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**MINISTRY OF NATURAL RESOURCES
AND ENVIRONMENTAL PROTECTION
OF THE REPUBLIC OF BELARUS**

Belarusian Scientific and Research Center "Ecology"

NATIONAL REPORT
ON THE STATE OF THE ENVIRONMENT IN THE REPUBLIC OF BELARUS

Minsk 2006

State of surface and ground waters

Fresh water resources and their management

Water is relatively abundant in the Republic of Belarus and the available water resources are sufficient to meet both present and future needs of the country. Per capita water supply in Belarus constitutes 3,6 thousand m^3, including 1,4 thousand m^3 of ground water. This index is higher than in England (2,6 and 1,0 correspondingly), the Netherlands (0,7 and 0,25) and Ukraine (1,0 and 0,2). The highest water supply indices are in Norway (89,0 and 27,5) and Russia (9,0 and 2,0).

Surface water resources are mainly represented by river runoff, which in average years constitutes 57,9 km^3 (table 2.1). Rivers of the Black sea basin comprise about 55% of annual flow and rivers of the Baltic sea basin - 45%. In high-water years the total river flow increases up to 92,4 km^3, and in dry years (95% of the supply) decreases to 37,2 km^3 a year.

Picture 2.1. Lake Kroman

Table 2.1 – River water flow resources in the context of main river basins in Belarus

River basins	Water resources in average year, km^3/year	
	Formed within the country	aggregated
Zapadnaya Dvina (including river Lovat)	6,8	13,9
Neman (excluding river Vilia)	6,6	6,7
Vilia	2,3	2,3
Zapadnyi Bug (including river Narev)	1,4	3,1
Dnepr	11,3	18,9
Pripyat	5,6	13,0
Total	**34,0**	**57,9**

Big part of the river water flow (34 km^3, or 59%) is forming within the country. Water inflow from the territories of the neighbor states (Russia and Ukraine) equals 23,9 km^3 a year (41%). The total volume of water, accumulated in the lakes of the country, comes up to 6-7 km^3, and in 153 water bodies – up to 3,1 km^3.

Fresh ground waters are one of the most valuable renewable natural resources. They are spread along the whole territory of Belarus, natural resources comprising 15,9 km^3 a year, probable – 18,1 km^3 a year. More than half of fresh ground water resources are hydraulically connected with the river resources. Amount of natural and probable resources depends on the ground waters' formation conditions, which are the most favorable in the central, North-Eastern and Western parts of the country.

Modules of ground waters' resources here comprise 250-350 m^3/day from one km^2, in separate sites exceeding 400 m^3/day from one km^2. In the Northern, South-Western and South-Eastern parts of the country probable resources are characterized by a comparatively low module value (100-200 m^3/day from km^2).

As of 2004 256 ground water aquifers have been located**.** Their total operating stock constitutes 6586 thousand m^3/day, or 13% of the total probable resources in the country. Distribution of resources and supplies of ground waters by the basins of main rivers is presented in table 2.2. Superficially lying water-bearing fields (50-200 m), having close hydraulic connection with superincumbent ground water aquifers and surface water flows, are mainly operated.

Table 2.2 – Resources and supplies of ground waters in the basins of main rivers in Belarus

River basins	Probable ground water operational resources, thousand m^3/day	Number of aquifers	Located operational ground water resources by categories, thousand m^3/day				
			A	B	C_1	C_2	Total
Zapadnaya Dvina	8141,2	26	332,3	223,3	194,8	-	750,4
Dnepr	15144,8	113	1612,6	977,6	372,12	10,0	2972,32
Pripyat	10278,4	45	508,1	383,8	122,7	41,0	1055,6
Neman	9629,3	46	452,56	486,64	209,5	10,0	1158,7
Vilia	4589,0	14	134,0	125,3	40,1	-	299,4
Zapadnyi Bug	1813,3	12	205,25	122,65	22,2	-	350,1
Total:	**49596,0**	**256**	**3244,81**	**2319,29**	**961,42**	**61,0**	**6586,52**

The biggest ground water aquifers with the located supplies of more than 40-50 thousand m^3/day are situated around big industrial centers and settlements of Minsk, Gomel, Vitebsk and Grodno regions.

Use of natural waters

Starting form the 90-s total water consumption fell both from surface and ground water sources. In 2005 water intake from natural water bodies of the Republic of Belarus constituted 1773,2 million m^3 (in 2000 – 1882,7 million m^3), including 739,4 million m^3 - from surface water sources and 1033,8 million m^3 – from ground water sources (table 2.3). Minsk remains the largest water consumer in the country. In 2005 254 million m^3 of water was consumed within the city's territory, including 205 million m^3 - for public water supply, and 49 million m^3 – for industrial use. In 2004 Brest consumed 38,3 million m^3 of water with the intake constituting 44,8 million m^3; Vitebsk – 44,3 million m^3 (intake – 53,6); Gomel – 72,0 million m^3 (intake – 80,5); Grodno – 69,9 million m^3 (intake – 73,3); Mogilev – 67,9 million m^3 (intake – 78,0). In 2004 the biggest volume of water was taken from the Dnepr river basin – 1092 million m^3, including 443 million m^3 – from the Berezina river basin and 362 million m^3 – from the Pripyat river basin.

A 24-hour service water consumption rate per capita in the Republic of Belarus is about 180 liters. Nevertheless, per capita consumption of drinking water in the cities of Belarus is substantially higher as compared to most European countries (120-150 liters with 24 hour service).

Consumption decrease is ensured by regulation of the instrumental control of water intake volumes in the household and communal sectors, and introduction of resource saving tendencies. In 2004 instrumental control covered 66% of water intake from natural sources and 63 % of sewage water discharge. 2960 enterprises have wastewater outlets. 387 of them - directly into surface water bodies (456 outlets). Discharge waters from 3500 outlets flow beyond water bodies.

