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GEOECOLOGICAL STATE OF THE OSETR RIVER BASIN

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This paper presents the results of a geoecological assessment of the human-induced impact on the geosystem components of the Osetr river basin in the Moscow region in the low water period 2017–2018. To assess the surface water quality of this river basin, hydrochemical surveys were conducted which included the determination of parameters such as the pH index, water temperature, the amount of dissolved oxygen (O_2), electrical conductivity, salt content, COD, BOD_5, etc. As part of the environmental monitoring, a reconnaissance survey of the dam in Zaraysk was conducted, during which the main environmental indicators were determined, an assessment was made on radiation, chemical, sanitary-epidemiological and physical factors of environmental risk (*Table 1. a-d)*.

Group Number	Human-Induced Load Factor	Scale
1	-Results of hydrochemical and hydrobiological monitoring (the amount of dissolved oxygen (O2), BOD5, indices of WPI and SCWPI); -Results of ecogeochemical examination of soils (soil pollution index)	Eight-tier scale (0 to 7 points)
2	-Results of hydrochemical and hydrobiological monitoring (salt content); -Number of "hot spots" (enterprises \ major water pollution sources); -Density of highways and main roads; -Number of mining quarries;	Three-tier scale (0 to 2 points)
3	-Results of hydrochemical and hydrobiological monitoring (pH, water temperature, COD, petroleum products, heavy metals, suspended solids, sulfates, chlorides, nitrogen group, organoleptic indicators (smell, taste, color), impurities); -Results of ambient air analysis (amount of electromagnetic radiation, noise exposure, heavy metals); -Results of ecological geochemical examination of soils (area contaminated with radioactive cesium-137, radiation, heavy metals, pH, petroleum products, bens(a)pyrene, epidemiological indicators).	Two-tier scale (0 to 1 points)

(a)

No. of section	Modal Intervals of Mass Concentrations Values, mg\L			Ecosystem Condition	Amount of Human-Induced Load	Human-Induced Load Degree
	Min.Value O_2	EOS by BOD5	Ammonium Nitrogen			
1 (Zaraysk)	7.9	2.6	0.109	natural	25	0
2 (Markino)	7.6	1.6	0.109	balanced	25	0
3 (Radushino)	7.3	2.3	0.140	crisis	31.25	0
4 (Spas-Doschaty)	9.8	4.5	0.039	natural	31.25	0
5 (Vlasyevo)	8	3.6	0.242	crisis	31.25	0
6 (Akatyevo)	10.1	6.6	0.0039	natural	31.25	0

(b)

No. of Section	Modal Interval of Human-Induced Impact Amount, %	Human-Induced Load
1 (Zaraysk)	less than 30	low
2 (Markino)	less than 30	low
3 (Radushino)	30 to 45 inclusive	moderate
4 (Spas-Doschaty)	30 to 45 inclusive	moderate
5 (Vlasyevo)	30 to 45 inclusive	moderate
6 (Akatyevo)	30 to 45 inclusive	moderate

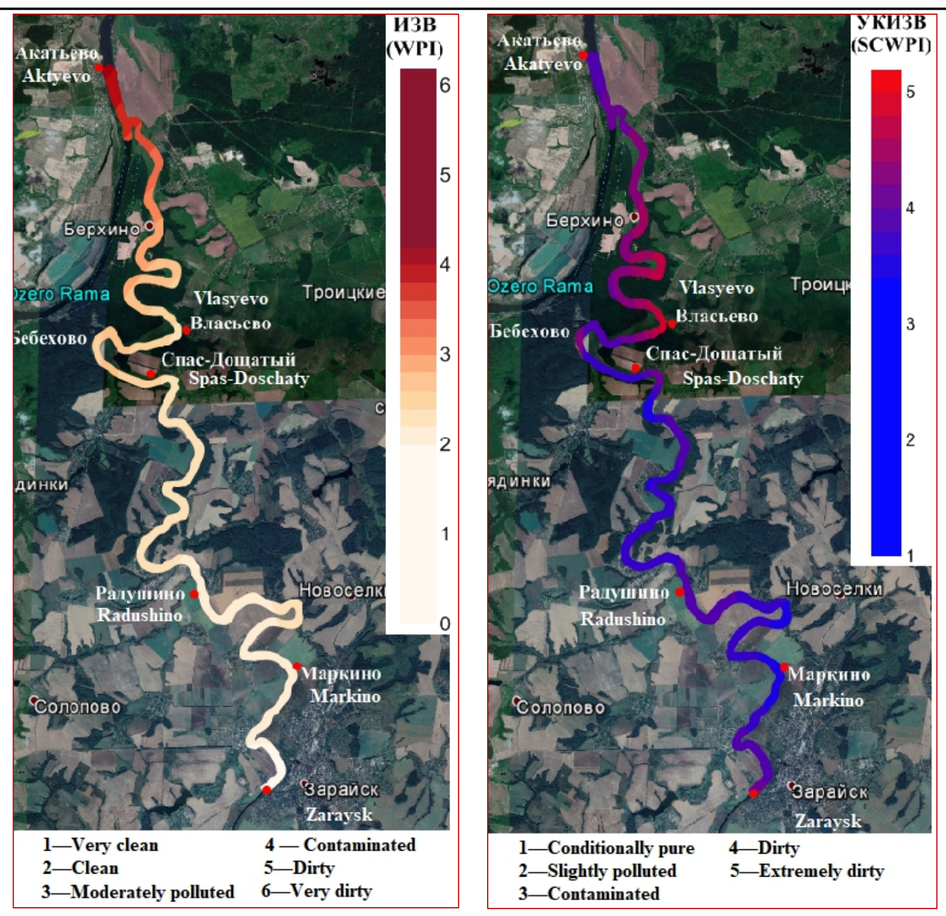
(c)

