly grow, are the main source of water sources contamination. About 95% of the total amount of return water is made up of collector-drainage water drained from the irrigated fields. The rest part of return water is sewage from industry and communal-general services (Fig. 26).

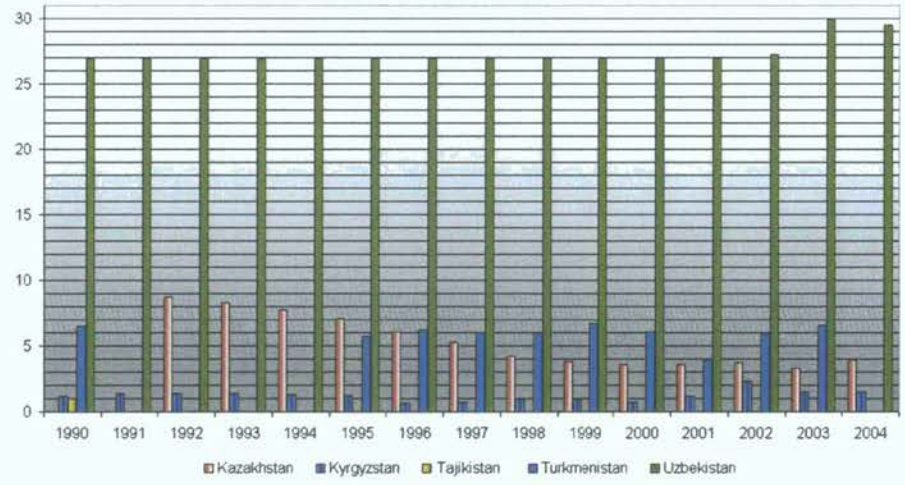

Fig. 26. Sewage disposal (km^3)

On average during the period of 1990-1999 the total amount of return water varied from 28.0 km3 up to 33.5 km3 per year, including 13.5-15.5 km3 of return water were formed in the Syrdarya River basin and 16.0-19.0 km3 in the Amudarya River basin.

As a result of the return water discharge into natural depressions several hundreds of water reservoirs of different volumes were formed, which, as a rule, do not have flowage and fish production, flora and fauna in them are not developing because of the instability of water-salt regime.

In states of the sub-region the main water consumer is agriculture, to the share of which of the total amount of consumption falls:

In Kazakhstan – up to 75%

In Tajikistan – about 90%

In Turkmenistan – 88%

In Uzbekistan – 92%.

As a result of formation of huge amount of contaminated collector-drainage water, the main volume of which is discharged into the surface water sources, their contamination with biogenic substances, mineral salts, residuals of mineral fertilizers and pesticides used in agriculture takes place. So, for instance, the growth of water mineralization in the Amudarya River with regard to the shaft Tuyamuyun is 0.7 g/l in comparison with initial one of 0.32 g/l and the share of each of the states in the mineralization growth because of the collector-drainage water discharge is:

- from irrigated lands of Tajikistan – by 0.1 g/l
- from irrigated lands of Turkmenistan – by 0.18 g/l
- from irrigated lands of Uzbekistan – by 0.4 g/l.

The exceed of norms of irrigation of agricultural crops because of the low technical level of irrigation network, low efficiency of machines used as well as technologies of agricultural crops irrigation contribute to the formation of huge amount of contaminated collector-drainage water. Large volume of river water is used for annual flushing of salted water for securing favorable water-salt soil regime, which also results in formation of large amount of return mineralized and contaminated water.

As a result of intensive development of irrigated agriculture during the last decades and in conditions of insufficient natural degree of drainage the level of ground water has been changed everywhere that stipulates intensification of processes of salt exchange and necessity of development of artificial drainage. At present the level of ground water is above 2.0 meters in the basin of the Syrdarya River on the area of 905 thousand ha and in the basin of the Amudarya River on the area of 1566 thousand ha. Currently in Central Asia 200.55 thousand km of collector-drainage network, 7782 wells of vertical drainage on the area of 834.6 thousand ha have been built, which collects and divert great amounts of contaminated water.

One of the reasons of high level of morbidity rate of the population is the shortage of the centralized water supply and water disposal. As is known, many water sources of economical-drinking water supply have unsatisfactory quality and are unsuitable for drinking water supply.

During the last years the measures for developing of centralized water supply have been taken in Central Asia but the level of the population's well being, particularly the rural population still remains low (Fig. 27). So, for instance, in Tajikistan only 52.1% of the population have the access to the tap water, the rest 47.9% use water from open water reservoirs and irrigation system, wells without transfer network, springs, rivers and canals. Provision of the population with the centralized sewage system is also unsatisfactory; moreover, from 1990 its condition has worsened even more decreasing from 40% to 28.7% (Fig. 28).

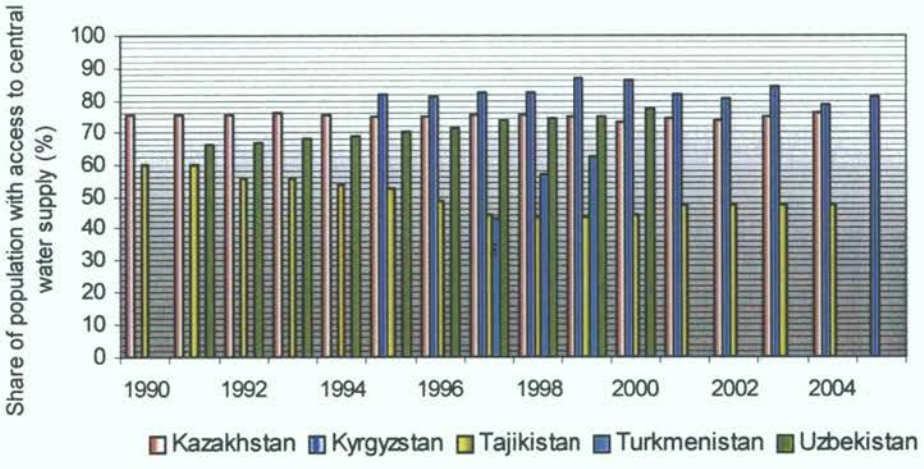

Fig. 27. Share of population with access to drinking water

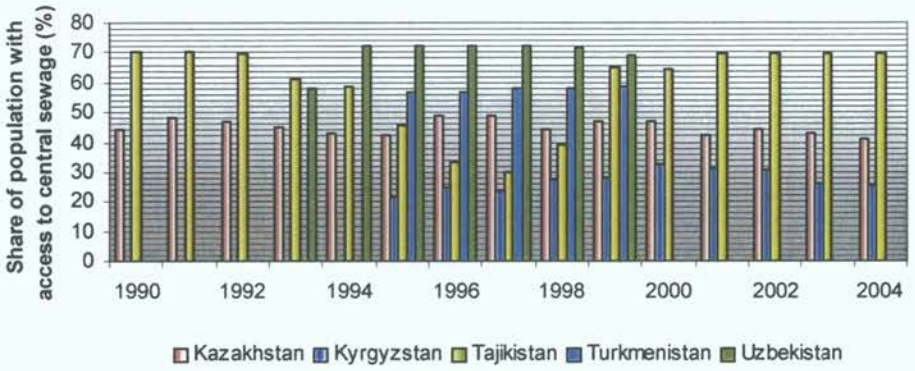

Fig. 28. Share of population with access to sanitary conditions

In Kyrgyzstan the drinking water supply of the population is 83%. At the same time in the majority of settlements in rural area the water-supply network is not available, of 1016 pipelines 64 do not have the sanitary protection zone, at 111 disinfection of water is not carried out, 40% water pipelines need major repairs. Centralized sewage systems with sewage disposal plants are available only for 28.4% of the population. More than a half of small towns and regional centers of the republic do not have centralized systems of sewerage and sewage disposal plant.

In Uzbekistan beginning from 1996 large regional, interregional and interfarm water lines are financed from the state budget, as a result of which provision of the population with centralized water supply has increased up to 89% of the urban and 64.5% of the rural population. At the same time there is a difference in the level of provision with centralized water supply by regions. For instance, 32% of the population of Karakalpakistan has the access to the high-quality drinking water and 24% of the population of Bukhara Oblast. Of the total length of 48772 km of water pipelines 13368 km need to be replaced, existing capacities of water pipelines are used at 63%. Of 12.7 thousand rural settlements of the republic 59% use untreated water. In general more than one third of the population of Uzbekistan uses water, the quality of which does not meet the state standards. 54% of the population of cities and 3% of rural population are provided with the centralized sewerage system. The volume of sewage undergone the treatment is less than 40%, as a result of which water reservoirs and environment are subject to contamination.

Because of the low technical conditions of water pipeline networks and low technology of water resources utilization in different branches of economy non-productive water losses take place.

Industrial and domestic sewage though occupy an insignificant part in the total amount of water disposal, in contrast to agricultural sewage, they are the most contaminated and can contain high concentration of biogenic substances, heavy metal ions, oil products, phenols and synthetic surface-active materials (SSAM). Disposals of this sewage in untreated and in insufficiently treated form significantly impact water resources and other components of environment.

Tailing dumps, different storage devices of technological wastes, burrows for mountainous rocks, unauthorized dumps of domestic wastes are also the potential source of ground water contamination.

So, for instance, in Tajikistan industrial sewage is disposed into the municipal sewage disposal plants, on filtration fields and into water sources because of the insufficient capacities

of existing treatment plants and in some cases because of their unavailability. From the North industrial zone 81.3 million m^3/year of industrial sewage are discharged into the Syrdarya River, and from Aizeb ore mining and processing enterprise 252.3 thous. m^3/year are discharged into the Zaravshan River, from Dushanbe industrial zone 154.5 million m^3/year are discharged into the Kafirshgan River basin and from Kurgan-Tube industrial zone 19.1 million m^3/year of industrial sewage are discharged into the Vakhsh River basin. In whole in Tajikistan of the total amount of 3581 million m^3 of sewage water 3 million m^3 of contaminated sewage without treatment and 23 million m^3 of insufficiently treated sewage are discharged into the natural objects.

In Kyrgyzstan in spite of the fact that sewage water is received 2.5 times less at the sewage disposal plans than it is designed the half of them is working inefficiently. In total 140 of sewage water treatment plants are in operation in republic, and only 84 (60%) meet sanitary requirements, 56 (40%) completely do not execute their functions. Discharge into the water reservoirs is made from 41 sewage water treatment complex and 25 on the filtration fields. Municipal-domestic and industrial sewage water from settlements, where there are no sewage and centralized sewage withdrawal systems (more than 27% of the total drainage system), are annually accumulated and utilized at the drain territories.

In Kazakhstan up to 24% of industrial sewage water comes into the sewage disposal plants, which are not designed for treatment of industrial sewage.

In Uzbekistan, though the share of industry in the total amount of sewage water is less than 20%, it is the main source of water object contamination with heavy metals ions and a number of other highly toxic substances.

In sewage water of metal mining enterprises the concentration of heavy metals 50 times exceeds the MPC and oil concentration 200 times exceeds MPC. More than 80% of water pollutants are contributed by industrial branches of Tashkent, Fergana, Navoyee and Samarkand Oblasts. Work efficiency of treatment facilities is 30-40% on average. As a rule they are overloaded and poorly operated. One of the sources of contamination of water sources are accumulations of industrial and domestic wastes – dumps, burrow, slag dumps, etc.

Measures for prevention of water resources contamination. Great attention is paid to the problems of prevention of water sources contamination. In February 1992 the Interstate Coordinative Commission for Water Management was established. This allowed the countries of the sub-region to start mutually acceptable cooperation after the collapse of the Soviet Union. Within activities of ICWC the issues of contamination of transboundary rivers water, assessment of water quality and contents coming from neighboring countries are also considered.

As it is seen from the mentioned above analysis, the main reason of contamination of surface and ground water are breaches of water protection regimes of drainage area and water supply, big losses in water pipeline systems and irrational use of water resources, collector-drainage water, industrial sewage water and municipal sewage discharges into water objects, relief depressions, unauthorized dumps formation, tailing dumps, terraces, filtration fields, sludge pits in places impacting water conditions, insufficient and unsatisfactory work of sewage disposal plants, etc. Certain work in order to solve these problems is being fulfilled in countries of the sub-region (Fig. 29).

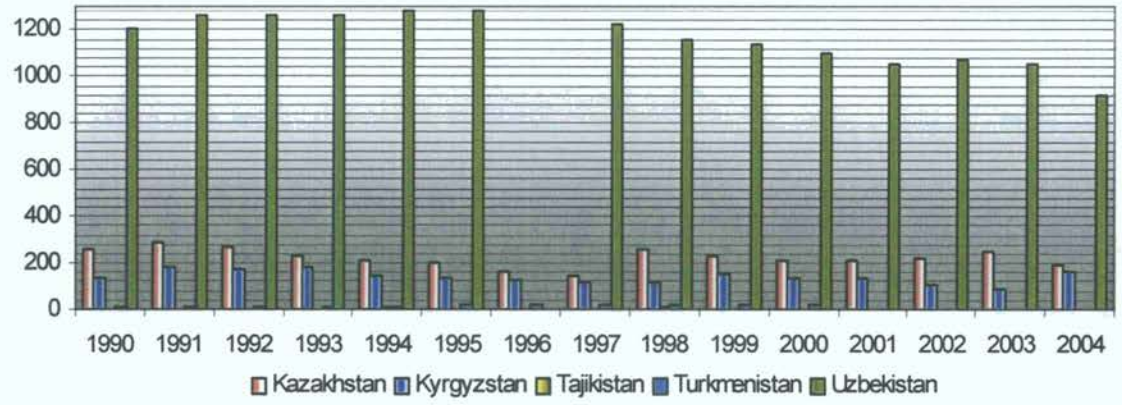

Fig. 29. Volume of refined sewage (mln.m^3)

The Government of Tajikistan in 2001 adopted the Concept of Rational Use and Protection of Water Resources. Adopted National programs "Hygiene and Environment Protection" and "Clean Water and Sanitary" envisage step-by-step rehabilitation of existing treatment facilities, completion of started construction and beginning of new constructions of sewage disposal plants. Beginning from 1992 economic mechanism for determining the cost for pollutants discharges into water objects, etc, has being realized.

In Turkmenistan the strategy of water supply stipulates the increase of efficiency of irrigation network from 0.57 at present up to 0.67 by 2010 and up to 0.75 by 2020. The program of construction of numerous domestic-drinking water treatment stations and sewage disposal plants with using of sewage water is being implemented.

For the purpose of authorized collector-drainage water discharges and prevention of contamination of surface and ground water sources with them, flooding or waterlogging of desert pastures and fundamental improvement of cultivation state of land within the irrigated massifs the Turkmen Lake is being built in Central Karakums.

In Uzbekistan the restructuring of water management complex according to the basin principle is implemented, economic mechanisms for water resources management are allotted that ultimately will provide more rational and efficient use of water resources. Zones of fresh ground water are granted the status of natural protected territories (NPT). Currently, for 19 large deposits of fresh ground water and 6 rivers are granted water protection zones with the area of 73116.2 ha. Self-leaking and ownerless water wells, which were the potential sources of contamination of ground water, are liquidated.

4.2. Air Contamination

State of the problem. The main sources of pollutants emissions into the atmosphere are mineral resource and oil-and-gas industries, ferrous and non-ferrous metallurgy, transport and municipal economy.

In Kazakhstan observations of air basin contamination are carried out systematically in 20 largest cities and industrial centers.

On average in the republic 163 kg of different chemical compounds per one citizen are emitted into the atmosphere during a year, and in Karagandinskaya Oblast – 793 kg, in Pavlodarskaya Oblast - 547 kg.

The state of the air contamination in Kyrgyzstan in comparison with the beginning of

1990s has a tendency to decrease that can be explained by the setback in production. But by the year 2003 in comparison with 1995 the growth of emissions into the air became outlined that is related to the development of industry. In Kyrgyzstan the main sources of the air contamination are also energy enterprises, construction industry, municipal economy, mineral resource and processing industries, transport.

To a significant extent the air basin of the republic is contaminated by enterprises of the energy industry that is related to the usage of solid fuel having the relatively low calorie content and high ash content.

Atmosphere contamination in Tajikistan is related to also industrial production and transport development.

Prevalence of the raw material industries during reduction of the share of the priority types of machine-building, light and food industries resulted in reduction of emissions of pollutants into the atmosphere from the enterprises of this sphere, significant part of which functions in cities and urban settlements of the republic.

In Turkmenistan climatic factors are of significant importance in formation of the air composition. High temperature and low air humidity, quick drying of the upper soil layer and high speeds of wind result in high suspended materials concentration in the atmosphere.

Accelerated development of the oil-and-gas industry and power engineering, and the increase in the number of transport during the last years results in the growth of the air contamination. Emissions from the oil and gas complex during different years amounted to from 75% to 95% of the total gross emissions of pollutants.

One of the most dangerous manifestations of the transboundary transfer of pollutants in the atmosphere is the salt and dust transfer from the zone of the Aral Sea. On the territory of Turkmenistan annually from 200 to 800 (and more) kg/ha of dust and salts accumulate from the dried bed of the Aral Sea.

In Uzbekistan the main sources of suspended materials concentration in the air is the dried bed of the Aral Sea, from the surface of which huge masses of saline dust are elevated and transferred of the west to the east.

From industrial and transport sources about 4 million tons of chemicals – products of incomplete fuel combustion, raw material processing, materials manufacturing are emitted into the atmosphere. 96% of all emissions account for carbon, sulfur, nitrogen oxides as well as hydrocarbons and solid substances, and 4% constitute emissions of highly toxic substances numbering 150 names.

Air contamination by stationary sources. Typical for industries of all CA countries, determining emissions from stationary sources, are enterprises of power engineering, construction industry, municipal economy and a number of processing industries.

At the same time, there is a certain differentiation of industrial production. For instance, enterprises of mining and non-ferrous metallurgy are typical for Kazakhstan, Uzbekistan and Tajikistan. Mineral resource industry and mining-processing industry are developed in Kazakhstan, Uzbekistan, Tajikistan and Kyrgyzstan. Oil- and gas-producing industry and oil-refining industry are developed in Turkmenistan, Kazakhstan and Uzbekistan, etc.

It should be mentioned that during the last years a tendency has been outlined to enhancing of emissions from the stationary sources in Kazakhstan and Turkmenistan.

In Kazakhstan emissions of pollutants into the atmosphere from stationary sources amounted to more than 2 million tons.

Pollutant emission limits for 2004 amounted to 3,202,297.09 tons that comes to 97.36% of emission amount for 2003 год (3,119,833.8 tons). While estimating the qualitative compo-

7.5%), as well as harmful admixture with the content of sulfur: sulfur dioxide (from 34.7 up to 41.0%), hydrogen sulphide (from 0.03 up to 0.1%). The content of nitrogen oxide remained practically unchanged.

Significant growth of emissions by processing, metallurgic industries, transport and communication has been revealed as well as decrease of the total amount of emissions in the industry and distribution of electricity, gas and water.

In Kyrgyzstan the main stationary sources of emissions are enterprises of power engineering, construction materials industry, municipal economy, mining and processing industries as well as the private sector. Emissions of pollutants from all stationary sources of contamination in 2003 increased in total in the republic (in comparison with 2001-2002) and amounted to 35.72 thousand tons.

Analysis of the composition of pollutants emissions into the atmosphere shows that the share of the main pollutants totals about 98.5%-99% of all emissions (as of 1999–2003). The largest share falls on solid substances - 44%, sulfurous anhydride - 28.2% of the total amount, emissions of carbon oxide and nitrogen oxides – 7.7 and 11.9, respectively.

In Tajikistan enterprises of mining and mining-processing industries, chemical and petrochemical, machine-building and textile industries, non-ferrous metallurgy and fuel and energy complex, enterprises of construction and ginning industries belong to the main centers of the atmosphere contamination. They produce in total in the republic about 88% of the aggregate emissions of pollutants from the stationary sources.

Provision of acting industrial enterprises with the dust-and-gas-cleaning equipment, with the total capacity of about 16,700 thousand m3, amounts to 80%.

Into the atmosphere in Turkmenistan in 2003 there were emitted pollutants from the stationary sources in the amount of 442.3 thousand tons, including solid pollutants – 10.8 thousand tons, sulfurous anhydride– 12.1 thousand tons, carbon oxide – 57.4 thousand tons, nitrogen oxide – 20.1 thousand tons, hydrocarbons – 331.4 thousand tons, volatile organic compounds – 9.9 thousand tons, other gaseous and liquid pollutants – 0.6 thousand tons, that is related to the growth of the level of oil and gas production in the country. In Balkan Velayat their amount from 1997 till 1999 grew up 4.4 times. This happened mainly because of the almost 5-fold increase of hydrocarbon emissions.

Total emissions into the atmosphere of pollutants in 1999 amounted 1,404.3 thousand tons, significant share of which accounts for the enterprises of oil-and-gas industry.

In 2003 emission of dust (solid) particles from stationary sources came to 10.8 thousand tons. Among chemical substances emitted from stationary sources hydrocarbons prevail, emission of which during the last years varies within 70 - 90 %.

In Uzbekistan the main share of the atmosphere pollution falls on Tashkentskaya (42.7%), Kashkadaryinskaya (14.6%), Bukharskaya (10.9%), Navoiiskaya (8.1%) and Ferganskaya (6.8%) Oblasts.

The main input into emissions from stationary sources of Uzbekistan falls to the share of power industry or amounts to 31.3%.

The main amount of installed capacities has been in operation for more than 25 years; efficiency of fuel using is extremely low and amounts to from 33% up to 35%.

Oil-and-gas-production and processing industries occupy the second place among the stationary sources of air contamination.

Approximately 15% of all atmosphere emissions from stationary sources account for the metallurgic industry. The share of chemical industry equals only about 3% of the total amount.

Approximately 15% of all atmosphere emissions from stationary sources account for the metallurgic industry. The share of chemical industry equals only about 3% of the total amount.

Air contamination from mobile sources. Mobile sources of contamination significantly affect the cleanliness of the atmosphere in large cities and urbanized zones of the majority CA countries. In such cities as Almaty (Kazakhstan) emissions reach 90% of total amount. Emissions from motor transport in cities of Tashkent, Samarkand, Bukhara (Uzbekistan), Ashkhabad (Turkmenistan) total 80%.

The main problems of the atmosphere contamination in CA countries are stipulated first of all by depreciation of existing stock of cars, import of foreign vehicles being in exploitation beyond the set period or not meeting the modern technical requirements, using of motor fuel not meeting the requirements of standards, by imperfection of control system of the road traffic with the low quality of the roadway covering.

In Kazakhstan motor transport emits pollutants annually of the total amount of 1098 thousand tons. In majority of large cities the input of motor transport into the air basin contamination achieves 60% and more during the last years, and in the city of Almaty it achieves up to 90% of total emissions.

In Kyrgyzstan the most intensive source of the atmosphere contamination is also motor transport. As of the year 2000 86.6% of the total emissions of pollutants came from mobile sources. In 2003 emissions amounted to 199.13 thousand tons.

Intensifying of emissions from motor transport directly results in the increase of the total level of background pollutants' concentration. In Bishkek the total amount of motor transport reached 86.9 thousand units and emissions made up 70 thousand tons.

In Tajikistan during the last decade the role of the railroad and the air transport has decreased and importance of the motor transport increased, which executes more than 84% of all freight transportations and 68.4% of carriage of passengers.

Emission of pollutants into the atmosphere from motor transport in 2003 amounted to 77% or 122.9 thousand tons (in 1998 82%) of the total amount of pollutants fell into the atmosphere in total in republic.

In Turkmenistan emission of pollutants by motor transport reaches in some cities more than 80% of the total amount; for instance, in Ashkhabad as of now these indices are for carbon oxide - 82%, nitrogen oxides - 36%, hydrocarbons - 39%.

In Uzbekistan emissions from mobile sources continue being the main source of contamination of the atmosphere. In 2004, emissions from mobile sources amounted to 1310.9 thousand tons or 67% of the total amount of emissions of pollutants into the atmosphere.

In large cities more than 80% account for emissions from mobile sources.

During the period from 1996 till 2000 there was some increase of pollutant emissions from 1316 thousand tons up to 1593 thousand tons related to the growth of the number of individual motor transport. Beginning from 2001, there is the decrease of emissions of pollutants from motor transport by 3-5% on average.

Emission of the greenhouse gases and ozone depleting substances CA countries are the Parties to the Framework Convention on Climate Change as well as Vienna Convention and Montreal Protocol on substances depleting ozone layer.

At the end of 1990s in all CA countries there was developed the program of surveys and inventory of anthropogenic impact on climatic system, analysis of climate changes, systematization of sources and run-off of greenhouse gases (GHG); approaches to the estimation of

According to the results of investigations made related to the inventory of sources and run-offs of GHG the national cadastres were made up, forecast for their emissions prepared, measures and trends in activities for reduction of GHG emissions defined.

The total emission of GHG in Central Asian countries significantly differs from each other. For instance, total emission of GHG in 2002 amounted to 160.0 and 170.6 million tons of CO_2 equivalents, respectively, in Kazakhstan and Uzbekistan.

Enterprises of fuel-energy complex, mobile sources of contamination, agricultural production as well as waste storage and processing belong to the main sources of greenhouse gases in CA countries.

For the purpose of realization of the Vienna Convention the CA countries implement certain activities for undertaking necessary legal measures to control the implementation of the relevant international requirements for its realization.

Uzbekistan regularly implements investigations of the total ozone contents in mountains and foothills of Central Asia.

In countries of central Asia measures are implemented for removal and recycling of refrigerating mediums.

In Kazakhstan the annual emission of greenhouse gases (GHG), expressed in CO_2 equivalent to 17,203 thousand tons. It is made up of 7,852 thousand tons of methane and 9,351 thousand tons of nitrous oxide. The main constituents of the total GHG emission are methane from the internal fermentation of agricultural cattle (38%) and nitrous oxide from agricultural soils (53%).

The main sources of emissions of methane in Kazakhstan are cattle-breeding, rice growing and combustion of agricultural wastes on fields.

The main sources of emissions of nitrous oxide are agricultural grounds. They constitute 98% of the total emission of N_2O from agriculture. The rest 2% account for activity related to manure, combustion of vegetation remains – 1.8% and 0.2%, respectively.

Total emissions of all greenhouse gases in Kyrgyzstan in 1990 in CO_2 equivalent amounted to more than 36,647 Ggm (Gigogram), including 29,105 Ggm of CO_2 emissions. Net emission, taking into consideration the absorption of CO_2 – 35,817 Ggm. Specific emissions of greenhouse gases in 1990 amounted to more than 8.28 tons per capita, of them 6.58 tons fall at CO_2. The biggest input into the emission of greenhouse gases in republic is made by power-producing activity, which account for about 80% of emission of all main greenhouse gases in CO_2 equivalent, and 74% in 2000.

