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APPRAISAL OF CURRENT ENVIRONMENTAL SITUATION ON THE MIL AND KARABAKH PLAINS IN AZERBAIJAN

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SUMMARY

The expanding global population has surged from 500 million in the mid-18th century to 7.8 billion today, with projections indicating sustainability for 10 billion individuals. Hence, optimization of water and land resources is imperative to feed the growing population. This article examines the Mil and Karabakh Plains, an important agricultural region in the Kura-Araz Plain of Azerbaijan. Historically, the said area relied on natural resources like rivers and aquifers for irrigation until the construction of the Orjonikidze Canal in 1933. Subsequent initiatives, including the Old Khangizi and New Khangizi canals, also enhanced the irrigation capacity. Soil reclamation projects between 1971 and 1985 aimed to maximize the utilization of arable lands, as challenges, i.e., water scarcity, persisted. The introduction of the Main Mil Canal in 1976 and the New Khangizi Canal in 1985 bolstered water access. However, incomplete drainage systems considerably affect the hydrogeological conditions. Despite setbacks in the Mil Plain, the evolution of irrigation systems underscores the ongoing efforts of sustainably managing the water and land resources for better productivity.

Keywords: Water resources, canals, drainage, mechanical irrigation, kahriz, canal construction, drain construction, ground water

Key findings: The Mil and Karabakh Plains have seen considerable overgrazing, leading to soil degradation and vegetation loss. Overgrazing can also cause soil erosion and reduce the area's crop productivity. The over-extraction has resulted in loss from agricultural runoff, and climate variability has contributed to water shortage in certain areas, affecting the ecosystem and crop production.

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INTRODUCTION

In the Mil and Karabakh Plains, Azerbaijan, the environmental situation has significantly evolved due to historical, geopolitical, and climatic factors. The said region with unique geographic features hosts various ecosystems and, most importantly, biodiversity. However, the environmental balance has gained disruptions in previous decades due to conflicts, intensive agriculture, industrial activities, and climate change. This research aimed to provide an overview of the current environmental situation in these areas, focusing on key challenges and ongoing conservation efforts (Aliiev, 2021).

The Karabakh Plain is a vast area located in the central part of Azerbaijan, bordered by the Lesser Caucasus Mountains to the east. It is also an essential agricultural zone, well known for fertile soil and abundant natural resources (Babaev *et al.*, 2011; Hasanov *et al.*, 2018). The Karabakh Plain comprises diverse landscapes, including steppes, forested areas, and wetlands. The climate is typically semi-arid, characterized by hot summers and mild winters. The said plain is rich in biodiversity, with unique plant species such as wild grasses and shrubs and diverse animal species, including various birds and mammals.

The Mil Plain lies to the southeast of the Karabakh Plain and is part of the extensive Kura-Araz Lowland. It is popular for its low-lying, flat terrain and suitable for agriculture. The region is home to the Kura River, a crucial water resource that significantly affects the local ecosystem and farming. The exponential growth of population over the past centuries has led to unprecedented challenges in managing water and land resources. This underscores the urgent need for nations worldwide to focus on optimizing the utilization of current water and land resources through innovative approaches (International Soil Classification System for Naming Soil and Creating Legends for Soil Maps, 2014; Babaev *et al.*, 2017; Sadigov, 2018a; Sadigov and Mustafayev, 2024a).

In this context, the presented study delves into the complex dynamics of water and land management in the Mil Plain (Mustafayev, 2018; Jafarov, 2020; Mehdiyeva *et al.*, 2023). Covering an area of 369,500 hectares, the Mil Plain is an influential agricultural landscape, comprising regions such as Imishli, Beylagan, and Aghjabadi. With time, the region observed considerable improvement in irrigation systems and land reclamation projects aimed at enhancing agricultural productivity and sustainability. The study embodies a multidisciplinary approach, integrating historical research, field studies, data analysis, expert insights, and policy consideration. Historical data collection involved past literature review to trace the evolution of irrigation systems in the Mil Plain, providing valuable insights about agriculture in the said region. Field surveys, geospatial analysis, and hydrological measurements occurred to evaluate the current state of irrigation infrastructure, water flow rates, consumption patterns, and water quality along the irrigation canals (Mammadov *et al.*, 2025; Ministry of Agriculture of Azerbaijan State Land Management Project Institute, 2020).

