J Biochem Tech (2019) (4): 103-107
ISSN: 0974-2328

Anthropogenic Impact on the Natural Environment (on the Example of the Nura River Basin)

Zhangozhina G.M.*, Talzhanov S.A., Dosmakhov S.M., Kozhakmetova L.T., Chistyakova G.N.

Received: 05 July 2019 / Received in revised form: 02 December 2019, Accepted: 16 December 2019, Published online: 27 December 2019

Abstract

This article considers the historical stages of the geoecological situation of the Nura river basin. The main regions of the conversion of the river basin were studied. Based on the classification of the anthropogenic impacts, the effect of industrial enterprises on the Nura river basin environment was identified.

Key words: anthropogenic factor, geoecological situation, anthropogenic, basin, techno genesis

Introduction

Anthropogenic factors are caused by various forms of human impact on the individual components of the environment and geosystems. They cover the processes occurring in the course of the direct impacts of humans on the environment or indirectly due to their technogenesis. Anthropogenic factors are the development of land under crops and crop planting, deforestation, construction of hydro, passive and active foreign importation of various animals and plants, pest control, etc. (Khammar and Rahdarpoodine, 2018; Mirnategh et al., 2018; Faid and Al-Matrafi, 2018; Kuznetsova et al.).

For quantitative and qualitative characteristics of anthropogenic factors using the concept of the anthropogenic load. It characterizes the amount of direct or indirect anthropogenic impacts on the environment. Anthropogenic factors are usually related to the side effects of interaction between society and the natural environment. Most often they appear as random, one-time impacts on the natural environment and geosystems accompanying purposeful human activities. These effects may be in the nature of intentional (planned, expected impacts) and unintended (unexpected consequences) impacts on geosystems (Alseroury, 2018).

There are several versions of the classification of anthropogenic environmental factors developed by different authors. I.P. Laptev offers to classify them based on the following criteria: nature, origin, and time of action, for the duration of human impacts, the ability to accumulate in the nature and type of human activity (Akpambetova and Zhangozhina. 2008).

Human impact on the natural environment such as river Nura can be associated with industrial development around it (Zhangozhina. 2010). All studies conducted in the basin certain environmental impacts. In this regard, the geo-environmental situation can be considered at different stages: 1) pre-industrial stage 2) industrial development stage 3) agricultural development stage in the basin, and 4) the current basin formation stage (Table 1).

Each stage in the formation of geo-ecological situations presents a certain picture of the development of territories. Each stage recognizes and reflects the signs of anthropogenesis including hydrogeological work (drilling, exploration), hydraulic engineering, exploration of mineral deposits, construction of dams, urban planning, etc. The incidence of r.Nura anthropogenic signs increases with each step, causing the tension level of geo-ecological situations from relatively fair to critical.

Pre-industrial stage Archaeological sites indicate that the basin in river Nura.

Table 1: Historical stages of formation of geo-environmental Situations in the r.Nura pool

Historical stages, years	The main signs of the emergence of anthropogenesis	Environmental implications
Pre-industrial (Paleolithic - 30s. XX century).	Provision of drinking water for the Karkaralinsk city; construction of water point for rural areas; development of the basin plains for railway construction. The first drilling near Romanovka. Starting the construction of a railway in the direction of Petropavlovsk-Kokshetau.	Transforming impact on the natural environment of r.Nura; the formation of local sources destabilizing the environment.

Zhangozhina G.M.*, Talzhanov S.A., Dosmakhov S.M., Kozhakmetova L.T., Chistyakova G.N.

Ye.A. Buketov Karaganda State University, Karagandy, Kazakhstan.

Stage of industrial development (30-g. XX century. - 50s. XX c.)	The creation of large industrial centers: Karaganda, Temirtau, Saran, etc. Shahtinsk workers' settlements; drilling and mining, construction of railways and mining drilling, exploration, construction of hydraulic structures; exploration of mineral deposits	The appearance of technogenesis the formation of anthropogenic forms of relief: piles, embankments, piles, pits, quarries, excavation, subsidence of the basin encountered in the exploitation of the deposit, mines, tunnels, wastewater pollution, changes in the r.Nura biodiversity.
Stage of agricultural development of the basin (50^{th} gg. XX century. - 80^{th} gg XX century)	Creation of urban settlements (Karagaily, Aktas), construction of dams and levees, construction of reservoirs on the former coal cutting site, the use of water for agriculture, irrigation, and construction of recreational facilities.	Processes – deflation, accumulation, water and wind erosion, dust storms, vegetation degradation
The present stage of development (90^{th}. XX century - the present state)	Major agglomeration, increase the number and types of transports, construction of private houses and summer, increase agro-technical, recreational, urban, transport, industrial and mining estates	NFB problems - water pollution r.Nura mercury deflationary processes in the vicinity of Karaganda, waterlogging and flooding. Loss of stability geosystems to violating effects, the urgency of environmental problems.