Kyrgyzstan does not produce any ozone depleting substances, equipment and goods, but imports them both in pure form and in goods. Total consumption of ozone depleting substances in 2000 was 79.45 metric tons, and taking into consideration ozone depleting capability – 67.49 tons.

In Tajikistan industry, transport and fuel and energy complex are the main sources of GHG formation. Biggest emissions of GHG in Tajikistan were observed in 1991 and amounted to 23,317.4 thousand tons. The smallest emissions were in 1998 – 2,073.5 thousand tons. Emissions of carbon dioxide – CO_2 (without taking into consideration its absorption) formed as a result of fuel and energy complex, industrial enterprises, institutions of housing and communal services as well as operation of the motor transport during the period of 1990-1998 were reduced 10.3 times and amounted in 1998 to 1,867.3 thousand tons.

According to the data of НОЦ МОП during the period from 1992 till 2003 consumption of ODS in republic decreased 6.3 times, emission of ODS into the atmosphere reduced by 108.4 tons, consumption of ODS per capita in 1992 amounted to 0.017 kg, in 2003 it was

of ODS in republic decreased 6.3 times, emission of ODS into the atmosphere reduced by 108.4 tons, consumption of ODS per capita in 1992 amounted to 0.017 kg, in 2003 it was 0.002 kg.

In Turkmenistan 95% of all emissions of GHG falls at the share of oil-and-gas and power complexes. The state of ozone layer above the territory of Turkmenistan has been studied insufficiently. Investigations were sporadic and they do not give a complete picture of existing situation. However they allow making a conclusion that beginning from 1993 the negative annual average divergences from climatic norms of total ozone are observed. They are particularly obvious in summer period. In 1995 the total concentration of ozone in winter reduces by 13 - 16%, and in summer - by 15 - 18%. This indicates the necessity of further regular observations of the state of ozone layer of the atmosphere.

In Uzbekistan enterprises of fuel and energy complex, construction industry, metallurgic and chemical industry, motor and railroad transport, agricultural activity, extraction and transportation of minerals, as well as storage and processing of wastes belong to the main sources of greenhouse gases (GHG).

According to the first National Statement of Republic of Uzbekistan on the UN Framework Convention on Climate Change (2 phase, 2001), in 1999 total emission of GHG achieved 160.5 million tons of CO_2 equivalent and amounted to 0.7% of the global GHG emission. During the 10-year period (1990-1999) GHG emission increased by more than 11% (110 million tons of CO_2 equivalent, 1990) that is related to the growth of consumption of the natural gas by the population (from 7.5% up to 20.2%).

Impact of the air contamination on the health of the population. Contamination of the air is a serious problem for the health of the population of the region, particularly living in industrial centers. Increased concentration of suspended substances in the air, nitrogen oxides, carbon and sulfur dioxides, anhydrous hydrogen fluoride, ozone, formaldehydes, benzpyrene, etc., contributes to the development of serious pathologies of respiratory organs and digestive apparatus, blood circulation system.

It should be mentioned that each of pollutants has its specificity from the point of view of formation of pathologies of different etiology.

Occurrence of these or those specific diseases is stipulated first of all by the concrete ingredients or their synergetic action.

In cities with high level of contamination the risk of occurring of different diseases sharply rises, from diseases of respiratory organs till origination of pathologic new growths. Rather high level of risk can be observed in such cities as Shimkent, Ust-Kamenogorsk, Riddera, Navoee, Tashkent, Bishkek.

For Kazakhstan the problems of the air contamination were and remain significant. The growth of the level of diseases of respiratory organs in total in republic does not reduce.

Nowadays not less than 5 million people of Kazakhstan live in conditions of contaminated air, at the same time not less than 2 million people live in conditions of extremely high level of contamination.

From the point of view of possible impacts on the health of the population the most considerable is the air contamination of the populated areas with dust, sulfur dioxide, nitrogen dioxide, phenol, lead, formaldehyde, chlorine, anhydrous hydrogen fluoride, ammonia, carbon oxide, hydrogen sulphide and hydrogen chloride.

Total pressure of contamination is able to affect the immune system, result in the growth of oncologic diseases. With this respect the highest level of contamination happens to be in

cases per 100 000 people with the average republican level of 485. In Eastern-Kazakhstan Oblast and in Almaty the highest level in the country of incidence of respiratory organs diseases is 28,235 and 43,871 cases per 100,000 people, respectively.

Kazakhstan's scientists have developed the model for calculating the damage to the health of the population as a result of deterioration of environment taking into consideration total expenditures for treatment, diagnostics and prevention of diseases among the population, average life expectancy; expenditures for sick leaves payments, expenditures for pensions for disabled. According to estimations of specialists of the Center of Health Care and Ecodesigning, losses of Kazakhstan amount to $55.7 per each citizen per year or $60 per one ton of emissions into the atmosphere.

Almost in all regions of Kyrgyzstan respiratory organs diseases are the most spread, which are on the first place and cover 1/3 of all diseases.

The most unfavorable situation has developed in Bishkek, where the level of air basin contamination is the highest and sometimes exceeds 10 MPC on the summation scale, and such ingredients like benzpyrene in separate cases exceeds MPC 43 times in the center of the city. Correlation executed by SES (Sanitary-Epidemiological Service) of Bishkek has found out the strong and direct link between the level of bronchopulmonary diseases and benzpyrene concentration. So, in Bishkek the number of bronchopulmonary diseases amounts to 42.3%. During the last years the level of distribution of congenital anomalies constantly grows.

Data of investigations of the republic's Sanitary-Epidemiological Service of Tajikistan in Dushanbe certify that the total level of morbidity rate in zones with the high atmosphere contamination, conditionally "dirty" zone, is 1.4 times higher than the level of morbidity rate in conditionally "clean" zone.

Of all dangers for the health of the population related to the air contamination in cities the most dangerous as for nowadays are soli particles, concentration of which during the period under study (1990-2003) in Dushanbe increased up to 4 MPC, in Khurjand – up to 3.3 MPC.

In Turkmenistan dust is the main natural factor of the atmosphere contamination. Being present in the air in suspended condition, the mechanical particles have an allergic, toxic and irritating affect of the human organism. Besides, dust causes the development of different diseases of upper airways and lungs.

High level of the atmosphere contamination in a number of cities of Uzbekistan with such ingredients as nitrogen and sulfur dioxide, ammonia, phenol, can contribute to the appearance of a number of diseases in the population.

High index of the atmosphere contamination (IAC) was noticed in such cities as: Andijan, Tashkent, Navoee, Kokand.

Measures for preventing the atmosphere contamination. The normative-legal basis has been developed in CA countries, providing regulation of norms for pollutants emissions into the atmosphere.

Issues of air protection are the integral part of the national environmental action plans. International organizations provide the actual financial and technical assistance in realization in practice of commitments resulting from UN Conventions and Programs by countries of the region.

In Kazakhstan there are limits and quotas existing for nature use, including volumes of pollutants emissions and dumping into the environment, placing of wastes of production. Limits and quotas are set by the Government of Republic of Kazakhstan in compliance with the

pollutants emissions and dumping into the environment, placing of wastes of production. Limits and quotas are set by the Government of Republic of Kazakhstan in compliance with the current norms of environment quality and environmental requirements to the economic activity.

The necessity of setting norms of pollutants emissions into the atmosphere is aimed at fixing scientifically-ground maximum permissible norms of affecting the atmosphere guaranteeing safety and health protection of the population, ensuring reproduction and rational use of natural resources.

Technology of the atmosphere protection is based on traditionally used principles of revealing the cause-effect relation of pollutants emissions formation, and determining the optimal technical and economical decisions for their elimination or limitation.

The size of financing the projects aimed at the reduction of greenhouse gases amounted to 2.9% of the total size of financing of environmental measures of republic of Kazakhstan, and for the introduction of energy-saving technologies - only 0.01%.

Currently in Almaty the project "Reduction of negative Impact of Motor Transport on Environment and Health of the Population of Almaty" is being implemented. The aim of the project is the creation of conditions for improvement of the state of transport facilities, fuel quality, as well as enhancing of the behavioral culture on roads and efficient management of the road traffic.

For solving the environmental problems in difficult conditions of the transient period in 1995 the National Environmental Action Plan was adopted in Kyrgyzstan in 1995, and in 1999 the State Action Plan on Hygiene of Environment of Kyrgyz Republic, which supplements NEAP.

Kyrgyzstan acceded to the Vienna Convention on Ozone Layer Protection and the UN Framework Convention on Climate Change; it ratified the Convention on Transboundary Air Pollution on Large Distances.

For the purpose of introduction of new technical devices and technologies the work is being done in the republic for industrial implementation and wide-scale introduction of solar heat supply systems, on utilization of biomass energy, energy of small mountain water flows, wind energy and geothermal energy.

The problem of the atmosphere contamination in republic is of local significance and is typical for large cities and industrial centers.

In Tajikistan the requirements on the air protection are regulated by the Laws "On Nature Protection" (2002) and "On the Atmosphere Protection" (1996). The State Environmental Program for the period of 1998-2008 is implemented in Kyrgyzstan, in which a very important place is given to the maintaining of optimal conditions of the atmosphere.

The Government of the republic has adopted the Program on Discontinuing Usage of Ozone Depleting Substances and the Action Plan of the Government for its realization.

Besides, the national Program on Rehabilitation and Recycling of Refrigerating Mediums is under the implementation (2001), which allows to continue running the existing refrigerating and conditioning installations during a long period of time due to the use of rehabilitated and recycling HFU-12 and GHFU-22.

The draft Program for Monitoring of the Quality of Environment for the Period of 2004-2008 was developed, in which creation of efficient system of the atmosphere monitoring is envisaged, which corresponds to the international level and meets requirements and needs of republic. However the lack of the necessary funds does not allow realizing this Program.

Subdivisions of ecological police are functioning (EKOGAI), which together with the

tion of pollutants in vehicles of ОГ ДВС to the state standards.

Normative-legal basis adopted in *Turkmenistan* allows regulating the issues of air basin protection.

For the improvement of the state of the air in the National Environmental Action Plan of Turkmenistan it was proposed to carry out the following measures:

- establishment of park and forest park zones;
- introduction of international environmental standards (ISO 14000) for enterprises under construction;
- equipment of acting enterprises with the modern systems dust and gas cleaning;
- development of a system of monitoring of the air contamination;
- switch of the motor transport to the use of environment-friendly fuel (condensed and liquefied gas, lead-free gasoline);
- intensification of control of the fuel quality, including at the stages of its production, realization, transportation and utilization;
- improvement of the system of control of emissions from mobile sources;
- organization of industrial processing of domestic wastes;
- organization of regular observations of the state of ozone layer.

In Uzbekistan in 1999 a complex of measures was developed, which was included in separate blocks into the "Environmental Action Program of Republic of Uzbekistan for 1999 – 2005". The Program included such measures as:

- Realization of measures for reduction of harmful emissions into the atmosphere at the largest enterprises of the republic in cites of Almalyk (AGMK), Bekabad (APO "Uzmetkombinat"), Nurabad (Novo-Angrenskaya GRES), Navoee (Cement industrial complex, NGMK), Chirchik (PO "Elektrokhimprom").

Implementation of measure for reduction of wastes emissions from motor transport and other mobile sources of contamination is realized due to:

- intensifying of control and establishment of 36 environmental points "Ekotransnazorat" at the entrance to Republic of Uzbekistan, Tashkent, Nukus and regional centers.

At present a model project of the environmental point schemes of location of environmental points "Ekotransnazorat" have been developed in the republic.

Every year the State Committee for Nature Protection (Goskomprirody) of Republic of Uzbekistan together with the Ministry of Domestic Affairs with the involvement of Oil-and-gas Inspection of Uzbekistan implement the operation "Clean Air" in two phases, in the course of which they inspect the environmental state of transportation organizations, filling stations, maintenance stations and automobile transport.

In the nearest future it will be necessary to implement a number of environmental measures.

4.3. Land Degradation

After 1991 appreciable quality changes took place in the structure of available land in the states of Central Asia. If in 1991 their total area amounted to about 319 million ha, then in 2004 it totaled 159 million ha. Of them about 8.7 million ha were occupied in 1991 by irrigated lands and 9.2 million ha - in 2004. In all countries pastures constitute the main share of agricultural lands – from 82 up to 97%.

During the years of independence (1991-2004) arable lands per capita have reduced in all countries within the range of 19-31% of the initial level of 1991 (Fig. 30).

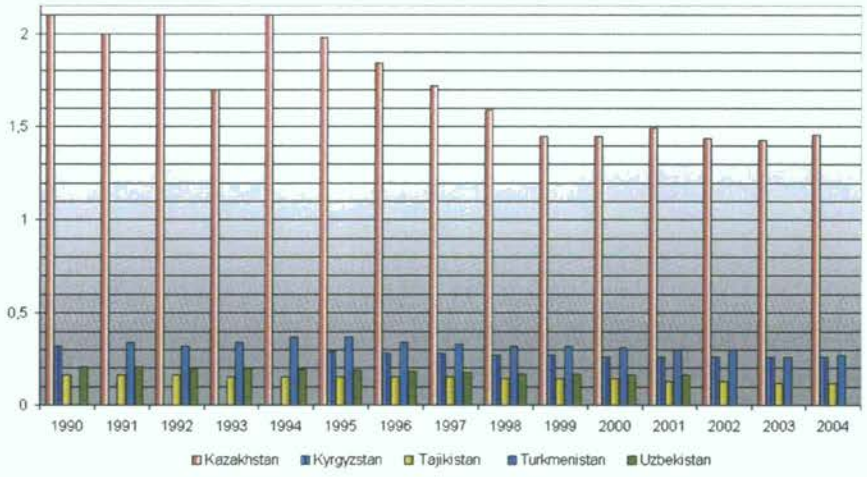

Fig. 30. Arable land per capita (ha/capita)

The collapse of the Soviet Union and formation of new independent states greatly influenced conditions of irrigated and pasture lands. Rupture of the former economic relations, breaking-up of the system of kolkhozes and sovkhozes, formation of new farmers' and peasants' farms, changes in conditions of the state and private ownership on land, reduction of centralized financing of agricultural branches impacted the qualitative conditions of available land, soil fertility and productivity of many agricultural crops.

In Kazakhstan the areas of agricultural lands have reduced from 220.7 to 77.9 million ha in 1990-2004. The main causes of the areas reduction of agricultural lands are as follows: economic (reduction of the product market for grains, products and areas for grain-crops sowing); social (population's migration from villages to city); demographic (reduction of the number of the population because of the emigration). As a result of this a significant part of agricultural land was not used, its quality aggravated under the influence of other natural-anthropogenic factors (deflation, erosion, desertification).

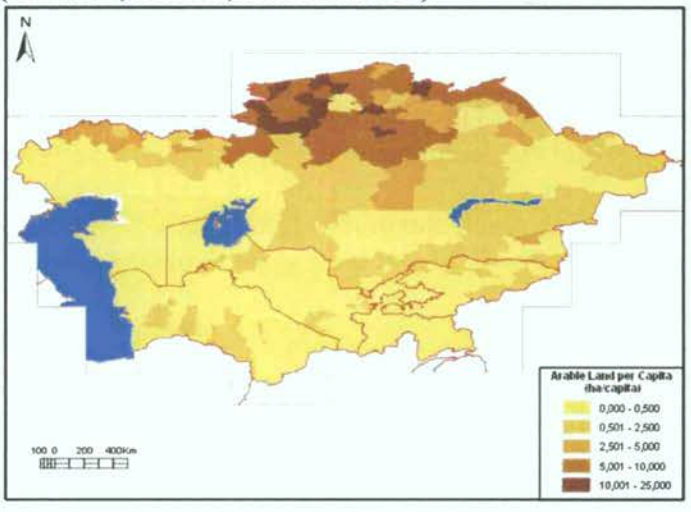

Fig. 31. Arable land per capita

In the structure of agricultural land in all countries the hayfields and pastures constitute the biggest part: in Turkmenistan 95.5%, in Kyrgyzstan 87.7%, in Uzbekistan 82.7%, in Taji-

kistan 81.7 and in Kazakhstan 68.1%.

Considerable part of land resources is subject to the processes of desertification: vegetation cover degradation, water and wind erosion, irrigated lands salinization, made-caused desertification, soil contamination with industrial and domestic wastes, pesticides, etc. These factors in aggregate cause changes in soil functions or to the quantitative and qualitative aggravation of soil features that decreases its productivity. The main causes of the land degradation in Central Asia are:

- Usage and development of new lands without necessary meliorative preparation;
- Insufficient usage of rotation of crops in cotton-growing, grain-growing, and monoculture agriculture prevalence;
- Wide distribution of extensive method of land utilization in the irrigated regions;
- Inefficient usage of irrigation water;
- Poor introduction of water-saving technologies and irrigation techniques in agricultural production;
- Discharge of unpurified collector-drainage and waste waters into the superficial watercourses;
- Waterlogging of irrigated and pasture lands;
- Insufficient provision of irrigated lands with collector-drainage networks;
- Irrational usage of pesticides and mineral fertilizers;
- Insufficient intensity of works for the degraded lands restoration;
- Usage of highly mineralized water for irrigation;
- Inobservance of nature-protective norms in pasture rotation, trees and shrubs felling in mountainous regions;
- Transboundary transfer of salt-dusty aerosols from the dried bottom of the Aral Sea;
- Insufficient number of mud-flow protective installations;

In the irrigated agriculture of Central Asian countries mainly the outdated, water-spending technologies of irrigation prevail. With them headrace channels and feeders are built on the ground bed. As a result of this up to 50% of irrigation water is wasted for the filtration into the grounds, for the replenishment of ground waters that causes the processes of the secondary salinization of soil. Collector-drainage runoff is discharged into the natural water sources and river beds, desert depressions without the necessary purification that causes the waterlogging of irrigated and pasture lands, contamination of environment and sickness of the population.

For instance, more than 60% of land in *Kazakhstan* is exposed to the desertification processes, development of which during the period of 1991-2004 has caused the 2.5 time reduction of the area of agricultural lands. Exhaustion of water resources, loss of land because of the salinization, waterlogging and using them as rocket testing and launching grounds – all this has caused the setback in production in a number of regions of the country.

During the development of virgin and long-fallow lands in Kazakhstan (1954-1960) considerable areas of saline lands were included into the *ploughed fields* (8 million ha) and soils of the light mechanical composition (12 million ha). In 1970-1980 11 additional million ha of low-productive lands were developed. Thus, by 1990 "lands under the development" in Kazakhstan amounted to 47 million ha (36 million ha of ploughed fields and 11 million ha of lands for fundamental improvement). However, the lack of soil-protective technologies led to the loss of humus by 18-25% of developed territories and to the reduction of soil fertility. Ploughing up of low-productive lands of the steppe zone (solonetzs, sandy and saline soils)

has caused the *destruction of natural pastures*. These lands at present are moved to the category of "fallow land"; they became overgrown with weed vegetation and even poisonous species of plants; their productivity has 2-3 times decreased. As a result, the annual damage averages more than 85 million tons of natural fodders.

The last ten years are characterized for Kyrgyzstan as disastrous from the point of view of land degradation. As a result of a number of anthropogenic and natural factors destruction processes occurred on the significant part of the top-soil. Of 10 million ha of agricultural lands 88% were considered to be degraded and exposed to the processes of desertification. Altogether in Kyrgyzstan by current moment 260 thousand ha of lands are exposed to the different degree of salinization, 30 thousand – to overwetting and 500 thousand ha are subject to the water and wind erosion, about 500 thousand ha are overtightened. Wind and water erosion predominate in the country. Water (irrigation) erosion prevails on lands of the foothills-submontane plains and piedmonts of Kyrgyzstan. Territories with heavily erosive soils constitute 31% of the area of agricultural lands, with medium-erosive soils – 27.1%, and with slightly erosive soils – 17%. Areas of soils without erosion constitute only 3.5%. Different degree of soil degradation has decreased the crop capacity of agricultural crops by 20-60%.

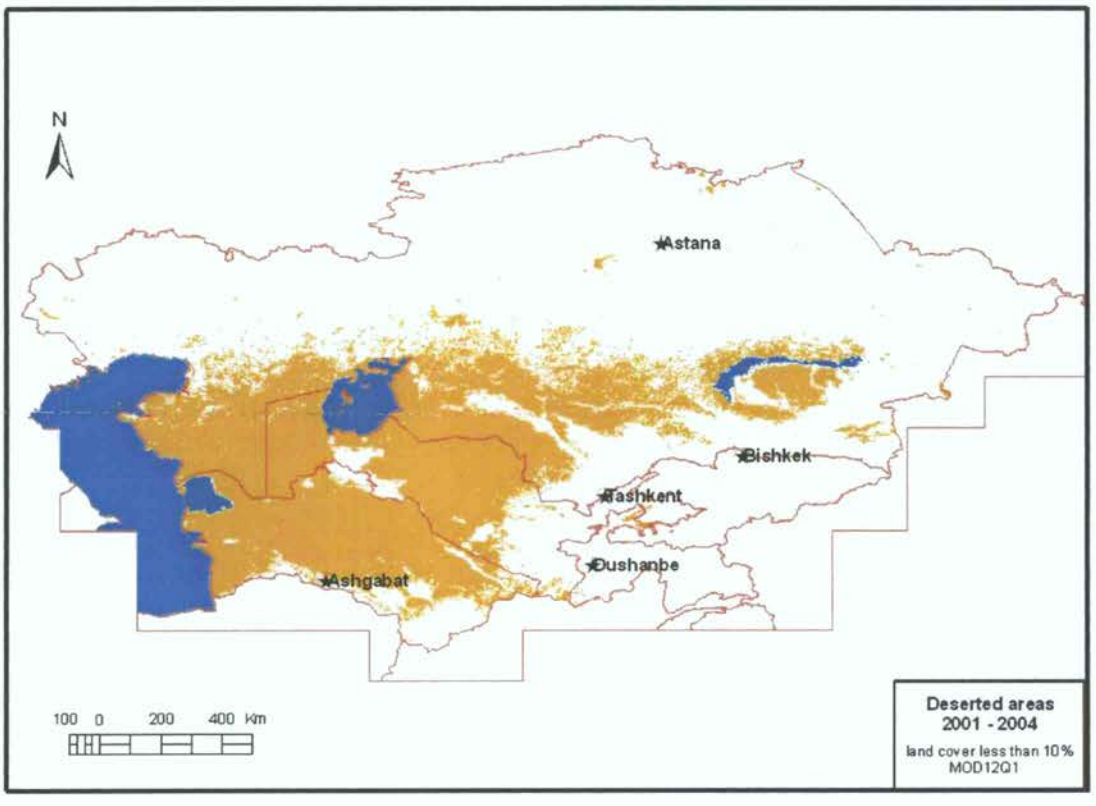

Fig. 1. Deserted areas, land cover less than 10%

In *Tajikistan* about one third of lands are agricultural lands. The area of the plough-land has reduced because of the degradation from 815 thousand ha to 720.2 thousand ha during the period 1990-2003 (or by 12%), and irrigated arable land - from 565 thousand ha to 502.8 thousand ha (or by 11%).

The area of agricultural lands exposed to the processes of degradation during the last decade amounted to 4.33 million ha or 1.3 million ha more than it was in 1990, including soils damaged by erosion – 3.78 million ha. In total in the country soils subject to water erosion

constitute 58.8%, including weakly washed out – 14.8%, moderately washed out – 20.1% and severely washed out – 23.9%. About 1% of the area of republic is subject to the irrigation erosion.

Aggravation of technical state of irrigation and collector-drainage systems resulted in the permanent waterlogging of 142 and seasonal waterlogging of 490 inhabited localities, as well as in overwetting of 12-15% of areas of irrigated lands. Annually by reason of meliorative damages from 15 to 22 thousand ha of irrigated lands are not used in the republic.

In *Turkmenistan* the secondary salinization and overwetting of soils became widely spread in irrigated regions. Of the total area of irrigation of about 2 million ha almost 96% are saline to this or that extent. Poor provision with drainage (42%) and close bedding of ground water (higher than 3 m) at the area about 80% of irrigated lands considerably determine the meliorative conditions of these lands. Currently, good irrigated lands concerning melioration occupy 16% of their area, satisfactory – 49% and unsatisfactory lands – 35%. Using of water from the Amudarya River with high mineralization (where CDW from Uzbekistan, Turkmenistan and Tajikistan are discharged, particularly in the middle flow of the river) for irrigation is one of the main factors of salinization and contamination of irrigated soils.

In 1980-90s significant amounts of pesticides, herbicides and defoliants were used against plant pests and weeds of cotton, rice, vegetables, melons and gourds and forests. During the years of independence the usage of chemicals has been gradually reducing in Turkmenistan. During 1995-2001 their amounts have reduced 2.9 times, and the area of land processed with them reduced 4 times that contributes to the environment improvement.

In *Uzbekistan* during the last decades the areas of saline land has increased by 120 thousand ha, of them 43 thousand ha are severely saline lands. 51% of irrigated lands (1938 thousand ha) are saline to the different extent, of them 30% are weakly saline, 17% - moderately and 4% severely saline. The area of severely and moderately saline lands has increased by 57% in the Amudarya River basin, by 78% in the Syrdarya River basin. Accordingly, the area of lands with the level of ground water higher than 2 meters has increased by 21% in the Amudarya River basin and by 65% in the Syrdarya River basin. In general soils subject to erosion and deflation amount to about 2 million ha or 50% of the area of agricultural lands. Wash-out of slope soil during one vegetation period of cotton reaches 100-160 thousand ha. According to the estimation, about 15% of the yield is lost because of the unfavorable melioration conditions of land.

During the last 10 years one of the factors of land degradation is the monoculture, which is spread in all cotton and grain growing regions.

It is known that cotton monoculture used in practice during the long period of time inevitably results in the degradation of irrigated lands. With this soils become exhausted, activity of biological organisms decreases and nutrition elements accumulation slows down. In conditions of using of heavy tractors the soil consolidates, the "sole shoe" with the volume weight of more than 1.45 g/cm^3 is formed in it that leads to the reduction of soil fertility and decrease of productivity of cultivated crops.

In *Turkmenistan* the share of cotton in 1991 in the structure of crops was 48.7%, and by 2004 it reduced up to 32.2%, though its total area kept staying on approximately the same level. Changes in the structure of crops occurred because of the increase of areas under graincrops and leguminous plants (from 19.4 up to 49.6% during the indicated period). At present the structure of areas under crop and rotation of crops is revised with the wide land release into the long-term tenancy.