Furthermore, hydrogeological analysis of groundwater dynamics and statistical evaluation of water quality took place to understand the long-term effect of land and water management practices. The expert's consultation with hydrogeologists, agricultural scientists, policymakers, and stakeholders was instrumental in interpreting the required data and formulating recommendations for sustainable water and land management practices. The results and discussion presented herein shed light on the historical evolution of irrigation systems in the Mil Plain, from ancient canals dating back to the 4th–6th centuries to modern infrastructure development initiated during the Soviet era.

Detailed analysis of irrigation networks, water consumption rates, and land reclamation projects provides valuable insights and opportunities in optimizing resource utilization in the region (Mehdiyeva *et al.*, 2023). Moreover, the study highlights the vital

importance of addressing issues of inefficient drainage systems and soil salinization to ensure the long-term ecological sustainability in the Mil Plain (Sadigov, 2018b; Sadigov *et al.*, 2024b; State Standard of the Republic of Azerbaijan, 2013). Thus, the concerned study serves as a comprehensive assessment of water and land management issues in the Mil Plain, offering valuable insights and recommendations for policymakers, stakeholders, and researchers striving toward sustainable agricultural practices and environmental stewardship (Gumbatov *et al.*, 2024; Kashinsky, 1970).

MATERIALS AND METHODS

The methodology used encompassed a comprehensive approach integrating historical research, field studies, data analysis, expert insights, and various policy considerations to address the water and land management challenges in the Mil Plain. During field studies, the total humus measurement in the soil employed I.M. Tyurin's method, total nitrogen estimation employed the Kjeldahl technique, and carbonates' measurement used a calcimeter. By titration, CaCO_3 , total phosphorus (P), and total potassium (K) succeeded their determination by the ICP-MS (Agilent), with granulometric content determined by the method of N.A. Kaczynski. The detection of absorbed cations to establish soil absorption capacity followed the approach according to D. Ivanov, while verifying hygroscopic humidity engaged the thermal method and reaction of the soil environment. With a pH meter, uncovering absorbed ammonia employed the Konyev method; water-soluble ammonia by Nesler; and nitrates by the Grandal-Laju technique. The results' integrity reached validity by various statistical methods (Dospekhov, 1984; Dai *et al.*, 2021; Kovda, 1973; State Standard of the Republic of Azerbaijan, 2013; FAO, 2020; Sadigov, 2019; Salimov and Huseynov, 2025).

RESULTS AND DISCUSSION

The Mil Plain, within the southern region of the Kura-Araz Plain, stretches from the Gargar River in the north to its merging point with the Karabakh Plain. Its delineation starts from the Shirvan Plain by the Kura River to the east and from the Mughan Plain by the Araz River to the south. From the western plains of Karabakh, the terrain gradually proceeds toward the junction of the Kura and Araz rivers (Jaboil *et al.*, 2013). At the meeting point of the Araz and Kura rivers, the Mil Plain elevation is approximately 15.0 m, while it rises to 70.0 m at the point where it meets the Karabakh Plain. The Mil Plain comprises the arable lands of the Imishli, Beylagan, and Aghjabadi regions. The total area of the plain spans 369,500 ha.

Irrigation water sources come from nine distinct water outlets to irrigate 131,500 ha of land in the Mil Plain. Main canals have succeeded in construction across the Mil Plain over various times to facilitate effective irrigation (Table 1). The Mil Plain boasts a network of irrigation canals spanning approximately 847 km, varying in sizes designed to accommodate the diverse flow rates and hydraulic requirements of the region's arable lands. The irrigation network density ranges from 3.3 to 16.2 m/ha. The total water consumption for irrigating cultivated fields amounts to 71.3 cubic meters per second (m^3/s). The quality of irrigation water varies across its diverse sources (Sadigov and Mustafayev, 2024a). Past studies revealed the total water consumption for irrigating cultivated fields in the Mil and Mughan plains amounted to be between 4.8 and 15.4 m (Mustafayev, 2018) (Figure 2).

In 1869, no engineering and specific irrigation system existed in the Mughan and Mil plains (Figure 1, Map 1, with a scale of 1:42000). In historical sources, the channel name also had the record of Borbos. Following the Arab occupation, the canal received the name of Govurarch. According to the master plan, large-scale reclamation endeavors

Table 1. Distribution of irrigated areas according to water sources.