the Paleolithic man lived. He was engaged in hunting, fishing, and gathering plant foods in the river basin in the Neolithic. Nura seems to be the basics of agriculture. Parking this period is found on p. PMCU Late Neolithic - Green bar. Since the 2nd millennium BC (Bronze Age), the ancient population of the region originates from the pastoral-agricultural economy with a predominance of cattle. This is confirmed by archaeological excavations settlement Suykbulak (Karkaralinsk) and the ancient irrigation system.

In X-VIII centuries BC in the territory of r.Nura basin, distinctive cultivation of Begazy-Dandybai along with the raising of cattle was developed that played a crucial role in the development of productive forces and tribes producing smelting ores.

In stage, the major role in forming the initial geo-environmental impact on the environment is played by keeping the fortified lines along the road of the Siberian Cossacks. As a result of these works, the first settlements appear: the villages Karkaralinsk (1824), Ulytau (1841), Aktau (1837), etc. In 1833, A. Baizhanov opens the first Karaganda coal, and in 1834 Popov in the tract Berikkara (Karkaralinsk) opens the first copper mine in serebrosvintsovye. The first - Stefanovsky in the history of the r.Nura pool industry gave 30 thousand pounds of silver and lead (10 tons of lead per year). In the 80ies XIX century, coal mining started at the Karagandybasy tract. In 1886 Ushakov received permission to build a smelter Spassky within 40 km of the Karaganda coal basin. At the end of the XIX century in the Karaganda 500 workers.

It was located in the river valley near the mouth of r.Taldy oz.Karasor 50 km from the village Koyandy. Creating favorable conditions for the development of regional trade and economic ties Koyandinskaya Fair attracted merchants from Russia and Central Asia. In 1905-1910 Department of Land Improvement Resettlement conducted surveys to ensure the resettlement of water points, as a result of which were characterized by surface water and groundwater basins districts Nura Sherubainura, city Karkaralinsk, Balkhash, etc. and were the first recommendations for their use. In 1916, the near s.Romanovka already received the first information on the stock of the Nura River. Studies of the Nura River started in the first five years of the former Soviet Union when the industrial cities were built in the territory of Central Kazakhstan (Karaganda, Zhezkazgan, Balkhash, Shahtinsk, etc.).

Analysis of the pre-industrial stage of the development of the region shows that economic activity began to have transformative impacts on the environment. During this period there was a change in the geo-ecological situations of r.Nura pool environment before the formation of local sources of environmental destabilization.

Stage of industrial development (30^{th}. XX century. – 50^{th} . XX c.). During the years of Soviet power, Karaganda region became one of the largest industrial centers in Kazakhstan. In 1940, the Karaganda coal basin had 22 mines. Karaganda coal basin played an important role in the industrial development not only in the Republic of Kazakhstan but also in the whole of the USSR (now CIS), since the Karaganda coal supplied with Enterprise Middle Volga region, the Urals, Bashkiria, etc. The pool was the third coal base of the USSR. Coalfield development led to the establishment of other industries. In the 30s and 40s. XX century, for the successful formation of the Karaganda region as an industrial center, water was plumped from r.Nura (Samarkand reservoir) to it. By the end of 33 -ies, the construction of the central power was completed and a hydroelectric power station began to build. In 1937, the Karaganda cement plant was put into operation, which annually produced 14 tons of cement. In the same years, mechanized bakeries, brewery, dairy, and other plants were commissioned in Karaganda and the construction of railways through Akmola to Karaganda continued.