Further reduction of drinking quality water consumption for production purposes has been registered (from 171 to 151 million m^3 in 2005). Reduction tendency of water use for production purposes, observed during last five years, has remained unchanged (from 529 million m^3 in 2000 to 441 million m^3 in 2005). Reduction rates of water consumption in agriculture have also remained: from 155 million m^3 in 2000 to 121 million m^3 in 2005.

Nonwithdrawal use of surface water resources is accomplished by the hydroenergy sector (6 thousand kilowatt of the established capacity), fish industry (1100 ponds), water transport (extension of rivers and channels with firm depth – 2,5 thousand km^2).

In comparison with the year 2000, in 2005 volume of water, involved in recycling water supply system increased from 6155 to 6369 million m^3. Due to the introduction of the recycling water supply system, percentage of fresh water saving in industry increased by 1% and constituted 93%.

Table 2.3 – Main indices of water consumption in the Republic of Belarus, 2000-2005

Index	Water volumes, million m^3 a year					
	2000	2001	2002	2003	2004	2005
Water intake from natural water bodies	1883	1885	1865	1832	1791	1773
Fresh water use:	1700	1705	1692	1667	1646	1600
-for household and drinking purposes	782	794	794	785	767	750
-in industry	529	523	500	455	469	442
-in agriculture	155	148	139	134	125	121
-for irrigation	5	6	5	12	8	6
Water rate in reverse water supply systems	6155	6100	5722	5842	6391	6369
Water loss at transportation	117	113	117	116	107	101
Water, discharged into surface water bodies:	1174	1205	1169	1143	1140	1149
- polluted and insufficiently purified	25	23	20	15	11	10
- treated to standard quality	884	903	884	872	866	846
- normative clean (without purification)	264	279	265	256	261	290
Capacity of purification facilities, after which sewage waters are discharged into water objects	1329	1328	1329	1346	1351	1329

In comparison with the year 2000, in 2005 the discharge of sewage waters into surface water bodies fell from 1174 million m^3 to 1149 million m^3. There was also a 14 million m^3 reduction in the discharge of polluted and insufficiently purified waters, and a 35 million m^3 reduction in the discharge of effluents, treated to standard quality. The biggest volume of normative clean water was discharged into water bodies by agricultural enterprises, mainly, of fish industry.

The main part of discharged waters is composed of effluents, treated to standard quality. The share of insufficiently purified sewage waters in aggregated discharge volume decreased and constituted 0,98% of the total amount of sewage waters. According to the statistical data, in 2004-2005 discharge of polluted waters did not take place without having completed purification procedures.

In the sphere of industrial production the biggest input to water discharge belongs to the energy sector (91,6 million m^3). A slightly smaller volume of sewage waters is released by petrochemical industry (71,2 million m^3) and fuel industry (35,0 million m^3). Sewage from these sectors and from the food industry sector (17,3 million m^3) constitute 89% of all sewage waters discharged by the industrial sector.

Total volume of normative clean sewage waters (98%), discharged into water bodies by industrial enterprises, is generated by three industrial sectors: electroenergy, food, chemical and petrochemical. Together with fuel industry they discharge 81% of effluents, treated to standard quality, generated by the industrial sector.

Pollution of rivers with sewage waters and quality of surface waters

On the whole in the country the amount of pollutants, contained in sewage waters and discharged into water bodies has undergone only slight changes. In 2004 there remained a tendency of reducing discharge of organic substances, oil products, suspended particulates, ammonia nitrogen and copper (table 2.4). A slight increase in the discharge volume was only registered for ammonia nitrogen and nitrate nitrogen. Small amounts of lead, cobalt, fluorides, molybdenum, phenols were discharged into rivers and water bodies.

Table 2.4 – Discharge of pollutants as part of sewage waters in the Republic of Belarus over the period of 2000-2004

Indicator	Dimension	Year				
		2000	2001	2002	2003	2004
Organic substances (BOD-5)	Thousand tons	10,6	9,7	8,9	8,5	9,7
Oil products	Thousand tons	0,23	0,23	0,20	0,19	0,16
Suspended particulates	Thousand tons	14,8	15,1	13,2	13,4	13,4
Sulphates	Thousand tons	64,0	63,1	62,7	68,4	64,0
Chlorides	Thousand tons	77,8	79,5	72,7	74,7	77,6
Ammonia nitrogen	Thousand tons	6,6	7,2	6,3	6,2	5,9
Nitrite nitrogen	Thousand tons	0,2	0,21	0,23	0,23	0,36
Nitrate nitrogen	Thousand tons Thousand tons	2,7	3,1	2,8	2,8	3,8
Copper	t	18	21	13	13	15
Other metals (iron, zinc, nickel, chrome)	t	491	521	435	418	454
Number of enterprises having wastewater outlets into natural surface water objects	unit	422	426	422	396	387

The main share of sewage waters, containing pollutants, is generated in the housing and communal services sector (74,6% of the aggregated volume of sewage water with the content of pollutants). These waters contain 91,8% of all ammonia nitrogen, discharged into the rivers, as well as 94,4% of nitrite nitrogen, 90% of phosphates, 89% of organic substances, 88% of synthetic surfactants, 87% of chlorides and oil products, 83% of suspended particulates and 57% of sulphates.

94% of all sewage waters, discharged into water bodies, are treated at purification facilities of 98 cities. Modern sewage system usually envisages simultaneous purification of effluents from industrial enterprises and housing and communal services sector. Aggregated capacity of these purification facilities in 2005 constituted 1329 million m^3. At the same time real volume of effluents, treated to standard quality, and insufficiently treated sewage waters does not exceed 856 million m^3. Capacity load of purification facilities constitutes 64,4%.