No.	Sources of irrigation water	With an irrigation system area (min. ha)	Where canals take water
1	Old Khangizi Canal (Orjonikidze)	35.5	Araz River
2	Upper Karabakh channel	25.3	Mingachevir reservoir
3	Main shaft channel	30.0	Araz River
4	Mechanical irrigation from the Araz River	5.9	Araz River
5	Mechanical irrigation from the Kur River	8.6	Kura River
6	Gargarchay	6.7	Gargarchay
7	Khonashachay	0.9	Khonashachay
8	The Khahrizs	0.7	Groundwater
9	Artesian and sub-artesian wells	17.9	Groundwater
	Total	131.5	



Figure 1. Schematic plan of Mughan and Mil plains in 1869.

proceeded in the Aghjabadi region, covering 13,907 ha in the first phase (1971–1975), and in the Beylagan region, encompassing 53,744 ha in the second phase (1976–1984), as depicted in the schematic plans (Figure 3). As mentioned before, the water regulation is mechanical from the Araz River into the Old Khangizi Canal. From the river, the water consumption considerably declines in July–August, leading to hurdles in supplying the required water volume to the arable area. The proposed construction of the Main Mil Canal tended to address this issue.

With the inauguration of the Main Mil Canal in 1976 (Figure 3), the Old Khangizi Canal primarily sourced its irrigation water from this canal. With irrigation needs, 8–15 m³/s of water attained diversion from the Araz River to the Khangizi Canal. Essentially, the Old Khangizi Canal drew the necessary water from the Main Mil Canal for arable lands. However, in this system, the canals were land-based, requiring reconstruction according to the master plan between 1971 and 1985. The New Khangizi Canal prevailed in its construction parallel to it without affecting the

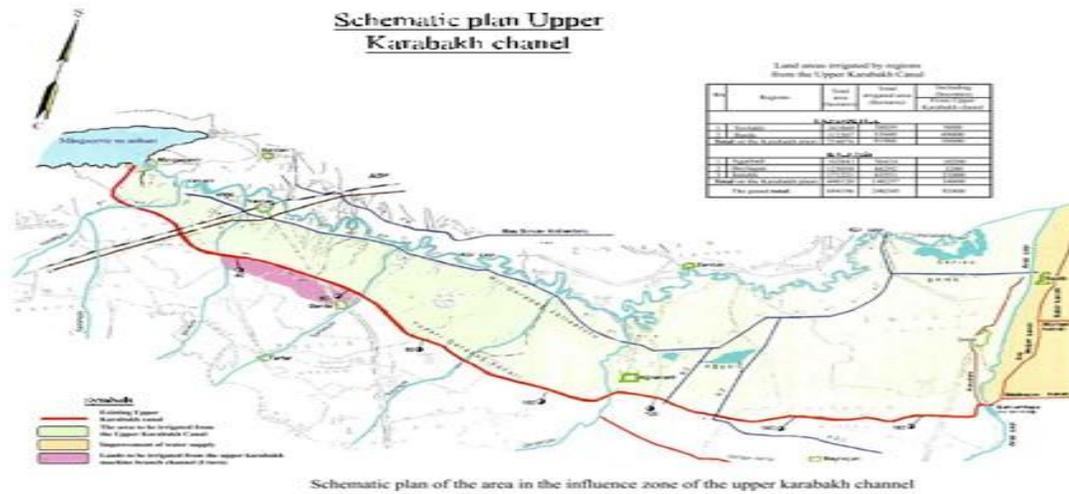


Figure 2. Schematic plan of areas in the influence zone of the Upper Karabakh Canal.

