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ASSESING THE IMPACT OF ANTROPOGENIC FACTOR ON THE ECOSYSTEMS OF THE PALIASTOMI LAKE REGION

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Abstract

The ecological problem of the Paliastomi Lake is caused by anthropogenic factor. Due to its distinctive natural conditions, the Paliastomi Lake area has never been densely populated by humans, although small early settlements date back to the Bronze Age. The insignificant population density did not lead to a radical change in the ecological condition, therefore, the development of landscapes took place in a naturally conditioned ecological environment. From 1860s, the intensive development of the Paliastomi Lake region began, which was caused by the growth of the population of the city of Poti, construction of Poti Port, and intensive drying up of the swamps around the Paliastomi Lake. In 1920s-1930s, the ecological condition of the Paliastomi Lake was further aggravated by the construction of the Rioni River canal, the drying up of swamps, the extraction of peat, as well as the alignment of the Pichori River Basin – a main tributary of the Paliastomi Lake. Changes in the landscapes of the Paliastomi Lake region as a result of various agricultural activities are also observed in the late 20th and early 21st centuries.

Keywords: Original landscape, ecology, anthropogenic stress, Paliastomi Lake

Introduction

The ecological problems of the Paliastomi Lake region (Fig. 1) are mainly due to the human wrong activities during the last century and a half. According to the paleogeographical surveys and information preserved in the ancient written sources, for the last 5-6 thousand years, this area has been covered by impassable swamps, ravines, dense forests and a dense network of swampy rivers with shallow depths. During this time, the climate of this region has not changed much. It has always been characterized by abundant atmospheric precipitations, high relative humidity, periodically strong winds and quite hot summers. The existence of such climatic conditions is confirmed here by the continuous development of peat mass in the spread wetlands. The peat mass, in the vertical cuts of the swamps, does not contain layers of sediments of other genesis (clay, sand, etc.). This proves that the process of peat formation-accumulation in this area is still going on in humid climates.

Study Area

Due to unfavorable physical and geographical conditions in terms of residential and agricultural use, the population density in the confluence of the Rioni River (Fig.

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2) was negligible. According to the results of archeological research, human started to develop this area from the early stage of the Late Bronze Age (3,300-3,500 years ago) (Papuashvili, 2005; Papuashvili and Papuashvili, 2014). People inhabited the elevated and relatively dry sections of both banks of the Rioni River on the north side of the Paliastomi Lake. Herewith, we also note that on the shores of the Paliatomi Lake the city of Phasis, now Poti (Fig.2), one of the oldest cities in Georgia, was founded in the 5th-4th centuries BC.

Fig. 1. Location of the Paliastomi Lake region

The insignificant population density, together with the low level of means of production, led to the weak impact of anthropogenic factors on the physical-geographical landscape of the Paliastomi region. Therefore, in the past, its development took place mainly in a naturally balanced ecological environment. Natural or slightly modified wetlands, swamps and forest massifs fed with ecologically clean surface waters the Paliastomi Lake, which has always been characterized by an active hydrological regime under the influence of a humid climate.

Until the mid-1920s, the Paliastomi Lake was discharged from excess water masses through the Kaparcha River (Fig. 2). The river started in the north-west corner of the lake at a distance of about 4.6 km; it went directly along the western (seaside) shore of the lake, then flowed along the sea shoreline and about 8 km away from the head (near the village of Grigoleti) it joined the sea. Along the sea shoreline, due to the outflow of the Kaparcha River, at a quite long distance, the salt water of the sea was not intruded into Paliastomi. Therefore, Paliastomi has always been a freshwater reservoir and was characterized by favorable conditions for the development of

freshwater ecosystems (ichthyofauna, algae, aquatic plants, phyto- and zooplankton, benthos).

