The state of natural resources of the West Kazakhstan region (1990s – early 2000s)

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Abstract. The purpose of the study was to analyze the state of natural resources in the West Kazakhstan region during the 1990s to the early 2000s. The ecological condition of the region's natural resources remains one of its most pressing issues, necessitating regular monitoring. Analysis of official data sources revealed that the socio-economic development of the region coincided with the establishment and operation of large industrial and construction enterprises, leading to adverse effects on the region's natural environment. Monitoring of arable land in areas with dark chestnut soils indicated a continued loss of humus during this period. Presence of nitrates and high permanganate oxidizability suggested the presence of organic compounds linked to the decomposition of heptyl rocket fuel. Disease patterns indicated that populations in the southern areas of the region experienced high chemical burdens alongside radiation exposure. Furthermore, the article addresses concerns regarding the state of forest resources and wildlife, with authors highlighting a significant risk of natural resource contamination by industrial waste from heavy industries in the region.

1 Introduction

The issues surrounding the state of natural resources and their consumption are currently among the most pressing concerns in the Republic of Kazakhstan, demanding close attention [1-7]. In this context, the West Kazakhstan region stands out as one where the protection of natural resources is undoubtedly a top priority. The article primarily focuses not only on mineral resources but also on all natural resources of the region, including land, forests, water, and more. In the West Kazakhstan region, the depletion of traditional sources is an urgent problem, given the systematic increase in resource extraction volumes in the region [8-9]. Additionally, the article addresses the inefficient utilization and limited availability of land resources, as well as the problem of drinking water scarcity in the West Kazakhstan region. This is despite the region's status as one of the promising and vital areas of modern Kazakhstan [10].

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2 Materials and methods

The article is based on interdisciplinary approaches, using materials from the Ministry of Natural Resources and Environmental Protection of the Republic of Kazakhstan, along with other government departments. The interdisciplinary nature of the research is evidenced by the incorporation of data from meteorology, ecology, and biology. This combination enabled independent investigation of the environment in the West Kazakhstan region.

3 Results and Discussion

3.1 The state of land resources

The total land area of the region amounted to 15,032 thousand hectares. Based on soil and climatic conditions, the region was categorized into three zones: dry-steppe, desert-steppe (semi-desert), and desert.

In the first soil and climatic zone, as per the Ural branch of the State Scientific and Production Center for Land Management, there were 1,291 thousand hectares of arable land with a soil bonitet ranging from 16 to 47 points. In the second zone, there were 421 thousand hectares with a soil bonitet of 20–32 points. Overall, the region had a total of 1,875.5 thousand hectares of land with a bonitet exceeding 12 points.

Soil monitoring conducted by the Municipal State-owned Enterprise "Kunarlylyk" revealed a decrease in humus content over 24 years of agricultural land use: from 2.6% to 2.2% on chestnut, medium-sized soils, and from 3% to 2.1% on dark chestnut, medium-sized soils. This equated to a humus loss of 0.4% and 0.9%, respectively. Chestnut-type soils lost up to 24–30% of humus over a quarter-century.

Between 1987 and 1992, of the surveyed area by the Municipal State-owned Enterprise "Kunarlylyk", 36% of arable land covering 1,889 hectares had a low content of mobile phosphorus, averaging at 48%, while only 301.8 thousand hectares were sufficiently supplied with mobile phosphorus. 91% of the surveyed areas exhibited a high content of exchangeable potassium.

Arable land monitoring by the state Research and Production Center of agriculture in the dark chestnut soil zone indicated a continued process of humus loss, with a sharp decrease observed in the 1990s from 40.3% to 59.4%. A critical level of dehumification was observed in dark chestnut underdeveloped soils, where humus losses ranged from 64.1% to 71.1% [11].

Overall, in the primary grain-bearing areas of the region (zones I and II), every second hectare of arable land contained less than 2% humus and exhibited low availability of mobile forms of nitrogen and phosphorus. The primary causes of humus loss were the activation of erosion processes and the irrevocable technology of crop cultivation.