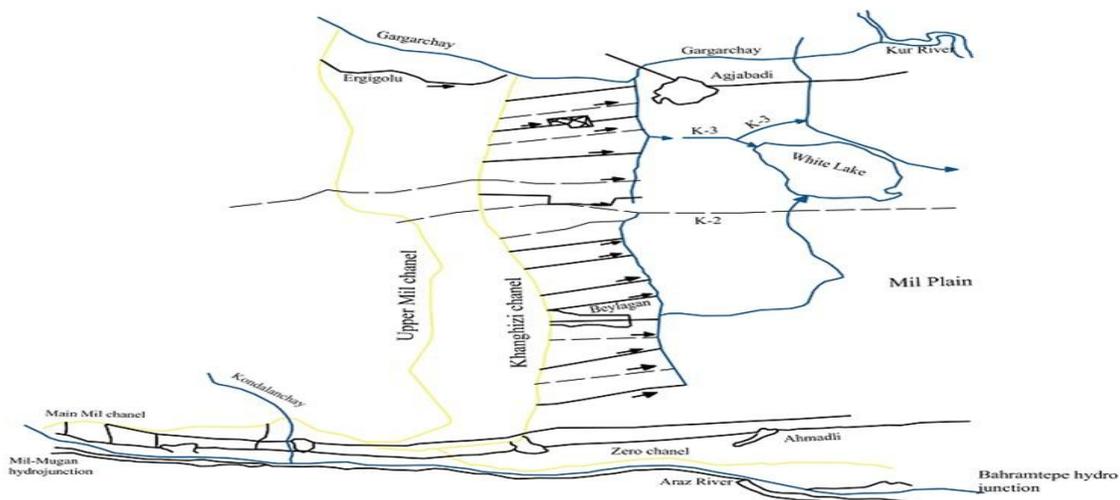


Figure 3. Schematic plan of trunk channels and collectors as influence of the Main Shaft channel.

Old Khangizi Canal. The initial water consumption of the New Khangizi Canal was 32 m³/s. The construction of the New Khangizi irrigation system, featuring a concrete cover, reached completion in 1985. The canal received a flow of 40.0 m³/s from the Main Mil Canal, and the main channel spans 58.5 km. In some sources, it is also possible to find that the amount of water flow per second has decreased to 32–36 m³ due to the turbidity of the water (Salimov and Huseynov, 2025).

With reclamation construction carried out between 1971 and 1985, nine inter-farm canals, drawing water from the New Khangizi Canal, also proceeded to line with concrete (Figure 3). Five of these channels (R-1, R-2, R-3, R-4, and R-5) were in the Beylagan Region, while the remaining four (R-6, R-7, R-8, and R-9) sat in the Aghjabadi Region. The inter-farm channels' lengths were as follows: R-1 (18.7 km), R-2 (14.7 km), R-3 (passing through the town of Beylagan, 7.0 km), R-4 (12.3 km), and

R-5 (12.0 km). In the Beylagan Region, the total length of inter-farm canals amounts to 76.5 km. The R-6 farm canal receives water at PK-394 in the New Khangizi Canal, starting from the Aghjabadi District's territory. Within the Aghjabadi Region, the cultivated area within the canal's influence zone spans 13,907 ha. However, in the New Khangizi Canal, the standard flow rate was 9.65 m³/s, while the forced flow rate was 12.06 m³/s.

Although the planned construction of a collector-drainage system was in 1940 for the Mil Plain, the onset of World War II halted progress in this area. Preparatory work for the construction of a collector-drainage system began in 1950 on the plain. However, for various reasons, in this area, the planned work poorly progressed. As per required design parameters, the failure to construct a collector-drainage system considerably affects the hydrogeological and melioration conditions of the said area. Therefore, presently, the drainage system in the shaft plane operates below the intended design parameters. Construction of collector-drainage systems on the Mil Plain commenced in 1953. Area water collectors entailed designs to remove the surface water from fields within irrigation systems, underwent excavation, and conversion into open drains (Figure 3).

Within the Old Khangizi irrigation system, the primary collector K-2 (named after Orjanikidze) attained construction for the Beylagan District. The K-2 spanned a length of 54.0 km. The main collectors feeding water into K-2 were as follows: K-2-1 (33 km), K-2-2 (6.7 km), K-2-3 (7.2 km), K-2-4 (6.8 km), K-2-5 (7.0 km), and K-2-6 (8.2 km). The drains that discharge water into the collectors completed their construction as open channels, with depths ranging from 3.0 to 3.5 m with intervals of 1000 to 1200 m.

In the Aghjabadi Region of the Old Khangizi irrigation system, the primary collector was K-3, and it spans 13.2 km. The collectors discharging water into K-3 are as follows: K-3-1—with a length of 12.3 km, it serves as an area of influence covering 4430 ha, with a discharge rate at the mouth of 1.55 m³/s; K-3-2—spanning 9.3 km, it covers an influenced area of 4060 ha, with a

consumption rate of 1.42 m³/s; and K-3-3—extending over 17.3 km, it comprises an influenced area of 6060 ha, with a consumption rate of 1.92 m³/s.

In total, the K-3 collector receives drainage water from 18,300 ha. The outfall's water transport capacity was 6.4 m³/s. The drainage water collected in the K-3 collector goes beneath the Upper Karabakh Canal before discharging into the Mil-Karabakh collector. The long-term studies showed the reclamation enhanced the fertility potential of soils used in agriculture. Considering reclamation parameters and the natural and anthropogenic factors, the soils underwent division into four categories: good, satisfactory, at risk of deterioration, and unsatisfactory, with the same discussed herein (Sadigov and Mustafayev, 2024a).