In the early 30s of the XX century, Filimonov and Bourtsev conducted hydrogeological studies regarding the construction of several large industrial enterprises in Kazakhstan. The article entitled «Prospects reclamation in Central Kazakhstan» (1930), summarizes the materials, reclamation, and expedition in Central Kazakhstan, who worked on the rivers Tokrau, Bakanas, Nura, and Sarysu (Faid and Al-Matrafi, 2018).

At the same time, Kuznetsova studied the cracks of water limestones and volcanic rocks that carry water and railway stations. She also organized groundwater monitoring organizations in wells and mines.
This period coincides with the war and postwar years. After the war, 17 powerful mines were commissioned and reconstructed, including coal deposits in Saran Tentek, Sherubainura, and Shakhan. Moreover, the chemical industry (Karaganda plant synthetic rubber) was extensively developed and the first carbide furnace began to work in 1943. The largest iron and steel enterprise in the country at this stage was the Temirtauskiy Metallurgical Plant. Along with the engineering factories, the New Karaganda factory, which produces up to 100 various types of machinery and equipment, began to develop.

The stage of industrial development is characterized not only by the robust development of the economy but also by a major shift in the geographical distribution of production. There are pockets of industry, incorporated in the economic circulation of large areas of grassland. Simultaneously, relief changes are implemented. The development of negative processes: salinity, flooding, wind, and water erosion, and degradation of soils and vegetation was observed. Due to weak administrative control by the relevant departments and organizations for nature protection, environmental management issues have not been implemented in a timely manner.

Stage of agricultural development of the basin (50^{th} XX century – 80^{th} gg.XX in).

During these years, the need to expand the resources for industrial enterprises in the Southern Urals led to significant geological researches , as well as hydrogeological works in areas where railroads and mining were designed and built. This line of work increased especially during the Great Patriotic War. Note some of them. In 1944-1948 M.B. Gamaley, A.A. Emelyanov, V.A. Kurdukov, N. I. Timpani summarized extensive factual materials of groundwater as combined hydrogeological maps, which were mainly displayed on the first surface aquifers. These maps formed the basis of planning for the subsequent exploration of the water. In 1946, V.S. Zhavago launched and in 1947-1951 A.F. Kalmykov and I.I. Subbotin continued to explore water sources for the Akmaya, Bainazarov fields . In general, based on the results of hydrogeological studies, the first stage of the assessment of groundwater resources was carried out and the surface waters of the region were studied. At the stage of agricultural development, the Nura River was rebuilt for the cultivation of virgin lands. Intensive development of agricultural production led to the appearance of organic waste. In this regard, environmental protection systems began to exist that prevent erosion and bind it to drainage of soils. There are certain pockets of agriculture. Intensive development of agricultural production led to an increase in agricultural waste, which together with household waste significantly affected the chemical composition of the soil, causing a deterioration of its quality. In this regard, there are systems of environmental protection measures, which include prevention of erosion.

The modern stage of the development of the basin (90th. XX century - the present state).

The most important direction of researches in the 70s - 80s of the XX century in Kazakhstan was hydrogeoecological studies with funds and aero-space monitoring, the emergence of which is connected with the resolution of water and environmental problems in the basin of the lake Balkhash, the Aral Sea, and later, in the 80s - 90s, mining areas, the Semipalatinsk nuclear test site, the Caspian Sea, etc.

Important scientific and practical results have been obtained in the development of Kazakhstan as a deterministic including analog modeling, which is widely and successfully used in the evaluation of water inflows into mines (mines and quarries), the calculation of groundwater withdrawals (V.V. Veselov, S.M. Shapiro, T.N. Vinnikov, M.T. Djumagulov, O.V. Podolny, T.T. Makhmutov, M.M Burakov, V.P. Zolotarev, L.S. Verveykina, R.N. Urmanova, etc.), multivariate statistical modeling and factor analysis of hydrogeochemical and water environmental problems of Kazakhstan (L.M. Paulichenka, K.M. Davletkalieva, A.R. Kurmangaliyeva, etc.), as well as the theory of unsteady filtration in relation to intakes of groundwater (M.M. Burakov) (Akpambetova and Zhangozhina. 2008).

