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State Agency on Environment Protection
and Forestry under the Government of the Kyrgyz Republic

UNDP-UNEP Poverty and Environment Initiative
in the Kyrgyz Republic

THE NATIONAL REPORT ON THE STATE OF THE ENVIRONMENT OF THE KYRGYZ REPUBLIC for 2006-2011

Bishkek-2012

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УДК 502/504
ББК 20.1
Т 47

Т 47 The National Report on the State of the Environment of the Kyrgyz Republic for 2006-2011. – B.: 2012. – 126 p.

ISBN 978-9967-26-859-3

The National Report on the State of the Environment is a key informational product based on environmental indicators, which allows assessing status of the environment and trends of its changing. Within preparation of «The National Report on the State of the Environment of the Kyrgyz Republic for 2006-2011», a situation analysis of environmental parameters in the Kyrgyz Republic was conducted in following areas: air pollution and ozone depletion, climate change, water resources, biodiversity, land resources, agriculture, energy, transport and waste.

This publication is purposed for broad range of the specialists, staff of the scientific and research institutions, higher education institutions, business structures, public associations, representatives of the local authorities and decision-makers, and it serves as a basis in development of the social-economic strategic documents and effective interventions to improve state of the environment in the republic and rational use of its natural resources.

Electronic version of «The National Report on the State of the Environment of the Kyrgyz Republic for 2006-2011» is posted on following Internet resources: www.gov.kg, www.nature.kg, www.unpei.org, www.undp.kg.

The UNDP-UNEP "Poverty and Environment" Initiative provided support in preparation of the National Report. "Poverty and Environment" Initiative implemented by the UN Development Programme (UNDP) and the UN Environmental Programme (UNEP) is a global UN activity supporting efforts of the countries in comprehensive consideration of interlink of the poverty and environmental issues in national planning processes for development. PEI provides financial and technical assistance to the states-partners in implementation of activity aimed to address specific aspects of the poverty and environment. PEI is funded by the Governments of Belgium, Denmark, Ireland, Norway, Spain, Sweden, United Kingdom, USA and European Commission; main financial assistance is provided by the UNDP and UNEP.

Published in 2012
Free distribution

Т 1502020000-12
ISBN 978-9967-26-859-3

УДК 502/504
ББК 20.1

Foreword

2012 is a unique year for international sustainable development processes. 40 years ago the decision to establish the United Nations Environment Programme was made. The first "Earth Summit" was held 20 years ago, where the "UN Agenda 21" and three major environmental conventions were adopted. This year the UN conference "Rio +20" was held in Rio de Janiero, where the document "The future we want" was adopted and the principles of "green" economy has gained impetus in the context of promoting sustainable development and poverty eradication.

In this context, I am very pleased to present the National Report on the State of the Environment of the Kyrgyz Republic for 2006-2011, which is a joint contribution of the Government of the Kyrgyz Republic and the UNDP-UNEP Poverty and Environment Initiative into the national process of the implementation the global decisions made during the Rio + 20 Conference. It is pleased that in Kyrgyzstan for the first time this document was developed on the basis of international standards and was officially approved by the Government.

I hope that it will promote the broad attention to existing environmental issues, a better understanding of the links of the state of the environment and the poverty rate. It will also serve as the basis for decision-makers in developing strategic documents aimed at socio-economic development, the achievement of Millennium Development Goals and promoting "green" economy trends.

Everyone takes the responsibility for meeting the current social, economic and environmental needs, which are not compromise the needs of future generations. As a rule, the first step towards solving any problem it is a need for its understanding and the correct choice of options for its decision, which requires reliable data and information. A system of internationally recognized environmental indicators on which this report is based can be a good basis for decision-making in the field of sustainable development. Subsequently, it can be expanded and transformed into a multifunctional tool for promoting the principles of "green economy" through mainstreaming socio-economic indicators. Promoting the principles of "green economy" allows dispelling the myth that the interests of economic prosperity and environmental protection are contradictory.

I believe, based on reliable data and information, the Kyrgyz Republic is able to conserve the environment through taking rational policy and implementation of reasonable investment, growth of economy, creation of working places and speed up the social progress. All these are elements of complex approach, which will provide the sustainable future – future, we are aiming to.

Sabirdjan Atadjanov
Director, State Agency on Environment Protection and Forectry under the Government of the Kyrgyz Republic

Alexander Avanessov
UN Resident Coordinator in the Kyrgyz Republic

Authors group

Coordination and editing

Atadjanov Sabir, PhD, Director, State Agency on Environment Protection and Forestry under the Government of the Kyrgyz Republic

Tulegabylov Nurbek, Deputy Chairman, National Statistics Committee of the Kyrgyz Republic

Bekkulova Djiparkul, Head of the Department of the Environmental Strategy and Policy, State Agency on Environment Protection and Forestry under the Government of the Kyrgyz Republic

Baidakova Natalya, Deputy Head of the Department of the Environmental Strategy and Policy, State Agency on Environment Protection and Forestry under the Government of the Kyrgyz Republic

Grebnev Vladimir, Leading expert, Head of Experts Group

Experts

Koichumanova Kulipa, NSC KR

Sulaimanova Gulsara, NSC KR

Gorshkova Irina, Expert on atmospheric air

Iliyasov Shamil, Expert on climate change

Sahvaeva Ekaterina, DWRI MA

Davletbakov Askar Temirbekovich, BSI NAN

Kustareva Lidiya, BSI NAN

Laz'kov Georgy, BSI NAN

Mil'ko Dmitry, BSI NAN

Penkina Ludmila, SPI "Kyrgyzgiprozem"

Pak Vladimir, DCUPP MA

Zhusupov Kubanychbek, Expert on Energy

Dooletov Keneshbek, Expert on transport

Elemanov Omurbek, Expert on Wastes

Iliyazov Mirbek, Expert on wastes

Kadyrova Gulshat, MES KR

Vashneva Nina, MH KR

Turdumatova Nazgul, SAEPF

Satkynalieva Kanybek, KSUCTA

Nyshanbaeva Ludmila, Kyrgyzhydromet, MES KR

Titova Larisa, Kyrgyzhydromet, MES KR

Bondareva Vera, Kyrgyzhydromet, MES KR

Tolstihina Galina, SAGMR

Sarybaeva Elmira, SCS

The official data used in the National Report on the State of the Environment of the Kyrgyz Republic are provided by:

- State Agency on Environment Protection and Forestry;
- National Statistical Committee;
- Ministry of Agriculture and Melioration;
- Ministry of Energy and Industry;
- Ministry of Economic Development and Antimonopoly Policy;
- Ministry of Health;
- Ministry of Transport and Communications;
- Ministry of Emergency Situations;
- Central Administration on Hydrometeorology under the MES;
- State Agency for Geology and Mineral Resources;
- Biology and Soil Institute of the National Academy of Sciences of the Kyrgyz Republic;
- State Customs Service of the Kyrgyz Republic;
- SPI "Kyrgyzgiprozem";
- Center for Problems of Renewable Energy Sources;
- Centre for Standardization and Metrology at MEAP;
- Ozone Center of Kyrgyzstan;
- JSC "Power Plants";
- Bishkek Heating and Power Plant;
- OJSC "Kyrgyz Chemical and Metallurgical Plant";
- JSC "Kara-Balta Mining Enterprise";
- Small Enterprise "Tazalyk";
- General Directorate "Biosphere Territory of Issyk-Kul";
- Kalinin HPS
- and other organizations.

State Agency on Environment Protection and Forestry expresses gratitude to ministries, agencies and organizations for the information and active participation at preparation of the National Report on the State of the Environment of the Kyrgyz Republic, and hopes for further fruitful cooperation.

Millennium Development Goals

1. Eradicate extreme poverty and hunger

2. Achieve universal primary education

3. Promote gender equality and empower women

4. Reduce child mortality

5. Improve maternal health

6. Combat HIV/AIDS, malaria and other diseases

7. Ensure environmental sustainability

8. Develop a Global Partnership for Development

THE NATIONAL REPORT ON THE STATE OF THE ENVIRONMENT OF THE KYRGYZ REPUBLIC FOR 2006-2011

Approved by the Decree No. 553
of the Government of the Kyrgyz Republic
as of August 7, 2012

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List of abbreviations:

ADB	Asian Development Bank
API	Atmospheric air pollution index
BSI NAN	Biology and Soil Science Institute of the National Academy of Sciences of the Kyrgyz Republic
CACILM	Central Asian Countries Initiative for Land Management
CAPP	Climate-related atmospheric pollution potential
CDM	Clean Development Mechanism
CIS	Commonwealth of Independent States
CFC	Chlorofluorocarbons
CDS	Country Development Strategy
CPMAP	Control points for monitoring atmospheric pollution
DCUPP MA	Department of Chemical Use and Plant Protection of the ministry of Agriculture of the Kyrgyz Republic
DSES MoH	Department of Sanitary and Epidemiological Surveillance of the Ministry of Health of the Kyrgyz Republic
DWRI MA	Department of Water Resources and Improvement of the Ministry of Agriculture of the Kyrgyz Republic
EEA	European Environment Agency
EECCA	Countries of Eastern Europe, Caucasus and Central Asia
EC	European Commission
EIA	Environmental Impact Assessment
EPR	Environmental Performance Review
EurAsEC	Eurasian Economic Community
FAO	United Nations Food and Agriculture Organization
FEC	Fuel and energy complex
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gases
GOST	State Standard
HEE	Higher education establishment
HEP	Hydroelectric Plant
ICWC	Interstate Commission for Water Coordination
ICSD	Interstate Commission for Sustainable Development
IPCC	Intergovernmental Panel for Climate Change
IUNC	International Union for Nature Conservation
IASF	International Aral Sea Fund
KASPI	Comprehensive ambient air pollution index
kWh	Kilowatt-hour
KIHE	Kyrgyz integrated hydrological expedition
Kyrgyzhydromet	Hydrometeorology Agency of the Ministry of Emergency Situations of the Kyrgyz Republic
LSG	Local Self-Government
MA	Ministry of Agriculture of the Kyrgyz Republic
MAC	Maximum allowable concentration
MAC a.d.	Average Daily Maximum Allowable Concentration
MEI	Ministry of Energy and Industry of the Kyrgyz Republic
MoH	Ministry of Health of the Kyrgyz Republic
MoES	Ministry of Emergency Situations of the Kyrgyz Republic
MP	Montreal Protocol
MSW	Municipal Solid Waste
NAS	National Academy of Sciences of the Kyrgyz Republic
NMVOC	Non-methane volatile organic compounds
NSC	National Statistical Committee of the Kyrgyz Republic
NGOs	Non- governmental (non-profit) organizations
NP	National Park
ODSs	Ozone-depleting substances
ODP	Ozone Depletion Potential
OECD	Organization for Economic Cooperation and Development
OJSC	Open Joint Stock Company
OSCE	Organization for Security and Cooperation in Europe
PAs	Protected Areas
PM	Particulate matter
POPs	Persistent organic pollutants
PSIR	Pressure-State-Impact-Response
PSR	Pressure-State-Response
PS	Polluting substances (pollutants)
RES	Renewable Energy Sources
RCM	Resolution of the Council of Ministers
RFEPFD	Republican Fund for Environmental Protection and Forestry Development
SAEPF	State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic
SAGMR	State Agency for Geology and Mineral Resources of the Kyrgyz Republic
SDFECM	State Department for Fuel and Energy Complex Management of the Ministry of Energy and Industry of the Kyrgyz Republic
SCS	State Customs Service of the Kyrgyz Republic
SWI DWRL	State Water Inspectorate of the Department of Water Resources and Land Improvement of the Kyrgyz Republic
TOE	Ton of oil equivalent
TPP	Thermal Power Plant (CHPP - central heating and power plant)
TRF	Ton of reference fuel
UN	United Nations Organization
UNEP	United Nations Environment Programme
UNESCO	United Nations for Science, Education and Culture
UNECE	United Nations Economic Commission for Europe
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention for Climate Change
UNCCD	United Nations Convention to Combat Desertification
VOC	Volatile Organic Compounds
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization

Introduction

Kyrgyzstan is a mountainous country particularly vulnerable to natural and anthropogenic effects, which is going through a difficult period of transition to a market economy. It is vitally important to take into account environmental factors in the policy of economic reform alongside thesocial aspects.

The Agenda for the XXI Century[1] contains a call addressed to countries and the international community for the establishment of sustainable development indicators. Reliable, objective and timely environmental impact assessment is necessary as a priority for the prevention and elimination of the negative anthropogenic impact on the environment and for the establishment of a normal environment for life. Such indicators are needed to draw attention to the issues of sustainable development and to contribute to the provision of assistance to organizations at all levels in making informed environmental decisions, taking into account environmental issues and for the formulation of a "green" development policy.

The collection, analysis and use of environmental indicators are the basis for policy development and the implementation of a "green" development policy. The effective use and management of resources is one of the central goals of economic policy, and it relates to many tax and regulatory interventions that are not commonly associated with "green" development. The "green" growth strategy is based on the mutually reinforcing aspects of economic and environmental policy. It takes into account the full value of natural capital as a factor and it also focuses on effective ways to mitigate the pressure on the environment with the purpose of moving to new development schemes and at the same time not crossing over the critical local, regional and global environmental thresholds.

In conducting the assessment of the environmental status t and the effectiveness of actions for environmental protection, it is important to have objective and up-to-date analytical information on the state of the environment. This information should be available to both the public authorities and the general public.

The national reports on the state of environment are key information products for the country. The environmental indicators on which the reports are based are the key tool for environmental assessment, reporting and policy creation. The process of drawing up regular national reports leads to the improvement of environmental data collection and reporting and also allows for the comparison of environmental statistics and indicators with other countries.

At the Sixth Environment for Europe Conference (Belgrade, 10-12th October 2007), the environment ministers of EECCA countries approved the guidelines for the preparation of assessment of environmental protection, based on environmental performance (hereinafter - the UNECE Guidelines) developed by the Monitoring and Assessment Working Group of the UNECE Committee on Environmental Policy.

The guidelines observe the approach applied in the All-European assessment reports on the environment, including the widespread analytical scheme DF-P-S-I-R (Driving force - Pressure - State - Impact - Response), used by the European Environment Agency (EEA).

Analytical scheme: Driving forces - Pressure - State - Impact - Response

Driving forces are socio - economic factors and activities that enhance or weaken environmental impact.

Pressure means direct anthropogenic environmental pressure exerted by the emission or discharge of pollutants, and by the use of natural resources.

State refers to the current state and trends of the environment, including air, water and soil quality parameters, the diversity of species in a specific geographic area, and the availability of natural resources such as forests or fresh water.

Impact means the consequences of environmental change on human health and other organisms, and the consequences for the environment and biodiversity.

Response is a specific action to address environmental problems.

Source: European Environment Agency.

[1] "Agenda of XXI Century", a global conceptual document, adopted by the UN Conference on Environment and Development, Rio de Janeiro.

Within the framework of the Kyrgyz government's program - Stability and Decent Life[2] and The mid-term agenda of the Kyrgyz Republic for 2012-2014[3], SAEPF developed The National Report on the State of the Environment of the Kyrgyz Republic.

In the framework of the preparation of the National Report, an analysis of the current situation was carried out, according to UNECE Guidelines for 36 environmental indicators, and nine areas: atmospheric air pollution and ozone depletion, climate change, water resources, biodiversity, land resources, agriculture, energy, transport and waste.

In order to provide a complete analysis of the available information, the NSC and all ministries, departments and organizations, with responsibility for collecting and analyzing the information in the field of environmental protection, were involved in the development of the National Report.

According to official data from the National Statistics Committee, ministries, agencies and national experts prepared sections of the National Report to be discussed at seven thematic round tables with participation from representatives of the Kyrgyz parliament, ministries, departments, NAS, civil society and international organizations.

Support in the preparation of the National Report was provided by the UNDP / UNEP Initiative - Poverty and the environment.

The State Agency for Environment Protection and Forestry under the government of the Kyrgyz Republic would like to thank the ministries, departments and organizations for the information provided and active participation in the development of the National Report on the state of the environment of the Kyrgyz Republic, and looks forward to future cooperation.

[2] Approved by the Government of the Kyrgyz Republic on 25 January 2012, # 55
[3] Approved by the Government of the Kyrgyz Republic on 12 April 2012, # 239

Background

The Kyrgyz Republic is a sovereign, multiethnic state located in the heart of the Eurasian continent in the mountainous massif of the Tien Shan and Pamir-Alai, between 39 ° and 43 ° north and 69 ° - 80 ° east.

The total length of the country's borders is 4,508km. In the north, west and south the Kyrgyz Republic has borders with the Republic of Kazakhstan (1,113 km), Uzbekistan (1,374 km), Tajikistan (972 km), and to the east and south-east it has a border with China (1,049 km).

Figure 1. Map of the administrative and territorial division of the Kyrgyz Republic

The Kyrgyz Republic consists of seven regions (Figure 1), 40 districts, 25 cities, 28 towns and 440 ail aimags (rural units).

The area of the Kyrgyz Republic is 199.9 thousand square kilometers, and almost 90% of that area is more than 1,500 meters above sea level, the highest point of which is Peak Pobeda (7,439 m).

The resident population of the Kyrgyz Republic on 1st January 2011 was recorded as 5 million 478 thousand people, 49.4% of which are men, and 50.6% women. More than one-third of the population (34%) live in urban areas and about two thirds (66%) live in rural ones. The average population density is 27 people per square kilometer. The most densely populated regions are Chui oblast and Bishkek - the capital of the state - where almost a third of the country's total population (859.8 thousand people, more than 80 people per square kilometer) is concentrated. The Kyrgyz Republic is home to over 100 different nationalities.

The rather harsh extreme environmental conditions and high vulnerability of mountain ecosystems are specific features of Kyrgyzstan. The predominance of heavily dissected topography creates special conditions in the foothills, plains and valleys, where settlements are concentrated. According to bioclimatic zoning, 4 million people (79%) live in the area (17%) attributed to the comfort zone for life, 1 million (19%) live in the area (19%) of relative comfort or compensated comfort at an altitude of 1,500 to 2,200 meters, and the remaining 2% of the population live at altitudes above 2,200 meters in conditions of uncompensated bioclimatic comfort.

According to preliminary estimates, in 2011, the GDP calculated by the method of production, amounted to 273,107.8 million KGS, an increase of 5.7% on the figure for 2010. In 2010, the GDP per capita was USD922.6, and according to preliminary estimates for 2011, the figure was USD1,130.7.

PART 1
Ambient air pollution and ozone depletion

The main sources of atmospheric air pollution in the Kyrgyz Republic are enterprises of the energy industry, mining and processing sectors of industry, construction materials, utilities and the private sector, as well as mobile sources of pollution, such as transport.

The emission of polluting substances into the atmosphere depends mainly on the economic state of an industry with the greatest impact on envpressure ironment. A combination of the lack of Kyrgyzstan's own natural gas reserves and the irregular supply of electricity have forced most private family homes to return to the use of locally produced solid fuels which have a relatively low calorific value and high ash content.

A wide variety of harmful substances are emitted into the atmosphere. Everywhere, substances such as dust, sulfur dioxide, nitrogen dioxide and carbon monoxide, known in many countries as the classic pollutants, are emitted into the air. Additionally, the so-called specific pollutants are emitted in the atmosphere by individual production facilities and by all types of vehicle. In terms of having an impact on public health, the major specific pollutants are formaldehyde, benzopyrene and heavy metals - including toxic lead salts, as well as particulate matter.

In recent years, the pattern of emissions into the environment has changed significantly. The dominant contribution to the level of air pollution is made by motor vehicle emissions, the rapidly growing number of which is the characteristic feature of towns and cities in the country.

The emission of pollutants into the atmosphere

Increased air pollution adversely affects human health and the stability of ecosystems, as well as increasing the corrosion of elements of technical infrastructures. This leads to an increase in spending on health and ecosystems, and entails additional economic costs for infrastructure maintenance. This indicator provides an opportunity to assess the environmental impact of individual sectors, such as: energy, transport, industry, agriculture, and waste management activities.

This index is formed from emissions of both stationary and mobile sources. In the Kyrgyz Republic, the indicator for emissions from stationary sources is produced by the National Statistical Committee by collecting information from businesses and other activities on the source and amount of pollutants emitted into the atmosphere. Emissions from mobile sources are calculated based on the IPCC methodology[4].

[4] Intergovernmental Panel for Climate Change, www.ipcc.ch

Emissions from stationary sources of pollution

The f total gross emissions in the republic for the last five years has partly changed. Substances such as particulate matter, sulfur dioxide, carbon monoxide, nitrogen oxides and hydrocarbons dominate the emissions from stationary sources.

The emission of polluting substances from stationary sources shows a trend by the group of companies which report to the NSC, but this data does not reflect emissions across the whole country, because many sources of emissions are not covered by statistical reporting (private sector, agriculture, etc.).

Gross emissions of solids substances and gases into the atmosphere in 2011, are almost equally distributed.

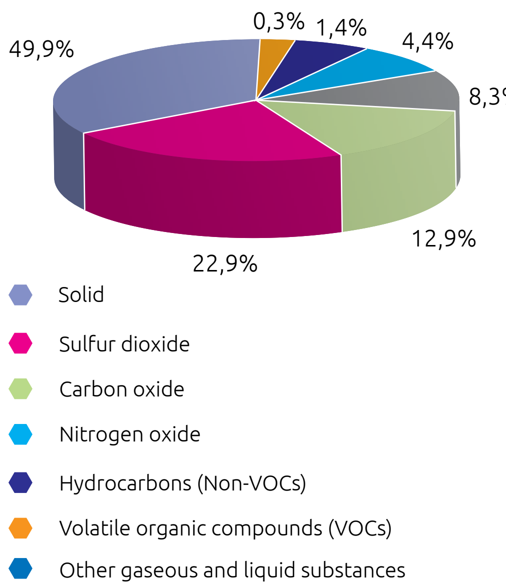


Figure 1.1. Emissions from stationary sources in the Kyrgyz Republic in 2011

Sulfur dioxide emissions at 46%, dominate the gaseous emissions. Emissions of carbon monoxide and nitrogen oxide were 26% and 16%, respectively. Of specific substances, emissions are predominately hydrocarbons (non-VOC), comprising about 9% (2011).

The main volume of polluting emissions is associated with the thermal power plant (66.7%), manufacturing sector (26.6%) and mining sector (6.1%). They collectively emit into the atmosphere about 94.4% of the total pollutants.

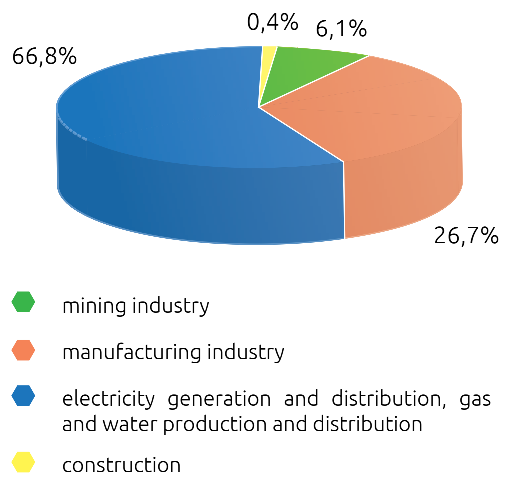


Figure 1.2. Emissions by economic activity

Total emissions from stationary sources into the atmosphere increased for the period from 2006 to 2009. In 2010, there was a decrease in the total mass emissions of 21% compared to 2009, due to some decline in production in some economic sectors such as mining, the petroleum industry , food industry, leather and leather products and wood processing. In 2011, emissions increased by 1.2 times compared to 2010.

Of the total volume of waste pollutants, 93% are forwarded to treatment facilities, of which 96% are neutralized. About 7% of pollutants are emitted without any treatment. For the most part, these are liquid and gaseous substances.

In 2011, 92% of the total volume of polluting substances emitted by all stationary sources and by enterprises in the Republic were trapped and treated (Table 1.1).

In the republic, the greatest volume of trapped and treated pollutants is in Chui oblast at 64.4%, and the city of Bishkek with 32.7%. The least amount of trapped and destroyed emissions were in the Batken region (0.05%) (Table 1.2).

The main volumes of polluting substances are generated in the city of Bishkek and Chui and Issyk-Kul regions. In 2009, there was a total of 118.2 thousand tons of atmospheric emissions in the Republic, thereof 79.4 thousand tons were produced by "Kyrgyzneftegaz" in the Jalal-Abad region (Table 1.3). In 2009, 79.9 thousand tons of emissions were recorded for the Jalal-Abad region, while in other years the total amount of emissions in this region did not exceed 2.5 thousand tons.

Table 1.1. Emission of atmospheric pollutants (tons)

Emission of atmospheric pollutants (thousand tons)	2006	2007	2008	2009	2010	2011
Number of enterprises producing emissions of polluting substances (PSs)	181	170	175	162	163	167
Number of sources producing emissions of polluting substances (PSs)	3196	3169	3060	3015	2910	2997
Amount of pollutants (PSs) emitted by all stationary sources(thousand tons) including:	463.8	476.8	526.3	473.6	469.0	473
Emitted without treatment	17.7	19.2	17.8	94.2	23.6	26.5
Received at treatment facilities	446.0	457.6	508.5	379.4	445.4	447.4
Ccaught (treated) harmful substances (tons)	427.7	438.9	486.6	355.4	438.3	437.6
Percentage of total amount	92.2	92.0	92.4	75.1	92.1	90.5
Including disposed of from polluting substances (%)	60.7	62.1	49.8	32.7	36.9	34.2
Total emission of pollutants into the atmosphere from stationary sources, thereof:	**36.1**	**37.9**	**39.7**	**118.2**	**30.7**	**36.3**
Solid	18.1	20.4	21.2	23.3	15.0	18.1
Gaseous and liquids:	18.0	17.5	18.6	94.9	15.7	18.2
Sulfur dioxide	7.9	7.1	8.8	9.7	7.6	8.3
Carbon monoxide	4.6	4.5	4.1	3.1	3.4	4.7
Nitrogen oxides	3.1	3.2	3.4	2.1	2.5	3.0
Hydrocarbons (without VOCs)	1.6	1.8	1.5	1.5	1.5	1.6
Volatile organic compounds (VOCs)	0.4	0.4	0.3	0.3	0.2	0.1
Other gaseous and liquid substances	0.4	0.5	0.5	78.2	0.5	0.5

Source: NSC

Table 1.2. Capture and utilization of air polluting substances from stationary sources in 2011 (thousand ton)

Name of region	Volume of caught pollutants (thousand tons)	Thereof	
		treated	utilized
The Kyrgyz Republic	**437.58**	**287.96**	**149.62**
Batken	0.22	0.22	-
Jalal-Abad	0.29	0.13	0.16
Issyk-Kul	3.37	3.31	0.06
Osh	8.19	8.19	-
Chui	281.98	146.0	135.98
Bishkek (city)	143.18	129.83	13.35
Osh (city)	0.35	0.28	0.07

Source: NSC

Table 1.3. Distribution of atmospheric emissions from stationary sources in the Kyrgyz Republic (thousand tons)

Name of region	2006	2007	2008	2009	2010	2011
Batken	1.0	0.8	0.6	0.6	0.3	1.6
Jalal-Abad	2.2	2.2	2.1	79.9	2.5	2.4
Issyk-Kul	3.1	2.8	2.6	2.6	3.0	3.5
Naryn	0.04	0.04	0.04	0.04	0.04	0.03
Osh	0.3	0.16	0.15	0.12	0.09	0.99
Talas	0.2	0.2	0.2	0.13	0.15	0.16
Chui	12.3	13.3	11.5	8.5	9.4	9.3
Bishkek (city)	16.4	17.8	21.9	25.6	14.4	17.0
Osh (city)	0.6	0.7	0.6	0.7	0.9	1.3
Total: The Kyrgyz Republic	36.1	37.9	39.7	118.2	30.7	36.3

Source: NSC

In the years 2006-2011, the highest pollutant emissions from stationary sources were observed in Bishkek and they comprised 45-47% of the total emissions in the country. In 2011, they increased by 3.5% compared with 2006, and by 15% compared to 2010.

In the town of Kara-Kol and the city of Osh, an increase in the total reported emissions from stationary sources is observed. But in the towns of Kant and Kara-Balta, the recorded emissions of air pollutants decreased (Table 1.4).

Table 1.4. Emissions of polluting substances into the air from stationary sources in selected cities/ towns (thousand tons)

City	2006	2007	2008	2009	2010	2011
Bishkek	16.4	17.8	21.9	25.62	14.4	17.0
Kant	5.9	6.0	5.3	2.81	3.8	3.3
Kara-Balta	4.1	5.1	4.3	4.3	3.9	3.9
Kara-Kol	1.3	0.9	0.9	1.27	1.2	1.6
Osh	0.6	0.3	0.6	0.75	0.9	1.3

Source: NSC

In 2011, the highest emissions of air pollutants were recorded in Bishkek, Kara-Balta and Kant (Table 1.5).

Table 1.5 Emissions of atmospheric polluting substances from stationary sources in selected cities, 2011

City/town	Total tons	Including				
		solid	gases and liquids	Comprising:		
				sulfur dioxide	nitrogen oxides	carbon oxides
Bishkek	17.0	8.8	8.2	6.0	1.8	0.4
Kant	3.3	1.8	1.5	0.3	0.2	0.9
Kara-Balta	3.9	2.8	1.1	0.5	0.1	0.4
Kara-Kol	1.6	1.1	0.5	0.4	0.02	0.13
Osh	1.3	0.4	0.9	0.5	0.1	0.3

Source: NSC

Emissions of particulate matter and sulfur dioxide per unit of the republic increased until 2010, and then there followed a decline. For particulate matter this figure decreased by 16.7% and for sulfur dioxide by 2.6%. In the period from 2006 to 2010, carbon monoxide and nitrogen oxide emissions decreased by 26.1% and 20.0% respectively. In 2011, there was some increase in all emissions (Table 1.6).

Table 1.6. Emissions of atmospheric pollutants from stationary sources (kilogram/square kilometer)

Polluting substance	2006	2007	2008	2009	2010	2011
Particulate matter	90	102	106	117	75	91
Sulfur dioxide	39	36	44	48	38	42
Carbon monoxide	23	23	20	15	17	23
Nitrogen oxides	15	16	17	10	12	15

Source: NSC

The maximum density of emissions of particulate matter in the Republic - 117kg/sq. km and sulfur dioxide - 48kg/sq. km were recorded in 2009, for carbon monoxide 23kg sq. kmwas recorded in 2006, 2007 and 2011, and 17kg/sq.km of nitrogen oxides was recorded in 2008. During the period from 2006 to 2011, the registered emissions of pollutants from stationary sources into the atmosphere (in per capita terms), for particulate matter decreased by 5.7%, for carbon monoxide by 11.1%, for nitrogen oxides – 16.7%, while figures for sulfur dioxide did not change (Table 1.7).

Table 1.7. Emissions of polluting substances into the atmosphere from stationary sources (per person/ kilogram)

Polluting substance	2006	2007	2008	2009	2010	2011
Particulate matter	3.5	3.9	4.0	4.5	2.9	3.3
Sulfur dioxide	1.5	1.4	1.7	1.9	1.5	1.5
Carbon monoxide	0.9	0.9	0.8	0.6	0.7	0.8
Nitrogen oxides	0.6	0.6	0.6	0.4	0.5	0.5

Source: NSC

In 2011, there were 19.5kg of pollutants per resident in Chui oblast - 11.3kg, and 7.9 kg per inhabitant in the Issyk-Kul oblast. The minimum amount of pollutants, 0.1 kg/person, was recorded for the Naryn region. The maximum amount of emissions from stationary sources was recorded in 2009; there were 29.4kg per capita in Bishkek (Table 1.8).

Bishkek Central Heating and Power Plant, © Grebnev V.V.

Table 1.8. Emissions of atmospheric pollutants from stationary sources (per resident by territory/ kilogram)

Name of region	2006	2007	2008	2009	2010	2011
Kyrgyz Republic	7.0	7.2	7.5	23.0	5.9	6.5
Batken	2.4	1.9	1.4	1.3	0.8	3.5
Jalal-Abad	2.3	2.2	2.1	84.7	2.6	2.3
Issyk-Kul	7.2	6.5	6.0	6.1	7.0	7.9
Naryn	0.1	0.1	0.1	0.2	0.1	0.1
Osh	0.2	0.2	0.1	0.1	0.1	0.9
Talas	0.9	0.9	0.9	0.4	0.7	0.7
Chui	16.3	15.9	15.1	10.7	11.7	11.3
Bishkek	19.8	21.3	25.9	29.4	16.3	19.5
Osh (city)	2.4	2.7	2.4	3.1	3.9	5.0

Note: in 2009 in the Jalal-Abad region there were 79.4 thousand tons of emissions, emitted by "Kyrgyzneftegaz."
Source: NSC

Emissions of air pollutants from mobile sources

The main emissions from mobile sources are calculated in accordance with guidelines provided by the IPCC[5]. The input data for the calculation were the NSC data on the consumption of gasoline and diesel fuel according to the lines "for transport operations (including public holidays) and "utilities, cultural and other needs" for 2006 - 2010.

The calculations did not take into account the volume of illegally imported fuel and fuel produced in the republic by the addition of synthetic additives which increase the octane number of gasoline. In the calculation of non-methane volatile organic compounds, emissions from the incineration/combustion and evaporation of fuel in use were totalled.

According to expert estimations, more than 80% of major air pollutants are from mobile sources. The greatest emissions in 2010 were comprised of carbon monoxide (75.9%), non-methane volatile organic compounds (14.3%), nitrogen oxides (8.4%) and sulfur oxide (1.4%). Emissions of major pollutants from mobile sources for the same period are characterized by a significant increase (Table 1.9).

From 2006 to 2010, atmospheric emissions of nitrogen oxides increased by 1.8 times, carbon monoxide by1.6 times, NMVOC by 1.6 times and sulfur oxides by 2.1 times.

Table 1.9. Emissions of polluting substances into the atmosphere fromconsumed motor fuel (tons)

Polluting substance	2006	2007	2008	2009	2010
Nitrogen oxides	10.85	16.40	18.57	22.45	19.67
Carbon monoxide	111.11	164.43	184.74	208.86	178.37
Non-methane volatile organic compounds (NMVOCs)	20.89	30.92	34.74	39.30	33.57
Sulfur oxides	1.56	2.41	2.75	3.56	3.20

Source: Expert estimations

Atmospheric air quality in urban settlements

The recording of atmospheric air quality factors, especially in populated areas, is an important element for the development of socio-economic policy. It allows the assessment of the state of environment in terms of air quality, and the negative effect of increased concentrations of pollutants in the surface layer of the atmosphere, producing a diverse negative impact on human health, vegetation and materials.

The meteorological conditions of the Kyrgyz Republic are characterized by highly repeatable surface and elevated inversions, and low annual and monthly mean wind speeds, which often change the calm, relatively low air humidity, total annual precipitation, and high ultraviolet radiation intensity.

[5] Intergovernmental Panel for Climate Change, www.ipcc.ch

The impact of particulate matter, measured as a concentration of PM_{10} and $PM_{2,5}$ in the surface layer of the atmosphere, as well as heavy metals and POPs, represents one of the most serious risks to human health caused by atmospheric air pollution. Inhaling high concentrations of PM_{10} and $PM_{2,5}$, for even a short period of time, can cause increased symptoms of asthmatic disease, respiratory disease, reduced lung capacity and increase the risk of other serious diseases. In addition, there are research findings showing the negative effects of increased concentrations of carbon monoxide (CO), sulfur dioxide (SO2), nitrogen oxides (NOx), ozone and other substances present in the air on an individual's health.

The climatic characteristics of the region, combined with the natural and anthropogenic sources of pollution affect air pollution levels, especially in large urban areas with a high population density, heavy traffic and ecologically hazardous industries, as well as having a harmful effect on the health of people living in these areas.

Also affecting air pollution levels , is the presence in the air of fine particles of loess and dust brought into the Chui valley by the atmospheric phenomena of air flows from the Iranian plateau.

By a combination of weather factors and their quantitative ratio, areas of the Chui valley, Bishkek and Osh cities are characterized by a high climatic potential for air pollution (HCPAP = 3.4-3.6) and a low self-cleaning capability. Therefore, even small emissions can create high levels of air pollution, especially in winter. 58.7% of the urban population are exposed to that. The monitoring of stationary sources at state level is performed by two divisions of the SAEPF, which are in the cities of Bishkek and Jalal-Abad. Departmental monitoring is performed at the five largest enterprises in the Republic. Monitoring of air emissions is performed at a total of 32 industrial enterprises. Contained in the emissions are 18 air pollutants which change dependingon the profile of the industrial facilities.

Air quality monitoring is conducted in 5 cities of the Kyrgyz Republic, Bishkek, Kara-Balta, Osh, Tokmok and Cholpon-Ata, where about 64% of the urban population live. Monitoring is carried out at 14 stationary posts[6] of Kyrgyzhydromet. There are 7 stationary monitoring posts in Bishkek, Kara-Balta, Tokmok and Cholpon-Ata each have 2 stations, and there is 1 in Osh. The air pollution monitoring posts are located in residential areas, which are near major sources of pollution in the centers of the towns and cities. The work program of each post is individually created, based on its location, proximity to the emission sources and the composition of the emissions. Monitoring in Bishkek and Osh is performed three times a day, based on a continuous program, while in Kara-Balta, Tokmok and Cholpon-Ata it is carried out daily based on a reduced program with a rotating schedule within 20 minutes.

Stationary monitoring posts are equipped with standard sets of laboratories, which are morally and physically obsolete and they still work in manual mode.

The Kyrgyz Republic has a program for air quality monitoring for only five pollutants: nitrogen dioxide, sulfur dioxide, nitrogen oxide, formaldehyde and ammonia. Since 1990, no measurements have been made for dust, carbon monoxide, benzopyrene, soluble sulfates, phenols, cyanide and heavy metals. Additionally, there has been no measuring of the ozone concentration of particulate matters, volatile organic compounds and persistent organic pollutants (POPs), which are internationally recognized as being most harmful to human health and the measuring of environmental pollutants is performed in the surface air layer.

The level of air pollution is measured based on the air pollution index (API), which is calculated in all the cities, where the monitoring of air quality is performed. Air pollution is considered to be very high if the total API is more than 14, high at7- 14 API 7, relatively high at 5-7 API 5,and low - at less than 5API. In the Kyrgyz Republic a very high level of air pollution according to API is observed only in the capital city,Bishkek (Table 1.10).

[6] PMP – pollution monitoring point for monitoring atmospheric air pollution

Table 1.10. Comprehensive air pollution index (CAPI) of cities in the Kyrgyz Republic in 2006-2011

City	2006	2007	2008	2009	2010	2011
Bishkek	14.8	10.0	16.1	14.7	15.3	8.2
Kara-Balta	2.1	1.9	1.7	1.4	1.7	1.4
Osh	0.8	1.1	1.1	1.1	1.1	1.4
Tokmok	1.3	1.3	1.4	1.7	1.6	1.5
Cholpon-Ata	0.5	0.5	0.5	0.5	0.3	0.5

Source: Kyrgyzhydromet

5 pollutants: sulfur dioxide, and nitrogen dioxide, formaldehyde, and ammonia are determined in the air. In assessing air quality the average daily and the maximum one-time allowable concentrations (MACs) are being recorded.

Table 1.11. Maximum allowable concentrations by substances (kg / cu. M)

Polluting substance	Value of MAC(microgram /cu. M)	
	Maximum one-time	Average daily
The main polluting substances		
Sulphur dioxide	500	50
Nitrogen dioxide	85	40
Nitrogen oxide	400	60
Specific polluting substances		
Ammonia	200	40
Formaldehyde	35	3

Source: Kyrgyzhydromet

Sulfur dioxide. According to the data, from 2006 to 2011, the level of air pollution with sulfur dioxide in all the cities was low. The average and maximum single concentrations are much lower than the maximum allowable limits. Average annual concentrations were in the range 0.03-0.10 MAC (Table 1.12) and the maximum annual concentrations were 0.04-0.33 MAC (Table 1.13). During the period in question, no excess of average daily MACs was observed.

Table 1.12. Annual average concentrations of atmospheric sulfur dioxide in the Kyrgyz Republic in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	4	4	3	2	2	2
Kara-Balta	4	4	3	2	2	2
Osh	4	5	6	5	4	3
Tokmok	4	4	3	3	3	2
Cholpon-Ata	6	5	5	3	5	5
MAC a.d.	50					

Source: Kyrgyzhydromet

Table 1.13. Maximum concentration of atmospheric sulfur dioxide in the Kyrgyz Republic in 2006-2011. (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	60	55	94	39	49	68
Kara-Balta	62	19	17	23	17	36
Osh	24	32	30	27	26	19
Tokmok	47	24	18	25	34	32
Cholpon-Ata	48	44	55	43	14	15
MAC max one-time.	500					

Source: Kyrgyzhydromet

Nitrogen dioxide. According to observations, the level of nitrogen dioxide air pollution in Bishkek was steadily increasing between 2006 and 2011. The average annual concentrations in the whole city were observed in the range of 1.25-1.75 MAC, and the maximum single concentration from 3.6-6.0 MACs. At the same time, the area of the city is characterized by uneven spatial air pollution (Figure 1.3).

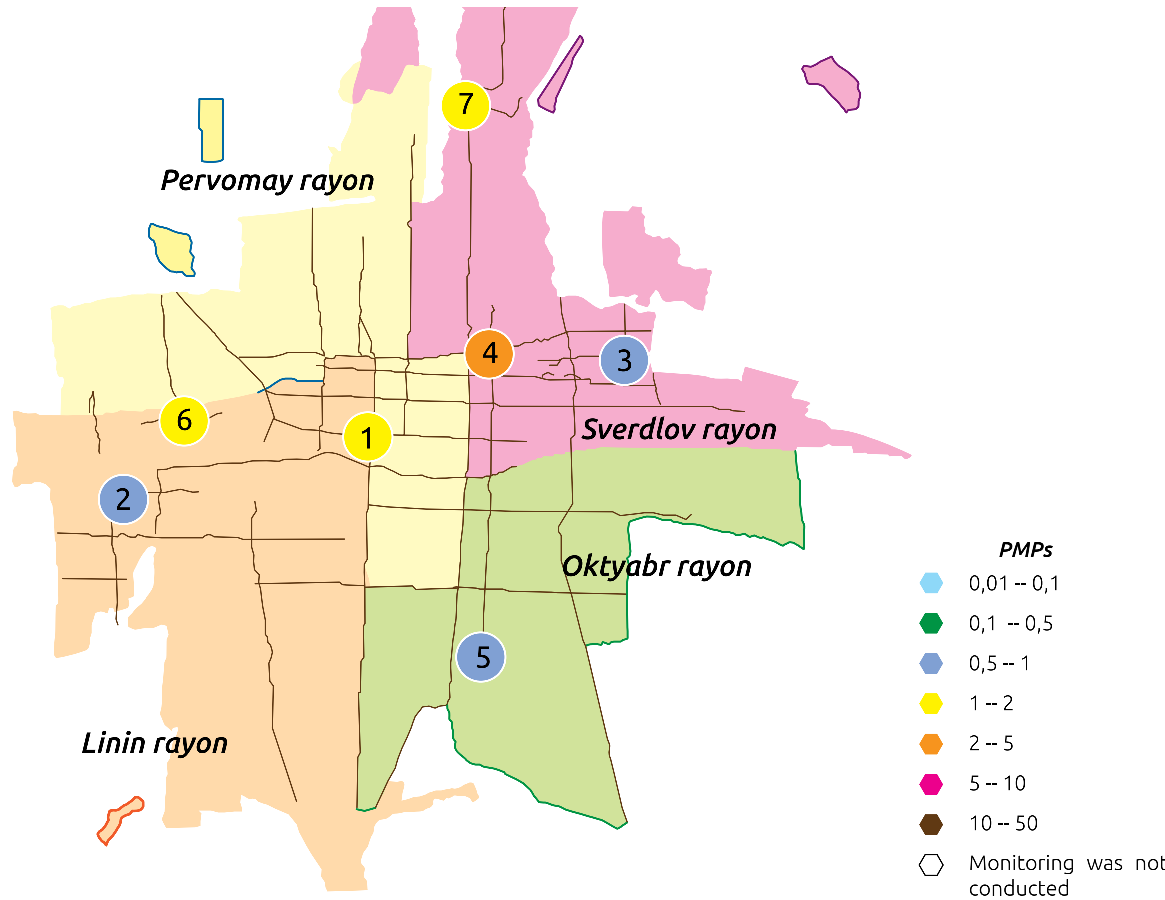


Figure 1.3 Results of nitrogen dioxide monitoring at PMPs in Bishkek as of January 2012
Source: Kyrgyzhydromet

From 2006 to 2011, in the central part of the city near the main roads (PMP No. 1 and No. 4), the highest values of nitrogen dioxide were shown, in which the annual average content was recorded between 1.75-3.25 MAC. The maximum concentration was 6.0 MAC. In the residential area of the city (PMP No. 5), the average concentrations of nitrogen dioxide in the air were 0.5-1.25 MAC, and the maximum was 1.2-1.8 MAC. The repeatability of emission concentrations above the maximum one-time MAC (MAC maximum one-time) for the year in the whole city was 16-29%, while in the city center it was 32-68%, and in the residential area 1-8%. The number of days exceeding the MAC ranges from 276 to 295 (Table 1.16).

The level of air pollution in other cities was low. The average content of nitrogen dioxide for the period stated was in the range 0.5-1.5 MAC, and the maximum 0.9-3.9 MACs. The repeatability excess of MAC maximum one-time in Kara-Balta averaged 7% over the 6 year period, in Osh 6%, and in Tokmok 4%. In Cholpon-Ata no excess was observed and the number of days exceeding the average daily MAC in Osh was 53-137.

Table 1.14. Average annual atmospheric nitrogen dioxide concentrations of the Kyrgyz Republic in 2006-2011, (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	60	50	60	60	60	50
Kara-Balta	40	40	40	30	40	30
Osh	30	40	40	40	40	50
Tokmok	30	30	40	40	30	40
Cholpon-Ata	20	20	20	20	10	20
MAC average daily	40					

Source: Kyrgyzhydromet

Table 1.15. Maximum values of atmospheric nitrogen dioxide concentrations in cities/towns of the Kyrgyz Republic in 2006-2011 (microgram/cu. M)

City/town	2006	2007	2008	2009	2010	2011
Bishkek	510	490	310	510	490	370
Kara-Balta	220	170	190	170	210	120
Osh	120	170	210	200	170	200
Tokmok	330	140	210	130	180	170
Cholpon-Ata	90	110	120	110	80	70
MAC max one-time.	85					

Source: Kyrgyzhydromet

Table 1.16. Number of days exceeding the MPC of atmospheric nitrogen dioxide in Bishkek and Osh in 2006-2011

City	2006	2007	2008	2009	2010	2011
Bishkek	288	283	295	290	289	276
Osh	53	87	79	79	94	137

Source: Kyrgyzhydromet

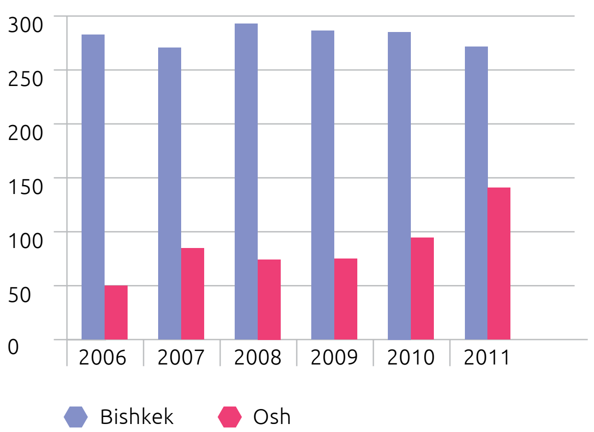


Figure 1.4. Number of days exceeding permissible nitrogen dioxide levels in Bishkek and Osh

Nitrogen oxide. Nitrogen oxide is measured in Bishkek, Kara-Balta and Tokmok. The highest level of pollution was in Bishkek. The city's total average annual concentrations in 2006-2011 were between 1.3 - 2.2 MAC, and in the city centerwere recorded at 2.8-3.8 MAC (Table 1.17). The maximum concentration was in the range of 1.5-1.8 MAC (Table 1.18). The repeatability excess for the period, as a total for the city, was 3.01% and in the city center was3-7%. The number of days with an excess of MPC, ranges from 235 to 295 (Table 1.19). The level of atmospheric nitrogen oxide pollution in the remaining towns is low, with average annual values comprising 0.5 - 1.0 MAC, and the maximum - 0.4 - 1.1 MAC.

Table 1.17. Average annual atmospheric nitrogen oxide concentrations in the Kyrgyz Republic in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	120	80	120	130	120	90
Kara-Balta	60	60	50	40	40	40
Tokmok	30	30	40	40	30	30
MAC a.d.	60					

Source: Kyrgyzhydromet

Table 1.18. The maximum values of atmospheric nitrogen oxide concentrations in the Kyrgyz Republic in 2006-2011 (microgram / cu. M)

City/town	2006	2007	2008	2009	2010	2011
Bishkek	630	590	730	670	660	490
Kara-Balta	420	220	390	160	160	160
Tokmok	150	150	170	140	210	130
MAC max one-time	400					

Source: Kyrgyzhydromet

Table 1.19. Number of days exceeding the MAC for atmospheric nitrogen oxide in Bishkek in 2006-2010.

City	2006	2007	2008	2009	2010	2011
Bishkek	287	227	236	291	295	287

Source: Kyrgyzhydromet

Formaldehyde. Formaldehyde is only measured in Bishkek at 2 PMPs (No. 1 and No. 4) - in the city center and near the main motorways.