Picture 2.2 – Svisloch river in Minsk

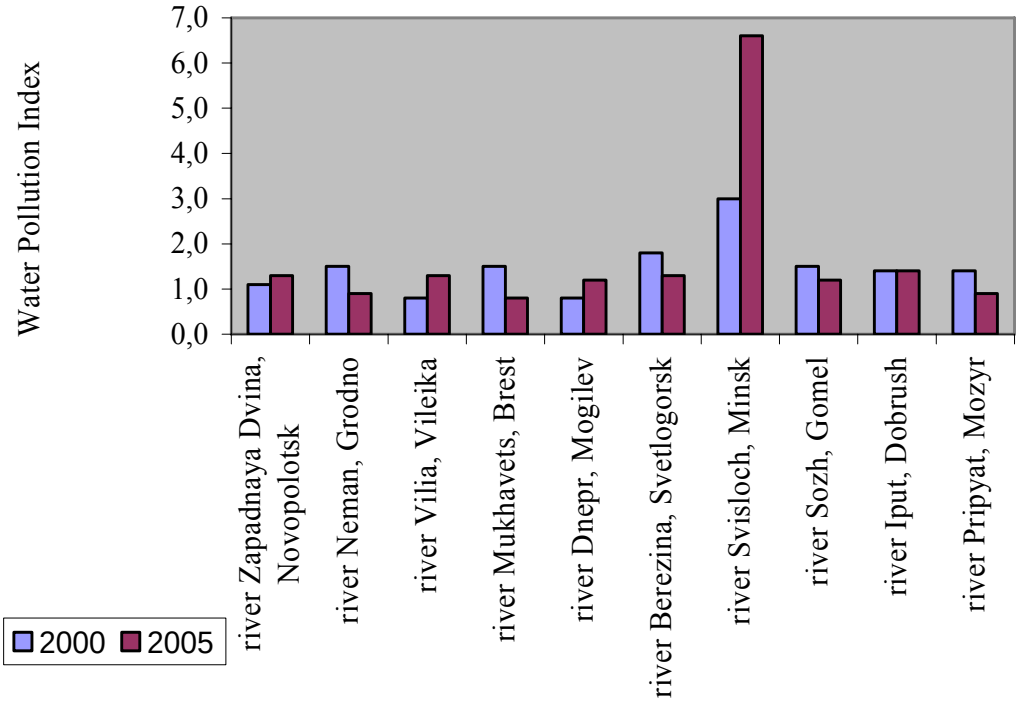
Due to big discharge volumes fishery is the main source of pollution, received by rivers and water bodies as part of effluents: about 100% of phosphates, 96% of iron and suspended particulates, 86% of sulphates, 83% of chlorides, 81% of organic substances and 67% of ammonia nitrogen from the total amount of pollutants generated within the agricultural sector.

Among local sources of surface water pollution regional centers stand out. Their share in the total load of heavy metals (nickel, iron, zinc, chrome) is 68%, of suspended particulates - 64%, nitrogen compounds (ammonia nitrogen, nitrate nitrogen and nitrite nitrogen) - 58%, oil products - 63%, organic substances - 54%. The biggest local source of surface water pollution is the city of Minsk. It generates 26% of the aggregated amount of heavy metals, 36% - of nitrogen compounds, 38% - of oil products, 40% - of suspended particulates, 32% - of organic substances. It should also be noted that 99% of the total phtorides' volume, contained in the effluents, is generated in Gomel. Mogilev is responsible for 35% of the phenols, discharged into water bodies.

The level of effluents, discharged into the surface waters of main river basins differs. Water bodies in the Dnepr river basin are exposed to the most significant anthropogenic impact. Rivers in the basins of Neman, Zapadnaya Dvina, Zapadnyi Bug receive a much smaller technogenic load. The most affected by sewage waters are the following river stretches: Svisloch river down from Minsk, Uza river down from Gomel, Dnepr down from Mogilev, Neman down from Grodno,

Sluch down from Soligorsk, Zapadnyi Bug down from Brest, Zapadnaya Dvina down from Vitebsk and Novopolotsk, Berezina down from Bobruisk, Pripyat down from Mozyr.

According to the monitoring data most of the rivers of Belarus are classified as relatively clean (picture 2.3). Surface water quality assessment is carried out in conformity with the water pollution index, which is based on such parameters as dissolved oxygen, BOD, ammonia nitrogen and nitrite nitrogen, oil products and zinc.



Picture 2.3 – Dynamics of Water Pollution Index on the main gauges of the monitoring network

Higher values of Water Pollution Index are characteristic of river stretches down from large industrial centers. The most polluted river is Svisloch at the stretch down from wastewater outlet of Minsk aeration station.

State of ground waters

Levels and quality of ground water are monitored at observation groundwater wells. According to the monitoring results' analysis ground water level decrease at most of group water intake points does not exceed the allowable values, established while calculating the operational supply of water bearing fields and groundwater aquifers. Practically all water intake points function under the established filtration regime. Nevertheless, long-term and intensive groundwater use by means of group water intake in large industrial centers (Minsk, Gomel, Grodno, Baranovichi, etc.) led to the formation of vast depression cones in the operated aquifers. The result of several group water intake points' functioning in Minsk district was a cone of depression with the diameter of more than 40 km and a 25 – 30 m submergence in the central part.

Pointed ground water intake carried out near small rivers greatly influences the water flow. Thus, operation of Minsk ground water intake points affected the water flow upriver Tsna, Loshitsa, Slepyanka, Volma, Trostyanka and Sennitsa.

Quality of fresh ground waters does not always meet sanitary and hygiene standards. The most characteristic feature for a number of regions is excess of iron in the ground water (up to 2-5 mg/dm^3 and more, MAC being 0,3 mg/dm^3) and, consequently, increased water turbidity and

color. Sometimes excess of magnesium concentrations is registered (up to 0,3-0,8 mg/dm^3 with MAC = 0,1 mg/dm^3). The most part of fresh ground water has fluorine and iodine deficit.