Following the independence of the Republic of Kazakhstan, a new stage in the hydrogeological and geomorphological studies began. At this stage, the ecological and geomorphological studies of the Karaganda coal basin associated with the study of modern land processes, the impact of industry on the environment, and the impact of Baikonur cosmodrome zones on the environmental conditions.
In 1997-98 Inco-Copernicus, Intas-Kazakhstan, and the UK Foreign Office conducted studies on mercury pollution of the Nura River. New INTAS project aimed at the study of microbiological processes, including the formation of methyl mercury in sediments and floodplain soils of the Nura River, currently coordinated by the Institute of Soil Ecology Nyuherberga (Germany) (Zhangozhina. 2010).

During field studies, data on mercury contamination of the surface and groundwater, floodplain sediments, soils, and river valley soil were evaluated.
Nura and Western industrial zone of Temirtau.

The same has been done surveying the coast Nura bridge in Temirtau to the village Rostovka (in 1997-98 studied the effect of external factors on the character of anthropogenic mercury in the microbiological processes, sulfate reduction, and methylation slag r.Nura.

During expeditionary works, the amount of mercury contamination of superficial and underground waters, the streamside sedimentations, and soils of the valley Nura and Western industrial zone of Temirtau were evaluated. The geodesic survey of coasts Nura was similarly conducted from a bridge in Temirtau (1 kilometer downstream of the Samarkand reservoir) to the settlement Rostovka (a distance of 25 kilometers) - through every 250 m. Studies showed that the surface-water of r. Nura and underwaters of its valley contain Mercury below the sanitary norms in the flow of year except for the inflow place in its main ditch in the effluents of Temirtau city. Exceeding of sanitary norms of Mercury in surface-water takes place on an area from Samarkand to Intimak of storage pools only in the period of snow melting. The bed of the river between two storage pools has considerably low sild, only about 550000 m^3 fallouts and has about 10 т. of Mercury.

A basic amount of technogenic sild and more than 90% of Mercury is on the area of the river in 25 kilometers below the Samarkand storage pool. Therefore, in the pool of r. Nura, contamination of the environmental wastes, by-products, wastewater of all types of industrial productions, agriculture, communal economy of cities purchased serious character, necessitates doing activities to protect nature.

The national economy of independent Kazakhstan began to gradually develop, because there appeared joint-stock, closed and open companies in the conditions of market relations. Many enterprises in the region started working on the basis of investment plans, and the industry of small and medium-sized businesses is developing. For example, in 1996, the Karaganda confectionery factory was purchased by the English company UIG, in 1997 the Karaganda brewery was bought by the Efes Beverage Group and formed the MODULE power plant enterprise. At the considered stage, the coal industry occupied 26.3% of the production volume and continues to develop rapidly.
According to RU «Tsentrkaznedra» in Karaganda coal basin, there were 24 mines and 5 and 7 sections of Mining and Processing Plant. In this regard, the concentration of harmful substances in dumps and heaps increased by 3 times. Serious environmental problem is the problem of mine water. Reducing the discharge of saline mine water, demineralization, and resettlement of mineralized mine water leads to contamination of surface and groundwater, waterlogging and salination of large areas of land.

The analysis shows that the mining industry has become the cause of the intensification of environmental problems in the region. Heaps a long time (since the start of operation of a coal deposit and still) pollute the atmosphere, where the ecological and economic damage is not taken into account.

Anthropogenic impacts in the Nura river basin can be considered industrial, and residential, transport, hydrotechnical, and agricultural impacts.

Industrial impact

To study the industrial impacts, it is necessary to identify the factors of technogenesis. Technogenesis is the origin and change of landscapes under the influence of human production activity, allocating the direct and indirect effects. Direct anthropogenic impact on the environment (PV) is by economic objects and systems in direct contact with it in the process of nature management or dumping waste into it. PV begins, proceeds, and stops simultaneously with the corresponding stages of the economic systems that cause this impact.

Territorially, the zones of MF practically coincide with the zones of the corresponding economic systems. The composition of natural components exposed to PV includes various combinations including atmospheric air, biota, soil cover, groundwater, surface water, lithological foundation, and relief. Especially significant changes in natural complexes occur as a result of the man-made transformation of the relief, which always entails the removal or burial of vegetation and soil cover. The transformation of the relief also causes changes in the position of the surface relative to the groundwater level and the formation of new denudation bases. The indirect impact of technogenesis (CV) is manifested as a result of the “chain reaction” caused by the PW and is caused by natural connections and interactions between the elements and components of the landscape. The manifestation of HF includes the following main groups: 1) changes in the water regime; 2) surface violation (landslides, subsidence, landslides, debris); 3) change in the speed of the direction of the relief formation processes; 4) changes in soil formation processes; 5) pollution of the atmosphere, soil, and surface- and groundwater by production of deflation dump; 6) a change in the microclimate leads to a change in the conditions of existence and development of the biological world.