The level of atmospheric formaldehyde pollution is consistently high. From 2006 to 2011, the API of formaldehyde was 4.8-16.6. The average API content for the period 2006-2011, was between 3.3-8.7 MAC (Table 1.20) and the maximum concentrations were from 2.1 to 3.3 MAC (Table 1.21). The repeatability excess for the period at PMP No. 1 was 1-24% and at PMP No. 4 it was 2-19%. The number of days in excess of MPC varies from 280 to 299 (Table 1.22).

Table 1.20. Average annual atmospheric formaldehyde concentrations in Bishkek in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	18	13	20	18	19	10
MAC daily average	3					

Source: Kyrgyzhydromet

Table 1.21. Maximum concentration of atmospheric formaldehyde in Bishkek in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	105	92	82	78	77	75
MAC max one-time.	35					

Source: Kyrgyzhydromet

Table 1.22. Number of days exceeding the MAC of atmospheric formaldehyde in Bishkek in 2006-2011

City	2006	2007	2008	2009	2010	2011
Bishkek	299	286	293	286	299	280

Source: Kyrgyzhydromet

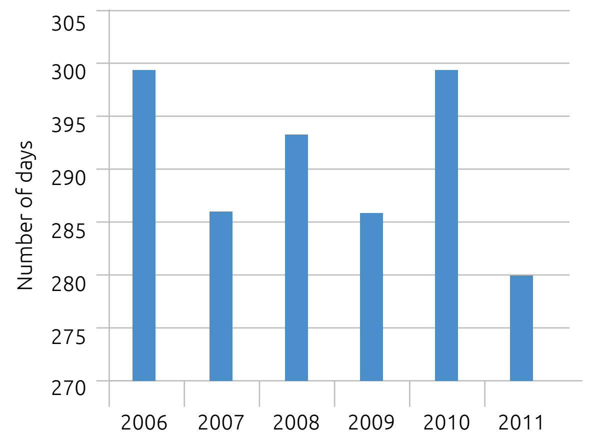


Figure 1.5. Number of days exceeding the MAC of formaldehyde in Bishkek

Formaldehyde is a substance which is highly toxic to humans. According to experts, the main source of air pollution with formaldehyde in Bishkek is vehicle emissions. The symptoms of formaldehyde poisoning include: pallor, fatigue, unconsciousness, depression, difficulty breathing, headache and cramps (often at night). To reduce the risk of poisoning, it is necessary to breathe in less exhaust fumes, especially in traffic jams, ventilate living/working premises more frequently and it is also beneficial to have houseplants such as ferns, spray chrysanthemum, dracaena, ivy, etc., which absorb formaldehyde.

Ammonia. Ammonia is only measured in Bishkek at 2 PMPs (No. 2 and No. 6), in the western part of the city. In general, for the whole city, atmospheric ammonia is low, 0.5-0.75 MAC (Table 1.23). The maximum concentrations were

Table 1.23. Average annual atmospheric ammonia concentrations in Bishkek in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	30	20	20	20	20	20
MAC daily average	40					

Source: Kyrgyzhydromet

observed in the range of 0.5-1.5 MAC (Table 1.24). The repeatability excess ranged from 0 to 8% (2005). The number of days with MAC excess ranges from 15 to 96, with a tendency to decrease (Table 1.25).

Table 1.24. Maximum concentration of atmospheric ammonia in Bishkek in 2006-2011 (microgram / cu. M)

City	2006	2007	2008	2009	2010	2011
Bishkek	200	290	140	120	100	160
MAC max one-time	200					

Source: Kyrgyzhydromet

Table 1.25. Number of days with MAC excess of atmospheric ammonia in Bishkek in 2006-2011

City	2006	2007	2008	2009	2010	2011
Bishkek	96	48	31	20	15	20

Source: Kyrgyzhydromet

Dust, carbon monoxide, heavy metals and benzopyrene. Monitoring of air pollution by dust, benzopyrene and carbon monoxide in the cities/towns of the country ceased between 1998-2000 and heavy metals in 1997, due to the lack of funds for the purchase of analytical instruments and expendable materials.

However, based on long-term data from Kyrgyzhydromet, the average dust concentration in Bishkek from 10 years of observation (1991-2000) was 1.6-6 MAC, with a tendency to increase. The absolute value of the average dust concentration in 2000 increased by 2.3 times compared to 1991. The maximum concentrations of dust during this period reached 7.12 MAC.

The average annual concentrations of carbon monoxide during the period of monitoring were recorded in the range of 1-2 MAC, with a maximum one-time concentration within 7.12 MPC, the most important of which was recorded during the cold season.

According to data from 1999, in the city of Bishkek, near major roads with heavy traffic, the average concentrations of benzopyrene exceeded the MAC by 25-35 times, while during the heating season (winter) the highest concentrations for the year were recorded of up to 48.5 MAC.. In sleeping areas, the average content of benzopyrene was recorded within 3-10 MAC (summer-winter).

According to data from 1996, in Bishkek in the areas near major roads and heavy traffic, the heavy metal content in the air exceeded the MAC for lead by 1.5-5.6 times, nickel by 2-8 times and copper by 1.3-12 times.

Consumption of ozone depleting substances

This environmental indicator allows the evaluation of the total production, distribution or consumption of ozone-depleting substances (ODS) in the Kyrgyz Republic. The ozone layer in the stratosphere is a key component of Earth's atmosphere. It protects human, animal and plant life from damaging shortwave ultraviolet (UV) radiation. The active use of ODS exacerbates the situation with climate change and increases the possible effectst of UV radiation. ODS include chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFC), methyl bromide, etc. They are used as solvents, refrigerants, foam blowing and degreasing agents, aerosol propellants, in fire extinguishers (halon) and agricultural pesticides (methyl bromide).

Kyrgyzstan ratified the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, committing themselves to stopping the production and use of ODS. ODS consumption in the Kyrgyz Republic is determined based on data from the State Customs Service. All information on the import of ODS and associated products are received as aggregated data for the republic. Data on the consumption of ozone-depleting substances in the regions is not available.

In the year 2000, the total consumption of ozone-depleting substances in the Kyrgyz Republic was about 79.35 metric tons. In 2005, as a result of the first phase of the state program to eliminate the use of ozone-depleting substances, the total ODS consumption (excluding HCFCs) decreased to 15.3 ODP tons. This was due to the replacement of the cooling industry refrigerant CFC 12 with HCFC 22.

As of 2005, the largest sphere of ODS consumption in the country was refrigeration equipment maintenance, both stationary equipment and that installed in transport (8.793 metric tons), the maintenance of which accounts for about 80% of the total consumption of ozone-depleting substances in the Kyrgyz Republic. The second largest sphere is agriculture, using ODS for cooling in the dairy industry and to fumigate grain reserves (for protection against pests), the consumption of methyl bromide in agriculture was 13.0 metric tons (7.8 ODP tons). In 2010, the Kyrgyz Republic stopped using CFC R12, however HCFCs R22 and methyl bromide are still being used (Table 1.26). In 2010, the refrigerants R-12, R-11, R-113, R-502 and halons 1301 and 2402 were completely withdrawn from use. Also a ban on importing equipment using chemical substances from list A of the Montreal Protocol was established. However, methyl bromide is an exception and is used in limited quantities for quarantine treatments. In 2011, the company "Winterlux" in the Free Economic Zone (FEZ) Bishkek completely eliminated the use of HCFC-142b in the manufacture of foamy materials and changed to cyclopentane.

Ozone-depleting substances are compared in their ability to deplete stratospheric ozone, using the term "ozone depletion potential" (ODP). A substance with a high ODP has more potential for ozone destruction throughout its life span in the atmosphere. ODP is calculated based on the "unit of mass", which is based on the ratio of matter and ozone depletion potential of CFC-11, the ozone depletion potential of which is measured as 1.

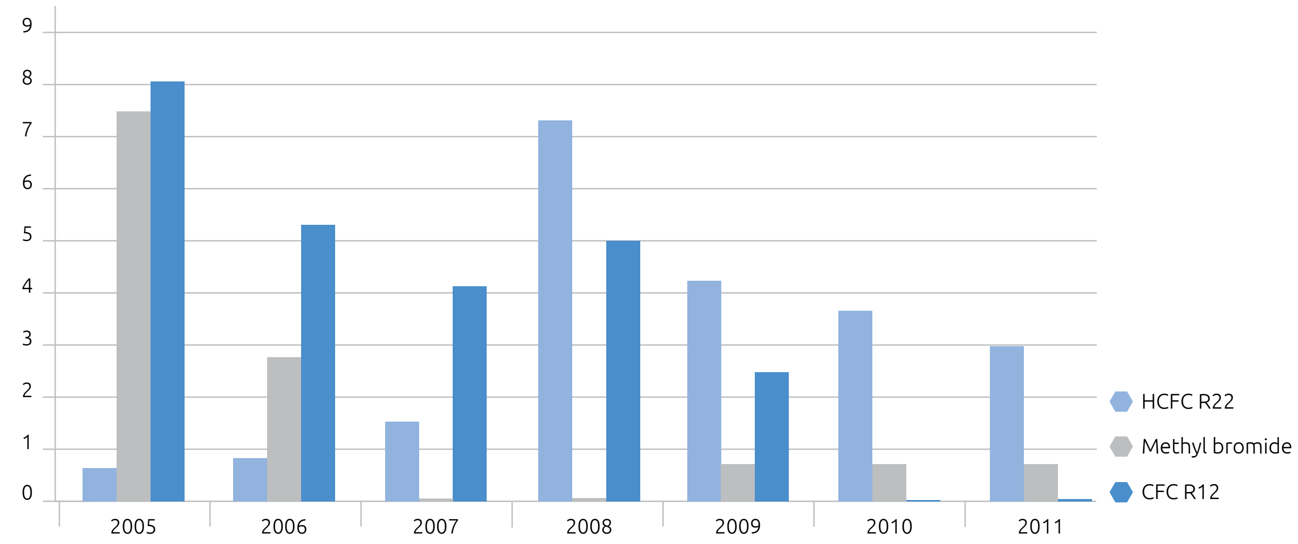


Figure 1.6. Consumption of ozone depleting substances with ODP

Table 1.26. Consumption of ozone depleting substances in the Kyrgyz Republic (Metric Tons)

Substance	2005	2006	2007	2008	2009	2010	2011
CFC R12	Tons ODP (ODP = 1)						
	8.1	5.3	4.2	5.0	2.7	0	0
HCFC R22	Tons ODP (ODP = 0.055)						
	0.7	0.8	1.6	7.4	4.4	3.7	2.96
Methyl bromide	In ODP tonnes with (ODP = 0.6)						
	7.6	2.7	0	0	0.6	0.6	0.6

Source: Ozone Centre

The Kyrgyz Republic has never produced ODS, equipment or products containing ODS, which are controlled by the Montreal Protocol. It does however, import them both in their pure form and in different items. ODS imports, as well as equipment and products containing ODS, are subject to licensing under the state regulation of the import and export of ozone-depleting substances and products containing them (Resolution No. 594 by the Kyrgyz government, 19th September 2009). Some ODS might also be entering the country as a result of illegal imports.

According to the State Customs Service, virtually all ozone-depleting substances in Annex A, B, C, E of the Montreal Protocol are imported from the Russian Federation and China, except for a small amount received from other transitional countries.

PART 2
Climate change

The climate of the Kyrgyz Republic is determined by its geographical location and is characterized by sharp continental weather with cold winters and hot summers, which is strictly dependent on the altitude above sea level. In general, precipitation is concentrated in autumn, winter and spring, while summer is usually hot and dry. In various areas of the Kyrgyz Republic, the climate varies dramatically from sharp continental to an almost marine climate due to substantially rugged topography and the presence of Lake Issyk-Kul. Winter temperatures, especially in the mountains and mountain hollows, are rather low, and can be between minus 20° C and minus 30° C. Thaws are frequent in winter. In July, the average temperature is from +25° C to +37° C in the Fergana Valley, while at the same time at an altitude of 3,600 meters the temperature is no higher than +4° C. In the central Tien Shan mountains the average temperature difference for each 100 meters of altitude is 0.6° C. The maximum temperature ever recorded is +44° C (the Chui weather station), and the lowest temperature -53.6° C (the Aksai weather station). However, these extreme temperatures are a very rare phenomena in Kyrgyzstan.

The highest annual precipitation is on the western slopes of the Fergana Range at 1,090 mm, while the lowest, at the the western end of the Lake Issyk-Kul basin is 144 mm.

Usually, the average annual precipitation ranges from 300 to 600 millimeters. As a rule, sunny weather is more typical for Kyrgyzstan (247 days a year), and March and April are cloudless months.

Morning hours in the mountains are usually sunny, while in the afternoon showers are common. In January, heavy snowfalls are occasionally observed, while February is a more temperate month.

Climate formation is strongly affected by the mountainous relief that accounts for the vertical climatic zonation and significant values of solar radiation (from 5,547 MJ / sq m. in the Chui valley to to 6,660 MJ / sq m. at the Tien Shan weather station). The mountainous nature of the Kyrgyz Republic determines the vertical zonation of climatic zones. When climbing from the foothills to the top of a mountain, there is a similar change of climatic zones, as when we move from the subtropics to the Arctic coast. Vertical climatic zonation is aggravated by orographic structures: high rugged mountain ranges and intermountain basins have a significant influence on formation of climatic conditions. The alpine terrain of the country determines significant contrasts in temperature conditions and the degree of humidity. Characteristic features of mountain climates are the lowering of atmospheric pressure and air temperature (on average by 0.6°/100m) as you climb to higher altitudes and the decrease of temperatures, and annual variations in temperature and increases in precipitation to a certain altitude.

During the cold period of the year, the majority of the country is under the influence of the Siberian anticyclone, which brings clear, cold weather, while precipitation is the result of the passage of the western, north-western and northern weather fronts and also of southern weather fronts, which

have the greatest impact on the south-western region of the country. During the warm period of the year the Republic is not affected by major intrusions.

Mountain-valley circulation, characterized by a regular change of wind direction - at night from the mountains to the valleys (predominant), during the day - from the valleys to the mountains (in winter – mildly defined) is the prevailing wind pattern. The mountainous terrain prevents strong winds and the annual average wind speed usually ranges from 1 to 3 m/sec. The number of days with strong winds (greater than or equal to 15 m/s) is small and varies from 2-3 to 15-20 per year. In the Issyk-Kul basin, the frequency of strong winds is higher in the central and eastern areas of the basin, on average 20-50 days with strong winds are recorded, while in the western part there are more than 70 days. For the most part, the western wind, known as "Ulan", blows along the lake, and in the eastern part the east wind, "San-Tash."

Climatic zoning in the Kyrgyz Republic was adopted on the basis of the unity of the main climatic characteristics with the identification of 4 climatic regions other than the administrative divisions:

- The North-West region, which includes the Chui and Talas valleys with their surrounding mountain ranges. This region is characterized by a moderately warm and rather humid climate, with maximum precipitation in spring.
- The North-East region, to which the Issyk-Kul basin belongs, is characterized by maximum precipitation in summer; generally, the climate is characterized by the notable features of a marine climate, as the lake, which never freezes, produces a moderating effect.
- The South-West region, to which the Fergana, the Alai and the Chatkal valley with their surrounding mountain ranges belong.. This is the warmest and most humid region with a significant amount of precipitation in the cold season, in contrast to other regions.
- The Inner Tien-Shan region is characterized by a cold and rather humid climate, the specific feature of which is low evaporation at low temperatures. Maximum precipitation occurs in May, June and July.

Instrumental monitoring in the republic was launched in 1883. Following the launch, the number of weather stations in the country increased and changed greatly, and the largest network of weather stations was developed in the period from 1963 to 1990. Subsequently, the number of weather stations has significantly decreased due to a lack of funding.

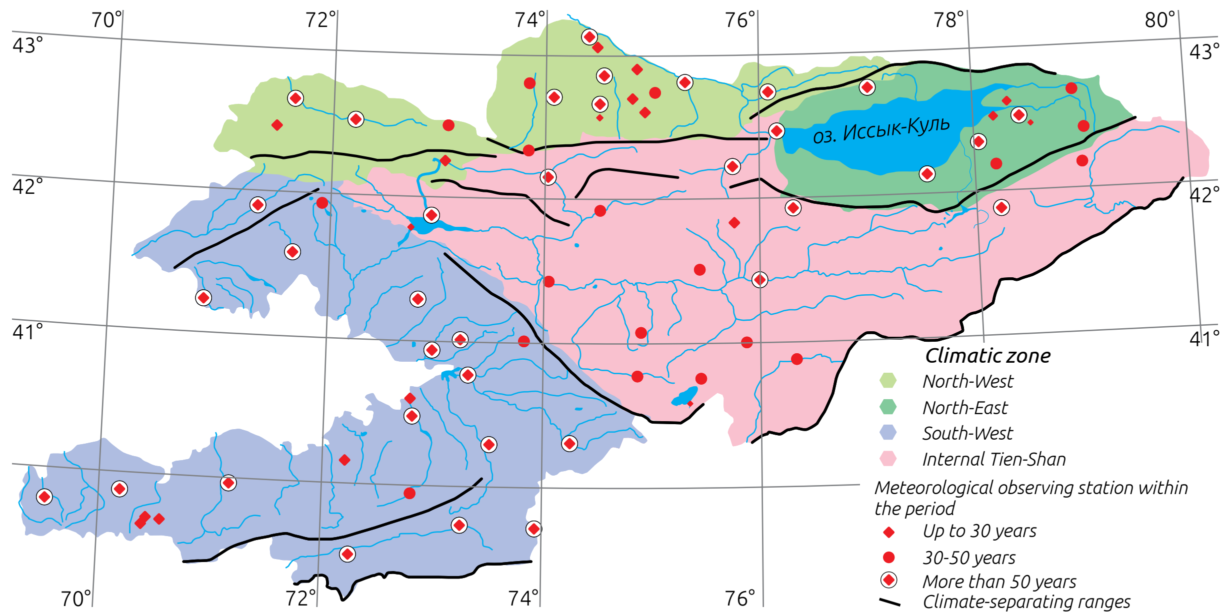


Figure. 2.1. Climatic zoning of the Kyrgyz Republic and the localization of weather stations
Source: Second National Communication on Climate Change

The Kyrgyz Republic actively supports the efforts of the world community to address the global environmental problem of climate change; it acceded the United Nations Framework Convention on Climate Change (UNFCCC)[7] and ratified the Kyoto Protocol to the UNFCCC[8]. In accordance with the requirements of UNFCCC, the Republic prepared the First and The Second National Communications on Climate Change (SNC)[9].

[7] Law of the Kyrgyz Republic "On the accession of the Kyrgyz Republic to the United Nations Framework Convention on Climate Change and the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP) Transboundary Air Pollution" dated January 14, 2000 No. 11.
[8] Law of the Kyrgyz Republic "On the ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change" dated January 15, 2003 No. 9.
[9] "Second National Communication of the Kyrgyz Republic on the United Nations Framework Convention on Climate Change", GEF / UNDP, 2009, approved by the Government of the Kyrgyz Republic on May 6, 2009, No. 274.

Figure 2.2. A schematic map of the administrative-territorial division and the monitoring system of MoES for tracking the development of natural and man-made activities in the Kyrgyz Republic
Source: MoES

Air temperature

The index characterizes the trends, average annual temperature fluctuations and allows for the determination of the degree of changes associated with both the natural cycles of climate change and the anthropogenic impact of global climate changing processes. Changes in the absolute values of temperature and the degree of these changes are important parameters that characterize the possible consequences of climate change: glaciers melting, floods, droughts and changes in the morbidity pattern of the population and other phenomena. The assessment and analysis of changes in air temperature are of great importance in the formulation of social and economic policy, especially for such sectors as agriculture, fuel and energy and health, etc.

The general trend in the average surface temperature for the whole country was defined based on data from the entire network of Kyrgyzhydromet's meteorological stations for the entire period of instrumental monitoring, i.e. for the period 1885 – 2010. In fact, monitoring began in 1883 at the KaraKol weather station, but from 1885, monitoring of the whole country was carried out relatively regularly. According to data

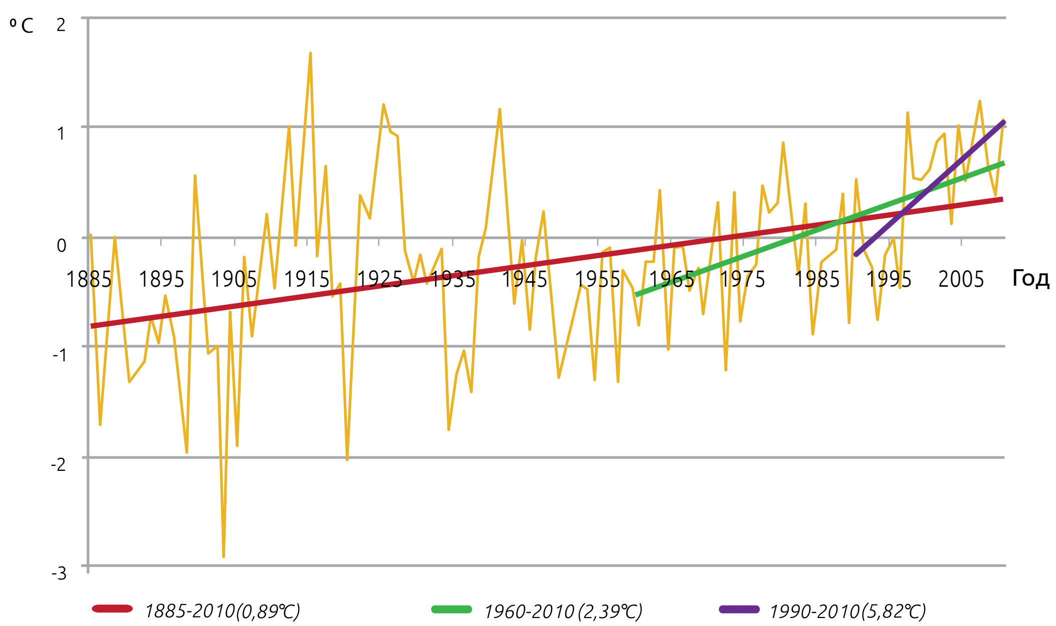


Figure. 2.3. Trends in the average surface temperature over time. The rate of temperature change for various time periods in o C/100 years is shown in parentheses.

from the intergovernmental panel on climate change, the general trend of the average annual surface air temperature as a whole coincides with the global trend. The increase in temperature has accelerated sharply over time. Thus, during the period 1960-2010 the increase in the average annual temperature was 2.39° C, while from 1990-2010,the increase was 5.82° C (Figure 2.4).

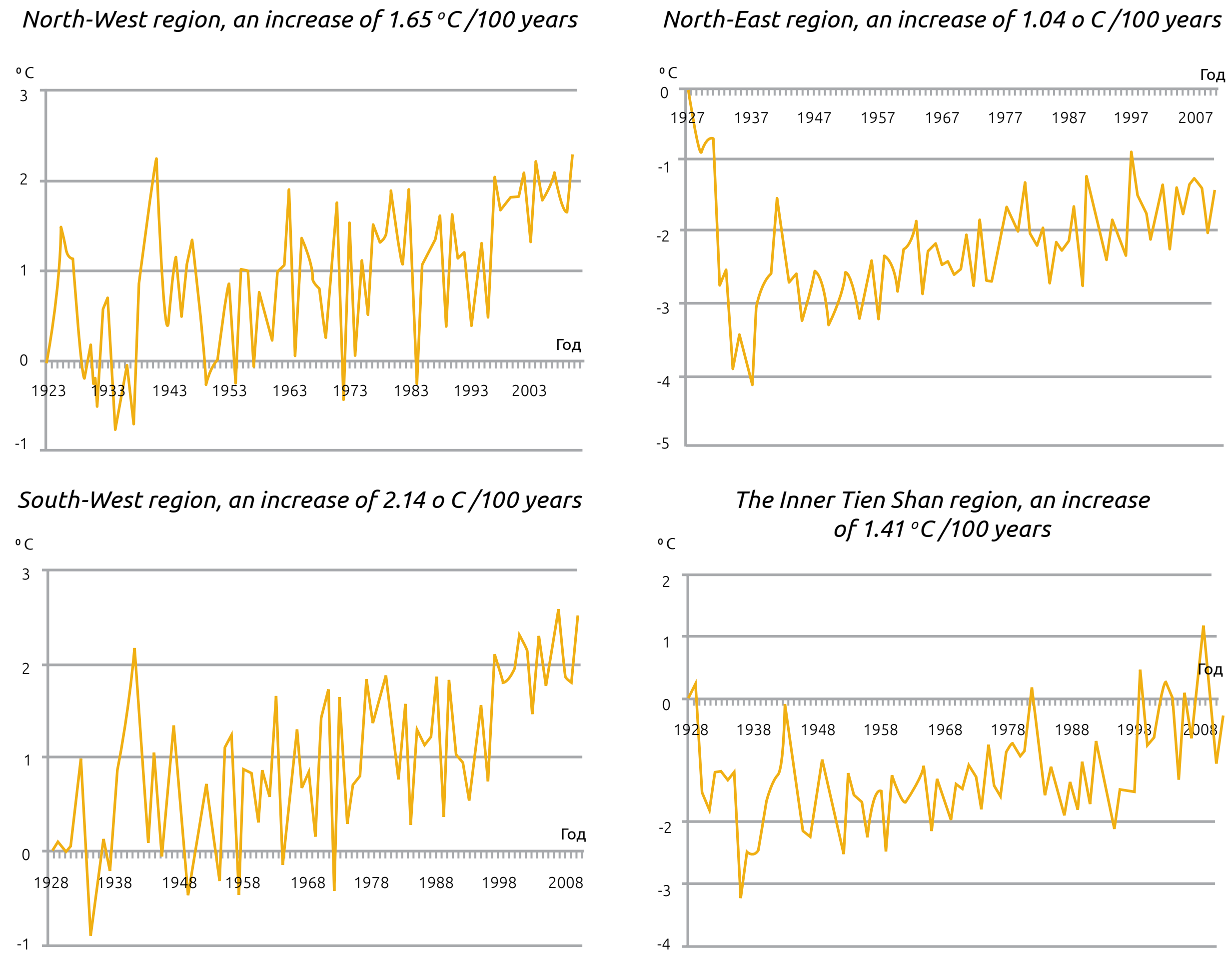


Figure 2.4. Temperature trends by climatic region

Trends for the individual climatic regions of the country have a comparable temperature increase over the observed period. Differences at the beginning of the period of assessment were due to a lack of data and actually reflect the beginning of regular monitoring for individual regions. The highest increase in temperature was observed in the South-West region, and the lowest increase in temperature was observed in the North-East and the Inner Tien-Shan regions.

The above estimates are area-based ones, the use of which is based on a correlation of surface temperature changes by individual weather stations in relatively small areas. These estimates do not reflect the specific temperature, but only the trend of its change.

Point estimates of trends in temperature values, reflecting specific changes in temperature for individual weather stations are shown in Figure 2.4.

Monitoring periods for the different weather stations are different, but in spite of this there is a tendency, from a statistical point of view, of about the same increase in average surface temperature, defined by the linear approximation of monitoring using the least squares method.

Automatic meteorological observing station in Naryn city © Kyrgyzhydromet

Table 2.1. Increase in actual temperature values for individual weather stations

Weather station	Altitude above sea level (m)	Increase of annual temperature (°C/year)	Base period		1991 - 2010	
			Average (°C)	Number of recordings	Average (°C)	Number of recordings
Batken	1050	0,0215	12,49	11	12,65	20
Bishkek	756	0,0249	10,68	30	11,53	20
Jalal-Abad	917	0,0356	12,6	30	13,55	20
Karakol	1716	0,192	6,30	30	6,7	13
Naryn	2039	0,0158	3,46	29	4,16	20
Osh	1016	0,0239	11,98	30	12,2	6
Talas	1217	0,027	8,06	30	8,88	20
Cholpon-Ata	1645	0,0261	7,9	30	8,54	20

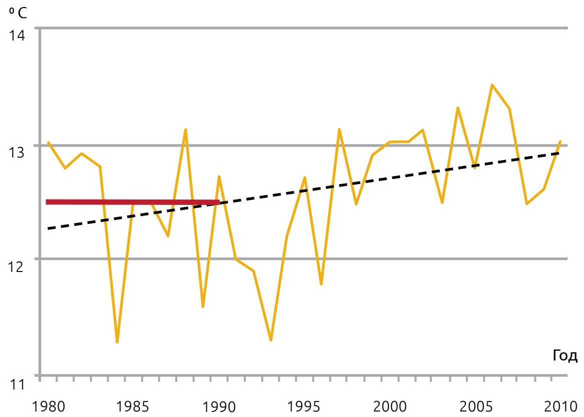
Source: Kyrgyzhydromet

The biggest increase was recorded at the Jalal-Abad weather station, and the smallest at the Karakol weather station , which is probably due to an influence of factors that do not reflect actual climate change, but rather a lack of regular monitoring in recent years, i.e. the period of greatest increase in average annual temperatures. For all weather stations, except Batken, the average annual temperature at the end of the monitoring period increased from that at the beginning. It should be noted that monitoring in Batken started during the second half of the base period (1980).

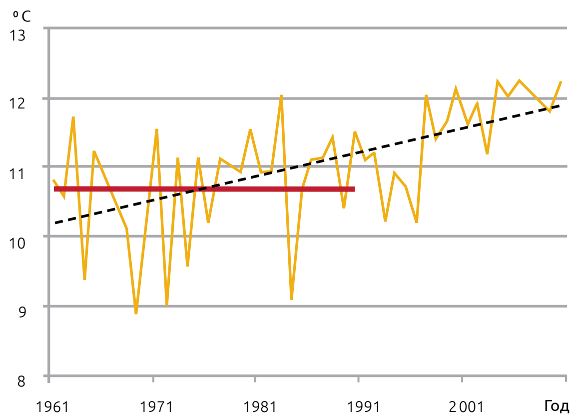
A comparison of trends in average annual temperatures (Figure 2.5.) compared to the average value for the base period (1961 - 1990), shows that the observed average annual temperatures prior to the base period are below base values for most weather stations. The red line corresponds to the average temperature for the base period, the black line to the linear approximation of the trend using the least squares method.

It should be noted that a significant increase in average yearly temperatures has been observed over the last two decades. In some cases, this increase is even comparable to the predicted increase by the year 2100, this is according to the most optimistic climate scenarios developed by the Intergovernmental Panel for Climate Change, which defines the situation as a critical one in terms of a transition to irreversible climate changes.

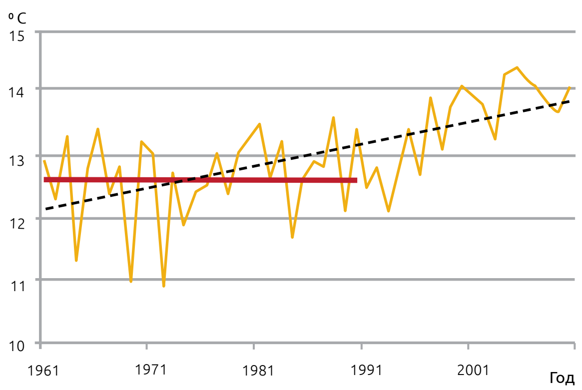
Batken



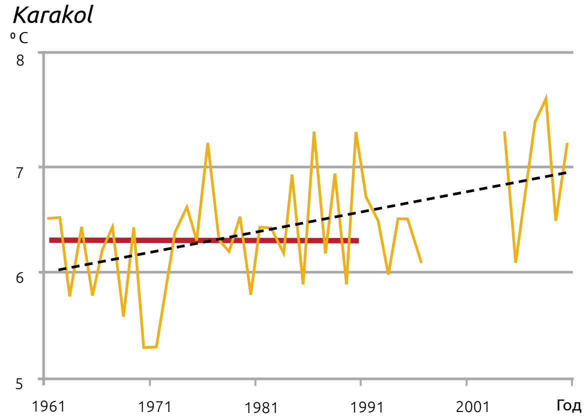
Bishkek



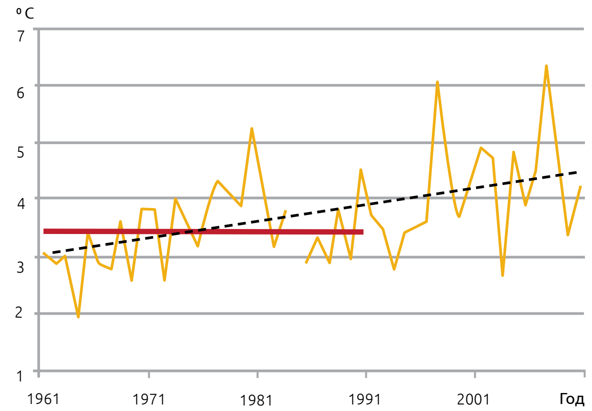
Jalal-Abad



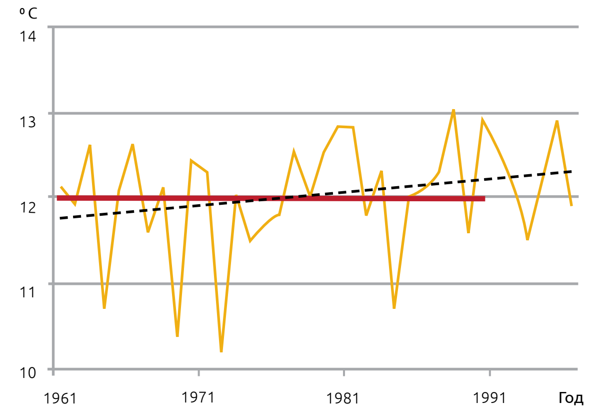
Karakol



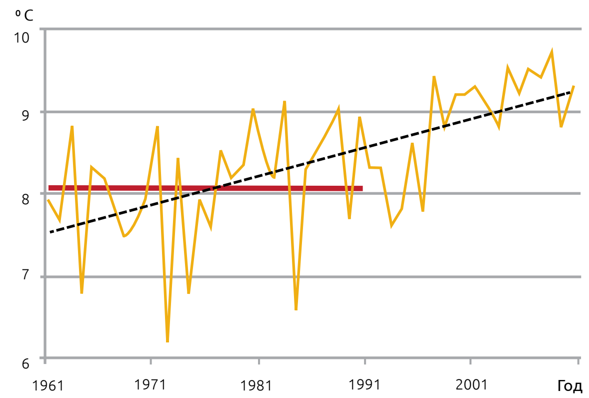
Naryn



Osh



Talas



Cholpon-Ata

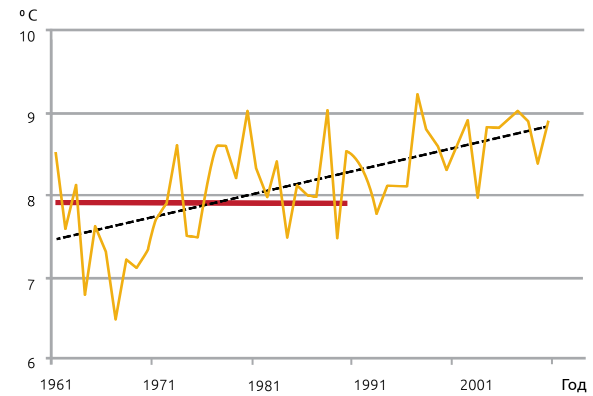


Figure 2.5. Trends in the average annual temperature relative to the base period (1961 - 1990)

Precipitation

This indicator is one of the most important climatic characteristics. Precipitation (the total amount of water collected in a certain area during a certain time period) is water in a liquid or solid state, falling from clouds or settling out of the air on the earth's surface and various objects or plants. It affects the formation of renewable freshwater resources, which in turn affect the condition of environmental components (soil, flora and fauna). Additionally, the amount of precipitation affects the overall state of the air by regulating its moisture content, as well as preventing the spread of solid particle concentrations in the surface layer of the atmosphere. The amount, distribution and seasonality of precipitation are essential, especially for agriculture and the forecasting of natural disasters.

Trends in precipitation are multidirectional (i.e., both decreases and increases of precipitation are observed at individual weather stations) and mildly expressed, which does not allow for reaching a clear conclusion about either the increase or decrease of annual precipitation for the entire Kyrgyz Republic. In this situation it is only possible to consider local trends. The current insufficiency of the instrumental monitoring network of these conditions further complicates the analysis of the changes that have already taken place.

The amount of annual precipitation varies in different years on a large scale (by several times), which reduces the informed nature of comparison in terms of the amount of annual precipitation at the beginning and end of the monitoring period due to the substantially random nature of the magnitude of monitoring in individual years.

Automatic meteorological observing station in Bishkek city © Kyrgyzhydromet

Table 2.2. Changes in the magnitude of annual precipitation for individual weather stations

Weather station	Altitude above sea level (m)	Change in annual precipitation (mm /year)	Base period		1991 - 2010	
			Average (mm / year)	Number of recordings	Average (mm / year)	Number of recordings
Batken	1050	0.682	198.8	22	226.3	20
Bishkek	756	1.3178	439.1	30	471.2	20
Jalal-Abad	917	-0.3478	484.4	30	520.3	20
Karakol	1716	0.5198	429.7	30	459.2	11
Naryn	2039	0.4344	296.7	29	318.1	20
Osh	1016	-0.0077	334.3	30	368.8	6
Talas	1217	0.6188	324.4	30	337.7	20
Cholpon-Ata	1645	0.6932	269.0	30	302.7	20

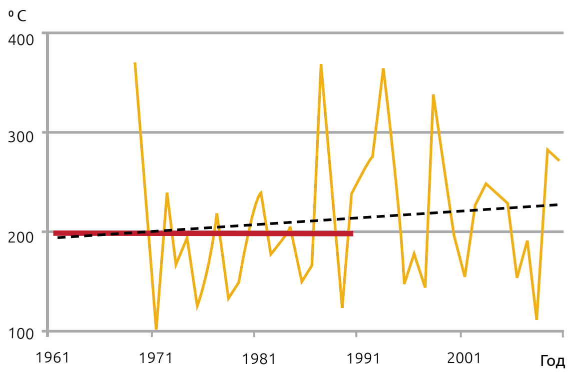
Source: Kyrgyzhydromet

For the North-West climatic region during the entire monitoring period, a rather clear trend of an increase in the amount of annual precipitation is observed only at the Bishkek weather station. At the Talas weather station, the annual precipitation has an insignificant increase.

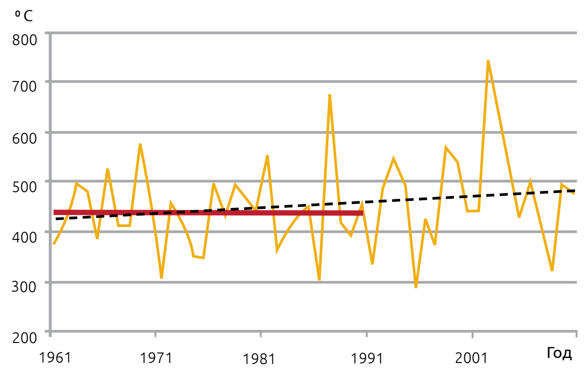
In the North-East climatic region, there was a slight increase in the amount of annual precipitation at all the weather stations. The weather station with the highest increase in precipitation in the region is in Cholpon-Ata (0.6932 mm /year).

In the South-West climatic region, the annual precipitation increased slightly at the Batken weather station. However, this weather station had a very short series of recordings (from 1969), therefore this increase cannot be deemed sufficiently probable. At the weather stations in Osh (-0.0077 mm/year) and Jalal-Abad (-0.3478 mm/year), a slight decrease in the amount of annual precipitation was observed. At the weather station in Osh, monitoring was discontinued in 1996, calling into question the finding of an actual reduction in precipitation at this weather station.

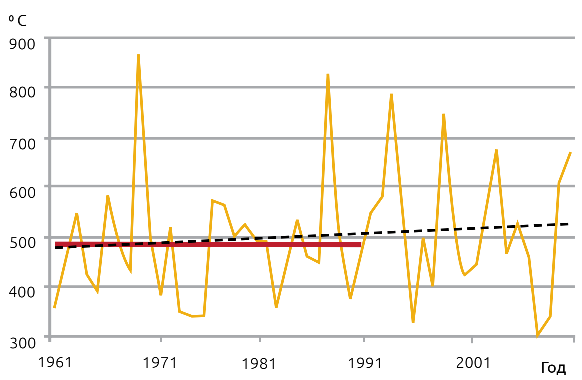
Batken



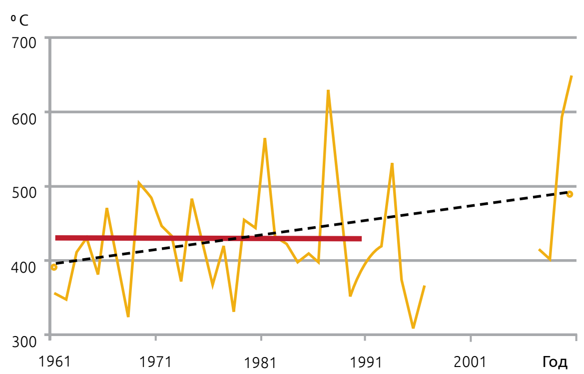
Bishkek



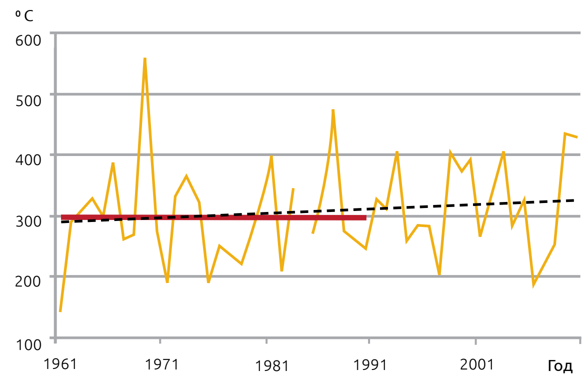
Jalal-Abad



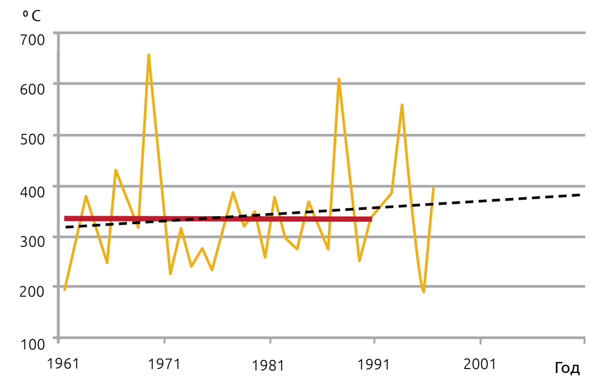
Karakol



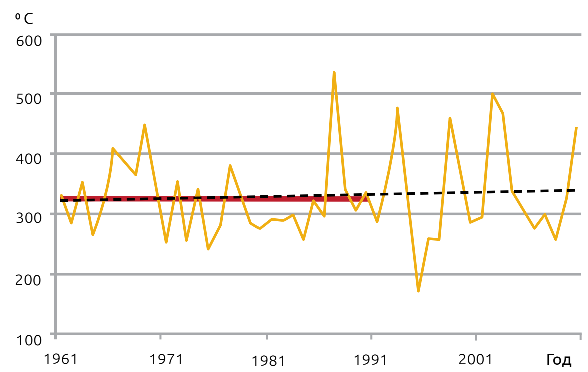
Naryn



Osh



Talas



Cholpon-Ata

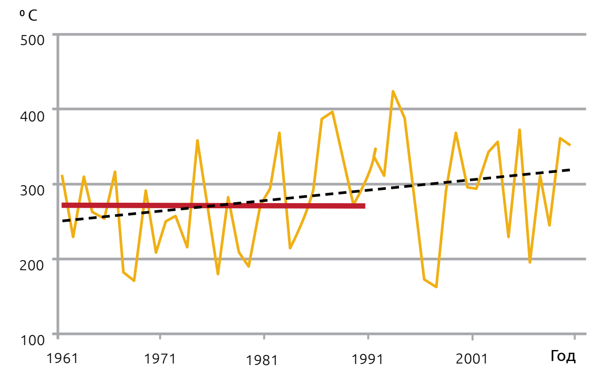


Figure 2.6. Trends of annual precipitation for individual weather stations compared to the base period. (the red line indicates the average annual precipitation in the base period, the black line shows the linear approximation of the trend based on the least squares method)

For the Inner Tien-Shan region, there was a slight increase in the amount of annual precipitation at the weather station in Naryn (0.4344 mm/year).

For all weather stations, an increase in precipitation in the period 1991 - 2010 was observed compared with the base period, as well as a positive trend for the period 1961 – 2010. Moreover, this increase is also observed at the weather stations for which there was a general tendency of a decrease in precipitation over the entire monitoring period.

Emergency situations of a natural and climatic nature

Due to its unique geographical position, the Kyrgyz Republic is a country that is prone to many natural disasters and the bulk of them are of a natural or climatic nature (61% of the total number of emergency situations are of a natural origin). This indicator provides an opportunity to assess and forecast the development of natural emergencies.

Serious geological and climatic threats, and the challenges of global climate change produce permanent negative effects on the population and the national economy. In this regard, increased preparednessand the security of the population and the environment in case of emergencies, allow the minimizing ofeconomic costs, human victims and the impact on elements of the surrounding flora and fauna.

The high altitudes of this mountainous country, varying from 401 to 7,439m above sea level, form a high-altitude climatic zone and natural and landscape-related vertical zonation with high values of relief energy and seismo-tectonic movements that cause landslides, avalanches, rock falls, mudflows and floods earthquakes, flooding, breakthroughs of glacial lakes and permafrost and other hazards. The mountainous system from the standpoint of exposure to emergency situations of natural, technological, environmental and socio-biological nature would be particularly vulnerable.

Table 2.3. Number of emergency situations from 2007 to 2011

Type of emergency situation	2007	2008	2009	2010	2011
Mudflows, floods	70	83	93	131	61
Landslides	5	2	13	40	12
Avalanches	14	25	35	63	22
Earthquakes	18	44	22	22	31
Flooding	4	26	1	12	3
Heavy rains	3	1	7	3	
Large fires	42	38	10	50	73
Infection	14	24	7	7	
Man-made accidents large transport accidents	26	26	15	61	15
Hurricanes	5	34	14	36	24
Hale	3	1	3	1	
Snow, ice jam		5	4	11	14
Rock falls, landslides	5	2	2	1	
Other		1	1		
Total ES	209	312	227	439	255

Source: MoES

Statistical data shows that during the period 2007 - 2011 in the Kyrgyz Republic the greatest number of emergency situations (ES) was registered in 2010 with 439, the lowest in 2007 at 209, while in 2011 there were 255 emergency situations. Most of these were natural and climatic emergencies: mudflows, floods, landslides, avalanches, flooding and weather-related emergency situations (wind, hail, snow, rain).

Often, natural and climate-related emergency situations are caused by mudslides and floods which make up 29% of all emergencies. These depend on the amount of precipitation, an increased frequency of which has been observed over the years, thus in 2008 there were 83 mudslides and floods, in 2009 – 93 and in 2010 - 131. For the period 2000-2010, the biggest number of landslides and floods occurred in Jalal-Abad (9.1% of the total number of emergencies in the Kyrgyz Republic), Batken (6.2%) and Osh (6.1%) regions. In 2011, the number of registered ES caused by mudslides and flood processes was 61, this was due to a smaller volume of precipitation, as well as to preventive measures that were taken to reduce them. Emergencies cause economic damage (destruction of sections of roads and railways, bridges, dams, irrigation projects, homes, destruction of crops and domestic animals) and sometimes there are human casualties in mudflows. Almost the entire republic is prone to mudflows – there are in total 3,103 mudflow-prone rivers in the country. The greatest number of such rivers is in the Chui region with 479, in Talas there are 254, Naryn has 789, Kara-Darya - 666, and Issyk-Kulhas 375.

In the Kyrgyz Republic there are about 5,000 landslides (6% of emergency situations). The number of landslides is increasing every year due to the enhanced interaction of modern geodynamic movements, seismicity, rising groundwater levels, abnormal atmospheric precipitation, as well as engineering and human activities, which violate the balance of slope stability in mountainous areas. The total area of land affected by landslides is about 7.5% of the country. The greatest number of landslides occur in the Osh and Jalal-Abad regions. There are about 300 settlements in landslide-prone areas, the danger of which will continue to exist in the future. For the period 2000-2010, the highest number of landslides occurred in Osh (4.7% of the total number of emergencies in the Kyrgyz Republic), Jalalabad (3.2%) and Chui (0.8%) regions.

Giant avalanches and stone falls in the mountainous areas of the country are not uncommon, the volume of which can reache a million or more cubic meters, and they account for 11% of the country's emergencies. In the basin of the Padsha-Ata River an avalanche with a volume of 6.4 million cubic meters was recorded, in Uzun Akmat one of 4 million cubic meters, in Enilchek - 2.2 million cubic meters, in Chichkan (Kochkubulak) - 2.5 million cubic meters, in Isfara - 1.3 million cubic meters and in Susamyr - 1 million cubic meters. The greatest economic damage caused by avalanches is on the road from Bishkekto Osh, especially in the section 216-265km from Bishkek. Thus, in 2009, at the section 226km from Bishkek, an avalanche with a volume of 1.5 million cubic meters occurred and stopped traffic at this site for a total of 7 days.

In early 2012, due to increased snow cover, and despite low temperatures, 59 avalanches occurred in the mountainous areas of the country, in which 8 people were killed and 19 people were injured.