3.2 Land pollution

Soil contamination with salts of highly toxic heavy metals, including lead, cadmium, copper, nickel, manganese, and other components, was observed in the Bokeyordinsky, Zhangalinsky, Zhanibeksky, Kaztalovsky, Karatobinsky, and parts of the Akzhaiksky districts of the region, covering an area of 9.2 million hectares. This contamination was particularly pronounced in areas affected by the military landfill system, notably on the island of Mynzhas around the Sisengali wintering area.

According to the Scientific and Production Association Typhoon (1994), the presence of nitrates and a high value of permanganate oxidizability indicated the existence of organic compounds associated with the decay of heptyl rocket fuel, exacerbating the desertification process [8].

The extent of developed sands (zone III) in the southern regions of the West Kazakhstan region, specifically the Bokeyordinsky, Zhangalinsky, and Karatobinsky districts, doubled in the 1990s, reaching 56.5 thousand hectares. Consequently, villages such as Koktau and Kazarma in the Zhangaly district faced sand coverage, with threats extending to the village of Mukhor. Since 1992, the areas of degraded lands have stabilized at levels ranging from 9,688.7 to 11,939.6 thousand hectares, including eroded lands spanning 1,118.7 to 2,146.5 thousand hectares, and lands susceptible to water erosion covering 622.2 to 639.5 thousand hectares.

According to the state land cadaster, the region's saline lands covered 1,430.8 thousand hectares, with salt and salt complexes occupying 7,406.3 thousand hectares, sandy loam soil covering 714 thousand hectares, and sandy soil spanning 2,511 thousand hectares.

Reclamation efforts for disturbed lands progressed at a slow pace, reaching only 2.5% to 16% of the total required volume, except in 1997 when half of the disturbed lands were reclaimed. See Table 1.

Table 1. Dynamics of reclamation of disturbed lands of the region (ha).

years	at the beginning of the year		during the reporting period			at the end of the year	
	disturbed	depleted	disturbed	depleted	reclamated	disturbed	depleted
1996	1359	140	754	87	87	2026	140
1997	2026	140	127	1782	1216	937	706
1998	937	706	573	158.3	38.3	956	826
1999	956	826	235	202	187	1004	840
2000	1004	840	1295	1230.1	319.2	1979.6	1750.9

The region belonged to the typically agricultural and industrial regions of the republic. However, the reorganization of collective farms and state farms into peasant farms led to a sharp decline in agricultural production and a decrease in the arable land area from 1453.6 in 1996 to 574.1 thousand hectares in 1999, with a stable increase in the area of fallows, respectively, from 515.0 to 1202.3 thousand hectares. At the same time, the areas of hayfields and pastures underwent minor changes from 0.25 to 3.3%. See Table 2.

Table 2. Distribution by land (thousand hectares).

years	Distribution by land						
	in total	Including					
		arable land	fallow	haymaking	pastures	eroded	Exposed to water erosion
1996	13888.5	1453.6	515.0	1230.1	10679.4	1165.6	636.5
1997	13886.9	1103.8	728.9	1230.4	10815.2	2146.0	622.0
1998	13888.1	964.9	811.0	1230.7	10872.2	2146.5	622.0
1999	13888.1	574.2	1202.3	1230.4	10872.3	2146.5	622.2
2000	13888.2	437.1	1185.2	1230.0	11029.2	2146.5	622.1

3.3 The state of water resources

The basis of the region's water resources was river runoff, amounting to 2.7 cubic meters in average water content years, of which 80% came from the territory of the Russian Federation. In total, there were 50 rivers and watercourses in the region. The largest of them, used for water supply to the population and agriculture, were the Urals, Chagan, Derkul, Ilek, Barbastau, Bolshoy and Maly Uzen. All rivers had a snow supply, were fleeting and unevenly distributed throughout the region [10]. See Table 3.

Table 3. The water fund of the West Kazakhstan Region (million cubic meters).