All structural subdivisions that make up the mining enterprises of the Nura Basin - mountain shop, waste dump, storage of industrial effluents, engineering and repair shops, are located compactly in a relatively small area, lead to significant and concentrated man-made pressure. As a result of mining production, masses of dump soil accumulate, which are not only unsuitable for use in agriculture but also bury fertile lands beneath themselves, becoming a source of the migration of toxic substances. Unregulated destruction of vegetation cover and soil exposure without further agricultural or phytomeliorative development contributed to the development of suffusion-subsidence processes in part of the region.

Intensive degradation of processes is determined by the duration and spatial distribution of industrial exposure. The area of man-made disturbed land is 44.1 thousand hectares. The most negative features of the industrial impact on the environment of the basin are relief changes; transformation and destruction. Destruction of land cover; change of geological and geomorphological structure; pollution of soil and hydro objects with chemicals; changes in water-salt composition, regime and groundwater reserves.

Technogenic types and forms of impact on the environment cause the development of land degradation processes: technogenic disturbance of topography and soil and vegetation cover, changes in the hydrological regime, pollution of soil cover and water, debris, etc. The maximum transformation of geosystems occurs in the mining areas. Open castings, mines that form anthropogenic landforms (heaps, dumps) and often stimulate the development or increase the intensity of exogenous processes - subsidence, cause destabilization of geoecological situations. The geomorphological studies of the anthropogenic topography of the Nura basin on the development of coal deposits, ferromanganese ores, building materials are extensive and indicate the presence of various types and relief forms specific to this region.

Acknowledgment

The work was carried out by the authors from 2010 to 2014. The authors are grateful to all those who contributed to this study.

Authors contribution

Analysis of the ancient pre-industrial stage development of the region shows that economic activity began to have transforming effects on the natural environment. During this period, there is a change in geo-ecological situations in the Nura basin from ecological well-being to the beginning of the formation of local centers of environmental destabilization. The stage of industrial development is characterized not only by a powerful recovery of the economy but also by large shifts in the geographical location of production: it has become more uniform. There were centers of industry, watered and included in the economic turnover of large areas of pastures.

The authors have developed a transformation system for the Nura River basin.

Conflict of interest

In the article, there is no information capable of provoking conflicts of interest.

References

Akpambetova, K. M., Zhangozhina. G. M., (2008). Modern relief formation processes Nura river basin (Central Kazakhstan) //Otechestvennaya geomorphology: past, present, future: sat. XXX Plenum of the geomorphological Commission of the RAS. - SPb: SPbSU, 184-185.

Alseroury, F. A. (2018). The Effect of Using Photocatalytic to Decontaminate Wastewater in Natural Sunlight Exposure. *International Journal of Pharmaceutical Research & Allied Sciences*, *7*(3).

Faid, S. M., & Al-Matrafi, M. M. (2018). Evaluation of Okra Pods Quality (Abelmoschusesculentus L.) After Reduction of Pesticides. *Journal of Biochemical Technology*, *9*(4), 81.

Khammar, G., & Rahdarpoodine, S. (2018). Evaluation and Analysis of Space and Activity Nature in Zabol with an Emphasis on Administrative-Governmental Uses. *World*, *7*(1), 84-91.

Kuznetsova, M. A., Iakusheva, O. I., Rogozhin, A. N., Statsyuk, N. V., Demidova, V. N., & Borovsky, K. V. Reduction of Environmental Pollution with Pesticides: in silico Evaluation of the Efficiency of the Agrodozor Online Resource.

Mirnategh, S. B., Shabanipour, N., & Sattari, M. (2018). Seawater, Sediment and Fish Tissue Heavy Metal Assessment in Southern Coast of Caspian Sea. *International Journal of Pharmaceutical Research and Allied Sciences*, *7*(3), 116-125.

Zhangozhina. G. M., (2010). Geoecological estimation of land resources in the basin of the river Nura //Search. 4. 154-156.