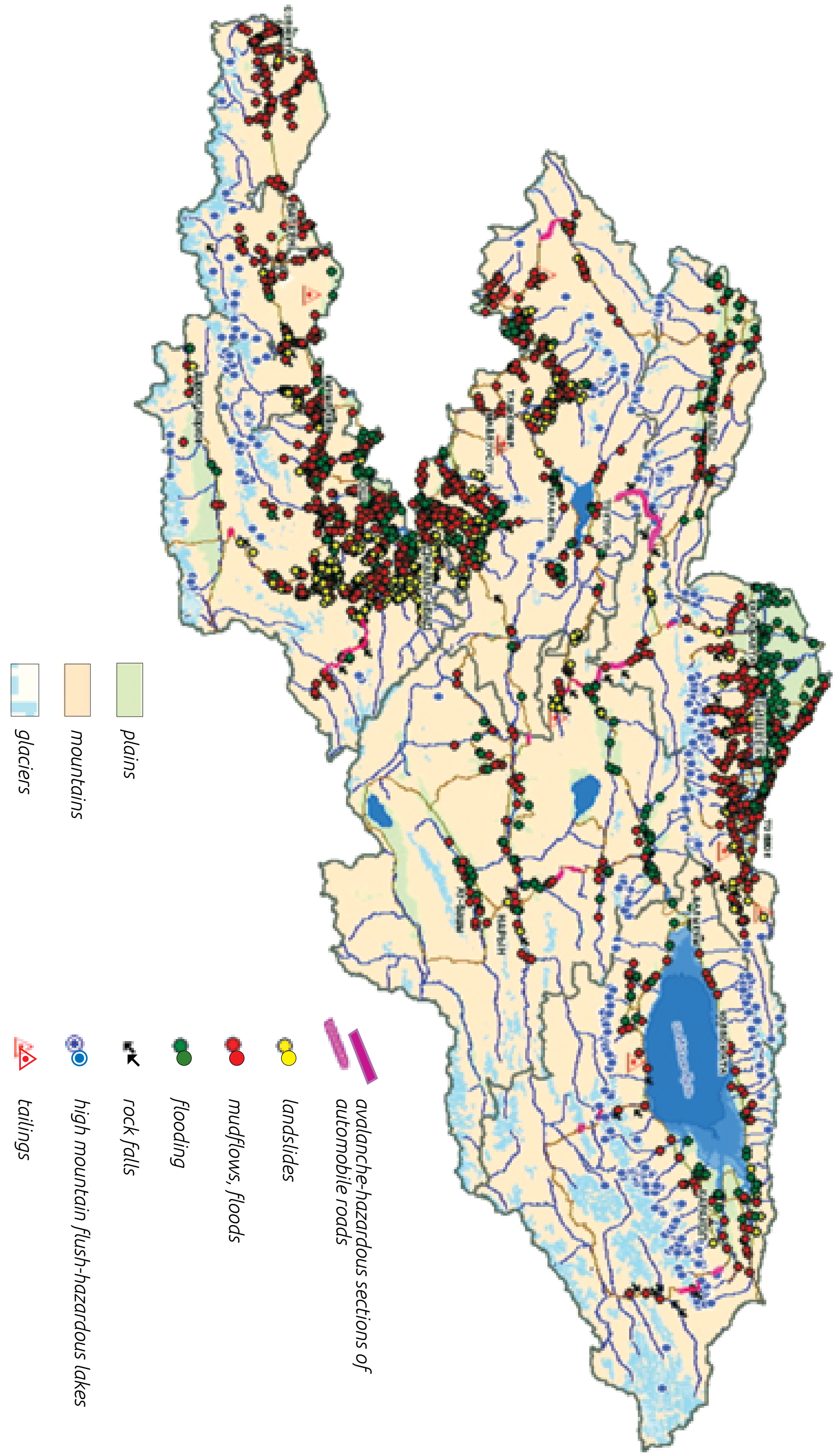


Figure 2.7. Schematic map of the distribution of dangerous processes and phenomena in the Kyrgyz Republic
Source: MoES

53% of the Kyrgyz Republic is exposed to avalanches. Within 779 avalanche-prone areas more than 30,000 avalanche foci were identified, of which about a thousand avalanche foci presented a threat. Avalanches occur almost everywhere where there are steep slopes and snow cover of sufficient thickness. In Kyrgyzstan, the avalanche danger period lasts for 3-4 months in the western Tien Shan and for 10-12 months in the Central Tien Shan. Most frequently, avalanches in the Tien Shan hit highways in February and March (63% of the total recorded number of avalanches which caused damage to highways). 16% of the total number of avalanches occur in January. As a rule, 13% occur in April, while in December there are about 4%. In November and May 1.5% and 2.5% of avalanches occur, respectively. The maximum amount of snow is displaced by avalanches in March (52.6%). The majority of avalanches descend from northern and north-western slopes. During the period 2000-2011, the largest number of emergencies caused by avalanches occurred in Jalal-Abad (4% of the total number of emergencies in the Kyrgyz Republic), Osh (1.9%), Naryn (1.6%) and Issyk-Kul (1.6%) regions.

Greenhouse gas emissions

Despite some global progress achieved in reducing the dependence of economic growth on volumes of CO2 emissions and other greenhouse gases, their emissions are still increasing. An increase in the concentrations of greenhouse gases (GHG) produces a negative effect on global temperatures and climate, as well as leading to the potential adverse effects of these changes on ecosystems, human settlements, agriculture and other socio-economic activities. This indicator allows for the determining of not only the extent of the existing and expected pressure of GHG emissions on the environment, but also shows the effectiveness of the carried out national policy, which is aimed at reducing GHG emissions.

UNFCCC obliges all parties to regularly conduct an inventory of greenhouse gas emissions. The ongoing assessment of greenhouse gas emissions is represented by the results of an inventory held as part of the Second National Communication on Climate Change of the Kyrgyz Republic to the UNFCCC for the period 2000-2005. In subsequent years greenhouse gas inventories have not been conducted.

During the process of taking an inventory of emissions,6 greenhouse gases: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O); hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6) were identified. Emissions of perfluorocarbons and sulfur hexafluoride were assessed as insignificant and, therefore, they were not included in the final results. Also emissions of precursor gases: carbon monoxide (CO), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs) and sulfur oxides (SOx) were determined.

According to the results of the inventory, a slight increase of greenhouse gas emissions, mainly due to the energy sector can be noted. However, the level of emissions in 2005 amounted to less than 40% of the level of 1990.

The main sources of emissions are the energy sector (74%), agriculture (16.1%), waste (5.5%), industrial processes (4.2%), land use change and forestry (0.2%). The use of solvents and other products of the greenhouse gas emissions is negligible in the sector. Land use, land use change and the forestry sector are also absorbers of carbon dioxide from the

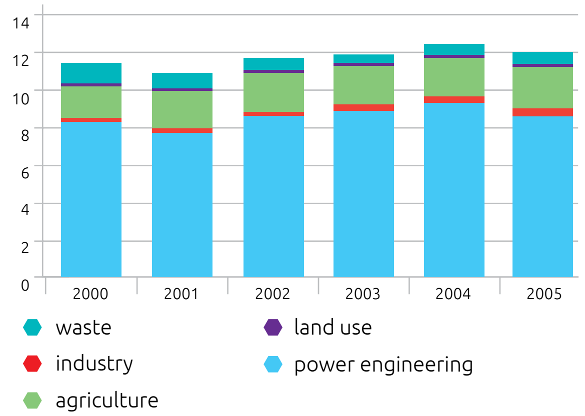


Figure 2.8. Dynamics of greenhouse gas emissions by major sectors (excluding sewage) (million tons of CO_2-equivalent)

atmosphere. 0.71 million tons of carbon dioxide were absorbed from the atmosphere in 2005.

The main emitted greenhouse gases are carbon dioxide (73.5%), methane (24.9%), nitrous oxide (1.5%) and hydrofluorocarbons (0.1%). Changes from year to year are primarily related to emissions of carbon dioxide and hydrofluorocarbons, the intensive use of which has only recently been observed.

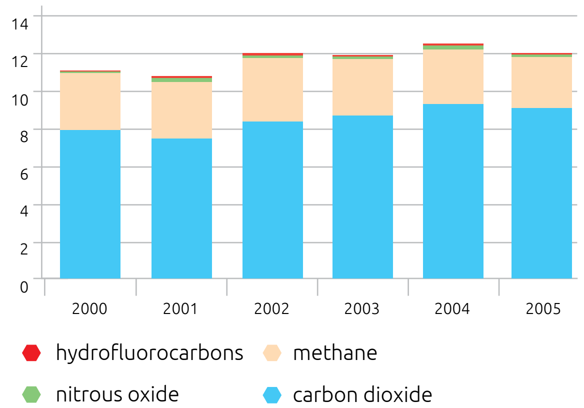


Figure 2.9. Emissions of the main greenhouse gases (million tons of CO2-equivalent)

Because of increase of emissions in general and carbon intensity per square km, carbon intensity per capita, per 1 current KGS in GDP and 1constant U.S. D. of 2000, GDP has steadily declined, due to the increase in population and GDP.

Table 2.4 . Carbon intensity of greenhouse gases (CO2-equivalent)

Index of emissions	2000	2001	2002	2003	2004	2005
Total, million tons	11.124	10.836	11.684	11.818	12.443	12.037
In t /capita	2.260	2.181	2.331	2.329	2.423	2.320
In t /square km	55.635	54.192	58.433	59.105	62.231	60.198
In kg /GDP at current KGS	0.170	0.147	0.155	0.141	0.132	0.119
In kg /GDP in U.S. dollars at 2000 year	8.120	7.509	8.102	7.654	7.532	7.299

Source: Kyrgyzhydromet

The distribution of greenhouse gas emissions is uneven by region, which is associated with the current location of the main industrial facilities and the size of the resident population. The largest contribution is made by Bishkek (34.8%), followed by the Chui region (23.2%), Jalal-Abad region (13.5%), Osh region (12.0%), Issyk-Kul region (5.3 %), Batken region (4.5%), Naryn region (4.2%) and the Talas region (2.5%).

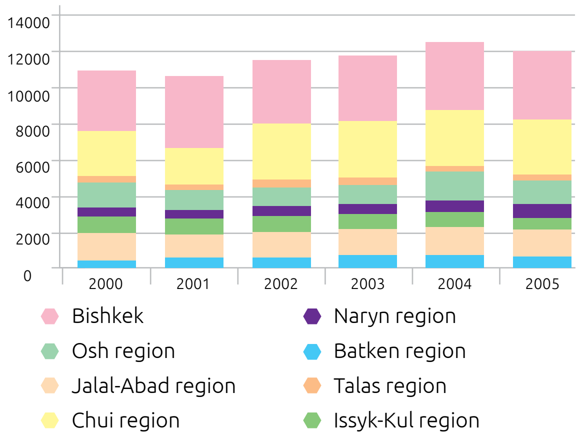


Figure 2.10. Distribution of emissions by administrative units (thousands of tons of CO2-equivalent)

In addition to greenhouse gas emissions, from an environmental point of view, emissions of precursor gases also play a significant role. The distribution of precursor gas emissions is similar to the distribution of those of greenhouse gases. The energy sector (82.9%) plays a dominant role, followed by industry (9.8%), agriculture (6.8%), solvents, and land use change (Figure 2.11). In the waste management sector emission levels of precursors are not available.

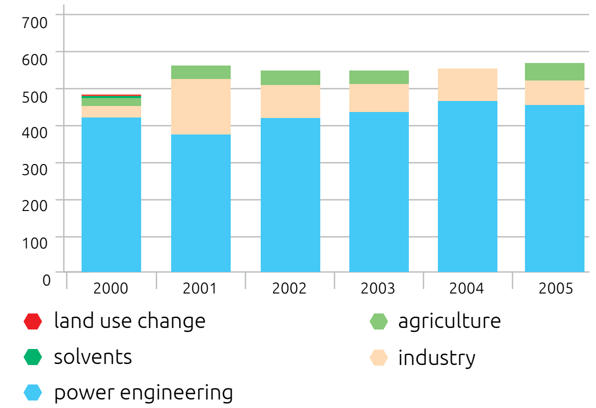


Figure 2.11. Precursor emissions by sector (metric tons)

The bulk of emissions of precursors in the country is represented by carbon monoxide (72.3%), followed by non-methane volatile organic compounds (11.8%), nitrogen oxides (11.2%) and sulfur oxides (4.7%) (Figure 2.12).

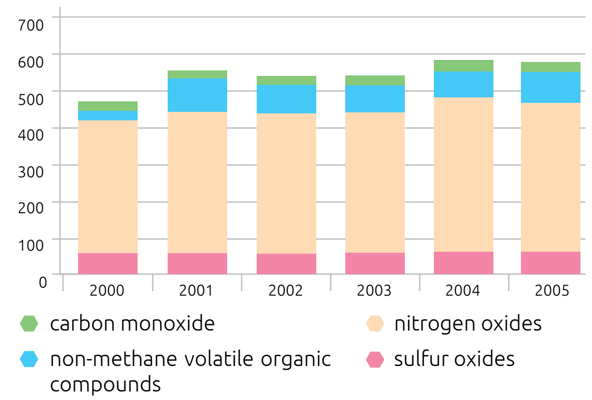


Figure 2.12. Precursor emissions by gas (metric tons)

PART 3
Water resources

The Kyrgyz Republic is the only country in Central Asia with water resources which are fully formed in its own territory; this constitutes its hydrological features and advantages. Kyrgyzstan has significant resources of ground- and surface water. which are located in rivers, glaciers and eternal snow masses.

There are more than 3,500 rivers and streams in the country, which belong to the main basins of the rivers Syr Darya, Amu Darya, Chui, Talas, Ili, Tarim and Lake Issyk-Kul. The waters of these rivers flow across the territory of the Kyrgyz Republic and then on to other Central Asian countries. No water flows into the republic from abroad. In addition to naturally occuring water,, the run-off of surface water, which also includes run-off and returned water from irrigated land areas, flow into the water courses via surface and underground waterways.

Glaciers and snowfields cover 4.1% of the total area of the country. According to available data relating to the period of 60th, there are 8,208 glaciers with a total glaciation area of 8,076.9 sq.km. in the Kyrgyz Republic. Currently, active glacier melting is being observed, and experts estimate that the above figures will decrease by 20%.

There are 1,923 lakes in the country. Water stock in the lakes is estimated at 1,745 cubic km., or about 71% of total national water reserve. The largest lakes- Issyk-Kul, Son-Kul, Chatyr Kul and Sarychelek are located in closed basins. All remaining lakes are in the Syrdarya river basin. The largest endorheic (without outflow) mountain lake is Issyk-Kul, with a volume of 1,738 cubic km. and a surface area of 6,236 sq. km., it is a potent factor in the climate throughout the basin of the lake.

About 45% of the total number of glaciers in Central Asia, which are the major source of water supply for the rivers located in Kyrgyzstan, and forecasts relating to their state due to the effects of global climate change are of particular concern.

Climate change is causing the glaciers to shrink and as a result, the run-off of small rivers from these glaciers is reducing. The seasonal distribution of run-off has also changed. Before 2020-2025, an increase in surface run-off due to the increased melting of glaciers is expected, which is then projected to decrease to about 42-20 cubic km, which is only 44 to 88% of the run-off in the year 2000. The consequences of this process could lead to a lack of water resources, a reduction in energy generation capacity and land productivity, not only in Kyrgyzstan, but also in the whole Central Asian region.

Substantial underground freshwater reserves and mineral-thermal waters were prospected in the republic. The main resources of underground high-quality fresh water are concentrated in the intermountain hollows. Forty-four deposits were explored, and thereare total proven reserves of fresh groundwater making up 10,545.2 thousand cubic meters /day[10].

Water is one of the key factors of socio-economic prosperity in Central Asia; therefore it is natural that water resources are the subject of inter-state interests.

The states neighbouring Kyrgyzstan need water for irrigation, mainly during the summer growing season. However, the current deficit of energy resources makes it more profitable for Kyrgyzstan to discharge water from its reservoirs in winter, when the electricity consumption level in the country increases. The change of water usage in one country inevitably affects the interests of other countries. At present, the issues of water allocation and water distribution are being resolved on the basis of intergovernmental agreements, that were developed in the 1990s.

Renewable freshwater resources

Renewable freshwater resources have major environmental and economic value. Their distribution varies widely between countries and within countries. Freshwater resources are seriously affected by their over-exploitation and the degradation of the environment. Linking water extraction to the renewal of water stocks is one of the central issues in the sustainable management of freshwater resources. Countries depend on each other in terms of water resources. In particular, in Central Asia, cooperation between countries on integrated water resource management and distribution plays an exceptionally important role in the lives of the population, economic prosperity and political stability in the region. Trends in the change of this indicator allow the determination of the state of renewable fresh water resources in the country.

Currently, work on water cadastre development is being carried out in the Kyrgyz Republic, therefore, it is not possible to determine the annual amount of water resources, both as a total for the country and by river basin.

Kyrgyzhydromet performs data collection on precipitation volume, climate indicators and river flow. Data is collected at hydro-points and hydro-meteorological stations (the network has dramatically reduced due to under-funding of the operations). Precipitation is measured at the 30 stations of the Kyrgyz Republic, and the aggregated value of all stations is not calculated. Actual aggregated evaporation is only being maintained at two stations.

The Kyrgyz integrated hydrogeological expedition (KIHGE) of the GAGMR is responsible for monitoring ground quality, quantity, and groundwater levels. Data collection is performed at monitoring wells located across the country (the network has dramatically reduced due to shortage of financing of the operations). Each year, only 10-15% of the operational wells, or 10% of the total number of registered wells, are being surveyed. Over the past 10 years only wells in the Chui, Talas and Issyk-Kul basins were examined, while other regions in the north of the Kyrgyz Republic were not examined because of insufficient financing.

I – Issyk-Kul
II – Chu
III – Talas+Kurkureu
IV a, b, c, d – Syr Darya
V – Chatyr-Kul
VI – Amu Darya
VII – Tarim
VIII- Lake Balkhash

Figure 3.1. Map of the river network of Kyrgyzstan

[10] Data of the Kyrgyz Integrated hydrogeological expedition

Kyrgyzstan is located in the upper reaches of many rivers and the region where both surface and groundwater resources are formed. The Kyrgyz Republic is the source of the Tarim, Amu Darya, Syr Darya, Chui and Talas rivers.

Renewable freshwater resources in the Kyrgyz Republic are represented by river flows and groundwater, the volume of which is formed naturally due to precipitation and glaciers melting in the country.

The total volume of glaciers is 417.5 cubic km. The rivers of Kyrgyzstan belong to three main endorheic basins: the Aral Sea (76.5% of the total area of the country), Lake Issyk-Kul (10.8%), Lake Lop Nor - Tarim River (12.4%), which is the water artery of western China. A small part of the territory (0.3% of the area of the country), which is the catchment area of the Karkyra river (Ili river basin), belongs to the basin of Lake Balkhash (Figure 3.1).

The major rivers, in terms of the size of their catchment area, are the Naryn, Kara Darya, Tarim, Chui, Talas and Chatkal (Table 3.1). In turn, the Syr Darya River basin is represented by its right-hand component, the Naryn River, which is formed from the confluence of the Big and Small Naryn, and the left component, which is the Kara Darya River, which having confluenced abroad Kyrgyzstan with the Naryn River, form the Syr Darya River. Direct tributaries of the Syr Darya River are left bank tributaries: Isfairamsai, Shakhimardan Sokh, Isfara and Khodjabakirgan and the right bank tributaries: Padshaata, Kassansay, Gavasay, Kekserek and Chatkal flowing down from the southwestern slope of the Chatkal range.

The basin of the Chui River occupies most of the northern territory of Kyrgyzstan. The river is formed by the confluence of the Kochkor and Dzhuanaryk rivers in the Kochkor valley. At the exit from the Boom Gorge, one of the major tributaries,the Chon-Kemin river, flows into the Chui river as the right-hand tributary. In the northwest, the Chui River basin borders with the Talas river basin, and is enclosed on the north and south by the Kyrgyz and Talas mountain ranges. The Talas river is formed by the confluence of the Karakol and Uchkosha rivers.

The Assa river basin (in the upper reaches of the Ters river) is located in the western part of the Talas valley and is the Kurkureusu River Basin in the Kyrgyz Republic, which is the right tributary of the Ters river.

The endorheic basin of Lake Issyk-Kul is located in the north-eastern part of Kyrgyzstan. More than 80 small rivers, which form a run-off on slopes and ridges Terskey Kungei Ala-Too, bordering the lake basin, flow into the lake. The largest of them are the Jergalan and Tiup rivers, which begin in the precipitation-rich, eastern part of the basin. In the east, the Lake Issyk-Kul basin borders with the Ili river basin (Lake Balkhash), a tributary of the Ili River, the Karkyra River, orginates in Kyrgyzstan. The south-east part of Kyrgyzstan, bordering China, belongs to the hydro-graphic Lake Lop Nor system. The Aksay River, Chong-Uzengikuush River, Sary Jaz River, Keksuu River (Kyzylsu, Dzharkent), which are all tributaries of the Tarim River, which flows into China, are formed in the Kyrgyz Republic. The largest of the rivers in this basin is the Sary River, which is fed by the snow and glaciers of the highest mountain ranges Kokshaal Too, Enilchek Too and the Ak-Shyyrak range.

The Kyzyl-Suu River (in western Alay), flows south to Tajikistan, where, with the Muksuu River, it becomes the Surkhob River (Vakhsh), one of the tributaries of the Amu Darya River.

Table 3.1. Hydro-graphic characteristics of the major rivers of Kyrgyzstan

River basin, lakes	Water catchment area(square km)		Length (km)	
	Total	Including within Kyrgyzstan	Total	In Kyrgyzstan
Syr Darya	219000	102502	2212	-
Naryn	59900	59900	578	578
Kara Darya	30100	30100	180	180
Chatkal	7110	5520***	217	175.0***
Talas	52700	8250	661	194**
Chui	22491	15901	1186	381.0*
Issyk-Kul	11233	11233	-	-
Tarim	-	25550	-	-

Source: DWRA of the MAA
** in the section near Blagoveshenka village*
*** in the section near Kirovskoye village*
**** in the section of the Naiza River*

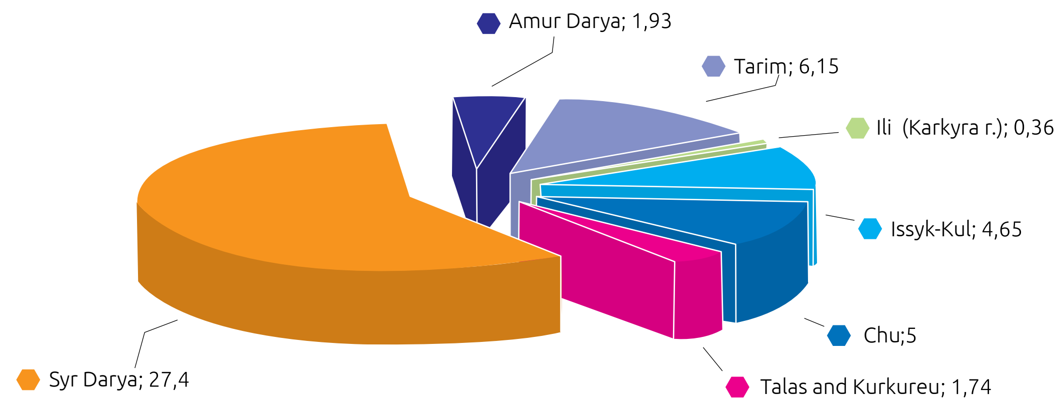


Figure 3.2. Water resources of rivers formed in the territory of Kyrgyzstan, cubic km

All the rivers, with the exception of closed (endorheic) basins of lakes Issyk-Kul and Chatyr Kul, are transboundary ones (Figure 3.1). In the arid climate of Central Asia, water from Kyrgyz rivers is important to the downstream countries: China, Kazakhstan, Tajikistan and Uzbekistan.

The rivers of the Kyrgyz Republic are formed entirely within the country. The largest volume of river flow is formed in the basins of the Syr Darya (58%), Tarim (13%) and Chui (11%) rivers and Lake Issyk-Kul (10%). The rivers originating in the river basins of the Amu Darya and Talas-Kurkureu comprise 4% and less than 1% of the total river flow is from the Karkyra (Figure 3.2).

The total river flow volume, flowing abroad from Kyrgyzstan ("resources less water extraction by the Kyrgyz Republic"), based on an average year, is 34 cubic km, with the largest volumes of flow are observed in the Syr Darya River with 69% and the Tarim River at18%, while in other rivers it fluctuates between1% and 6% of the total river flowleaving Kyrgyzstan (Table 3.2.).

Table 3.2. Average multiyear river flow of the main river basins of the Kyrgyz Republic (cubic km)

Syr Darya	Amu Darya	Chu	Talas+ Kurkureu	Ili (Karkyra)	Tarim	Issyk-Kul	Total
Average multiyear river flow, cubic meters							
27.4	1.93	5.0	1.74	0.36	6.15	4.65	47.2
58	4	11	4	0.8	13	10	%
Volume of water leaving Kyrgyzstan. less water extraction by the Kyrgyz Republic. based on an average year (cubic km)							
23.6	1.90	1.15	0.96	0.36	6.15		
69	6	3	3	1	18		%

Source: DWRA of the MAA

The water content of rivers in the republic in 2006, 2009 and 2010 was above the average multi-year figures and was 109%, 101% and 115 %, respectively. The water content of rivers in the years 2007 and 2008 was below average multi-year figures and was 95% and 87 % respectively (Table 3.3).

Table 3.3. Annual river flow in Kyrgyzstan (cubic meters)

2006	2007	2008	2009	2010	Average
51	45	41	48	54	48

Source: DWRA of the MAA

The amount of water per inhabitant of the republic during this period varied from 7,823 to 10,007 cubic meters/person, with the lowest figures in the law-water year 2008 (Table 3.4).

Table 3.4. Amount of water per inhabitant of the republic (cubic m / person)

2006	2007	2008	2009	2010	Average
9996	8656	7823	8893	10007	9075

Source: NSC

An integral part of the river network in lowland regions of the country is the rivers fed by groundwater ("karasu"). The western part of Chui and Talas are fed by the Toktash, Sargou, Shymkent, Kirov rivers and others are characterized by an extensive network of rivers. Such water flows are formed in places where ground water comes to the surface at the periphery of the alluvial fans of mountain rivers. Sometimes, such water courses produce independent river beds (e.g. the Red River of the Chui River basin and the Garaty River of the Sokh River basin), but they most frequently occur in ancient river beds of flat areas, such as Issyk-Ata, Ala-Archa Alamedin andJeti-Oguz rivers. Watercourses, fed by ground water, are characterized by stable water flow in time and a low flow rate. The total flow of the rivers fed primarily by groundwater ("karasu"), is estimated at 1,911 million cubic meters per year, with the highest amounts in the Chui River basin (69%) and Lake Issyk-Kul basin (23%) (Table 3.5).

Table 3.5. River flow of rivers fed primarily by groundwater ("karasu")

River basin, lake basin	Average multi-year flow Qav.cubic meters (m/sec)	River name
Talas	4.05	Bakiyan, Karabura-Karasu, Kirov, Shymkent, Beisheke
Chu	41.7	Including: Red River (Qav.=23.6 cubic m/sec), "karasu" of the Kochkor valley (Qav.= 2.5 cubic m/sec)
Issyk-Kul	14.1	Jergalan, Karakol, Karasu, Jeti-Oguz
Syr Darya	0.74	Garaty River
Total, cubic m/sec	60.6	
million cubic m	1.911	

Source: institute JSC "Kyrgyzsuudoolbor"

The use of river water for irrigation is linked to the non-returnable consumption, as well as the formation of secondary water resources returned from irrigated fields. The total volume of return water flow is estimated at 1,981 million cubic meters per year, of which 57% is formed in the Chu River basin (Table 3.6).

Table 3.6. Return water

River or lake basin	Return water flow Q_{return}
Talas+Kurkureu	9.6
Chu	35.8
Issyk-Kul	17.4
Total: cubic m/sec:	62.8
million cubic m	1.981

Source: institute JSC "Kyrgyzsuudoolbor"

The quantity of returned water to the Syr-darya River basin has not been estimated due to the fact that the return water flows generated in the basins of the rivers Naryn, Karadarya and its tributaries, wedge out in the Republic of Uzbekistan.

Groundwater According to state data, the main proven fresh groundwater reserves of the Kyrgyz republic are concentrated in the intermountain basins, the areas which the most economically developed – in the Chui, Issyk-Kul, Talas and Osh regions. The main reserves of fresh groundwater are confined to friable fragmental alluvial-pro-alluvial sediments of the quaternary age. The main water-bearing rocks are gravel-pebble and boulder-pebble deposits with sand and gravel aggregate. The thickness of exploited water-bearing horizons in different hydrogeological zones is different and varies from 20 to 500m.

The proven reserves of fresh groundwater in the country had been explored, calculated and approved by the State Commission on Mineral Reserves of the USSR in forty-four deposits, including twenty-eight in the northern areas of the Kyrgyz Republic. The total proven reserves of fresh groundwater resources in the Kyrgyz Republic, as the sum of all categories (under continuous operation mode) are 10,545.2 cubic meters /day, including (by category): A - 2,946.65 cubic meters/day, B -3,116.17 cubic meters/day, C1 - 1,689,58 and C2 - 2,792.8 cubic meters/day. Thereof, in the northern regions of the Kyrgyz Republic, the total proven reserves are 8,239.09 cubic meters/day, including (by category): A – 2,035.98 cubic meters/day, B – 2,425.33 cubic meters/day, C1 -1,334.98 cubic meters/day and C2 – 2,442.8 cubic meters/day. Additionally, reserves of fresh groundwater were estimated at 4,099.14 tcubic meters/day. Predicted groundwater resources in the Kyrgyz Republic are 30,441 cubic meters/day, including in the north of the Kyrgyz Republic an estimated 25,948 cubic m/day. There has been no increase in proven reserves of fresh groundwater in the last 20 years. The last re-estimation of the reserves was in 1995 at the Ala-Archa deposit of underground water, which is used to supply water to the capital.

All the underground fresh water deposits are used as potable water (drinking water), for household, industrial and technical (irrigation) needs, regardless of the targeted purpose at the time approval of the proven groundwater resources. The degree of use of underground water reserves is low between 20%and 30%. The highest degree of groundwater use is at the deposits in the capital and other economically developed regions of the country.

For ground water extraction in the area of groundwater deposits and areas with non-proven reserves of groundwater, about 15,000 wells were drilled, and springs and under river-bed drains were drowned out. Currently, the actual number of operational wells that are being used is not known, especially in the south of the country. In the northern regions of the Kyrgyz Republic there are 2,079 operated wells, including 281 wells that discharge groundwater virtually without using it (spouting).

Reservoirs. The country's twelve large reservoirs are for power generation and irrigation purposes, mainly for seasonal regulation, with a total volume of 21.1 billion cubic meters. They are essential for electricity generation and a guaranteed water supply for irrigated land. The largest are the Toktogul reservoir with the total volume of 19.5 billion cubic meters, the Kirov reservoir with 550 million cubic meters, the Orto-Tokoy reservoir with 470 million cubic meters and the Papan reservoir with 260 million cubic meters (Table 3.7). Kyrgyzstan also receives about 400 million cubic meters of water a year from reservoirs in Tajikistan and Uzbekistan.

Table 3.7. Data on reservoirs

Name	Water source	Year commissioned	Million cubic meters
Reservoirs in Kyrgyzstan			
Toktogul	Naryn River	1982	19 500 5 500
Kirov	Talas River	1974	550 6.0
Orto-Tokoy	Chu River	1958	470 20
Papan	Ak-Bura River	1982	260 20
Tortgul	Isfara River	1971	90 15
Ala-Archa (channel-based)	Ala-Archa River	1989	80 0.0
Ala-Archa (off-channel)	Chu River	1964	52 6.0
Naiman	Abshirsay River	1970	39.5 1.5
Spartak	Sokuluk River	1975	22.0 0.6
Bazarkorgon	Karaunkyr River	1962	22.0 2.4
Sokuluk	Sokuluk River	1968	9.3 2.2
Karabura	Karabura River	2007	17.0
Total:			21 112 5 574
Reservoirs in Uzbekistan			
Andijan	Kara-Darya River	1978	1 900 150
Kerkidon	Isfairamsai River, Kara-Darya	1963	160 5.0
Kassansay	Kassansay River	1954	165 10.0
Kairakkum	Syr Darya River	1956	4 200 1 600

Source: DWRA of the MAA

Interstate water allocation. The allocation of river water between Kazakhstan, Tajikistan and Uzbekistan, is based on the principle of "equal provision (with water) of an irrigated hectare." For this purpose, schemes were developed and protocols were adopted, the legitimacy of which was confirmed in 1995 by the adoption of the Nukus Declaration by the heads of Central Asian states, declaring that: "The Central Asian states recognize the previously signed and existing treaties, agreements and other regulations governing the relationship between them for water and adopt them for mandatory execution." Also, the Interstate Aral Sea Council made a decision dated 19th April 1996 in Kyzyl-Orda, stating that "unless adoption of the Regional Water Strategy to be guided by the adopted principle of water allocation." In accordance with the listed documents, Kyrgyzstan has the right to use 24% of the water, the total limit is 11.9 cubic km., including the Syr Darya River basin - 4.88 cubic km, Chu River basin- 3.85 cubic km, Talas and Kurkureu River basins - 1.0 cubic km and Amu Darya River basin - 0.45 cubic km per year, Table 3.8.

Table 3.8. The limits of the Kyrgyz Republic in the context of the major river basins

River or lake basin	Flow formed in Kyrgyzstan (cubic km)	Kyrgyzstan:	
		Limit in cubic km.	% of the flow
Talas + Kurkureu	1.74	1.00	57
Chu	5.0	3.85	77
Issyk-Kul	4.65	1.56	33
Ili (Karkyra)	0.36	0.18	50
Tarim	6.15	-	-
Amu Darya	1.93	0.45	22
Syr Darya	27.4	4.88	18
Total:	**47.2**	**11.9**	**25**

Source: DWRA of the MAA

Despite the fact that the water resources of Lake Issyk-Kul are not subject to the interstate water allocation, the limit, which is equal to 33% of the water flow, was established in accordance with the environmental requirements of Lake Issyk-Kul.

Water resources are transferred to downstream neighbouring countries via transboundary rivers partially through hydraulic structures, such as canals and reservoirs, but primarily through the riverbeds (winter water flow, not relating to water discharge).

Additionally, Kyrgyzstan also receives irrigation water for water extraction and accumulation from hydro-technical structures, owned by the neighbouring republics of Uzbekistan – the Kampyrravat (Andijan) and the Kassansay reservoirs, the South Fergana, Sawai, Pakhtaabad, Great Fergana canals, a total of 385 million cubic m; Tajikistan - Kairakkum Reservoir - 77 million cubic meters (Table 3.9).

Table 3.9. Volume of water received by Kyrgyzstan from interstate water objects of neighbouring countries, mln. cubic m

Name	State from which Kyrgyzstan receives water	Annual volume of produced water(million cubic meters)
Andijan reservoir, including:	Uzbekistan	269.0
Right Bank Kampyrravat Canal	Uzbekistan	193.0
South Fergana Canal	Uzbekistan	32.0
Savay	Uzbekistan	44.0
Pakhtaabad	Uzbekistan	10.0
Feeding Kerkidon reservoir	Uzbekistan	17.0
Great Fergana Canal	Uzbekistan	10.0
Kassansay reservoir	Uzbekistan	19.0
Great Namangan Canal	Uzbekistan	60.0
Cascade of the Arka pumping stations from the Kairakkum channel	Tajikistan	77.0
Total:		**462.0**
Including	From Uzbekistan:	385.0
Including	From Tajikistan:	77.0

Source: DWRA of the MAA

Fresh water extraction and use

Freshwater resources are of great ecological and economic value. Over-exploitation and degradation of the environment have an effect on freshwater resources. Since water quality is largely dependent on quantity, linking freshwater extraction to the renewal of water resources is one of the central issues in the sustainable management of freshwater resources. This indicator can show the extent to which fresh water resources are used, and determines whether there is a need to adjust policies to regulate water extraction and use.

The Kyrgyz Republic is using 20-25% of the available water resources. The rest of water flows to neighbouring countries: China, Kazakhstan, Tajikistan and Uzbekistan. A significant part of water resources in the country (over 90%) is used for irrigation and agricultural water use. At the same time, 80-85% of the water is used during the growing season.

According to official figures, during the period 1987-2010, the total water extraction of the Kyrgyz Republic decreased from 12.9 cubic km to 8-10 cubic km or by 40% (Figure 3.3).

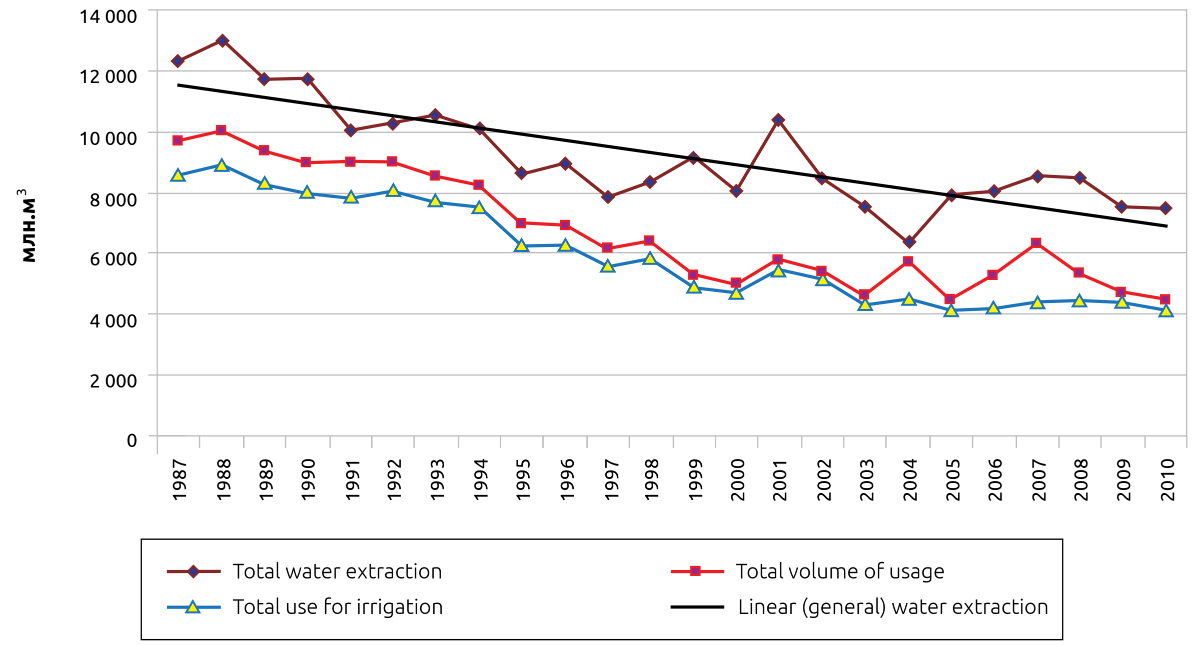


Figure 3.3. Freshwater extraction(million cubic m)

For the period 2006-2010, the largest amount of water extraction was observed in the Chui region, amounting to 2.71 - 3.43 cubic km, Osh region - 1.2 - 1.36 cubic km, Talas region - 0.83-1.11 cubic km, Jalal-Abad region - 0.59-1.36 cubic km. Water extraction volumes are lower in Naryn region - 0.59-0.69 cubic km, Batken region - 0.58-0.62 cubic km and Issyk-Kul region - 0.51-0.61 cubic km (Table 3.10).

Table 3.10. Extraction of fresh water from natural water sources by region (million cubic m)

Region name	2006	2007	2008	2009	2010
Kyrgyz Republic	8007	8530	8469.4	7600	7562
Batken	621	614	616	599	578
Jalal-Abad	644	1357	644.1	586	695
Issyk-Kul	510	507	612	587	555
Naryn	650	663	676.2	688	592
Osh	1365	1323	1253.7	1316	1290
Talas	847	849	1113.8	892	829
Chui region	3253	3047	3431.6	2708	2804
Bishkek city	117	170	122.1	141	136
Osh city	…	…	…	83	83

Source: NSC based on data from DWRA of the MAA

In terms of the major river basins, it should be noted that the highest amount of water extraction varies in the basins of the Chu River with an average of about 4.0 cubic km and the Syr Darya with 3.1 cubic km. Water extraction volumes in the basins of the Talas River and Issyk-Kul Lake is 930 and 651 million cubic meters. The water of the Kyzylsu River (West) - 53 million cubic meters is poorly used,, while water from the Tarim River basin and the Karkyra river is not used at all (Figure 3.4).

Figure 3.4. The volume of extraction in the context of the major river basins (million cubic meters)

Over recent years, the comparative mean values of actual water extraction in the Chui and Talas river basins, show that they are approaching the maximum limit of possible extractions ext ractionextractionextraction(Table 3.11). In the remaining reservoirs, values of water extraction volumes have not reached the limit and range from 11% (the Amu Darya river basin) to 60% (the Syr Darya river basin).

Table 3.11. Volume of freshwater extraction in the context of the major river basins compared to the limit (million cubic m)

River (lake) basin	Average water extraction for 2008-2010	Limit	%
Talas	0.94	1.00	94
Chu	3.32	3.85	86
Issyk-Kul	0.61	1.56	39
Syr Darya	2.94	4.88	60
Amu Darya	0.05	0.45	11
Total:	7.86	11.9	66

Source: SWI under DWRA of the MAA

Total groundwater reserves in the country hold second place after the volume of surface water resources, which are concentrated in the rivers, lakes and reservoirs. But groundwater has advantages that fully compensate for a relatively small volume. Primarily, the advantages, are as follows: an almost ubiquitous availability within the intermountain basins, high quality and independence from seasonal climate changes and associated phenomena, making difficult extraction of surface water, in the form of floods and mudflows.

In the early 1990s, groundwater was used at 5-15% of natural fresh groundwater from artesian basins, mainly for household needs and in some districts for irrigation[11].

The capital costs for groundwater extraction are rather high,but with the proper maintenance of wells and pumping equipment it is possible to have a stable source of good quality water, almost close to consumption standard.

Underground water is fed by run-off water from the soil surface, water seepage from rivers, canals and other water bodies. It happens primarily in the foothills of the depressions where the rivers emerge from mountain gorges onto the plains. Water from rivers, as itfilters through the thickness of rocks is cleaned and, as a rule, in its natural environment, groundwater is clean. The dynamics of fresh groundwater extraction shows that in some years of the early 1990s, extraction reached 1.1 cu. km. per year, but beginning in 1992, it decreased from 900 million cubic meters to 300 million cubic meters and in recent years it approximately 299-324 million cubic meters (Table 3.12).

[11] Atlas of the Kirghiz SSR. Head Office of Geodesy and Cartography under the Council of Ministers of the USSR, Moscow 1987

Table 3.12. Freshwater extraction, including from aquifers (million cubic m)

	2006	2007	2008	2009	2010
Water extraction from natural sources, including:	8007,0	8530,1	8469,4	7600	7562
from aquifers	306	334	302	299	324

Source: NSC

Groundwater is most intensively exploited for water supplies in Bishkek, Chui, Jalal-Abad and only slightly in Naryn, Osh,Issyk-Kul and Talas regions. Groundwater is never used in the Batken region (Table 3.13).

Table 3.13. Water extraction volume from aquifers in the Kyrgyz Republic (million cubic m)

Region name	2006 год	2007 год	2008 год	2009 год	2010 год
Talas	60.4	0	2.7	3.16	3.15
Chui	24.1	82.2	69	51.9	67.8
Issyk-Kul	18.4	16.2	27.5	15.40	54.4
Naryn	4.05	1.3	0.09	0	0
Batken	0	0	0	0	0
Osh	42.7	22.1	26.9	20.80	21.4
Jalal- Abad	39.9	52.5	53.6	66.9	42.2
Bishkek (city)	116.7	159.4	122.1	141.2	1353
Total:	306	334	302	299	324

Source: NSC

In 2010, the largest proportion of extracted freshwater, 93%, was used for irrigation and agricultural water supply, 4.6% was used for household needs and as potable water and 2% for industrial purposes (Table 3.14). This consumption pattern continued throughout the monitoring period. Both surface water and groundwater are used for irrigation, while for industrial purposes and as potable water, underground water ismostly used.

Table 3.14. Fresh water use profile (million cubic m)

	2006	2007	2008	2009	2010
Total water consumption, of which:	4533	5547	5315,1	4729	4478
For production needs	72	72,8	74,6	80	91
For irrigation and agricultural water supply	4215	4549,3	4445,4	4425	4163
For household needs	128	159	136,8	180	206

Source: DWRA of the MAA

Household water consumption per capita

The availability of sufficient water to meet basic human needs is a prerequisite for life, health and development. This figure is the key indicator of the level of development of the water economy and availability of water to meet household needs. Household water consumption is not uniform in the different regions and depends on many environmental and economic factors.

Compared to 2006, the volume of water used for domestic needs, increased by 1.6 times. The highest water consumption is observed in Chui (including Bishkek) and Osh regions. In 2010, the household water consumption per capita was 40 cubic meters, which is 1.6 times higher than in 2006 (Table 3.15).

Table 3.15. Total water consumption for household needs (million cubic meters)

	2006	2007	2008	2009	2010
Household needs of the republic, of which:	128	159	136.8	180	206
Batken region	0	0.0	0.00	0.0	0.0
Jalal-Abad region	17.4	16.5	15.4	10.6	25.3
Issyk-Kul region	7.97	10.4	12.4	11.6	11.5
Naryn region	0	0.0	0.4	0.0	0
Osh region	41.4	75.7	41.2	87.9	46.4
Talas region	0.98	2	2.5	2.7	2.7
Chui region	24.1	18.4	19.7	18.3	20.6
Bishkek	36.6	35.9	45.3	49.2	58.1
Per person, cubic m	**25**	**30**	**26**	**35**	**40**

Source: NSC

The country's population is provided with potable water from 1,073 centralized household water supply systems, at that in 133 systems potable water sources are from surface water. Exceeding the term for equipment depreciation at the wells, water treatment and decontamination facilities, hourly water supply and the physical deterioration of water supply systems causes water loss (20-50%), the occurrence of hazardous situations and contributes to the secondary pollution of potable water.

About 85% of water supply systems in the Kyrgyz Republic use underground water, although the uneven distribution of groundwater across the country has led to their limited use in the southern regions, where their reserves are much lower. At the same time, a lack of funding for the operation and maintenance of water wells and the running water network leads to the rejection of using groundwater resources and focuses on the extraction of less safe water from open water bodies (rivers, wells).

Rapid population growth in the cities of Bishkek and Osh in the last 15-20 years has created significant challenges with regard to the provision of potable water. As a result of population migration from rural areas to cities in search of work, illegitimate and sub-standard settlements were built in suburban areas, which were then later legalized. In some of these areas water supply and water treatment infrastructure either does not exist, or does not meet the established standards. About 15-20% of the population of Bishkek do not have access to piped potable water. In Osh, problems were also recorded with the quantity and quality of the water being supplied.

Access of the population (rural and urban) to potable water during the period in question, increased from 89.8% in 2006, to 91.5% in 2010. Full coverage of population with running water systems is seen in Bishkek. High coverage (over 90%) is observed in Chui, Issyk-Kul, Talas and Jalal-Abad regions, while the lowest is in the Batken region; water supply in the city of Osh, Osh and Naryn regions is insufficient.

At the same time, the level of potable water supplied via running water systems in the Naryn region has increased in recent years from 59.9% in 2006 to 90.1%, and in Osh region - from 75.1% (2006) to 82.3% (2010), the remaining regions are characterized by insignificant growth rate in the piped supply of water. In the Batken region, the proportion of the population with access to safe potable water has dropped from 80.3% in 2007, to 72.7% in 2010 (Table 3.16).

On average, for the period 2006-2012, in rural areas across the country, 604 thousand people, or 16% of the total population, were not supplied with clean potable water. The highest level of provision among the rural population with potable water was observed in the Chu region - 96%, Issyk-Kul region - 93%, Naryn region - 87%, while the lowest level was in the Batken region- 64% (Table 3.17).

Table 3.16. Proportion of the population with access to safe potable water by region (%)

Name of the region	2006	2007	2008	2009	2010	Agerage
Kyrgyz Republic	89.8	93.0	90.4	90.4	91.5	91
Batken region	-	80.3	76.7	72.8	72.7	61
Jalal-Abad region	94.4	94.9	94.4	94.4	95.0	95
Issyk-Kul region	95.5	95.8	99.3	99.3	98.8	98
Naryn region	59.9	88.6	92.0	95.9	90.1	85
Osh region	75.1	83.0	77.3	77.1	82.3	79
Talas region	98.4	99.3	95.9	96.1	96.9	97
Chui region	99.3	99.6	98.6	98.9	99.0	99
Bishkek (city council area- gorkenesh)	100	100	100	100	100	100

Source: NSC

Table 3.17. Provision of rural population with piped water for 2010 (thousands of people)

Name of region	Total (thousands of people	Provided with piped water		Not provided with piped water	
		thousands of people	%	thousands of people	%
Osh city (suburb, 8 settlements)	23	16	70	7	30
Osh region	973	773	79	199	21
Jalal-Abad region	790	633	80	170	20
Talas region	340	132	39	19	61
Chu region	697	700	96	31	4
Issyk-Kul	309	288	93	21	7
Naryn region	222	194	87	28	13
Batken region	361	232	64	129	36
Kyrgyz Republic	3714	2969	84%	604	16%

Source: DSES MoH

Water losses

Water use efficiency plays a key role in providing balancing balance between water supply and water consumption. Partially this objective can be solved by reducing losses through the use of more efficient technologies and the maintenance of water supply systems in a good condition. Water losses during transportation to the sites of use are an indication of inefficient use of limited natural resources and the inefficiency of the water supply system, including technical conditions affecting it, as well as the price of water and public awareness. This allows for determining the effectiveness of measures aimed at improving the water utilization system.