Total water fund	rivers	lakes	Groundwater	swamps	Springs, wells	The waters of riverbeds	reservoirs	ponds
27946	27070	–	876	–	–	26300	765	5

For the water supply of industrial complexes in Russia, the river flow of the Ural River basin was regulated by a number of large reservoirs with a total capacity of 4.1 cubic meters. Overregulation of the runoff and water intakes from the river for the needs of Russia led to a decrease in water supply to Kazakhstan. See Table 4.

Table 4. Dynamics of the annual runoff of the Ural River in 1994–2000 (million cubic meters).

Runoff	1994	1995	1997	1998	1999	2000
annual runoff	16900	7380	7180	9040	9139	13150
Runoff coming from adjacent territories	12822	4518	4460	6200	6397	9205

Until 2000, the placement and development of productive forces in the Ural basin proceeded in accordance with available raw materials and the needs of the region's economy and the country as a whole, without adequate consideration of the water factor [10]. Consequently, a situation arose where the demand for water significantly exceeded the actual capacity to meet it, particularly during low-water years. Water consumption breakdown was as follows: utilities – 69%, industry – 65%, heat and power – 65%, agricultural water supply – 61%, and regular irrigation – 39%.

The Bolshoy and Maly Uzen Rivers originate in the Russian Federation. During low-water years, along with the Dzhanybekov system, they relied on water diverted from the Saratovsky and Pallasovky canals, drawing water from the Volga River via pumping stations to meet the needs of the West Kazakhstan region. Water supply through these channels operated on a contractual basis. In average water years, it was anticipated that flood runoff along the Bolshoy Uzen would supply 124 million cubic meters to Kazakhstan and 66.5 million cubic meters along the Maly Uzen.

Additionally, there were plans to deliver water from the Volga using 5 pumping stations along the Saratov Canal, amounting to 181 million cubic meters, including 62.7 million cubic meters for the Bolshoy Uzen River and 118.4 million cubic meters for the Maly Uzen River. However, due to insufficient funds to pay for water supply services from Russia, the volume of Volga water supply had decreased by tenfold over the past three years. In 2001, only 9.42 million cubic meters were received from the Saratovsky Canal to the West Kazakhstan Region, and 9.8 million cubic meters from the Pallasovsky watering and irrigation system (from the Volgograd region). See Table 5.

Table 5. Water intake by economic sectors in the Ural-Caspian basin for 1995-1999 (million cubic meters).

Years	Agricultural industry	Industry	Drinking and household	Other industries
1995	107	1374	183	100
1996	1021	1372	143	58
1997	1240	1258	127	224
1998	963	939	105	201
1999	563	794	106	204

The qualitative condition of most of the water bodies in the region remained unsatisfactory.

In the Ural River, the bulk of pollutants came from small rivers of the Orenburg region, as well as within the Aktobe region through tributaries of the Ilek River. The main pollutants of surface waters were: ammonium nitrogen, boron, chromium, fluorine, phenol, sulfur and others.

The most at risk of pollution were the waters of the Ilek River, whose pollution index was 4.51 (class 5, “dirty”) with boron content up to 19.4 the Maximum Permissible Concentration (MPC) and hexavalent chromium content up to 15.8 MPC. Contamination of the Ilek river with boron occurred as a result of boric acid production at the Aktobe Chemical Plant, contamination with hexavalent chromium occurred from wastewater entering the watercourse of Aktobe Chromium Compounds Plant JSC.

3.4 Underground water resources

In the West Kazakhstan region, 25 groundwater deposits were explored, with total operational reserves amounting to 376.9 thousand cubic meters per day. Among these, 19 were allocated for household and drinking water supply (281.6 thousand cubic meters per day), 1 for household, drinking, and industrial-technical water supply (25.3 thousand cubic meters per day), 1 for production and technical water supply (2.2 thousand cubic meters per day), 2 for land irrigation (67.4 thousand cubic meters per day), and 2 for balneological use (0.43 thousand cubic meters per day).