In the last decades deterioration of ground water quality has been observed due to anthropogenic impact with the main role played by agricultural, housing and communal services and industrial sectors. Dangerous levels of ground water pollution occur around large landfills of communal solid waste, purification facilities and filtration fields.

Application of fertilizers and toxic chemicals leads to the increased concentrations of chlorides (a 4-6 times excess of the background concentration), sulphates (a 2-4 times excess), nitrates (a 6-10 times excess) in the ground waters. Around livestock complexes, irrigated fields, storage facilities of mineral fertilizers and toxic chemicals ground water pollution takes focal character. Here MACs of chlorides and sulphates are exceeded by 2-3 times, nitrates – by 4-5 times, ammonia – up to 200 times, nitrites – by 2-3 times; content of potassium and sodium is increased by up to 200 mg/dm^3.

Around salt dumps and sludge depositories of Soligorsk potassium fertilizer plant there is a zone of sodium chloride salinization. Both ground and surface waters of Soligorsky reservoir and river Sluch are being polluted.

Water supply and drinking water

Groundwater is the main source of urban water supply. 155 group water intakes are used for centralized water supply of 92 cities and industrial centers of Belarus. Aggregated water intake from these sources constituted 0,656 km^3/year. Water intake from the sources with unconfirmed supplies is 0,384 km^3/year. In 2005 surface water was partially used only for the drinking water supply of Minsk and Gomel.

Sanitary and hygiene parameters around water intake points and their sanitary and technical conditions, as well as specificity of purification facilities have a substantial influence on the drinking water quality. A number of water intake wells (14%) in the country lack strict water conservation zones around them and about 80% of communal water pipeline needs a complex of purification facilities (mainly, for deferrization) to be installed.

Ground water quality of operated aquifers mainly corresponds to the provisions of State Standard 2874-82 “Drinking water” and Sanitary Regulations and Norms 10-124 RB 99. However, by a number of parameters (hardness, color, turbidity, content of magnesium, iron, ammonium) ground waters do not correspond to these provisions on most of water intakes.

In 2004 13995 sources of centralized public water supply were examined. Results of the laboratory research revealed inconsistency between 47,5 % of water samples, taken from these sources, and sanitary and hygienic standards for drinking water. In comparison with the level of 2003 the above mentioned indicator increased by 21% and varies from region to region (from 30,9% in Mogilev region to 66,8% in Brest region). On the whole in the republic 45,8% of examined water samples failed to meet the sanitary and chemical norms. The main reason for deviation of drinking water quality from hygienic standards is the enhanced content of natural iron in water and connected with it excess of turbidity and color norms. In total 50,6% of examined water samples did not meet sanitary norms for iron content in drinking water. In 16,1% of the cases this indicator exceeded the allowable value for the water sources of the 1st class by 5 and more times.

Besides, according to the data of state sanitary control laboratories in 2004 the following percentage of the examined water samples revealed excess of drinking water standards (% of the examined samples):

- water hardness – 2,6;
- magnesium content – 5,9;
- ammonium content – 2,0;
- nitrates’ content – 0,5;
- other chemical substances – 0,5.

There was a 0,1% improvement of water quality according to microbiological standards. Only 1,6 % of samples did not meet these standards of drinking water. In 0,5% of the cases coli-index of the examined samples exceeded 9 (quality standard for drinking water from non-centralized water supply sources).

In 2004 institutions of state sanitary control examined 13997 sources of decentralized public drinking water supply. 18,8% of them failed to meet sanitary norms. More than 40% of water samples from these sources did not correspond to sanitary and chemical standards, 20,9% of the samples did not comply with the microbiological norms. Main quantity of water samples, deviating from the established norms, had enhanced concentrations of nitrates (39,4 %), organoleptic properties (9,2%), total hardness (12,4%), iron (5,4%), ammonium (0,9%) and magnesium (2,1%).

Pollution of water wells is connected with the application of organic and mineral fertilizers. Inappropriate state of adjacent territories, close proximity of barns for cattle, lack of clay bunds around the wells are important reasons for the increased level of water pollution.

Water bodies of the first category have been used for public water supply of Gomel and Minsk. In 2004 Grodno was transferred to a water supply system from ground water sources. In 2004 61,9% of water samples from the above mentioned sources did not meet hygienic norms in sanitary-chemical indicators, and 14,5% – in microbiological.

Inconsistence of water quality with the established norms of color and turbidity is, as a rule, noted during the flood period. It may be stated that in 2004 water quality in this group of indicators deteriorated in the open water sources used for the water supply of Minsk.

In 2004 14,5 % of water failed to meet microbiological standards. It is connected with the enhanced concentration of lactose positive colibacillus. Deviation from microbiological norms was registered at Gomel water intake point.

On water bodies of 2nd category, used by population for cultural and household purposes, water samples were taken on 788 gauges. In 2004 water quality in the locations under state sanitary control was better than in 2003: 15,5% of samples didn't meet sanitary and chemical norms; 8,7% - microbiological. Excess of microbiological standards was mainly predetermined by enhanced concentration of lactose positive colibacillus. At the same time in 1,2 % of the cases agents of infectious diseases were tested in the water. The biggest share of water samples, failing to meet sanitary and chemical norms, was registered at the water bodies, used by the population of the city of Minsk (22,9%) and Gomel region (41,3%). The most unfavorable water quality by microbiological criteria was detected in the water bodies of Minsk and Minsk region. 12,7% of water samples taken in Minsk and 12,0% - in Minsk region did not meet the hygienic norms.

Water is one of the most important environmental components. It is used and protected in the Republic of Belarus as a vital part of human life and natural systems. **Ministry of Natural Resources and Environmental Protection of the Republic of Belarus** is responsible for water resources' management. It implements state control over use and protection of water resources, as well as elaborates legal acts, standards and measures in this sphere, and issues permits for special water use.