A significant proportion of extracted water is lost during use. The reason for the loss is the poor technical condition of irrigation and water distribution systems, the depreciation of equipment and use of inefficient irrigation methods.

During the period from 2006 to 2010 the average, water loss during transportation amounted to 1,852 million cubic meters per year, or 23% of the volume of extracted water. (Table 3.18). The highest volume of losses was observed in the Jalal-Abad and Naryn regions, reaching in some years 37% and 31.8%, respectively. In other regions of the country the figure varies between 20-30% of the total water extracted. In fact, about one-third of the extracted water resources is lost in transportation due to the high deteriation level of transport systems and extremely low water use efficiency.

Table 3.18. Water losses during transportation by region (million cubic meters)

	2006	2007	2008	2009	2010	Average
Water extraction from natural sources in the Kyrgyz Republic	8007	8530	8470	7600	7562	
Water loss during transportation:						
Kyrgyz Republic	**1830**	**1738**	**2062**	**1862**	**1768**	**1852**
percentage of (total) water extraction	23	20	24	24.5	23.4	23
Batken region	-	90	119.7	119.6	116.2	89
percentage of (total) water extraction	12	15	19	20.0	20.1	17
Jalal-Abad region	216	238	243	203.2	189.8	218
percentage of (total) water extraction	34	18	37	34.7	27.3	30
Issyk-Kul region	121	112	182.8	172.6	164.6	151
percentage of (total) water extraction	19	22	24	29.4	29.7	25
Naryn region	199	205	210.2	214.3	188.7	203
percentage of (total) water extraction	31	31	31	31.1	31.9	31
Osh region	335	302	238.5	239.9	220.8	267
percentage of (total) water extraction	23	23	19	17.1	17.1	20
Talas region	253	225	280	240.0	228.9	245
percentage of (total) water extraction	30	27	25	26.9	27.6	27
Chu region	608	543	776.4	648.7	627.5	641
percentage of (total) water extraction	19	18	23	24.0	22.4	21
Bishkek	25	24	11.8	24.0	24.8	22
percentage of (total) water extraction	22	14	10	17.0	18.2	16

Source: NSC

Returned and circulating freshwater use

This indicator is important for the provision of targeted water efficiency at production facilities and allows for determining the effectiveness of response measures aimed at improving the systems of rational use of water for industrial needs.

The repeat and circulating use of freshwater is demonstrated based on the example of the Bishkek CHP (Table 3.19), which is based on an annual agreement with the Chui Basin Water Management Department, which receives water for technical needs from the Big Western Chui Canal.

The average annual water extraction volume for technical purposes varies between 7.6 to 10.9 million cubic meters per year, of which the irretrievable water is 3.36-5.64 million cubic meters or 5% of the total water extraction. 4%-30% of the water is repeat water use and 10% of the total volume of water is circulating water supply.

The remaining volume of water after use is returned through rapid flow chutes into the Big Western Big Chui Canal.

Table 3.19. Repeat and circulating water supply to the Bishkek CHP (thousand cubic m)

	2006	2007	2008	2009	2010
Volume of water extracted for technical needs	77.406	76.714	109.457	92.313	88.921
Irretrievable consumption	4.538	4.357	5.645	4.806	3.360
%	6	6	5	5	4
Circulating water supply	7.785	10.262	6.827.4	11.641.9	7.998.1
%	10	13.4	6.2	12.6	9.0
Repeat water supply	23.151.2	20.906.0	15.597.3	23.217.6	25.659.8
%	30	27	14	25	29

Source: CHP of Bishkek

Quality of potable water

This indicator allows the evaluation of the level of potable water contamination with chemicals and microbiological organisms. It enables the determination of the risk and effect of poor quality potable water on human health, and shows the extent to which potable water meets sanitary requirements and standards. Access to safe potable water is one of the indicators of the Millennium Development Goals. Limited access to water and its poor quality leads to the increased morbidity of the population, additional health care costs of and a reduction in the overall quality of life.

Contamination of water resources by various chemical and biological agents is the most dangerous factor, leading to the depletion and degradation of water resources, in particular to that of potable water.

In rural areas, the quality of tap water has deteriorated because of the increased use of surface water as potable water. Due to a shortage of investments, the condition of water treatment facilities has deteriorated, and most tap water does not undergo any treatment. Potable water from household wells is usually not disinfected, and its quality, as a whole, is not very satisfactory. In general, the quality of surface water is low. More than 600 thousand people in Kyrgyzstan do not have access to clean potable water, which leads to high level of gastrointestinal diseases.

During the period 2006-2011, 103,025 water samples were taken in the country in order to check the compliance with requirements for microbial indicators, of which 11,187 samples did not meet the required standards, which is 10.9% of the total number of samples taken. In this regard, was adverse situations were observed in the city ofOsh, and the regions of Chui, Jalal-Abad and Issyk-Kul, in which the number of samples that did not meet the requirements, was 20.5%, 18.4%, 17.6% and 16.4% respectively of the total number of samples taken. A more favourable situation was observed in Bishkek (2.6%) (Table 3.20).

Table 3.20. Microbial indicators for the quality of potable water period 2006 to 2011

Name of administrative territory	Number of samples tested for compliance with the requirements for microbial indicators		
	Total	number of samples which did not comply	% of those which did not comply
Bishkek (city)	10.207	263	2.6
Osh (city)	4.977	1.022	20.5
Osh region	22.039	705	3.2
Jalal-Abad region	17.322	3.043	17.6
Issyk-Kul region	12.253	2.006	16.4
Naryn region	5.633	460	8.2
Chu region	15.373	2.831	18.4
Talas region	5.796	430	7.4
Batken region	4.433	427	9.6
Kyrgyz Republic	**103.025**	**11.187**	**10.9**

Source: DSES MoH

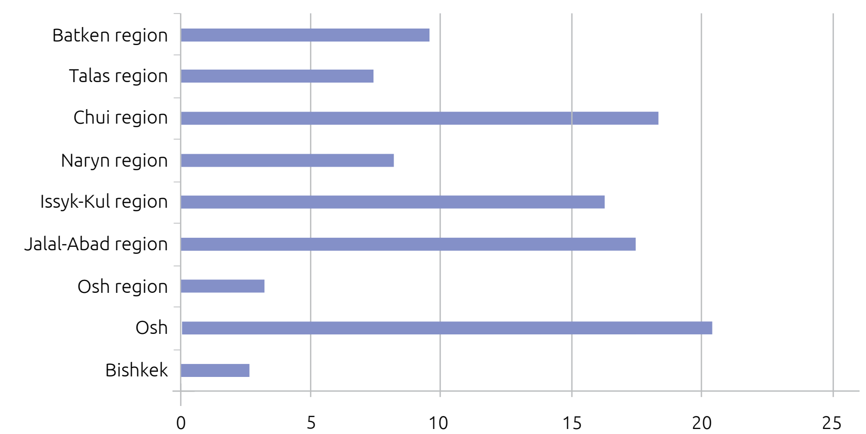


Figure 3.5. The percentage of samples that did not comply with the requirements for microbial indicators in the Kyrgyz Republic for the period 2006-2011

For the period 2006-2011, a total of 91,148 samples were taken across the whole of the Kyrgyz Republic to verify compliance with sanitary-chemical indicators, thereof 2,358 or 2.6% of the total did not meet the requirements (Table 3.21).

Table 3.21. Chemical indicators for the quality of potable water for the period from 2006 to 2011

Name of administrative territory	Number of samples tested for compliance with sanitary-chemical indicators		
	Total	number of samples that did not comply	% of samples the number that did not comply
Bishkek (city)	12.137	8	0.1
Osh (city)	2.953	307	10.4
Osh region	22.863	364	1.6
Jalal-Abad region	11.591	171	1.5
Issyk-Kul region	12.634	609	4.8
Naryn region	5.706	91	1.6
Chu region	12.873	268	2.1
Talas region	4.519	6	0.1
Batken region	5.872	534	9.1
Kyrgyz Republic	**91.148**	**2.358**	**2.6**

Source: DSES MoH

The greatest number of samples that did not meet the chemical indicator requirements was recorded in Osh (10.4%), followed by Batken (9.1%) and Issyk-Kul (4.8%) regions. A safer situation was recorded in the Talas region and Bishkek for the period from 2006 to 2011 (Figure 3.6).

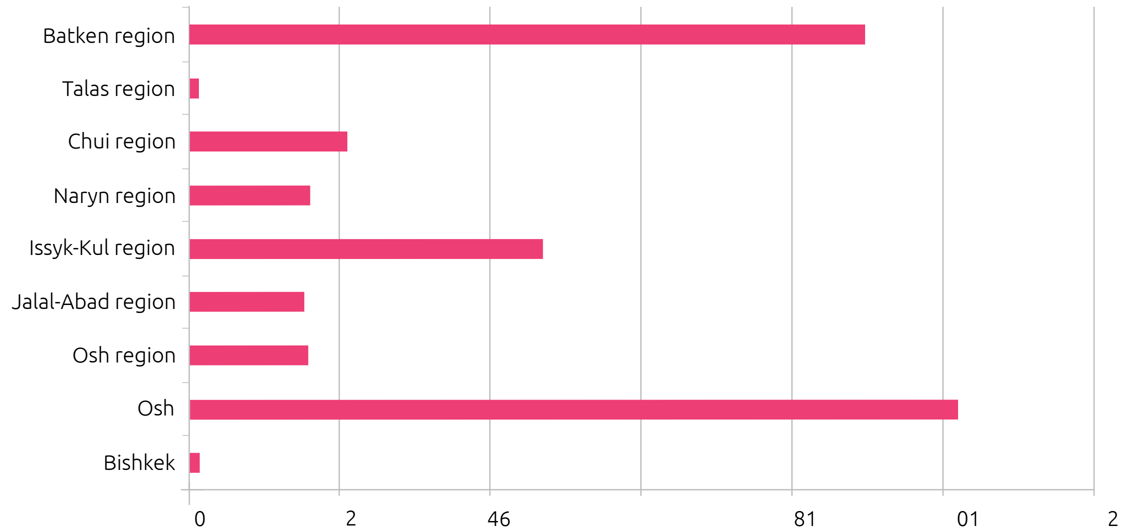


Figure 3.6. The percentage of samples that did not meet sanitary and chemical requirements in the Kyrgyz Republic, 2006-2011.

In 2011, in the Kyrgyz Republic, water from pipes that are fed from surface sources, did not meet the requirements for chemical indicators in 2.7% of tested samples, and for microbiological parameters in 12.6% of samples.

The highest level of bacterial contamination of tap water was observed in the Jalal-Abad (28.3%), Chui (18.4%) and Issyk-Kul (15.2%) regions and in the city of Osh (17.6%). The greatest number of samples that did not meet the health and chemical indicators in 2011 was 34.1% in the city of Osh.

Biochemical absorption of oxygen and ammonia nitrogen concentrations in river water

Large quantities of organic matter (microorganizms and decaying organic waste) can lead to a reduction in the chemical and biological quality of river water. It can also lead to a reduction in the biodiversity of aquatic communities and to microbiological contamination, which may adversely affects water quality. Organic contamination promotes the acceleration of metabolic processes that require oxygen. This can lead to oxygen deficiency (anaerobic conditions). The conversion of nitrogen in reduced forms under anaerobic conditions, in turn, leads to increased concentrations of ammonia, which is toxic to aquatic life in concentrations that exceed a certain level.

The characteristics of mineralization, chemical composition and physical properties of the river water at various sections of the Chui River and its tributaries within the Chu valley, are based on monitoring data for the period 2006-2011. Similar monitoring in other basins has not been carried out. Regular monitoring of thirty-three chemical components is conducted by Kyrgyzhydromet at twenty-three river sections of ten water bodies in the Chui River basin.(Figure 3.7).

The Chui River is the largest water body of the Chui valley. Formation of the chemical composition of Chui River water occurs under the influence of natural factors and human activities. Pollution sources are mainly located in the middle and lower reaches of the river. The natural regime of the river has been distorted by water intakes and is regulated by reservoirs.

The chemical composition of the river water is attributed to the hydrocarbonate class in the calcium group. In the middle and lower reaches an increase in sulfate ions was observed. The water mineralization of the Chui River varies depending on the hydrological regime, and in the period from 2006 to 2011 it was in the range of 169 to 468 mg/l (0.17 - 0.47 MAC). An increase in the amount of ions was observed downstream and reached maximum values near the village of Nizhne-Chuisky at 468 mg/l (May 2008). Water hardness was recorded at 2.31-5.56mmol/l. The oxygen levels can be described as satisfactory, with a dissolved oxygen content seen in the range of 7.08-11.72mg/l (0.85 - 0.51 MAC).

Chui River tributaries are the Chon-Kemin, Kichi-Kemin, Red, Nouruz, Alamedin, Ala-Archa and Ak-Suu rivers and the Western Big Chui Canal. The chemical composition of water in all the rivers, with the exception of the Ak-Suu River, has a pronounced hydrocarbon-character; the cation composition is dominated by calcium ions. In certain months, the sulfate ion content in water of the Ak-Suu River is higher than the content of hydrocarbonate ions.

Tributaries of the Chui River are characterized by varying degrees of mineralization, which in the course of a year is subject to significant changes. The degree of mineralization in the tributaries ranged from 53 mg / l to 729 mg / l. The smallest amount of ions was recorded at 53mg/l in the Ala-Archa River upstream from the city of Bishkek. The highest mineralization, 729 mg/l, was recorded in the Ak-Suu River, at the section downstream from Tyulek village (May 2008.).

Water hardness in the Chui River's tributaries varied from 0.76 to 8.87 mmol/l. The minimum concentration, 0.76 mmol/L was recorded at the section of the Ala-Archa river, upstream from Bishkek and the maximum concentration, 8.87mmol/l, in a section of the Nouruz River, downstream from the village of Novopokrovka.

The dissolved oxygen content in all tributaries was satisfactory at 7.03 - 12.92 mg /l (0.85 - 0.46 MAC).

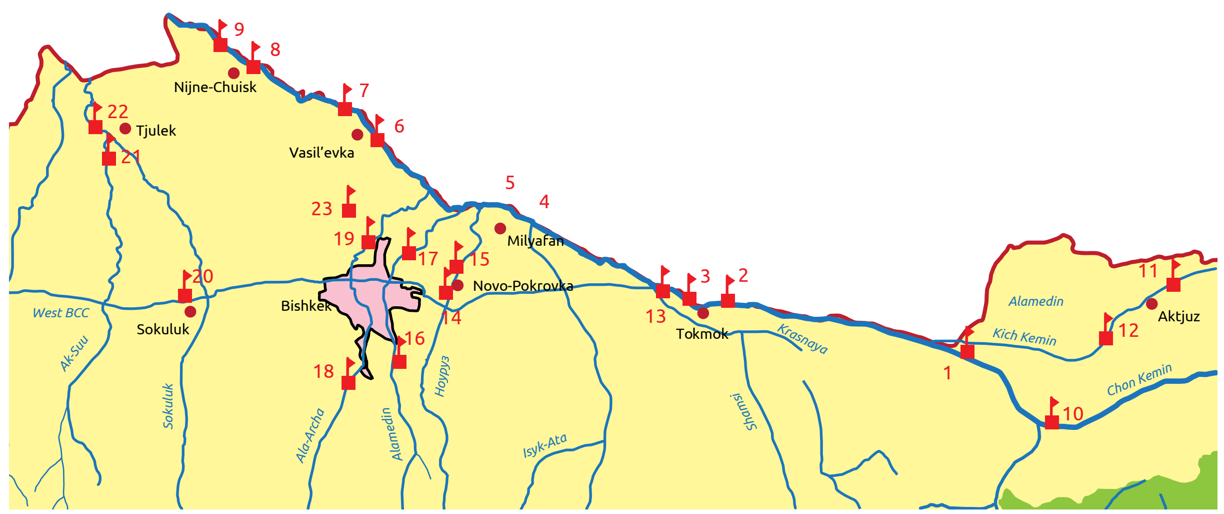


Figure 3.7. Map of Kyrgyzhydromet' monitoring points for the quality of surface water.

The chemical composition of the water in the Nizhne-Alaarchinskoye reservoir is classified as belonging to the hydrocarbonate class of the calacium group. The total ion level was 106 - 401 mg / l, with a hardness of 1.48 - 5.09 mmol / l. The oxygen levels were satisfactory and the dissolved oxygen in the water was between 6.52 - 13.67 mg / l (0.92-0.44 MPC).

Biochemical Oxygen Demand (BOD) - the amount of oxygen used for aerobic biochemical oxidation by bacteria, and the decomposition of decomposable organic compounds contained in the test water. BOD is one of the most important criteria for determining the level of water pollution with organic substances. BOD5 is the Biochemical Oxygen Demand for 5 days required for the oxidation of organic compounds in water, and these BOD5 values are subject to seasonal and diurnal variations. Seasonal fluctuations depend on changes in temperature and the initial concentration of dissolved oxygen. Daily fluctuations are also dependent on the initial concentration of dissolved oxygen. Changes in the values of BOD5 are significant, depending on the degree of contamination of water bodies.

Table 3.22. Reservoir classification dependent on BOD_5

Contamination degree (reservoir classification)	BOD_5 (mg O_2/l)
Very clean	0.5-1.0
Clean	1.1-1.9
Moderately contaminated	2.0-2.9
Contaminated	3.0-3.9
Dirty	4.0-10.0
Very dirty	10.0

During the period from 2006-2011, the organic matter content by BOD5 of water from the Chui River varied between 0.15 - 4.66 mgO2/l (0.05 - 1.55 MAC). The highest value recorded, was 4.66 mg / L (1.55 MAC) at the section downstream from the village of Nizhme-Chuisky in February 2008. A characteristic feature is the increase of BOD5 from the top to the bottom of the upstream section to the downstream section, indicating a deterioration in water quality section from the bridge to step Burulday Bridge to Nizhne-Chui village. In 2011, for example, there was an increase from 0.62 to 1.31 mg O2/l, i.e. it doubled. In addition, an increase in the BOD5 was being recorded downstream from the settlements of Tokmok, Milyanfan, Vasiljevka and Nizhne-Chuisky. In 2011, the BOD5 upstream from Tokmak was 0.51mgO2/l, while downstream from the city Tokmak it was 1.53mgO2/l (three times higher), while an almost double increase in BOD5 was observed downstream from the village of Vasiljevka (Table 3.23).

Table 3.23. Biochemical oxygen demand in 5 days (BOD_5) of the Chui River in mgO2/l (averaged values)

	2006	2007	2008	2009	2010	2011
Burulday Bridge, 0.01km upstream from the bridge			0.89	0.50	0.62	0.62
Tokmok, 1km upstream from the town	0.79	0.56	0.74	0.60	0.71	0.51
Tokmok, 0.5km downstream from the town	1.18	0.88	1.06	0.85	0.49	1.53
Miliafan, 2.5km upstream from the inflow of collection drain No. 17	0.82	1.18	0.90	0.73	0.59	1.49
Miliafan, 1.5km downstream from the inflow of collection drain No 17	1.09	1.35	1.62	0.77	0.84	0.84
Vasiljevka 0.5km upstream from the village	0.87	1.11	0.74	0.92	0.6	0.84
Vasiljevka 0.3km downstream from the village	1.17	1.98	1.48	1.66	1.54	1.6
Nizhne-Chui, 0.5km upstream from the village	0.86	1.26	1.27	1.19	0.87	0.81
Nizhne-Chui, 0.7km downstream from the village	1.05	1.36	1.84	1.30	0.84	1.31

Source: Kyrgyzhydromet

Note: The evaluation criteria of surface water runoff pollution from commercial fisheries (BOD): dissolved oxygen in winter is at least 4mg/l, and in the summer - not less than 6 mg /l, BOD5 - 3 mg/l

As for BOD5 of water from the tributaries of the Chui River, its average value was measured at 0.14 - 6.23 mgO2/l (0.05 - 2.08 MAC). The maximum value of BOD5 was recorded in the section of the Nouruz River, downstream from the village of Novopokrovka at 6.23 mgO2 /l (2.08 MAC) in November 2006.

Table 3.24. Biochemical oxygen demand in 5 days (BOD5) in tributaries of the Chu River in mgO_2 /l (averaged values)

	2006	2007	2008	2009	2010	2011
Chon-Kemin River - , 0.3km upstream from the estuary	0.69	0.55	0.9	0.54	0.35	0.69
Kichi-Kemin River - Aktyuz, 3km upstream from the village	0.49	0.57	0.37	0.34	0.4	0.52
Kichi-Kemin River - Aktyuz, 8km downstream from the village	0.59	0.70	0.71	0.52	0.53	0.70
Red River- Tokmok, 11km downstream of the town	0.67	0.56	0.63	0.49	0.36	0.36
Nouruz River - Novopokrovka, within the village area	1.24	0.95	0.97	0.51	0.65	1.01
Nouruz River - Novopokrovka, 0.5km downstream from the village	2.30	1.84	0.73	0.56	0.54	1.43
Alamedin River - Bishkek, 1km upstream from the city	1.09	1.17	1.33	1.30	0.8	1.18
Alamedin River - Bishkek, 2km downstream from the city	1.15	1.56	1.77	1.03	0.88	1.53
Ala-Archa River- Bishkek, 4km upstream from the city	1.19	1.33	1.09	0.59	0.94	1.06
Ala-Archa River- Bishkek, 2km downstream from the city	2.23	2.02	2.55	1.07	1.2	1.78
Aksu River –Tiulek, 1km upstream from the village	1.89	1.85	1.75	1.31	1.13	1.43
Aksu River –Tiulek, 2.8km downstream from the village	1.87	1.61	1.28	1.53	1.19	1.18
Channel Western Big Chui Canal- Sokuluk, 0.8km downstream from the village	0.71	0.94	0.89	0.77	0.3	0.54
Nizhne-Ala-Archinskoe Reservoir – village of Maevka	2.22	2.25	2.64	1.53	2.02	2.62

Source: Kyrgyzhydromet

Note: MAC BOD5 = 3 mg/l

In the Nizhne-Ala-Archinskiy Reservoir, the content of organic substances on BOD5 ranged from 0.24 - 4.49 mgO2/l (0.08 - 1.50 MAC). The highest value 4.49 mg /l (1.50 MAC) was recorded in August 2007.

Ammonium nitrogen. The main sources of ammonium ions are farm animals, domestic waste water, and waste water from the food and chemical industries. The limiting health hazard indicator of ammonium nitrogen is a toxicological one.

For the Chui River, the characteristic ammonia nitrogen content is 0.00 - 0.94 mg/l (0.0 - 2.41 MAC), the highest value was recorded in the section downstream from Tokmok, in March 2011.

At the same time, in the section of river at the Burulday Bridge, ammonia nitrogen was not found. For the period 2006-2011, an increase in concentration from the upper to lower section was observed (Figure 3.8).

Additionally, in some years there was a significant increase in the concentration of ammonia nitrogen downstream from the following villages and settlements: downstream from Tokmok by 15.5 times (2011), downstream from Milyafan by 5 times (2007, 2009), downstream from Vasilievka by 17 times (in 2007) and by 11.5 times (2009).

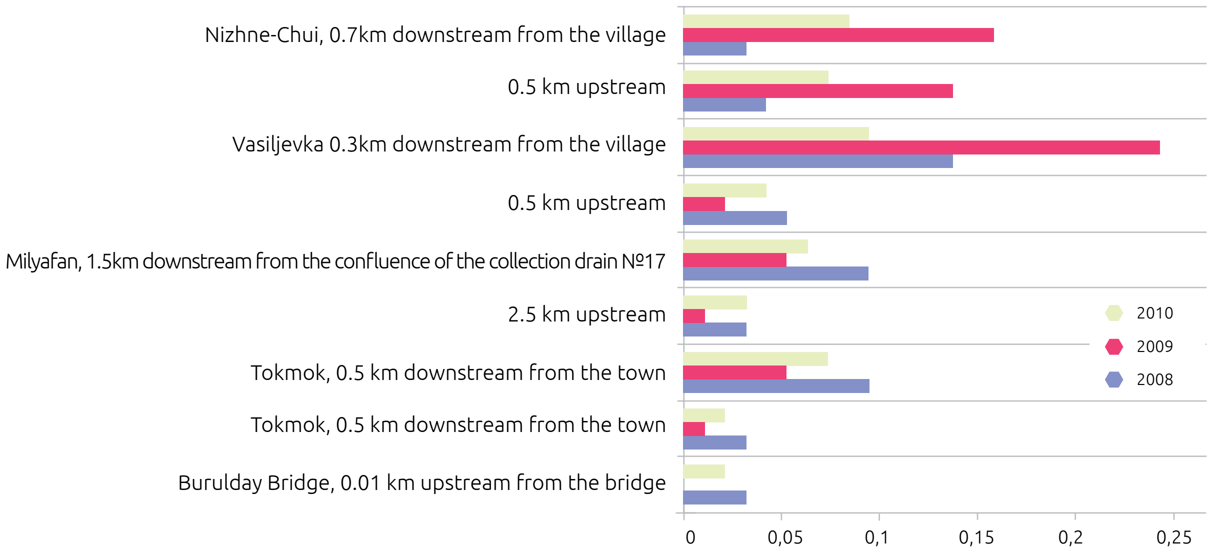


Figure 3.8. Ammonia nitrogen concentrations in the Chui River (mg/l)

Table 3.25. Ammonia nitrogen in the Chui River (mg/l) (averaged values)

	2006	2007	2008	2009	2010	2011
Burulday Bridge, 0.01km upstream from the bridge	-	-	0.03	0	0.02	0.01
Tokmok, 1km upstream from the town	0.03	0.03	0.03	0.01	0.02	0.02
Tokmok, 0.5km downstream from the town	0.05	0.05	0.09	0.05	0.07	0.31
Milyafan, 2.5km upstream of the confluence of the collection drain	0.03	0.01	0.03	0.01	0.03	0.02
Milyafan, 1.5km downstream of the confluence of the collection drain	0.04	0.05	0.09	0.05	0.06	0.06
Vasiljevka, 0.5km upstream from the village	0.02	0.01	0.05	0.02	0.04	0.06
Vasiljevka, 0.3km downstream from the village	0.11	0.17	0.13	0.23	0.09	0.24
Nizhne-Chui, 0.5km upstream from the village	0.05	0.05	0.04	0.13	0.07	0.06
Nizhne-Chui, 0.7km downstream from the village	0.06	0.07	0.03	0.15	0.08	0.05

Source: Kyrgyzhydromet
Note: MAC = 0.39 mg / L

The dynamic of changes in the concentration of ammonia nitrogen in the section of the Chui River, around the village of Vasiljevka, shows that it increased from 0.11 to 0.24 mg / L or a twofold increase, during the period 2005 - 2009 (Figure 3.9).

The ammonia nitrogen content in the waters of the River Chui tributaries is insignificant and was in the range of 0 - 0.18 mg/l (0.00 - 0.46 MAC). The highest level of ammonia nitrogen was noted in the Ala-Archa River, downstream from Bishkek, and in some years, in the Alamedin River, also downstream from Bishkek and in the Nouruz River, downstream from Novopokrovka. Higher concentration of ammonia nitrogen were found in the water of the economic objects of the Chui Valley – in the Western Big Chui Canal and the Nizhny Alaarchinsky reservoir.

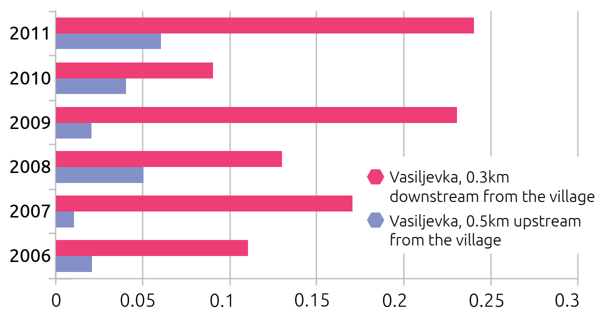


Figure 3.9. The dynamic of changes in the concentration of ammonia nitrogen in the Chui River, around the village of Vasiljevka (mg/l)

For the period 2006-2011, in the Nizhny Ala-Archinsky reservoir, the concentration of ammonia nitrogen was 0.0 - 0.66 mg/l (0.0 - 1.69 MAC), with the highest value of 0.66 mg/l (1.69 MAC) recorded in November 2006.

Biogenic substances in freshwater

This indicator allows the measurement of thecondition of freshwater of rivers, lakes and groundwater in terms of biogenic substances. The intake of large amounts of biogenic substances into freshwater bodies from urban, industrial and agricultural areas can lead to eutrophication of water bodies, which causes ecological changes that may be accompanied by the loss of plant and fish species (environmental degradation), and produce an adverse effect on water use, on its consumption by humans and other purposes.

The content of biogenic components is measured only in the Chui River and its tributaries, and is based on monitoring data for the period 2006-2011. No similar monitoring in other basins has ever been carried out (Figure 3.7). Regular monitoring is conducted by Kyrgyzhydromet at twenty-three sections of ten water bodies of the Chu River basin.

The Chui River. The nitrogen nitrate content in the Chui River is within 0.000 - 0.173 mg/l (0.00 - 8.65 MAC). The highest concentration was observed in March 2010 in the section of the river in the village of Vasiljevka, downstream from the Bishkek waste water (sewer) discharge. Every year in this section of the river, an excess in the maximum allowable concentration, by 2-5 times, was being recorded (Table 3.26).

An increase in the concentration of nitrogen nitrite usually indicates recent contamination. Nitrite is an intermediate step in the chain of the bacterial oxidation of ammonium to nitrate – nitrification under aerobic conditions, while there is a reduction of nitrates to nitrogen and ammonia during nitrification under anaerobic conditions. Seasonal fluctuations of nitrite are characterized by its absence in winter and reoccurrence in spring. The highest concentration was observed at the end of summer, while in autumn, nitrite concentrations reduced.

Over the last years there has been an increase in the concentration of nitrites downstream from villages and settlements in the following section: below village Vasilievka – by 5-9 times; downstream from town Tokmak – by 2-10 times (2011), downstream from the village Milyafan - by 1-2 times.

Table 3.26. Nitrogen nitrite in the Chui River (mg/l) (average values)

	2006	2007	2008	2009	2010	2011
Buruldaysky Bridge, 0.01km upstream from the bridge	-	-	0.005	0.003	0.004	0.006
Tokmok, 1km upstream from the town	0.004	0.003	0.006	0.003	0.006	0.003
Tokmok, 0.5km downstream from the town	0.01	0.02	0.016	0.029	0.014	0.02
Milyafan, 2.5km upstream of the confluence withthe collection drain	0.01	0.01	0.01	0.009	0.013	0.012
Milyafan, 1.5km downstream from the confluence with the collection drain	0.01	0.01	0.02	0.015	0.018	0.015
Vasiljevka, 0.5km upstream from the village	0.01	0.01	0.014	0.014	0.014	0.01
Vasiljevka, 0.3km downstream from the village	0.05	0.09	0.07	0.098	0.09	0.08
Nizhne- Chui, 0.5km upstream from the village	0.02	0.03	0.05	0.05	0.03	0.04
Nizhne- Chui, 0.7km downstream from the village	0.024	0.026	0.04	0.039	0.045	0.048

Source: Kyrgyzhydromet
Note: MAC = 0.02 mg/l

During the period from 2006 to 201,1 the nitrogen nitrate content was in the range 0.51 - 3.16 mg/l (0.06 - 0.35 MAC) and did not exceed the maximum permissible concentration (MAC = 9.0 mg/l).

An increase in the concentration of nitrogen nitrate usually indicates contamination at a previous time. The presenceof nitrate ions in natural waters occursbecause of intra-reservoir processes under the influence of nitrifying bacteria and precipitation, which absorbs nitrogen oxides formed by atmospheric electrical discharges, industrial and domestic waste water, especially after biological treatment. Its concentration in surface waters is subject to noticeable seasonal fluctuations, the lowest levels seen in the growing season, while in the autumn it increases and it reaches its maximum levels in winter.

The content of inorganic phosphorus ranged from 0.000 mg/l to 0.243 mg/l. The highest concentration of 0.243 mg/l was found at the section of the river in Vasiljevka, downstream from the Bishkek sewage/waste water discharge in November 2007. At the same time, no maximum allowable concentration for mineral phosphorus for fisheries was established.

The excessive content of phosphates in water may be an indicator of the presence of fertilizer impurities, components of domestic waste water and decomposing biomass.

The Chui River tributaries: the Chon-Kemin River, the Kichi-Kemin River, the Red River, the Nouruz River, the Alamedin River, the Ala-Archa River, the Ak-Suu River and the Western Big Chui Canal. During all the years in question an increase in the concentration of nitrogen nitrite was observed in the Ala-Archa and Alamedin rivers downstream from Bishkek by 2-15 times and by 5.2 times, respectively. Every year, in the Ala-Archa River downstream from Bishkek, an excess in the maximum allowable concentration was being observed. Excessive levels of nitrogen nitrite was observed in the Ala-Archa River –with levels of 0.173 mg / l (8.65 MAC) in May 2008, and 0.089 mg / l (4.45 MAC) in June 2011 (Table 3.27).

Table 3.27. Ntirogen nitrite in the tributaries of the Chui River (mg/l) (averaged values)

	2006	2007	2008	2009	2010	2011
Chon-Kemin River - , 0.3km upstream from the estuary	0.004	0.001	0.012	0.005	0.005	0.004
Kichi-Kemin River - Aktyuz, 3km upstream from the village	0	0.001	0.002	0.005	0.001	0.001
Kichi-Kemin River - Aktyuz, 8km downstream from the village	0	0.002	0.002	0.005	0.001	0.002
Red River –Tokmok, 11km downstream from the town	0	0.006	0.009	0.006	0.003	0.003
Nouruz River - Novopokrovka, within the village	0.01	0.01	0.01	0.01	0.01	0.013
Nouruz River - Novopokrovka, 0.5km downstream from the village	0.01	0.013	0.012	0.013	0.013	0.018
Alamedin River –Bishkek, 1km upstream from the city	0.02	0.006	0.005	0.008	0.005	0.004
Alamedin River –Bishkek, 2km downstream from the city	0.01	0.019	0.017	0.018	0.008	0.02
Ala-Archa River –Bishkek, 4km upstream from the city	0.003	0.005	0.004	0.005	0.006	0.008
Ala-Archa River –Bishkek, 2km downstream from the city	0.02	0.02	0.06	0.041	0.013	0.04
Ak-Suu River - Tyulek, 1km upstream from the village	0.01	0.02	0.013	0.013	0.013	0.015
Ak-Suu River - Tyulek, 2.8km downstream from the village	0.01	0.01	0.017	0.015	0.015	0.016
Western Big Chui Canal - Sokuluk, 0.8km downstream from the village	0.01	0.007	0.01	0.02	0.018	0.009
Nizhne-Ala-Archinsky Reservoir - Maevka	0.01	0.015	0.016	0.014	0.013	0.017

Source: Kyrgyzhydromet
Note: MAC = 0.02 mg / l

Nitrogen nitrate concentrations did not exceed the maximum allowable concentrations and were within 0.43 - 3.87 mg/l (0.05-0.43 MAC).

Over the entire monitoring period in the sections of the Ak-Suu River, increased levels of sulfate ions were being recorded. In August 2010, at the section of the river downstream from Tyulek village, the greatest value of 356.6 mg/l (3.57 MAC) was recorded. in In the Nizhne-Ala-Archinsky Reservoir, the nitrogen nitrite concentration was 0.05 - 0.043 mg/l (0.25 - 2.15 MAC). The highest concentration of 0.043 mg/l (2.15 MAC) was recorded in December 2011.

The nitrogen nitrate nitrogen concentration was 0.28 - 2.05 mg/l (0.03 - 0.23 MAC) and did not exceed permitted levels.

The content of inorganic phosphorus in the Nizhne-Alaarchinsky Reservoir varied from 0.002 mg /l to 0.092 mg /l.

Polluted waste water

Wastewater, polluted with organic, biogenic substances and hazardous compounds, has a significant negative impact on water resources. One of the essential factors of the anthropogenic load on water bodies is the inability to provide a sufficient treatment level of the total amount of wastewater flowing into the treatment plant, due to poor capacity or the inefficient use of the treatment facilities. This indicator measures the level and nature of the pressure on the natural water bodies, and obtains the information necessary for the development of environmental protection measures, especially as a priority for the improvement of treatment facilities and increasing environmental monitoring of their operations.

The country's worsening economic situation has created serious problems in operations of waste water treatment, sewage and sanitation facilities, leading to decline in quality of wastewater treatment and a worsening of the indicators of water for open water bodies.

The discharge of wastewater into surface water bodies has decreased in the last 5 years from 12.6 to 6.7 million cubic meters (with the exception of 2007 and 2008, when it was 20.0 and 18.5 million cubic meters of water, respectively).The untreated wastewater discharged into surface water bodies and streams may contain nitrates, chlorides, chromium, sulphates, petroleum and petroleum products, heavy metals and other substances that have a negative impact not only on the general state of water resources, but also, ultimately, on the population's health.

The main sources of water pollution are agricultural and industrial plants, municipal sewage systems, animal farms and household/ municipal waste. The reasons for the discharge of inadequately treated wastewater is the unsatisfactory operation of obsolete and outdated sewage treatment plants, the capacity of which does not match the volume of inadequately treated discharged wastewater. Of the existing 350 waste water treatment plants, 40% do not meet the established wastewater treatment standards. Household waste water from cities/towns and district centres is treated at twenty municipal sewage treatment facilities with an operational capacity of 719,800 cubic meters / day.

The recording and control of wastewater discharges in storage facilities outside the major cities is a complicated problem. No records are maintained of the volume of water used and disposed of by mining operations. There is no reliable information on the number of discharged pollutants from agricultural activities, be it local pollution (livestock manure) or dispersion (fertilizer and pesticides that affect quality of surface water). Unauthorized discharges of waste water from agricultural facilities and water run-off from agricultural fields are a major source of water pollution.

The waste water volume during the years in question varied over a wide range from 153.9-1,036.5 million cubic meters, of which the volume of those treated according to regulations was 138.3-354.3 million cubic meters, which is 18 to 93% of the total waste water volume.. The volume of inadequately treated water varied between 2-4% of the total volume of waste water (Table 3.28).

Table 3.28. Volume of polluted waste water discharged into surface waters (million cubic meters)

	2006	2007	2008	2009	2010
Total volume of waste water discharged:	700.8	1036.5	1016.6	174.5	153.9
Volume of discharged waste water treated according to regulations	148.3	354.3	345.2	162.1	138.3
Volume of discharged waste water (without treatment or insufficiently treated)	12.6	20.0	18.5	6.4	6.7
Including waste water discharged without treatment	9.7	14.5	13.0	5.3	5.6
Per person (cubic meters)	2.4	3.8	3.5	1.3	1.3

Source: NSC

In 2010, of the 123 sewage systems available in the republic, only 101 systems were functioning; out of individual sewage systems only 91 were operational. The total length of the street sewer system was 988.6 km, and the length of the main collectors was 821.8 km. Of the 132.8 million cubic meters that went through the sewerage systems each year, only 124.1 million cubic meters or 93.4% had been treated by or at treatment facilities. Of the total treated waste water volume that had passed through treatment facilities, 95% or 118 million cubic meters of the treated water underwent complete biological (physical and mechanical) treatment, which is 14.2% lower than the level of 2006.

In recent years, in the outskirts and adjacent areas of the capital city Bishkek, there has been an on-going process of illegitimate land plot seizure and a massive allocation of land plots for the construction of individual houses. In the new settlements there is no centralized sewage system, detrius tanks or septic tanks. Household waste water from these new areas is discharged into drains, into the ground and into water bodies, which leads to the pollution of both underground and surface water.

PART 4
Biodiversity

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The Kyrgyz Republic is surrounded by the arid plains of Central Asia and the effect of this harsh desert zone determines the general aridity and continentality of the climate. 90% of the country is at an altitude of 1,000m above sea level. Its dissected relief defines the mosaic structure and other features of biodiversity formation. Despite the fact that the Kyrgyz Republic is a small country in terms its total area (0.13% of the world's land), it is one of two hundred priority eco-regions on the planet. This is due to a high concentration of species diversity, about 2% of the world's flora and 3% of the world's fauna can be found in the country.

The relative richness of life in the Kyrgyz Republic is possible thanks to the high mountain ranges of the Tien Shan and Pamir-Alai, rising to a height of over 7,450m above sea level and the accumulation of water from the upper strata of atmosphere. High mountains look like islands of biological diversity among monotonous plains. The nature of biodiversity, which is dominated by mountains and alpine species, reflects the altitude climatic zonality of the greater part of the territory.

About 26,500 types of viruses, bacteria, fungi, plants and animals have been recorded in the diverse ecosystems in the Kyrgyz Republic. More than two-thirds of those are species of organisms. The most extensive group in the fauna of the Kyrgyz Republic are insects, represented by approximately 14,600 species. The list of vertebrate animals now includes 587 species: 70 species of fish, 4 amphibians, 39 types of reptile, 390 different birds and 84 species of mammal.

The plant world (Plantae, Mycota) of the Kyrgyz Republic is represented by 8,153 species. Of it's wild flora, there are 2,179 species of funghi, 1,119 different types of algae, 495 lichens, 183 bryophytes and 4,100 species of flowering plants. Ninety-eight species of fungi are edible, but people usually only use about ten of these. Of the total vascular wild plants, more than 200 are used for technical needs, 400 species of wild plant are commonly used for medicinal purposes; however, in officially recognised pharmacopeic use, only 200 species of wild plants are used.

Invertebrates constitute the largest group of organisms, exceeding by many times the group of vertebrates in its richness of species: about 17,500 species in the fauna of a Kyrgyz Republic are attributed to the 31 class of eleven types, including more than 14,600 species of insects, which are representatives of 28 units of class Insecta (from 34 recent ones known in the world fauna). Invertebrates inhabit all the country's ecosystems, from the driest desert areas and deepest water bodies to permanent snow fields and rocks, including rocks of nival zones, however, the greatest species diversity and group size is achieved in the lower zonal belts of high-altitude zones, because most of them are temperature-dependent organisms.

Fish (Pisces) – the water bodies of the Kyrgyz Republic are a habitat for 70 species and 19 subspecies of fish, all of which belong to the class of ray-finned fishes (Actinopterygii). The greatest number of fish species, twenty-six, inhabit Lake Issyk-Kul, these are attributed to the families of Salmonidae, Cyprinidae, Balitoridae and Percidae. Statistical data on the numbers of many species of fish is not available, such data is only available for the catch (in tonnes) of certain types of fish, mainly from the cyprinid group. The following fish can be caught in the Toktogul reservoir: Gegharkuni trout, Amudarya trout, rainbow trout, herbivorous fish, crucian carp and Marinka ordinary. Eighteen species of fish are commercially fished.

There are four species of amphibian (Amphibia), one of which is invasive, and thirty-nine species of reptile (Reptilia) found in the Kyrgyz Republic. Most reptiles live in the low-mountainous zone of the south of the country (Batken, Osh and Jalal-Abad regions). In this region, these animals are of insignificant economic importance, however, almost all of them perform regulating and stabilizing functions in the ecosystems and therefore, the state of their populations can be informative in assessing some of the indicators of environmental change.

The greatest diversity of vertebrates is found among the birds (Aves). Currently, there are 390 bird species, 233 of which nest in the country, 114 are non-migratory and 119 migratory, 109 are passing, 20 visiting and 28 are winter visitors. The list of game birds include 34 species, however only nineteen of these are preferred by hunters. Massive hunting is for species such as the snow partridge, partridge, bearded partridge, quail, pheasant and others. Six species of bird are used as hunting birds: the Golden Eagle, Saker falcon, Shaheen falcon, goshawk and sparrow hawk.

The mammalian fauna (Mammalia) of the Kyrgyz Republic has 6 orders and 84 species:

- There are total of five species of insect-eating animals (insectivore). All of them are common, except for the Eurasian water shrew (Neomys), which in small numbers finds a habitat in the north-eastern parts of the country;
- chiropterous animals (Chiroptera) or (Bats) are the least studied order in Teriofauna of the the Kyrgyz Republic;
- Lagomorphs (3 species). Of these the Tolai hare is of commercial value for hunting;
- Rodents (32 species) is the most numerous group. Successfully introduced species include the squirrel and muskrat;
- Predatory–(22 species). These are second only to rodents in their abundance.

Artiodactyls (6 species - wild boar, roe deer, red deer, gazelle, ibex and argali). With the exception of the gazelle, which population in the Kyrgyz Republic does not exceed fifteen Siberian stag (red deer - Cervus elaphus) animals, what is still critically low, and Pamir argali subspecies that is the subject of hunting by foreigners, other native species of ungulates are the basis of hunting products in the Kyrgyz Republic.

The following mammals were introduced: hare, squirrel, muskrat, mink, raccoon dog, North American racoon (Procyon lotor), Siberian striped weasel (Mustela sibirica), fallow deer (Cervus dama) and bison.

Animals, plants and fungi are integral elements of the natural environment and biodiversity of the republic and perform important environmental, regulatory and stabilizing functions.

Specially protected natural areas

The sustainable development of the country depends on a healthy environment, which, in turn, depends on the state of ecosystems. Specially protected natural areas are essential for the conservation of biodiversity, which is a major component of the ecosystem. This indicator shows the degree of protection against the misuse of areas valuable for the conservation of biodiversity, cultural heritage, scientific research, recreation, natural resources and other valuable environmental components.

They are areas of the republic (both on-land and in water bodies) with a unique reference or other valuable natural complexes and objects that are of special ecological, scientific and aesthetic value. A special regime for their protection and use has been established. Depending on their targeted purpose and the mode of protection of natural resources and objects, the SPNAs are divided into the following categories[12]:

- State nature reserves;
- State nature parks;
- State closed wood and game parks;
- Natural monuments;

[12] Law of the Kyrgyz Republic " On specially protected areas and natural area" (of 3 May 2011, No 18).

In 1931, the first SPNA in the Kyrgyz Republic were established; these were temporary closed wood and game parks in the mountain gorges of Kyzyl-Belek, Orobashi and Belek-Kulak in the Kyrgyz range.

In 1945, the first SPNA in the area of wild-growing fruit tree forests were established in the south of the country.

In 1948, the first national park, Issyk-Kul, was established.

During the years of following independence, the SPNA of the Kyrgyz Republic increased by 2.5 times.

Currently, the largest state closed wood and game park is Sarychat-Ertash with a total area of 129,760 hectares.

- State botanical gardens, dendrological and zoological parks;

- Biosphere reserves and /or reservations;

- Transboundary specially protected areas.

Currently, in the Kyrgyz Republic, there is a functioning network of protected areas totaling 1,200,872.0 hectares (6.006% of the total area of the country).

In October 1998, the biosphere territory, Issyk-Kul, was established with an area of 4,314.4 square km, which under current law, is equivalent to the status of protected natural areas at a national level, with a special protection regime. In September 2001, the Issyk-Kul biosphere reserve was included in the World Network of Biosphere Reserves by UNESCO. The most important part of the Issyk-Kul biosphere reserve is the core area with reserve status, this consists of Issyk-Kul and the Sarychat-Ertash state closed wood and game park and other specially protected natural areas. However, the mode of economic activity in the Issyk-Kul biosphere does not fully meet the requirements for protected areas.

The network of specially protected natural areas of the Kyrgyz Republic includes:

10 State Nature Reserves	596345.4 ha;
9 natural national parks	302949.2 ha;
68 closed wood and game parks	301426.7 ha;
2 comprehensive SPNAS	10142 ha
23 botanical SPNAS	6115.4 ha
14 zoological (hunting) SPNAS	262482 ha
10 forest	22587.3 ha;
19 geological SPNAs	100 ha
1 botanical garden, the E. Gareev Botanical Garden, Bishkek	142 ha
1 Zoological Park, Karakol	8.7 ha.

In 2002, the Kyrgyz Republic acceded to the Ramsar Convention on the protection of wetlands and the lakes Issyk-Kul (since 1976), Chatyr-Kul (since 2005) and Son-Kul (from 2011) are included in the list of wetlands of international importance.