In *Uzbekistan* until recently cotton occupied 75% in the structure of the areas under crop

into the long-term tenancy.

In *Uzbekistan* until recently cotton occupied 75% in the structure of the areas under crop that resulted in exhaustion of land, reduction of soil fertility, aggravation of water-physical features of soils and intensifying of processes of their deflation and erosion.

One of the threatening factors of degradation of pasture lands in Central Asia is the cattle overgrazing. Long-term observations have revealed that during the rational use of vegetation its productivity remains intact; during the irrational use (pasture overloading, nonobservance of pasture rotation, breach of seasonality of grazing, etc.) its degradation takes place and as a consequence - desertification.

In *Tajikistan* summer pastures are subject to the desertification by 90%, winter pastures - by 92.5%. In places of ruined pastures, particularly on the bluegrass-sedge pastures, changes of the species composition of plants takes place. Productivity of pastures in this case reduces 5-10 times.

In *Uzbekistan* more than 70% of pastures are subject to digression, including about one third of them are digressed severely. Soils of pastures are subject to a significant extent to deflation processes. During the last 15-20 years digression of pastures is observed because of their unbalanced use in outrun cattle-breeding, erosion, overgrazing and other anthropogenic pressures, as well as lack of phyto-melioration techniques. Of 22.4 million ha of pastures 16.4 million ha (73%)of pastures are subject to digression, including the fact that on the area of 9.3 million ha the fodder capacity has been lost by 20-30%, on 5.0 million ha it is lost by 30-40% and on 2.1 million ha – more than by 40%.

Increase of the pressure on mountainous pastures results in degradation of vegetation and soils. In mountainous ecosystems more than 30% of soil coverage is ruined and forest underbrush is almost completely destroyed. This leads to the strengthening of storm discharge and intensifying of mudflow recurrence rate. Of the total amount of registered mudflows in Central Asia more than 70% fall on Uzbekistan.

In *Kyrgyzstan* 8693.1 thousand ha of low-productive pastures turned to the category of reserve lands, area of irrigated lands has reduces, their total area amounts to 813.5 thousand ha.

In Kazakhstan 2.5 million tons of nutrition elements are withdrawn irretrievably annually from the arable lands. For their replenishment it is necessary to import into the soil 1.8 million tons of phosphor, 1.1 million tons of nitrogen and 0.4 million tons of potassium pomaces in active substance annually. The real threat has occurred for the development of erosion and degradation of chernozem soil. In the layer of 0-20 cm of chernozem the humus content decreases by 27%, 20-50 – by 23%, 50-100 – by 16%. Annual losses are estimated at 0.8...1.0 ton/ha.

Soil coverage is destroyed and taken out from the turnover on the urbanized territories of cities, mining enterprises, transport systems and hydraulic engineering construction.

Thus, the main anthropogenic factors causing intensification of processes of degradation are as follows:

- Agricultural land utilization (development of irrigated agriculture with intensification of the secondary salinization, degradation, erosion and contamination of land with pesticides).
- Outrun cattle-breeding with extreme cattle grazing.
- Construction of dams, hydro-power stations, mineral resources extraction, felling and stubbing of forests, urbanization.

- Intensification of processes of desertification in the Aral Sea sub-region (distribution of dust storms and salt-dust aerosols, degradation of hayfields and pastures, drying of coastal wetlands, decrease of areas of hydromorphic soils and their substitution with solonchaks (alkali soil) and saline soils, increase of mineralization of water of the Amudarya and Syrdarya Rivers as a result of CDW discharge, curtailment of species composition of fauna and flora, etc.) (Fig. 31, Fig. 32, Fig. 33)

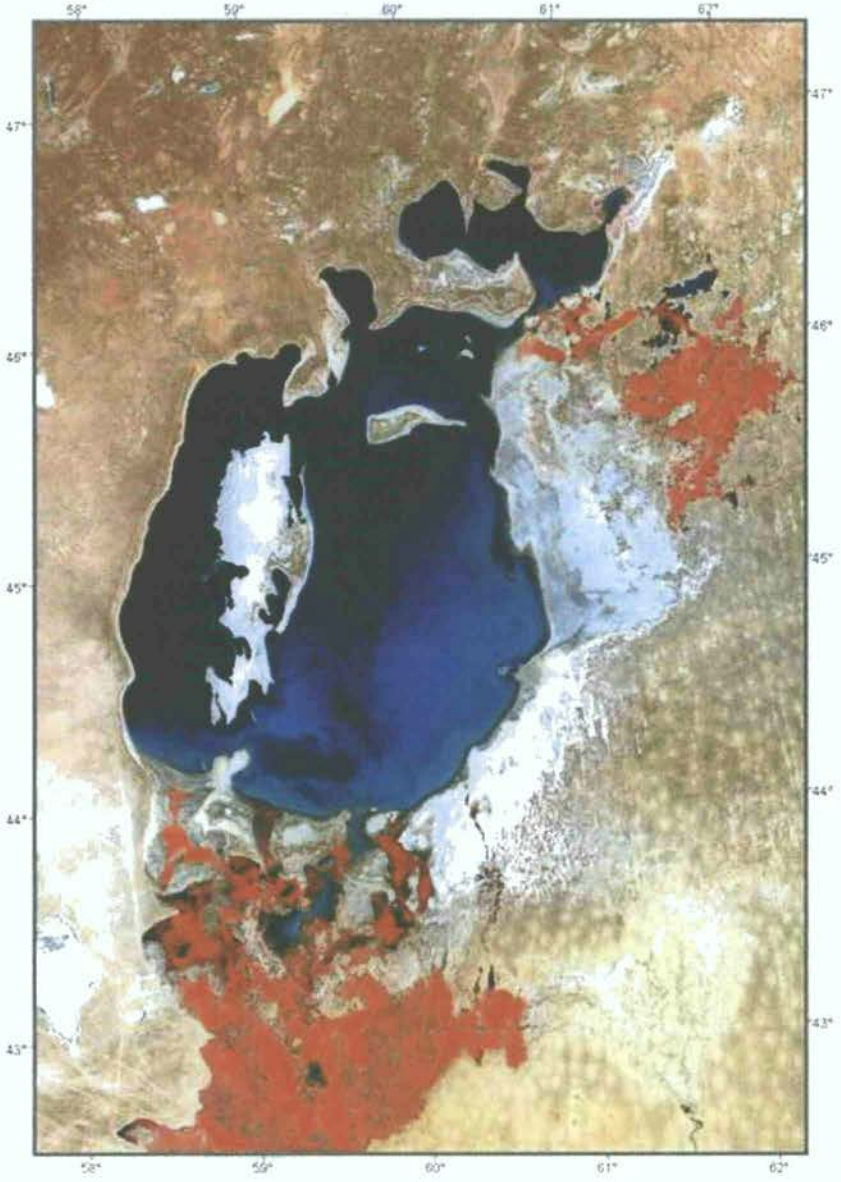

Fig. 31. Space image MSU-SK "Resurs – 01", July 17, 1993, resolution 166 m, color composition of band 4, 2, 1, area of water mirror – 35,6 thousnad km^2

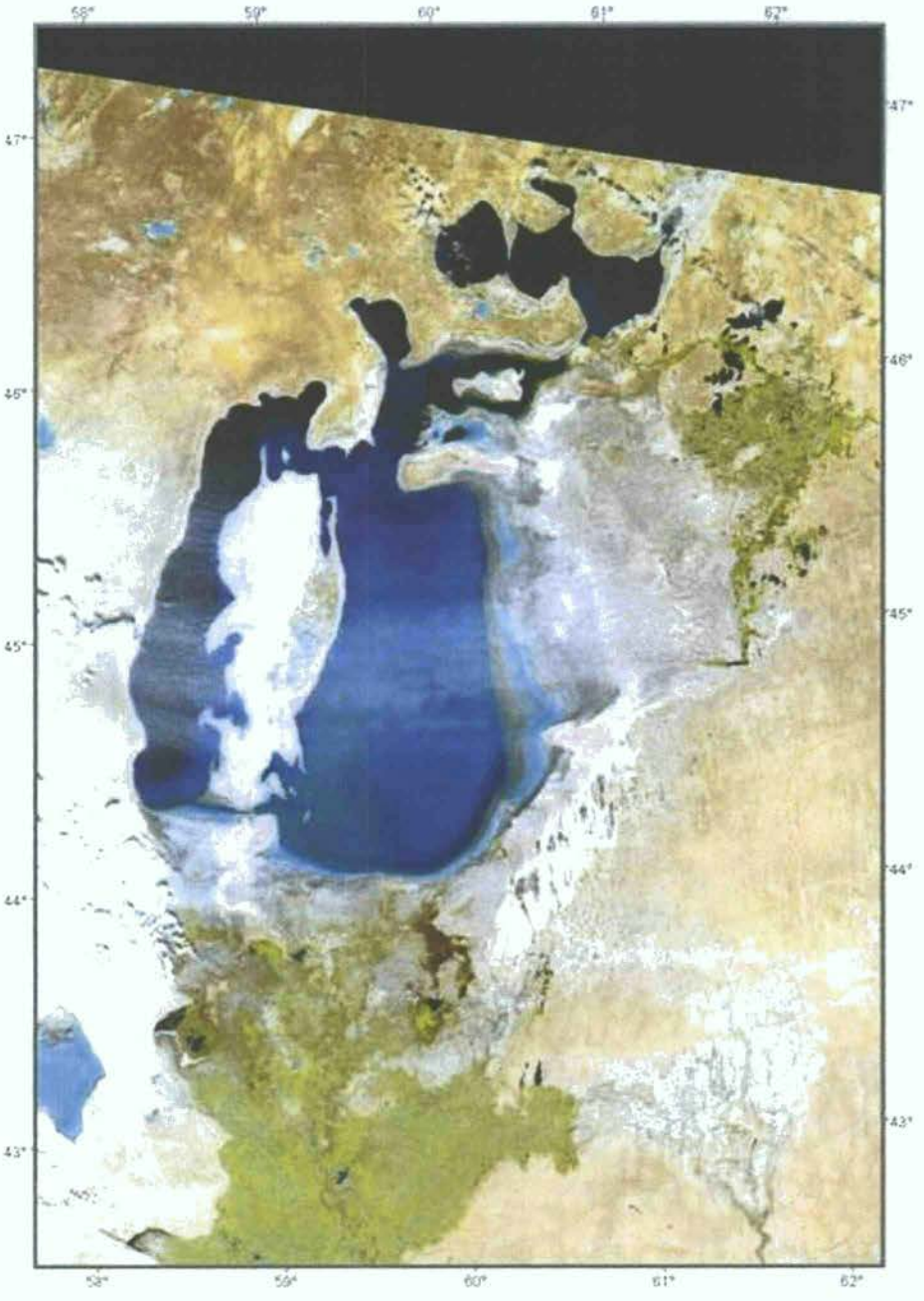

Fig. 32. Space image MODIS (spaceplatform TERRA), June 7, 2001, resolution 250 m, color composition of band 6, 2, 1, area of water mirror – 24,5 thousnad km^2

Fig. 33. Space image MODIS (spaceplatform TERRA), July1, 2004, resolution 250 m, color composition of band 6, 2, 1, area of water mirror – 20,4 thousnad km^2

Images' URL: http://www.ntsomz.ru/galery/aral

Main measures for preventing land degradation.

- Implementation of mandatory to all preventive measures on irrigated lands (regulation of water use, phytomelioration, introduction of cotton-lucerne crop rotation, etc.);
- Using of a complex of agro-technical and agro-reclamation techniques of soil desalinization, ensuring at the project level the length of collector-drainage systems;
- Cessation of non-purified CDW and sewage water discharges into the water sources;
- Prevention of processes of soil erosion and deflation (following the developed norms

and riles of pasture rotation, implementation of a number of preventive, organizational-economic and environmental measures in erosion-risky zones;
- Implementation of measures aimed at the rehabilitation of degraded vegetation cover during the industrial development and use of sandy territories as pastures;
- Establishment of a system of field-protective forest belts;
- implementation of forest-phytomeliorative measures in the zone of precipitation of salt-dust aerosols in the Aral Sea regions;
- Informing and involving of wide sections of the population in solution of problems of land degradation;
- Improvement and harmonization of environmental legislation for creation of institutional conditions to combat the land degradation, etc.

4.4. Loss of Biodiversity

State. Vast and mountainous arid landscapes of Central Asia are the ancient hotbed of formation and development of original species of flora and fauna. Intensive exploitation of biological resources in the past resulted in significant reduction of their species composition and total amount.

The present-day rates of reduction of species numbers in ecosystems against a background of anthropogenic pressure iteratively exceed the rates of species diversity changes occurring naturally.

Determination of a status of just species diversity is considered to be the most widely spread approach to the assessment of biodiversity as the habitat formed by appropriate environmental factors should be considered from the point of view of qualities stipulating the existence of species and their population. Therefore analysis of biodiversity and extent of their losses should be based first of all on reliable species inventory of organism diversity. Reasoning from the given principle to estimate biological diversity of Central Asia the inventory lists of species were made based on which the estimation of biodiversity was obtained (Table 1). In order to receive comparative results groups of organisms, extent of taxonomic investigation of which happened to be more or less high for all countries of the region, were included into the analysis. According to this estimation the total number of species of the main taxonomic categories of Central Asia can amount to 0.13 million and more. If to take into consideration the fact that according to the contemporary estimations the global amount of microorganisms, plants and animals taken together on the Earth totals from 5 up to 30 million, and only 2 million of them are described, one can assume that for Central Asia it will total, respectively, from 0.3 up to 1.6 and more than 0.1 million species.

The most numerous group of organisms happens to be *Magnoliophyta (Angiosperms)* and *Mycophyta (Fungi)*, and among animals – Insecta *(insects)*. Their species diversity in all countries amounts to 2 - 3 thousand and more species, for *Insecta* this figure is higher – from 4 up to 40 and more thousand. This is quite natural, as exactly these groups are the most widely spread and diverse in the world. Poorly represented (2 orders lower) are *Pteridophyta (Filicoids)* and *Pinophyta (Gymnospermouses)*, and of vertebrates are *Amphybia (Amphibia)*.

Table 1

Biodiversity Assessment (Excluding Bacteria and Viruses) in Central Asia: Number of Species /1/ and Loss Tendency /2/.

Taxons \ Countries	Kazakhstan		Kyrgyzstan		Tajikistan		Turkmenistan		Uzbekistan	
	1	*2*	*1*	*2*	*1*	*2*	*1*	*2*	*1*	*2*
Mycophyta - Fungi	4821	22(0.5%)	1936	0(0%)	2233	4(0.2%)	2585	3(0.1%)	2008	0(0%)
Lichenes - Lichens	485	4(0.8)	495	0	524	0	470	5(1.1)	?	0
Phycobionta - Algae	2000	6(0.3)	850	0	2145	0	827	0	1052	0
Bryophyta - Mosses	500	4(0.8)	183	0	358	8(2.2)	140	2(1.4)	?	0
Pteridophyta - Ferns	35	2(5.7)	18	0	22	7(31.8)	17	6(35.3)	18	0
Pinophyta – Gymnospermouses	26	2(7.7)	8	2(25.0)	35	1(2.8)	12	1(8.3)	17	1(5.9)
Magnoliophyta - Angiosperms	6000	362(6.0)	3780	65(1.7)	4454	206(4.6)	2969	92(3.1)	4250	300(7.0)
Insecta - Insects (expert assessment)	45000	96(0.2)	4000	5(0.1)	4000	50(1.2)	9000	43(0.5)	12000	53(0.4)
Pisces - Fish	104	16(14.4)	75	1(1.3)	52	4(7.7)	115	12(10.4)	83	18(21.7)
Amphybia - Amphibia	12	3(25.0)	3	0	2	0	5	1(20.0)	3	0
Reptilia - Reptiles	49	10(20.4)	28	3(10.7)	46	21(45.6)	82	22(26.8)	59	16(27.1)
Aves - Birds	489	56(11.4)	368	20(5.4)	346	37(10.7)	376	41(10.9)	424	48(11.3)
Mammalia - Mammals	178	40(22.5)	83	13(15.7)	84	42(50.0)	104	30(28.8)	97	24(24.7)
Other animals (expert assessment)	2600	0	500	0	450	0	970	0	1250	0
T O T A L	**62299**	**623(1.0)**	**12327**	**109(0.9)**	**14751**	**380(2.6)**	**17672**	**258(1.5)**	**21261**	**460(2.1)**

Other groups occupy intermediate position and vary within the range of 10-20 thousand species, excluding Kazakhstan, where this amount exceeds 60 thousand species (Fig.4.2). And it is nor surprising as its territory 2.1 times larger than the area f other countries of Central Asia taken together and includes the diversity of all natural-climatic zones existing in other countries. For the purpose of analysis of the biodiversity loss at the species level in each taxonomic group the percentage (share) of rare and endangered species in compliance with the lists of the National Red Data Books of all the countries members of the Central Asian region. At the same time one should bear in mind that first of all the indicators obtained represent the minimum level (the so called "reference point") of the biodiversity losses, and so they could be relatively called "indicators of biodiversity loss tendencies". They unfortunately have presuppositions of increasing. Second, it is impossible to calculate the real loss of diversity at the genetic and ecosystem levels. Third, obtained figures – loss tendencies even for well studied (except invertebrates) species diversity, are not so objective as one can conceive as they are based on only Red Data Book lists, criteria of making of which in each of the countries were different. It is considered to be principle that much depends not only on the natural habitat and amount of species but also on vulnerability of their populations. For instance, the populations of the overwhelming amount of invertebrates are considered very vulnerable because they initially have restricted distribution and low quantity, therefore even small changes in ecosystems may cause their extinction, result in irreversible loss of gene pool and as a consequence the loss of biodiversity at the level of ecosystems.

Reduction in abundance of fauna and flora. Conjugate analysis shows that the tendencies of biodiversity loss in different countries even within the framework of the same taxon differ. So, among plants the tendency of loosing *Pteridophyta (Filicoids)* in Turkmenistan and Tajikistan of, respectively, 35% and 32%, deserves specific attention. At the same time, none of these species of this taxonomic group is included for some reason into the National Red Data Books of Uzbekistan and Kyrgyzstan. But among representatives of *Pinophyta (Gymnospermouses)* the highest loss tendency is in Kyrgyzstan (25%). Other groups of vegetation organisms in general cause less anxiety though in each of the countries taken separately this situation looks in different ways.

As it was expected, in all the countries the highest tendency of biodiversity loss appeared to be in vertebrates, particularly in *Reptilia (*reptiles*)* due to narrow habitat species and *Mammalia (*mammals*)* due to large animals, particularly, representatives of predators and ungulate animals. Among *Reptilia* the tendency of loss amounts to from 10% (Kyrgyzstan) up to 45% (Tajikistan); among *Mammalia,* in the same countries it is from 16 up to 50%. These indicators in other countries occupy the intermediate position (Table 1).

Genetic diversity is the foundation for species diversity that in its turn predetermines the complicated structure of ecosystem diversity of the region.

It is known that sustainable development of any sub-region is based first of all on natural ecosystems. The more natural cenosis the greater is its input into prevention of natural habitat contamination. Therefore conservation of desert and mountainous forests, mat-grass and fescue steppes, polster upland xerophytes of rocks and water vegetation of small rivers, and along with others all species of living creatures equals to the conservation of biodiversity.

The main types of biodiversity are related to the following ecosystems: mountains, steppes, semideserts and deserts (Fig. 1).

All ecosystems of the sub-region and their biodiversities without exception suffer to this or that extent from anthropogenic pressure and, first of all, agricultural one. The role of the ecosystem diversity is invaluable, it could be considered equal to the fundamental problem for the present period for Central Asia: regulation of desertification and soil degradation processes. Increase of sustainability of natural ecosystems due to the conservation of their biodiversity reduces the level of soil erosion in all its forms. This is particularly important for the real prevention of salinization on valleys, and processes

of mudflow formation in mountainous regions, causing great economic damage. Reduction of natural vegetation and continuing drying of the Aral Sea has aggravated the urgent problem of desertification in all countries of Central Asia. Degradation of natural resources of the Aral Sea sub-region resulted in escalation of socio-economic problems. The most vulnerable layers of the population: children, women and old people, have become the first victims of this crisis. Not only the Nature itself but the whole population of the Aral Sea zone has been aggrieved from the radical degradation of environment. Many decades citizens of the sub-region have been suffering from the impact of dust-salt flows transferred by winds from the bottom of the dried sea. Environmental misbalance, shrinking of the area of the Aral Sea, in particular, has regional consequences. Malfunctions in the irrigation systems and water distribution can have a serious destabilization effect.

The conservation of biodiversity on territories both with natural and artificial vegetation is of great importance for reduction of processes of desertification. By present time on the territory of CA there is no any natural ecosystem, which has not suffered from human pressure to this or that extent. Such situation does not allow the ecosystem executing the most important functions in full measure: maintenance of environmental balance, CO_2 binding, fixation of slopes, runoff regulation, creation of soil layer, air purification, and finally, support and development of biodiversity.

It is known that sustainable development of any sub-region is based on first of all on natural ecosystems. The more native is the natural community, the bigger its input into prevention of the natural habitat's contamination. Therefore, the conservation of desert and mountain forests, stipa- fescue steppes, cushion-like upland xerophytes of rocks and water vegetation of small rivers and along with them, of all species of living creatures – that is the conservation of biodiversity.

Reduction and significant changes in natural habitats of species is of the main treat to biodiversity. The process of loosing the species and genetic diversity both as a result of direct and indirect impact of the man happens permanently because of ecosystem degradation and is of large-scale character.

Natural habitat reduction. As an example of direct impact on biodiversity we can indicate that with respect of the majority species of game animals the reduction of their number is observed even if only limits of them are bagged. To certain reasons of this the influence of direct anthropogenic impact should be attributed that leads to the changes of conditions in habitats of animals, extremely increased level of poaching as well as possible shortcomings of accounting of actual preys. Of indirect reasons we can indicate high number of predators (wolves and jackals), causing significant damage to their livestock. The state of the population is of specific alert: rehabilitated in 1950s its number ensured till recently up to 50% of the total amount of hunting products in Kazakhstan. Taking into consideration migration saiga antelope occupied the habitat with the area up to 45% of the territory of republic. Currently because of the poaching the saiga population has reduced up to the critical level. The number of steppe saiga antelope during 10 years has reduced by 99% or from 2,000,000 animal to 240.000 animals. The reasons are as follows: state purchases of horns of stags for the purpose of import for manufacturing of medications; or hunting by local population for the foodstuff.

Thus, the number of Betpakdala population, earlier the most numerous, during the last 4 years has dropped from 350 to 120 thousand heads. For instance, in 1990s the kulan (Asiatic wild ass) population in Badghyz amounted to about 5000 heads and already in 1999 it totaled 200-300 animals. Thanks to the purposeful work of the Ministry of Nature Protection of Turkmenistan they succeeded to save this population (900 heads), being under the threat of extinction. The same concerns a number of other ungulate animals, both in deserts and mountains. For a long time significant purchases of Middle Asian tortoise (*Agrionemys horsfieldi*), that considerably undermined its amount in many natural habitats. Such venomous snakes as copperhead snake (*Agkistrodon halys*), regular viper and steppe viper (*Vipera berus, Vipera ursini*), cobra (*Naja oxiana*) and lebetina viper (*Vipera lebetina*) are in danger of extinction, which are capture for obtaining snake venom used in medicine. During the last years the commercial demand has sharply grown for falcons. Incidentally, one more example: in Kazakhstan 35

species of predators are to be found, of them almost a half found themselves in the category of rare and endangered as a result of ruthless extermination. Of invertebrate animals the commercial demand has increased for different species of spiders (their poison), as well as insects, particularly butterflies, with the purpose of collecting.

So, in Turkmenistan the most vulnerable species of flora and fauna are as follows:

a. Wild congeners of cultivated plants and a number of species being of large scientific and practical interest (*Juglans regia*, *Pyrus turcomanica*, *Malus siversii*, *Pistacia badghysi*, *Juniperus turkomanica*, *Mandrogora*, almost all species of tulips, *Aegilops*, rye, barley, great number of onion, etc.). For instance, fragile sand *Acacia konnoli* grows in sand of Karakums and is on the verge of extinction;

b. Narrow areal species of animals (Acipenser nudiventris, Pseudoscaphirhynchus hermanni and Pseudoscaphirhynchus kaufmanni, Alsophylax laevis, Phrynocephalus maculatus, Otis tarda, Chylamydotis undulata, Tetraogallus caspius, Francolinus francolinus, Falco cherrug, Falco peregrinus, Ursus, Hyaena, Pardus pardus, Saiga tatarica, Cervus elaphus, Capra falconeri and Capra aegagrus, Ovis ammon, Gazella subgutturosa, Equus hemionus).

The most fragile are *ecosystems of deserts* and therefore anthropogenic pressure, which they experience, results in more rapid destruction and loss of biodiversity. At the same time the main threat, along with the many-year drought, is the imperfection of pasture turnover and overgrazing, extinguishment of woody and shrubby vegetation, unregulated traffic of transport and road construction, geological prospecting work and drilling activity, increase of oil and gas development, flooding with drainage-waste waters.

Intensive felling of forests and fires extremely negatively influenced the state of flora and fauna, and resulted in development of erosion processes, expansion of scales of natural disasters occurrence.

In tugais up to 1958 there lived now completely extinct *Panthera tigris turanica*; till present days such rare species as *Cervus elaphus elaphus bacticanus*, *Phasianus colchicus*, *Naja oxiana*. Tugais are easy of access and have been used for the provision of fuel, hay and for grazing for a long time; sometimes they are cleared for agricultural lands. For instance, a tendency for reduction of forest areas keeps going on in Kyrgyzstan. During the last fifty years forest areas only in regions of Western Tien Shan has reduced almost twice, and at the same time areal of rare species of both plants and animals were subject to reduction. But the biggest disaster for these ecosystems happened to be the regulation of the river flow and water diversion for irrigation because periodical flooding was one of the main factors, which determined the formation of this type of ecosystems.

If the growth of the population causes anthropogenic changes of the river basins, the chemical contamination of water environment results in death and violation of life of very important components of biodiversity, such as bacteria, algae, amphibian, fishes.

Disturbance of the habitat stability of flora and fauna results in the worsening of physical and chemical conditions of water environment, aggravation of conditions of life of water organisms, migration and fish spawning, reduction of bio-productive potential of water reservoirs and threat of infringement of environmental structure and complete loss of biodiversity.

Specially protected areas of nature provide for the most important task of conservation of the representative areas of natural ecological systems and landscapes, diversity of flora and fauna, maintaining of the necessary environmental balance. They, being the natural models, uniques and relicts, are of specific importance for scientific investigations, education, tourism and recreation, as well as for executing the monitoring of environment changes.