Soil reclamation status follows:

- Good: When groundwater depth is lower than the permissible limit. Then, soil-forming processes proceed in a positive direction, with no risk of subsoil water rising, increasing salinity, or formation of a nitric horizon, and geological processes do not affect irrigation. In such soil conditions, if the initial parameters ensure soil fertility, the status of reclamation and agrotechnical measures requires maintaining (Jafarov, 2020).

When the groundwater table remains below the acceptable threshold, soil development occurs under favorable conditions. This prevents the upward movement of subsoil water, eliminates the risk of salinization and nitric horizon formation, and ensures that geological factors do not hinder irrigation. In such environments, provided the initial conditions support soil fertility, it is important to sustain the current level of reclamation and agrotechnical practices (Sadigov and Mustafayev, 2024a).

- Satisfactory: When groundwater depth is at a permissible level in the vegetation period, soils are not saline and solonchak-like, and soil-forming processes are stable, there is no risk of subsoil water rising. However, if the initial parameters ensure soil fertility, no engineering-geological processes exist to impede irrigation of the area larger than 10%–15%. Then, the reclamation and agrotechnical

measures should proceed to abolish salinization and solonetzification, ensuring the implementation of prophylactic measures (Jafarov, 2020).

Satisfactory conditions were notable, with groundwater levels remaining within permissible limits during the vegetation period. Under these conditions, soils are free from salinization and solonchak characteristics, and soil-forming processes remain stable, with no risk of rising subsoil water. If the initial parameters support soil fertility and engineering-geological factors do not affect more than 12%–16% of the area, irrigation is smooth. In such cases, reclamation and agrotechnical efforts should focus on preventing salinization and solonetz development, along with implementing appropriate preventive measures.

- At risk of deteriorating the satisfactory status: When the subsoil water depth is lower than permissible during the vegetation period, but it is variable and rises at the rate of 0.2–0.5 m/year, or when the depth of subsoil waters is at a permissible limit. Similarly, the soils are non-saline, but deterioration of water-physical parameters is evident. When the secondary salinity appears and salinization with the formation of a nitric horizon is apparent in soils. Likewise, if the initial parameters do not provide soil fertility and engineer-geological processes occupy an area smaller than 10%–15%. Hence, the complex agro-reclamation countermeasures need preparation for the soils of this category (Hasanov *et al.*, 2018; Jafarov, 2020).

During the vegetation period, when groundwater depth remains formally within permissible limits but it is variable—rising at 0.22–0.56 m/year—or remains at the threshold level, the soils may not yet be salinized. However, degradation of water's physical properties often begins to emerge. In such cases, early signs of secondary salinization and the formation of nitric horizons indicate the onset of negative pedogenic transformations. Under these conditions, the initial soil parameters are insufficient to sustain fertility, even if engineering-geological constraints affect less than 12%–16% of the total area. Therefore, for soils within this transitional risk

category, it is essential to develop and implement integrated agro-reclamation strategies aimed at halting further deterioration and restoring soil health.

- Unsatisfactory: When the subsoil water depth is more than permissible in the vegetation period and salinization and solonetzification variations are from weak to intense in natural saline soils. Then, the initial parameters do not influence the soil fertility; engineer-geological processes develop intensively in the zone larger than 10%–15%. In such cases, the reclamation measures should concentrate on decreasing mineralization and the depth of subsoil water to improve the water's physical properties (Hasanov *et al.*, 2018; Jafarov, 2020).

When groundwater levels exceed permissible thresholds during the vegetation period, soils typically exhibit varying degrees of salinization and solonetzification, ranging from mild to severe, particularly in naturally saline landscapes. Under such conditions, the baseline soil parameters no longer contribute effectively to fertility. Furthermore, engineering-geological processes often intensify and affect more than 12%–16% of the area, complicating agricultural use. In this context, targeted reclamation efforts are essential, with a focus on reducing groundwater mineralization and lowering the water table depth. These measures aim to restore favorable water physical properties and mitigate further soil degradation.