Table 4.1. Data on closed wood and game parks in the Kyrgyz Republic

Name of closed wood and game park	Act and date of establishment	Location	Purpose of establishment and area of main activity
Issyk-Kul	Resolution of the Council of People's Commissars of the Kirghiz SSR No. 1205, 10.12.1948	Issyk-Kul region (4 district)	Conservation of wetland ecosystems included in the Ramsar Convention network
Sary Chelek Biosphere	Resolution of the Council of Ministers of the Kyrgyz SSR No. 118, 05.03.1959	Jalal-Abad region, Aksy district	Conservation of biodiversity and typical landscapes of the Western Tien Shan and the unique Sary Chelek Lake
Besh-Aral	Resolution of the Council of Ministers of the Kyrgyz SSR No. 140, 21.03.1979.	Jalal-Abad region, Chatkal district	Conservation of Menzibir marmot and medium-altitude mountains plant communities of the Western Tien-Shan
Naryn	Resolution of the Council of Ministers of the Kyrgyz SSR No. 671, 29.12.1983	Naryn region, Naryn and At-Bashy districts	Conservation of the deer population and spruce ecosystems of the Inner Tien-Shan
Karatal-Zhapyryk	Resolution of the Government of the Kyrgyz Republic No. 91, 01.03.1994.	Naryn region, Naryn and At-Bashy districts	Conservation of mountain goose populations, biodiversity ecosystems, and wetlands of Inner Tien Shan
Sarychat-Ertash	Kyrgyz Republic Government Resolution No.76, 10.03.1995	Issyk-Kul region, Jety-Oguz district	Conservation of the snow leopard , mountain sheep and Pallas populations and alpine rangeland ecosystems
Padysh-Ata	Kyrgyz Republic Government Resolution No. 405, 03.07.2003.	Jalal-Abad region, Aksy district	Conservation of the Semenov fir tree and juniper forests of the Western Tien-Shan
Kulun-Ata	Kyrgyz Republic Government Resolution No. 598, 11.08.2004	Osh region, Kara-Kuldzha district	Conservation of biodiversity, rare and endangered species of flora and fauna, andLake Kulun
Kara Buura	Kyrgyz Republic Government Resolution No. 233, 17.06.2005	Talas region, Kara Buura district	Conservation of biodiversity and typical landscapes of the northern part of the Western Tien-Shan
Surmatash	Kyrgyz Republic Government Resolution No. 414, 27.06.2009	Batken region, Kadamjay district	Conservation of biodiversity, and rare and endangered species of flora and fauna

Source: SAEPF

The distribution of SPNA by region of the Kyrgyz Republic is as follows:

Batken: 1 Reserve (Surmatash - 66,194 ha), 1 SNNP (Sarkent - 40,000 ha), 7 reserves, of which 5 are botanical (863.9 hectares) and 2 are geological reserves;

Osh: 1 Reserve (Kulunatinsky - 27,780 ha), 2 GPNP (Kyrgyz-Ata – 11,172 hectares and Kara-Shoro – 14,340 ha), 15 nature reserves: 3 zoological (20,273 ha), 2 forests (684 ha), 3 botanical (160 ha) and 7 geological reserves (100 ha);

Jalal Abad region: 3 Reserve (Sary Chelek - 23,836 hectares, Besh-Aral - 112,018 ha and Padysh-Ata - 30,556.4 ha) 1 SNNP (Saimaluu Tash - 32,007.2 ha), 16 are reserves, of which 3 are zoological (108,981 ha), 5 are forests (21,008.3 ha), 5 are botanical reserves (1,590 hectares) and 3 are geological reserves;

Talas region: 1 nature reserve (Karabuura - 59,067 ha), 1 SNNP (Besh-Tash – 13,650 ha), 5 game reserves, including: 1 zoological (13,557 ha), 1 comprehensive (2,511 ha) and 3 botanical reserve (310 ha);

Chui region: 2 SNNP (Chon-Kemin – 123,654 ha and Ala-Archa – 19,400 ha), 8 reserves, including: 1 complex (7,631 ha), 4 botanical (2,378.5 m), 2 geological and 1 zoological reserve (3,000 ha);

Naryn region: 2 nature reserves (Naryn - 91,023.5 ha and Karatal-Zhapyryk - 36,449 ha), 1 SNNP (Salkyn Tor – 10,470 ha), 7 reserves, including: 1 zoological (2,335 ha), 2 forests (800 ha), 1 botanical (693 ha) and 3 geological reserves;

Issyk-Kul region: 2 nature reserves (Issyk-Kul - 19,661.5 ha and Sarychat-Ertash - 129,760 ha), 1 SNNP (Karakol - 38,256 hectares), 10 nature reserves, of which 5 are zoological (114,336 ha) 2 are botanical (120 ha), 1 forest (95 ha) and 2 geological reserves.

Currently, there is an on-going effort to organize the Natural parks: Alay in Osh (43.2 ha), Sary-Jaz in the Issyk-Kul region (187.5 hectares), the Dashmansky state nature reserve (8.2 thousand hectares) and the SNP "Avletim-Ata" (more than 45.0 hectares) and to expand the territory of the Padysh-Ata State nature reserve (15.8 hectares).

Economic development, particularly mining, which in some cases leads to a decrease in the size of protected areas, significantly affects special natural protected areas. Thus, the Resolution by the Government of the Kyrgyz Republic (No. 93 dated 15th February 2012) On the Annulment of the Resolution of the Government of the Kyrgyz Republic (,No. 374 dated 13th June 2009) On changing the boundaries of Chon-Kemin State Natural Park, , in order to preserve the unique natural, biological and landscape diversity, as well as for the conservation of flora and fauna listed in the Red Book of the Kyrgyz Republic, annulled the Kyrgyz government's Resolution of 13 June 2009 No. 374, according to which the following land areas were withdrawn from the List of SNNPs in the Chui region- Chon-Kemin SNNP for the development of exploration and mining:

- land area "Ak-Tuz";
- land area "Oktorkoy";
- land areas located east of the following boundaries:

The eastern section of the border beginning at a height of 4,029m placed on the crest of the Trans-Ili Alatau Ridge, and running along the ridge westwards to the source of the Basydzhay River, and then along the river to the confluence with the Chon-Kemin River. It then continues upstream along the course of the Chon-Kemin River, to its confluence with its left tributary, the Koysuu River. From there it continues along the bed of the Koysuu River, upstream and along the course of its left tributary, to a height of 4,337m placed on the crest of the Kungei Ala-Too.

However, the mining company concerned, appealed to the Inter-District Court of Bishkek with a claim to the Government of the Kyrgyz Republic to invalidate the government's Resolution No.93, dated 15th February 2012. The Inter-District Cour'st decision dated 4th April 2012, met the petition of the mining company and the Kyrgyz government's Resolution No.93 dated 15th February 2012, was annulled.

SAEPF filed a petition to the Bishkek City Court, trying to appeal against the Inter-District Court's decision, but the writ of the Bishkek City Court dated 12th June 2012, left the decision of the Inter-District Court 4th April 2012, in force.

Forests and other wooded land areas

Forests are among the most diverse and widespread ecosystems on the Earth and perform a variety of functions, and as a living part of the Earth's surface, they are involved in the global cycles of water, oxygen, carbon, etc. They are the only natural absorber of atmospheric carbon dioxide, the excess of which leads to global warming. In the Kyrgyz Republic, forests are unique and of great ecological value due to their function of moisture accumulation. Forests growing on the mountain slopes help to prevent mudslides, prevent the formation of landslides and avalanches in the mountains and regulate water flow in rivers by making them more even throughout the year. Therefore, it is hardly possible to overestimate the importance of forests for water regulation for both Kyrgyzstan and other Central Asian countries, where agriculture is based on irrigation.

The Kyrgyz Republic has sparsely wooded territories, but at the same time about 2 million people live in the area of the Forest Fund (or close to it), and their well-being is directly dependent on forest resources. The effectiveness of forest management, restoration and conservation makes a significant impact on the poverty level, especially in rural areas.

In the Kyrgyz Republic, approximately 90% of forested areas are located at an altitude of 700 to 2,500m above sea level. As of 1st January 2011, the forest area of Kyrgyzstan is 1,116.56 hectares or 5.61% of the total area of the country[13]. Of these, 846.5 thousand hectares were studied in the course of forest management activities; 85.6 hectares in the course of land management activities, while 184.5 thousand hectares have not been studied.

The forests are mainly populated by four species: walnut, pine-fir, juniper and floodplain species. Softwood forests, walnut and fruit tree forests, pistachio and almond forests, all of which are mostly grown in areas with a high population density, are under the greatest human pressure.

All land areas which are state, municipal or private property and are designed for the needs of forestry use, form a single Forest Fund (forest reserve). They include:

1. Woodland and non-wooded land (sparse forest species, plantations, nurseries, logging areas, light forest, openings, barren land).
2. Non-forest land, which together with forests form a single natural complex: agricultural and other land area, the land on which forest was logged during construction-related business activities (roads, fire breaks, electricity transmission lines, pipelines).
3. The Forest Fund of the Kyrgyz Republic is the responsibility of several government agencies: the State Agency for the Environment and Forestry, Office of the President of the Kyrgyz Republic, local state administrations and local self-government bodies.

Forest inventory by species, age and other characteristics by local governments is not conducted; therefore the data on forest resources for the country is not quite accurate.

Among the administrative regions, the Jalal-Abad region has the largest forest area, and Chui region has the smallest areas. (Table 4.2).

Table 4.2. Forest areas of the Kyrgyz Republic by region

Name of the region	Total forest area		Including:			
			The forested area of the State Forest Fund and special protected areas		The forested area of the State Forest Fund and special protected areas	
	% of the area	Thousand hectares	% of the area	Thousand hectares	% of the area	Thousand hectares
Batken	0.83	166.50	0.69	138.77	0.14	27.73
Jalal-Abad	1.90	380.25	1.62	324.80	0.28	55.45
Issyk-Kul	0.71	142.36	0.51	102.80	0.20	39.56
Naryn	0.68	135.60	0.52	103.62	0.16	32.98
Osh	0.93	186.31	0.55	110.55	0.38	75.76
Talas	0.33	61.01	0.16	28.06	0.16	32.94
Chui	0.22	44.53	0.15	30.96	0.07	13.57
Total:	5.61	1116.56	4.22	839.56	1.39	277.00

Source: "The national forest inventory of the Kyrgyz Republic" (Government of the Kyrgyz Republic of July 26, 2011 No. 407)

[13] "National forest inventory of the Kyrgyz Republic" (Government of the Kyrgyz Republic,26th July 2011, No. 407).

The dynamics of areas in which forest species were planted (Table 4.3) or cut down (Table 4.4), can be a highly informative indicator of the long-term success of the long-term environmental policy implemented by the state.

Table 4.3.Activities to increase the forest area in the Kyrgyz Republic

Type of reforestation work	Measurement units	2006	2007	2008	2009	2010	2011
Reforestation in forests of national importance, including:	Thousand hectares	11.5416	9.4934	10.0572	9.4296	9.0349	7.5995
planting and sowing;	Thousand hectares	2.9416	2.1934	2.0572	2.0512	2.0249	1.3895
promote natural regeneration of forests	Thousand hectares	8.6000	7.3000	8.0000	7.3784	7.0100	6.2100
Establishing plantations in ravines, gullies, sand and other unsuitable land, including:	Thousand hectares	0.0860	0.5864	0.9640	0.7628	0.5878	0.2267
planting protective forest plantations on grazing lands;	Thousand hectares	-	0.0260	0.0623	0.0735	0.0125	0.0470
Planting windbreaks to protect fields	Thousand hectares	-	0.0022	0.0100	0.0035	0.0700	0.0221
planting and seeding forests on re-cultivated lands	Thousand hectares	0.0241	0.3300	0.0815	0.0501	0.2170	0.1427
Growing seedlings and introducing them into the category of valuable timber trees in state forests	Thousand hectares	1.0760	1.1580	0.8250	1.0360	1.4180	1.0380
Protective forest plantations in ravines, gullies, sand and other unsuitable land of the State Forest Fund transferred into the operation	Thousand hectares	0.0590	0.6050	0.5890	0.0555	0.1000	
Trees and shrubs planted/ sewn in nurseries	Thousand hectares	0.0251	0.0293	0.0283	0.0256	0.0228	0.0215
Seedlings and cuttings of trees, shrubs, fruits and technical cultures planted at schools	Thousand pieces	6337.5	5815.4	6640.5	7472.0	6365.8	5242.0

Source: SAEPF

Table 4.4. Thinning and selective-sanitary logging in the forests of the Kyrgyz Republic, Thousand hectares

Types of logging	2006	2007	2008	2009	2010	2011
Total thinning, selective-sanitary logging and forest restoration logging, including:	2.3912	1.6300	3.0072	7.6956	10.515	34.055
Logging for improvement	0.1407	0.9428	0.0557	0.0413	0.0364	25.244
Thinning	0.1554	0.1125	0.1307	0.2224	0.1606	0.3206
Regeneration logging	0.0085	0.0238	0.1207	2.8459	0.0011	0.0328
Selective sanitary logging	0.5456	0.4411	0.7012	1.6656	0.8993	0.9996
Reshaping logging	0.0368	0.074	0.066	0.0725	0.0821	0.0471
Experimental logging	N/A	N/A	N/A	0.8991	0.0325	0.524
Other types of logging	1.2299	0.5549	0.3944	1.8209	2.4171	6.6748
Reproduction (seeding) cutting	0.2743	0.8581	0.1613	0.1279	6.8859	0.2128

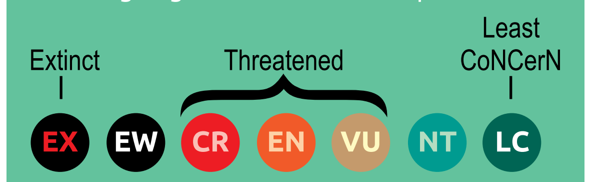
Source: NSC

Endangered and protected species

Biological diversity is a prerequisite for the sustainable functioning of ecosystems. One of the main environmental management challenges is the conservation of rare, endemic and endangered species of plants and animals.

The legal basis for the conservation of rare and endangered plant and animal species was identified by the Council of Ministers of the Kirghiz Soviet Socialist Republic on 18th May 1979, No. 261 and other corresponding regulations (until 2010). The lists of species in the Red Book of the Kyrgyz Republic were approved by the Resolution of the Government of the Kyrgyz Republic, dated 28th April 2005, No. 170, On the approval of the list of rare and endangered species of animals and plants included in the Red Book of the Kyrgyz Republic. The IUCN system of categories, 2004, was used in all sections of the Red Book of the Kyrgyz Republic (2007) (with the necessary modifications).

Since 1963, the IUCN maintains the international list of species at risk (the Red Book). The following degrees of threats are specified in it:



Extinct (EX);

Extinct in the Wild (EW);

Critically Endangered (CR);

Endangered (в опасности) (EN);

Vulnerable (VU);

Near Threatened (NT);

Least Concern (LC);

Data Deficient (DD);

Not Evaluated) (NE).

According to the official national data, in the Kyrgyz Republic there are no species according to IUCN, which could be classified in the categories EX and EW, although according to unofficial published data, such species are available in fauna and flora of the Kyrgyz Republic. Species which are classified as CR, EN and VU, are deemed to be under threat of extinction on a global scale. Species included in the IUCN Red List under LR / cd, NT, DD or LC categories, are not currently at risk on a global scale. However, on a regional scale (i.e. in a certain country) national populations of such species may be different for better or worse. Therefore a threat category assigned to a particular species in the national Red List may be different from the one assigned to it in the IUCN Red List[14].

[14] The IUCN Red List official web site: www.iucnredlist.org

Plant world (Plantae, Mycota). The list of plants and fungi subject to protection increased by an additional 22 species in the second edition of the Red Book of the Kyrgyz Republic (2007) contains) compared to the first edition. The number of protected species of flowering plants increased to 83 (previously it was 71), and 4 species of fungi (not previously listed) were included. Some species, such as the Niedzwiecki apple tree (Malus niedzwetzkyana Dieck), Sivers apple (M. sieversii (Ledeb.) M.Roem.), Korzhinskii pear (Pyrus korshinskyi Litv.), Regel pear (P. regelii Rehd.) etc. were included in the IUCN Red List and Red Book of the Kyrgyz Republic (Table 4.5).

Table 4.5 Number of flora species of the Kyrgyz Republic listed in the IUCN Red List

Category in the IUCN Red List	Number of species
Critically Endangered (CR)	6
Endangered (EN)	6
Vulnerable (VU)	2
Near threatened (NT)	3
Data deficit (DD)	5
Least concern (LC)	46
Total	**68**

Source: Biology and Soil Science Institute, NAS

Species listed in the Red Book of the Kyrgyz Republic are unevenly distributed across administrative regions (Table 4.6), the greatest number of them (46 species) grow in the Jalal-Abad region.

Table 4.6. Distribution of plant species listed in the Red Book of the Kyrgyz Republic by administrative region

Name of the region	Number of species
Batken	6
Jalal-Abad	46
Issyk-Kul	6
Naryn	14
Osh	14
Talas	11
Chui	13

Source: The Red Book of the Kyrgyz Republic, 2nd ed., 2007

See the distribution of some rare plant species included in the Red Book, by region of the Kyrgyz Republic, in Figure 4.1.

Figure 4.1. The distribution of some endangered species in the Kyrgyz Republic
Source: Ecological Movement "BIOM"

Endemic families of higher plants (Embryophytes) in the flora of the country are not found, but there are endemic or subendemic (slightly beyond the borders of the country genera) such as Fumariola, Nathaliella, Sclerotiaria, Fergania and Mogoltavia. About 10% of vascular plant species are endemic (found nowhere else).

Animal world. To date, the Red Book of the Kyrgyz Republic includes 115 species of animals, 18 species of arthropod, 7 species of fish, 2 species of amphibian,8 reptile species, 57 birds and 23 species of mammal. Thus, there are more birds than any other group among those listed as rare and endangered species of animal. (Figure 4.2).

Invertebrates. In general, the level of fauna endemism in terms of species among the invertebrates of the Kyrgyz Republic, exceeds 25%. According to estimations made in 2010, 49 taxons of the entomofauna genus are conditional endemics of the Tien Shan (among them: monotypic Mesasiobia of dermapterans, Ferganusa, Plotnikovia and Ferganacris of Orthoptera, etc). Two orders from the Raphidioptera class of insects, about 20 species and the Mekoptera class, two species endemic to the Tien Shan, are characterized by high, almost absolute, levels of endemism in the Kyrgyz Republic. About 150 species of insects and over 30 species of other invertebrates are, according to some published data, in real danger of extinction, and two species are considered as proven to be extinct in the country.

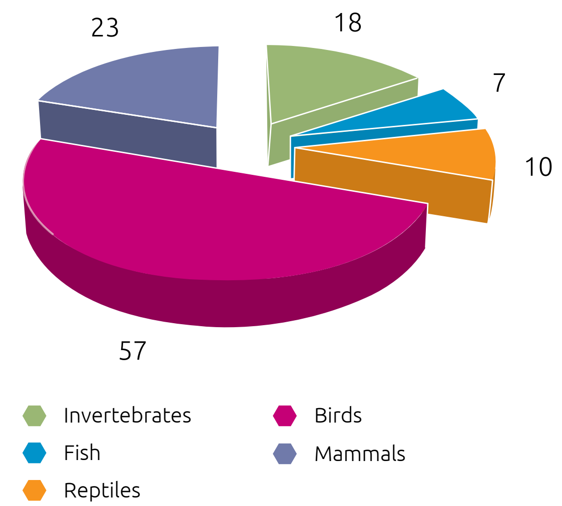
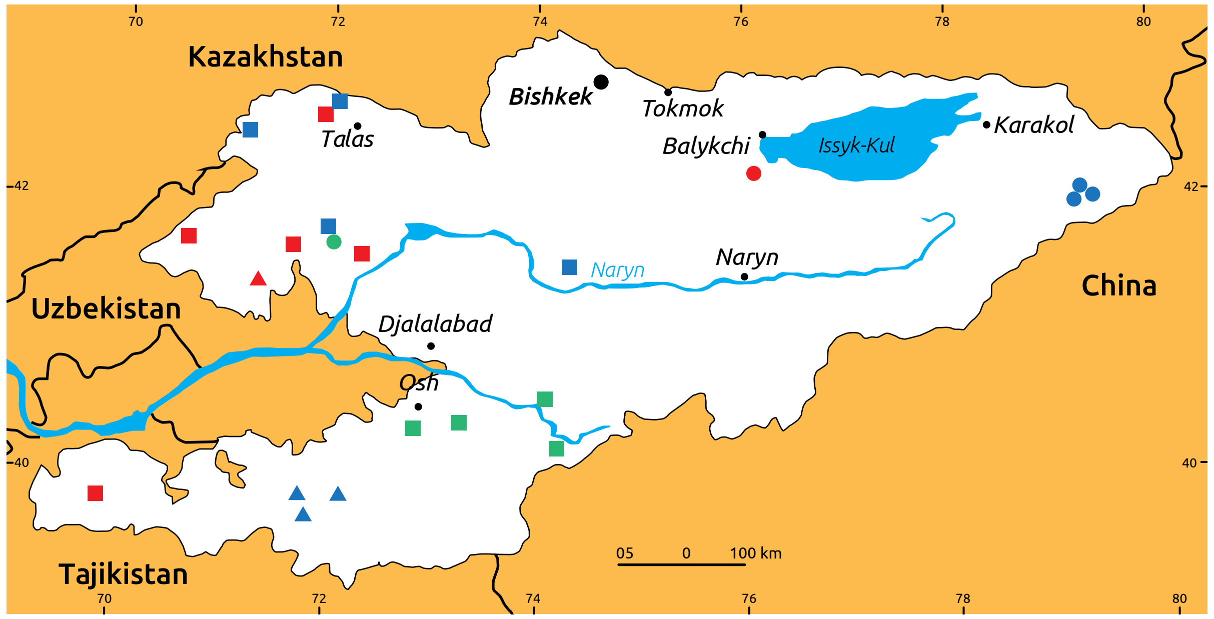


Figure 4.2. The distribution (by main group) of rare and endangered species of fauna in the Kyrgyz Republic.

Until 2005, only insects (19 species) of this group of animals had been included in the Red Book of the Kyrgyz Republic. In 2004-2005, this list was reviewed and qualitative changes were made; eurychoric species were excluded, but narrow local rare species requiring protection were included. Currently it contains 17 species of insects, and also one species of Arachnida, Tricholathys relicta, was added.

Three species of invertebrate in the Kyrgyz Republic are critically endangered globally (IUCN Red List version 2011.2: Table 5), in addition more than a dozen of theinvertebratesfound in the country were added to the categories LR / cd, NT, DD or LC IUCN Red List.



■ Cordulegaster Dae incoronataT ● richolathys relicta ■ Papilio alexanor judeus ● Kirgisobia bohnei
▲ Cephalota galathea ● Parnassius loxias tashkorensis ▲ Colias christophi ■ Polochrum pamirepandum

Figure 4.3. Recorded habitats of some critically endangered species of arthropods in Kyrgyzstan
Source: The Red Book of the Kyrgyz Republic, 2007

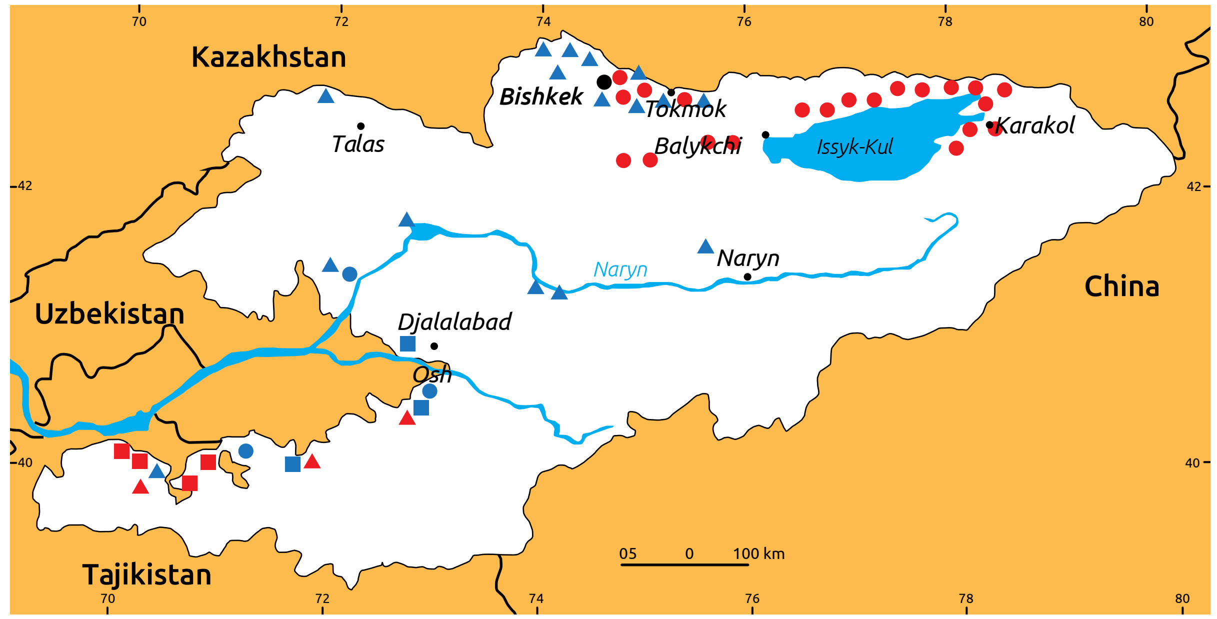
Fish (Pisces). Among vertebrates in the Kyrgyz Republic, fish are in the are the leading endemic species with eight species. Seven species can only be found in Lake Issyk-Kul - the Issyk-Kul gudgeon (Gobio gobio latus), Issyk-Kul dace (Leuciscus bergi), Issyk-Kul rudd (Leuciscus schmidtii), Issyk-Kul minnow (Phoxinus issykkulensis), Issyk-Kul Marinka (Schizothorax issykkuli), Issyk-Kul scaleless osman (Diptychus dybowskii) and Issyk-Kul stone loach (Triplophysa strauchi ulacholicus).

Twenty species are subendemic to Central Asia. An additional five species - pike chub, Aral and Turkestan barbel, Turkestan catfish and sharpray (Capoetobrama kuschakewitschi), were included in the The Red Book of the Kyrgyz Republic, along with the species endemic to Issyk-Kul – the Issyk-Kul marinka (Schizothorax pseudaksaiensis) and the Issyk-Kul scaleless osman (Diptychus dybowskii). Population figures for both of these protected fish and the rest, are not currently available.

Amphibians (Amphibia) and reptiles (Reptilia). There are two species of reptile endemic to the Kyrgyz Republic –Altiphylax tokobaevi and Cyrtopodion narynensis, and three indigenous species of amphibians are endemic to Central Asia.

In the 1968 list for strictly protected species, animals from this group appeared for the first time and in 1981, the Council of Ministers of the Kirghiz SSR approved the list of rare and endangered reptiles. It includes two types of snakes and desert monitor. Later, these species were included in the The Red Book of the Kyrgyz SSR (1985). In 2007, the number of reptiles taken under state protection has increased to eight, and two species of amphibian were included in The Red Book of the Kyrgyz Republic. Thus, in the Kyrgyz Republic, two of the four species of amphibian and more than a fifth of the reptile species are under protection. There are two species of herpetofauna in the Kyrgyz Republic that are globally endangered. (IUCN Red List version 2011.2: Table 5).

In general, the concentration of endangered species of this group is observed in the low mountainous zone (Figure 4.4), at the same time the Batken region has populations of all the reptile species listed in the country's Red Book.

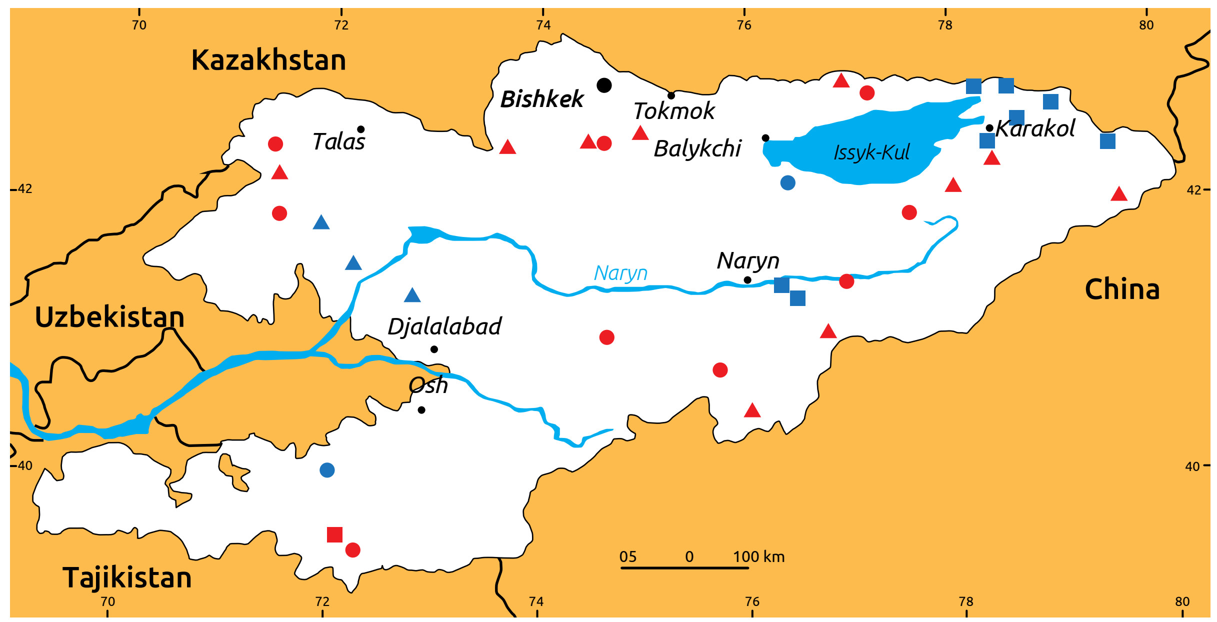


● Rana asiatica ▲ Eumeces schneideri ■ Spalerosophis diadema
■ Phrynocephalus saidalievi ● Varanus griseus ▲ Vipera ursini

Figure 4.4. Recorded habitats of some endangered amphibian and reptile species in Kyrgyzstan
Source: The Red Book of the Kyrgyz Republic, 2007

Birds (Aves). The Red Book of the Kyrgyz Republic includes 57 species of birds, 16 of which are critically endangered with global extinction (IUCN Red List version 2011.2: Table 5). About 300 species of birds found in the country are common or even abundant in the whole of the Kyrgyz Republic, and the IUCN Red List categories are assigned to LR / cd, NT, DD and LC categories.

Mammals (Mammalia). The Red Book of the Kyrgyz Republic includes 23 mammal species, six of which are critically endangered with global extinction (IUCN Red List version 2011.2: Table 5). The distribution of some mammals species included in The Red Book of the Kyrgyz Republic is shown in Figure 4.5. Data on the numbers of some mammals included in the Red List is presented in Table 4.7.



■ Ursus arctos ● Uncia uncia ■ Cervus maral
▲ Lutra seistanica ● Gtizella subgutturosa ▲ Marmota menzbieri

Figure 4.5. Recorded habitats of the six endangered mammal species of the Kyrgyz Republic
Source: The Red Book of the Kyrgyz Republic, 2007

Table 4.7. The the number of some mammal and bird species which inhabit hunting grounds and protected areas and are included in The Red Book of the Kyrgyz Republic

year	Tien Shan mountain sheep	Tien Shan Maral	Snow Leopard (Panthera pardus)	Lynx (Felis Lynx)	Bear	Pallas' cat (Manul)	Otter	Granulated gazelle (Gazella subgutturosa)	golden eagle Golden Eagle(Aquila chrysaetos) Berkut	Porcupine	Stone marten
2006	1277	10	201	823	115	128	10	20	330		3414
2007	386	28	212	942	177	60	10	20	180		3297
2008	1964	20	231	1023	157	61	10	20			3279
2009	2949	94	268	997	290	64	20	20	176	384	3494
2010	3000	448	293	1029	337	69	20	20	131	405	4273
2011	2391	367	286	1007	326	85	20	20	114	385	3994

Source: Hunting Department, SAEPF

Population trends of certain species

Multilateral environmental agreements recognize the intrinsic value of biodiversity and that biodiversity is essential to human life and sustainable development. Because of high economic interest, many biological resources at gene, species and ecosystem level are now at risk of modification, damage or loss. The indicator shows the status of fauna and flora populations that belong to groups of species characterized by their highest resource importance and playing an important role for the conservation of biodiversity. It also helps to reflect a balance of economic interests with the interests of conserving biodiversity (especially when issuing hunting licenses).

Monitoring in the Kyrgyz Republic is only conducted for some bird species (Table 4.8) and animals (Table 4.9). In this case, the calculation of the number of wild animals hunted and those included in The Red Book is carried out only in the SPNA by the SAEPF services, together with experts from the Biology and Soil Science Institute of the National Academy of Sciences of the Kyrgyz Republic. This data is used to determine the hunting quotas for certain game animals.

The populations of rare and endangered flora and fauna species listed in the National Red Book, demonstrate a clear tendency to increase. According to unofficial data published over the last 20-30 years, a clear downward trend towards the shrinking of the of the habitat, the population and number of populations is demonstrated by many species of plants, while the status of many plant communities, both in the lowlands and the highlands, has become an endangered one.

In recent years, a clear trend in the reduction of population, the number of populations and habitats is observed in more than 250 species of insects, mostly belonging to the entomological complexes in low mountainous altitude zones (the steppe communities), which includes many particularly endangered relict and endemic species with fragmented habitats. Also, there is a noticeable increase in the list of invertebrate species, having their habitat in the Kyrgyz Republic due to the discovery of new fauna and invasive species. Unfortunately, the vast majority of invasive species are unwanted, alien species, and sometimes objects of external (export-related) plant quarantine. Currently, due to the lack of representative data for the past 20-25 years, it is not possible to quantify trends in the population and habitats of individual invertebrate species, even from a prominent group such as butterflies.

There is currently an increase in the species composition of fish due to planned and accidental introductions, as well as a reduction in the number of protected species endemic to Lake Issyk-Kul.

The general change in the population and spatial distribution of many species of terrestrial vertebrate is the widespread and increasingly dangerous charateristics of diminishing habitat and a reduction in the number and size of populations. For example, the habitats of large animals, such as mountain sheep and ibex, are now greatly reduced in size and fragmented (Figure 4.5). In the avifauna of the Kyrgyz Republic, there has been a slight increase in the species composition due to an increase in species composition and habitat of some common migratory birds. An alarming decrease is observed in the number of bird and mammal species used for hunting and commercial exploitation.

Table 4.8. Game bird Populations, those which inhabit the hunting grounds and Specially Protected Natural Areas of the Kyrgyz Republic

Species	Total population (birds)					
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Game birds:	**536772**	**336939**	**573324**	**364810**	**307867**	**375545**
Partridges	324909	165104	255997	254487	200641	273246
Pheasants	32647	44331	30588	22722	23630	20585
Ducks	130214	88701	242755	49390	48434	45613
Ulars	42591	32801	36274	33264	30263	32243
Geese	5774	5407	7130	4307	4262	3148

Source: NSC

Table 4.9. Mammal numbers - the main game animals inhabiting the hunting grounds and Specially Protected Natural Areas of the Kyrgyz Republic

Species	Total population					
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Ungulates:	**50916**	**46464**	**45927**	**44415**	**48332**	**51336**
Boar	1954	1627	1706	1697	1472	1552
Roe deer	4718	4759	4603	4682	5004	4792
Ibex	38852	35429	34778	34186	34223	36333
Fur-bearing animals (game):	**354459**	**362221**	**364242**	**339645**	**310799**	**322083**
Squirrel	9545	9027	8414	8238	9092	8515
Hare	53136	48254	52128	51658	45914	55020
Marten	3186	3024	2952	2779	2791	2997
Fox	10878	10167	10376	9419	7184	10110
Muskrat	9230	11689	7715	11405	18220	12958
Mink	3	144	8	687	167	525
Wolf	3135	3076	2695	2695	2250	2797
Marmot	265159	276621	279706	252599	225027	229020

Source: NSC

Adventitious Specie of Ovis ammon polii in the Red Book of Kyrgyzstan. © Davletbakov A.T

PART 5 Land resources

Land is one of the main natural resources providing sustainable development for the country. For environmentally sound and sustainable use and protection of land resources, it necessary to create an optimum land use structure, minimize negative effects on the land from diverse economic activities, to improve the regulatory framework and methodological support for the use and protection of land and soil.

Data on the availability of land in the Kyrgyz Republic, its breakdown down by category, land areas/parcels, owners, land users and qualitative characteristics, is used to characterize the country's land resources and assess the impact on them by diverse business activities.

Records of the Land Fund are provided annually by the district land use planning and control (land tenure) services and are approved by the Kyrgyz government. They are the main information source allowing the identification of transformed land, that is land which is taken out of agricultural use for the expansion of villages, construction of transport infrastructure, mining of mineral resources, establishment of special l protected natural areas and areas in their natural state.

According to the State land records, as of 1st January 2011, the total area of the Kyrgyz Republic was 19,995.1 thousand hectares. These land areas are subdivided into the following categories (Figure 5.1):

Agricultural land	- 5.679.7
Land used for settlements	- 266.4;
Land used for industry, transportation, communications, defense infrastructure, etc.	- 222.7;
Land of specially protected natural areas	- 707.4;
Forest Fund land	- 2617.2;
Water Fund land	- 767.3;
State Reserve Land	- 9734.2;
- thereof unallocated pastures/ rangelands	*- 4824.3.*

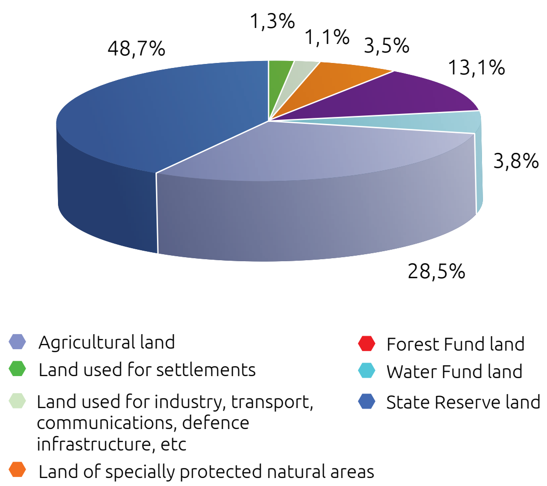


Figure 5.1. Land reserves (Land Fund) by category in 2011

The Land Fund

As of 1st January 2011, agricultural land comprised 28.5% of the total Land Fund or 5,684.5 tthousand hectares. In comparison with 2009, agricultural land decreased by 30.2 thousand hectares or by 0.5%. Land used for specially protected natural areas increased significantly (3.5% of the total Land Fund). In 2010, the land area of this category was 707.4 thousand hectares, the area increased by 174.8 thousand hectares (32.8%) compared to 2009. Forest lands occupied 2,617.2 thousand hectares, an increase of 3.5 ha compared to 2009, during which there was a decrease in the amount of land used for forestry of 54.8 thousand hectares (2% of forestry lands).

Table 5.1. Kyrgyz Republic Land Fund (land reserve) by land category as of 1st January 2012 (thousand hectares)

Land category	2006	2007	2008	2009	2010	2011
Total land in use thereof:	19.994.9	19.994.9	19.994.9	19.994.9	19.994.9	19.994.9
- agricultural land	5.702.9	5.714.9	5.709.9	5.684.5	5.679.7	5.674.9
- land used for settlements	252.1	254.3	259	263.2	266.4	272.9
- land used for industry, transport, communications and defence infrastructure, etc	222.3	221.5	223	223.6	222.7	224.3
- land used for specially protected natural areas (SPNAs)	532.2	532.3	532.6	707.4	707.4	707.3
- Forest Fund land	2.710.6	2.710.1	2.672	2.613.7	2.617.2	2.617.8
- Water Fund land	767.3	767.4	767.4	767.7	767.3	767.3
- State Land Reserve	9.807.5	9.794.4	9.831	9.735.1	9.734.2	9.730.5

Source: National Land Reports for the period 2006 – 2011

Settlement lands comprised 272.9 hectares or 1.3% of the total land fund, an increase of 20.8 thousand ha. compared to 2009. Human settlement areas tend to continually and significantly increase. Significant changes also occur in the State Land Reserve. In 2010, their total area was 9,734.2 ha (48.7% of the total land fund) and this decreased by 0.9 thousand hectares when compared to 2009. When this year (2009) is compared to the previous year of 2008, there was only a decrease of 96.8 hectares (1%). Land used for industry, transportation, communications and defense, etc. was 222.7 hectares (1.1% of the land fund) and only varied slightly from year to year.

Water Fund lands were virtually unchanged at 767.3 hectares - 3.8% of the Land Fund.

Table 5.2. Land reserves (Land Fund) by category (thousand ha)

Land category	2007 +/- compared to 2006	2008 +/- compared to 2007	2009 +/- compared to 2008	2010 +/- compared to 2009
- agricultural land	+12.0	-5.0	-25.4	-4.8
- land used for settlements	+2.2	+4.7	+4.2	+3.2
- land used for industry, transport, communications and defence infrastructure, etc	-0.8	+1.5	+0.6	-0.9
- land used for specially protected natural areas (SPNAs)	0.1	+0.3	+174.8	+0.0
- Forest Fund land	-0.5	-38.1	-58.3	+3.5
- Water Fund land	+0.1	+0.0	+0.3	-0.4
- State Land Reserve	-13.1	+36.6	-95.9	-0.9

Source: State Reports on Land for the period 2006 – 2010.

As of 1st January 2011, the total agricultural area of the Kyrgyz Republicwas 10,650.8 thousand ha (53% of the total land fund), which according to the State Land Records are attributed to different categories of land, including:

Arable land	1.276.2 thousand hectares
Perennials	44.2 thousand hectares
Fallow land	38.9 thousand hectares
Hayfields	168.4 thousand hectares
Pastures	9.064 thousand hectares
Additionally there are also:	
Forest areas	1.164.1 thousand hectares
Trees and shrubs areas	463.5 thousand hectares
Swamps	6.2 thousand hectares
Other	7.648.8 thousand hectares

Pastures, which constitute the majority of the land used for agriculture (85.3%), are steadily decreasing in size. (Table 5.3).

Table 5.3. Land Fund of the Kyrgyz Republic by land use as of 1st January 2012 (thousand hectares)

Year	Total area	Including[15]								
		arable land	land for perennials	fallow land	hayfields	pastures/ rangelands	forest areas	land for trees and shrubs	Swamps/marsh	other
2007	19.995.1	1.280.0	73.4	35.8	172.4	9.174.4	1.059.6	464.0	6.3	7.640.8
2008	19.995.1	1.279.5	73.4	35.9	172.4	9.173.1	1.059.4	463.8	6.1	7.641.6
2009	19.995.1	1.276.0	75.0	37.9	169.1	9.068.9	1.164.6	463.5	6.1	7.644.2
2010	19.995.1	1.276.2	74.2	38.9	168.4	9.064	1.164.1	463.5	6.2	7.648.8
2011	19.995.1	1.275.9	74.7	38.6	168.4	9.058.4	1.164.1	463.5	6.2	7.649.7

Note: 90.6 thousand hectares are listed as private plots belonging to citizens, which are adjacent to their households, and include collective orchards, gardens, vegetable plots and comprise 0.04% of the land fund, the area of which increased by 6.2 thousand hectares in 2006.

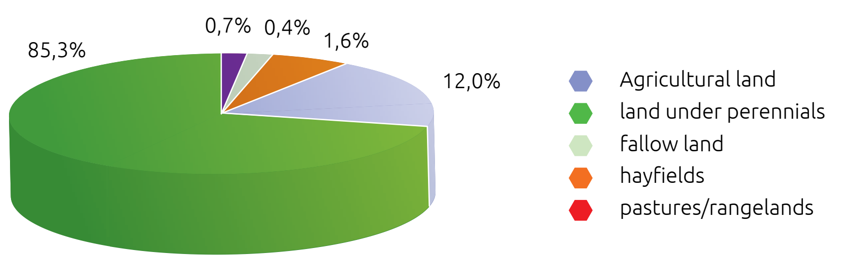


Figure 5.2. Agricultural land of the Kyrgyz Republic in 2010

[15] Without land in the stage of ameliorative preparation and the State borders

Table 5.4. Land Fund by use

Type of land	Area in thousand hectares		
	2008 +/- compared to 2007	2009 +/- compared to 2008	2010 +/- compared to 2009
Total land in use	--	--	--
arable land	- 0.5	- 3.3	+ 0.2
land under perennials	--	+ 0.6	- 0.8
fallow land	+ 0.1	+ 2.0	+ 1.0
hayfields	--	- 3.3	- 0.7
pastures/rangelands	- 1.3	- 104.2	4.9
forest areas	- 0.2	+ 105.2	- 0.5
land under trees and shrubs	- 0.2	- 0.3	--
swamps	- 0.2	--	+ 0.1
other	+ 0.8	+ 2.6	+ 4.6

The Land Fund underwent significant changes in terms of its useage. There is a general trend for a reduction in the amount of arable land, where in 2009 there was a decrease of 3.3 hectares compared to 2008.. Over the past five years, the area of arable land has decreased by 57.7 thousand hectares, 4.3%, pasture lands have decreased by 120.5 thousand hectares, or 1.3%.

Over the period of 5 years, forest areas increased by 104.9 thousand hectares, or 9.9%. Land for trees and shrubs, which includes forest shelter belts (wind breaks) decreased by 0.5 thousand hectares (0.1%), which represents a major threat to soil prone to deflation(soil erosion by the wind). During 2010, swamp areas increased by 0.1 ha due to small farms having a lack of funds available to clean the drainage system.

Land in the "Other" land category increased by 20.9 thousand hectares.

Table 5.5. Breakdown of the land fund of the Kyrgyz Republic by region in 2010

Name of region	territory size (thousand hectares)	Area used for agriculture (thousand hectares)	Number of owners and land users
Batken	1699.6	589.3	230543
Jalal Aabad	3365.3	1855.8	319601
Issyk - Kul	4314.4	1602.6	364529
Naryn	4520.2	2819.7	227768
Osh	2901.2	1681.0	391312
Talas	1144.6	743.3	97270
Chui	2018.9	1346.7	523024

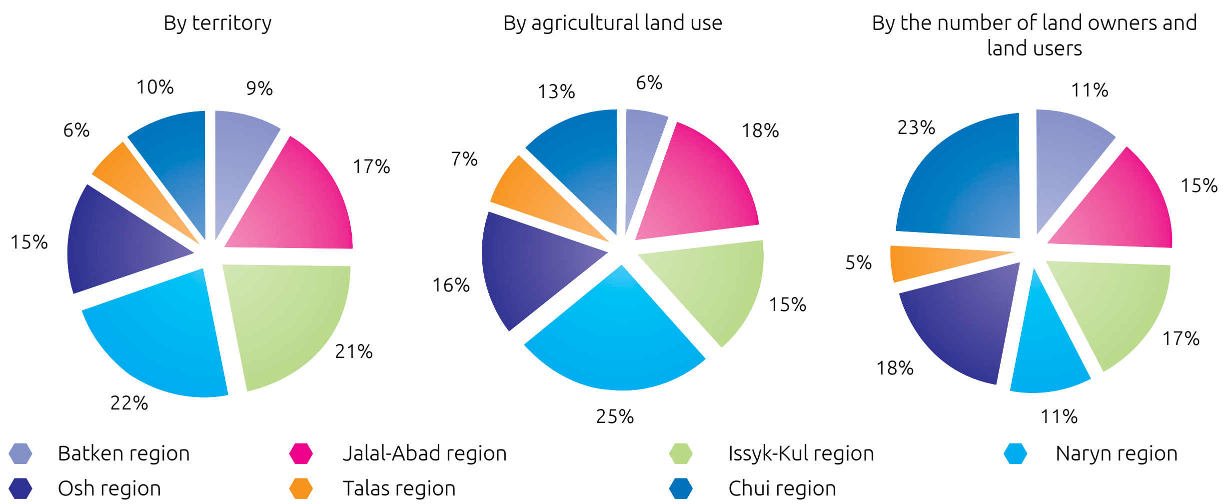


Figure 5.3. Breakdown of the land fund of the Kyrgyz Republic by region

The Land Fund of the Kyrgyz Republic is unevenly broken down. The territories of the regions are placed by their size in the following order: the largest region is Naryn, it occupies 4,520.1 thousand hectares, or 22%, it also has the largest area of agricultural land, 2,819.7 thousand hectares, of which 2,676.9 thousand hectares (95% of the total area of agricultural land) are pastures and arable land is only 120.9 ha. The number of land owners and land users in Naryn is 227,768 people. The average land user in the Naryn region has 12.4 hectares of farmland.

The Issyk-Kul region occupies 4,134.4 thousand hectares (21% of the country area), the area of agricultural land is 1,602.6 hectares (17%), of which is 191 hectares is arable land, 12% of the agricultural land area. Compared to 2009, the cultivated area increased by 306 hectares due to the development of low productivity pastures (only for registered land parcels). The number of land owners and users in the Issyk-Kul region is 364,529, this figure has risen by 15,665 over the last five years. The average land user in the Issyk-Kul region has 11.3 hectares of agricultural land.

The Jalal-Abad region occupies 3,365.3 thousand hectares (17%), the area of agricultural land is 1,855.8 thousand hectares (55% of the total area of the region). The area of arable land is 165.6 thousand hectares (8.9% of the total agricultural land area) and this has decreased by 1,482 ha (0.9%) compared to 2009, and during the last 5 years it reduced by a further 8,073 ha (4.6%). The number of owners and users is 319,601, this figure has increased by 15,256 compared to 2009. The average land user in the Jalal-Abad region has 10.5 hectares of agricultural land.

The Osh region covers 2,901.2 hectares, which is 15% of the country. The area of agricultural land is 1,681.0 thousand hectares (58%). Arable land area is 188.1 thousand hectares or 11% of agricultural land area. In 2010, this figure increased by 748 hectares compared to 2009. The number of owners and users in the Osh region is 391,312, and according to data from 2009, there was an increase of 41,016. The average land user has 4.3 hectares of agricultural land.

The Chui region occupies 2018.9 thousand hectares, which is 10% of the total land area. The agricultural land area is 1,346.7 thousand hectares (67%) and the area of arable land is 419.3 thousand hectares (31%). Compared to 2009, the area of arable land has increased by 902 hectares,and the number of land owners and users in the Chui region increased by 82,836 (19%) to a total of 523,024 The average land user in the Chui region has 2.6 hectare of agricultural land.