In general the area of all types and categories of specially protected areas of nature amounts to 2.6% of the territory of Kazakhstan that is insufficient for environmental balance and conservation of the unique zonal biodiversity of the republic. The existing network of reserves does not cover 37 species of mammals (21.1% of the total number of species), 50 bird species (12.6%), 18 reptile species (36.8%), 6 amphibian species (50%), 81 fish species (78%). The territory of the republic is poor in for-

ests. According to the State Stock-taking, the area of the forest fund and SPAN as of 01.01.2002 amounts to 26.08 million ha, including area covered with forest of 11.47 million ha.

By nowadays there are 80 various objects in Kyrgyzstan, forming a network of specially protected areas of nature (SPAN further), with the total area of 915.2 thousand ha or 4.5% of the territory of republic. In the international practice 10% are considered the minimum acceptable value of aggregate area of protected natural territories (decisions of the World Congress of National Parks in Karakas, 1992). In accordance with the classification adopted by the International Union for Conservation of Nature (IUCN), SPANs of the republic belong to four categories:

I category - 7 reserves, the total area of which amounts to 270.7 thousand ha, where any economic or other activities are prohibited, which disturbs the natural development of natural complexes;

II category – 8 state natural national parks, with the total area of 258.5 thousand ha, in which a differential protection regime is set by areas (reserve area, recreational zones, and zones for economic activity);

III category – monuments of nature or geological nature reserves, which are about 18 (60 ha) in republic;

IV category – special nature reserves (forest, botanical, hunting), which are established for protection of separate components of the nature, as well as 2 complex reserves. The total area of special nature reserves in republic amounts to more than 283 thousand ha.

In Tajikistan the concept of forestry developed up to 2005 envisages the increase of forest rehabilitation up to 3.5 thousand ha annually. During executing the necessary work for forest rehabilitation and strengthening protection of existing forests the CO outflow with wood biomass can increase as of 2015 by 14% and achieve 475 Ggm per year. The area occupied by SPAN amounts to 489.2 thousand ha.

For the purpose of conservation of the landscape diversity intensive work is done for afforestation and planting of trees and gardens in arid territories in Turkmenistan. Due to the gasification of the urban, regional and rural areas the recovery of degraded lands is taking place through planting and sowing of different species of forest crops. Specially protected areas of nature amount to 2703.2 thousand ha.

The total area of specially protected areas of nature in Uzbekistan amounts to 1355.6 thousand ha. Reserves, natural and national parks, game reserves, monuments of nature belong to specially protected areas of nature (SPAN).

Under the assistance of GEF the project "Complex Conservation of Priority Wetlands as Migrant Birds' Habitats" was developed in Kazakhstan, aimed at the demonstration of possibilities of efficient management of natural resources of the most important water reservoirs, provision of the landscape and biological diversity conservation, support of local initiatives for conservation and creation of conditions for reproduction of migrant species of birds (including rare and endangered birds). Regions of realization of the project should first of all become delta of the Ural River and northern coast of the Caspian Sea, system of lakes Alakol-Sasykol, Tengiz and Korgaljino.

In many respects these gaps can be filled up by the interstate project "Establishment of Econet for the Long-term Biodiversity Conservation in Ecosystems of Central Asia", initiated by the states of Central Asia and international environmental organizations (Program REAP with the support of GEF /UNEP /WWF), which started in April 2003. In 2004 the development of the data base was finished for establishment of the preliminary scheme of «Econet" development for all countries. The scheme was presented at the session of the Interstate Commission for Sustainable Development (ISDC), the members of which are ministers of environment protection of five states.

Measures for biodiversity conservation.

- Conservation of specifically protected natural territories of the priority importance;

- Development of environmental education and awareness of the population in the field of biodiversity conservation;
- Improvement of environmental education of managers of institutions, organizations and enterprises concerning the legislative and normative acts on fauna and flora conservation;
- Expanding of specially protected areas of nature (SPAN) and organizing of existing reserves and game reserves in accordance with the set objectives;
- Training of the highly qualified specialists on biodiversity conservation in higher educational institutions of the country;
- Development of environmental monitoring in natural habitats and changes in the number of rare and endangered species of plants and animals;
- Breeding of rare and endangered species of plants and animals.

Elaboration of the state program for SPAN informational network development based on recommendations of the interstate project for establishments of Econet in Central Asia.

Brief review of the present-day state of biodiversity in Central Asia allows making a conclusion about the fact that the vast territory of the Central Asian sub-region is the interrelated unified ecosystem possessing high socio-economic potential. Severity of the natural-climatic conditions has evolutionally formed specific national features of the local population and determined its traditionally careful attitude to flora and fauna. In this aspect establishment of the unified Interstate Program for Biodiversity Conservation in the sub-region is the pledge for carrying out commitments of Central Asian countries to the main provisions of the UN Convention.

4.5. Mountain Ecosystem Degradation

State of the problem. In the sub-region of Central Asia mountain ecosystems are represented by low-mountain and high-mountain complexes, where there is a combination of the variety of relief-forming factors and soil-vegetation cover and fauna.

Ecosystem diversity is mostly abundantly represented in the West-Tien-Shan and Central-Tien-Shan biogeographical regions, where there represented 16 of 22 classes of ecosystems. The poorest are Fergana and South-Kazakhstan regions, where there represented 3-5 classes of ecosystems, or 22.7%. Between them are Alai (13 classes of ecosystems, 59.1%), North-Tien-Shan, Issyk-Kul and Central-Tien-Shan (10 classes of ecosystems each, or 45.4%) regions.

On the territory of the mountain sub-region none of natural ecosystems is left, which has not suffered from human influence to this or that extent.

Illegal feeling of forests, unregulated cattle grazing, and ploughing of slopes resulted in the intensification of mudflow processes and soil erosion. Preventive and rehabilitative measures used are not sufficient.

Severe natural-climatic conditions, low level of employment of the population because of poorly developed network of the agroindustrial complex and transport, low level of infrastructure contribute to the anthropogenic impact on environment of mountain territories. Extremely distinctly this can be observed in issues of deforestation, pasture degradation, slope erosion, growth of superficial exogenous processes.

On the territory of Central Asia there are 5600 lake with the total area of 12.197 km^2. The most spread basins for mountain lakes by genetic origin are tectonic, glaciologic and goaf ones. Such large lakes as Issyk-Kul (Kyrgyzstan), Karakul (Tajikistan), Balkhash (Kazakhstan) and others belong to the tectonic group of lakes. These lakes belong to closed depression and are the giant evaporators of the

river run-off. The debacle-risky Sarez Lake is widely renowned, which was formed as a result of Usoi obstruction caused by the 9-grade earthquake in the Murgab River valley on the East Pamirs in February 1911.

Absolute height mark of the water level in the lake is 3.265 m. 17 km^3 of pure fresh water is accumulated in the lake. The dam of 550-650 meters in height and 2 km long is the highest in the world.

More than 20 lakes in Central Asia are debacle-risky.

There are about 2000 glaciers with the total area of about 1900 km^2 on the mountain territory of Central Asia.

Main factors of mountain ecosystem degradation. For mountainous territories of CA the spectrum of ecosystem degradation is common – it is afforestation, soil erosion, drop of biological productivity, growth of amount and extent of destructive consequences of natural disasters, depletion of the species composition of flora and fauna, potential; danger of possible debacles of mountainous lakes, breaking, of dams in places of hazardous wastes burial, and possible infiltration of contaminated run offs into the underground horizons, high level of poverty and low labor employment of the population, etc..

Excessive exploitation of mountain resources against a background of their scantiness, usage of irrational techniques of the land use, imperfection of forest and water resources management affect the state of mountain ecosystems and lead to their reduction and degradation.

Main factors of the natural and anthropogenic character influencing the degradation of mountain ecosystems are as follows:

Natural factors. Mountain regions of CA are the delicate system, when human activity provokes the intensifying of the risk of occurrence of natural disasters. Located in the zone of high seismic activity (8-9 grades) they are subject to the impact of earthquakes, landslides, landslip, mudflows, ground thinning.

Because of the global climate changes during the last 50 years there has been outlined the process of reduction of glacier and snowfield areas. This affects or the time being only water capacity of rivers with high share (40% - 50%) feeding from glaciers. The problem of glacier monitoring requires attraction attention to the organization of regular observations, particularly in forecasting of water capacity of rivers.

Anthropogenic factors. Forests are of great importance in conservation of biodiversity and environmental stability of natural ecosystems.

Forests in mountains of CA fulfill exclusively nature protective and soil protective functions, and their felling for economic needs is prohibited. Limited sanitary felling in all countries of the sub-region exceeds authorized norms because of the lack of electric power during winter period; because of the high level of poverty the population is unable to purchase such traditional types of fuel as coal, gas and wood. Because of the mass forest felling forest resources are subject to rarefaction, become more vulnerable to pests and diseases, the air temperature and soil humidity changes. Crowns and leaves of trees detain from 10 up to 40% of precipitation, which does not reach the root system. In conditions of multipartite of relief the speed of intrasoil run-off, particularly under the cut off areas of nut forests, reduces twice.

Extent of illegal felling exceeds reafforestation that ultimately results in deforestation of the territory. Economic estimation of these losses has not been made in countries of the region, rehabilitation measures defy calculations. Adequate resources for forest rehabilitation are not allocated in these countries.

Investigations showed that the aerosol contamination of the atmosphere over CA happens because of the transboundary transfer of pollutants from Iran, Iraq, and Afghanistan, deserts of Central Asia, Mongolia and China. Total input into the salt and dust transfer on the glaciers of Tien Shan from the

Aral Sea basin by air flows is estimated to constitute 30.4%. Transfer of air masses from South Asia contaminated with aerosol takes place in 25% of cases, and in 23% of cases transfer occurs from mining coal-mining industries, particularly from the territory of Kazakhstan.

In the basin of the Aral Sea about 60 water reservoirs are located and 45 electric power stations are in operation. Central Asia can meet more than 71% of demand in electric power due to the hydropower engineering. In its turn, development of hydraulic power systems requires withdrawal of significant areas of land resources, changes in landscapes and natural habitats of biological diversity.

Construction of artificial dams and water reservoirs often results in disturbance of natural equilibrium and appearance of secondary consequences of the earthquakes.

Active development of mountain territories during the last two decades showed that without detailed investigation and forecasting of the state of ecosystems it is impossible to guarantee the security of socio-industrial objects located in zones of mountain relief with unfavorable ground conditions.

Complicated relief and geodynamic features in mountain conditions and shortage of land for construction and running of tailing dumps do not allow following requirements of waste storage almost in all ore-dressing enterprises. Because of this the tailing crushed ore is dumped into the surface water reservoirs, where the inflow seepage of contaminated water into the underground horizons takes place, and the territory is subject to denudation processes.

Processes of cattle overgrazing are characteristic to all foothill and mountainous pastures of the CA region, where the main cattle stock is concentrated. Alpine pastures suffer less from anthropogenic pressure and the vegetation cover there has the tendency to recover.

Uncontrolled hunting, medicinal herbs picking-up and their collecting led to the loss of capability of separate species to rehabilitate. Some species of fauna kept untouched as small populations and separate individuals on restricted territories. As a result of poaching, for instance, 10-12 red sheep, 50-70 heads of birds of prey, 40-80 wild sheep (Ovis ammon), etc., are annually shot or illegally are taken away abroad.

In connection with the slope land development, cutting up shrubs and light forest in the zone of dry agriculture erosion processes strengthen. Non-observance of requirements of the land use and anti-erosion measures resulted in the intensification of soil washing out and erosion, formation of ravines and scours.

Annually about 30 million tons of soil are washed out from slopes, with more than 500 thousand tons of humus. Continuation of the unsystematic and uncontrolled use of arable lands can result in the loss of soil-vegetation coverage that plays here the main anti-erosion role on mountain slopes.

Mountainous territories of the sub-region preserve unique landscape diversity, monuments of nature, representative of fauna and flora, which require the special regime of protection and development. The network of specially protected areas of nature (SPAN) in CA is insufficient and protection itself does not have a well-defined regional policy and strategy. Degradation of mountain ecosystem of CA requires that the SPAN system was expanded. At the same time, a poorly developed monitoring system of the mountain ecosystem state does not allow to substantiate to a quite unbiased extent proposals to expand the SPAN.

For instance, Tajikistan has the highest share of alienated lands for Specially Protected Areas of Nature (22.1%) in CA, but in its national parks and reserves the necessary infrastructure is lacking for research works, planning and resources provision for the bio-technical and other environmental measures.

Mountains of CA possess the great natural potential for tourism development; therefore it is necessary to consider them as one of the most important factors contributing to decreasing of economic disproportions and stimulating growth. In the future this tourism can become an important source of money intake, which can be used for establishing new working places in order to fight against poverty and stimulation of economic and social development.

Development of transport infrastructure in mountainous conditions of the CA region, where mountains amount to more than 50%, high seismicity, intensive geodynamic processes is of extreme importance, mainly for the conservation of ecosystem capacity, prevention of slope degradation and other exogenous processes.

Development of the road network during the last 50-60 years resulted in the partial and sometimes complete fragmentation of ecosystems and impediment for animals' migration. Wild mammals have suffered to the most extent from the destruction of their natural habitats.

In CA forest plantations are of specific importance in stability of the slope territories, particularly in zones along routes playing a role on one hand as a buffer from emissions of pollutants, and on the other hand, as a stabilizing factor from degradation of slope processes. Up to several millions of young plant s are planted every year, of which 70-80% strike roots. Local population and national and international enterprises and organizations take part in this process.

Measures for prevention of mountain ecosystem degradation.

- From 1997 the Program MSDSP (Mountain Sustainable Development Support Program) of the Aga-Khan Fund provides the grant support to the development of agriculture of mountainous territories in Tajikistan;
- In Khorog (Tajikistan) the issue of establishing the University of Central Asia is in its completion stage. This higher educational institution is established under the initiative of His Highness Aga Khan and the President of Republic of Tajikistan E.Sh. Rakhmonov under the support of the Presidents of Kazakhstan and Kyrgyzstan.
- Office of the German agroaction assists the rural population in strengthening the private business through providing with seeds and fertilizers;
- World Bank provides assistance in development of agriculture;
- ТАСИФ implements the work on rehabilitation and development of electric mains, communications, water pipelines;
- For the purpose of implementation of the Convention of Migrating Species of Animals a Memorandum of Assistance to Central Asian countries of the Wild World Fund for the rehabilitation of some species of wild animals;
- In 2002 the Regional Strategy for Sustainable Development of Mountainous Territories of Central Asia was approved at the Bishkek World Mountain Summit

4.6. Waste management

State. Environment pollution with industrial waste is closely associated with the problem of rational use of natural resources.

The main source of formation of waste is industrial production: power engineering, non-ferrous metallurgy and ferrous metallurgy, chemistry and building industry.

The biggest amount of wastes in CA falls on the enterprises of mineral resource and ore mining and processing industries.

Numerous terraces and tailing dumps of mining enterprises, where radioactive substances, salts of heavy metals, cyanide-containing substances are utilized, cause serious anxiety.

Domestic wastes are particularly dangerous for densely populated cities and settlements.

In total on the territory CA there are more than 130 works with waste products of the mineral resource industries, which makes the main contribution into the total amount of existing industrial wastes. In Kazakhstan the amount of accumulated wastes totals 500 million tons annually.

During the long period of extraction and processing of minerals in countries of Central Asia significant amounts of waste products have been accumulated in depositories, storages, depots, burial grounds and other sites. In Kazakhstan they amount to 20-30 billion tons; in Uzbekistan – 1.3 billion

tons; Kyrgyzstan – 1 billion tons; Tajikistan – 210 million tons; and Turkmenistan - 165 million tons.

During the last time amounts of domestic wastes have been also grown, which total 20 million m3 in Kazakhstan; 15 million m3 in Kyrgyzstan; 30 million m3 in Uzbekistan; up to 3.5 million tons in Tajikistan and 1 million tons in Turkmenistan.

Accumulation of significant amounts of radioactive wastes in CA was the consequence of activities of mining and processing enterprises of uranium industry from the late 1940s. Existing points of burial of radioactive wastes being main sources of ionizing radiation have not exhausted yet their capacities.

Analysis of materials about wastes has revealed a number of common problems related with the solving first of all of investment and institutional tasks. In particular: the lack of waste recycling plants; sanitary norms discrepancy of domestic wastes sites (dumps); the lack of grounds for burial of toxic industrial wastes; inefficient measures for recultivation of wastes.

Industrial and toxic wastes. In Central Asia extracting industries are prevailing. First of all these are hydrocarbon resources, different metals, including iron ore, gold, uranium, lead, manganese, copper, etc. At the same time the mining industry extracting huge masses of minerals deposits use only 5-10% of them. The rest part is accumulated in tailing dumps having a negative influence on environment.

According to the preliminary inventory data at present 20-30 billion tons of wastes have been accumulated in Kazakhstan. Every year more than 500 million tons of industrial wastes are formed, including about 80 million tons of toxic wastes.

Actual amount of wastes disposal during the year 2004 totaled 317,948,193.4 tons, that in comparison with 2003 (303,936,174.9) has increase by 4.61%. Relative stability has been reached as a result of regulation of formation and secondary utilization of man-caused mineral buildups.

More than 141 945.7 thousand tons of toxic wastes are accumulated in storages, depots, depositories, burial grounds, and sites, dumps and other places of Kazakhstan.

In Kazakhstan there is a continuous growth of toxic wastes amounts. It is explained by the fact that during last years old enterprises are rehabilitate and new ones are established.

Almost the whole amount of toxic wastes (more than 90%) is of industrial origin. 55% are formed in mining industry, more than 38% in processing industry. Agriculture and housing and communal services contribute less than 1%.

Distribution of toxic wastes by danger classes totaled respectively: 1 danger class – 0.01%, II class – 2.395, III class – 2.8%, IV class – 94.8%. The increase of amounts of accretion of wastes of danger classes II and III becomes obvious.

During the years 20% of toxic wastes of danger class I, 0.1% - of class III, 2.9% - of class IV have been completely neutralized (annihilated). 80% of wastes of danger class 1, 24.5% - of class II, 83.4% - of class III and 152.7 – of class IV have been dispatched to places of authorized stroraging and burial

In Kyrgyzstan amounts of industrial and toxic wastes are very significant. The accumulated amount of only solid wastes totals more than 60 million tons. The special anxiety is provoked by accumulation in waste piles and dumps of toxic wastes, including those that contain also carcinogenic substances, the total amount of which reaches 33 million tons.

Wastes of the mining and processing industries, including dangerous ones, are presented by: solid wastes (terraces of overburden operations, "tails" of ore-dressing, etc) and "by-product" wastes (residuals of production constructions, devices and materials used at the mining and reprocessing enterprises).

In Batkenskaya Oblast of Kyrgyzstan 2.5 million cubic meters have been stored, which contain salts of heavy metals (Pb, Zn). In Djalal-Abadskaya Oblast amount of wastes of uranium production

totals about 2 5 million cubic meters. In terraces of the mine in settlement Shekaftar about 700 thousand cubic meters of low-radioactive mountainous rocks and ill-conditioned ores are stored. In Issyk-Kulskaya Oblast in 1.5 km to the south of the coast of the Issyk-Kul Lake the total amount of accumulated tails make up about thousand cubic meters. 4 tailing dumps and 4 mountainous piles with radioactive materials with the total amount of 1.15 million cubic meters are located in Narynskaya Oblast. 4 tailing dumps are located in Chuiskaya Oblast, where 1.7 million cubic meters of wastes of complex and rare-earth metals ore processing are stored.

The largest amounts of toxic wastes are formed in metal mining industry during the ore-dressing and extraction of metals with the use of chemical decomposition of ores (gold production, rare-earth elements, uranium, molybdenum and their oxides, etc.). In total on the territory of Kyrgyzstan there are 54 tailing dumps of functioning and wound up metal mining enterprises. The total amount of stocks of all tailing dumps and industrial sewage ponds according to the independent data is 109 million m3.

In Tajikistan industrial wastes are formed practically in all industries. Of the extracted in the country raw ore only 5-10% is used. The rest are the overburden rocks, poor ores and technological wastes. In the total amount of wastes the main share falls on in metal mining and processing industries – 77%, non-ferrous and chemical industries - 17%, food and light industries and mechanical engineering - 6%.

Different types of wastes are stored in the, sludge stockers and piles in the amount of 210 million tons. The total territory occupied by tailing dumps and different types of storages in the republic amounts to more than 1000 ha. Of 22 tailing dumps 14 are in satisfactory conditions, 8 require urgent rehabilitation. Complex relief and geodynamic features in mountainous conditions and shortage of land territories for construction and operation of tailing dumps do not allow in the present economic conditions to follow requirements for storage of wastes at the Anzobsky and Takobsky ore mining and processing enterprises.

More than 1 million tons of wastes of production and consumption are formed in Turkmenistan. Toxic industrial wastes are of the definite danger for environment and require special organization of storage and burial. There are only 4 well-arranged sites for toxic wastes: Mary Velayat, Dashoguz Velayat, Akhal Velayat and Lebap Velayat, where mainly invalid chemicals and pesticides are stored. Places of the specially organized storage and burial of industrial wastes are practically not available. Therefore enterprises have to dispose toxic wastes to the domestic wastes dumps or organize dumps at their industrial zones or at the other organized sites. At present in the storages, grounds, dumps 32.3 thousand tons of toxic wastes of production and consumption are stockpiled; 93% of the mentioned amount are concentrated in Balkan Velayat. More than 90% of toxic wastes are formed from oil-slime.

In 2004 1062.6 tons of toxic wastes were formed on the territory of Turkmenistan, mainly of the 3rd danger class (763.7 tons). Main polluting component of toxic wastes is oil-slime (92%).

In Uzbekistan facilities of power engineering, non-ferrous and ferrous metallurgy, chemical production and building industry are the main sources of environment pollution. Annual amount of wastes formation here is more than 100 million tons, more than 14% of which are toxic ones. The volume of utilized wastes amounts to about 0.2%, and the rest mass of wastes is stored in waste tips (tailing dumps, sludge ponds) on the territory of enterprises and insignificant their part on grounds (dumps) of solid domestic wastes. More than 300 sites of waste storage are there in the country.

In the mineral resource and processing industry the maximum amount of wastes is produced, which totals about 90 million tons per year.

In tailing dumps more than 1.3 million tons of ore-dressing wastes are stowed and in special piles great amount of dross from metallurgy industry is stored. Annual formation of the mentioned wastes in the complex amounts to, respectively, 25 million m3 of overburden rocks, 42 million tons of wastes of ore-dressing and 300 thousand tons of metallurgic industry dross. In non-ferrous and ferrous industries about 300 thousand tons of dross is formed annually.

Industrial wastes significantly influence the soil pollution. Mines of underground leaching contaminate not only surface but also air and ground water.

At the gold-mining and gold-washing sites soil contamination with arsenic, nickel, molybdenum and toxic elements is observed. So, in the sub-region of the Zaravshan River at the tailing dump of the gold-ore mine production (GMZ-2), in the radius of 3 km there was observed the soil contamination with arsenic from 3.5 up to 21 MPC, as well as with nickel and vanadium. High contents of arsenic, molybdenum, vanadium, chromium and copper were noticed in soils and around fields Dau-gyz-Tau, Amantai-Tau, Kokpatas, etc.

Domestic wastes. Efficient system of collecting and disposal of solid domestic wastes is very urgent first of all for protection of health of the population of all countries. Usual municipal solid domestic wastes contain more than 100 names of toxic compounds and among them are: dyes, pesticides, mercury and its compounds, solvent, lead and its salts, medications, cadmium, arsenious compounds, formaldehyde, thallium salts, etc. More than 4% of wastes are toxic. Special place among solid wastes is occupied by plastics and synthetic materials, which are not subject to the processes of biological decay. During combustion of plastics and synthetic materials numerous toxicants are emitted, including polychlorbiphenyls (dioxines), fluoric compounds, cadmium, etc.

In Kazakhstan up to 20 m3 of domestic wastes are accumulated annually. Dumps for SDW pose hazardous as sources of infectious and epidemiological diseases for people and domestic animals. In conditions of limited financial resources authorized dumps (grounds) are the cheapest and acceptable method of the long-term burial of wastes. Fundamental reconstruction of dumps and re-equipping them into the real grounds is required: wastes separation by fractions and composition, damp course, diversion of gases formed in wastes, covering wastes layers with clay, construction of green zones, etc.

In Kyrgyzstan the total amount of domestic wastes form about 15 million cubic meters. Increase of domestic wastes amount, complication of their chemical structure results in growing of danger for the health of people and environment. Accumulation of solid domestic wastes in cities amounts to 250-300 kg per capita annually. And annual increase of wastes per capita amounts to 4-6% that 3 times exceeds the rates of population growth.

In Tajikistan the average annual amount of SDW totals 3-3.5 million tons. Here the systems of selective collection of solid domestic wastes (SDW), as well as trash-utilizing and trash-burning plants are lacking. Utilization, reutilization and recirculation of wastes are not carried out here.

The lack of appropriate system of control and registration of SDW at wastes dumps does not allow observing requirements, which are contained in schemes of sanitary cleaning of cities and settlements.

As a consequence, the growth of the number of unauthorized and unregulated dumps takes place, which are located along the river banks, terraces, in neighboring to settlements the worked-out quarries, foundation pit of dwelling industrial buildings, including those, which are within the city boundaries.

In Turkmenistan the most accessible and quite reliable constructions for neutralizing solid domestic wastes are advanced wastes dumps (grounds) providing protection from contamination with observance of special environmental technological and sanitary rules. On average about 1 million tons of different types of wastes are accumulated in the country annually.

For instance, in 2001 these indicators reached 1287.0 thousand tons, and in 2003 they reduced to 992.7 thousand tons. These are mainly food wastes, glass, plastic, metal, building wastes.

In Uzbekistan about 30 million m3 of domestic wastes are generated annually, which mainly are stored at urban and rural dumps. At the same time with each million tons of domestic wastes 360 thousand tons of food wastes, 160 thousand tons of paper and cardboard, up to 55 thousand tons of textile, up to 45 thousand tons of plastic and many other valuable components are lost.

Analysis of activities of municipal services of republic showed that almost at all dumps techno-

logical, sanitary and ecological requirements are not observed during storage, neutralizing and burial of wastes. Dumps of domestic wastes do not have a design-technical documentation.

Wastes received at the dump are compacted and partially covered with ground; their composting is carried out without observance of technological regime that results in their self-ignition.