By 2000, 12 groundwater deposits were being exploited, with a total water withdrawal of 46 thousand cubic meters per day, representing 1.7% of the total water consumption in the region. The main sources of pollution at the Ural groundwater deposit were wastewater filtration fields and storage facilities for petroleum products, with phenol levels reaching 2.5 times the MPC, manganese levels at 12 times the MPC, and iron levels ranging from 2 to 10 times the MPC. In the Serebryakov deposit area, pollution sources included sewage storage ponds, manure storage from the Ural poultry farm, and agricultural irrigation fields from state farms

3.5 Water supply for the population and the economic complex

Ensuring the population’s access to high-quality drinking water emerged as one of the most pressing tasks, given the pollution of water sources, deteriorating sanitary and epidemiological conditions, and the unsatisfactory technical state of water supply systems [10].

Overall, the population of the West Kazakhstan region faced a shortage of drinking water meeting standard quality criteria. Moreover, some irrigation and watering systems lost connectivity with water sources due to pump station failures, riverbed silting, or simply lack of demand. In the 2000s, the Drinking Water program was introduced, outlining several measures aimed at maintaining the normal operational conditions of water supply systems in urban areas [11].

Water was supplied to 130 settlements via six group water pipelines totaling over 2,000 kilometers in length. However, by the late 1990s, the Furmanovsky and Taipaksky water pipelines had ceased operation and were deemed irreparable due to their expired service life. Among the aforementioned group water pipelines, only minor branches of the Urdinsky and Kamensky group water pipelines remained operational, while the rest had been inactive for over four years.

During this period, the number of settlements receiving water decreased to 17, representing a 90% decline.

In 2001, the total water intake by economic sectors amounted to 564.44 million cubic meters, or 21% of available resources, including: housing and communal services – 17.0 million cubic meters, industry – 7.1 million cubic meters, agriculture – 360.34 million cubic meters, and fisheries – 180 million cubic meters.

The primary reason for the decrease in water consumption was the lack of funds for water supply, exacerbated by the deepening economic crisis in the agricultural sector due to reforms in the public sector.

Although surface water resources from the Ural River adequately met the region's population's drinking water needs, they were geographically restricted. This posed challenges in transporting water over long distances through group pipelines, resulting in high operating costs. Surface water sources were also prone to pollution, necessitating costly improvements in composition quality and maintenance and repair of water pipes, hydroelectric facilities, and other water management infrastructure.

Despite these challenges, local underground water sources remained untapped. For water supply in the West Kazakhstan region, operational reserves from 27 groundwater deposits totaling 385.9 thousand cubic meters per day were explored and approved.

In 2000, only 11 deposits were operational through borehole water intakes. Over 300 promising sites suitable for centralized water supply of settlements were identified, with estimated resources totaling 187.0 thousand cubic meters per day, including 179.5 thousand cubic meters per day of fresh water. However, these water intakes extracted only 14.4 thousand cubic meters per day of fresh water, representing 9.5% of their projected resources.

The combined demand for household drinking water in settlements within the Ural River basin (Akzhaysky, Zhangalinsky districts) and the basins of Maly and Bolshoy Uzen Rivers (Kaztalovsky district) amounted to 34.2 thousand cubic meters per day. Previously, surface water from the Furmanovsky group water pipe supplied water to the population in these areas. To meet the water supply needs of settlements in these regions, where promising areas were not identified following geological exploration, it became necessary to utilize the explored Aimekenskoye and Kushumskoye groundwater deposits. The approved operational reserves of these deposits totaled 38.8 thousand cubic meters per day. Achieving this required the construction of several new group water pipes with headwater intakes at these two deposits [11].