The Batken region covers 1,699.6 thousand hectares, which is 9% of the total land area of the country. The agricultural land area is 589 hectares, which is 35% of the territory. In 2010, the arable land area was 71.5 hectares (12% of the agricultural land area), a decrease of 366 hectares when compared to 2009. The number of owners and users of Batken region is 230,543 and compared to 2009 this indicator increased by 56,328 (32%). The average land user in the Batken region has 2.3 hectares of agricultural land area.

Talas is the smallest region of the country. It occupies 1,144.6 hectares or 6% of the total area of the republic. The area of agricultural land is 743.3 hectares (7%), the area of arable land is 117.5 thousand hectares (16% of the agricultural land area), which when compared to 2009, by 2.05 ha (1.7%). The number of owners and users is 97,270 and compared to 2009 this figure increased by 5,304, and over the past five years, it has increased by 15,295. The average land user in Talas has 7.6 hectares of agricultural land.

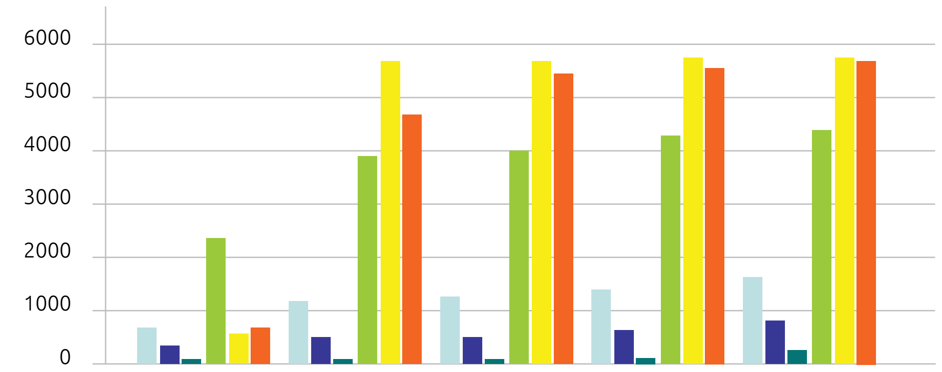
Currently, the number of people living in rural areas who have received their share of land is 2,665.4 thousand people. As a result, 54% of the population of Kyrgyzstan became owners of land parcels for agricultural use. Market reforms and redistribution of land by types of ownership also occurred in other land categories. In January 2011, of 266.3 thousand hectares of land settlements, 185 thousand ha or 69.5% were transferred into private ownership and to juridical persons, owners of residential houses, industrial enterprises and organizations. Of land for industry, transport, communications, defense and other purposes, 6 thousand hectares were transferred into the private ownershipof people with buildings and other facilities.

Area of agricultural land affected by degradation

This indicator provides an opportunity to assess the status of land in terms of its exposure to degradation processes. Erosion is a natural process, but it is often dramatically intensified as a result of human activity. In most cases, erosion is the result of the unsustainable use of agricultural land, large-scale farm activities, over-grazing, and inefficient irrigation systems and water management. One of the most important factors affecting soil quality, crop yields and consequently the level of poverty is the agricultural system used. In turn, soil erosion is the most visible indicator of the unacceptably adverse impacts of agricultural practices, leading to declines in crop yields and often to irreversible damage to soil.

Agricultural land is the most prone to a decrease in biological productivity. Factors which should be emphasized as particularly affecting the biological productivity of land in Kyrgyzstan, are erosion, salinization and water logging/flooding. (Figure 5.4.).

PART 5. Land resources



	1985	1991	2002	2005	2010
Salinated	666,3	1170,3	1180,8	1289,7	1332,8
Alkaline	243,4	469,3	471,2	496,8	650,6
Waterlogged	28,9	89,2	90,9	118,6	123,8
Stony	2397,4	3808,8	4021,2	4272,1	4272,0
Prone to deflation (wind erosion)	616,2	5475,3	5689,8	5795,4	5789,3
Prone to water erosion	725,7	4544,8	5626,8	5699,8	5699,8

Figure 5.4. Qualitative characteristics of agricultural land by signs of degradation

The diagram clearly demonstrates that, since 1985, the area of degraded land has increased significantly, at the same time it is necessary to note that the last comprehensive land monitoring was conducted in 1990, and the subsequent random surveys did not fully reflect new developments.

The development of water and wind erosion processes is caused by many factors and reasons, both natural and anthropogenic. Among the environmental factors, it is necessary to note that the republic has a strongly dissected topography, including all hydrographic formations (watersheds, slopes, ravines, gullies and river valleys). Soil properties, the parent and the underlying rocks (loess and loess-like loams, which due to their looseness are washed away considerably easier than clay) also strongly affect the development of erosion processes. One of the exclusively negative factors of water erosion manifestations in the republic is surface slopes. Arable land, particularly irrigated land, is most vulnerable to water erosion. Precipitation and wind patterns also trigger these erosion processes.

Flash points of wind erosion are located in the west of Issyk-Kul, eastern Kemin district, western Kara Buura, the Kochkor depression and in Batken, Osh and Chui regions.

Anthropogenic factors of erosion processes are directly related to human activities, and especially the misuse of irrigated lands. Strong flushing and washing out of soil occur when tillage techniques are not complied with and crop placement is irrational.

There are also other types of land degradation (Table 5.6) - salinity, waterlogging and the rising water table, which are observed in areas of the country which are of a lower altitude and where there is an active use of irrigated lands. The Chui region is most prone to degradation irrigated agricultural lands in these areas. Due to decline in investment and the lack maintaining the irrigation and drainage systems throughout the area there has been an increase in bad land areas, especially in Osh, Batken, Chui and Talas regions.

Primary salinity is due to mineralized groundwater, whereas secondary salinity is associated with the deterioration of drainage systems, and has also became significantly widespread in recent years, and is found in varying degrees in arable land. Work on gypsuming alkaline soils stopped, although this technological method was one effective way to restore agricultural land.

Load on pastures/rangelands

Over 60% of the five million residents of the Kyrgyz Republic, live in rural areas and are directly dependent on natural resources as a source of survival, and therefore, have a tremendous impact on them. The main natural resource is the mountain pastures, which cover 40% of the country and 85% of agricultural land. The management of the

Table 5.6. Characteristics of agricultural land in the Kyrgyz Republic as of 1st January 2010

Type of agricultural land	Salinated	Alkaline	Wetlands	Stony	Deflation-prone (wind erosion)	Water erosion prone
All agricultural land	1289.7	496.8	118.6	4272.1	5795.4	5699.8
Irrigated agricultural land	235.6	87.4	36.7	216.8	784.1	811.4

Source: Data on land monitoring by RPAS "Kyrgyzgiprozem"

load on pastures/rangelands is one of the most important elements of their sustainable use, and allows for higher productivity in the long term.

The development of erosion processes on pastures/rangelands is significantly contributed to by unregulated grazing, which leads to the widespread degradation of the pastures/rangelands. With the destruction of the natural fodder-producing area, the water absorption and water-holding capacity of the soil is lost (due to dusting, soil consolidation and the destruction of structural units of soil), which in turn contributes to its washout.

Table 5.7. Distribution of livestock by region in 2010 and the calculation of loads on pastures/rangelands

Name of region	Livestock population in thousand head			Conventional stock units	Pastures area in thousand hectares	Livestock load per hectare of pasture
	Cattle	Sheep and goats	Horses			
Batken	115.9	454.2	6.5	1,072.7	484.7	2.2
Jalal-Abad	259.0	997.1	52.7	2,608.3	1,627.5	1.6
Issyk-Kul	179.2	747.5	78.1	2,112.1	1,384.8	1.5
Naryn	129.8	871.3	90.8	2,065.1	2,676.9	0.8
Osh	300.3	942.0	81.2	2,993.2	1,400.2	2.1
Talas	64.1	456.8	22.9	914.7	615.8	1.5
Chui	239.8	546.4	45.4	2,029.7	869.2	2.3

Source: NSC
On 1st January 2011, livestock was converted into the following conventional stock units: 1 cow is equal to 5 head of sheep, 1 horse is equal to 6 head of sheep.

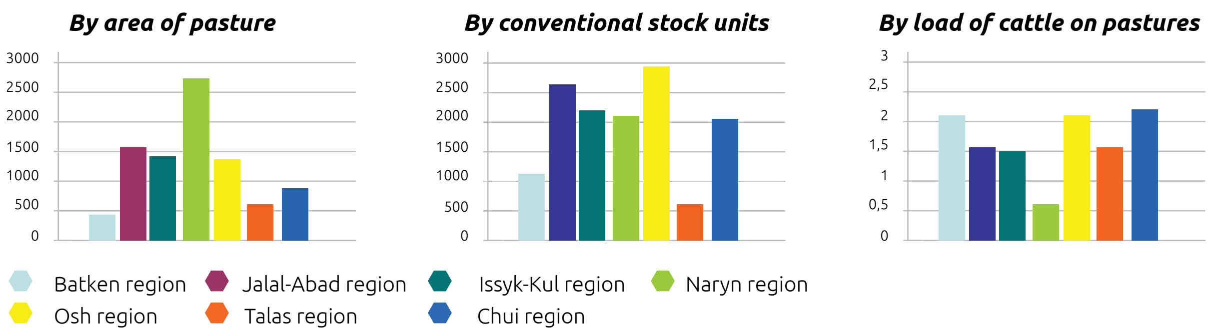


Figure 5.5. Distribution of livestock by region in 2010

Table 5.7 shows the distribution of livestock by region of the Kyrgyz Republic in 2010, and the calculation of the load on pastures that characterize the impact on the system of land use in general, because exceeding the optimum standards of environmentally sound grazing leads to degradation, the reduction of biological productivity of pastures and their withdrawal from agricultural use.

In 2010, the pasture area in the Naryn region comprises 2,676.9 hectares, the total livestock population in conventional stock units is 2,065.1 thousand head, an increase of 26.3 thousand heads, or by 1.3%, compared to the previous year. The livestock load per hectare of pasture is 0.8 conventional stock units.

GEF / UNDP project, The Demonstration of Sustainable Mountain Pasture Management in the Susamyr Valley, conducted door-to-door registration of all livestock during the grazing planning process and identified discrepancies between the statistical and actual data (based on the pilot villages): the cattle population was three times bigger, and the sheep and goats population was five times larger.

The pasture area in the Issyk-Kul region is 1,384.8 thousand hectares. When compared with 2010, the total livestock population has increased by 97.1 thousand head (48%) to 2,112.1 thousand head. The livestock load per hectare of pasture is 1.5 conventional stock units.

The Jalal-Abad region has 1,627.5 thousand hectares of pasture. The total number of livestock is 2,608.3 thousand head, has increased by 67.4 thousand conditional stock units or 2.6%, when compared to 2010. The livestock load per hectare of pasture is 1.6 conventional stock units. The Talas region has 615.8 thousand hectares of pasture area. In 2010, the total number of livestock was 914.7 thousand heads (conventional stock units?), which increased by 26.7 thousand heads or 3%, in comparison to 2009. The livestock load per hectare of pasture is 1.5 conventional stock units.In the Osh region there are 1,400.2 thousand hectares of pasture. The total livestock population in 2010 was 2,993.2 thousand heads, an increase of 90 thousand heads (conventional stock units?), or 3.1%, when compared to 2009. The livestock load per hectare of pasture is 2.1 conventional stock units, which exceeds the environmentally sound pressure by 1.5 times.

The pasture area of the Batken region is 484.7 thousand hectares. In 2010, livestock figures were 1,072.7 thousand heads(conventional stock units?), an increase of 25.8 thousand head, or 2.5%, compared to the previous year. The livestock load per hectare of pasture is 2.2 conventional stock units.The Chui region pasture area is 869.2 thousand hectares. The total number of livestock was 2,029.7 thousand head in 2010, it increased by 43 thousand heads, 2.2%, compared to 2009. The livestock load per hectare of pasture is 2.3 conventional stock units

The Chui, Batken and Osh regions have exhausted the potential for livestock population growth, and further efforts should be aimed at improving animal productivity and optimizing the species composition.This is due to the recent increase of cattle in all regions of the country, especially in the numbers of young feeder/steer cattle, which is environmentally hazardous to the pasture herbage of the Kyrgyz Republic.

Mountain pastures of Issyk-Kyl region. © UNDP

PART 6 Agriculture

The Kyrgyz Republic is an agrarian country in which 66% of the population live in rural areas, where the poverty rate is much higher than in urban areas and dependent on agricultural produce. The GDP share of agriculture in 2011 (Provisional NSC) was 18%, which is 0.6% higher than in 2010. Over the past five years, a steady decline in the share of agriculture in the GDP of the Kyrgyz Republic has been observed. In 2006 it amounted to 28.7%, while in 2009 and 2010 it reduced to 22.1% and 17.4%, respectively.

Agriculture specializes in the production of meat, dairy products, wool, grain and forage crops, cotton, tobacco, vegetables, fruits, vegetable oil and other crops. Of the total agricultural output in 2011, crop production made up 52.1%, animal products were 46.2% and agricultural services 1.7%. As of 1st January 2011, the cultivated area of the republic within the use boundaries was 1,276.4 thousand hectares (ha). The –majority, 79.5%, is in private ownership. In the use of (peasant) farms are 885.2 thousand hectares of arable land (69.4%), and that of collective and state farms is 83.4 thousand ha (6.5%). Arable land adjacent to households, land plots belongingto citizens and collective gardens/orchards comprise 71.1 thousand ha (5.6%). In addition, about 20% of arable land is in the Agricultural Land Redistribution Fund (LRF), which is managed by AO, and a significant part of this is used by (peasant) farms.

In 2011, crops were planted on 1,159.2 thousand hectares, thereof 1,157.6 thousand hectares were arable land and 1.6 thousand hectares of gardens, pastures and floodplains, 4.7 thousand ha was left fallow, protected ground accounted for 0.04 thousand hectares. 2.6 thousand hectares of arable land was used for nurseries or had perennial plants. From 1980-1990, the productivity of arable land was on average, 34 centner (1 centner = 100kg) of grain per hectare (processed weight);during 1996-2010 productivity has being dropped to 25.2t/ha (status of 2011. A reduction in the productivity of arable land by 8.8kg/ha has resulted in an annual shortfall of more than 970.0 thousand tons of grain.

When compared to the figures of 2010, the area of unused arable land in 2011 decreased by 10.9 thousand hectares and comprised 111.5 thousand hectares (8.7% of the total area of arable land). The main reasons for the non-use of arable land are: hard rainfed area (56.7 thousand hectares), remoteness and stoniness (21.8 thousand hectares), lack of irrigation and irrigation network failure (14.0 thousand hectares), salinity and waterlogging (6.1 thousand hectares), lack of fuel, lubricants, seeds and machinery (4.2 thousand hectares), lack of funds (3.4 thousand hectares), etc. Of all the unused arable land, the Naryn region accounts for 19.5%, Jalal-Abad region 18.9%, Talas region 12.6%, Chui region 11.9%, Issyk-Kul region 11.8%, Osh region 11, 5%, and Batken region 10.8%.

Application of mineral and organic fertilisers

Irrational use of mineral and organic fertilizers to increase crop yields in agriculture, increases the risk of environmental hazards such as pollution of water and soil. In this case, potential negative effects on other parts of the environment are possible, including the violation of natural balance of the soil microflora. In turn, high levels of nitrate and nitrite in potable water poses a public health risk. Theenvironmental effects will depend on the methods of fertilization employed, soil conditions and plants used, and weather conditions. A time series analysis of the fertilizers applied, allows the control of their impact on the environment and the taking of preventative measures to reduce adverse environmental effects.

To obtain the harvest in 2010, 28.9 thousand tons of nutrient fertilizers were applied, or 16.6% of those used in 1990. This figure includes 27.2 thousand tons of nitrogen (28.8%), 1.6 tons of phosphorus (2.4%), and 1,040.0 thousand tons of manure (35.2%). Potassium was not used in 2010, and has not been applied for 5-6 years. The area fertilized was 359.2 thousand hectares, and the grain yield was 25.2 t/ha. The volume of mineral fertilizers used by region, are presented in Table 6.1.

Table 6.1. The import and use of fertilizers, by region of the Kyrgyz Republic for 2000, 2010, 2011

Name of region	Year	Amount of mineral fertilizers required	Actually imported, (weight in tonnes)	Applied mineral fertilizers, (weight in tonnes)
Batken	2000	18180	18200	18200
	2010	12597	13283	12700
	2011	20100	13835	7900
Jalal-Abad	2000	62040	27000	27000
	2010	29652	37480	37480
	2011	57200	36308	27390
Osh	2000	57290	37200	22620
	2010	28543	20622.8	16100
	2011	48500	25296	25296
Talas	2000	27360	1300	1200
	2010	14581	2892	2892
	2011	24400	4438.3	4438.3
Chui	2000	86490	13000	12000
	2010	57330	14549	14549
	2011	102600	23041	14453
Issyk-Kul	2000	53000	3000	1740
	2010	38092	1848	1848
	2011	62700	4485	4000
Naryn	2000	24270	700	290
	2010	19205	121	121
	2011	25300	277	277
Total	**2000**	**328630**	**100400.0**	**83050.0**
	2010	**200000**	**90795.8**	**85690**
	2011	**340800**	**107680.3**	**83754.3**

Source: Department for chemical use and plant protection of the Ministry of Agriculture

The Kyrgyz Republic, which has no factories producing mineral fertilizers, annually imports on average about 100.0 thousand tons fertilizers from Russia, Uzbekistan and Kazakhstan, over 95.0% of which are nitrogen fertilizers. In 2010, the total volume of import of mineral fertilizers, compared to that of 2005, decreased more than 1.5 times (Table 6.2). 95% of imported and applied fertilizers are nitrogen (ammonium nitrate, urea), 4.5% are phosphorus (ammophos, superphosphate and superphosphate), and 0.5% potassium. On average, the estimated requirement of agricultural fertilizers in the republic is 320.0 - 340.0 thousand tons, annually approximately 100.0 thousand tons are used, which means the provision of mineral fertilizers is equal only about 30% of the requirement.

Table 6.2. Total import and use of mineral ferilisers in the Kyrgyz Republic

Year	Mineral fertiliser requirement(tonnes)	Actually imported and used, (weight in tonnes)	Applied mineral fertilisers (weight in tonnes)
2005	337.641	84.961.0	78.794.3
2008	340.000	99.935	76.843.0
2009	340.000	93.800	89.090
2010	340.000	90.795.8	85.690
2011	340.800	107.680.3	83.754.3

Source: Department for chemical use and plant protection of the Ministry of Agriculture

The soils of the republic's agricultural zones are poor in organic matter (humus). The humus content in the plowed layer ranges from 1.0-3.0%. Intensive land use results in a decrease of humus, which in turn leads to a significant loss of soil fertility and the development of water erosion and soil degradation. Many arable soils have lost 20-45% of humus compared to virgin lands. Humus is a reserve of nutrients, so in order to maintain and replenish soil humus,it is necessary to observe rotations with perennial grasses and regularly use organic fertilizers (manure). In 2010, 393.2 thousand tons of organic fertilizers were applied, which is almost half as much of that used in 2006 (Table 6.3). In 2011 slightly larger amounts of organic fertilizers was applied, 401 thousand tons.

Table 6.3. The use of organic fertilizers (manure) by region of the Kyrgyz Republic (thousand tonnes)

Name of region	2006	2007	2008	2009	2010	2011
Batken	7.6	8.4	4.8	4.9	9.7	10.9
Jalal-Abad	5.5	26.5	69.4	94.4	58.3	57.2
Issyk-Kul	34.4	20.0	142.0	81.1	146.0	151.4
Naryn	96.2	82.8	99.6	88.6	85.6	100.2
Osh	296.2	229.1	298.1	32.3	28.6	25.2
Talas	175.2	22.8	24.8	25.8	31.9	33.4
Chui	34.6	40.2	59.0	48.8	33.1	22.7
Total	**649.6**	**429.8**	**697.7**	**375.9**	**393.2**	**401.0**

Source: Department for chemical use and plant protection of the Ministry of Agriculture

"Manuring. © UNDP

Import and application of pesticides

The natural climatic and soil conditions of the Kyrgyz Republic permit the cultivation of various crops. The losses incurred by the country's agriculture from pests, are forcing farm owners to carry out agricultural activities on a large scale for the protection of plants, using different types of pesticide, which create a threat to the environment and public health.

The Kyrgyz Republic has never produced pesticides and commercial enterprises import permittedpesticides for agricultural purposes. The list does not include products related to POPs. The unauthorized appearance in the Republic of pesticides containing POPs is only possible through smuggling/contraband.

The total volume of pesticides imported by the Kyrgyz Republic has considerably decreased since 1990 (Figure 6.1). This is not only due to the collapse of the Soviet Union, the breaking of existing economic ties, and the low financial capacity of farmers, but also due to a decrease in the ferilizer consumption rate per 1 hectare. Accordingly, the load on crop areas has also reduced: in 1990, the load per hectare was about 3.7 kg, while in 2003 it was approximately 1 kg (without sulfur). This is explained by a very low useage rate of modern pesticides per hectare (0.01 kg /ha).

When compared to 2006, the total import of pesticides in 2011 declined by more than 2.6 times, from 934 tons to 355.4 tons (Table 6.4). The largest amounts of imported pesticides in 2011 were herbicides (45%),fungicides and seed disinfectants (28.3%).

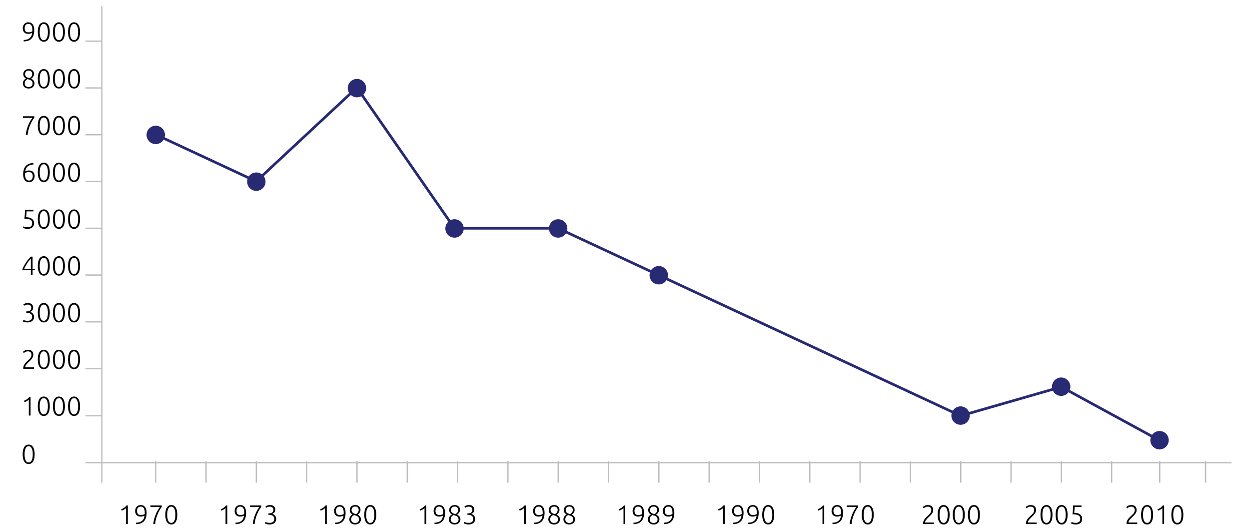


Figure 6.1. Pesticides imported by the Kyrgyz Republic during the period 1970-2010(tons).

Table 6.4. Import of pesticides to the Kyrgyz Republic for the period 2006-2010

Type	Amount (tonnes)					
	2006	2007	2008	2009	2010	2011
Insecticides	104.5	120.1	122.8	86.8	111.4	94.8
Herbicides	148.1	125.6	144.0	165.6	172.2	160.0
Fungicides and seed disinfectants	677.9	921.1	375.2	82.4	120.5	100.6
Other	3.5	13.5	7.5	0.1	10.0	-
Total	**934**	**1.180.3**	**649.5**	**334.9**	**414.1**	**355.4**

Source: Department for Chemical use and Plant Protection of the Ministry of Agriculture

However, while there has been a reduction inthe volume of imported pesticides, the area of their application has not reduced, and has even slightly expanded. In 2006, fertilizers were applied to 433.2 thousand hectares, while in 2010 to 453.4 thousand ha, and in 2011 to 510.7 thousand hectares, which means that fertilizers are being used more efficiently. (Table 6.5).

Table 6.5. The area of agricultural land having pesticides applied in the Kyrgyz Republic for 2006-2011.

	2006	2007	2008	2009	2010	2011
Area (thousand hectares)	433.2	420.6	488.8	456.3	453.4	510.7

Source: Department for chemical use and plant protection of the Ministry of Agriculture

The distribution of imported pesticides in the regions of the republic is based on the structure of crop areas. The requirement and availability of pesticides and their movement is controlled by the plant protection service. In 2010, the largest number of insecticides was used in the Jalal-Abad and Osh regions, herbicides in Chui and Jalal-Abad, fungicides in Batken, and seed desinfectants in the Chui region. In 2010, defoliants used to facilitate the machine harvesting of crops (mostly cotton) were used only in the Osh region (Table 6.6), and in 2011 they were not used or imported at all.

Table 6.6. Use of pesticides in the regions of the Kyrgyz Republic in 2010 - 2011 (tons)

Name of region	Insecticides		Herbicides		Fungicides		Seed disinfectants		Defoliants	
Year	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Batken	11.1	12.3	6.4	8.1	53.5	45.7	6.4	3.4	-	-
Jalal-Abad	51.7	57.2	40.5	34.2	2.1	3.3	8.9	3.1	-	-
Issyk-Kul	3.7	4.5	31.5	19.9	0.7	0.9	7.0	6.9	-	-
Naryn	1.6	1.4	0.8	0.7	-	6.1	1.5	0.6	-	-
Osh	33.2	9.2	10.1	11.4	13.9	6.1	1.0	1.4	10.0	-
Talas	3.2	4.3	6.0	12.4	0.8	1.2	1.9	7.0	-	-
Chui	4.9	5.7	73.7	73.0	0.7	0.7	15.3	19.7	-	-
Total	109.4	94.8	169.0	160.0	717	64.0	42.0	42.1	10.0	-

Source: Department for chemical use and plant protection of the Ministry of Agriculture

Inventory of old pesticides storage in Djalal-Abad region. © Zhakipova I.K.

A big problem for the country is also the problem of storing pesticides, because it affects the environment, the extent of pesticide safety and the efficacy of their effect when they are used. Of total currently existing storages in the country, 72% are converted premises (in which about 35% of the chemicals must be stored), and not all of them meet health and safety standards. At the same time, in the mountainous regions (Naryn, Issyk-Kul and Talas), where the main rivers in Kyrgyzstan have their sources, almost all warehouses are adapted/re-profiled for the purpose of storage. But in model storages, there are also big problems with the safe storage of pesticides, resulting in rusting containers and leakage of pesticides.

Over the past 15 years, POPs pesticides have not been imported into the country. However, the shelf life of most pesticides is 2-3 years, so obsolete, banned and unusable pesticides and POPs continue to be stored at warehouses and other storage locations.

According to the Department of chemical use and plant protection of MAA, at the end of 1989, 47.9 tons of banned pesticides were stored in the national warehouses, and 170.8 tons by the end of 1994. However, this record of the availability of pesticides does not fully reflect the objective picture, since after the denationalization of RPNO "Kyrgyzselhozhimiya" and the dissolution of collective and state farms, the formerly established system of strict reporting stopped functioning and no reports were provided. As a result, there is no complete and objective information on the quantity, quality and storage areas of obsolete and banned pesticides. Therefore, more accurate data can only be obtained by conducting stock-takes at all warehouses and storage facilities, regardless of ownership, with the participation of competent professionals.

PART 7
Power engineering

The power engineering sector is one of the most important sectors of the Kyrgyz economy and plays an important role in the economic development of the country as a major power supplier to businesses and the public, and contributes to the GDP from the electricity exports.

The electric power engineering sector in Kyrgyzstan has some specific features that influence its future development: the availability of interstate transmission lines (between Kazakhstan, Uzbekistan, Tajikistan and China) with voltages of 10-500 kV, the major Toktogul reservoir with a multi-year management , and a high prevalence of hydroelectric power is a positive balance in the production of power. The siginificant production of hydroelectricity at HPPs, about 90%, greatly reduces costs and allows for high power efficiency.(Table 7.1).

On the other hand, an unfavourable feature is that the majority ofenergy sources are imported into the republic, including coal (66%), gas (92%), diesel (89%), gasoline (96%), fuel oil (75%) and kerosene (100%). These products are mainly imported from Russia, Kazakhstan and Uzbekistan. The basis for the energy sector, which consists of hydroelectric power plants, was created during the 1960s of the Soviet era. The reason for constructing power plants was to meet the hydroelectric requirements not only in the Kyrgyz Republic, but also in neighbouring Soviet republics. (Uzbekistan and Kazakhstan during the growing season).

Along with the construction of large cascade of HPPs on the Naryn River, during the Soviet period, many small hydroelectric plants were built in Kyrgyzstan. However, in the 60 years since the adoption of the program of concentration and centralization of electric power generation in connection with the development of the power grid and connection of all users to it, the construction of small HPPs was considered unprofitable. The construction of small HPPs was discontinued, and the operation of existing hydroelectric gradually subsided, except for some plants. For several reasons, these plants have low technical and economic parameters, therefore, due to a massive shift to centralized power, the further operation of these HPPs was considered inappropriate, and many of them were decomissioned, with only the most economical remaining in operation.

Major generating facilities which were built in the period 2009-2011 are as follows: the Aygultash-Samat and Samat 110kV high voltage lines, and the construction and commissioning of the first hydroelectric plant at Kambarata-2.

Table 7.1. The largest HPPs in Kyrgyzstan

HPP	Power generating capacity (MW)
Toktogul HPP	1 200
Kurpsai HPP	800
Tash Kumyr HPP	450
Shamaldy-Say HPP	240
Uch-Kurgan HPP	180
Kambarata HPP-2	120
At-Bashi HPP	40
Bishkek CHP	666
Osh CHP	50
Total	3 746

Source: State Department for fuel and energy complex management of the Ministry of Energy and Industry of the Kyrgyz Republic

The transmission of electricity from the generating company to the distribution company is provided by JSC "National Electric Network of Kyrgyzstan" (NESK). NESK is a power transmission company, which consists of six regional companies of high voltage electric networks (FWEPS) operating electrical networks with voltages of 110-220-500 kV. Four distribution companies are divided on a regional basis: JSC "Severelectro" covers Bishkek and the Chui and Talas regions, "Vostokelektro" covers the Issyk-Kul and Naryn regions, JSC "Oshelectro" in Osh and Batken, and JSC "Jalalabatelectro""in the Jalal-Abad region.

In 2010, the total electricity generated in the Kyrgyz Republic was 12,073.9 million kWh, 11857.2 million kWh of which was produced by JSC "Electricheskie Stantsii ("Electric Power Plants"). Large HPPs generated 11,070.0 million kWh, while power plants operating on thermal power generated 787.2 million kWh

In 2010, electricity exports totaled ,1827.6 million kWh and it was performed by the following companies:

- JSC "Electricheskie Stantsii ("Electric Power Plants") – 1,469.5 million kWh;
- JSC "Chakan HPP" - 165.9 million kWh

115.8 million kWh of electricity were imported in 2010 and this was mainly due to electricity cross-flows.

HPPs generate about 90% of the electricity and the amount produced depends on the water inflow to Toktogul reservoir.

Table 7.2 specifies the amount of electricity generated at each JSC "Electricheskie Stantsii ("Electric Power Plants") plant in the last 5 years.

Table 7.2. Electricity generated by HPPs and CHP (thousand kWh)

Name ofHPP, CHP	2006	2007	2008	2009	2010
Toktogul HPP	5.722.800.0	5.615.400.0	3.937.000.0	3.579.500.0	4.748.200.0
Kurpsai HPP	3.420.800.0	3.714.700.0	3.052.600.0	2.709.100.0	2.769.100.0
Tashkumyr HPP	2.137.500.0	2.251.300.0	1.816.600.0	1.735.900.0	1.745.500.0
Shamaldysai HPP	1.047.500.0	1.104.200.0	869.000.0	878.800.0	820.200.0
Uch-Kurgan HPP	1.023.200.0	1.085.200.0	840.500.0	877.300.0	827.500.0
At-Bashi HPP	133.600.0	70.500.0	92.800.0	144.700.0	146.600.0
Kambarata HPP-2					12.900.0
CHP, Bishkek	824.200.0	803.300.0	1.000.600.0	948.200.0	787.200.0
CHP,Osh	16.300.0	200.0	11.400.0	15.800.0	0.0
Total	**14.325.900.0**	**14.644.800.0**	**11.620.500.0**	**10.889.300.0**	**11.857.200.0**

Source: State Department for fuel and energycomplex managementof the Ministry of Energy and Industry of the Kyrgyz Republic

Electric power consumption and losses

In 2010, the average electricity consumption per capita was 680 kWh per year, based on the net supply rate of electricity to the public of 3,646.8 million kWh. The most energy is use in the Chui region. The 2010 electricity consumption by regions and cities at the national level per capita is shown in Table 7.3.

Table 7.3. Electricity consumption per capita in 2010

Name of region	Consumption, kWh
Bishkek (city)	919.4
Osh (city)	939.1
Chui	1.078.2
Naryn	811.9
Issyk-Kul	655.3
Talas	695.6
Osh	349.6
Batken	412.0
Jalal-Abad	502.0
National average	**680.0**

Source: calculations based on data from NSC

98% of citizens have access to electricity, except for those who live in remote mountain areas where there are mostly local and temporary dwellings, for the grazing of livestock. Due to the lack of power lines in these areas, it is necessary to arrange autonomous power supplies from renewable energy sources, in particular, through the installation of micro-and small HPPs on mountain rivers, solar panels, etc.

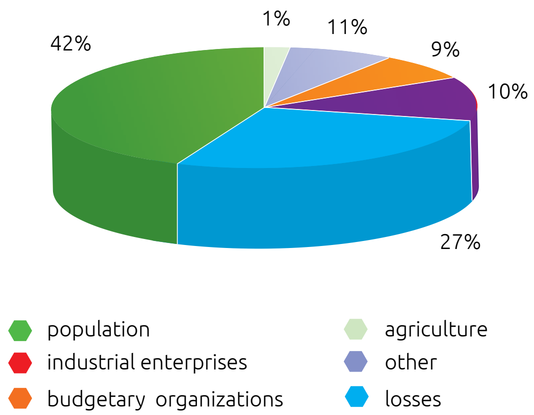


Figure 7.1. Electricity consumption in 2010

Table 7.4. Electricity consumption by user (thousands of kWh)

Year	Effective supply of the consumers, losses					
	industry	budget	agriculture	population	other	losses
2007	820.756.8	762.470.4	56.034.4	3.898.418.0	964.405.3	3.710.847.3
2008	732.001.0	784.359.5	92.786.7	3.515.104.1	1.044.856.5	2.875.724.5
2009	813.328.7	709.873.9	85.648.0	3.445.959.9	1.081.083.5	2.113.797.0
2010	**820.359.5**	**784.087.9**	**81.260.4**	**3.646.833.2**	**991.105.4**	**2.327.578.8**

Source: Ministry of Energy and Industry

Electricity losses gradually reduced as a result of continuous, consistent monitoring and in 2008 amounted to 31.6%, 25.6% in 2009, and 26.7% in 2010. The main causes of energy losses include network overload, the absence or inproper use of meters, incomplete record of electricity consumers and the theft of electricity.

In 2011, according to preliminary data from the Ministry of Energy and Industry of the Kyrgyz Republic, electricity losses during its transit to the distribution companies was 22.2%, and the losses during its distribution by these companies was as follows: the loss of electricity received by the distribution companies, was 22.2%, and the level of losses by distribution companies is as follows:

- JSC Severelectro - 23.5%, 1.5% less than 2010;
- Vostokelektro - 23%, 8.1% less than 2010;
- JSC Oshelectro - 19.5%, 6.8% less than 2010;
- JSC Jalalabatelectro - 20%, 8.7% less than 2010.

Final energy consumption

The energy sector, through its use of different fossil fuels, coal, natural gas, and petroleum products, creates the most industrial gas emissions. Final energy consumption is the consumption of energy supplied for use as energy; both the total volume and that consumed by major users (transport, industry, services, agriculture and households) and is measured by international standards in thousands of tonnes of oil equivalent. The trend in final energy consumption, as a whole, shows how much progress has been made in reducing energy consumption and the environmental impact by different final consumers.

Over the last 3 years there has been a trend of partial production, import and export of energy resources in the Kyrgyz Republic, with relative preservation of consumption. A positive aspect of the fuel and energy balance is the reduction oflosses, which shows the effectiveness of the use and consumption of energy resources, as well as a reduction of the environmental impact. (Table 7.5). However, in 2010, there was a partial increase in losses (687 thousand tonnes of oil equivalent) compared to 2009 (667 thousand toe).

Table 7.5. The fuel and energy balance of the Kyrgyz Republic

Balance structure, thousand tons of oil equivalent	2007	2008	2009	2010
Resource total	6533	6318	5885	5586
Mining (production)	3545	2963	2831	3047
Imports	2570	2912	2469	2049
Other receipts	91	99	111	60
Beginning of year balance	327	344	474	430
Distribution total	6533	6318	5885	5586
Domestic consumption, including:	4039	4259	4079	3905
For conversion into other types of energy[1]	683	769	685	557
For production,technological and other needs[2]	3356	3490	3394	3348
Export	1075	699	667	500
Losses	1079	897	667	687
Year end balance	340	463	472	494

1- electro- and thermo power *2- including sales to the general public*
Source: NSC

The highest value of final energy consumption for the period of 2007-2010 was in 2008 at 4488.5 thousand tons of oil equivalents, while the lowest was in 2010 at 4081.2 thousand tons of oil equivalent (Table 7.6). In Kyrgyzstan, data for the consumption of energy in the energy mix before 2008 was counted in conventional values - tons of conventional fuel, and after 2008, reporting was based on international requirements in tonnes of oil equivalent.

Table 7.6. The volume of final energy consumption by the main users (thousands of tons of oil equivalent)

Volume of energy consumed by major users:	2007	2008	2009	2010
Domestic	1795.5	1831	1716.7	1712.5
Industry	946.5	919.1	699.6	797.6
Construction	49.5	76.1	105	49.5
Agriculture	252.9	231.1	218.1	160.2
Transport	305.6	366.9	419	359.1
Service industry	925	1064.2	1121.2	1000
Final energy consumption	4275.1	4488.5	4279.5	4081.2

Source: NSC

For the period 2007-2010, domestic use accounted for approximately 42% of the final energy consumption, followed by the service sector(24%), industry (19%), and transport (9%) (figure 7.2). The analysis shows that some households reduced energy resources consumption, which is a positive dynamic. Overall, in 2010, the main users reduced energy consumption, and the greatest reduction was in the construction sector at over 50%.

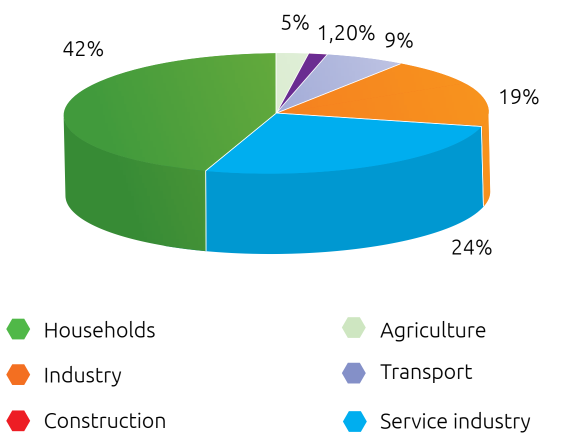


Figure 7.2. Final Energy consumption by economic activity in 2010

Domestic energy consumption was mainly for heating, lighting and cooking. Energy consumption in the service sector is dominated by commerce, government and healthcare.

Total energy consumption

Traditionally, energy has been considered a key element of economic progress, but current energy production and consumption, produces a negative impact on the environment. For example, in the case of coal being used as a fuel, the degree of impact is based on the high levels of pollutants, whereas natural gas is one of the environmentally friendly fossil fuels. Renewable energy sources have the lowest impact on environment. The index of total energy consumption, which reflects its cumulative consumption and consumption by fuel, is an indicator of power engineering development and appropriate levels of energy consumption. It shows the total consumption of energy resources within the country by all types of economic activity.

Total energy consumption is the key element of energy balances and reflects the actual consumption. The calculation of this indicator requires the use of data on the real, and not actual consumption and it is calculated based on a formula which takes into account production, exports, imports, and changes in fuel stocks.

Since 2008, data on energy consumption in the fuel and energy balance are maintained by the Kyrgyz National Statistics Committee in tons of oil equivalent (toe).

In 2010, the majority of fuel consumed was by the electricity industry (2186 thousand toe) - 46%, coal (784.2 thousand toe) - 16%, and gasoline (456.5 thousand toe) - 9% (figure 7.3). For the period 2007-2010, the amount of fuel oil used increased from 43.5 thousand toe. to 128.9 thousand toe, or by almost 3 times.

According to the strategy for the development of fuel and energy sector until 2025, after the commissioning of Kara Keche TPP, coal production will increase from 574.9 thousand tons in 2010 to 3 million tons in 2025, which will significantly affect the amount of energy consumed and negatively affect the environment.

Table 7.7. Total energy consumption by fuel

	Measurement unit	2007	2008	2009	2010
Total energy consumption, including:	Thousand toe	**5.425.1**	**5.456.7**	**5.020.5**	**4813.1**
Coal	Th. toe	651.8	852.5	840.3	784.2
	Th. tons	1.310.7	1.741.5	1.703.9	1.592.2
Oil	Th. toe	141.5	141.9	84.5	102.4
	Th. tons	136.8	134.9	79.0	97.1
Natural gas	Th. toe	715.1	694.5	301.9	274.5
	Mln. cubic meters	670.4	639.9	254.5	236.5
Diesel fuel	Th. toe	264.3	276.2	333	321.9
	Th. tons	259.8	271.4	327.8	316.7
Motor gasoline	Th. toe	428.1	481.8	535.6	456.5
	Th. tons	405.3	455.6	508.3	433.2
Aviation kerosene	Th. toe	263.5	308.4	358.6	253
	Th. tons	243.6	285.0	331.4	253.0
Fuel oil	Th. toe	43.5	42.9	166.7	128.9
	Th. tons	43.9	42.3	168.2	130.1
Electricity	Th. toe	2.586	2.326	2.087	2.186
	Mln. cubic meters	7.672.7	7.334.0	7.134.5	7.447.3
Thermal energy	Th. toe	331.3	332.5	312.9	305.7
	Thousand of G-calories	2.600.7	2.604.3	2.384.4	2.393.9

Source: NSC

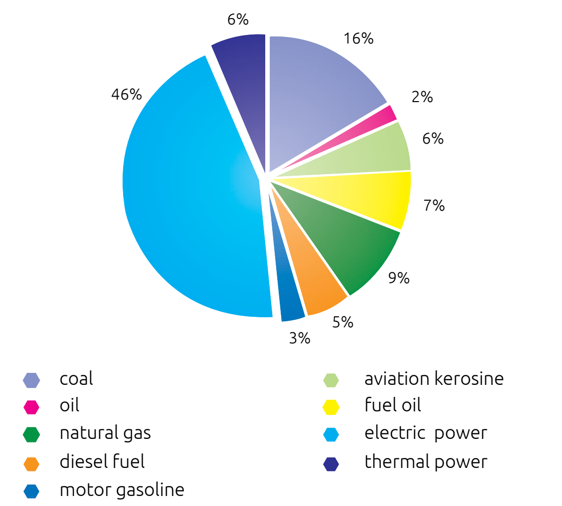


Figure 7.3. Energy consumption by fuel type in the Kyrgyz Republic in 2010

Energy intensity

Energy intensity is a measure of sustainable development and its dynamics characterizing the level of energy consumption efficiency in the country. Energy intensity is defined as the ratio between the final energy consumption and GDP, calculated for a calendar year at constant prices. Energy intensity indicates the general correlation between energy consumption and economic development, and provides a framework for the evaluation of energy consumption and its impact on the environment as a result of economic growth.

Measurement unit - thousands of tonnes of oil equivalent (thousand toe) per unit of GDP at constant prices.

Renewable energy sources

The potential renewable energy sources (RES) of the country, that are actually available with the current level of technology development and technologies is 840 million tons of coal equivalent per year. Currently, the practical use of renewable energy sources is insignificant and it makes up only 0.17% of the country's overall energy balance. The most technically prepared for common use are developments for heating by solar energy and biogas technologies, and electricity based on wind power, small rivers and solar photovoltaic plants.

The development of small hydroelectric plants should be implemented through the rehabilitation and construction of small HPPs. The aggregate hydropower potential of the surveyed areas of the republic is represented by 172 rivers and streams, with flow rates from 0.5 to 50 cubic m/s, more than 80 billion kWh per year, of which 5-8 billion kWh a year is technically acceptable for the use or development.

According to proposals by experts, there is a possibility for the construction of 92 new small HPPs with a total capacity of 178 MW, and an annual output of upto 1.0 billion kWh of electricity. Thirty-nine of the existing small HPP, with a total capacity of 22 MW and an

Table 7.8. Energy intensity indicators

Category	Measurement unit	2007	2008	2009	2010
Final energy consumption	Th. toe	3.520.6	3.767.1	3.578	3.347
Total energy consumption	Th. toe	5.130	5.170	4.762	4.605
Gross domestic product (GDP)					
at 2005 market prices in the national currency (KGS)	Mln. KGS	112.906.2	122.390.7	125.922.2	125.316.8
In purchasing power parity (PPP) in U.S. dollars (constant 2005 prices).	Mln. USD	9.945.1	10.780.6	11.091.8	10.941.2
The energy intensity to final energy consumption					
at 2005 market prices in the national currency (KGS)	Toe/ 1000 KGS	0.031	0.030	0.028	0.027
In purchasing power parity (PPP) in U.S. dollars (constant 2005 prices).	Toe/ 1000 USD	0.35	0.35	0.32	0.27
Energy intensity of total energy consumption					
at 2005 market prices in the national currency (KGS)	Toe/ 1000 KGS	0.045	0.042	0.038	0.037
In purchasing power parity (PPP) in U.S. dollars (constant 2005 prices).	Toe/ 1000 USD	0.51	0.48	0.43	0.38

Source: NSC

annual output of 100 million kWh of electricity, can be rehabilitated. Proposals were made for the construction of seven HPPs on irrigation reservoirs with an installed capacity of 75 MW and an annual power generation of about 220 million kilowatt-hours.

All of these HPPs could be important for supplying electricity to mountainous and rural areas with the developed hydrographic network, where construction of large power transmission lines is unprofitable economically.

Currently, six licensed companies (JSC Chakan HPP, LLC Kalinin HPP, LLC Ark, the ICC Maryam, JSC Kadamzhai Antimony Plant, and LLC Naiman HPP) operate small HPPs with a total power generation of 191.4 mil.kilowatt/h, which is 1.6% of the total electricity production in the country for 2010 (Table 7.9).

Also, a small number of micro-HPPs that use electricity for their own (–mostly domestic) needs are operating in the country. No records of either generated or consumed electricity is maintained for these entities. To operate a micro-HPPs, no permits or licenses from the authorities are required. About 110 thousand square meters of solar installations were set up in the country and were being used at various industrial and agricultural facilities, as well as in housing and households, of which no more than 15-20% are currently being used.

Wind energy is used for generating and supplying electricity to individuals through the use of small wind turbines, which generate 1-5kW of electricity in areas where there is a wind strength of 10-12m/s, e.g. mountain passes and valleys. Balykchy, in Issyk-Kul region, is the place with the greatest number windy days, up to 120 days, whereas in other places it is only up to 40 days. In different areas of the country, wind facilities were established with a generating capacity of 4 kW. Assessment of the potential use of renewable energy sources (RES) shows that a square meter of solar panel can produce 5700 MJ of thermo power per year. In the Kyrgyz Republic, the average annual sunshine is 2,630 hours, which is slightly lower than Uzbekistan (2,870 hours) and Turkmenistan (2,900 hours).

Table 7.9. Electricity generation by small HPPs in Kyrgyzstan

HPP	Measurement unit	2006	2007	2008	2009	2010
JSC Chakan-HPP	Th. kWh	157.050.4	151.482.8	141.590.3	161.144.4	173.902.9
Kalinin HPP	Th. kWh	8.054.4	7.011.3	5.865.8	7.380.1	6.440.2
Issyk-Ata HPP	Th. kWh			1.557.3	9.092.8	10.882.2
Naiman HPP	Th. kWh					226.7
Total RES	Th. kWh	165.104.8	158.494.1	149013.4	177617.4	191.452.0
Proportion of RES of total energy generated	%	1.1	1	1.2	1.6	1.6

Source: State Department for fuel and energy complex management of the Ministry of Energy and Industry of the Kyrgyz Republic

The use of alternative energy sources is restricted by several factors, mainly the high cost of electricity compared with its generation at the lower Naryn HPP cascade and the average sale prices of these energy sources.

Thermal water resources (geothermal energy sources) with temperatures of 40-60 degrees Celsius, have an energy capacity of 613 million GJ per year, and 70% of them are situated in the north of the country. Internationally, such water is mainly used for the heating and cooling of various objects using heat pumps and peak water heating, as well as for spa purposes. In the short term, there is the potential to develop about 27% of the geothermal water reserves, giving an energy capacity of approximately 170 thousand GJ per year. Of those that should be considered for development are Ak-Suu, Issyk-Ata, Jergalan, Jeti-Oguz, Jalal-Abad, and others with currently operational health resort complexes, the transfer of which on their own thermal sources is very important.