Considerable problem is the shortage of the specialized equipment for processing, utilization and transporting industrial wastes.

Radioactive wastes. In Kazakhstan the following belongs to the sources of formation of radioactive wastes:

- uranium-mining and processing enterprises and concomitant to them exploration work;
- metal mining and ore mining and processing enterprises;
- nuclear explosion;
- electric power and exploratoryэнергетические nuclear installations (of reactors);
- enterprises using radioisotope production.

The problem of burial of large-dimension wastes is of specific complexity (contaminated technological equipment, vehicles, ground), and industrial tailings and non-reclamated sites, where extraction and processing of uranium is carried out with open-cut method. For liquidation of radiation contamination of land, populated areas and equipment 1154 million USD are required.

The total area exposed to the radioactive contamination reached 6 thousand ha, where more than 145 million tons of radioactive wastes are concentrated. The largest threat of contamination persists in transboundary sub-region on the slopes of mountains in Ferganskaya and Chuisaya valleys (sub-region of town Miluu-Suu, settlement Shekaftar, town Kara-Balta, settlement Ak-Tyuz, etc.). According to the territorial factor radioactive and toxic wastes are located in Batkenskaya, Djala-Abatskaya, Issyk-Kulskaya, Narynskaya and Chuiskaya Oblasts.

For Tajikistan the important problem in waste management is collection, transportation and utilization of ionizing liquid and solid radioactive wastes formed at the enterprises of republic. In 44 km from Dushanbe the Republican Point for Radioactive Wastes Burial (RPRWB) is in operation. As a result of leaking of flood water there in 1993 the raise of the level of radioactive liquid wastes is observed in tanks. Joint study of the burial point by the relevant national structures and experts of IAGATE in 2000-2003 showed the necessity of carrying out measures for strengthening the physical protection of the point.

At enterprises of republic accumulated hundreds of sources of ionizing substances. At present inventory of such sources are made in order to create a databases and further undertaking of measures to render them safe.

In Turkmenistan there are heaps of activated charcoal at Khazar chemical and Balkanand iodine-bromine plants. On the territory of Khazar plant the centralized heap stores up to 18000, and at Balkanand plant 5000 tons of radioactive wastes.

At present on Cheleken peninsula in settlement Aligul at significant distance from the coastal line the building of a new burial ground for radioactive wastes has been completed.

In the sub-region of settlement Anew near Ashgabat a special point for radioactive wastes burial (SPRWB) is located. The cumulative activity of waste obtained here during the year is not high and does not exceed 1.05×10^{12} BK.

The concentration of radioactive substances is at the level of background values.

It should be noticed that on the territory of Turkmenistan nuclear tests are not executed, there are no, and were not industrial and other nuclear reactors, there is no uranium-extracting industry. Natural background varies within the range of 8-15 microentgen/hour.

In Uzbekistan the main source of radioactive contamination of environment are sites for mining and primary processing of uranium ores, other minerals containing increase amount of radioactive ele-

ments and places of storage of radioactive wastes.

During the post-war years extracting of radioactive ores had significantly increased. In the process of uranium extraction numerous heaps were formed both in the mountainous mining of uranium and underground dump leaching requiring regular deactivation and reclamation under the special program. In Uzbekistan and on the neighboring areas of Tajikistan and Kyrgyzstan there are tailing dumps, in which significant amount of radioactive nuclides are concentrated. Well-founded anxiety is caused by the state of tailing dumps of field Miluu-Suu. On the sites uranium extraction is performed with the underground dump leaching method, with which local contaminations of environment sometimes occur. The main reasons of contamination are leakages of technological solutions, breach of the pumping-pumpdown balance, and residual solutions at the operational areas.

Tailing dump of the hydrometallurgical plant located on the left bank of Zarafshan River near Navoee City is of the certain radiation danger.

Waste management. On the territory of CA countries in wastes piles, ranges, slime storages and other sites tens billion tons of production and consumption wastes are accumulated, including toxic and radioactive wastes.

Industrial and domestic waste storing and burial sites are operated with the violation of environmental requirements, in particular, they do not have screens preventing filtration of hazardous substances into underground water-bearing horizons and cause threat of contamination of water supply sources. In many storages of mineral resource mining and processing industry the erosion-preventive protection is not available that causes the precondition for soil and sir basin contamination and degradation.

Reduction of contamination of boundary and transboundary territories, experience exchange if the field of waste handling, harmonization of legal and normative-methodological provision are considered to be the regional priorities.

In order to solve the problems of waste management in Central Asia it is necessary to develop a Regional Program "Waste Management", including the definition of the policy in the sphere of waste management, legal regulation of waste handling, norm-methodological provision, economic mechanism of management and monitoring system of wastes. To realize the given program it is necessary to make inventory of existing tailing dumps and heaps with the estimation of their technical level and state, specification and study of flows, amounts and components of the formed and stored wastes, to estimate risks for the managerial decision-making.

Appropriate work for minimization of negative impact of sites of waste storage and industrial and consumption waste burial is done in Kazakhstan.

Enterprises of ore mining and processing and metallurgic complexes, enterprises of petrochemistry and heat-and-power engineering, coal open-pit mines carry out the technical rehabilitation of tailing dumps, ash dump, heaps of open-cast mines with the use of industrial wastes. So, in the most intensive in waste formation regions the percentage of using industrial wastes varies from 2% to 25%.

Small amount of wastes are used in technological chains of production and for building purposes.

At the ore mining and processing enterprise association (Kostanaiskaya Oblast) the following technologies of processing and neutralization of wastes: processing of mountain rocks for crushed rock, which is used for the building purposes, utilization of tailings of ore-dressing for extraction of collective sulphide concentrate at the floatation machine and its further processing at the mining and chemical industrial complex.

The use of off-balance ores from heaps of overburden rocks, including heaps located on the territory of settlement Maikain, was started in Pavlodarskaya Oblast. Introduction of environmentally appropriate technologies in production of copper-zinc concentrate has been scheduled.

Accumulation of significant amounts of wastes of production and consumption in Kyrgyzstan,

besides damaging the landscape, is related to the problem of their placing and consistent land amortization. Moreover, waste of ore dressing or tailings of flotation, fine-dispersated geological material treated with the chemicals, are the source of intensive pollution of air and water environment. The following belongs to the main problems of management of all types of production and consumption waste:

- big accumulation and progressive growth of amounts of production and consumption waste in the country;
- insufficient state support to establishment of complete management system of collection, storage and processing of all types of production and consumption wastes;
- the complex monitoring, control and mechanisms of executing the laws on wastes;
- lack of unified system of accounting and reporting, collecting payments for wastes;
- Low level of observance of sanitary and hygienic and environmental requirements for collection, storage and utilization of wastes;
- insufficient cooperation in the issues of transboundary waste management;
- low environmental literacy of the population in the issues of production and consumption waste handling.

In Turkmenistan the most important problem in preventing of negative impact on environment is the problem of waste utilization.

In the country the estimation of main elements and stages of oil tailings treatment and utilization is carried out. At the Turkmenbashi complex of oil refinery plants the methodology is used for complex treatment and utilization of oil tailings, which includes the deep reagent treatment in cavitational fields with further encapsulation of solid residual.

At present a mobile device "Duna 2m" has been produced.

At the Khazar chemical plant the reconstruction and introduction of efficient technologies of deposition of technological carbon is under way, and building of special site for toxic waste burial to the sum of 51 billion manats is on the final stage.

In Ashkhabad the old municipal dump was closed down and a new trash dump was moved outside the city border.

In Tajikistan Goals of the national policy in waste management consist in stabilization and reduction of levels of environment contamination related to waste, and saving of natural resources by reusing and recirculation of waste.

For the purpose of providing economic incentives to enterprises for reduction of waste formation, for involving them in recurrent turnover and introduction of low-waste technologies from 1993 the state policy has being realized stipulating obligatory payments for placing wastes in natural environment.

In 2002 the Law of Republic of Tajikistan "On Production and Consumption Waste", which defines environmental requirements in waste disposal and accounting in economic regulation for reimbursement of environment contamination and imposing penalty provisions.

In 2003 the Law of Republic of Tajikistan "On Radioactive Security" was adopted and the Agency for Nuclear and Radiation Security was established.

At present the stage of forming a system of legal, economic and normative conditions ensuring reduction of material resources losses, increase of amount of using of wastes of production and consumption, as well as utilization and disposal of wastes. Establishment and further improvement of this system is the main aim in strategic trend for minimization, utilization and disposal of wastes. For achieving this aim significant work is being dome in this direction.

For the purpose of minimization of production residue during 1997-2000 under the support of UNIDO demonstration projects were implemented in republic for introduction of clean production.

Based on the obtained results a methodology of complex estimation of the class of wastes danger

has been developed, based on which the ecological and hygienic classificatory of wastes will be elaborated. Investigations are carried out for substantiation of measures for utilization of resulting gas at site of depositing solid domestic wastes.

CHAPTER V. PARTICIPATION OF COMMUNITY IN DECISION-MAKING

Currently about 400 non-governmental organizations are functioning in Central Asia, many of which are united into the structure called "Ecoforum NGO". In the structure of ecoforum there are the relevant coordinative councils working in special subjects.

14 October 2003 the Civil Environmental Forum was held in the capital of Kazakhstan Astana, where the Declaration on Mutual Cooperation between the Ministry of Environment Protection and nongovernmental public organizations was adopted.

In September 2004 under the proposal of the Conference in Uzbekistan an Ecoforum was established with the participation of representatives of 48 environmental nongovernmental organizations.

Ecoforum NGO of Uzbekistan has become the form of consolidation of environmental organizations' efforts in order they could participate in the national and international environmental programs and projects, in decision-making on the issues of environment and sustainable development.

Under the supervision of Ecoforum a program was developed for environmental monitoring, environmental expertise, environmental education, etc. the access to environmental information is provided through publishing and distribution of the relevant materials (for instance: NGO "Armon" issues a bulletin "Environmental Security and Civil Initiative", NGO "Tashkent Infocentr" has issued a series of article collections of the leading journalists-ecologists "Writing Simply about Environment"), through periodicals, TV and radio broadcasting, web sites, etc.

The Laws "On Environment Protection" of all countries of Central Asia assign the rights of public organizations to receive the timely and complete information about the state of environment, about results of conclusions of the State environmental expertise, information on the planned for construction sites.

In Tajikistan the Law "On Public Associations" was adopted, in which nongovernmental organizations are considered as independent juridical persons and have the right of participation in the development of draft legislative acts, control of the law observance. Holding of various measures, workshops, trainings, conferences, actions, campaigns, exhibitions, festivals on environmental issues by national organizations together with public organizations allow to widely informing the population at the local level.

The most active NGOs in Tajikistan are: "Squad for Nature Protection", which deals with the formation of public opinion through cooperation with mass media; "For the Sake of the Earth", activity of which is aimed at the formation of people's perception of environment and sustainable development problems, upgrading of their role in decision-making participation; "Youth Environmental Center", supporting youth's initiatives for improvement of the quality of environment, capacity building of the local societies in solution of problems of poverty and sustainable development.

In Kazakhstan the NGO "Ecom, Ecology and Public Name" is actively functioning with the mission for formation of the public opinion in the sphere of environment, sociology, lobbying and direct participation in the work of environmental projects for environment improvement and population's health issues. NGO "Young Generation for Environmental Security and Sustainable Development" popularizes environmental knowledge among the population of all age groups.

NGO "Green Movement" assists with the help of nongovernmental methods to solve the environmental problems, to collect information and be an independent source of information on various aspects of public life. NGO "Ecology of the 21st Century" carries out educational work among schoolchildren and students. NGO "Ecocenter Tau" participates in organization and carrying out of environ-

mental measures in mountains of Zailiisky Alatau and in Almaty. "Nevada-Semipalatinsk" holds conferences and workshops on the issue of protection of people suffered from environmental disaster at the Semipalatinsk ground. In 2005 a Center of Environmental Information was established at the Ministry of Environment Protection of Kazakhstan.

In Kyrgyzstan an NGO forum was held in 1997, on which a resolution for activating nongovernmental organizations was adopted such as NGO "Tebigat", which has affiliated societiesr in all cities, "Diem" dealing with the environmental education in schools and infant schools, NGO "Independent Environmental Expertise" participating in the elaboration of laws and by-laws on ecological issues, "Association of Kyrgyz Women for Non-Nuclear World and Environmental Security".

In Turkmenistan mass measures take place under the slogans "In Chime with Law and Nature", "Care: Fires", "Let's Conserve Primroses", "A drop of Water is a Nugget of Gold", "Let's Conserve the Nature of the Caspian Sea", etc.

In order to provide the participation of public organizations in decision-making the Department on Cooperation with Public Organizations was established within the system of the Ministry of Nature Protection of Turkmenistan in early 2004. Public associations for nature protection of Turkmenistan actively participate in establishing the forest belt around the capital Ashgabat and other cities and populated areas. In 2005 the forum of public and nongovernmental organizations with environmental profile was held in order to establish the RIOD network in Central Asia. At the Turkmen national television a 30-minute weekly broadcast "Nature of Turkmenistan" is televised on a voluntary basis.

Ecological NGOs of Uzbekistan with the participation of representatives of the State Committee for Nature Protection (Goskomprirody) held the action "River for Everybody, Everything for River", the results of which were discussed at the relevant workshops.

In Kazakhstan the Law "On Administrative Procedures" was adopted in 2000. In 2002 within the project for assisting Kazakhstan in the implementation of the Aarhus Convention carried out under the support of the Denmark Agency for Environment Protection trainings were held for representatives of environmental nongovernmental organizations as well as lawyers and judges of the Supreme Court. On 1-4 November 2004 under the support of OSCE the workshops on the Aarhus Convention were held for judges and environmental prosecutors from all regions of Kazakhstan. During the training the judges were informed about requirements of the Aarhus Convention concerning the access of the community to the public justice, specific attention was attracted to the cases of dragging out hearings of environmental cases in courts initiated by citizens and nongovernmental organizations, groundless refusal to consider the applications, non-recognition of NGOs as representatives of citizens' interests in the court.

In compliance with the Agreement between Uzbekistan and European Community about partnership and cooperation of 30 August 1996 Uzbekistan undertook obligations for gradual achievement of compatibility of its legislation with the legislation of the European Community.

The legislative base was formed in Uzbekistan establishing legislative foundations for the freedom of the access to the justice in protection of the rights of the population to live in favorable environment. So, for instance, NGO of Nukus City has won the court hearing concerning illegal location of a collector of return-drainage waters on the territory of the Badai-Tugai Reserve. NGO "Arnon" assisted citizens of block 6 of the massif Bilinear of Tashkent City in preparation of the claim concerning the fact of illegal actions of khokimiyat (municipal administration) in putting up for auction the territory neighboring to houses and further land expropriation that resulted in annihilation of valuable species of trees.

In the states of Central Asia all the necessary legislative conditions have been created for the access of the community to the administrative and judicial procedures in all three categories of the "Aarhus" cases on the access to environmental information: participation in decision-making on special projects and other activity: appeal against actions of private persons and state bodies violating environ-

mental legislation.

CHAPTER VI. INTERNATIONAL COOPERATION IN THE FIELD OF ENVIRONMENT PROTECTION AND SUSTAINABLE DEVELOPMENT

At present the heads of states of Central Asia adopted several joint political declarations determining fundamental principles of regional cooperation in the field of environment protection and sustainable development.

All countries of Central Asia take active part in regional cooperation in the field of environment protection and sustainable development: within the framework of International Fund of the Aral Sea (IFAS) and its working bodies, Interstate Coordinative Commission for Water Management (ICWC) and Interstate Sustainable Development Commission (ISDC). Representatives of ministries of economy, environment protectionB and scientific organizations of Central Asian countries work in the ISDC. Under the financial and technical support of UNEP, ADB, UNDP the Regional Environmental Action Plan (REAP) was developed. REAP implementation is one of the real opportunities to consolidate efforts of Central Asian countries in solution of common regional problems and ensuring of sustainable development in Central Asia.

For enhancing the contribution of the civil society and NGOs in joint solution of regional environmental problems and problems of sustainable development the Regional Environmental Center of Central Asia (REC CA) was established in Almaty in 2000 under the initiative of Central Asian countries.

Nowadays countries of Central Asia can develop an independent, weighted environmental policy and implement cooperation in the sphere of environment protection at the regional and global level. Transition to the environmentally grounded sustainable development is the priority for the development of countries of the region. Significant amount of international conventions requiring appropriate national actions has been signed for strengthening environmental activities.

At the same time countries of the Central Asian sub-region do not find many common aspects, which would be able to encourage them to the actually integrated process. Growing globalization will objectively secure their integration in a number of positions. Therefore globalization can be considered as a process integrating countries of the sub-region into the regional association with the conservation of the state sovereignty of the countries, members of this association. If the process of globalization is managed in a proper way, with its help it will be possible to ensure the sustainable development in the interests of all parties.

Countries of Central Asia are connected between each other with common historical, cultural and economic roots that promote their cooperation in the environmental sphere. The nature predestines the coexistence of countries in CA in common ecosystems and sequential their interdependence in the issues of water, energy, transport, tourism and many other. For the future of CA countries it is beneficial in every respect to define common interests and goals as quickly as possible as the foundation of subregional cooperation.

In 1993 presidents of countries of Central Asia signed an "Agreement on Joint Action for Solution of Problems of the Aral Sea and Aral Sea Zone, Environmental Enhancement and Socio-Economic Development of the Aral Sea Region". For its development the International Fund of the Aral Sea (IFAS) was established. The main objective of the Fund is financing and crediting of joint practical measures and long-term programs and projects for rehabilitation of environmental, socio-economic situation in the zone of the Aral Sea crisis. Permanently acting executive body of the Fund is the executive Committee (EC) with branch offices in each of the CA countries. The Interstate Sustainable Development Commission (ISDC) is the member of the Fund, with its Scientific-Informational Center (SIC), which has their departments in all countries of CA.

More than ten-year experience of new independent countries CA has shown that uncoordinated efforts of separate sectors, countries or international organizations do not give expected results and do not promote the resolution of impended tasks in the sphere of environment and development of the region. Destruction of the ecosystem of the Aral Sea, degradation of mountain ecosystems, reduction of land fertility, irrational water use, etc., can serve an illustrative example for this.

After the conference RIO-92 the process of establishing Commissions for Sustainable Development as bodies ensuring efficient participation of the country in solution of issues of sustainable development of the sub-region and world community, improvement of interdepartmental coordination and implementation of practical action plans.

In 1995 the National Council on Sustainable Human Development was established in Kyrgyzstan, and in 1997 in Uzbekistan there was established the National Commission on Sustainable Development (NCSD).

In 1997 the National Council for Sustainable Development was established in Kazakhstan and in 1998 the National Commission on Sustainable Development – in Tajikistan. However because of insufficient understanding of objectives and priorities these structures did not have noticeable influence of the process of decision-making in the field of sustainable development. The State Commission on Ensuring Commitments of Turkmenistan ensuing from Conventions and UN Programs on environment was established in Turkmenistan in 1999.

In the course of preparation to WSSD at the regional conferences of ministers of the European sub-region (Geneva, 2001) and Asian-Pacific sub-region (Cambodia, 2001), as well at the Summit itself (Johannesburg, 2002) Ca countries received significant support of the Central Asian initiative on sustainable development (CAI). The final goals of CAI are the prevention of ecosystems degradation, improvement of water supply, poverty reduction, education development, achievement of other Goals of Millennium for the period till 2010- 2015. CAI entered into the final official documents of WSSD - Johannesburg Implementation Plan and Partners Initiatives, and is the foundation for further cooperation of CA countries with the world community in the implementation of the Summit decisions.

In March 1998 countries of Central Asia, UN European Economic Commission (EEC) and UN Economic and Social Commission for Asia and Pacific (ESCAP) adopted the Special UN Program for economies of Central Asia. The aim of the Program is to assist to the states of Central Asia in deepening of their mutual cooperation as well as cooperation with countries of Europe and Asia.

The 5th Al-European Conference of UN EEC Ministers (May 22 2003, Kiev) has become an effective event, at which countries of CA have reached:

- in the final Declaration of the Conference there was included a separate paragraph envisaging the preparation an Agreement on partnership between CA countries and world community in uniting efforts of all sides for realization of goals of sustainable development in CA;
- countries of CA have signed a Memorandum, in which they demonstrated the unified platform and desire to consolidate cooperation with all other interested countries and organizations ;
- in final conference document proposals of CA countries on development of environmental education and education for sustainable development were represented;
- a decision was made about holding the next conference of parties of Aarhus Convention in Almaty, Kazakhstan, in May 2005.

It should be noticed that the national environmental authorities of the Central Asian countries not having enough influence on ecological aspects of the national policy were not able to allocate funds for significant increase of financial resources for the purpose of environment protection and sustainable development.

Besides national and regional structures there exist and actively interact a number of international and nongovernmental organizations dealing with the issues of sustainable development. UNEP, UNDP,

GEF, Tacis, EEC, USAID, ESCAP, ADB providing the technical and financial assistance to the governments of Central Asian countries belong to them. With their assistance a number of projects in different aspects of environment protection and sustainable development are realized in the region.

From the second half of 1990s a new regional initiative of EU is realized concerning the countries of Central Asia, which aims at providing the economic and technical assistance to the states of the region. For implementation of this policy a Special Program for Central Asian countries (СПЕКА) was developed. Nominally SPECA is realized under the aegis of two regional economic commissions of UN — European Economic Commission (EEC) and Economic and Social Commission for Asia and Pacific (ESCAP).

In March 1998 heads of Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan as well as executive secretaries of EEC and ESCAP signed the Tashkent Declaration about SPECA establishment. Turkmenistan acceded to the program in September 1998.

The goal of the SPECA Program is the implementation of certain projects in socio-economic sphere. In 1998 in Tashkent there were approved 5 priority projects in the sphere of transport, energy, environment protection, assistance to the small and medium business development as well as medium entrepreneurship. Exactly these spheres are vitally important for the region; they play determinative role in socio-economic development of Central Asian states. Each of 5 countries began coordinating one these priority projects:

- Transport infrastructure and simplifying of procedure for crossing the borders (country-leader is Kazakhstan);
- Rational and efficient use of energy and water resources of Central Asian countries (Kyrgyzstan);
- International economic conference on Tajikistan, joint strategy of regional development and attracting foreign investments (Tajikistan);
- Regional cooperation in the sphere of development of multi-optional approach to the definition of routs of shipment to the world markets of hydrocarbon compounds through pipelines (Turkmenistan);
- Reforming of industrial potential of the sub-region with the purpose of establishing international competitive industrial enterprises (Uzbekistan).

Within the framework of ISDC under the support of UNEP, UNDP and ADB the process of development and realization of the Regional Environmental Action Plan (REAP) has been commenced in the region. A special working group of official representative of all Central Asian countries for considering incoming projects and including them for the priority financing within REAP.

Accedence to and ratification of international legal documents in the sphere of environment protection and development is an important element of implementation by CA countries of their commitments to international community. At present all five countries of the sub-region have signed and ratified the following documents: Convention to Combat Desertification, Convention on Biological Diversity, UN Framework Convention on Climate Change. Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan have ratified the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters and Health. Work is being done in Uzbekistan to accede to this Convention.

Ratification of International Conventions in CA countries is the evidence of the fact that the sub-region aspires to become the equitable participant of the world community observing norms of international law in the sphere of sustainable development and, consequently, reforming the existing legislation in accordance with the world standards. In these issues the leading country of the sub-region is Kazakhstan. So, by present Kazakhstan gas ratified: 19 international environmental conventions, among which 4 are global conventions: on biodiversity, to combat desertification, Framework Convention on Climate Change, Vienna Convention on Ozone Layer Protection; 5 conventions of the UN European

Commission, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, etc. The sign documents are: Kyoto Protocol to UN Framework Convention on Climate Change, Stockholm Convention on Persistent Organic Pollutants and Framework Convention on Protection of marine environment of the Caspian Sea.

At the same time, the necessity of acquiring their own regional convention on the issues of environmental security and sustainable development is obvious. In Almaty Declaration adopted in 1998by heads of states oh the sub-region it is declared about the aspiration for the preparation of such Convention. At present under the decision of ISDC the Framework Convention on Environment Protection and Strategy of Sustainable Development of Central Asia.

The feature of contemporary development of the sub-region is endeavor of states to both the integration to the world economic area and to the integration with regions of Europe and Asia, inside the subregion. Under the initiative of Kyrgyz Republic the Central-Asian Mountainous Charter (Declaration) has been prepared and approved, according to which the Member-States of the Central-Asian Mountainous Charter: Republic of Kazakhstan; Kyrgyz Republic, Republic of Tajikistan, Turkmenistan, Republic of Uzbekistan agreed that mountainous territories should be used only under conditions of the optimal combination of environmental, social and economic interests.

Development and realization of interstate projects on the use, protection and reproduction of natural resources, handling of wastes of transboundary character, as well as development of infrastructure in mountainous territories should use the wide state support. Monitoring, management, protection and reproduction of transboundary natural resources of mountainous territories, handling of wastes of transboundary character, should be implemented on the basis of two- and multilateral interstate agreements. Cooperation in the field of protection and use of resources of mountainous territories is implemented on the basis of equality, mutual benefit and in compliance with the national laws of the Central Asian countries.

Recognizing the necessity of further efforts on stabilization of environmental crisis in the Aral Sea basin five states on March 26, 1993, adopted the Agreement on Cooperation Development in Subregion Water Resources Management. Under the Agreement of July 19, 1994 one more body was established: Interstate Commission of Socio-Economic Development and Scientific, Technical and Environmental Cooperation, the name of which was later changed for Commission on Sustainable Development (CSD).

At the meeting of Heads of states in February 1997 for discussing activities of the given regional organizations МГСА and IFAS were united into the new, renewed IFAS. Executive Committee of IFAS, which is urged to solve issues in agriculture, water resources management and environment.

In Ashkhabad Declaration of 1999 is it noticed that on the threshold of the 21st century the mankind faced with serious environmental problems impeding its sustainable development. Environment degradation is the result of irrational use of natural resources. Consequences of the Aral Sea crisis negatively affected the quality of life of the Central Asian population, problems of social security and clean water supply became more intense.

States of Central Asia permanently pay attention to improvement of the situation in the region, attracting international community for solution of these problems. Together with the international organizations and funds the regional project "Water Resources and Environment Management" has been implemented under the support of the Global Environmental Facility, which is aimed at the fundamental improvement of the water and other resources utilization, raise of efficiency and culture in nature use in the sub-region and enhancement of environmental situation in general.

For Central Asian countries one of the most urgent tasks is the development of the long-term governmental policy aimed at the solution of strategic and current tasks of socio-economic development, simultaneously ensuring solution of environmental problems. All preconditions for integration are available in countries.