In this context, considering the high operating costs associated with maintaining group water pipes and the availability of local underground water sources, whose reserves exceeded the total water demand of settlements, it became imperative to segment the Karabotinsky and Kamensky group water pipes and transition them to local underground water sources. Such segmentation would lead to a significant reduction in the cost of 1 cubic meter of water, factoring in the expenses of organizing and operating group borehole intakes. Consequently, transitioning to local underground water intakes, based on the existing water supply network, would profoundly resolve the centralized water supply issue in the settlements of Karatobinsky, Srymsky, Taskalinsky, and Terektinsky districts connected to group water supplies.

The Bokeyordinsky district of the West Kazakhstan region faced depression, exacerbated by the negative impacts of the Kapustin Yar test site in the Russian Federation. Due to the high levels of chemical and radiological pollution in the environment, extreme land degradation, and periodic mass deaths of domestic and wild animals were observed. The incidence pattern suggested that the population in the southern areas of the region experienced both radiation exposure and high chemical exposure. Scientific research indicated that six southern districts, covering an area of 9.2 million hectares and a population of 149.5 thousand people, were directly affected.

In addition to these challenges, the district's population suffered from a shortage of drinking water, which negatively impacted their health. According to the regional sanitary and epidemiological service, in the 1990s, the incidence of acute intestinal infectious diseases in this area exceeded the regional average by 1.6–3.7 times. To address this issue and provide the population with high-quality drinking water, the construction of the

Iskrovsky group water pipeline in the Urdinsky district of the West Kazakhstan region was deemed necessary, specifically to supply water to the Saralzhin village. The total cost of this project was 157 million tenge. Upon completion of the Iskrovsky group water pipeline, it was projected to provide drinking water to four settlements with a combined population of 3,313 people. Furthermore, the project was envisioned to contribute to the development of animal husbandry on local pastures, supporting the breeding and maintenance of up to 8,000 cattle, 1,000 horses, and 30,000 sheep.

3.6 The state of forest resources and wildlife

The West Kazakh Regional Territorial Administration for Forests and Bioresources included 8 state institutions for the protection of forests and wildlife [12]. The total land area of the forest fund of the region as of January 1, 2002 was 206.1 thousand hectares, including the area of 94.4 thousand hectares covered by forest. See Table 6.

Table 6. Enterprises of the Forestry, Fisheries and Hunting Committee of the Ministry of Natural Resources and Environmental Protection.

No	Name of the institutions	Area, thousand hectares.	
		total	Including those covered with forest
1	Akzhaysky	33.4	13.9
2	Burlinsky	18.9	13.5
3	Taipaksky	302.	10.4
4	Uralsky	36.6	12.0
5	Chapaevsky	34.3	12.8
6	Chingirlausky	26.8	7.8
7	Yanvartsevsky	19.6	13.9
8	Urdinsky	16.4	4.0

The forest reserve of the region was predominantly situated in the floodplains of the Ural and Ileka rivers, supplemented by small forest outliers along the arroyos and depressions of the Chingirlaisky and Urdinsky districts, as well as protective plantations established artificially along highways, on sands, ravines, and arroyos. These forest plantations held significance in water protection, soil protection, and field protection, classified as forests of group 1. In 2001, thinning and sanitary fellings were conducted across the region, covering an area of 1.3 thousand hectares, and resulting in the harvesting of 20.9 thousand cubic meters of merchantable wood. Forest income for 2001 amounted to 133.9 thousand tenge.

Reforestation efforts in 2001 encompassed the lands of the state forest reserve, spanning a total area of 150 hectares. Additionally, the regional territorial administration for forests and bioresources undertook forest planting activities to stabilize sands in various districts and establish roadside forest belts, covering a combined area of 365 hectares [12].

During the same year, 1,438 thousand pieces of planting material (including poplar, maple, ash, elm, Elaeagnus, currant, and tamarisk) were cultivated. Of these, 142.7 thousand pieces were deployed for landscaping settlements in the region during spring planting works. The forest fire season of 2001 saw the registration of 18 forest fire incidents within the forest reserve area, affecting 160 hectares of land, including 82 hectares of forested area. Unauthorized logging in 2001 amounted to 1,102.9 cubic meters, resulting in damage to forestry worth 127.9 thousand tenge. Consequently, 553 violation protocols were issued, and 12 cases were forwarded to judicial authorities.