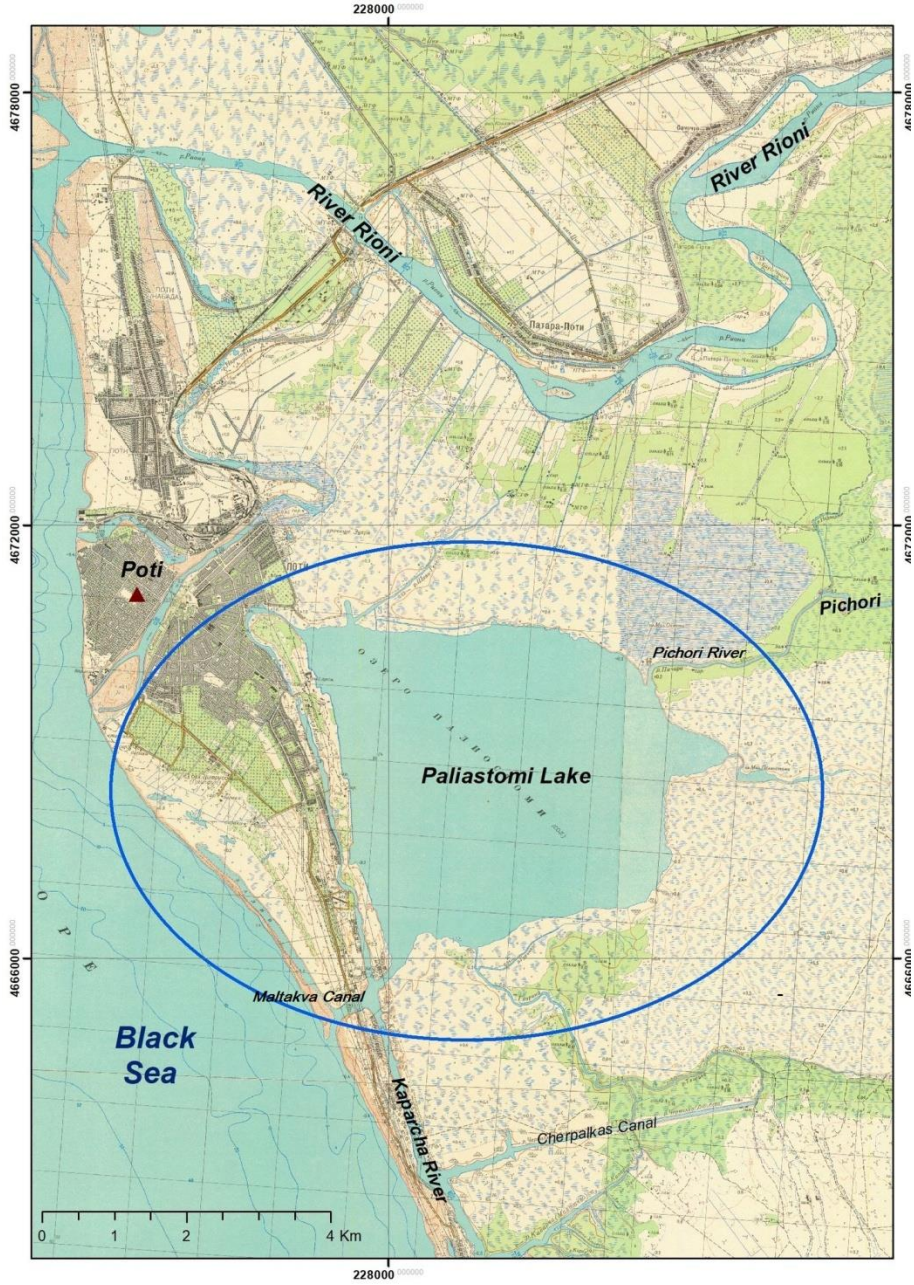

Fig. 2. Schematic map of the Paliastomi Lake region

The noticeable intensification of the negative impact of anthropogenic factor on the ecosystems of Paliastomi Lake and its area began in 1860s. This process was conditioned by the beginning of the construction and operation of the port and the adjacent city of Poti at the earlier confluence of the Rioni River (so-called "Big

Island"). According to the plan of the city of Poti, compiled by V. Maslovski (Maslovski, 1901), the modern central part of the city ("Big Island"), together with the areas directly adjacent to it, was already completely built. By this time the city had a population of over 9,000.

The rapid process of transport, trade-economic and demographic growth of the city of Poti, willingly or unwillingly, led to the over exploitation of natural resources in the surrounding areas (hunting, fishing, deforestation, extraction of large amounts of inert material), which led to the beginning of strong degradation of ecosystems of the Paliastomi Lake and its surrounding areas.

Until 1860s, the area of the city of Poti, along with the surrounding areas, was almost completely undeveloped by human. At that time, only at the direct confluence of the Rioni River (the shoreline of the "Big Island") stood several huts for fishermen and administrative officials and two or three shops. This information is confirmed by the well-known researcher Nikolai Shavrov, a well-known researcher of the Rioni River confluence, who has lived in the city for many years since the beginning of the construction of the city of Poti.

N. Shavrov has been researching the ecosystems of the Rioni River confluence since 1870s and the ecological problems that have arisen during the rapid development of the Poti transport and trade hub. These problems N. Shavrov well described in the article "Vanished wintering area of birds in the vicinity of Poti" (Shavrov, 1907-1908).

According to this article, in the early 1860s, dense forest massifs were widespread in the confluence of the Rioni River with large numbers of noble deer, roe deer, wild boar, and marten. There were many otters in the rivers of swamp. The article emphasizes that the Paliastomi Lake was extremely rich in fish, most of which were freshwater species.