These permits constitute an important foundation for water resources' management because they regulate fresh water intake volumes and the amount of effluents, generated by industrial enterprises and different communal services. They also envisage collection of fees for water intake and water pollution. Water Code of the Republic of Belarus (15.07.1998) is the main normative legal act in the field of water resources' management, which covers a wide specter of issues, aimed at rational use and protection of water resources.

State policy of water resources' management envisages improvements in surface and ground water use and protection systems. Construction and reconstruction of water supply systems and water purification facilities are carried out along with other measures in the field of water resources' protection. In 2002 Ministry of Natural Resources and Environmental Protection of the Republic of Belarus elaborated Regulation on water protection zones and riversides of big and middle-size rivers, which was then adopted by the Council of Ministers of the Republic of Belarus. Big work has been carried out to establish water protection zones for small, middle-size and big rivers, as well as for the largest lakes and water reservoirs.

Land resources and soils

Land use and types of soils

Land is the main natural and national resource of the Republic of Belarus. Social, economic and ecological situation in the country strongly depends on its effective use and protection. The specific feature of land is its multifunctional character: Land is a basic resource for material production; provides space for the distribution of economic sector, settlements and infrastructure; serves as a basis for agricultural and forestry management; is a constituent and indispensable part of natural systems. Its soils possess the unique quality of fertility – ability to produce biomass. Soil conservation and its rational use are the priorities of environmental protection policy.

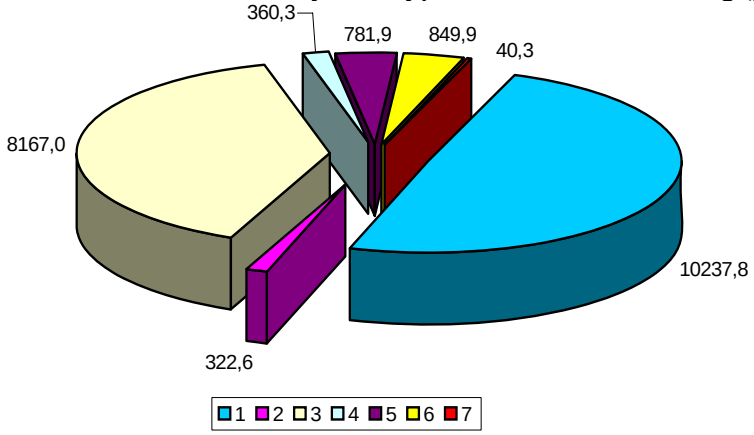
There are various types of soils on the territory of Belarus: sod-podzolic, sod-podzolic-waterlogged, sod and sod carbonate, sod and sod carbonate waterlogged, bog and flood plain (alluvial). The difference of granulometric composition is determined by a genesis variety of soil-forming materials, represented by morainic, aqueoglacial, lacustrine-glacial, eolian, lacustrine-bog and river-borne deposits. Light sandy loamy and loamy soils are the most suitable for agriculture. They have comparatively stable water regime and abundant supply of nutrients. Harvest, grown on loamy sands, almost half of which are underlain by loams and clays from the depth of up to 1 m, are substantially cut down. The lowest fertility rate is characteristic of sandy soils.

Agricultural lands are composed of clayey and clayey loamy soils - 0,4%, loamy and light loamy soils - 20,1%, loamy sands – 45,6%, sandy – 21,2%, peatlands – 12,7%. Moisture content is one of the most important characteristics, determining quality composition of agricultural lands, especially arable. The share of waterlogged lands in the total amount of arable lands is 51,3%. In regions this index varies from 43,8% (Grodno region) to 64,3% (Vitebsk region).

Agricultural lands have different degree of water content. Thus, automorphous (normally wetted soils) constitute 34,9 %, slightly gleyey (temporarily excessively wetted soils) – 22,9%, gleyic – 21,4%, gleyey – 7,0%, bog – 13,8%.

The distinctive feature of the country's territory is prevalence of peat soils, their distribution within the regions being uneven. The total territory of peat bogs before their intensive drainage constituted 2,9 million ha, or 14% of the country's territory. The main part of fen peat soils is concentrated in the Belarusian Polessye.

According to the data of State land cadastre (as of 01.01.2005), the total land area in the republic constitutes 20759,8 thousand ha. Land structure by main types of land is the following (picture 3.1).



Picture 3.1 – Land use in the Republic of Belarus (area thousand ha): 1 – lands of agricultural organizations, private farms and citizens; 2 –reserve land; 3 – lands of state forestry enterprises; 4 – lands for general use in settlements; 5 – lands, occupied by industrial, transportation, defense, communication and other facilities; 6 – lands of enterprises, organizations, as well as environmental, recreational, sanitary, historical and cultural lands; 7 – lands, occupied by hydroengeneering and other water facilities.

Information on land use and its change over the period of 2001–2004 is presented in table 3.1.

Table 3.1 – Land use in Belarus and its dynamics

Land types	Area, thousand ha		
	As of 01.01.2002	As of 01.01.2005	+, –
Agricultural lands, including arable	9204,7 5761,1	9076,3 5547,9	–128,4 –213,2
Forest and other afforested lands	8571,1	8821,7	+250,6
Lands under mires	934,0	916,2	–17,8
Lands under water bodies	475,6	478,5	+2,9
Lands under roads and other transport communications	358,4	362,2	+3,8
Lands under streets and other sites of general use	153,0	150,2	–2,8
Lands under constructions	329,8	330,7	+0,9
Disturbed lands	19,6	5,9	–13,7
Abandoned and other lands	713,8	618,1	–95,7

Analysis of land dynamics from 2001 to 2004 revealed main tendencies of land area changes by categories of their use:

1) gradual reduction of agricultural, including arable, land area (32,1 thousand ha and 53,3 thousand ha a year, correspondingly);