As of January 1, 2002, forest pest infestations had spread across an area of 5,500 hectares, with the pine sawfly affecting 2,500 hectares, the unpaired silkworm affecting 2,000 hectares, and Exaereta ulmi affecting 1,000 hectares.

It is worth noting that due to insufficient funding, fire-fighting measures and forest pest protection measures were not fully implemented in the region

3.7 Hunting farm

The total area of the region was 15,032 thousand hectares, with hunting grounds covering 12,418 thousand hectares. Of this, 2,841 thousand hectares, or 23% of the region's territory, were allocated to hunting users. To ensure the reproduction and conservation of wild ungulate animal populations, the decision of the Akim of the region dated December 25, 2000, No. 218, titled "On the Suspension of Hunting for Wild Ungulates", established a moratorium on the shooting of all types of wild ungulates until 2003 inclusive [11].

The regional maslikhat and the regional Environmental Protection Fund played significant roles in carrying out anti-poaching measures. In 2001, funds for environmental protection measures were allocated from the regional budget through the regional environmental protection fund, totaling 525.0 thousand tenge. This included funds for protecting saiga during migration, wintering, rutting, and lambing, as well as for accounting for the number of hunting animals (3 million tenge), biotechnical measures for wild ungulate reproduction (800 thousand tenge), and organizing the fight against wolves and jackals (1,450.0 thousand tenge). In 2001, the Batys Ormany RSE obtained 750 wolves in the region. The same amount of funds was allocated in 2002

3.8 Fisheries

The West Kazakhstan Region boasted a substantial fishery reservoir fund, spanning approximately 70 thousand hectares, comprising 28 rivers, 6 reservoirs, and 190 lakes. The complex hydro-climatic conditions of the area, coupled with aridity and intensive water extraction for agricultural purposes, resulted in production process instability within the reservoirs. Consequently, commercial fish production exhibited significant fluctuations from year to year. In 2001, despite an approved limit of 530 tons, actual development amounted to only 86 tons. This shortfall was attributed to the untimely implementation of fish farming and reclamation measures, such as clearing shallow waters of vegetation, fish cultivation, and timely water supply, leading to rapid degradation and, concurrently, loss of commercial value or complete drying out during the baseflow period.

To address these challenges, the following issues needed resolution:

- Determining the role of natural reproduction in preserving the gene pool and multi-age structure of populations.
- Developing measures to secure financing for fisheries reclamation of natural spawning grounds during years with varying water content.
- Ensuring effective protection of biological resources within the reservoirs.

3.9 Specially protected natural areas

There were 3 state zoological reserves of republican significance in the region: Kirsanovsky and Burlinsky, located in the floodplain of the Ural River, occupying areas of 61 and 80 thousand hectares respectively, and Zhaltyrkolsky, covering 19 thousand hectares, situated in a semi-desert zone. The forest lands within the Kirsanovsky state reserve covered an area of 21 thousand hectares, while Burlinsky encompassed 22 thousand hectares. The Zhaltyrkul State Reserve predominantly consisted of wetlands.

The Kirsanovsky and Burlinsky reserves were inhabited by various wildlife species including elk, roe deer, spotted deer, wild boar, marten, European mink, muskrat, badger, wolf, fox, and hare. Additionally, there were 14 species of birds listed in the Red Book of Kazakhstan found within the territory of the Zhaltyrkol reserve.

Furthermore, the region housed the Urdinskiy landscape and biological reserve of regional significance, spanning an area of 16.4 hectares. Its primary aim was to preserve unique pine and poplar plantations and serve as a reference area for the sandy landscape. Additionally, there were 4 state reproductive hunting farms and 31 hunting farms, covering a total area of 12.4 million hectares.