Micro hydro power station installed by UNDP in Issyk-Kul region. © UNDP

PART 8
Transport

The transport system in the Kyrgyz Republic consists of rail, road, pipeline, air and water transportation. Transport's proportional share of the GDP has grown from 2.8% in 2006 to 4.8% in 2011 (table 8.1).

Table 8.1. Share of transport sector in GDP of Kyrgyz Republic

	2006	2007	2008	2009	2010	2011
Total GDP	113.800.1	141.897.7	187.991.9	201.222.9	220.369.3	273.107.8
Transport	3.. 191.5	4.697.9	7.539.2	9.485.6	10.571.0	13.072.9
% of GDP	2.8	3.3	4.01	4.7	4.8	4.8

Source: NSC

By 2011, Kyrgyzstan's public transport network consisted of 34,000 km of roads and 425.3 km of railways.

18,810 km of the country's roads are serviced by the road units of the Ministry of Transportation and Communications, and 15, 190 km of roads are the responsibility of cities, towns, villages and agricultural and industrial enterprises. 4,163 km of roads are of international importance 5,678 km of state importance and 8,969 are of local significance. In general use are 7,228 km of paved roads, 9,961 km of gravel roads and 1,621 km of dirt roads.

Of the country's 425.3 km of railways , there are 260 km of dead end tracks in the stretch from Chaldybar station at the border with Kazakhstan to Balykchy on the lakeshore of Issyk-Kul, and dead ends of various lengths, between 6 to 34 km, in the Fergana valley in the south.

Travel by train is one of the most popular modes of transport for travelling long distances (mainly internationally)and has comparatively cheap passenger and freight costs.

Water transport is only possible at Lake Issyk-Kul with a maximum possible travelling distance of 160 km. In the country's overall freight turnover, transportation by boat accounts for 0.14%. Due to the mountainous terrain and seasonal river flow, there is not a single river in the country that can be used for the transportation of passengers and freight.

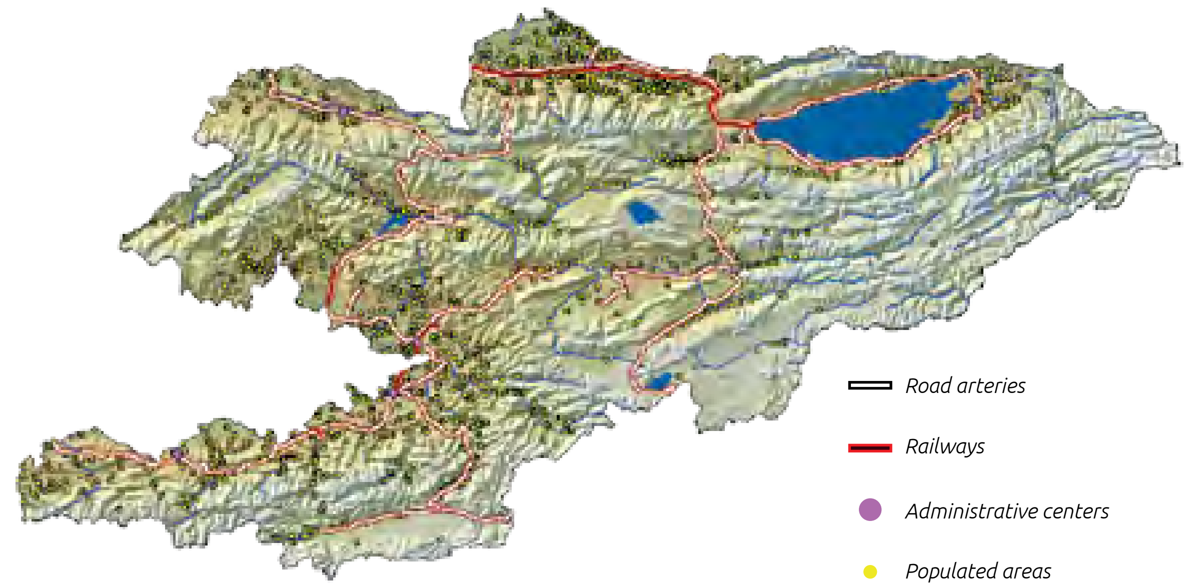


Figure 8.1 Main road arteries in Kyrgyz the Republic

Passenger turnover

Passenger turnover is vital for modifying the development of different modes of transport. Travelling is an important component of the economic and social life of a community. The continual growth in demand for transport, particularly in motor vehicle transportation, raises serious concerns over the possible development of environmental and health problems, especially related to air pollution, noise and the withdrawal of land from productive use. The importance of developing a policy that would distribute transport services among different modes of transport is determined by the uneven environmental friendliness of the various forms of transport. Electric modes of transport are more environmentally friendly than other types.

From 2006 to 2011, the yearly average passenger turnover in the country was equal to 7654.7 million passenger-kilometers, (mill. pass. km) and was provided by three categories of transport: Road– 6856.1 mill. pass. km, rail– 83.5 mill. pass. km and air – 715.2 mill. pass. km.

From 2006 to 2011, the total number of passengers increased by 24.7%, from 453.69 million people to 565.8 million people (table 8.2) The majority of passengers travelled by private vehicle. In 2011, the amount of passengers that used buses grew by 30.8 million passengers in comparison to the previous year, and their proportional passanger share was 93%.

It bears mentioning that use of trolley buses, as a more environmentally friendly mode of transport, almost halved over the period, from 42.7 million people in 2006 to 23.8 million people in 2011. Beginning in 2010 there has been a partial growth in the use of trolley buses due to an upgrade of the fleet. In 2011, the number of people travelling by air to 707.5 thousand people, almost a three fold increase on the figures from 2006. The use of trains in 2011 decreased to 608.4 thousand passengers, compared to the figure of 711.3 thousand for 2010, but this is still 1.3 times more passengers than 2006.

When compared to the previous year, the number of passengers in 2011 showed an increase of 32.9 million people. In 2011, a growth in the volume of passengers using all modes of transport could be seen throughout the country, except in Batken oblast and the city of Osh.

Table 8.2. Passenger turnover

	2006	2007	2008	2009	2010	2011
Passengers (million people) including by mode of transport:	**453.6**	**470.7**	**504.3**	**545.7**	**532.9**	**565.8**
Rail	0.45	0.43	0.64	0.75	0.71	0.61
Bus	403.5	436.2	474.4	510.5	492.6	523.4
Taxi	6.8	9.1	11.5	12.9	14.5	17.26
Trolleybus	42.7	24.7	17.4	21.1	24.6	23.8
Air	0.23	0.28	0.37	0.36	0.46	0.71

	2006	2007	2008	2009	2010	2011
Passenger turnover, million passengers - including by mode of transport:	**6.538.5**	**7.037.4**	**7.541.0**	**7.834.7**	**8.122.4**	**8.854.1**
Rail	61.5	59.9	90.2	106.1	98.7	84.4
Bus	5.816.6	6.162.6	6.508.6	6.806.8	6.810.0	6.915.6
Taxi	129.3	204.3	235.8	265.0	298.6	356.2
Trolleybus	170.9	101.3	71.1	84.9	100.9	97.6
Air	360.2	509.3	635.3	571.9	814.2	1400.3

Source: NSC

Freight turnover

The distribution by type of transport is the driving force, which characterizes the volume of supplies to the country. Its analysis allows us to improve policies that promote the redistribution of freight using modes of transport that meets healthcare and environmental requirements.

Freight turnover in Kyrgyz Republic is mainly provided by two forms of transport: by road 1,300.3 million ton-kilometers and by rail 797.4 million ton-kilometers, which account for 55.1 % and 33.8 % respectively for 2011. (Table 8.3)

In 2011, the volume of freight transported by all modes of transport increased by 773.9 thousand tons compared to 2010, and was 1.4 times more than that of 2006. The growth in the volume of road shipments was secured by entrepreneurs (individuals and businessmen), whoe had a 64% share of the total road freight shipments. In comparison to 2006, transport by rail dropped by 1.8 times, by pipeline it dropped by 2.2 times and by water it plunged by 3.2 times.

In 2011, freight turnover by all modes of transport increased by 178.9 million ton-kilometers compared to 2010, and exceeded 2006 indexes by 531.2 million ton-kilometers. This increase in volume could be seen everywhere except for the city of Osh.

Table 8.3. Freight turnover

	2006	2007	2008	2009	2010	2011
Freight transportation (million tons) including:	**27.4**	**30.0**	**34.3**	**36.3**	**36.9**	**37.7**
By rail (thousand tons)	1.911.1	2.284.8	1.816.3	1.044.4	1.032.1	1.034.7
By road (thousand tons)	24.9	27.1	31.9	35.0	35.6	36.4
By water (thousand tons)	34.6	26.5	42.6	23.4	16.0	10.8
By air (thousand tons)	0.7	0.6	0.9	0.9	1.0	1.3
By pipeline (thousand tons)	597.6	607.6	589.2	252.3	255.5	270.2
Freight transportation, (million ton-kilometers) including:	**1.825.8**	**2.021.6**	**2.338.3**	**2.140.7**	**2.178.1**	**2.357.0**
Rail	751 7	848.9	945.5	744.5	737.7	797.4
Road	819.0	902.5	1.113.9	1.256.4	1.281.5	1.300.3
Water	6.3	4.8	8.0	4.4	3.0	2.0
Air	34.2	47.1	59.4	45.4	64.4	111.0
Pipeline	214.6	218.3	211.5	90.0	91.5	146.3

Source: NSC

There was a growing volume of transit freight through Kyrgyzstan. The volume of transit freight transported by road in 2011increased by 18.8 times in comparison to 2006, and amounted to 239.1 thousand tons (Table 8.4)

Table 8.4. Volume of transit freight through the Kyrgyz Republic

Year	Net weight, tons	Cost	
		Thousand USD	Thousand soms
By road			
2006	12.728.91	26.841.13	1.055.014.71
2007	41.861.92	89.173.95	3.307.408.86
2008	48.614.11	107.951.54	3.992.271.50
2009	75.907.36	85.147.58	3.638.082.91
2010	105.224.76	87.011.42	4.009.728.62
2011	239.108.93	352.092.21	16.175.333.03
By air			
2006	1.725.19	54.037.13	2.188.198.85
2007	429.84	4.330.56	165.665.99
2008	1.192.99	7.940.81	279.244.52
2009	1.803.54	230.271.68	9.972.439.67
2010	76.38	62.598.78	2.908.585.76
2011	136.78	333.811.10	15.220.290.05

Source: State Customs Service

Content and age of the vehiclefleet

Transport is a significant source of polluting emissions, greenhouse gases, and also has other adverse effects on public health and the environment. These effects increase with the age of vehicles. This is a driving forcebehind a measure of the the technical condition of the fleet in terms of its age. The priority of the state policy on transport development should be the improvement of the fleet by replacing old motor vehicles with new ones, and less environmentally friendly vehicles with new, more environmentally friendly ones.

Vehicles play a vital role in the development of market infrastructure and the growth of internal and external trade. Fuel consumption by vehicles, construction machinery and agricultural equipment is 90-98%, in addition, the environmental impact of vehicles also increases.

The European Program for Transport, Environment and Health, requires the implementation of national systems to monitor the use of old vehicles, make necessary changes to tax systems and improve the national motor vehicle certification system. Concurrently, new cars should already be meeting the EURO standards that limit air pollution emissions.

An analysis of the operational car fleet, indicates that during the period from 2006 to 2010, in most regions of the country, the number of vehicles has risen multiple times. (Table 8.5) In Jalalabad and Chui regions, the number of vehicles has risen 1.8 and 1.5 times respectively, and in Osh city by 2.2 times.

A significant effect on the environment and social-economic development, especially at a regional level, comes from the seasonal increase of vehicles. An analysis of transport movements through the ecological posts of Issyk-Kul, Kyzyl-Ompol and Karkyra, indicates that each year, the Issyk-Kul biosphere, which has the same borders as those of the Issyk-Kul region, is visited by approximately 100 thousand vehicles. The highest figures were recorded in 2008, totaling 129,496 vehicles, while the lowest figures, 72,747 vehicles, were in 2010. (Table 8.6) The ecological posts of the Issyk-Kul biosphere only register visiting vehicles. An increase in the number of visiting vehicles, leads to an increase in environmental pollution and the burden on the road infrastructure.

The annual averages for 2006–2011 indicate the uneven flow of visiting vehicles. The maximum burden of approximately 60% of the annual traffic occurs during the peak of the tourist seasonin July (29.5%) and August (30.1%) (Table 8.2). Of the total number of visiting vehicles, approximately 15% are registered outside the country.

Table 8.5. The number of registered vehicles in different regions of the Kyrgyz Republic

Region	2006	2007	2008	2009	2010
Batken	10,396	10,794	11,408	14,968	14,390
Jalalabad	23,362	25,614	36,038	39,447	39,396
Naryn	8,515	9,499	7,397	7,343	7,599
Osh	27,902	28,374	37,931	48,243	50,824
Talas	8,889	9,043	9,039	9,039	9,087
Chui	69,924	73,801	112,190	102,072	103,494
Osh (city)	14,190	14,428	25,887	31,555	31,523

Source: NSC
Note: Data for the Issyk-Kul region and Bishkek is classified information.

Table 8.6. Movement of visiting vehicles through the ecological posts of the Issyk-Kul biosphere

Month	2007	2008	2009	2010	2011	Av. %
January	2,101	2,220	1,965	2,297	2,558	2.2
February	2,417	3,130	1,954	2,782	2,849	2.6
March	3,050	3,698	2,373	4,143	3,794	3.3
April	2,978	3,557	2,714	1,800	5,052	3.1
May	3,647	4,371	3,351	3,196	5,347	3.9
June	10,651	10,626	8,248	5,356	9,504	8.6
July	31,110	45,573	28,922	16,680	29,370	29.5
August	34,399	41,110	36,462	17,435	25,407	30.1
September	6,226	5,065	5,550	5,533	6,087	5.5
October	3,776	4,051	4,392	5,176	4,813	4.3
November	4,122	3,560	3,463	4,882	4,395	4.0
December	3,032	2,508	2,981	3,467	3,231	3.0
Total:	107,509	129,469	102,375	72,747	102,407	100

Source: Director General's office of the Issyk-Kul Biosphere

The annual averages for 2006–2011 indicate the uneven flow of visiting vehicles. The maximum burden of approximately 60% of the annual traffic occurs during the peak of the tourist seasonin July (29.5%) and August (30.1%) (Table 8.2). Of the total number of visiting vehicles, approximately 15% are registered outside the country.

Significant numbers of vehicles are being imported each year. The largest number of vehicles were imported (according to customs receipt voucher - CRV) in 2008, equaling 95 316 units, while thesmallest amount was imported in 2010 (27 900 units). In 2011, 59 504 units were imported. (Table 8.7)

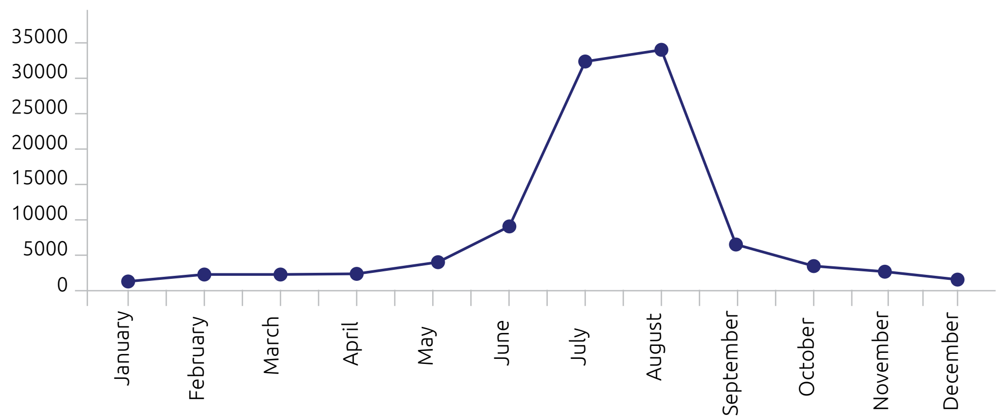


Table 8.2. The average number of visiting vehicles to the Issyk-Kul Biosphere for 2005– 2011, by month

Of the total number of motor vehicles imported from 2006 to 2011, more than 90% were cars. In 2011 alone, 52,704 cars were brought in. (Figure 8.3).

An analysis of vehicle age indicates that the fleet is aging. A significant number of motor vehicles are reaching the end of their service life. Old cars are a far greater source of environmental

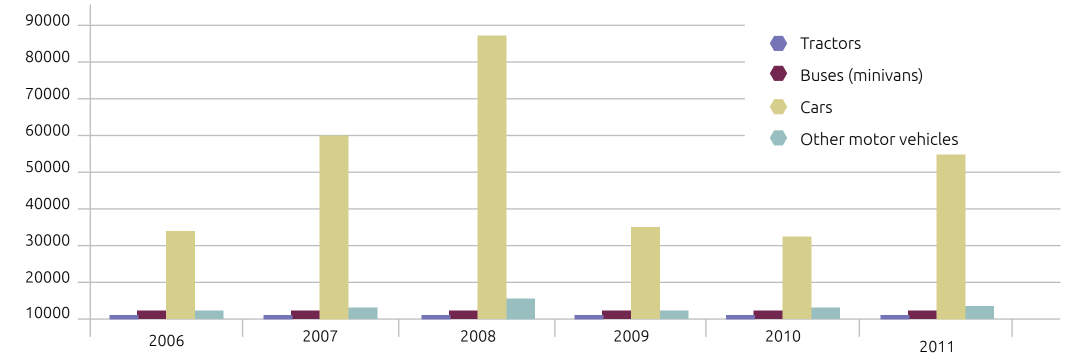


Figure 8.3 Motor vehicles imported by CRV

Table 8.7. Number of imported vehicles, registered by individuals by CRVs, classified by age

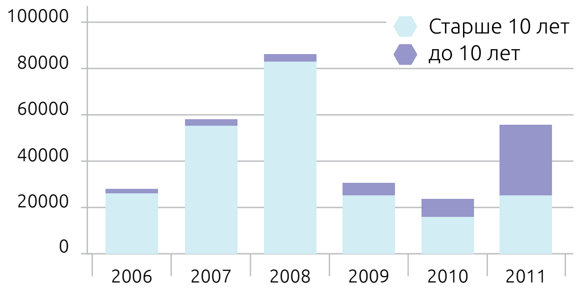
Year	Vehicle	Up to 2 years old	2 to 5 years old	5 to 10 years old	More than 10 years old	Total
2007	Tractors		30	33	307	370
	Buses (Minivans)		10	11	1 750	1 771
	Cars (passenger cars)		581	1 207	58 824	60 612
	Goods vehicles		94	84	2 427	2 605
2008	Tractors		119	87	191	397
	Buses (Minivans)		4	8	1 297	1 309
	Cars		1 127	4 616	81 748	87 491
	Goods vehicles		337	1 019	4 763	6 119
2009	Tractors		8	112	57	177
	Buses (Minivans)		1	10	248	259
	Cars		647	4 176	22 275	27 098
	Goods vehicles		86	641	1 802	2 529
2010	Tractors	2	5	76	51	134
	Buses (Minivans)		1	13	189	203
	Cars	98	479	6 678	17 383	24 638
	Goods vehicles	22	19	568	2 315	2 924
	Special Purpose vehicles				1	1
2011	Tractors	11	45	198	152	406
	Buses (Minivans)		1	14	74	89
	Cars	349	1209	26 761	24 385	52 704
	Goods vehicles	258	74	2710	3262	6304
	Special purpose vehicles				1	1

Source: SCS

pollution than newer ones. Before 2009, a huge numbers of cars with a service life exceeding 10 years were being imported. This is clearly shown in the pattern of vehicle imports. (Figure 8.4).

In order to limit the import of old motor vehicles, at the end of 2008, the rate of single customs duty was increased by 11 times[16], for cars whose service life exceeded 13 years. In 2008, the service life of 81,748 imported motor vehicles exceeded 10 years, in 2009 there were only 22,275 such imports. Moreover, in 2011 there was a positive decrease in the import of cars with a service life exceeding 10 years, and this equates to 46.2% of the total import by CRV (in contrast

[16] Resolution by the government of Kyrgyz Republic, on the changes and amendments of the Kyrgyz government resolution dated 31.12.2004, #976 "On the ratification of instructions for the movement of goods and automobile transport through the state border of Kyrgyz Republic by individuals" dated 21st November 2008 # 632



Source: NSC

to 93.4% in 2008), and the import of newer cars with a service life ranging from 5 to 10 years equaled 50.8%. The import of cars from other age groups remains unchanged: 2.3% for those with a service life of 2 to 5 years and 0.7% for those with less than 2 years.

For the whole period of 2006 to 201,1 there is a negative tendency to import buses (minivans) with a service life of more than 10 years. In 2010, out of the 203 imported buses (minivans), 189 had service life of more than 10 years, and in 2001 of the 89 vehicles imported, 74 had service life of more than 10 years.

Consumption of fuel & energy resources

In recent years, due to a rapid and steady growth in numbers, vehicular transport has become the main source of environmental pollution in cities and towns.

The overwhelming majority of fuel was consumed by vehicles, whose share in total consumption of fuel & energy resources by transport fell from 99% in 2008 to 85% in 2010. Diesel fuel is mainly used byagricultural machinery, equipment and vehicles, while aviation fuel is mainly consumed by the air industry.

As the figures for fuel consumption indicate, the consumption of gasoline by vehicles increased by 1.3 times, from 273.3 thousand tons in 2006 to 368.5 thousand tons in 2010. The consumption of diesel fuel over the last 5 years has also increased by 1.7 times, growing from 99.9 thousand tons in 2006 to 171.6 thousand tons in 2010 (Table 8.8).

With the increase of vehicles and consumption of fuel and energy resources in recent years, there is an increase in the number of gas stations, both active and under construction. In Bishkek alone, the number of gas stations increased by 33.3%, with 62 gas stations in 2006, and 93 in 2011. (Figure 8.5)

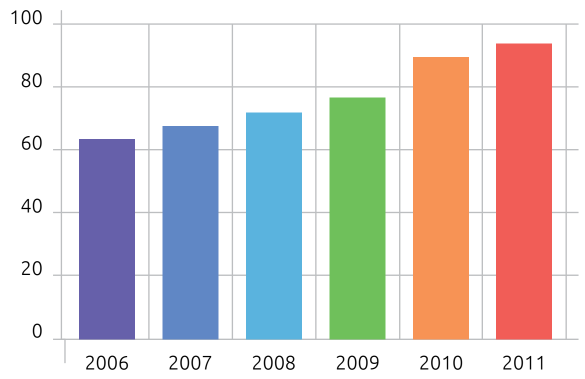


Figure 8.5 The increase in gas stations in Bishkek during 2006 - 2011.

Quite often, gas stations operate in violation of environmental legislation. Gas stations are being built in plantation areas, close to residences, near the water conservation zones of rivers, canals and ponds, and without any system for the filtration of rain-water run-off or the necessary protection of ground waters. Such accidental location of gas stations leads to a significant deterioration of the environmental situation and the increased risk of potential accidents.

National fuel quality standards

The main toxic air pollutants are lead and heavy hydrocarbons from vehicle fuel. The quality of the fuel must meet the requirements for clean fuels.

According to the list of items that require mandatory certification, approved by the decree of Kyrgyz government On the mandatory quality conformity of a product, dated 30th December 2005, #639, the mandatory certification of fuel is carried out in accordance with government standards GOST P 51313-99 and GOST 2084-77, and in accordance with the requirements for the maximum permissible amount of lead in gasoline with performance number AI 98 or less and AI 95 or less, which should not exceed 0.013 gr/liter. Certification of diesel fuel is done in accordance with GOST 305-82, the sulfur content of which, depending on performance number of the fuel, should not exceed 0.2% to 0.5% of sulfur mass fraction. According to information from the Standardization and Metrology Center under the Ministry of Economy and Anti-monopoly regulation of the Kyrgyz Republic, over the last 5 years, tests have shownthat there has been no excess of the maximum permissible amount of lead in gasoline or sulfur in diesel fuel.

Much of the emission of harmful substances into the environment also depends on the technical condition of vehicles. Due to the absence of ecological posts on the roads and at the country's border-control points, there is lack of: ecological control of harmful substance emissions from vehicles , radiation control, interception of illegal imports, control of the export and movement (transit) of environmentally hazardous freight (materials), flora and fauna, and raw materials that are harmful to environment. For this reason, it is impossible to identify the actual amount of vehicles that violate emissions standards. In 2010, according to RFNP&FD under the SAEPF, from 90,998 vehicles that voluntarily went through the instrumental measurement of carbon monoxide concentrations and exhaust fumes, only 268 or 0.2% of vehicles did not meet the required emission standards (Table 8.9).

An analysis of the development of the car-fleet in the Kyrgyz Republic and its environmental impact, indicates that an environmentally oriented transport policy should be based on tough environmental standards that correspond with acting international standards and an effective system of compliance control. Of great concern, is the impact of municipal transport on air quality in big cities, as they convey the largest number of passengers.

There is a necessity to increase the effectiveness of a state system for the monitoring and control of vehicles. The need for institutional and legislative reform is clear, as well as financing to equip the controlling institutions with modern vehicle diagnostics equipment.

Table 8.8. Relative share of fuel and energy resource consumption by transport (%)

Type	2006	2007	2008	2009	2010
Aviation fuel	100.0	94.0	100.0	99.9	100.0
Gasoline	98.8	99.3	99.0	89.1	85.0
Diesel fuel	71.0	61.4	66.5	49.5	54.2

Source: NSC

Table 8.9. Number of measurements and vehicle compliance with emission standards

	2007	2008	2009	2010	2011
Number of instrumental measurements of the carbon monoxide concentration and exhaust fumes	7.024	40.472	26.491	90.998	105.519
Number of vehicles that fail to comply with emission standards	-	-	-	268	-

Source: RFNP&FD under the SAEPF

PART 9
Wastes

In Kyrgyzstan, wastes are divided in to three main categories – consumption residual, production residual and radioactive waste. Consumption residual stands for products, materials and substances that have lost their usefulness due to physical wear or obsolescence. Consumption residual also includes solid domestic waste that appears as a result of human sustenance. This category of waste is usually managed by local state institutions, which organise waste collection, its transportation and disposal at specially designated areas.

Production residualis the remnants of materials, feedstock (raw materials) and semi-finished products that are used in the production process or during the performance of work and have fully or partially lost their application properties, as well as concurrent substances that are produced during the production process and cannot be used in it.

Generally, consumption and production residuals can contain hazardous wastes that have dangerous features (such as toxic or infectious properties, potentially explosive, flammable or highly reactive). If consumption residual, owing to its source of formation, contains low amounts of hazardous wastes, production residual can contain certain types and sufficient quantities of hazardous wastes that is directly or potentially hazardous to public health or the environment.

Over a long period of economic activities in the Kyrgyz Republic, huge amounts of solid and industrial wastes have accumulated in the country. Wastes containing radionuclides, saline of heavy metals (cadmium, lead, zinc, mercury), as well as toxic materials (cyanide, acids, silicates, nitrates, sulfates etc.) that have a negative impact on the environment and public health. According to statistical data, the total volume of generated and accumulated wastes grows each year. The areas allocated for waste burial are also growing, and all this is taking place amid a weak system of reducing the generation of wastes and recycling technologies.

The bulk of toxic wastes ise located in the Issyk-Kul and Batken regions. In the Batken region, the main sources of waste generation are the Khaidarkan mercury plant and the Kadamjai antimony plant. In Issyk-Kul region, the volume of wastes has soared since 1997, with the start of operations by the Kumtor gold-mining company.

A special challenge is the accumulation of waste dumps, overburdens, out of balance ores and tailings impoundments situated near populated areas, mountains and water catch basins etc. The greatest threat of contamination remains in the cross-border areas on the slopes of the mountain ranges that encircle the Ferghana and Chui valleys, the area close to the town of Mailuu-Suu and Shekaftar village, and others.

Generation and disposal of waste

The recycling and disposal of waste can be the source of environmental pollution and have a hazardous effect on humans. The intensity index of waste generation is the driving force behind the reaction to anthropogenic activity. It is linked with level of economic activity in the country and reflects production and consumption patterns, within the country. A decrease in waste generation indicates the shift of economic sectors towards less material-intensive patterns of production and consumption.

In 2010, Kyrgyzstan generated 6,921.4 thousand tons of waste, of which 5,745.9 thousand tons or 83% was hazardous (Table 8.9), and in 2011, 11,326.7 thousand tons of waste was generated, of which 5,876.2 thousand tons were hazardous.

Table 9.1. Waste generation in the Kyrgyz Republic for 2010-2011 (thousand tons/year)

Description of waste (thousand tons/year)	2010	2011
Agriculture, forestry and fishing	17.9	5.9
Mining industry and open pit mining	5606.8	5826.7
Manufacturing industry	156.1	4294.1
Construction	3.6	4.1
Other types of economic activity	22.4	22.1
Total volume of municipal waste	1114.6	1173.8
Total waste	**6921.4**	**11326.7**
Hazardous waste (from total waste)	5745.9	5876.2

Source: NSC

In 2010, 99.9 % of hazardous waste was classified as category IV waste (Table 9.2), and this remained the case in 2011.

Table 9.2. Classification of toxic waste generated in the Kyrgyz Republic by hazard tons

Year	Total hazardous waste	including				
		I class	II class	III class	IV class	V class
2010	5745.9	1.7	4.2	0.1	5739.8	0.1
2011	5876.2	1.6	1.3	0.1	5873.1	0.1

Source: NSC

In 2010, 97 % of all hazardous waste was created inthe Issyk-Kul region, and the same was true for 2011. Data is unavailable for the occurrence of hazardous waste in Osh and Naryn regions. (Table 9.3).

Table 9.3. Breakdown of hazardous (toxic) waste generationin the regions of Kyrgyz Republic, 2011 thousand tons

Name of region	Waste hazard class			
	I	II	III	IV
Batken	-	-	-	55.2
Jalal-Abad	0.0	0.0	0.1	0.1
Issyk-Kul	1.6	-	-	5.813.3
Chui	-	1.3	0.0	3.6
Bishkek (city)	0.0	0.0	0.0	0.9

Source: NSC

50 % of all the areas allocated for hazardous (toxic) waste disposal are located in Bishkek or its suburbs. 65 % of all areas allocated for waste disposal are located in the Issyk-Kul region. Data is unavailable for the Osh and Naryn regions. (Table 9.4)

Table 9.4. The number of areas allocated for hazardous (toxic) waste disposal and their total size in 2010 and 2011.

Name of region	Number of areas allocated for hazardous (toxic) waste disposal		total size (hectares)	
	2010	2011	2010	2011
Kyrgyz Republic	50	46	406.5	354.5
Batken	9	6	104.8	79.4
Jalal-Abad	5	14	5.0	5.6
Issyk-Kul	4	4	261.5	261.5
Chui	8	4	34.5	6.5
Bishkek (city)	24	18	0.7	1.5

Source: NSC

In addition to the data in Table 9.4, there are areas belonging to organizations that have temporary hazardous waste storage.

Table 9.5. Data on installations of hazardous waste storage that belong to the owners of the wastes 2010-2011*

Name of region	Number of installations		Area (hectares)		Volume of waste (thousand tons	
	2010	2011	2010	2011	2010	2011
Kyrgyz Republic	108	2011	604.6	666.7	84.858.9	94.929.5
Issyk-Kul	11	99	247.7	247.8	76.305.7	82.122.0
Jalal-Abad	6	11	3.4	3.4	0.6	0.7
Naryn	5	6	0.6	0.6	0.5	0.3
Batken	21	5	104.9	99.5	8.316.9	8.305.6
Chui	16	9	52.4	53.3	227.9	236.0
Bishkek	43	16	195.2	261.8	6.9	4.264.3
Osh	6	46	0.2	0.2	0.3	0.6

Source: NSC
**Table 9.4 data is considered*

Kyrgyzstan has accumulated more than 83 million tons of toxic waste, the bBulk of which is in the Issyk-Kul region(91.83% of the total) (Figure 9.1).

In 2010, Kyrgyzstan generated 1,114.5 thousand tons of municipal waste. 62 % of all waste generated is in Bishkek alone, a city with a population of 800,000 (Table 9.6)

In 2009, there was a rapid increase in the generation of municipal waste with a decrease in 2010 due to Bishkek city indexes.

The highest figures of per capita for municipal waste generation are from 2009 and equal to 490 kg/person. Population growth has fallen behind the level of municipal waste generation (Table 9.8). In 2011, 211.4 kg/person of waste was generated.

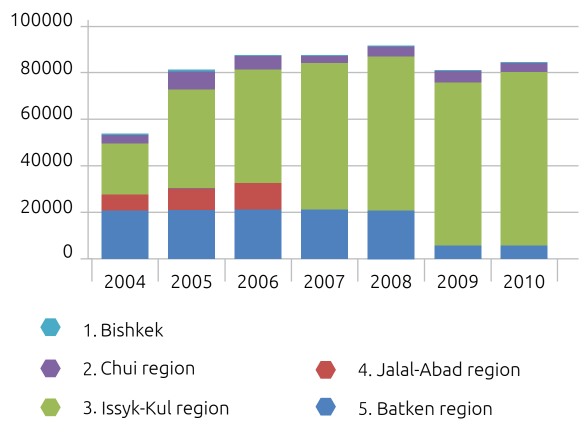


Figure 9.1 Toxic waste accumulation in the Kyrgyz Republic by region and Bishkek (city)(thousand tons)
Source: NSC

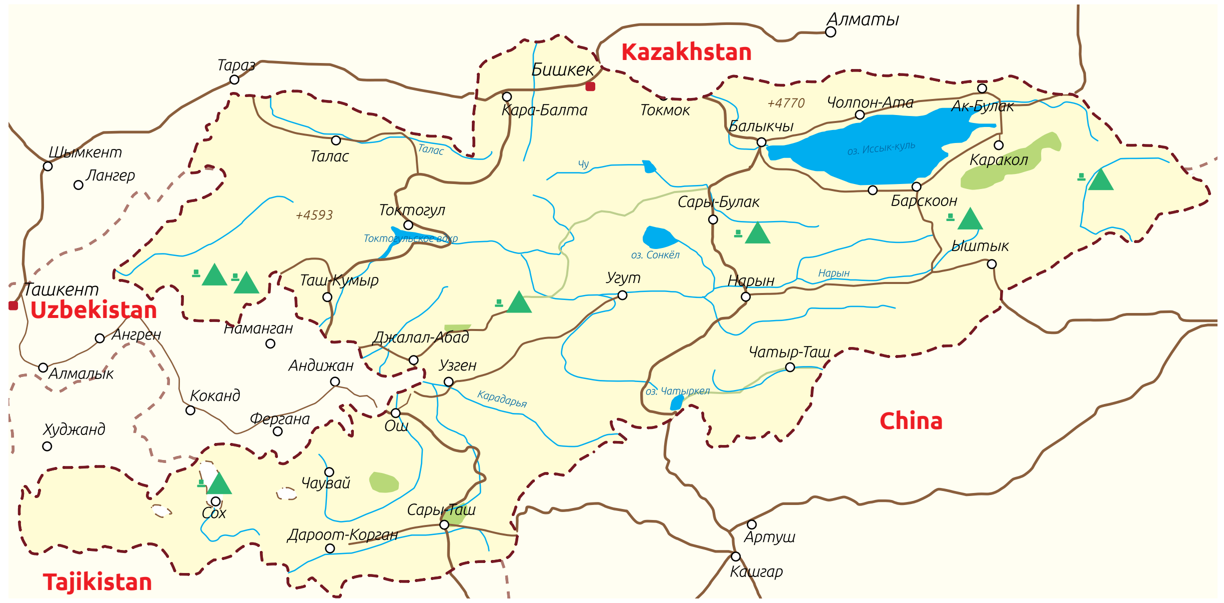


Figure 9.2 Location of toxic tailings dumps in the Kyrgyz Republic
Source: Public record of mining wastes of the Kyrgyz Republic

Table 9.6. Municipal waste generation by region in 2010-2011

Name of region	Waste (thousand tons)	
	2010	2011
Kyrgyz Republic	1.114.6	1.173.8
Issyk-Kul	148	109.3
Jalal-Abad	77	82.7
Naryn	15	17.8
Batken	2.6	4.5
Osh	16.3	9.6
Talas	18.3	15.3
Chui	55.4	98.7
Bishkek	692.4	729.6
Osh	90.1	106.2

Source: NSC

Table 9.7. Municipal waste generation in Kyrgyzstan (Thousand tons)

Wastes type	2006	2007	2008	2009	2010	2011
Municipal wastes*	617.8	663.4	1.008.6	2.656.7	1.114.6	1.173.8

Source: NSC
**Measurement unit of data for 2006-2009 period, was converted from thousand cubic meters to thousand tons, in accordance with NSC data*

Table 9.8. Volume of solid municipal waste generated per capita

Title	Unit of measurement	2006	2007	2008	2009	2010	2011
Municipal waste per capita*	Kg/person	117.7	125.4	188.6	490.3	203.5	211.4

Source: NSC
**Data has been estimated for 2006-2009*

According to MP Tazalyk, the company responsible for municipal waste management in Bishkek, there was a steady and substantial growth in the generation and disposal of municipal waste. In 2009, there was a growth of 20% on the previous year and an increase of 19% in 2010.

Solid municipal waste disposed of at the Bishkek city dump (thousand cubic meters)					
2006	2007	2008	2009	2010	2011
1440,0	1524,0	1600,0	1917,7	2364,3	2431

Each day, approximately 1,000-1,200 tons of solid municipal waste is collected and disposed of at the Bishkek city dump. The overall volume of stockpiled waste equated to 13,160 million tons, by the end of 2011.

The ratio of the volume of generated waste to the sizeof the waste dumps is an indicator of the load level and decision making for the implementation of technologies that decreases the generation of waste, their recycling or waste dump territory expansion. The largest per unit area load is in Bishkek.(Table 9.9).

According to the 2011 data of Republican Sanitary & Epidemiological Service, there are 31 waste dumps, more than half of which (55%) do not meet sanitary standards. The existing containers and special purpose machinery did not meet the city demands. The system for separate waste collection (food waste, waste paper, textile, waste metal, plastic etc.) was completely destroyed, and the system for removal of municipal waste was not perfect. There was no sorting of household refuse or use of waste as secondary raw materials, and recycling was at a very low level. The largest city waste dumps of Bishkek, Osh and other populated areas were built and used in violation of sanitary and environmental standards and were sources of environmental pollution.

Table 9.9. Ratio of the volume of generated waste to the size of the municipal waste dumps in 2010 and 2011

Name of region	Municipal wastes generated in thousand tons		Size of municipal waste dumps (hectares)		Ratio of the annual volume of waste generated to the size of waste dumps (thousand tons/hectare)	
	2010	2011	2010	2011	2010	2011
Kyrgyz Republic	1.114.6	1.173.8	215.2	221.4	5.2	5.3
Issyk-Kul	148	109.3	43.2	39.7	3.4	2.8
Jalal-Abad	77	82.7	43.7	39.5	1.8	2.1
Naryn	15	17.8	9.3	9.6	1.6	1.9
Batken	2.6	4.5	10	9.7	0.3	0.5
Osh	16.3	9.6	4	4.0	4.1	2.4
Talas	18.3	15.3	3	3.0	6.1	5.1
Chui	55.4	98.7	18	31.9	3.1	3.1
Bishkek	692.4	729.6	22	22.0	31.5	33.2
Osh	90.1	106.2	62	62.0	1.4	1.7

Source: NSC

Table 9.10. Territories designated as waste dumps

Waste type	Area, in hectares
Toxic waste	406.5*
Municipal waste	215.2*
Radioactive waste	650**
Waste dump of the Republican Special Plant	302***

** Source: National Statistics Committee*
*** Source: Emergency Situations Ministry, (without notice of OJSC Kara-Balta Mining Company)*
**** Source: Republican Special Plant*

Transboundary movement of hazardous waste

The Index of Transboundary Movement of Hazardous Waste is the driving force that characterizes transboundary movement of hazardous wastes. The following are all classified as hazardous waste: toxic, explosive, oxidizable and acidifying, corrosive, flammable, eco-toxic and other wastes. The uncontrolled movement and burial of such wastes can have dangerous consequences for public health and can cause negative effects on water and soil. In some cases transboundary movement is required for environmental safety and safe disposal. In international practice, the transboundary movement of hazardous wastes is regulated by The Basel Convention for the control of transboundary movement of hazardous wastes and their disposal, by the notification and then issuance of permission for such movement.

The Kyrgyz Republic joined the Basel Convention in 1995. The onvention acts in order to protect peoples' health and environmental safety from the risk of adverse effects of hazardous wastes through the creation of other waste control and disposal systems.

In 2009, in accordance with liabilities before Basel Convention, Kyrgyzstan reported the export of 1,375 metric tons of hazardous waste. In the draft version of the Report for 2010, the data indicates a threefold increase in exports to 3,525.1 metric tons and the occurrence of the import of 398.05 metric tons of hazardous waste that fall under Attachment 1 of the Basel Convention. The Report for 2011 has not yet been filed.

Table 9.11. Export and import of hazardous waste for 2009 and2010 (metric tons)

Type of waste	Country code of export/ import	Export (tons)		Import (tons)	
		2009	2010	2009	2010
Scrap and lead waste from batteries	DE, CN, LT, IR / KZ, UZ	1.370	2.769.5	-	176.28
Copper, zinc znd brass alloy waste	DE, CN, LT / KZ, UZ	-	756.01	-	42.17
Other processed petrochemicals	- / KZ			-	179.6
Total		1.375	3.525.51	-	398.05

Source: SAEPF

Radioactive waste

The accumulation of a substantial amount of radioactive waste in the Kyrgyz Republic is the result of the uranium mining and processing industry that operated in the 1940s and 50s. Between the mid-50s and now, 18 mining enterprises were shut down or conserved within the country, including 4 uranium mines.

According to data provided by the Emergency Situations Ministry, Kyrgyzstan has 33 tailings dumps and 21 stockpiles on overall area of 650 hectares. The total area of land that were in one way or another subjected to radioactive pollution reached 6 thousand hectares, concentrating 145 million tons of radioactive wastes. The volume of tailings dumps equates to 75 million cubic meters. There is a total stockpile volume of 620 million cubic meters that covers 1,950 hectares of land.

Upon that, most of these are located in the basins of transboundary rivers (Naryn, Mailuu-Suu, Sumsar and Chui), which is a substantial risk factor not only for Kyrgyzstan, but also for other countries, such as Kazakhstan, Tajikistan and Uzbekistan, and more than 5 million people are directly at risk. Many tailings dumps are located in the immediate proximity to populated areas (Mailuu-Suu, Min-Kush, Shekaftar, Sumsar, Kadji-Sai, Ak-Tuz and Kant) (Figure 9.3)

In 2008, there was an increase of radioactive waste handling at OJSC Kara-Balta Mining Company and decreased throughout 2009 and 2010. The volume of waste at OJSC Kara-Balta Mining Company depends on the volume of processed radioactive raw materials and the amount of waste received from third-party organizations.

Radioactive waste build-up at OJSC Kara-Balta Mining Company						
	2006	2007	2008	2009	2010	2011
Radioactive wastes (tons)	807.2	432.7	3741.48	6628.9	6115.38	4976.62

Source: OJSC Kara-Balta Mining Company

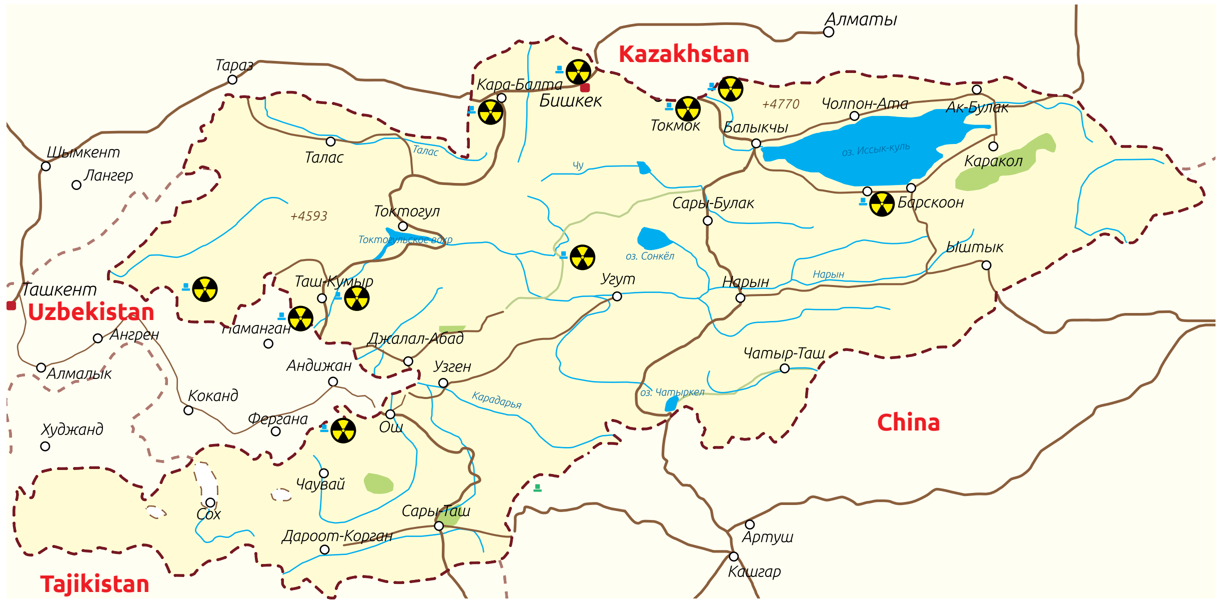


Figure 9.3 Location of radioactive tailings dumps and stockpiles in Kyrgyzstan
Source: Public records of mining industry waste of the Kyrgyz Republic

Recycling and salvaging of waste

In 2000 and in 2009, 4,011.4 and 19,342.7 thousand tons of hazardous (toxic) waste were sterilized (processed or utilized) (Table 9.2), and throughout the remaining years insignificant amounts of waste underwent processing.

In 2010, 73 % of wastes were sent for burial at specifically allocated areas, and 24% of waste was transferred for reprocessing (Table 9.13). In 2011, there was a decline in the volume of transferred wastes totaling 78.4 thousand tons compared to 185.5 thousand tons in 2010.

Table 9.12. The generation, build-up and recycling of hazardous (toxic) wastes in Kyrgyzstan for the year 2000, and the period 2006-2011 (thousand tons)

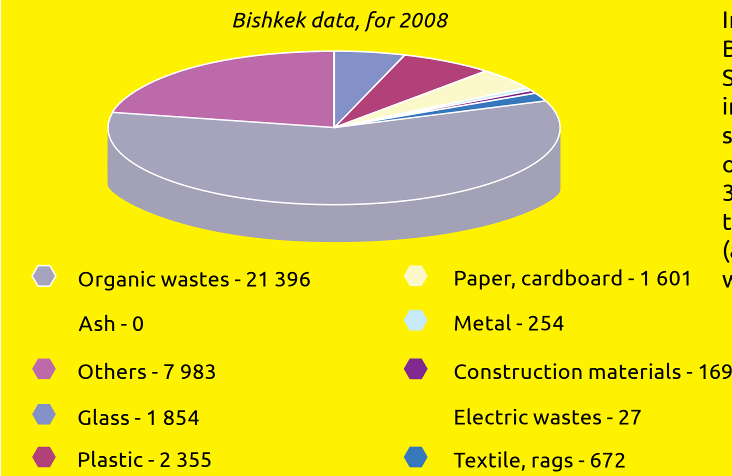
Index	2000	2006	2007	2008	2009	2010	2011
Presence of waste by the end of the year	50.172.5	87.774.4	85.411	90.995.2	77.336.2	83.082	88.923
Waste generated in the reference year	6.304.1	5.827	5.546.3	5.581.3	5.683.7	5.745.9	5.876.2
Fully sterilized, reprocessed or utilized	4.011.4	0.5	0.2	0.2	19.342.7	0.2	33.0

Source: NSC

Table 9.13. Data on the use of production and consumption waste in Kyrgyzstan for 2010 and 2011 (thousand tons)

Name of region	Waste transferred	Amount:			
		used	sterilized	buried	stored
	2010*				
Kyrgyz Republic	185.5	45.8	1.5	135.6	2.6
Issyk-Kul	14.3	8	0	6.3	0
Jalal-Abad	4.5	1.2	1	0.8	2.5
Naryn	0.1	0.1	0	0	0
Batken	0.04	0.0018	0.005	0.033	0
Osh	0.1	0.1	0	0.004	0
Chui	0.9	0.5	0	0.3	0.1
Bishkek	164.9	35.8	1.5	127.6	0.0013
Osh	0.5	0.019	0	0.5	0
	2011*				
Kyrgyz Republic	78.4	50.8	0.0	24.1	3.5
Issyk-Kul	14.7	8.7	-	5.0	1.0
Jalal-Abad	4.4	1.1	-	0.8	2.5
Naryn	0.4	0.3	-	0.1	-
Batken	18.9	18.9	-	0.0	-
Osh	0.1	0.1	-	0.0	-
Chui	6.9	0.5	-	6.4	0.0
Bishkek	32.5	21.2	0.0	11.2	0.0
Osh	0.5	0.0	-	0.5	-

Source: NSC
** Data for the Talas region is not available*



In 2008, the UNDP project "Capacity Building for the Introduction of Sustainable Waste Management Principles in Kyrgyzstan" carried out work on the study of the morphological composition of solid domestic waste in Bishkek. Up to 30% of waste could be recycled within the current waste management system (absence of separate waste collection, waste sorting)

Starting in 2010, there was a record of waste by types – paper, wood, plastic, glass, textile and others. The given data provided information on the content of main commercial waste.