2) sustainable increase of forest lands and lands, covered with wood and shrub vegetation (annual increase by 62,6 thousand ha);

3) very slow increase of the amount of lands under water bodies, roads and other transport communications (0,72 thousand ha and 0,895 thousand ha a year, correspondingly);

4) gradual reduction of the amount of disturbed, abandoned and other lands (3,4 thousand ha and 23,9 thousand ha a year, correspondingly);

Main reasons for agricultural land area reduction are withdrawal of low-yield lands from agricultural use and land allotment for other needs. Profile change is recommended for 1338 thousand ha of agricultural lands, of which 801,0 thousand ha is composed of arable lands, including 59,2 thousand ha in Brest region, 259,7 thousand ha in Vitebsk region, 119,2 thousand ha in Gomel region, 76,6 thousand ha in Grodno region, 157,0 thousand ha in Minsk region, 129,3 thousand ha in Mogilev region. Real work in this direction is already being carried out. According to the data of the Committee on Land Resources, Geodesy and Cartography under the Council of Ministers of the Republic of Belarus, by the beginning of 2005 about 600 thousand ha of low fertile arable lands have already been transferred.

At present there are 3416,0 thousand ha (16,5% of the country's territory) of drained lands, of which 2902,0 thousand ha are occupied by agricultural lands. 1068,2 thousand ha of bogs have been drained for agricultural purposes. About 30% of drained agricultural lands are occupied by sandy and loosened soils of light granulometric composition. Inventory data of land-reclamation systems showed that 760,8 thousand ha of lands in the country need reconstruction, and 184,0 thousand ha of drained lands need agromelioration to be held.

The biggest share of lands (42%) belongs to agricultural organizations. As of the beginning of 2006 there are 2204 farm enterprises with the total land area of 148,6 thousand ha (less than 1%), their average size being 67,4 ha.

Main environmental threats to lands and soils

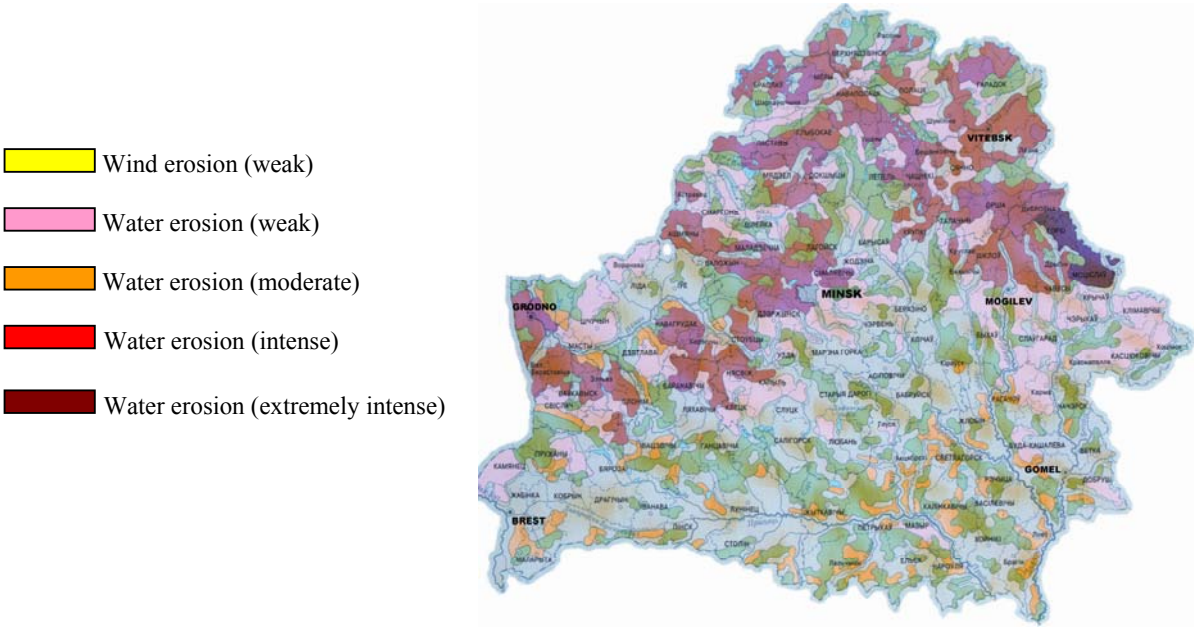
One of the up-to-date environmental problems in Belarus is protection and sustainable use of land resources. Land degradation in the variety of its forms is predetermined by natural factors, anthropogenic activities, non-observance of norms and rules of rational use and protection. Ac-

cording to natural and territorial conditions, as well as features of economic use, land/soil degradation is revealed in the following ways:

- water, wind soil erosion;
- chemical, including radionuclide, contamination of lands\soils;
- soil deterioration (especially peat soil) in the result of agricultural use;
- land degradation in the result of mining operations, road and other types of construction, and also flooding and submergence;
- degradation of peat soils on drained peatlands in the result of peat fires;
- degradation of forest lands in the result of irrational forest management and forest fires;
- land degradation due to excess of recreational, technical and other anthropogenic impacts.

Natural conditions and traditional practice of land use for agricultural purposes caused water and wind soil erosion on the territory of Belarus.

According to the data of the Institute of Soil Science and Agrochemistry of the National Academy of Sciences of Belarus, 491,2 thousand ha, or 5,4% of the total area of agricultural lands in the Republic of Belarus, are exposed to erosion, 426,6 thousand ha of which are made up of eroded arable land (7,7% of the total arable land area). Area of lands with potentially possible soil loss (erosion-prone) constitutes 1443 thousand ha, i.e. almost 7% of the country's territory (picture 3.2).