Research indicated the design parameters of the constructed drains acquired incorrect establishment, neglecting specific crucial factors. In the current collector-drainage system, the inter-drainage distances vary across different areas. Specifically, the proportions of areas with different inter-drain distances were as follows: 13.2% of the total area has 200 m between drains, 3.2% has 300 m, 21.8% has 400 m, 11.2% has 500 m, 17.5% has 600 m, 4.3% has 700 m, 10.2% has 800 m, 11.2% has 1000 m, 6.2% has 1200 m, and 1.2% has distances exceeding 1500 m.

The study revealed the existing collector-drainage system of the Old Khangizi irrigation succeeded its construction to regulate

the groundwater levels within the system, which deteriorated over time, regardless of maintenance efforts post-commissioning. Such sections appeared now completely inoperative, necessitating a comprehensive reconstruction. With the collector-drainage systems operating below their design capacity, drain water release was inefficient from the area within the required timeframe. Consequently, in the cultivated area, the groundwater level exceeds critical depth. Over the years, in the plain, the natural environment has undergone variations, leading to disruptions in the ecological balance and the onset of soil salinization.

The collector-drainage system covers approximately 92,000 ha in the Mil Plain. Annually, extracting around 200 million m³ of drain water with varying mineralization levels occurred from the fields. Throughout its operation, the collector-drainage systems have significantly affected the ecological state of the area. However, the existing system fails to meet their designated performance parameters. Improper spacing between drains has contributed to the inefficient operation of the collector-drainage system. During operational periods, relevant institutions regularly collect water samples from the drains and the collector, measuring consumption in the process. In drains, the chemical composition of the water corresponds to the underground water from which it originates. However, with time, the scope of land reclamation construction has expanded, causing an increase in irrigated areas and crop yields. Between 1950 and 1999, in the plain, the irrigated land areas grew 3.5 times, with drains constructed in approximately 70% of the irrigated areas.

Since the inception of the Old Khangizi irrigation system in 1933, arable land areas' uses have been effective. During the construction period of the system (1927–1933), the groundwater level was at the depth of 10–15 m. However, over the years, excessive irrigation water usage and seepage from earthen canals have caused the groundwater level to rise to a depth of 1–4 m. Consequently, underground salts have surfaced, leading to the effect of the crop's productivity in some areas. In total, 18,300 ha

of cultivated land prevail within the influenced area of the K-3 reservoir. Preserving the ecological environment in the Aghgol State Reserve, a habitat for migratory birds, discharge of drain water from the collectors K-2 and K-3 was continuous into Aghgol (Figure 3).

On March 02, 1978, the Azerbaijani Government established the Aghgol State Reserve with decree No. 26. Initially, the reserve covered an area of 4,400 ha, while on December 31, 1987, the reserve's area rose to 5,180 ha. The reserve spans across the Aghjabadi and Beylagan regions. The mineral content of water in the lake ranges from 50 to 100 g per liter, with chlorine and sodium compounds being the predominant constituents. The lake's maximum depth reaches 1.5 to 2.0 m, with an average depth of 0.6 to 1.0 m. Toward the end of summer, the lake's water level typically decreases. The reduction in the water surface area of Aghgol Lake, attributed to the construction of the Mingachevir reservoir and the overflow of the Kur River, has led to the redirection of drain water from the K-3 collector to Aghgol.

Water sourced for the Upper Mil Canal comes from the Main Mil Canal, located four kilometers east of Mahmudlu Village in the Fuzuli Region. The canal's planned length was 65.15 km. The initial 20.37-km section of the canal began operations in 1991, followed by the commissioning of the 4.23 km in the second stage during 2006. The construction of the remaining 40.55 km section, covering the final part of the Upper Mile Canal, commenced in 1914. The canal terminates near the village of Minakhorlu, where it flows into Gargarcha.

The Upper Mil Canal implementation has facilitated irrigation water supply to 37,238 ha of arable land in the Fuzuli, Beylagan, Aghjabadi, and Aghdam regions. The 24.6-km section constructed in the first and second stages covers an irrigated area of 14,238 ha, supplying water to 10,301 ha of cultivated land, with 3,937 ha irrigated via mechanical means. The 40.55-km section constructed after 2014 serves 23,000 ha of cultivated land. As per the project specification, an open irrigation system comprising concrete channels succeeded in its establishment across 21,200

ha of this area, while a closed irrigation system comprising polyethylene pipelines reached installation over the remaining 1,800 ha. As per the project design, water from the Main Mil Canal had the direction toward the Upper Mil Canal. In addition, 2,057 ha of winter pastures and land in the Land Reserve Fund received irrigation in the Beylagan Region, 4,625 ha in the Aghjabadi Region, and 8,496 ha in the Aghdam Region.