Regional cooperation of countries of Central Asia in the field of environment protection will serve in future the foundation for integration in the field of sustainable development within the framework of programs of the European and Asian-Pacific regions.

One of the main problems for sustainable development of Central Asia is the problem of water resources use. Agreement, according to which in 1992 the ICWC was established, includes the issue on interstate cooperation, which in the number of issues excels the achieved in other international basins. However, unfortunately ICWC could not provide the foundation for the complex solution by countries of water-economic problems. For instance, water quality issues are not solved by ICWC, responsibilities of countries of the basin are nor considered concerning the planned in the unilateral order water resources use, and measures, which can affect the interests of other states of the basin. It did not defined obligations of the countries in case of floods, droughts and other natural disasters, and the order of the data exchanged has not been considered. Ministers of water economy of CA countries were entrusted with the responsibility of solution disputes on water apportioning. However controversial issues in this area it also did not consider.

In wider scale, recognizing potential damage, which can be caused in case of uncoordinated actions, Heads of CA states emphasized the necessity of revision of the adopted earlier agreement on water apportioning in the Aral Sea basin.

Kazakhstan and Turkmenistan for the purpose of expansion of international cooperation in the field of environment protection and sustainable development entered the Framework Convention on Protection of the Marine Environment of the Caspian Sea.

This is the first regional convention on the regulation of anthropogenic impact on marine environment of the Caspian Sea, protection and rational use of hydrocarbon , biological and other natural resources of the Caspian Sea, as well as procedure issues of adopting the joint decisions by the states of the Caspian Sea zone.

Recommendations

Comparative assessment of modern condition of environment of Central Asian region have put out several tasks, part of which is at the solving stage, and the other stage which is crutual and needs to be solved in the nearest time.

Below is the list of recommendations on the most priority issues in the filed of environent protection.

Pollution prevention of ambient air. Strategic actions on development of action on pollution reduction of ambient air in the cities and inhabited localities are the following:

- Wide environmental policies for production industry;
- Introduction of economic press to stimulate minimization of pollution;
- Improvement and strengthening the Environmental Laws in the Industry filed;
- Creation of the State information system of monitoring over the air quality at local, national and regional levels;
- Step by step replacement of traditional fuel to alternative;
- Strengthening control system over technical conditions of existing transport.

Main measures foresee the following:

- Creation of the technical control system over the Greenhouse effect gases emissions;
- Technical reequipment of the heating industry and municipal services;
- Development of energy production on the bases of steam and gas and gas-turbine units;
- Developing of the potential of small hydro energy;
- Introduction of the counting devices for the natural gas and heat energy;
- Carrying out a considered tariff policy;
- Development of renewable energy sources.

Implementation of the measures for emissions reduction (transport waists and other movable pollution sources) by making the following:

- Strengthening of control measures;
- Improving the fleet structure and optimal transformation to diesel;

Implementation of the measures on fuel quality improvement, including the lead withdrawal from gasoline by making the following:

- Reconstruction of oil refineries in order to transform to production of lead free gasoline;
- Organization of production of gas-cylinders equipment to transfer the vehicle to compressed natural gas.

At present moment, the necessity of studying the energy potential **(renewable energy sources (RES))** stands clearly:

- Analyses and assessment of energy potential of provided solar radiation and based on it, conduction of theoretical research measures on its usage;
- Analyses of wind power resources and based on the analyses, development of wind load map and usage methods. Conduction of effectiveness research of wind power units;
- Analyses and study of biotechnologies, development of measures to generate electrical energy;
- Study the potential of generating hydro energy at the small water ways, e.t.c.

Based on the energy potential of renewable energy sources research the necessity of concepts development of RES for the period 2020 - 2030 years in Central Asian countries stands clearly. The outcome of the concept development would be – development of separate State Action Programs as well as Sub-regional development concept and use of RES in CAR.

Further perspective should foresee:

- Implementation and improvement of above mentioned primary measures;
- Introduction of vehicle import regulation measures;
- Introduction of differentiated taxation for the consumption of pollution free type of fuel as well as introduction of taxation system or other type of collection from transport means;
- Use of alternative types of transport (battery-driven vehicles, bicycles e.t.c.);
- Development and improvement of effective system of public transport;
- Execution of transformation of cargo transport from the highways to rail roads;
- Establishment and provision of strict norms related to the inspection of transport means;
- Introduction of catalytic neutralization system of exhaust gases;
- Development of own standards and norms of pollution in the exhaust gases of new vehicles and other transport means that would comply with European/International standards;
- Introduction of automatized air pollution control systems at the highways;
- Development of Gas analytical equipment for toxicity and emissions control of the exhauseted gases.

In perspective, the following will be the key tasks:

- **Use of economic instruments**: regulation of tariff policy; provision of counting equipment; introduction of standards and certification for energy consuming and widely applied equipment; introduction of national standards fro emission of carbon dioxide and marsh gas;
- **Institutional strengthening**: regular conduction of emission inventory and greenhouse gases; share distribution of CO_2 and marsh gas between the economy branches; creation of market infrastructure for handing over reduced emissions volumes on the bases of implementation of particular projects; Creation of National Funds on clean development mechanism;
- **Implementation of technical measures**: introduction of new technologies generating the electricity; development of combined production of heat and electrical; modernization of small size heating plants with equipment replacement; development of renewable energy sources; transfer of transport fleet to natural gas and other.

At present moment, a number of measures is implemented in Central Asia, for instance, periodical price increase for basic energy carriers, placement of gas, cold and hot water meters, construction of small hydro electrical power plant, several separate projects on solar energy generation, transfer of transport fleet to natural gas and other.

Priorities in implementation of projects on reduction of greenhouse gas emissions should be given to energy sector of national economy, which has the most potential for greenhouse gas emission reduction.

The potential of emissions reduction in energy sector will be fulfilled if following, very important and specific issues are solved:

- provision of energy price compliance with economic costs, and if possible, considering social and environmental costs;
- Creation of bodies, responsible for improvement energy use effectiveness;
- Creation of education system, teaching and informing energy consumers;
- Creation of economic and financial stimulating motives, in other words, any form of finance support to increase the effectiveness of energy use (tax decrease, grants and awards);
- Provision of normative regulation and standardization of energy consumption;
- Development of energy provision programs in CA countries for future perspectives on the bases of existing scientific and technical knowledge, simultaneously implementing the most effective, low cost projects of the existing development programs;
- Development of the use strategy of RES and special program of development off-center renew-

able energy sources for a long term perspective.

The potential of emission reduction of greenhouse gas could be implemented fully only if technical measures will be done along with improvement legal bases. Improvement of structure of industry funds e.t.c., as well as improvement of information level of population on the energy saving issues, on effective technologies and meter equipment.

To prevent pollution of water resources, the following has to be done:

- Harmonization of legislation of CA countries in the filed of water recourses protection taking into account the existing international experience in the filed. Development and approval of coordinated measures on pollution decrease of interstate waters.
- Improvement of existing water management system on the bases of integrated management of river basins. Develop a mechanism of rational use of interstate waters along with ratification of Interstate agreements, creating the interstate bodies on joint use of water resources;
- Provide for rational use of water resources by introduction of new water saving technologies, vicious and circulating water use systems, excluding drainage system to natural water sources.
- Conduct an audit of all pollution sources in order to elaborate reconstruction proposals, modernization of existing and construction of new sewage disposal plants. Introduction of water saving technologies in the manufacturing sector. Development and implementation of measures to provide for save maintenance of tailing dumps and rock dumps;
- Introduce economic mechanisms, create and evolve drinking water quality monitoring system. Pass water economy objects to municipal balance;
- Discontinue chops of sewage and waste waters to water sources;
- Develop and introduce methods of manifold-drainage water treatment and its reuse;
- Develop irrigation norms and standards for water quality that is used for irrigation. Regulate the use of chemical fertilizers, herbicides, pesticides, defoliants and other, limiting its dissemination to water objects;
- Continue works on provision quality water to population, creation of protected areas in the fields of underground water deposits and drain waters collection.

Prevention of land degradation:

- Improvement and harmonization of land cadastres, monitoring of land conditions in Central Asian countries;
- Harmonization of legislation of land tenure, taking into account peculiarities of socio economic development of the countries of the region;
- Creation and implementation of unified regional program and action plan to combat desertification;
- Stimulating development of farming in agriculture and cattle breeding;
- Conduction of obligatory and preventive measures at the irrigated lands (rationing water use, phytoirrigation, introduction of cotton-Lucerne crop rotation);
- Prevention of erosion processes and deflation of soils (following developed regulations and rules of pasture circulation, implementation of a number of preventive measures in erosion unstable zones);
- Applying a complex agro technical and agro irrigative methods for quality improvement of land resources;
- Conduction of measures aimed at rehabilitation of degraded growth by cattle breeding and industrial developing of sand territories;
- Creation of filed protection forest strips at the agricultural lands;

- Regulating the use of chemical fertilizers and chemical plant protection means, gradual transition to organic fertilizers;
- Forest phytoirrigation of dried bottom of Aral sea and impact zones of salt dust aerosols;
- Informing and involving population into land resources management;
- Improvement of institutional conditions on combating land degradation;
- Reestablishment of mountain, desert and flood-plain forests in order to strengthen slopes, rivers stabilization, re-cultivation of man-caused disturbance of lands;

On saving biodiversity.

- Protected environment territories should have priority status for solving the management problems of such.
- Development of environmental education and population informing in saving the biodiversity
- Increasing the environmental education level of institution/organization/factory managers' on legal and regulatory statements on flora and fauna protection.
- Development of protected territories (PT) and synchronizing of existing reserves and preserves with set tasks.
- Preparation of highly qualified specialists on nature and biodiversity protection at the universities and colleges of the country.
- Development of eco monitoring at the reference regions for obtaining up-to-date information on condition and numbering of the habitation places of rare and endangered flora and fauna.
- Breeding/raising of rare and endangered species and plants.
- Rationalization of biodiversity use for improvement of environmental situation.
- Creation of state program on development of information network of PT based on recommendations of interstate project on creation of ECONET in Central Asia.

On prevention mountain ecosystems degradation

- Harmonization of legislative and regulatory statements in the field of rational use of nature resources, nature protection and development of mountain territories.
- Support to local initiatives, plans of socio economic development of mountain territories considering the interest of the mountain regions.
- Declaration of the mountain regions as national cultural, humanitarian and nature property of all society and state.
- Creation of legal conditions for effective implementation of personal potential and economical development of mountain territories.
- Development of regional complex program on studying problems of mountain territories.
- Development of scientific approaches to study mountain territories within the frames of International biosphere-geosphere programs (IGBP), and programs of International Association of Science Academies of CIS (IASA) «Global climate change» and «mountain geoecology and sustainable development»:
    - Long term monitoring and analyses of change indicators nature environment in mountain regions (monitoring of water resources, including the dynamics of glaciations; change in flora and soils; change of the water balance in the water collecting basins);
    - Development of integral models of environment change in various ecosystems of region;
    - Studying the process of differentiation of mountain water collection basins (setting the impact reaction indicators of mountain ecosystems by various factors; analyses of water flow and its dynamics; interactions between formation and functionality of ecosystems;
    - Sustainable nature use and nature resource management (changes of the forest resources; intensification and/or extensification of agriculture in mountains in the context of food

safety; changes in the water resources usage).

- Improvement and renewing national emergency system management.
- Improvement of legal policy to stimulate mountain tourism.
- Preparation of specialists in the field of mountain regions development.
- Support and development of intercommoned relations at the border territories of mountain regions.
- Reestablishment of support of traditional nature use systems, cultural and nature heritage of mountains and mountain people.
- Support of inter border cooperation through the system of bilateral and multilateral Agreements, Treaties and Conventions.
- Creation and development of information network on problems of the development of mountain territories. Development of information connections between mountain territories.

On waist management

In order to solve the researched issues of waist management, it is planed to implement several short and long term activities. At the same time, all stages of waist management should be touched: education, placement, collection, transporting, sterilization, use, processing and disposal. One of the practical ways of solving these tasks is sorting of waists in order to get maximum of useful components that contained in the solid waists and its return to goods cycling as a raw material, as far as they contain valuable components and its further recycling.

Provision of environmental stability in Central Asia, improvement of system and development of effective mechanism of integrated waists management foresees the following:

- Develop Regional Program and National Strategies of waists management, implementing which should be done with inventory of existing tailing dumps and dumps with estimation of its technical level and condition, specification and study of flows, volumes and components formed out of waists. Conduction of risks assessment for decision making processes.
- Develop an action plan on implementation of National program and National strategies on waist management;
- Form a unified coordinating structure, provided with credentials of waist management and information provision to the population;
- Introduced progressive international experience in the field of waist management;
- Improve legislative regulations of waist management and interaction of state and municipal structures;
- Develop and introduce economic instruments, stimulating development of clean and low waist manufacturing;
- Develop stimulating instruments to lower waists forming;
- Assist in development of mid and small business in the field of waist management, maximize waist utilization, its safe recycling and reuse;
- Improve state system of control, collection and registration, transportation, sterilization and storing waists;
- Identify main criteria for implementing state monitoring of waist management;
- Optimize the tariff collection, transport and utilization;
- Create stock markets of secondary raw materials in order to solve problems of waist management;
- Creation of the system of continuous environmental and valeological;
- Conduction of information enlightening activities;
- Wide introduction of constant complex multi level environment monitoring and population health (especially children);

Annex

Tables of indicators of sustainable development of Central-Asian countries

WATER RESOURCES

Definitions:

Water resources – the surface and underground water reserves, which are used and can be used.

Water resources protection – the activity, which is aimed on protection and replenishment of water entities. The basic are the parameters describing a water-intake, water consumption and water removal, dump of the fouled sewage waters in natural water entities.

Volume of annual water consumption of ground and surface waters – Volume of water resources withdrawal (intake) from surface reservoirs (including the seas) and underground horizons with the aim of further usage of water. This parameter does not include volume of water dropout through hydrounits for production of the electric power, lockage of ships, fish dropout, maintenance of shipping depths and others.
Units of measurements - million cubic metres per year.
Type of the indicator - impact indicator.

Water consumption (usage of water) – Usage of the water resources from various sources for satisfaction of economic needs. The circulating water consumption, as well as re-use of waste and collector-drainage water are not included in it.
Units of measurements - cubic metres per year.
Type of the indicator - impact indicator.

Water usage for industrial needs – Volume of water consumption for the technical (technological) purposes in the industry, on transport, in construction and other branches of economy, including volume of the fresh water incoming on additional charging of circulating water-supply systems.
Units of measurements - % from total amount of annual water consumption.
Type of the indicator - impact indicator.

Water usage for irrigation, watering and agricultural water supply – Includes volumes of the water for vegetative watering, moisture charging, needs of animal industries and of some other purposes, including drinking needs of the rural population.
Units of measurements - % from total amount of annual water consumption.
Type of the indicator - impact indicator.

Water usage for household needs – Volume of water consumption for satisfaction of all household and municipal needs of the population (including the persons working at the enterprise).
Units of measurements - % from total amount of annual water consumption.
Type of the indicator - impact indicator.

Water consumption per capita – Volume of annual water consumption for household needs attributed to the number of population.
Units of measurements - cubic metres per capita.
Type of the indicator - state indicator.

Annual withdrawal of surface and ground water per capita – Volume of water per capita from volume of annual ground and surface water withdrawal, i.e. volume of annual water withdrawal of ground and surface water attributed to the population.
Units of measurements - cubic metres per capita.

Type of the indicator - state indicator.

Share of the population with access to the drinking water – Percent of the population with access to tap water.
Units of measurements - percent (%).
Type of the indicator - state indicator.

Share of the population with access to sanitary conditions – Percent of the population with access to sewer system.
Units of measurements - percent (%).
Type of the indicator - state indicator.

Biochemical Oxygen Demand (BOD_5) – is the amount of oxygen consumed for fixed time at biochemical oxidation of substances contained in water in aerobic conditions.
Units of measurements - one milligramme of oxygen per 1 litre (mg O_2/l).
Type of the indicator - state indicator.

Volume of refined sewage - amount of the processed sewage with the purpose of destruction or removals specific substances and elimination of their damage effect on environment.
Units of measurements - million cubic metres.
Type of the indicator - response indicator.

KAZAKHSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Annual withdrawal of surface and ground water, mln m^3	36,6	36,1	34,02	33,67	31,91	28,81	26,483	24,978	23,118	20,748	19,83	19,69	21,1	21,85	26,42
Sewage disposal, mln m^3			8,7	8,3	7,7	7,1	6,1	5,3	4,2	3,8	3,6	3,6	3,7	3,3	3,9
Annual water consumption, mln m^3:	30,2	28,4	27,4	26,9	24,9	23,4	20,5	18,3	16	14,2	14,7	14,6	14,9	15,2	20,2
municipal,%	4,5	4,5	4,7	4,2	6,8	5,3	5,2	4,9	7,8	7,9	7,4	7,2	5	5	4
industrial,%	23,8	16,9	19,3	17,8	16,2	24,1	22,2	22,4	22,4	23,6	24,4	25,4	25	26	21
agricultural,%	71,7	75,6	76,8	78	77	70,6	72,6	72,7	69,8	68,5	68,2	67,4	70	63	75
State															
Water consumption per capita, m3	83,49	80,3	81	81,01	81,51	77,81	72,81	53,38	48,8	43,45	41,89	40,57	39,9	40	44,1
Annual Surface and Ground Water Withdrawal per Capita, m^3	4300-6000														
Share of the population with access to the drinking water , %	75,6	75,2	75,4	75,9	75,3	75	75,1	75,2	75,2	75,1	73	74	73,7	75,1	76,4
Share of the population with access to sanitary conditions , %	44,1	48,1	46,7	45,2	43	42,5	49,1	48,5	44,2	46,8	47,1	42,1	44,1	43,1	41,1
Deflection of drinking water samples from national standards,%					9,1	11,5	10,5			7,9	9	8,5	7,2	4,7	4,3
Biochemical Oxygen Demand (BOD5) in water	0,3	0,3	1,3	1,2	0,8	1,1	1,1	1,1	1,1	1,6	1,6	1,5	1,4	1,3	1,4
Response															
Volume of refined sewage, mln m^3	256	289	263	227	210	203	164	142	254	228	212	212	217	253	188

KYRGYZSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1997	1998	1999	2000	2001	2002	2003	2004
Pressure																
Annual withdrawal of surface and ground water, mln m^3	11,12	11,15	11,5	11,41	10,92	9,31	9,6	8,47	8,47	8,32	9,18	8,03	10,39	8,46	7,56	9,03
Sewage disposal, mln m^3	1,17	1,36	1,35	1,34	1,31	1,18	0,65	0,73	0,73	0,93	0,93	0,8	1,16	2,27	1,49	1,51
Annual water consumption, mln m^3:	8,99	8,95	8,95	8,94	87,25	6,94	6,87	5,2	6,16	6,42	5,25	4,98	5,74	5,42	4,56	5,7
municipal,%	3,3	3,0	2,8	3,5	3,4	3,9	4,3	2,2	5,2	6,6	4,3	3,6	2,2	1,7	1,9	8,5
industrial,%	7,8	7,5	5,9	3,5	3,7	3,8	3,3		2,2	2,1	1,2	1,0	1,7	2,6	2,7	11,8
agricultural,%	88,9	89,5	91,3	93,0	92,9	92,3	92,4	92,6	92,6	91,3	94,5	95,4	96,1	95,7	95,4	79,7
State																
Water consumption per capita, m3	66,5	64,3	62,5	70	68,1	60,9	61,2	66,9	66,9	64,4	42,8	37	25,1	18,5	17,2	
Annual Surface and Ground Water Withdrawal per Capita, m^3	2534	2504	2572	2576	2453	2064	2101	1805		1748	1893	1634	2095			
Annual Surface and Ground Water Withdrawal per Capita, m^3	2534	2504	2572	2576	2453	2064	2101		1805	1748	1893	1634	2095	1697	1501	1523
Share of the population with access to the drinking water , %						81,8	81,3	82,6	82,6	86,5	85,9	81,5	80,6	84,2	78,6	81
Share of the population with access to sanitary conditions , %						21,3	24,4	23,3	23,3	27,5	27,8	32,8	31,4	30,3	25,9	25,1
Deflection of drinking water samples from national standards,%	13	13	12	11	12,5	11	15	14,5	14,5	15	15,1	12,4	13,1	13,1	13,1	13,1
Biochemical Oxygen Demand (BOD5) in water (Chu river)						0,95	0,95	1	1	1,1	1,2					
Response																
Volume of refined sewage, mln m^3	131	177	176	186	140	136	122	111	111	117	150	137,7	134	108	86	158

TAJIKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Annual withdrawal of surface and ground water, mln. m³	13662,43	13710	12803,63	13135,35	13566,18	12909,01	13168,14	13379,08	13152,42	10699,99	12609,3	12577,88	12469,74	12554,21	12316,09
Sewage disposal, mln. n	4549,85	4732	4854,7	4804,77	4921,75	3709,02	4090,55	4372,47	4809,28	3581,43	4706,1	4761,19	4693,23	47539,47	47939,87
Annual water consumption, mln. m^3:	12044,08	11854	10944,57	10998,57	11529,24	11873,19	11043,38	10197,58	9938,76	8817,21	9569,92	8475,89	9306,08	9268,70	9099,58
municipal	484,77	447,5	455,65	484,31	412,1	611,84	413,69	383,97	234,07	383,44	404,75	356	372,24	370,74	363,98
industrial	594,01	593,2	530,16	536,04	501,3	943,87	922,08	535,12	454,16	525,54	477,31	428,46	465,3	465,3	454,97
a spraying	9894,98	10213	9323,52	9501,9	9976,37	9638,98	9059,86	8676,48	8708,1	7468,51	8125,12	7210,14	7817,1	7785,71	7461,65
agricultural water facilities	695,71	536,8	571,93	408,2	622,63	658,59	608,48	601,97	533,28	439,69	554,18	461,33	651,39	646,9	818,93
other of the purpose	374,25	63,31	63,32	68,12	16,87	19,91	21,27	0,03	9,16	0,03	0,035	0,037	0,041	0,043	0,045
State															
Water consumption per capita, m3	91,5	82,5	82,4	86,8	73,4	167,8	75,3	65,9	39,4	63,1	64,2	56,5	59,1	63,9	63,7
Annual Surface and Ground Water Withdrawal per Capita, m^3	2509	2490	2500	2354	2480	2264	2282	2277	2192	1746	1837	1851	1837	1849	2001
Share of the population with access to the drinking water , %	60	60	55,1	55,1	53,3	52	48,5	43,8	43,3	43,7	44,3	47,1	47,3	46,9	47,4
Share of the population with access to sanitary conditions , %	70,3	70,1	69,5	61,4	58,3	45,3	33	30	38,7	64,8	64,4	69,8	69,8	69,6	69,3
Deflection of drinking water samples from national standards,%	8	7	12	21	31	32	39	45	47	51	48	39	38	46	47
Biochemical Oxygen Demand (BOD5) in water	3,8	5,0	4,1	4,7	3,8	3,7	5,6	6,3	5,2	5,3	6,1	6,3	6,3	6,2	6,3
Response															
Volume of refined sewage, mln m^3	4,49	4,62	4,76	4,73	4,88	4,49	4,41	4,35	4,78	3,55	3,58	3,61	3,69	3,57	3,63

TURKMENISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Pressure														
Annual withdrawal of surface and ground water, km³	24,82	26,12	24,93	25,71	25,97	27,61	26,35	24,21	25,95	27,60	21,94	24,92	27,15	26,67
Sewage disposal, km^3	6,5					5,7	6,2	6,0	6,0	6,7	6,1	3,9	5,9	6,6
Annual water consumption, km^3:														
municipal,%	1,23	1,50	1,30	1,46	1,49	2,00	2,00	2,00	2,00	2,00	2,48	3,10	2,49	2,34
industrial,%	7,77	6,60	8,80	8,54	7,78	7,00	7,00	8,00	7,00	6,00	7,75	8,39	7,46	7,71
agricultural,%	91	91,90	89,90	90.0	90,73	91.0	91,00	90,00	91,00	92,00	89,77	88,51	90,03	89,93
State														
Water consumption per capita, m3	63.4	78.76	70.5	68.8	67.4	64,5	63,7	61,9	80,1	76,9	72,7	83,1	80,7	80,5
Annual Surface and Ground Water Withdrawal per Capita, m^3	6464	6538	6007	5950	5796	6018,2	5594	4994	5197,4	5306,7	4086	4295	4571	4234
Share of the population with access to the drinking water , %								42,82	56,78	61,95	54,2	54,7	54,19	55
Share of the population with access to sanitary conditions , %						56,5	56,8	58,1	57,6	58,6				
Deflection of drinking water samples from national standards,%														
Biochemical Amudarya Kerki	0,69	0,66	0,52	1,49	0,47	0,51	0,75	5,5	5,08			4,5		
Oxygen Amudarya Lebap	1,68	1,66	2,69	1,6		2,08	3,62	0,75		4,22	4,8	4,3		
Demand (BOD5) Karakum-River, Head			0,86	0,86	1,08	2,08	1,6		3,1			5,2		
in water Karakum-River, 851 km	1,32	1,39	1,04	1,25	1,07	1,74	1,87	1,64	1,54	1,8	1,99	1,57		
Response														
Volume of refined sewage, mln m^3	13,3	13,3	13,4	13,5	13,5	18,3	19,3	19,1	19,1	18,3	18,4	18,0		

UZBEKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Annual withdrawal of surface and ground water, km³	-	56,2	61,5	61,51	58,7	60,6	60,3	59,2	59,2	60,7	48,1	44	50,3	56,5	58,5
Sewage disposal, km^3			Annual average sewage disposal - 26,9 km^3										27,2	29,9	29,5
Annual water consumption, km^3:	52,40	51,4	51,4	50,2	53,3	52,2	52,2	52,1	51,6	50,6	46,9	44	50,2	51,2	
municipal,%	-	-	-	5,7	-	-	4,5	-	-	-	5,0	4,8	6,1	6,1	6,1
industrial,%		-	-	1,6	-	-	1,5	-	-	-	1,5	1,8	2,2	2,2	2,2
agricultural,%		-	-	90,7	-	-	92,7	-	-	-	92,4	92,5	90,2	90,2	90,2
State															
Water consumption per capita, m3			0.35	0.356	0.297	0.341	0.324	0.304	0.257	0.236	0.209	0.199			
Annual Surface and Ground Water Withdrawal per Capita, m^3	-	2651	2846	2815	2609	2720	2607	2513	2471	-	1794.3	1623.9	1833.6	2039.6	2242.1
Share of the population with access to the drinking water , %	-	65,8	66,5	67,7	68,6	70	71,1	73,7	74,4	75,1	77,1	-			
Share of the population with access to sanitary conditions , %	-	-	-	58,1	72,1	72,5	72,4	72,05	71,5	68,7	-	-			
Deflection of drinking water samples from national standards,%															
Biochemical Oxygen Demand (BOD5) in water (Salar collector, downward from Tashkent city, Chirchik river)	3.38	4,41	4,72	4,35	3,77	3,53	3,68	4,05	4,87	4,56	-	-			
Response															
Volume of refined sewage, mln m^3	1209,0	-	-	-	-	-	1221.7	1220	1159,7	1137,2	1101,4	1053,4	1070.8	1053	922,3

LAND RESOURCES

Definitions:

Agricultural land – The land areas used for agricultural production. Its structure includes arable land, long-term plantings, hayfields and pastures.