An important part of the article is devoted to the description of the ornithofauna of the Paliastomi Lake and its surrounding area. More than 80 species of aboriginal and migratory birds have been described. According to the author, in 1860s, it was impossible to determine the number of groups of different species of birds in the confluence of the Rioni River due to their excessive number. It is interesting the information given in the article about the fact that N. Shavrov often had to warn the flocks of dozens of pheasants, which were in the edges of the forest of this area.

Until 1860s, the development of natural and less modified landscapes in the area of the Paliastomi Lake should have been stipulated by the fact that the city of Phasis founded near the lake in the 5th-4th centuries BCE ceased to exist in the 8th century CE. Since then, as evidenced by proper sources, the areas directly adjacent to the Paliastomi Lake have not been inhabited for centuries, and consequently, their natural resources have not been used by humans, or were used to a lesser extent.

Here we note that the landscape of the area of the Paliastomi Lake and the coastal area of the Kolkheti Lowland (Fig. 1) in general, in the conditions of humid and warm subtropical climate is characterized by a high capacity for self-renewal. Consequently, in case of weakening or stopping the negative impact of the anthropogenic factor, the process of its recovery is going quite fast.

During the following four decades since the beginning of the construction of the city of Poti (since the 1860s), as a result of the growth of the territory of this city and

the relatively rapid increase in population, the forest has been massively cut down and the number of wildlife hunters in the city has increased unprecedentedly. Carrying out various kinds of agricultural activities in the vicinity of Poti was frequently happened by ignoring elementary household life. This was the main reason why the natural look of the physical-geographical landscape of this region was strongly changed for four decades since the beginning of the construction of Poti.

N. Shavrov wrote about it with heartache: "when one sees the mutilated trees here and there, the washed and deserted shores of Rioni, the piles of manganese abandoned in the swamp, ... one sees such a desolate landscape... it is impossible not to deeply regret the amazing picture of the full beauty of life and the carefree happiness that has already passed into eternity, which adorned these places forty years ago, when nature was the same, as it was created by the hand of the Creator".

The negative impact of the anthropogenic factor on the ecosystems of the Paliastomi Lake and its surroundings has intensified since 1920s. One of the reasons for this was the connection of Paliastomi with the sea through the straight linear Maltakva canal (Fig. 2) (canal length – approximately 600 m, average width – 60 m) in the years of 1924–1925. The purpose of cutting the Maltakva canal was to quickly transfer excess water from the lake to the sea during heavy floods (which the Kaparcha River could not do) along the shore due to its long-distance runoff and, consequently, to prevent heavy flooding of Poti.

It is known that during heavy floods a large volume of water enters the Paliastomi Lake from its catchment area and the Rioni River. The Kaparcha River, as mentioned above, could not ensure the rapid transfer of excess water from the lake to the sea, due to which during heavy floods a large volume of water flowed into the Paliastomi Lake through the Pichori River. Before cutting the Maltakva canal, large volumes of water periodically flowing from the Rioni River into the Paliastomi Lake caused the lake level to rise rapidly. Due to the above, water flowed from the lake to the territory of the city of Poti and caused heavy flooding of the latter. Thus, the city of Poti was catastrophically flooded in 1895 and 1922, when the height of the torrents in the streets of this city reached 2.8 m.

Cutting the Maltakva canal solved the problem of flooding Poti from the side of the Paliastomi Lake. Instead, the Paliastomi Lake ceased to exist as a natural freshwater reservoir. The Maltakva canal opened a free path to the salt water of the sea towards the lake. As a result, the freshwater lake turned into a salt lake-lagoon. Prior to cutting the Maltakva canal, the salinity of the Paliastomi Lake water did not exceed 1 ppm. After cutting the canal, during the high turbulence in the sea, its salinity increased to 14-16 ppm. The increase in salinity of the Paliastomi Lake has severely limited the living ecological conditions of freshwater plankton, benthic organisms living on the lake bottom, and severely damaged freshwater ichthyofauna (Janelidze, 1997; Janelidze, 2008).

The second reason for the sharp deterioration of the ecological conditions of the Paliastomi Lake and its adjacent areas was the implementation of reclamation works in the Pichori catchment basin (a main tributary of the lake, which covers most of the Guria Lowland) since 1930s (deforestation, drying of swamps, cutting of ditches and canals on wetlands, straightening of zigzag beds of swamp rivers) and the extraction of peat from the swamps directly adjacent to Paliastomi.

The conduction of these measures further aggravated the already severely shaken ecological situation of Paliastomi Lake. The function of filtrates of swamps, canyons and moist forests as surface waters has been significantly disrupted.