Cereals and fodder crops dominate the irrigated fields, with cotton, grain, sugar beets, grapes, vegetables, potatoes, and onions being cultivated in the area. Among grain crops, winter barley, winter wheat, and grain corn were prevalent. However, among the cultivated crops, cotton and alfalfa yields were below expectations. Animal husbandry plays a pivotal role in the agricultural sector of the plain, with various types of fodder crops. One of the primary reasons for the deterioration of land used for crop production was environmental issues, including soil erosion and soil salinization.

Projects carried out in land reclamation and water management were crucial in driving large-scale economic reforms, increasing crop productivity, and ensuring a continuous food supply to the population. The population of the Beylagan, Aghjabadi, and Aghdam districts, within the areas affected by the Upper Mil Canal, totals approximately 383,476 people, with approximately 61,000 landowners, each receiving an allocation of 2.5 ha of land. There are approximately 23,500 farms, and each farm covers an area of around 6.5 ha. The renowned hydrogeologist, A.K. Alimov, extensively studied the Mil Plain for many years, and a graph illustrating the average annual groundwater level from 1930 to 2008 has reached its production (Figure 4). As depicted in the graph, until 1960, the groundwater level approached the surface; however, after 1965, the groundwater level significantly decreased. This can be ascribable to the implementation of the collector drainage system in the Mil Plain. Following the commissioning of the Mil-Karabakh collector, the groundwater level has achieved an effective regulation.

The graph in Figure 5 illustrates the variation in the average mineral content of drainage water from 1930 to 2008. As is evident from the graph, the mineral content of groundwater experienced a significant decline in the 1950s and 1960s, following the construction of drainage systems in the region, with this trend persisting in subsequent years. Figure 6 presents the variation in the average soil-salinity levels in the Mil Plain from 1930 to 2008. Comparing the 1965 data to that of the 1950s, a decrease in average soil salinity occurred, which continued to decline in the following years. Conversely, areas lacking drainage systems observe an increase in average soil salinity. Resulting from the land reclamation and water management projects implemented from 1970 to 1982, the average soil-salinity level displayed a notable reduction in the 1980s.

In the case of the Mil Plain, the historical irrigation system has evolved to meet the crops' demand. From the construction of canals in the early 20th century to the modernization efforts in the late 20th and early 21st centuries, the region has witnessed significant development aimed at enhancing irrigation efficiency and expanding cultivated areas. However, challenges persist, particularly concerning the drainage systems and their impact on groundwater levels and soil salinity. Although the collector-drainage systems have been instrumental in regulating groundwater and minimizing soil salinization, inefficiencies and deteriorations call for comprehensive reconstruction efforts in particular sections.

The establishment of the Aghgol State Reserve underscores the importance of balancing agricultural expansion with environmental conservation. By redirecting drain water to preserve vital habitats, such measures exemplify the need to harmonize economic development with ecological sustainability. Furthermore, research findings highlighted the effectiveness of land reclamation and water management in mitigating soil salinity and regulating groundwater levels. Graphical representations of average groundwater level, mineral content of drainage water, and soil salinity level offer

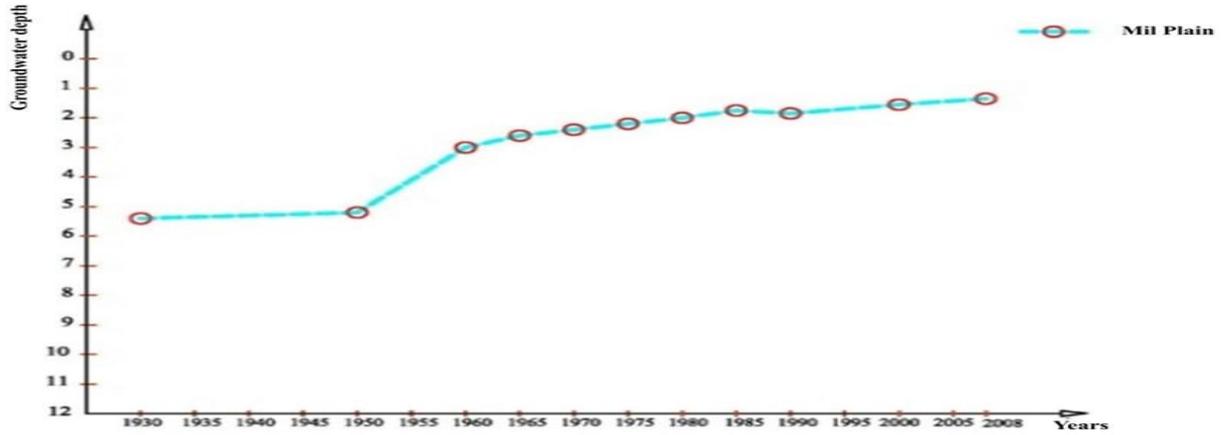


Figure 4. The dynamics of changes in the level of groundwater in the Mil Plain over the years.