Arable land – is regularly processed agricultural land, used for agricultural crops sowing, including crops of long-term grasses and dales.

Arable land per capita – The land areas (territory of arable lands), used for long-term harvesting in the country, expressed per capita. This definition in the Central Asia refers to the agricultural land, and arable land in structure of the agricultural land do not exceed 50 %.
Units of measurements - hectare per person.
Type of the indicator - state indicator.

Hayfield – Land areas, used for haymaking.

Pasture – Land areas, occupied by natural or sowing grasses, suitable for cattle breeding and not used for haymaking.

Forest area – Forest land of State Forest Fund, covered by sparse growth of trees (completeness 0,1-0,3), number of trees no more than 400-500 pieces per hectare.

Deforestation – The areas of annual industrial trees cutting.
Units of measurements - thousand hectare per year (thousand ha/year).
Type of the indicator - impact indicator.

Woods planting – The works on planting of seedlings, young plants and other planting material in forest areas.

Forest sowing – The works on sowing of wood and bushes irrespective of a type of sowing (manual, mechanized, aero-sowing).

Handling of felling – Periodic tree cutting in planting areas before final felling, for formation of the necessary compound, forms of plantings and growth increase.

Sanitary deforestation – Felling of dead, damaged or spoiled trees and bushes.

Reafforestation – Implementation of measures, which are aimed on forest restoration in cutting areas, burnt territories, waste areas, bottom-glades and others, former forest areas. Reafforestation includes planting, forest sowing and assistance to natural regeneration.

Protective woods planting – Sowing and forest planting in deserts.
(State Forest Fund)

KAZAKHSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Pressure																
Deforestation, thousand ha/year	58,0	49,6	49,1	48,9	41,8	37,2	37,2	42,5	53,9	35,9	48,7	66,0				
Use of agricultural pesticide, kg/ha											3,6	3,2	3	3,7	3,7	
Use of fertilizers: organic, tn/ha								0,0093	0,0063	0,0114	0,0293	0,0143	0,076	0,048	0,068	
mineral, tn/ha		0,0309	0,0367	0,0368		0,0363	0,0289	0,0169	0,0199	0,0107	0,0115	0,0141	0,0103	0,0109	0,023	
State																
Change of forest areas, thousand ha:																
Area covered by forest							10500			11400	11400	11400	11700	11700	12400	12400
Woods planting							4,7	3,6	13,5	4	7	6	8,4	10,7	10,4	
Sanitary deforestation							32,5	38,5	38,4	44,8	46,2	57,8	25,7	14,8	16,2	19,6
Restoration woods planting							9,1	9,7	26	10,4	12,1	9,3	12,6	14,3	13,4	
Protective woods planting							0,1		0,4	0,3	0,5	0,7	0,3	0,4	0,4	
Area of agricultural land, mln ha	220,7	195,5	180,0	181,3	179,2	173,9	161,6	137,6	120,1	98,3	86,4	84,6	80,4	78,6	77,9	
Land use change, restructuring:																
arable land ,%		18	19,1	19	18,6	18,2	17,7	18,8	18,9	20	22,4	24,2	26,6	27,1	28,1	
hayfield,%		81,6	80,5	80,6	80,6	80,2	79,9	70,8	76,9	74,7	73,3	72,3	70,1	69,1	68,1	
agricultural land,%																
fallow land,%																
Portion of irrigated arable land, thousand ha	2379,5					2381,4	2358,7	2348,7	2332,8	2314,1	2228,3	1386,4	2141,1	2131,2	2313,2	
Portion of irrigated lands to agricultural land area, %	1,07					1,22	1,3	1,57	1,90	2,16	2,39	1,50	2,6	2,6	2,9	
Arable land per capita, ha/capita	2,1	2,00	2,10	1,70	2,1	1,98	1,84	1,72	1,59	1,45	1,45	1,49	1,44	1,43	1,46	
Area affected by salinization, water logging thousand ha	58600	58600	58600	58585,6	33800	33800	338440	338440	33844	34428,2	34428,2	33916,2	33916,2	34143,8	34268	
Area affected by water logging, thousand ha																
Land affected by soil erosion, thousand ha	111900	123800	125600	127400	70900	31400	28959	26957	23900,8	30672	30675	30499,3	30468	30567,9	30482	
Land affected by desertification, thousand ha	Общая площадь опустынивания земель составляет 60-66% территории Республики Казахстан															
Portion of land area covered by forests/wetland to total area, %	3,7 / ...					4,0 / ...	3,9/..	4/..	4/..	4,2/..	4,2/..	4,2/..	4,3/..	4,3/..	4,6/..	4,5/..
Portion of agricultural land to total land area, %	81,2					71,5	67	50,4	44	36	31,7	31	29,5	28,8	28,5	
Response																
Protected forests area (from industrial products) as a percent of total forest area	8,7	8,7	9	9	9,5	9,5	10,1	10,1	11,3	12,3	14,7	14,7	14,7	14,7	22,5	

KYRGYZSTAN	1990	1995	1996	1998	1999	2000	2001	2002	2003	2004
Pressure										
Deforestation, thousand ha/year					1,013					
Use of agricultural pesticide, kg/ha	3,5	1,2	1,2	0,7	0,7	0,8	0,9	0,94	1,02	1,1
Use of fertilizers: organic, tn/ha	2,28	0,1	0,1	0,2	0,2	0,3	0,3			0,5
mineral, tn/ha	0,14	0,006	0,022	0,024	0,025	0,027	0,03	0,04		0,05
State										
Change of forest areas, thousand ha:										
Area covered by forest	680,9	702,1	702,1	849	850	850	850	789	865	860
Woods planting	1,6	4,3	4,2	4,7	5,1	5,2	5,2	3,06		
Sanitary deforestation	5,3	4,6	5,1	4,2	4,2	4,2	4,2	5,46		4,2
Restoration woods planting	3,6	11,9	12,5	14,1	44,6	28,2	22,9	15,3	12,3	12
Protective woods planting	1,1	0,72	0,77	0,98	1,17	1,1	1,1	0,05		
Area of agricultural land, thousand ha	10431	10620	10774	10572	10607	10656	10797	10797	10797	10797
Land use change, restructuring:										
arable land ,%	12,5	12,3	13	11,9	11,9	11,8	12,4	12,4	12,4	12,4
hayfield,%	2,0	1,5	1,6	1,5	1,6	1,6	1,6	1,6	1,6	1,6
agricultural land,%	84,9	85,6	84,5	86,2	85,9	86,0	85,3	85,1	85,1	85,1
fallow land,%	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Portion of irrigated arable land, thousand ha	842	837	747	797	824	830	915	916	915	906
Portion of irrigated lands to agricultural land area, %	9,97	8,6	8,6	8,6	8,61	8,63	8,65	8,5	8,5	8,4
Arable land per capita, ha/capita	0,32	0,29	0,28	0,27	0,27	0,26	0,26	0,26	0,26	0,26
Area affected by salinization, thousand ha	160,9	141,3	141,2	142	143	144,6	143,6		145,3	260
Area affected by water logging, thousand ha	20,2	26,4	28,9	30,5	31,5	38,8	44,8		114,1	30
Land affected by soil erosion, thousand ha	4544		65,8			5626		5686		
Land affected by desertification, thousand ha			90,3					251		270
Portion of land area covered by forests /	5,4	5,33		13	13,1	13,1				12
wetlands to total land area, %	0,5					0,5				0,4
Portion of agricultural land to total land area, %	52,4	53	53	53,3	53,3	53,3	53,3	53,3	53,3	53,3
Response										
Protected forests area (from industrial products) as a percent of total forest area										

TAJIKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Pressure												
Deforestation, thousand ha/year	0	0	0	0	0	0	0	0	0	0	0	0
Use of agricultural pesticide, kg/ha		...	...	...	...	...	...	...	...	...	...	...
Use of fertilizers: organic, tn/ha	1,9						1	0,9	0,8	0,9	0,8	0,7
mineral, tn/ha	0,2	0,19	0,11	0,11	0,6	0,6	0,4	0,4	0,6	0,3	0,3	0,5
State												
Change of forest areas, thousand ha:												
Area covered by forest		392,0	410,0	410,0	410,0	410,0	410,0	410,0	410,0	410,0	410,0	410,0
Woods planting	4,3	3,9	1,9	2,0	1,9	1,8	2,4	1,8	2,3	2,2	2,1	1,6
Sanitary deforestation		5,8	5,2	7,2	7,0	6,4	7,4	7,5	6,9	6,7	6,7	7,0
Restoration woods planting	4,4	4,0	2,0	3,2	3,1	3,0	2,6	3,0	3,1	3,1	2,9	2,2
Protective woods planting												
Area of agricultural land, thousand ha	4431,2	4434,1	4438,8	4480,1		4578,5	4585,5	4561,2	4546,2	4567,7	4572,2	4574,9
Land use change, restructuring:												
arable land	815	811,2	808,6	806,9		801,2	764,6	763,7	734,3	743,1	738,5	739,1
hayfield	27,1	26,4	26,3	26,1		23,7	23,6	23,6	23,6	23,8	23,8	23,9
agricultural land	3770,8	3473,4	3478,2	3518,8		3623,1	3666,3	3644,9	3659,5	3681,9	3686,5	3689,7
fallow land	19,3	19,7	19,4	19,7		19,3	23,0	23,4	26,1	17,1	21,4	20,0
Portion of irrigated arable land, thousand ha	709,1	713,2	713,3	714,7	715,2	715,1	717,9	718,4	713,6	713,8	715,4	718,9
Portion of irrigated lands to agricultural land area, %	14,6	14,7	14,6	14,4	14,1	14.0	13,5	13,2	12,9	14,4		
Arable land per capita, ha/capita	0,16	0,16	0,16	0,15	0,15	0,15	0,15	0,15	0,14	0,14	0,14	0,13
Area affected by salinization, thousand ha	17,6	18,4	19,2	22,3	22,0	21,6	22,0	22,8	19,1	21,0	23,0	23,9
Area affected by water logging, thousand ha	33,1	34,6	35,2	36,7	33,8	30,9	32	42,4	51,4	51,5	51,7	51,6
Land affected by soil erosion, thousand ha	...	...	...	...	...	...	...	...	...	...	...	...
Land affected by desertification, thousand ha	...	...	...	...	...	...	...	...	...	...	...	...
Portion of land area covered by forests	3,6	3,7	3,7	3,7		3,7	3,8	3,8	3,8	3,7	3,7	3,7
wetlands to total land area, %	1,85	1,78	1,77	1,77		1,79	1,81	1,83	1,85	1,83	1,82	1,82
Portion of agricultural land to total land area, %	31,0	31,1	31,1	31,4		32,1	32,2	32,0	31,9	32,0	32,1	32,1
Response												
Protected forests area (from industrial products) as a percent of total forest area	100	100	100	100	100	100	100	100	100	100	100	100

TURKMENISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Deforestation, thousand ha/year															
Use of agricultural pesticide, kg/ha	0,85	0,76	1,4	1,3	0,91	0,69	1,60	1,30	0,99	0,67	0,81	0,99			
Use of fertilizers: organic, tn/ha									0,45	0,24	0,14	0,14			
mineral, tn/ha									0,08	0,25	0,26	0,27			
State															
Change of forest areas, thousand ha:															
Area covered by forest	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100			
Woods planting															
Sanitary deforestation						4,5	7,1	4,3	3,9	2,8	2,1	1,09	1,70	2,90	
Restoration woods planting												35,3	35,40	35,40	
Protective woods planting															
Area of agricultural land, mln.ha		40,67	40,37	40,42	40,42	40,42	40,42	40,42	40,37	40,37	40,37	40,37	40,20	40,20	40,0
Land use change, restructuring:															
arable land ,%		3,1	3,3	3,7	3,9	4,0	4,1	4,0	4,0	4,0	4,0	4,0	4,20	4,20	4,20
hayfield,%		96,6	96,5	96,1	95,9	95,8	95,7	95,8	95,7	95,7	95,7	95,6	95,60	95,50	95,50
agricultural land,%															
fallow land,%															
Portion of irrigated arable land, thousand ha	1408,5	1421,5	1466,4	1629,6	1744,1	1770,9	1776,8	1788,2	1749,7	1769,2	1793,1	1814,70	1840,80	1849,70	1856,2
Portion of irrigated lands to agricultural land area, %		3,5	3,6	4	4,3	4,4	4,4	4,4	4,3	4,4	4,4	4,4	4,60	4,60	4,60
Arable land per capita, ha/capita		0,34	0,32	0,34	0,37	0,37	0,34	0,33	0,32	0,32	0,31	0,3	0,30	0,26	0,27
Area affected by salinization, thousand ha	659,2	576,3	647,1	676,0	653.0	633,6	607,7	625,3	597,5	590,7	516,9	538,7			
Area affected by water logging, thousand ha															
Land affected by soil erosion, thousand ha												300			
Land affected by desertification, thousand ha				19206											
Portion of land area covered by forests / wetlands to total land area, %	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -	8,2/ -			
Portion of agricultural land to total land area, %		82,8	82,2	82,3	82,3	82,3	82,3	82,3	82,2	82,2	82,2	82,2	81,80	81,80	81,40
Response															
Protected forests area (from industrial products) as a percent of total forest area	100	100	100	100	100	100	100	100	100	100	100	100			

UZBEKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Deforestation, thousand ha/year	-	-	-	-	-	-	-	-	-	-	-	-			
Use of agricultural pesticide, kg/ha	19.0	14,3	15,1	14,8	-	5,5	-	5,0	-	4,8	-	-			
Use of fertilizers: organic, tn/ha	-	-	-	-	-	-	-	2.4	2.0	1.4	1.2	-	9,3	4,80	5,10
mineral, tn/ha	0.286	0.283	0.250	0.232	0.189	0.163	0,158	0,241	0,191	0,177	0,195	-	2,2	0,89	1,01
State															
Change of forest areas, thousand ha:															
Area covered by forest	-	-	-	-	-	-	7294.4	8665.4	8696.5	8050.4	8073.2	-	8081,5	8110,5	
Woods planting	-	-	-	-	-	-	33.2	35.0	40.0	41.6	41.6	-	41,8	42	
Sanitary deforestation	-	-	-	-	-	-	anp.35	40.5	33.0	37.0	48.32	-	22,21	22,21	
Restoration woods planting	-	-	-	-	-	-	34.4	36.8	41.2	42.6	42.6	-			
Protective woods planting															
Area of agricultural land, mln.ha	28.08	28,10	28,10	28,10	27.9	27.79	27.68	27,50	26.82	26.75	26.73	26.69	25.8		
Land use change (restructuring):															
arable land ,%	15.5	15.6	15,9	16	16,5	15,10	15,30	15,20	15,20	15,20	15.20	15.20	15,7		
hayfield,%	83.6	82.70	82,40	82,20	81,30	83,20	83,20	83,20	83,20	83,20	82,40	83.20	82,7		
agricultural land,%															
fallow land,%	0.22	0.22	0.23	0.23	0.24	0.24	0.25	0.26	0.29	0.30	0.31	0.32	0,33		
Portion of irrigated arable land, thousand ha	3407.3	3331	3323	3330	3334	3339.4	3338.5	3329.6	3316.4	3313.6	3308.3	3309.4	3298,3	3399,7	3329
Portion of irrigated lands to agricultural land area, %	15.3	15.4	15.5	15.3	15.3	15.4	15.5	15.6	15.9	15.8	15.9	15.7			
Arable land per capita, ha/capita	0.207	0.204	0.198	0,196	0,190	0,187	0.181	0.176	0.169	0.166	0.164	0.162			
Area affected by salinization, thousand ha	50 % of the irrigated land is a subject to salinization														
Area affected by water logging, thousand ha															
Land affected by soil erosion, thousand ha	25273 thousand ha, including 2942 thousand ha of irrigated land, is a subject to soil erosion														
Land affected by desertification, thousand ha	On the average - 250 thousand sq.km or 55,8 %														
Portion of land area covered by forests / wetlands to total land area, %															
Portion of agricultural land to total land area, %	-	-	57,4	57,06	55,56	60,6	60,36	60,2	60	60	56,6	-			
Response															
Protected forests area (from industrial products) as a percent of total forest area															

ATMOSPHERIC AIR

Definitions:

In national cadastres of greenhouse gases there are data on emission of three gases with *direct greenhouse effect* – carbon dioxide, methane and nitrogen oxide, and groups of gases with *indirect greenhouse effect* – carbon oxide, nitrogen oxides, not metane evaporating organic compounds, and sulfur dioxide.

Carbon dioxide emission (CO2) – Calculations with use of two approaches. The first one - emission of CO_2 is calculated for each fuel type on the base of its general annual consumption in the country, and then summarized. Such approach allows to assess a fuel spectrum of carbon dioxide emission. The second one - the emission is calculated for separate branches and classes of sources, and then summarized. Such approach allows to assess branch-wise spectrum of carbon dioxide emission.

Methane emission (CH4) – calculated for fuel industry and agriculture. For the calculation of total number of methane emission at extraction of hydrocarbonic fuel, the mass of the extracted material was multiplied by the coefficient of emissions, dependent on a method of extraction and raw material processing. The methane emission from cattle-breeding facilities has been calculated by multiplication of cattle livestock and the appropriate coefficients.

Nitrogen dioxide emission (N2O), resulted of mineral fuel combustion, is calculated by multiplication of the power contents of the consumed petroleum products and gases, and appropriate emission coefficients, provided by the Manual of Intergovernmental Expert Group on Climate Change (IEGCC).

Units of measurements – absolute - thousand tons, and relative - thousand tons of CO_2-equivalent, for the share comparability of each of gases in the general emission, and depend of Global Warming Potential scale (GWP).

Type of the indicator - impact indicator.

"Agenda 21".

Indirect greenhouse effect emssion are taken from tables of the state statistical reporting, as these gases are toxic and subject to the record according to ecological standards of the Central-Asian countries.

Atmospheric air emission of pollutants – Air pollution by substances from stationary and mobile sources of emission (with unfavorable effect on health or activity of the population, and environment). All contaminants, entering in the atmospheric air both, after dust-gas-cleaning devices (due to incomplete catching and purification) at the organized polluters, and without purification - at the unorganized polluters, are considered. The record of pollutant emissions is conducted both, on a modular condition (amount of hard, gaseous and liquid), and on separate substances (components).

A stationary source of harmful substances outburst in atmospheric air is not mobile technological unit (equipment, mechanism, device, etc.), which allocate harmful substances while in service. Other objects (waste heaps, tanks, etc.) are relating to them as well.

Sources of harmful substances outburst, depending on their equipment with special gas-weeper mechanism (device), are subdivided on organized and unorganized.

The sources, harmful substances of which get into a gas or airway system (a pipe, aeration lantern, ventilating shaft, etc.), are organized sources of outburst, and the system itself can use for their catching corresponding gas-purifying and dust removal systems.

The unorganized sources of outburst are the sources, harmful substances of which get directly into the atmosphere due to the weak technology equipment (air-tightness), transport services and tanks. The burning waste heaps, raising dust refuse dumps and others apply here.

The amount of the harmful substances arising from stationary sources of outburst includes substances both, dumped to gas-weeper system, irrespective of their purification by dust-gas-cleaning installations, and directly falled into the atmosphere. The substances, contained in technological gases and specially caught for production, do not apply here.

The compound of the harmful substances, which have been ejected into the atmosphere by stationary sources, includes total amount of all contaminants, falled into the atmosphere after their purification by the dust-gas-cleaning installations (as a result of incomplete catching and cleaning), and without purification (from the organized and unorganized sources). Under the calculation of emissions on separate cities, the air polluting enterprises , located within the city, are taken into account.

KAZAKHSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Emission of greenhouse gases (CO_2, CH_4,	323.8	335.3	351.0	295.6	302.7	285.5	246.2	189.6	168.2	140.1	160.0	170.0	178.5	188.8	205.8
Carbonic gas - CO_2, mln.tn/year	238.4		274.7		179.4					105	120	125	142.6	150	150.4
Methane - CH_4, thousand tn/year	58100		51300		39500					27000	24000	24500	25700	23000	28100
Carbon oxide - CO, thousand tn/year	800	760	687	566	468	464	420	409	360.5	379.7	390.7	375.9	378	394	412
Emission of sulfur oxides SO_2, thousand tn/year	1500	1471	1422	1404	1135	1133	1134	987	983.3	945.5	1080	1208.6	1132.2	1385.4	1492.1
Emission of nitrogen oxides Nox, thousand tn/year	300	319	310	315	241	233	156.6	155	159	151	161.7	178.6	176.1	191.6	196.9
Consumption of ozone depleting substance, tn-						138.7	64.9	70.3	61.7	60.2	597.81	361.1	164	70.36	58.18
State															
Ambient concentration of air pollutants , mg/cu.m	6.4	6.8	7.2	7.6	8.9	6.3	4.8	5.8	6.5	5.9	6.5	6.1	6.24	5.79	5.98
Particulate matter															
Sulphur dioxide - SO2														0.018	0.15
Nitrogen dioxide - NO2														0.043	0.042
Nitrogen oxide - NO															0.026
Carbon oxide - CO														1.8	1.6
Greenhouse gas emission per capita, tn	19,1	18.6	19,1	16.2	14.3	12.6	16.5	12.8	11.6	9.3	10.9	11.4	11.5	12.6	13.72
Response															
Expenditures on air pollution abatement (% of GDP)											0.2	0.3	0.4	0.6	0.4
Participation in treaties and conventions				1	1	3	3	5	5	5	8	9	9	9	9
Development of national air quality standards and emission standarts for stationary as well as mobile sources															10

Pressure													
Emission of greenhouse gases (CO_2, CH_4, No_x...),mln.t/year	36,6	34,7	24,9	23,1	18,5	16,4	16,3	15,9	16,5	14,8	15,3		
Carbonic gas - CO_2, mln.tn/year	29,1	27,9	18,7	17,7	14,6	12,7	12,8	12,1	13	11,3	11,7		
Methane - CH_4, thousand tn/year	280	289	261	224	160	146	144	153	140	145	147		
Carbon oxide - CO, thousand tn/year	132	129	129	133	116	121	127	136	135	125	130		
Emission of sulfur oxides SO_2, thousand tn/year	11,3	108	55	57	48	35	33,2	30,7	34,2	30	32		
Emission of nitrogen oxides Nox, thousand tn/year	134	131	102	99	91	83	80	77	80	75	76		
Consumption of ozone depleting substance, tn-/year							10	140	270	70	20		
State													
Ambient concentration of air pollutants , mg/cu.m (in Bishkek city)	7,4	5,5	5,2	2,3	3,5	4,7	6,8	6,8	5,8	5,1	5		
Particulate matter	0,4	0,4	0,3	0,2	0,3	0,4	0,5	0,5	0,7	0,9	0,8		
Sulphur dioxide - SO2	0,01	0,016	0,009	0,007	0,008	0,008	0,005	0,004	0,006	0,005	0,006	0,012	0,08
Nitrogen dioxide - NO2	0,09	0,08	0,05	0,05	0,05	0,07	0,07	0,07	0,05	0,04	0,05	0,04	0,05
Nitrogen oxide - NO					0,12	0,17	0,17	0,2	0,15	0,1	0,1	0,016	0,012
Carbon oxide - CO	6,9	5	4,8	2	3	4	6	6	5	4	4		
Greenhouse gas emission per capita, tn	8,2	7,8	5,6	5,3	4,2	3,6	3,6	3,4	3,5	3,1	3,1		
Response													
Expenditures on air pollution abatement (% of GDP)	5,7					3,4		2,3					
Participation in treaties and conventions	1	1	2				2			7	7		2
Development of national air quality standards and emission standarts for stationary as well as mobile sources													

TAJIKISTAN	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure														
Emission of greenhouse gases (CO_2, CH_4, No_x...),mln.t/year														
Carbonic gas - CO_2, mln.tn/year		16.2	10.8	5.6	3.6	2.8	2.9	1.9						
Methane - CH_4, thousand tn/year	176.5	148.2	135.8	111.1	102.6	99.6	94.8	90.1						
Carbon oxide - CO, thousand tn/year	42.9	41.3	33.8	28.5	27.8	22.5	22	22.4	24.8	20.2	20.9	21.9	20.5	20.8
Emission of sulfur oxides SO_2, thousand tn/year	17,0	12,0	8,3	4,2	2.8	1.9	1.8	1.8	1.8	1.4	2.6	21.9	20.5	20.8
Emission of nitrogen oxides Nox, thousand tn/year	7,1	5,5	3,8	1,6	1	0.5	0.9	0.8	0.8	1.2	0.5	0.6	0.5	1.4
Consumption of ozone depleting substance, tn/year		96.91	86.00	-	44.87	59.36	80.86	92.28	69.35	48.90	37.80	38.00	38.85	64.26
State														
Ambient concentration of air pollutants , thousand tn (in Dushanbe city)														
Particulate matter	5.60	3.10	2.10	27.40	1.60	0.60	0.40	0.30	0.30	0.50	0.70	0.70	0.90	2.50
Sulphur dioxide - SO2														
nitrogen oxides NOx	3.70	2.70	1.20	0.60	0.20	0.20	0.40	0.30	0.30	0.10	0.20	0.10	0.10	0.40
Carbon oxides - COx	5.40	2.70	1.70	1.10	0.80	0.60	0.60	0.60	0.50	0.50	0.40	0.30	0.40	1.10
Greenhouse gas emission per capita, tn		2.95	1.96	1.02	0.66	0.50	0.51	0.33	...	...	...	...	...	...
Response														
Expenditures on air pollution abatement (% of GDP)	0.01	0.25		0.02	0.05	0.04	0.03	0.02	0.01		0.01	...	...	...
Participation in treaties and conventions	-	-	-	-	-	1	2	3	3	3	3	4	4	4
Development of national air quality standards and emission standarts for stationary as well as mobile sources	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TURKMENISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Pressure														
Emission of greenhouse gases (CO_2, CH_4, No_x...),mln.t/year					52.3						56.9		62.8	
Carbonic gas - CO_2, mln.tn/year					31.86						35.65		45.02	
Methane - CH_4, thousand tn/year					0.97						1.01		1.19	
Carbon oxide - CO, thousand tn/year					0.33									
Emission of sulfur oxides SO_2, thousand tn/year	22,4	98,11	31,2	20,5	0,23	32.2	8.13	4.6	6.4	9	7.8	11.3	11.2	12.1
Emission of nitrogen oxides Nox, thousand tn/year	34,8	32,71	29,1	26,3	0,83	32.3	20.5	29.3	15.1	11.4	16.5	18.3	22.2	20.1
Consumption of ozone depleting substance, tn-/year	156,8	111,7	79,6	71,4	66,6	64.9	56.8	41.4	47.5	39.6	21	57.7	10.5	
State														
Ambient concentration of air pollutants , mg/cu.m (in city)														
Particulate matter	0.8	0.6	0.7	0.7	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.30	0.30	
Sulphur dioxide - SO2	0.04	0.010	0.06	0.030	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.03	0.03	
Nitrogen dioxide - NO2	0.03	0.03	0.03	0.03	0.02	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
Nitrogen oxide - NO														
Carbon oxide - CO	2	2	3	3	3	3	3	4	3	3	3	4.00	3.00	
Greenhouse gas emission per capita, tn					11.67						10.59		10.58	
Response														
Expenditures on air pollution abatement (mln. manat)	3469,5 thos.rub.			15,51	81,4	634.1	2560.4	3637.1	6653	6126.5	6591.9	3724.2		
Expenditures on air pollution abatement (% of GDP)														
Participation in treaties and conventions				1		2		3						
Development of national air quality standarts and emission standards for stationary as well as mobile sources	In the terretorials Turkmenistan standards of the farmer USR work (1981-86 year), which are the registered buy standards of Turkmenistan's National committee											ТДС 579-2001		

UZBEKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Emission of greenhouse gases (CO_2, CH_4, No_x...),mln.t/year	163.2	164.3	158.2	160	154.2	153.2	156.3	155.7		160.6	170.6				
Carbonic gas - CO_2, mln.tn/year	114.6	114.1	107.2	107.5	102.2	101.6	104.6	102.8	100.5	104.7	109.5				
Methane - CH_4,mln.tn/year	37.75	39.29	40.09	41.84	41.81	42.31	42.55	43.68	46	46.6	47.8				
Nitrogen protoxide,mln.tn/year	10.9	10.87	10.87	10.66	10.18	9.37	9.17	9.18		9.1	13.3				
Carbon oxide - CO, thousand tn/year	1916	1939	1402	1258	1168	1277	1058	1185	1103	1175	1118				
Emission of sulfur oxides SO_2, thousand tn/year	646	573	502	482	414	449	436	449	400	410	338.5	288.6	289.7	274.8	141.6
Emission of nitrogen oxides Nox, thousand tn/year	342	337.0	264.0	228.0	274.0	230.0	196.0	210.0	206.0	207.0	208.0	200.2			
Consumption of ozone depleting substance, tn-/year															
State															
Ambient concentration of air pollutants , mg/cu.m (in Tashkent city)															
Particulate matter		0.2	0.2	0.2	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.3			
Sulphur dioxide - SO2		0.01	0.008	0.01	0.011	0.01	0.006	0.017	0.013	0.01	0.01	0.012			
Nitrogen dioxide - NO2		0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.07	0.07	0.06			
Nitrogen oxide - NO		0.05	0.03	0.03	0.03	0.02	0.03	0.03	0.06	0.06	0.05	0.04			
Carbon oxide - CO		3	4	3	3	3	3	3	2	2	1	1			
IZA		8.44	12.04	5.34	5.79	5.99	5.62	5.65	5.38	6.48	5.92	5.95			
Greenhouse gas emission per capita, tn															
Response															
Expenditures on air pollution abatement (% of GDP)			1.59	1.56	1.54	1.25	1.26								
Participation in treaties and conventions				4		4		1	3	1					
Development of national air quality standards and emission standarts for stationary as well as mobile sources															

BIODIVERSITY

Definitions:

Zapovedniks/reserves – are the sites, unique and most typical for geographical zones, withdrawn from economic use for preservation and improvement of a natural complex. The target task of reserves is restoration of valuable flora and fauna.

Expenditures on protection and reproduction of wild animals and birds – include charges for carrying out of the numerosity records, biotechnical actions on preservation and reproduction of wild animals and birds (their settling in a new place, preparation and laying-out of feedstuff for supplementary feeding wild animals and artificial jacks, and etc.), as well as charges for maintenance of State Hunting Service.

KAZAKHSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
Threatened species as a percent of total native species															
Animals	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22	22	22
Plants	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4	4	4
Number of species under threat of disappearance															
Mammals	44	44	44	44	44	40	44	44	44	44	44	44	44	44	44
Birds	39	39	39	39	39	39	56	56	56	56	56	56	56	56	56
Reptiles	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Fish	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Bushes, trees	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
Response															
Protected area as a percent of total surface area	3,1	3,1	3,4	3,4	3,4	3,4	3,7	3,7	4	4,2	4,5	4.5	4.5	4.5	5.4
Number of reserves	8	8	9	9	**9**	**9**	12	12	13	14	0	24	25	18	20
Area, thousand ha	820.2	820.2	876.3	876.3	**876.3**	**876.3**	1470	1470	1468	1584	1584	2816	2833	3262	3427

KYRGYZSTAN	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State											
Threatened species as a percent of total native species	7,2	12,6	13	13,5	14	15,5	16,5	16,5	17,1		
Number of species under threat of disappearance											
Mammals	13	15	15	16	17	17	18	13	13	13	13
Birds	20	40	42	44	46	48	50	32	32	32	32
Reptiles	2	7	8	9	10	11	12	3	3	3	3
Insects	5	35	40	45	50	54	58	60	61		
Bushes, trees	19	45	50	55	60	64	68	65	65	65	65
Response											
Protected area as a percent of total surface area	2,5	2,9	3,2	3,5	3,7	3,8	3,88	4,1	4,1	4,1	4,2
Number of reserves	4	6	6	6	6	6	6	6	6	7	8
Area, thousand ha	203,8	235,1	235,1	235,1	235,1	235,1	235,1	235,1	235,1	269,3	293,8
Number of national parks	1	2	3	5	5	5	6	8	8	8	9
Area, thousand ha	2,2	13,5	34,7	199,4	199,4	199,4	199,4	241,9	241,9	241,9	276,9

TAJIKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State															
Threatened species as a percent of total native species															
Animals	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
Plants	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Number of species under threat of disappearance															
Mammals	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
Birds	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Reptiles	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Insects	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Bushes, trees	27	27	27	27	27	27	27	27	27	27	27	27	28	29	30
Response															
Protected area as a percent of total surface area	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	21,5	21.5	21,5
Number of forest reserves	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
Area, thousand ha	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6	173.4	173.4	173.4	173.4	173.4
Number of reserves	14	14	14	14	14	14	14	14	15	15	14	14	14	14	14
Area, thousand ha	329.7	329.7	329.7	329.7	329.7	329.7	329.7	329.7	329.7	329.7	313.2	313.2	313.2	313.2	313.2
Number of national parks	-	-	1	2	2	2	2	2	2	2	2	2	2	2	2
Area, mln. ha	-	-	-	-	-	-	-	-	-	-	-	1/2,61	1/2,61	1/2,61	1/2,61

TURKMENISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
State														
Threatened species as a percent of total native species														
Animals	1,4								1.4	1,2	1.2	1.2	3,8	3,8
Plants	1,7								1,7	1.5	1.5	1.5	6.3	6.3
Number of species under threat of disappearance														
Mammals	27								30	30	30	30	30	30
Birds	35								41	41	41	41	41	41
Fish									13	13	13	13	13	13
Reptiles	23								23	22	22	22	22	22
Insects	43								43	43	43	43	45	45
Bushes	9	9	9	9	9	9	9	9	9	9	9	9		
Trees	6	6	6	6	6	6	6	6	6	6	6	6		
Response														
Protected area as a percent of total surface area	4,1	4,1	4,1	4,1	4,1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.8	3.8
Area, thousand ha	1977	1977	1977	1977	1877,2	1877,2	1877,2	1877,2	1877,2	1877,2	1883,2	1883,2	1883.2	1883.2
Number of forest reserves	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Area, thousand ha	819.0	819.0	819.0	819.0	820.0	820.0	820.0	820.0	820.0	820.0	820.0	820.0	820	820
Number of reserves	13	13	13	13	13	13	13	13	13	13	14	14	14	14
Area, thousand ha	1156	1156	1156	1156	1055.2	1055.2	1055.2	1055.2	1055.2	1055.2	1061.2	1061.2	1061	1061

UZBEKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State															
Threatened species as a percent of total native species															
Animals	-	-	1.3	-	-	-	-	1.07	-	-	-	1.35			
Animals	-	-	5.2	-	-	-	-	8.0	-	-	-	8.0			
Number of species under threat of disappearance															
Mammals	-	-	-	-	-	-	-	17.0	-	-	-	24.0			
Birds	-	-	-	-	-	-	-	29.0	-	-	-	47.0			
Reptiles	-	-	-	-	-	-	-	6.0	-	-	-	16.0			
Insects	-	-	-	-	-	-	-	54.0	-	-	-	54.0			
Bushes, trees	-	-	-	-	-	-	-	52.0	-	-	-	52.0			
Response															
Protected area as a percent of total surface area	2,5	2,5	3,0	3,0	3,0	3,0	3,0	3,0	3,6	4,6	4,6	4.6	4.6		
Number of reserves	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		
Area, thousand ha	202.3	202.3	202.3	202.3	202.3	202.3	202.3	202.3	209.6	209.6	209.6	209.6	209.6		
Number of national parks	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0		
Area, thousand ha	598.7	598.7	598.7	598.7	598.7	598.7	598.7	598.7	598.7	598.7	603.7	603.7	603.7		

SOCIO-ECONOMIC

Definitions:

Natural environment – is a set of the natural ingredients influencing a life quality, conditions for life activity, and a level of the person health. The environment ingredients are atmospheric air, water, soil, bowels of the earth, flora and fauna.

Environmental pollution – is a change of physical and chemical properties of the environment as a result of the economic-household activity of a man, causing emission of firm, liquid and gaseous waste products in natural spheres: atmosphere, hydrosphere, land; appearance in the environment of undesirable factors: noise, heat, radiation, ionizing radiation, ultrasonic waves, vibration, etc. Environmental contamination is characterized by a degree of excess of sanitary-and-hygienic standards.

Expenditures on environment protection – is a total sum of expenses of a country, enterprises (organizations, establishments), which includes both, target capital investments, current expenditures for maintenance and operation of a nature protection fixed capital, and operational budget expenditures for maintenance of governmental structures, basic activity of which is related to environmental protection. The structure of expenditures for nature protection can include charges of commercial, public and other organizations for scientific-technical, advertising, educational, and other service of nature protection activity.

The population – is persons sum-total, who are living on the certain territory. The existent population was formed of resident population, including temporarily living, and are excluded temporarily absent.

The total number of the population calculated on results of population censuses and current estimations. The current estimation of the population between censuses has been made on the base of results of population census to which quantity of new born and new arrived are annually added, and numbers died and left from the territory are deducted. Classification of the population on urban and rural is made according to a place of residing.

The population growth rate – is average annual level of the population change for the certain period.
Units of measurements – usually expressed as percentage.
Type of the indicator – driving force (impact).
"Agenda 21" – Chapter 5.

Density of the population – all population of a country or a territory, divided on the area of this territory.
Units of measurements – persons per square kilometer.
Type of the indicator – state.
"Agenda 21" – Chapter 5.

Gross National Product (GNP) – is an aggregate cost of final production at the stage of output, calculated by summation of value added cost on branches. GNP is calculated on the base of market prices, that is includes net taxes on the products and import. The term "net" means, that taxes are shown minus appropriate subsidies. Gross National Product is a

generalizing parameter of an estimation of economic activities.

Parity of Purchasing Power (PPP) of the national currency – is an amount of units of this currency, necessary for purchasing of a representative basket of the goods and services which can be purchased on one US dollar in the United States of America. The Parity of Purchasing Power can be expressed in other national currencies or Special Drawing Rights (SDR).

Rate of infant death – is a parameter defining death rate of children in the age of till one year. It is calculated as the ratio of number died in the age of till 1 year to number born alive.

Mortality rate of children till 5 years – is a parameter of probability of death in a period between a birth and 5-years age. This parameter reflects number of death for a year of children in the age of till 5 years per one thousand viviparities.

Expected life expectancy at a birth – is a number of years which on the average should be lived to one person, provided that during all life of this generation the death rate at each age remain such, as in the given period. It is resulted on the base of calculation of mortality tables and expected life expectancy. It is the most adequate generalizing characteristic of actual death rate at all age.

KAZAKHSTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pressure															
GDP per capita, $ PPC		5756	5561	5204	4711	4508	4682	4921	4969	5224	5892	6855			
Real GDP per capita, $				699	733,4	1052,4	1350,7	1445,9	1468,8	1127,4	1229	1490,9	1658,1	2068,1	2713,8
Rate of GDP growth, in % to the previous year	99,2	88,2	96,6	93,6	90,5	95,7	103,9	105,1	100,9	102,7	109,8	113,5	109,8	108,9	108,6
Sructure of GDP, %: - share of industry	20,5	27,2	30,9	28,7	29,1	23,5	21,2	21,4	24,4	28,2	33,3	30,7	29,5	29,1	31,1
- share of agriculture	34			16,4	14,9	12,3	12,2	11,4	8,6	9,9	8,1	8,7	8	7,8	7,9
- share of construction	12			8,29	9,6	6,5	4,4	4,2	4,9	4,7	5,2	5,5	6,3	6	5,9
- share of services	15,9			10,4	12,1	17,2	17,3	15,6	15,2	13,6	12,4	31,8	32,4	18,3	31,5
Foreign debt in % from GDP	16,4	16,4	24,5	33,4	28	21	20,1	26,9	36	49,4	68,6	65,3	66,3	64,2	65,6
Expenditures on scientific researches, % from GDP	0,46	0,56	0,26	0,97	0,32	0,27	0,31	0,34	0,22	0,18	0,23	0,28	0,37	0,31	0,33
Expenditures on environm. protection, % from GDP	0,5	0,5	0,02	0,8	0,3	1,158	0,9	0,799	0,634	0,702	0,24	0,69	0,8	0,6	0,7
Human development index	0,8	0,768	0,766	0,79	0,72	0,69	0,66	0,67	0,67	0,68	0,69	0,7	0,7	0,7	0,8
Gini index - discrepancy in earning			0,202	0,327	0,327		0,319	0,338	0,347	0,344	0,343	0,323	0,362	0,312	0,336
Population below income poverty line, in %	15,5	20,3	30,5	32,4	32,8	34,5	34,6	38,3	39	34,5	31,8	28,4	24,2	19,8	16,1
Annual energy consumption per capita, thousand kw	6,2	5,9	6,2	5,1	4,9	4,6	4,1	3,6	3,4	3,4	3,4	3,8	3,8	4,1	4,3
Number of population, thousand people	16,35	16,45	16,43	16,33	16	15,7	15,5	15,2	14,95	14,9	14,86	14,85	14,86	14,95	15,1
Rate of population growth, % to the previous year	101,20	100,6	101,0	99,90	99,54	98,21	98,96	98,87	98,06	98,03	99,75	99,89		92,7	120,8
Infant mortality rate: children under-one year per 1000 births		27,4	26,0	28,3	27,2	27,3	25,4	24,9	21,6	20,5	18,8	19,1	17	15,7	14,5
under 5 years	34	35	33,4	36	35,3	36,5	33,2	32,6	28,9	26,8	25,4	22,8	21,7	21	21
Average life expectancy, years		67,6	67,4	65,4	64,9	63,5	63,6	64	64,5	65,5	65,5	65,8	66	65,8	66,1
Dynamics of birth rate (per 1000 people of the population), in %		21,5	20,5	19,3	18,9	17,5	16,3	15,2	14,8	14,5	14,8	14,9	15,3	16,6	18,9
Dynamics of death rate (per 1000 people of the population), in %		8,2	8,3	9,4	9,4	10,5	10,4	10,1	9,8	9,7	10,1	10,0	10	10,4	10,1

KYRGYZSTAN	1992	1995	1996	1998	1999	2000	2001	2002	2003	2004
State										
GDP per capita, $ PPC	2730	1850	2101	2299	2377	2521	2634	2785	2878	
Real GDP per capita, $	810	690	580	343	257	293	308			
Rate of GDP growth, in % to the previous year	86,1	94,6	107,1	102,1	103,7	105,4	105,3	100	107	107,1
Sructure of GDP, %: - share of industry	32,1	12	11,1	16,3	21,7	25	23,1	17,9	17,3	16
- share of agriculture	37,3	40,6	46,2	35,9	34,8	36,6	34,5	34,4	33,6	32,9
- share of construction					3,8					
- share of services	21,7	34	29,6	34,7	33,3	29,6	31,4	35,6	36,8	38,1
Foreign debt in % from GDP		31,1	66,6	91,7	132,6	137,2				
Expenditures on scientific researches, % from GDP	0,3	0,3	0,2	0,2	0,2	0,2	0,2			
Expenditures on environm. protection, % from GDP		0,65	0,45	0,5	0,3	0,11				
Human development index	0,715	0,676	0,688	0,701	0,715	0,719	0,723	0,724	0,729	-
Gini index - discrepancy in earning		0,41	0,37	0,432	0,443	0,449	0,441	0,419	0,407	-
Population below income poverty line, in %		57	43,5	54,9	55,3	52	47,6	44,4	39,3	-
Number of population, thousand people	4469	4512	4574	4760	4851	4908	4947	4984	5037	5093
Rate of population growth, % to the previous year	100,6	101,5	101,6	101,6	101,3	100,8	100,8	100,8	101,1	101,1
Infant mortality rate: children under-one year per 1000 births	31,5	28,1	25,9	26,2	22,7	22,6	21,7	21,2	29	25,7
Average life expectancy, years				67,1	68,7	68,5	68,7	68,1	68,2	68,2
Dynamics of birth rate (per 1000 people of the population), in %	28,6	26,0	23,6	22,2	21,4	19,7	19,8	20,2	20,9	21,6
Dynamics of death rate (per 1000 people of the population), in %	7,2	8,2	7,6	7,4	6,8	6,9	6,6	7,1	7,1	6,9

TAJIKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State															
GDP per capita, $ PPC															
Real GDP per capita, $		390.2	307.2	254.1	195.8	169.5	126.7	128.9	135.7	211.6	224.6	241.3	262.1	285.1	304.2
Rate of GDP growth, in % to the previous year		94.6	67.7	83.7	78.7	87.6	83.3	101.7	105.3	103.7	108.3	109.6	110.8	111	110.6
Sructure of GDP, %: - share of industry			39.3	32.8	27.5	34.1	25.7	22	20.1	21.7	23.4	22.4	22.1	21	19.6
- share of agriculture			29.3	21	19.1	36.7	36	32	25.1	25.4	27	26.5	26.4	25.2	21.6
- share of construction			9.8	3.6	10.4	2.9	2.6	2.8	3.9	5.4	3.4	2.8	2.5	2.8	7.2
- share of services			20.7	31.5	42.5	26.1	27.7	33.2	42.7	40.2	37.4	37.7	41.4	38.6	42.3
Foreign debt in % from GDP						133,6	83,8	100.2	91.4	97.2	87.8	91.6	81.4	66.3	42.2
Expenditures on scientific researches, % from GDP						0.1	0.1	0.1	0.1	0.18	0.07	0.05	0.07	0.18	0.14
Expenditures on environm. protection, % from GDP		0.22	0.62	0	0.06	0.06	0.05	0.03	0.01	0.01	0.07	0.05	0.05	0.04	0.05
Human development index			-	-	0.55	0.537	0.524	0.528	0.54	0.601	0.667				
Gini index - discrepancy in earning															
Population below income poverty line, in %		...	...	...	...	...	...	...	...	82.82	83.02	83	83	83	64
Annual energy consumption per capita, thousand kw			3.04	3.16	3.06	2.61	2.61	2.41	2.41	2.61	2.3	2.49	2.47	2.48	2.43
Number of population, thousand people		5433.3	5536.4	5573.4	5606.8	5667.6	5735.3	5822.5	5938.6	6064	6188.4	6312.7	6441	6640	6780.4
Rate of population growth, % to the previous year		102.7	101.1	100.2	101	101.2	101.2	101.9	102.1	102.1	102	102	102.1	102.1	102.1
Infant mortality rate: children under-one per 1000 births		40.6	45.9	47	40.6	30.9	23.4	19.4	23.4	15.5	15.5	27.9	17.2	...	...
Infant mortality rate: children under-five per 1000 births		58,5	68,2	83,5	71,3	49,5	-	-	-	22,7	-	-			
Average life expectancy, years		70.1	68.3	62	66.1	68.3	66.9	66.7	66.9	68.4	67.6				
Dynamics of birth rate (per 1000 people of the population), in %		39.1	32.4	33.5	34.2	34.1	30.0	30.6	31.3	28.9	27.0	27.3	27.3	27.1	26.8

TURKMENISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
State														
Real GDP per capita, $														
GDP per capita, $ PPC					2174	2285	3893	3472	3630	4209	4971	5350	5727	
Rate of GDP growth, in % to the previous year			83,6	100,3	82,7	92,8	107,1	88,6	107,1	116,5	118,5	120,4		
Sructure of GDP, % : - share of industry					38,1	52,8	54,4	33	27,5	31,4	38	39,2	39,5	
- share of agriculture					32,5	16,1	12,6	20	25,2	24,8	26	25,2	23,8	
- share of construction					6,8	5,8	10,3	11,3	13,1	12,2	10	6,4	7	
- share of services					22,6	25,3	22,7	35,7	34,2	31,6	26	29,2	29,7	
Foreign debt in % from GDP	no foreign debt													
Expenditures on scientific researches, % from GDP						0,1	0,1							
Expenditures on environm. protection, % from GDP			0,1	0,18	0,1	0,1	0,17	0,18	0,17	0,17				
Human development index								0,711	0,713	0,72	0,74	0,747		
Gini index - discrepancy in earning								0,365	0,333					
Population below income poverty line, in %	no poverty													
Annual energy consumption per capita, thousand kw		2,40	2,14	2,19	1,97	1,85	1,82	1,65	1,64	1,62	1,69	1,69	1,69	1,65
Number of population, mln people	3,84	3,99	4,15	4,32	4,48	4,59	4,71	4,85	4,99	5,20	5,37	5,64	5,94	6,3
Rate of population growth, % to the previous year	104,2	104,1	103,9	104,1	103,7	102,4	102,7	102,9	103	104,1	103,3	105	105,3	106
Infant mortality rate: children under-one per 1000 births	45,2	47,0	43,6	45,9	46,4	42,2	39,6	37,5	32,9	26,4	21,3	20,1	17,7	16,4
Infant mortality rate: children under-five per 1000 births						13,0	11,9	10,6	9,8	7,1	6,3	6	5,6	5,2
Average life expectancy, years	66,4	65,8	66,2	65,6	64,6	64,7	64,8	64,8	65,4	66,8	68,3	68,6	68,1	68,8
Dynamics of birth rate (per 1000 people of the population), in %	33,5	32,4	32,4	31,1	29,7	28,3	24,2	21,6	20,8	18,5	18,8	16,1	22	21,8
Dynamics of death rate (per 1000 people of the population), in %	6,9	7,0	6,8	7,4	7,4	7,0	7,1	6,5	6,3	5,4	5,4	5,3	5,5	5,5

UZBEKISTAN	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State															
GDP per capita, $ PPC	-	-	2650	2510	2390	2404	2508	2670	2829	2994	3068	-			
Real GDP per capita, $	-	-	1174	1121	1043	1015	1012	1076	1137	1204	1274	1353			
Rate of GDP growth, in % to the previo	-	-	88.9	97.7	94.8	99.1	101.7	105.2	104.3	104.3	103.8	104.2	104	104.2	
Sructure of GDP, %: - share of industry	-	-	26.6	22.3	17.0	17.1	17.8	15.6	14.9	14.3	14.2	14.1	14.5	15.8	
- share of agriculture	-	-	35.4	27.8	34.5	28.1	22.4	28.3	26.8	29.0	30.1	30.0	30.1	28.6	
- share of construction	-	-	9.5	8.9	7.2	7.1	8.2	7.3	7.5	6.7	6.0	5.8	4.9	4.5	
- share of services	-	-	28.5	41.0	41.3	47.7	51.6	48.8	50.8	50.0	49.7	50.1	50.5	51.1	
Foreign debt in % from GDP								11.70							
Expenditures on scientific researches, % from GDP															
Expenditures on environm. protection, % from GDP			1,3		1,25				1.2	1.3	0.66	0.58	0.4	1.6	
Human development index	-	-	0,698	0,676	0,675	0,679	0,682	0.692	0.697	0.706	0.73	-			
Gini index - discrepancy in earning	-	-	0.27	0.32	0.34	0.31	0.32	0.42	-	0.37	-	-			
Population below income poverty line, in %															
Annual energy consumption per capita, thousand kw			2.60	-	-	2.60	-	-	-	1.92	1.95	1.92	1.95	1.91	
Number of population, mln people		20.71	21.21	21.70	22.19	22.56	23.01	23.56	23.95	24.31	24.65	24.97	25.27	25.43	25.71
Rate of population growth, % to the previous year	-	-	102,4	102,3	101,7	102	101,9	101,8	101,5	101,5	101,4	101,3	101.2	101.2	101.1
Infant mortality rate: children under-one per 1000 births		35,5	37,4	32,0	28,2	26,0	24,2	22,8	21,9	20,2	18.90	18.30	16.7	16.5	15.4
Infant mortality rate: children under-five per 1000 births															
Average life expectancy, years	-	-	69.4	69.3	70.1	70.2	70.2	70.25	70.3	70.3	70,8	71,3	71.2	71,6	
Dynamics of birth rate (per 1000 people of the population), in %	-	3.45	3,31	3.15	2.94	2.98	2.73	2.55	2.3	2,24	2.13	2.04	2.09	1.98	
Dynamics of death rate (per 1000 people of the population), in %	-	0.62	0,65	0.66	0.66	0.64	0.62	0.58	0.58	0.54	0.55	0.53	0.54	0.54	