Environmental protection measures in the region amounted to 2,467,609.1 thousand tenge, with 2,033,031.0 thousand tenge (82.4%) funded by own resources, 56,250.0 thousand tenge (2.3%) from the republican budget, 66,550.6 thousand tenge (2.7%) from the local budget, and 311,778.0 thousand tenge (12.6%) from other sources. Statistical data indicates that the largest share of financing stemmed from enterprises' own funds. Notable enterprises involved in environmental protection measures included Karachaganak Petroleum Operating B.V., a branch of Consolidated Contractor International Company S.A.L., Aksagaigazservice JSC, Intergazstroy JSC, Ural Plant Metallist JSC and Zenit, Condensate JSC, Alau LLP, BGS-Stroymechanizatsiya LLP, and Ural Oil Pipeline Administration.

An equally significant environmental concern in the region, particularly during the 2000s, revolved around ensuring environmental safety at the Karachaganak oil and gas condensate field [9].

Hydrocarbon production at the field led to a surge in pollutant emissions into the environment. For instance, emissions escalated from 4.3 thousand tons in 1997 to 14.3 thousand tons in 2000. Similarly, the generation of industrial waste soared from 503.5 tons to 29.9 thousand tons during the same period, constituting 63.5% and 80% of the regional pollution volumes, respectively.

Ten settlements were situated within the direct influence zone of the Karachaganak oil and gas condensate field. Additionally, the territory of Tungush village and the northern outskirts of Berezovka village fell within the sanitary protection zone of the deposit. Industrial monitoring conducted by the Kazhydromet laboratory revealed an excess of the maximum permissible concentration of nitrogen dioxide in the atmosphere of these settlements from the second half of 1998 to 1999, reaching levels 1.35–1.55 times higher than the permissible limits.

As a result of the measures taken in 2000-2001, nitrogen dioxide concentrations in the air basin of these settlements significantly decreased and amounted to 0.8 the MPC, only isolated cases of exceeding the MPC of nitrogen dioxide were observed. In recent years, the concentration of mercaptans has increased 2.0 times and amounted to 0.66 MPC.

Intensive soil pollution with hydrogen sulfide and petroleum products was also observed in the aforementioned settlements. In 1998, the presence of hydrogen sulfide was not noted, while in 1999, an excess was recorded only in the upper horizons (0–10 cm) at levels of 1.0–1.2 times MPC. By 2000, the accumulation of hydrogen sulfide in the upper horizons reached 1.25–1.75 times the MPC and 0.75–1.25 times the MPC in the lower soil layers.

The heads of several agricultural formations in the Burlinsky district attributed the decline in grain yields in 2001 to the negative impact of the Karachaganak oil and gas condensate field. Consequently, the regional territorial administration of the Environmental Protection System conducted a sample soil survey in grain crop fields across three rural districts of the Burlinsky district (Tungushsky, Zharsuatsky, and Kanaysky). The survey results revealed widespread soil contamination with hydrogen sulfide, both within the perimeter of the deposit (Tungush LLP) and outside the deposit's sanitary protection zone (Bars Farm, Shygyla LLP), at levels ranging from 9.3–21.3 times the MPC. Moreover, the highest concentration of hydrogen sulfide was detected at the soil surface (0–5 cm), with a notable decrease in concentration with increasing depth, clearly indicating soil contamination due to industrial emissions from the Karachaganak field [7].

4 Conclusion

In conclusion, the authors assert that the region experienced an extreme stage of agricultural land degradation and a persistent deterioration in public health due to high levels of chemical and radiological pollution in the environment. The disease structure highlighted a significant chemical burden on the population in the southern areas alongside radiation exposure. Preserving the ecosystem of the Ural River, crucial for stabilizing adjacent steppe territories, remained imperative. During the period 1996–1998, a sharp decline in groundwater levels due to water scarcity resulted in the drying and weakening of forests, exacerbating damage by pests and diseases. Furthermore, forest fires became more frequent. Uncontrolled livestock grazing led to the degradation of pasturelands during this period. Local executive bodies planned to address these and other natural resource challenges in the West Kazakhstan region in the ensuing years.

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