Table 9.14. Data on the quantitative composition of waste in Kyrgyzstan in 2011(thousand tons)

Waste type	Volume of imported waste for one year	Sorted	Used	Buried	Stored
Municipal waste, including:	9.705.665	704.447	0	906.855	9.148.698
Textiles	1.500	0	0	1.500	0
Paper	5.442	0	0	5.442	0
Wood	2.352	0	0	2.352	0
Others	9.685.897	704.447	0	887.088	9.148.698
Plastic	4.589	0	0	4.589	0
Glass	4.644	0	0	4.644	0
Ferrous metals	1.240	0	0	1.240	0

Source: NSC

PART 10

Environmental Protection Management

The Constitution of the Kyrgyz Republic is the starting point of the legal basis which envisages that all citizens of the Republic are entitled to favorable environmental conditions for living and health and for compensation of damage to health or property caused by actions in environmental management. The principles of the state policy for environmental protection and the efficient use of natural resources are established in the Concept of Environmental Safety of the Kyrgyz Republic[17]. The Concept defines the key environmental problems threatening the social and economic development and the health of the population; the principles and actions on mitigation and prevention thereof; as well as the directions and mechanisms of environmental safety for short-term, mid-term, and long-term periods. A package of measures for the environmental safety of the Kyrgyz Republic will be implemented to solve the problems defined by the Concept[18]. The principles of the state policy for forest ecosystems are defined in the Concept of Forestry Development for the period until 2025[19], and in the National Forestry Program for the period until 2015, and in the National Forestry Development Plan of the Kyrgyz Republic.

Relations in the sphere of environmental protection and the rational use of natural resources are regulated by the following Kyrgyz Laws: On Environment Protection, On Environmental Expertise, On water, On the protection of atmospheric air, On fauna, On the protection and use of flora, On the biosphere territories in the Kyrgyz Republic, On the preferential protection zones, etc., as well as the accordingly adopted regulatory and legal acts of the Kyrgyz Republic.

State environmental control for compliance with the requirements of the environmental regulations for protection of the atmosphere, water and land resources, biodiversity resources, and forestry ecosystems is carried out by business entities.

State environmental control has been carried out by the State Agency for Environment Protection and Forestry under the Government of the Kyrgyz Republic until 2012. From 2012, the controlling functions were assigned to the newly established State Environmental and Technical Safety Inspectorate under the government of the Kyrgyz Republic. Reformation of the state administration system, initiated by the Parliament of the Kyrgyz Republic Resolution No 1452-V On the structure of the Kyrgyz Republic Government dated 23 December 2011, significantly affected the structure of environmental protection participants. The functions were reassigned among the state bodies by the KR Government Resolution No 87 On measures in connection with the reformation of governmental agencies dated 10th February 2012.

The state environmental impact assessment of preliminary design and construction documents was carried out to prevent possible negative impacts on public health and the environment by business and other activities. The assessment was carried out by the State Agency for Environment Protection and Forestry under the government of the Kyrgyz Republic and the State Geology and Natural Resources Agency under the government of the Kyrgyz Republic (as related to subsoil use). In Kyrgyzstan, a public environmental impact assessment was carried out along with the state environmental impact assessment. One of the basic principles of the Kyrgyz Republic Law on Environmental Impact Assessment is the principle of a public hearing. The public environmental impact assessment is one of the forms of public consultations.

The organizational structure of environmental monitoring in Kyrgyz Republic was significantly segmented from the date of establishment. Monitoring functions are carried out by different ministries and agencies. The main agencies and authorities that monitor the environment and/or environmental impact are as follows: the State Agency for Environment Protection and Forestry under the government of the Kyrgyz Republic,KR Ministry of Agriculture and Melioration, State Geology and Natural Resources Agency under the government of the Kyrgyz Republic, KR Ministry of Emergencies (Kyrgyzgydromet), KR Ministry of Health, State Registration Service under the government of the Kyrgyz Republic, etc.

The KR National Statistics Committee developed environmental statistics including the collection and analysis of statistical data in the sphere of environmental protection and the rational use of natural resources. The information is based on data collected from respondents (business entities) and on data from administrative sources.

At present, Kyrgyzstan faces many difficulties in supporting and improving the environmental information system, as there is currently no unified national monitoring system. Practically no monitoring is conducted in important spheres such as hazardous waste and heavy metals; there is no morphological registration of wastes that are emptied at conventional surface waste dumps (especially in rural areas) or stored in other establishments.

There is no state inventory of flora and fauna, and thewater inventory is suspended, while the land inventory is conducted on the basis of state land reports for a five year period.

The economic mechanisms of environmental management include pollution charges, payments for the use of natural resources, etc. The economic mechanisms of environmental management serve two purposes: Obtaining financing for environmental protection and the creation of motivation to reduce pollution. Pollution charges are the main economical instruments used for environmental protection purposes in the Kyrgyz Republic. Pollution charges are imposed for many substances contaminating air and water, as well as wastes. These charges are associated with the system of maximum permissible emissions specified in the environmental permits for every business.

The economic principle of "contaminator pays", is the fundamental framework of the Kyrgyz environmental policy. Instruments such as taxes, penalties, and a system of returnable deposits, loan rates, donations, fiscal instruments (tax and environmental inspectors), provisional payments (water sector and wastes) are being used.

Adequate financing is required for the protection of environment systems and environmental safety. The current financing of environmental protection in Kyrgyzstan is conducted on a residual principle.

[17] Order of the President of Kyrgyz Republic on Concept of Environmental Safety of the Kyrgyz Republic dated 23 November 2007 No 506
[18] Resolution of the Government of Kyrgyz Republic on approval of the Package of measures for environmental safety of the Kyrgyz Republic for 2011 -2015 dated 23 September 2011 No 599
[19] Resolution of the Government of the Kyrgyz Republic on approval of the Concept of forestry development in the Kyrgyz Republic dated 14 April 2004 No 256

Table 10.1. Investments in fixed assets of environmental protection in the Kyrgyz Republic (million of som)

	2006	2007	2008	2009	2010	2011
		(million of som)				
Total, including:	**285.0**	**134.3**	**156.4**	**341.6**	**468.7**	**640.4**
Water resources protection	45.0	49.5	68.2	88.9	108.9	101.3
Air protection	4.1	12.3	61.6	4.1	6.6	9.8
Land conservation	63.2	8.1	16.0	248.4	352.1	417.9
Waste management	172.6	1.0	5.9	0.1	1.0	2.1
Other activities	0.1	63.4	4.7	0.1	0.1	109.2
		In %				
Total, including:	**100**	**100**	**100**	**100**	**100**	**100**
Water resources protection	15.8	36.9	43.6	26.0	23.2	15.8
Air protection	1.4	9.2	39.4	1.2	1.4	1.5
Land conservation	22.2	6.0	10.2	72.7	75.1	65.3
Waste management	60.6	0.7	3.8	0.0	0.2	0.3
Other activities	0.0	47.2	3.0	0.0	0.0	17.1

Source: NSC

Despite the fact that the financing of the current costs for environmental protection from the state budget was annually increasing, the available finances are not sufficient for the implementation of all required environmental protection measures.

Table 10.2. Total current expenditures for environmental protection by categories, thousand soms

Categories	2006	2007	2008	2009	2010	2011
Water resources	198.615.6	84.151.3	225.495.5	238.346.3	301.047.9	431.125.5
Air protection	22.182.3	26.835.4	39.623.2	65.590.0	76.121.8	75.521.9
Land conservation (including from pollution by production and consumption wastes)	35.206.1	28.324.6	57.710.4	67.727.2	118.037.0	190.097.4

Source: NSC

Table 10.3. Total current expenditure for environmental protection by region(thousand soms)

Name of region	2006	2007	2008	2009	2010	2011
Kyrgyz Republic	353.679	362.635.9	480.759.0	499.323.4	637.648.4	699.266.9
Batken	2.393.4	4.419.7	1.900.6	4.265.5	19.977.7	23.518.2
Jalal-Abad	13.757.4	13.267.3	24.328.8	23.047.7	23.808.1	28.193.5
Issyk-Kul	183.589.7	177.669	218.652.1	216.919.4	280.876.2	324.476.3
Naryn	3.670.2	2.813.2	7.191.8	11.786.2	3.691.1	3.855.8
Osh	267.6	225.6	209	286.3	382.4	509.3
Talas	167.2	169.7	191.3	432.4	391.9	2.146.4
Chui	30.083.7	30.034.7	53.603.4	49.313.8	73.360.1	79.923.3
Bishkek	109.166.9	115.742.6	168.084.2	176.293.9	232.924.1	217.804.2
Osh	10.582.9	18.294.1	13.840	16.978.2	2.236.8	18.839.9

Source: NSC

The main sources of finance for environmental protection are the resources of international donors and of Republican and regional environment protection and forestry development funds.

Environment protection and forestry development funds have been formed and their resources are used according to their annual income and expenditure estimates approved by the managements of the funds and agreement from the KR Ministry of Finance. Incomes of the environment protection and forestry development funds more than doubled in recent years. An increase in the financing of environmental measures is observed; in 2006, 19,526.6 thousand soms were allocated, and in 2011 the amount increased by 55,477.2 thousand soms or by 3.8 times (Table 10.4).

PART 10. Environmental Protection Management

Table 10.4. Information on the activities of the environmental and forestry conservation funds in Kyrgyzstan (thousand KGS)

Name of the Fund		Incomes					
		2006	2007	2008	2009	2010	2011
Local Funds of EP&FD		22.108.7	31.347.5	41.304.9	48.546.2	64.210.3	73.518.6
Republican Fund of EP&FD		19.773.9	27.102.0	32.976.1	38.132.3	44.770.6	50.749.5
Total income		41.882.6	58.449.5	74.281.0	86.678.5	108.980.9	124.268.1
Total expenses		36.211.7	57.362.7	65.830.8	87.214.0	107.612.8	118.553.1
Local Funds of EP&FD		22.250.3	30.887.1	40.290.8	46.659.6	60.491.4	69.395.7
Republican Fund of EP&FD		13.961.4	26.475.6	25.540.0	40.554.4	47.121.4	49.157.4
Finances allocated for environmental protection activities	Thousand soms	19.525.6	36.204.6	47.941.2	69.290.7	71.236.8	75.002.8
	from expense (%)	54.0	63.1	72.8	79.4	66.19	63.2
	from income (%)	46.6	61.9	64.5	79.9	65.4	60.4

Source: Republican Fund of Environment Protection and Forestry Development (RFEP&FD) of the State Agency for Environment Protection and Forestry (SAEPF)

In 2011, a significant amount of funds, 30,216.3 thousand soms, were allocated for the planting of greenery, landscaping and development of forestry.In 2010, the maximum amount of financing, 19,398.8 thousand soms, was allocated for the preservation of biological diversity. (Table 10.5).

Table 10.5. Allocation of funds for environmental actions (thousand soms)

Activity	2006	2007	2008	2009	2010	2011
1. Protection and rational use of water resources	5.189.9	9.556.1	10.119.6	9.806.4	10.639.3	4.416.8
2. Handling of production and consumption waste	1.030.1	5.340.0	6.461.2	6.410.8	4.627.6	1.506.4
3. Planting of greenery, improvement and development of forestry	4.457.4	9.362.0	11.335.8	17.303.4	18.963.1	30.216.3
4. Protection of flora and fauna	1.571.4	1.007.3	2.923.2	-	88.7	2.990.4
5. Air protection	400.0	-	1.200.0	5.593.1	7.505.4	5.083.6
6. Conservation of bio-diversity, development of special protected natural territories	2.444.6	3.986.1	4.625.0	21.252.4	19.393.8	17.175.2
7. Conducting environmental monitoring and raising capacity of local environmental protection agencies	1.972.2	3.688.7	7.298.3	2.730.7	2.287.9	1.210.7
8. Promotion of caring attitude towards environment and rational use of natural resources, education, development of ecological awareness, unification and correlation of laws and regulations	2.437.8	3.068.2	3.138.3	2.359.3	889.3	3.069.0
9. Increasing the capacity to conduct environmental survey	-	-	424.4	2399.6	- -	-
10. Scientific research	-	-	102.5	-	225.0	-
11. International cooperation, payment of membership fees for environmental conventions	22.2	196.2	312.9	152.2	-	-
12. Capacity building in environmental management				1.282.8	6.356.7	8.642.4
Total:	**19.525.6**	**36.204.6**	**47.941.2**	**69.290.7**	**71.236.8**	**75.002.8**

Source: Republican Fund of Environment Protection and Forestry Development (RFEP&FD) of the State Agency for Environment Protection and Forestry (SAEPF)

The Kyrgyz Republic pays special attention to international cooperation aimed at efficient cooperation with foreign countries in the implementation of multilateral and bilateral agreements in order to resolve transboundary problems in the sphere of environmental protection and the rational use of natural resources, the fulfillment of environmental conventions, a party of which is the Kyrgyz Republic and the attraction of international aid for dealing with environmental problems.

Kyrgyzstan has been a member of the Commonwealth of Independent States since 1991. In 1992, Kyrgyzstan joined the United Nations (UN) and became a member of a number of international environmental protection organizations such as: the United Nations Environment Program (UNEP), United Nations Development Program (UNDP), World Meteorological Organization (WMO), Food and Agriculture Organization, UN (FAO), World Health Organization (WHO), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Since 1992, the Kyrgyz Republic has been a member of the UN Economic Commission for Europe and takes an active part in the Environment for Europe process. In 1993, Kyrgyzstan joined World Trade Organization (WTO).

Kyrgyzstan cooperates with the other Central Asian countries within the framework of the Eurasian Economic Community (EurAsEc) and The International Fund for Saving the Aral Sea (IFAS), the Interstate Commission for Sustainable Development (ICSD)and the Interstate Commission for Water Coordination (ICWC).

Kyrgyzstan, being a participant of 12 international environment conventions and three protocols, on one side, joined the global environmental process, on the other, it is a full member of the global society and has the right to technical and financial aid from developed countries.

In accordance with the KR Government Order No 12-p dated 16th January 2006, the State Agency for Environment Protection and Forestry under the KR Government is the state body responsible for the implementation of requirements of 11 international environment conventions and three protocols. The executive body of the Convention to Combat Desertification (KR Law No 85 on accession dated 21.07.1999) is the KR Ministry of Agriculture and Melioration. In the framework of the obligations of international environment conventions, a number of projects for environment protection and the rational use of natural resources have been implemented.

Kyrgyzstan is a member of the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, more commonly known as the Aarhus Convention[20].

At a national level, delivering information to interested parties, including civil society, is stipulated by the Kyrgyz Republic Law on access to information under the state bodies and local administrations of the Kyrgyz Republic. This law provides the exercise and protection of the right for access to information under the state bodies and local administrations, as well as achieving the maximum informational transparency, publicity, and openness in the activities of the state bodies and local administrations. The national environmental report is one of the main systematic sources of information that enables the increase ofthe information awareness of the general public about the state of the environmental and its components.

[20] The KR Law No 5 on accession of Kyrgyz Republic to the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, dated 12 January 2001.

PART 11
Environmental and public health

Aspects of public health of the Kyrgyz Republic include quality of life affected by physical, chemical and biological environmental factors, which take into consideration climatic, geographical, social, economic and other characteristics.

The demographical situation at the end of 2010, is specified by a steady growth in fertility that came to 26.8% per 1,000 people (25.2% in 2009), i.e. an increase of 6.3% compared to 2009. Natural population growth is still occurring and this resulted in a year-end figure of 20.2% per 1,000 people (2009 - 18.5%), which is a higher rate of increase than that of 2009. In general, according to the preliminary results for 2010, the death rate decreased to 6.6 % (6.7% in 2009). The main descriptive aspect of the demographic situation, which determines the level of human development is a life expectancy. In 2010, the average life expectancy in the country was 69.3 years, 65.3 years for men and 73.5 years for women (in Bishkek, consequently: 71.7 years; 66.8 years (men); 76.0 years (women)).

In comparison with 2006, the average duration of life increased by 1.5 years (2.2%); 1.8 years for men (2.7%), 1.4 years for women (1.9%) (Figure.11.1)

The main causes of mortality in the Kyrgyz Republic in recent years are cardiovascular diseases, 48.8% in 2010 (49.3% in 2009); external causes of mortality: 10.9% (9.7% in 2009); neoplasitic diseases: 9.0% (9.1% in 2009); respiratory diseases: 7.9% (9.4% in 2009); digestive tract diseases: 6.8 % (6.6% in 2009); infectious and parasitic diseases: 2.5% (2.6% in 2009).

According to the KR Ministry of Health, starting from 1991, the mortality rate due to cardiovascular disease (CVD) increased by 33.5% (CVD on the basis of 100,000 people: 261.9 in 1991; 359.5 in 2010). In Kyrgyzstan, over 19 thousand people die from heart diseases annually. Cardiovascular diseases not only the main cause of mortality in Kyrgyzstan, but also are a cause of early retirement due to disability.

Premature mortality and disability of the main economic supporters and qualified workers might not only adversely affect family incomes, but also the national economics of the country as a whole. The calculation of economic losses from mortality caused by CVD showed that the total losses of labor potential, due to premature mortality is 49.938 manperson-years; economic losses are equal to 2,659,653 thousand soms. Total economic losses from premature mortality and disability caused by CVD amounted to 14,188,712 thousand soms.

Kyrgyzstan has the highest rate of mortality from ceberal strokes (88.5 cases per 100,000 people) in the Eurasion region, with respiratory diseases in second place and increasing. The health status of the population is determined by a system of key

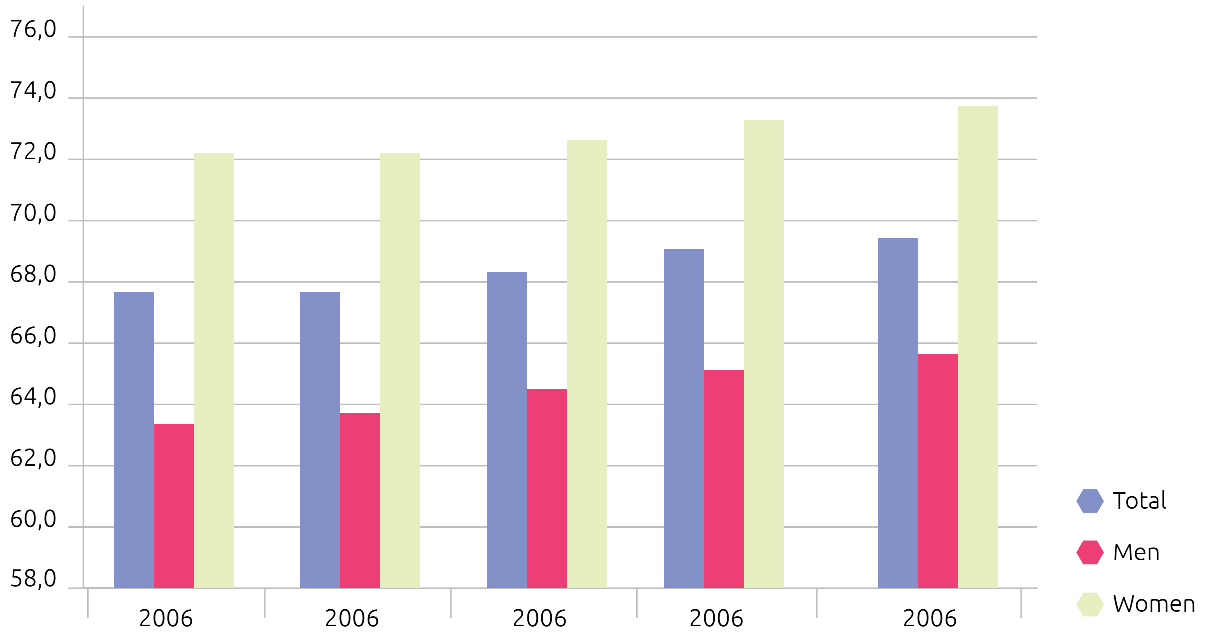


Figure 11.1. Life expectancy in the Kyrgyz Republic from 2006-2010.
Source: Ministry of Health

statistical figures. Diseases are an indicative and officially registered reaction to environmental hazards, and reflect both the long-term and chronic exposure to a contaminant. In particular, risks include respiratory diseases, nervous system diseases, skin and hypoderm diseases, birth defects and malignant neoplasms.

Air quality

According to Kyrgyzgydromet, more than half of city dwellers are exposed to pollutants exceeding the maximum allowable concentration (58.7%) which adds city dwellers to high risk groups in terms of pneumonia . Despite a decrease in industrial production and the reduction of contaminants into the atmosphere, motor traffic plays a significant role in air pollution (80%). Traffic emissions affect a distance of 1-2 km away from major roads and cover an altitude of over 300m. The composition of exhaust fumes includes more than 200 substances. Each of these has its own biological impact. From a hygienic point of view, the most important pollutants are carbon oxides, hydrocarbons, nitric oxides, oxidants and compounds of lead, iron, copper, zinc, bromine, and tri-chloromethane.

Carbon oxide toxicity is connected to its high reactivity with haemo-globulin which results in a reduction in the blood's capacity to transfer oxygen to body tissues. Chronic exposure to carbon oxide leads to the increase of hospitalization and/or doctor visits of elderly people with heart disease and or having heart attacks.

Nitric oxides are respiratory irritants which can cause lung disease and asthma attacks. Sulphur dioxide has similar effects and afflicts the respiratory system, central nervous system, skin and inhibits oxidation processes. Oxidants cause conjunctival irritation and reduce air transparency.

Formaldehyde can cause allergic reactions, strong irritation of the conjunctiva and respiratory tracts accompanied by cough, sneezing and excessive lacrimation. Formaldehyde affects central the nervous system and causes dermatitis. WHO accepts its relation to the increased risk of carcinogenesis of the nasopharynx. Carcinogenic benzopyrene holds special place in air pollution.

An Increase in oncological diseases has been seen, led by malignant neoplasms of the digestive tract, followed by melanoma and other malignant skin neoplasia, and in third place the respiratory tract and chest.

Long-term contact with an environment polluted by exhaust gases causes the general weakening of the body and immunodeficiency. Moreover, the gases alone can cause various diseases,for example, respiratory distress, sinus trouble, laryngotracheitis, bronchitis, bronchopneumonia, lung cancer and cerebral atherosclerosis. Various abnormalities of the cardiovascular system can be caused by mediated lung disease.

The quantitative air pollution index of Bishkek is accepted as very high. Pollutants per capita are more than 2.5 times higher than that of an Issyk-Kul resident, and 16 times higher than that for Naryn region. The complex air pollution index in Bishkek exceeds by 51 times the same index in Cholpon-Ata; 13.9 times that of Osh, and 9.6

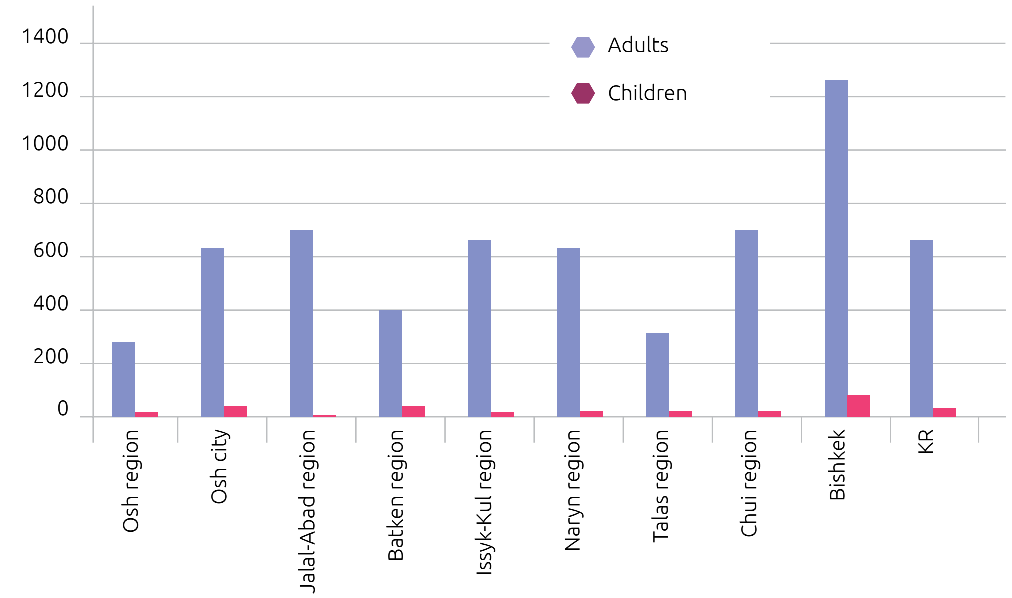


Figure 11.2 Neoplasms (index for 100 thousand people, 2010)
Source: Ministry of Health

times the Tokmok indices. Bishkek is represented by distinct spacial pollution of urban air-shed that determines a lower rate of bronchial and lung nosology of children living in the 7th micro district (PNZ No 5, control zone, 48%) than of children from the western (66%) and eastern industrial zones(63%).

The correlation between the total carcinogenic load of benzopyrene and the sickness rate of Bishkek residents and malignant neoplasms of the digestive tract, is characterized with a direct and strong correlation in men (r/0.9), while for women it is direct and medium (r/0.5).

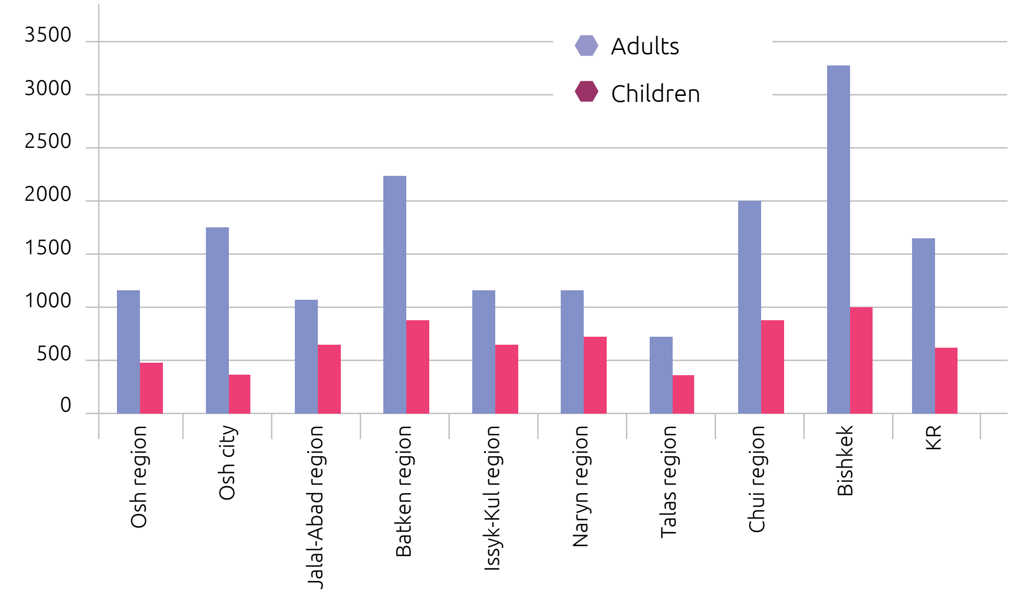


Figure 11.3 Total recorded respiratory diseases in 2010 (per 100,000 people)
Source: Ministry of Health

An increase in oncological diseases has been seen, led by malignant digestive tract neoplasms,, followed by melanoma and other malignant skin neoplasms, and thirdlyin the respiratory tract and chest. Stomach cancer is the leading cancer among men, while it occupies second place for women behind malignant breast and ovarian neoplasms) According to statistical data from the KR Ministry of Health, the combination of a number of adverse environmental factors cause high levels of neoplasms among Bishkek residents, congenital abnormalities among children under 14 years in the cities of Bishkek and Osh, and bronchial asthma among children in the Chui and Batken regions. An increase the incidence of sickness among new-borns has been seen, the the most common problems being abnormalities of the musculoskeletal system, diseases of the cardiovascular, urogenital, and digestive systems, as well as numerous birth defects.

The deterioration of female health represented by various genital system diseases has been observed. The use of pesticides, formerly applied in the southern regions of the republic against pests in tobacco and cotton cultivation, is one of the potential factors that causes sterility among women and men of the Osh region, and women in the Batken region.

Table 11.1. The rate of population disease (per 100,000 people, in 2010)

Name of region	Neoplasms		Infertility		Congenital abnormalities		Bronchial asthma	
	Adults	Children 14 and younger	Men	Women	Adults	Children 14 and younger	Adults	Children 14 and younger
Osh	294.8	7.4	154.5	149.9	51.3	170.1	104.7	5.3
Osh city	624.4	22.7	5.9	70.1	55.6	546.9	124.1	17
Jalal-Abad	707.4	16.0	28.0	78.9	37.5	194.5	158.2	5.0
Batken	393.7	39.5	72.7	148.1	43.3	237.7	276.0	9.2
Issyk-Kul	701.5	7.4	24.3	111.9	177.4	494.9	204.3	17.1
Naryn	666.9	12.5	29.0	119.5	136.3	383.9	234.9	17.0
Talas	324.5	15.3	10.61	31	21.8	107	113.5	5.6
Chui	766.7	13.5	7.0	68.9	77.4	360.7	229.6	39.1
Bishkek city	1219.6	100.5	4.7	100.9	142.8	663.9	100.0	15.1
Kyrgyz Republic	683.9	25.7	46.7	102.5	81.7	318.4	197.9	22.7

Source: Ministry of Health

Climate change

Climate change adversely affects population health; however impact assessment of potential climate change on health is uncertain at the moment. Additional effects of the climate change are the following acts of nature: floods, too many hot or cold days. Forms and means of this impact can vary:

- *Direct impact of high or low temperatures;*
- *Extreme climatic acts;*
- *Elevated pollution;*
- *Increase of water and food borne diseases.*

According to the guidelines of WHO[21], vulnerability indicators of the population are mortality, incidence of disease, appealability for diseases of the cardiovascular system (CVS), respiratory system (bronchial asthma, chronic obstructive lung disease), and infectious diseases, primarily enteric and transmissible infections. More pronounced changes in indicators are typical for high risk groups: elderly and senile age people and young children, who are most vulnerable to changes in temperature. Trauma and poisoning are indirect effects of climate change which arise fromemergency situations, such as avalanches, floods, mud flows, and droughts.

Children suffering from bronchial asthma and chronic obstructive lung disease are highly sensitive to weather changes. Sufferers living in cities are more sensitive since meteorological factors in cities are intensified by high levels of dust and gas pollution. The highest incidence of disease are observed in Bishkek and Chui region and Osh (city), and; for adults the Batken region, which is related to environmental pressure.

Annually, up to 40 thousand cases of acute intestinal infectious diseases are registered in the republic, over 80% of which are children under 14. The fatality rate ranges from 150 to 300 among children under 14 years (340 children in 2000; 105 children in 2010). The highest fatality rate is observed in the southern regions (Osh, Jalal-Abad and Batken regions) with 80-90% of all fatal outcomes.

The pattern of infectious diseases, with the exceptionof influenza and acute respiratory diseases is: 34% for parasitic diseases, 33% for acute intestinal infections, 14% viral hepatitis, 7% tuberculosis, 5% brucellosis, and 7% for other infectious diseases.

[21] "Methods of assessment of human health vulnerability and adaptation of public health service to a climate change" (Sari Kovats, Kristie L. Ebi и Bettina Menne, 2006)

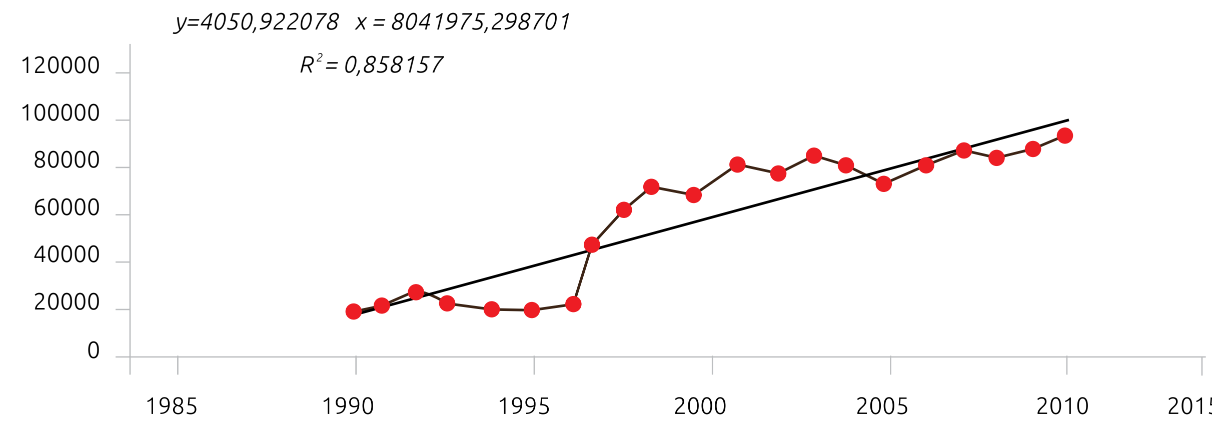


Figure 11.4. Bronchial asthma among children under 14 years of age (per100,000 people, in 2010)
Source: Ministry of Health

Water quality

Limited access to potable water and its low quality cause an increase of diseases among the population (Figure 11.6). The average incidence of disease in the republic for commonl intestinal diseases is at a constant high level reaching 332.4 (2001) to 490.2 (2010). The highest incidence of diseases was recorded in Batken 4,161 (980) and Jalal-Abad 5,400 (552.8) regions that exceeded the national rate by 1.8 times, and was caused by poor access to potable water.

Child mortality caused by common intestinal infections (diarrhea) remains at a high level reaching 132 in 2005, 106 in 2010 and included 84 children up to 1 year (77.4%).

Typhoid fever became endemic in the Jalal-Abad region and annually recorded in the form of sporadic and local episodes. The age pattern of those afflicted, covers 81.6% of children under 14, including 40.6% of children under 1 year.

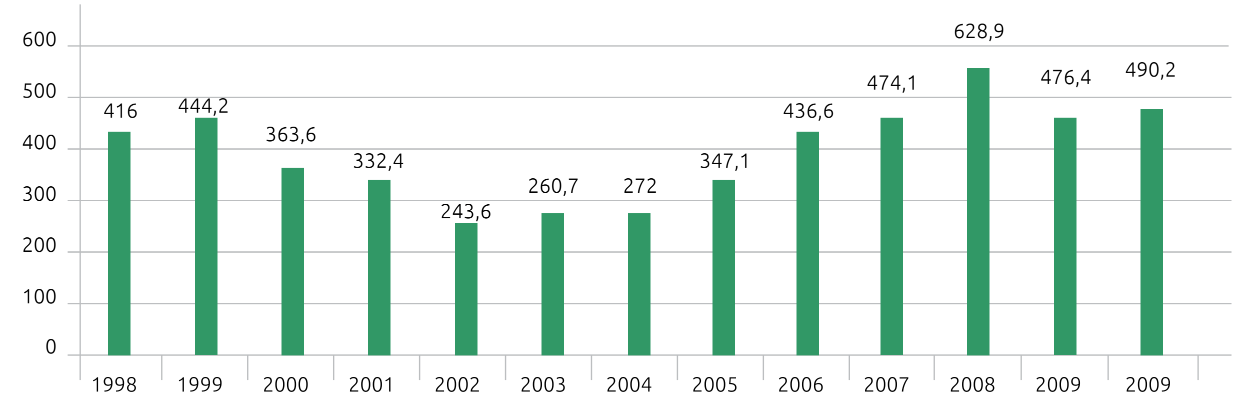


Figure 11.5 Longitudinal history of acute intestinal infections in the republic (1998-2010, per 100,000 people)
Source: M3

Global climate changes cause the potential reduction of potable water reserves, temperature increase of surface waters, and the increase of contaminant concentrations, which foster the growth of microorganisms and sustain common intestinal water-borne infections at a high level. The highest incidence of disease was registered in 2010 in Batken (980) and Jalal-Abad (552.8) regions, and exceeded the national rate by 1.8 times. The high rate of acute intestinal infection in the Batken region is related to the insufficient access to potable water by inhabitants. High temperatures and the availability or shortage of water resources foster the transmission of this infection.

Analysis of the incidence of intestinal disease among the population of the Kyrgyz Republic for last 10 years, showed that 82% of intestinal infections were recorded in the summer-autumn period from May to November.

Protecting surface waters from contamination is aimed at the prevention and elimination of water pollution that can cause water-borne poisoning and infectious and parasitic diseases when used for domestic and recreational water use.

In 2010, the pollution of water beds used for the supply of potable water y (I category reservoirs) and for sanitary needs (II category reservoirs) has continued, and has been proven by laboratory tests. The percentage of special sample water for sanitary-chemical properties was 5.9% in 1st category water basins and 3.2% in 2nd category water basins; for microbiological properties it was 25.5 % and 30.5 %, respectively.

The natural and climatic conditions of the republic enable the high probability of the local transmission of malaria (Table 11.2). A one degree increase in air temperature will all a tenfold increase in the population of malarial mosqitoes.

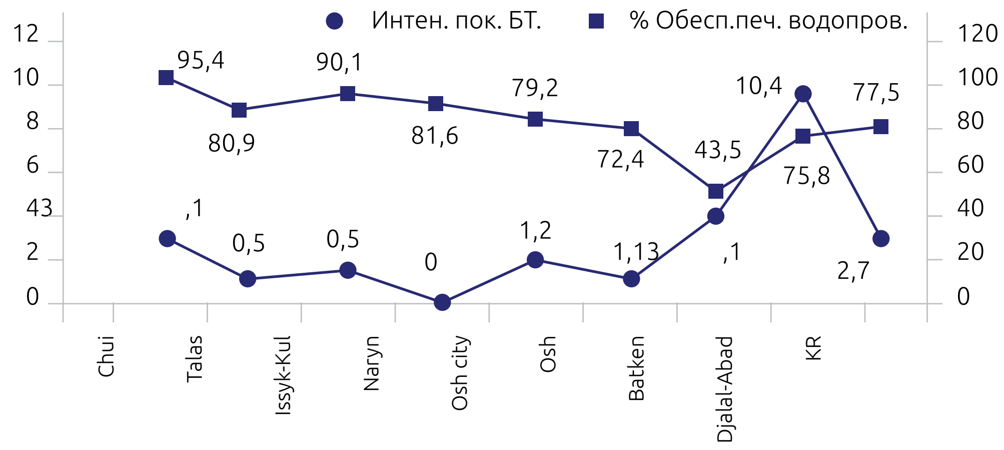


Figure 11.6 Correlation between potable water accessibility and typhoid disease in Kyrgyzstan
Source: Ministry of Health

An increase in the number of days with high temperatures causes the activation of ticks and subsequently, the increase of infections transmitted by them. An increase in the incidence of viral encephalitis has been observed in the Kyrgyz Republic (5 incidents in 2005; 15 in 2007; 21 in 2008; 14 in 2009; and 16 in 2010) (Figure 11.8).

Climate warming causes the increase of forest biogeocenosis, the rapid development of ticks and an increase of their active periods. The reasons for the increase of viral encephalitis are the expansion of tick habitats, the genesis of new foci, and the reduction of forest areas treated against ticks, as well as the insufficient vaccination of the population against the disease.

Favorable temperatures, an increase in rainfall and an increase in the population of gnawing animals in Central Asia can cause an epidemic plague of ticks.

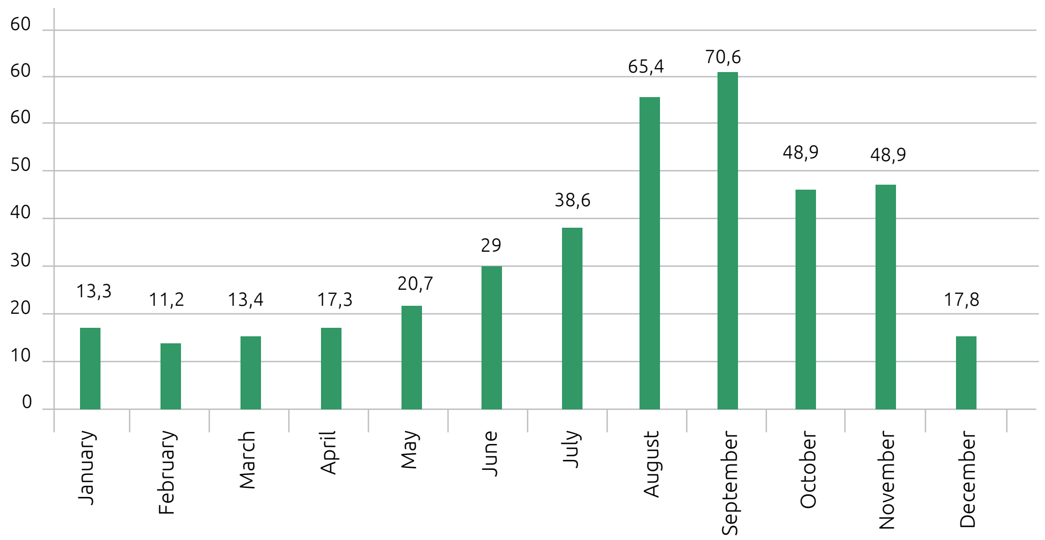


Figure 11.7. Seasonality of acute intestinal infections in the Kyrgyz Republic.
Source: Ministry of Health

Morbidity rate of tick borne encephalitis in Kyrgyzstan for 2000 – 2010 period

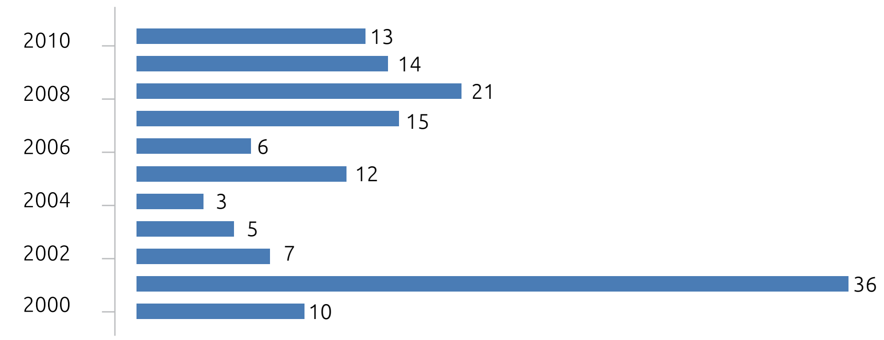


Figure 11.8. The incidence of tick-borne encephalitis
Source: Ministry of Health

Soil quality

Soil quality is a reservoir and factor of transmission of helminthes (parasitic worms) and anthrax spores, and these anthrax spores are highly viable (Table 11.3). The floods and landslides which accompany climate change foster the propagation of infectious agents to vast areas. The seasonality of anthrax depends on climatic,geographical, economic habitat conditions and housing conditions.

A reason for the high incidence of anthrax in the Jalal-Abad region is the mountain-valley grey soils which contain humus within 2.1-5.5% and this preserves anthrax spores in an abiotic cycle at sufficient effective temperatures in spring,summer and autumn.

The main factor that facilitates the high incidence of anthrax is the large number of soil source areas of anthrax that do not meet veterinary and sanitary requirements. At present, there are 1,236 soil foci of anthrax, and only 44% of them are identified.

Table 11.2. Incidence of malaria among the KR population in 2006-2010

	2006	2007	2008	2009	2010
Absolute numbers	321	97	18	4	3

Source: Ministry of Health

Table 11.2. Incidence of anthrax among the KR population in 2006-2010.

	2006	2007	2008	2009	2010
Absolute numbers	17	23	46	11	28

Source: Ministry of Health

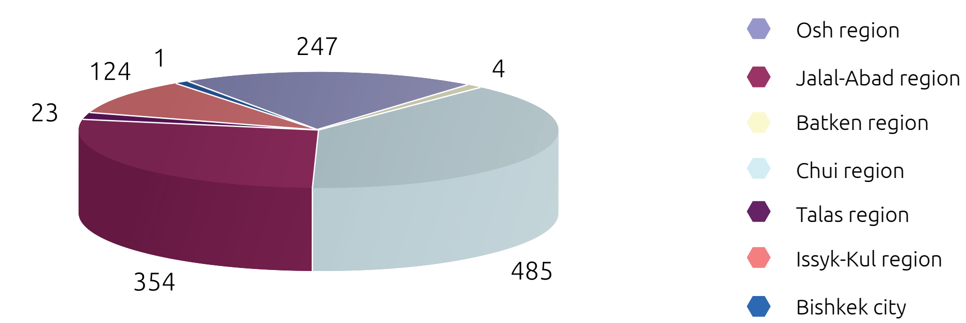


Figure 11.3 Soil source areas of anthrax in regional section (absolute numbers)
Source: Ministry of Health

Food quality

Climate change will foster the growth of many microorganisms which will result in an increase of food products filled with pathogenic germs, which in turn will result in an increase of poisoning cases. Over 70% of contaminants can enter human body with food. The microbiological and chemical purity of food depends directly on environmental conditions, availability of modern technology and the mechanization of processing methods. The contamination of food and raw food is caused by the man-made pollution of water basins, soil, radioactive contamination and toxic compounds formed as a result of secondary reactions. In 2010, 40 cases of bacterial food poisoning were recorded with 88 patients

Table 11.4. Food sample testing results, %

	2006	2007	2008	2009	2010
Contaminants	**Deviation percentage**				
Nitrates	3.3	3.2	1.9	1.6	1.8
Pesticides	0.4	0.4	0.18	0.1	0.2
Micro-toxins	3.2	2	1.29	1.1	2.5
Toxic elements	0	0.4	-	2.8	0.1

Source: Ministry of Health

Internet resources in the Kyrgyz Republic in the sphere of environmental protection and rational use of natural resources[22]

Official sources of information:

- www.gov.kg – Official web site of the Government of Kyrgyz Republic, web links to web sites of the ministries and agencies of Kyrgyz Republic.
- www.nature.kg - State Agency for Environment Protection and Forestry under the government of Kyrgyz Republic. Information about the State Agency for Environment Protection and Forestry including its structure, contacts, functions, authorities, performance, etc. The web site contains updated brief information about environmental status, The Red Book of Kyrgyz Republic and other materials.
- www.nature.kg/lawbase - Free electronic data base of the legal regulatory acts of Kyrgyz Republic in the sphere of environmental protection.
- www.aarhus.nature.kg – Official web site of the UNECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice regarding environmental matters in Kyrgyzstan.
- www.stat.kg – National Statistics Committee of Kyrgyz Republic.
- www.meteo.ktnet.kg - Hydro meteorology Agency under the Ministry of Emergency, Kyrgyz Republic.
- www.srs.kg - State Registration Service under the government of Kyrgyz Republic.
- www.energo-es.kg – Official web site of OAO Power networks.
- www.severelectro.kg – Official web site of OAO Severelektro.

[22] Functioning internet resources as of 21st April 2012.

On the UNDP-UNEP Initiative
"Poverty and Environment"

Poverty and Environment Initiative (PEI) is a global joint UNDP-UNEP Initiative supporting efforts at the country level in order to mainstream environmental management in the national and regional planning processes through the financial, technical assistance and capacity building. To promote changes in organizations, policy and investments, PEI focuses attention on integration of poverty and environmental issues in the national plans, sector-based strategies, environmental protection policy, economic decision making and regional planning.

Goal of integration of the poverty and environment issues is purposed to achieve sustainable changes in these areas addressed by the governments and their partners through mainstreaming of pro-poor environmental sound management in key activity of the government, national development strategies, poverty reduction, and sector-based planning and investment. More information on PEI is available on the official website: www.unpei.org

In the CIS countries, PEI activity is implemented in the Central Asian states – Kyrgyzstan and Tajikistan, and Armenia through provision of the targeted technical assistance.

The UNDP-UNEP Poverty and Environment Initiative in Kyrgyzstan is aimed to enhance contribution of environment in people's well-being, economic growth supporting the poor and achievement of the Millennium Development Goals. Intended long-term result of the first phase of PEI Programme of Kyrgyzstan is integration of link of the poverty and environment into the national, local, sector-based processes and documents, and the UN and UNDP development policy in order to improve economic sustainability and ensure pro-poor economic growth and consider rational use of the natural resources.

First phase of the PEI Programme for Kyrgyzstan covers a period – from January 2011 to December 2013 and contains three key areas of activity:

- Integration of joint consideration of the poverty and environmental issues in planning processes and design of programs at the country and UN level;
- Continue to consider jointly the poverty and environmental issues in the planning and budgeting including the pilot areas – the Naryn oblast and Suusamyr Aiyl Aimak;
- Capacity building and awareness rising regarding interrelation of the poverty and environmental issues.

At the global level, the PEI is funded by the Governments of Belgium, Denmark, Ireland, Norway, Spain, Sweden, United Kingdom, USA and European Commission; main financial support is provided by UNDP and UNEP.

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Danish Ministry of Foreign Affairs (DANIDA)

European Commission

Irish Aid

Norwegian Ministry of Foreign Affairs

Spanish Ministry of Foreign Affairs and Cooperation

Swedish Environmental Protection Agency

Swedish International Development Cooperation

UK Aid

US Department of State

Contacts:
State Agensy on Environment Protection
and Forestry under the Goverment
of the Kyrgyz Republic

228 Toktogul str., Bishkek, Kyrgyz Republic
Tel.: +996 312 352 727
Fax: +996 312 353 102

Contacts:
United Nations Development Programme
in the Kyrgyz Republic
Sosio-Economic Dimension

101/1 Manas ave, Bishkek, Kyrgyz Republic,
Tel: +996 312 694 380
Fax: +996 312 694 363
www.undp.kg
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