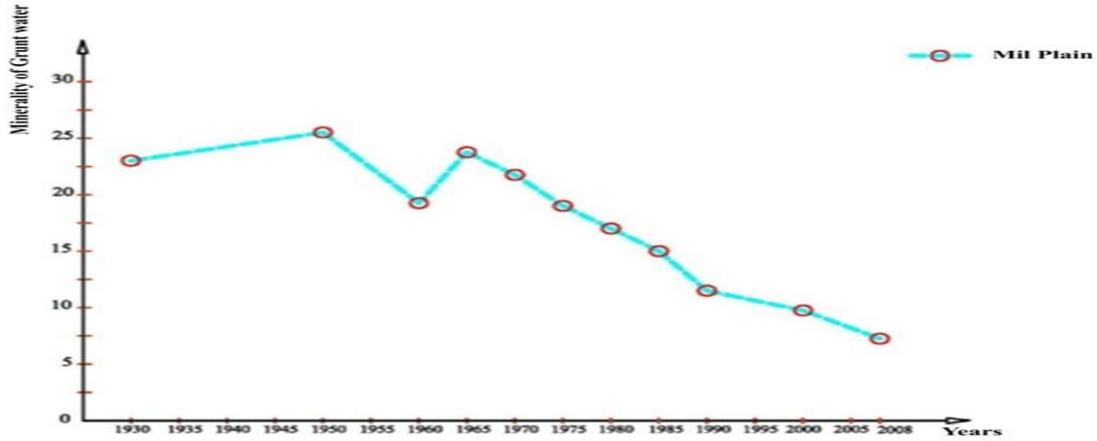


Figure 5. The dynamics of change of the average mineral level of groundwater in the Mil Plain over the years.

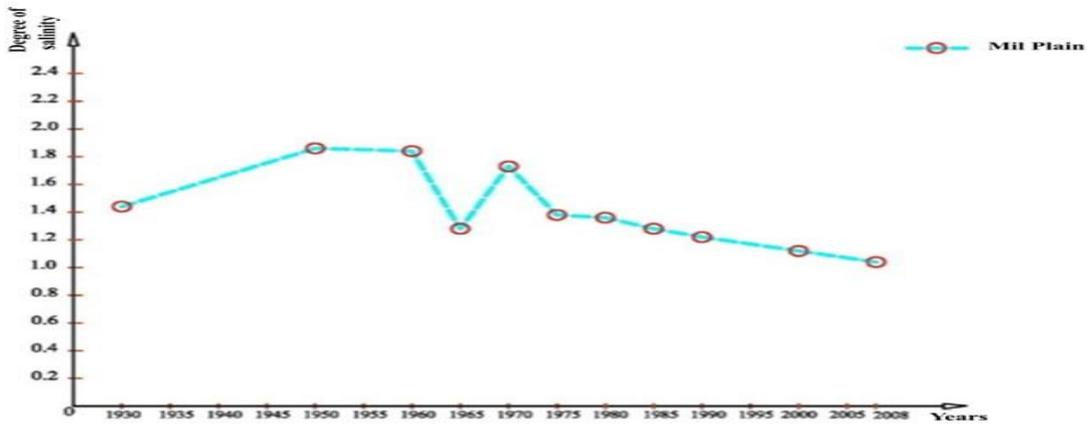


Figure 6. The dynamics of changes in the degree of salinity of soils in the Mil Plain over the years.

insights into the transformative impact of these initiatives over several decades.

CONCLUSIONS

The Karabakh and Mil Plains emphasize the significance of integrated approaches to resource management, combining technological innovation and environmental stewardship. The sustained investment in infrastructure, coupled with adaptive policies, will be essential in ensuring the resilience and productivity of agricultural landscapes in the face of evolving demographic and environmental challenges. The exponential growth of the global population over the past two centuries has necessitated a critical reassessment of natural resource use, particularly water and arable lands.

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