Intensive process of decaying and decomposition of dead vegetation mass began in puddles, depressions occurred in the peat extraction areas, as well as in the smoothed and silted riverbeds of swamps, in water drainage and water canals. This has led to the occurrence of large amounts of harmful biogenic elements that are brought into the Paliastomi Lake by its tributaries. With the contamination of Paliastomi, its water transparency and, consequently, the intensity of photosynthesis decreased.

As a result of the above mentioned, the production of phytoplankton was reduced and, consequently, its biomass was reduced as well. Due to the salinization of the lake water and its biogenic pollution, the freshwater plankton biomass in the lake was reduced by 15 times and that of benthos – by 6 times. This, in turn, negatively affected the production of ichthyofauna, as plankton and benthos biomass are important food for fish (Janelidze, 1997; Janelidze, 2008).

By cutting the Maltakva canal, the Maltakva River has lost its basic function. The river was split into two parts. Its northern section with a small runoff flows southward at about 4.6 km long from the head as before, and enters the Maltakva canal. The sharp decrease in the runoff of the Kaparcha River (which was caused by the cutting of the Maltakva canal) led to the gradual silting of this section of the riverbed and the swamping of separate areas.This section of the riverbed was used for a long time as dozens of man-made docs, as a result of which it was heavily polluted with harmful chemical and biogenic elements.

The southernmost (confluent) part of the southern section of the Kaparcha River, after cutting the Maltakva canal, was silted,swamped and eroded. The northern part changed the direction of the current and began to flow into the Maltakva canal. This part of the Kaparcha River bed is quite watery. It is conflowed by the swampy river of Dedabera and the plain south of the Paliastomi Lake, cut in 1950s and 1970s about 40 km long main canal.

With various theoretical calculations, the average multi-year discharge of the Pichori River at the confluence of the Paliastomi Lake is estimated from 8 m^3/sec. to 15 m^3/sec. In addition to the Pichori River, more than a dozen of small rivers of swamps conflow the Paliastomi Lake. The southern section of the Kaparcha River, as already mentioned, is quite rich in water. According to the above, the volume of water entering the sea in 1 second from the Maltakva canal should not be less than 20 m^3/sec. This, even a probable data, should be taken into account when discussing the closure and cancellation of the Maltakva canal.

A clear example of the negative impact of anthropogenic factor on the environment of the Paliastomi Lake region is the artificial increase in the volume of land-based terrestrial erosion at the confluence of the Maltakva canal that took place in the 1990s. In 1991, a water-skiing complex of international standards was built in Poti. For the preparation of the water-skiing route, at a distance of three hundred meters from the sea and at a distance of 2.5-3 km north from the confluence of the Maltakva canal a hollow was excavated with about 1.5 km length, 100 m width in average and 3–3.5 m depth. Several hundred thousand m^3 of silty sand removed from

the hollow was dumped directly along the coastline. In this part of the coastal zone, the alongcoastal underwater stream flows from the north (Poti Port) to the south (towards the confluence of the Supsa River). It caused a strong accumulation of sandy deposit on the underwater slope of the canal confluence.

As a result, sandy hill (dune) began to form and extend southward (towards the confluence of the Supsa River). In 4-5 years, the length of the hill reached 1.8-2 km. The hill blocked the confluence of the Maltakva canal, and the canal flow, which had previously entered the sea in a straight line in a westerly direction, began to drain along the inner edge of the newly formed hill. Thus, the Maltakva canal stream flowed between the mentioned sandy hill and the sea shore. The stream of the canal, due to the parallel drainage of the sea shore, caused the latter to wash away at a catastrophic rate. It was urgently necessary to restore the original (in the direction of the sea) Maltakva canal, which was resolved by artificial cutting of the sandy hill formed at the entrance of the canal.

It should be noted that from the time the Maltakva canal was cut (1924) until the early 1990s, the underwater slope in front of the canal was not filled with sand. The reason for this was that the underwater coastal flow moving from north to south was not saturated with solid deposits and no deposit accumulation was taking place at the canal confluence.

In recent decades, due to the excavation of a water-skiing hollow in 1990s, the remnants of the sandy deposits dumped along the coastline, were moved to the Maltakva canal confluence and accumulated there, which led to the formation of new sand hill.

Conclusion

A number of measures are needed to maintain ecological balance in the landscapes of the Paliastomi Lake, the most important of which are: To stop the artificial growth of solid depositary material at the confluence of the Maltakva River canal; Cleaning the Kaparcha River bed to improve its ecological conditions; Prohibition of extraction of peat and sapropel from the area around the Paliastomi Lake.

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