Picture 3.2 – Types of erosion and its intensiveness

The biggest share of eroded lands has been identified in Minsk region – 125,0 thousand ha, Vitebsk region – 116,2 thousand ha, Mogilev region – 89,8 thousand ha and Grodno region – 84,9 thousand ha. The total area of eroded agricultural lands in Brest region constitutes 42,6 thousand ha, and in Gomel region - 32,7 thousand ha. According to the share of eroded lands in the total area of agricultural lands the regions are distributed in the following way: Vitebsk – 7,3%, Minsk and Grodno – 6,6%, Brest – 2,9%, and Gomel – 2,3%.

Water erosion prevails in the Northern and central regions of the country: Vitebsk – 112,0 thousand ha (96,4%), Minsk – 103,6 thousand ha (82,9%), Mogilev – 87,1 thousand ha (97,0%), Grodno – 63,6 thousand ha (74,9%).On the whole in 18 administrative districts of Belarus eroded soils occupy more than 10% of agricultural land.

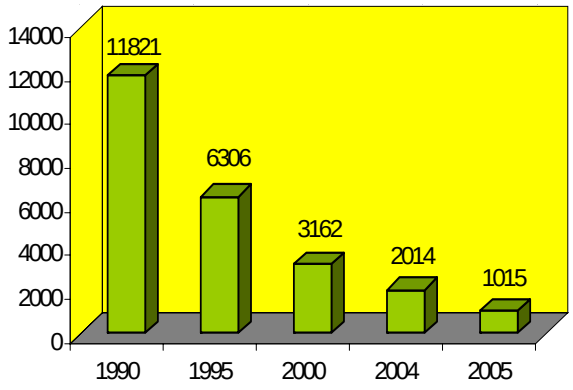
Wind erosion (deflation) is more often encountered in the South and the South-West, where large areas are occupied by soils of light granulometric composition (sandy soils and loosened loamy sands) and drained peatlands (Gomel region – 21,8 thousand ha; Southern part of Minsk

region – 21,4 thousand ha; Brest region – 11,3 thousand ha). Vast areas of land, affected by wind erosion, are also situated in Grodno region (21,3 thousand ha). In total 82,7 thousand ha of the country's territory is affected by soil deflation, of which 72,3 thousand ha are occupied by slightly deflated soils, 9,7 thousand ha – by moderately deflated soils, and 0,7 thousand ha – by deflated soils. Moreover, 3458,9 thousand ha of lands (that is 38,0% of agricultural lands) are referred to as deflation-prone, which may be exposed to wind erosion in the case of incorrect management.

Economic damage from land erosion means annual loss of fine grained soil matter and biogenic soil elements, as well as decrease of the fertility rate and pollution of water bodies and watercourses. The average of 10–15 tons of soil, 150–180 kg of humus substances, up to 10 kg of nitrogen, 4–5 kg of phosphorus and potassium, 5–6 kg of calcium and magnesium are annually leached from one hectare of surface run off land. Loss of nutritious elements and humus, deterioration of agrophysical and agrochemical characteristics lead to the fertility decrease of eroded soils. In Belarus average harvest shortage of grain-crops on slightly eroded soils constitutes 12%, on medium eroded – 28%, eroded – 40%; harvest shortage of tilled crops – 20, 40 and 60%; of flax – 15, 34 and 50%; perennial herbs – 5, 18 and 30%, correspondingly.

According to the data of agrochemical inspections, negative tendencies in maintaining fertility level of agricultural soils have outlined during the last years. A decrease of humus, labile phosphorus and potassium content has been noted in half of the country's regions. Soil acidification is taking place. A substantial excess of the allowable content of mobile forms of zinc and copper has been detected in a number of agricultural territories adjacent to industrial centers and large livestock complexes.

The most perspective way to prevent erosion of agricultural lands is adopting landscape-adaptable cropping system and introducing anti-erosion crop rotation.



Picture 3.3 – Dynamics of disturbed lands' recultivation, ha

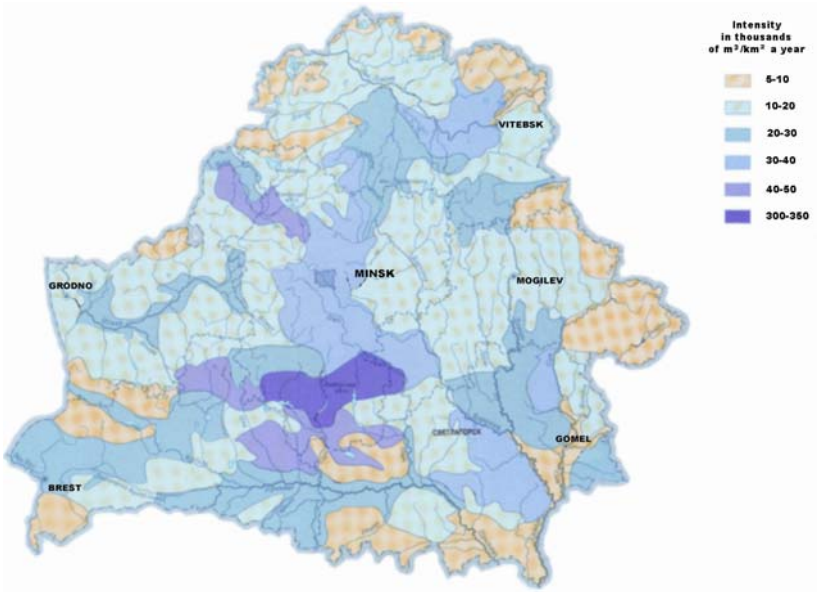
Agricultural use of peat soils remains to be intensive. This is especially dangerous for peatlands with small layer of peat. In the process of their exploitation 190,2 thousand ha of drained peat soils practically transferred into new soil formations of low fertility. The territory of cutover mires in the country is estimated to be 209,5 thousand ha, and mined deposits occupy 12,8 thousand ha. Thus, the total area of disturbed mires is 318,5 thousand ha.

At present one of the most perspective ways of peat deposits' management is rehabilitation by means of return to wetlands. By the beginning of 2005 about 40 thousand ha have been returned to wetlands. Recultivation of disturbed lands keeps going with a gradual decrease of their territory due to a cutdown of land allotment for peat extraction (picture 3.3).

Restoration of nature protective and media-forming functions of the cutover mires, strongly transformed peatlands and waterlogged grounds are the priority measures to combat land degradation. Land reclamation is not carried out in the country at present. All efforts are directed at selective reconstruction of reclamation systems of the lands, having been drained before. The adopted State Program of Preserving and Using Meliorated Land for 2006–2010 contains a number of urgent measures to ensure conservation and effective management of such lands.

The basic condition for conservation and further use of peat soils is the necessity to ensure high economic productivity level of cultivated crops, provided that consumption of the organic matters is economical and highly efficient during the whole period of peatland use, peat being moisture accumulator and nitrogen source. Floodplain lands with drained peat soils can only be used to grow forage hay crops.

Preservation and management of meliorated lands is not only of ecological, but also of big social and economic importance, meliorated lands constituting one third of all agricultural lands, including more than half of the meadows. The biggest social value is presented by these lands in 15 administrative districts (Berezinsky, Drogichinsky, Ivanovsky, Ivatsevichsky, Kobrinsky, Luninetsky, Maloritsky and Pinsky districts of Brest region; Kalinkovichsky, Lelchitsky, Narovlyansky and Oktyabrsky districts of Gomel region; Liubansky, Soligorsky and Starodorozhsky districts of Minsk region), where the share of meliorated lands exceeds 50%.



Picture 3.4 – Technogenic transformation of lands of Belarus

In some regions of Belarus lands are subject to radical transformation in the result of various economic activities, house-building, road and hydromeliorative construction, as well as mining operations. An example of technogenic transformation is Soligorsky district, where potassium mining is carried out. Within subsidences, which often constitute 3,5-4 m, soil degradation, swamping and submergence processes take place.

The Institute of Geochemistry and Geophysics of the National Academy of Sciences of Belarus has defined average volumes of technogenic load, which lands\soils are exposed to, by means of estimation of the removed soil quantity per unit area. They vary from 300 m^3/km^2 to tens thousands of m^3/km^2 and demonstrate a high level of this process manifestation on the territory of Belarus (picture 3.4). Technogenic transformation of lands\soils does not only directly influence the surface, but also activates many processes, which may lead to land degradation (development of slope taluses, erosion, landslides, gullies, bank erosion, soil deflation, etc.).

The available land monitoring data, as well as ecological and geophysical research results speak of the fact, that land pollution is mainly observed in cities and their impact zones, along automobile roads, in the proximity of communal and industrial waste deposits, on agricultural lands. Urban area with high level of land pollution constitutes 78 thousand ha, roadside territories comprise 119 thousand ha, impact zones of landfills - 2,5 thousand ha. Main pollutants are heavy metals, oil products, nitrates, sulphates, chlorides.

One of the most serious problems is radioactive contamination of land in the result of the Chernobyl catastrophe. Agricultural land area, contaminated with radioactive Caesium with the level grater than 37 kBq/m^2, constituted 1,8 million ha. 265,4 thousand ha of this area have been excluded from agricultural use, including 218,3 thousand ha in Gomel region and 47,0 thousand ha in Mogilev region. A 170 thousand ha restricted zone became part of the Polessye Radiation Ecological Reserve.

By the end of 2004 content of Caesium-137 in soil reduced by approximately a quarter because of natural radionuclide decay. Moreover, decrease of Caesium – 137 migratory capacity was noted. It happened due to transition to the non-exchangeable absorbed state, which led to decrease of its bioavailability over the period after the catastrophe by about 10–12 times. In connection with this 14,6 thousand ha of lands have been again converted into agricultural use. As of 1.01.2004 agricultural production is carried out on more than 1,1 million ha of lands, contaminated with Cae-

sium-137 with radioactivity 37–1480 kBqm^2. Main agricultural areas, contaminated with Caesium-137, are concentrated in Gomel (55%) and Mogilev (28%) regions.

Land contamination with Strontium-90 has a more local character. Strontium-90 contamination with radioactivity of more than 6 kBqm^2 was detected on the territory of 2,1 million ha, which is approximately 10% of the total area of the country. Maximum levels of Strontium-90 content in soil (up to 1798 kBqm^2) were detected on the borders of the 30-km zone within the Chernobyl Atomic Power Plant, in Khoiniksky district of Gomel region.

Land is an irreplaceable natural resource. Sustainable social and economic development of the country and the environment depends on its rational use. Therefore, the National Action Plan on Rational Use of Natural Resources and Environmental protection for 2006–2010 includes the following priority measures in the field of protection and use of lands and soils:

- creating a system of stimulating economic mechanisms for effective use and protection of lands;
- ensuring complex approach to planning, use and protection of lands, providing for support of ecological functions of soils in landscapes and implementation of measures to combat land degradation and contamination;
- continuing measures to optimize land use with the purpose of forming environmentally sustainable natural-territorial complexes by means of change in the profiles of low fertile agricultural lands, enhanced aforestation of territories with low percentage of forests, development of the network of specially protected natural areas;
- receiving reliable objective information on the state of lands\soils in the country on the basis of wide application of remote sensing methods, ecological-geochemical mapping, monitoring, development of methodical and analytical base in order to take timely and operational decisions;
- elaborating and implementing priority measures of the National Action Program to Combat Land Degradation with the purpose of improving coordination of the existing sectoral programs and joining efforts of all the stakeholders to ensure sustainable land use and protection of lands\soils;
- receiving information on soil pollution in settlements, ecological-geochemical mapping of the state of urban top soils, identification of typical pollutants for the main types of the country's enterprises.