Total Points	Human-Induced Load
up to 20	low
20–40	medium
40–60	moderate
60–80	high
80–100	critical

No. of Section	Total Points	Human-Induced Load
1 (Zaraysk)	22	medium
2 (Markino)	21	medium
3 (Radushino)	21	medium
4 (Spas-Doschaty)	21	medium
5 (Vlasyevo)	23	medium
6 (Akatyevo)	20	medium

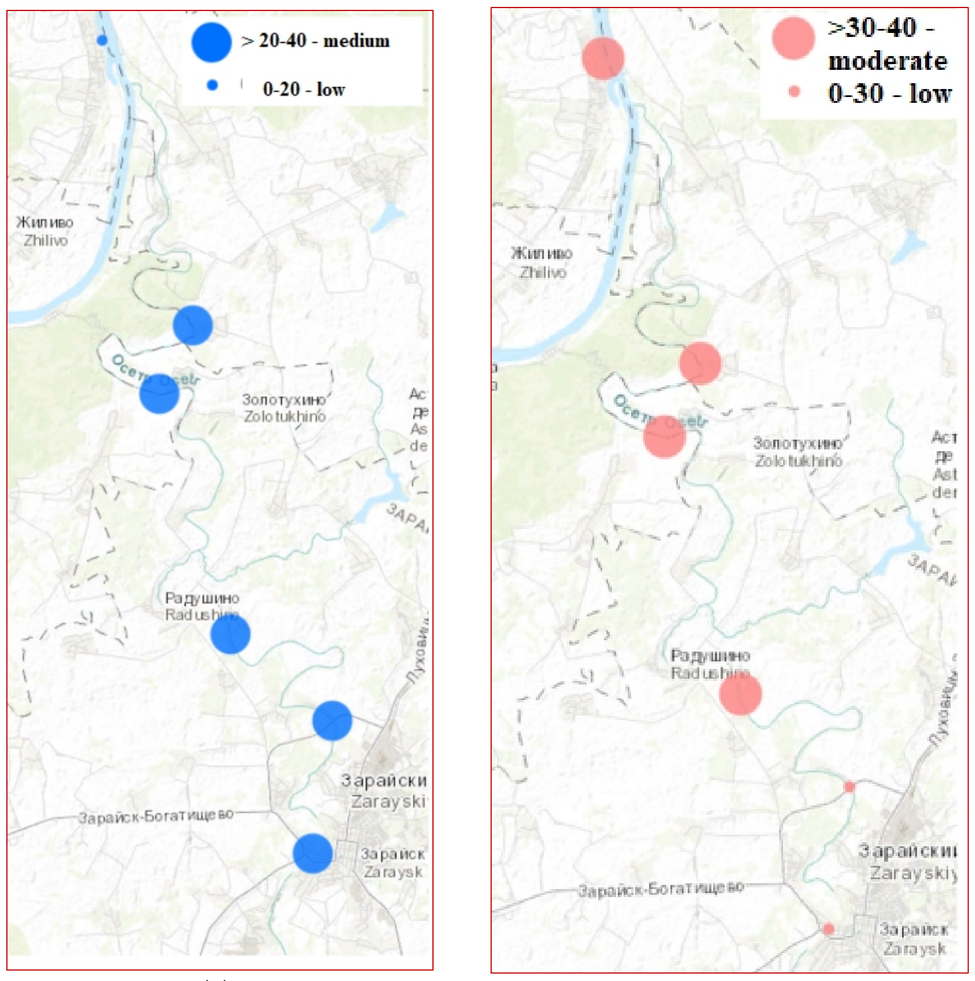
(d)

Table 1 (a-d). Stages of formation of a geoecological assessment using the point-rating method



(a) (b)

Figure 1. Map charts of the water quality change depending on the values: (a) water pollution index (WPI); (b) specific combinatorial water pollution index (SCWPI)



(a) (b)

Figure 2. Map charts of the human-induced load areas in the Osetr and Oka river sections for 2018: (a) In terms of the human-induced load degree; (b) In terms of the amount of the human-induced load.

The work resulted in geoecological zoning of the middle and lower part of the Osetr river basin based on water pollution levels (WPI—water pollution index, SCWPI—specific combinatorial water pollution index), the amount of human-induced impact, and the human-induced load (point-rating method), using definitions of five categories of river channel sections with human-induced load and ecosystem conditions:

- according to the water pollution index (WPI), the Osetr river water is defined as "moderately polluted" (WPI = 1.0–2.5) from Zaraysk to the Oka influx point (49.2 km) and changes to "polluted" (WPI =4.0–6.0) up to Akatyevo (2.09 km) *(Figure 1, a)*;

- the degree of contamination of the water of the Osetr rRiver is characterized as "high", which is due to the violation of existing standards for 5 ingredients *(Figure 1, b)*;

Human-induced loads (e.g., Zaraysk and the adjacent industrial zone) have a strong impact on the ecological situation of the Osetr river basin. This is the impact of the chemical, food, and metallurgical industries, as well as the influence of hydraulic structures.

The obtained results analysis reveals that the studied sections of the Osetr and Oka rivers are classified as having medium human-induced load, with total points of 20 to 22, which is mainly due to the use of water resources for agricultural, household purposes, as well as due to the lack of centralized waste water discharge *(Figure 2)*.

The materials obtained as a result of the study in 2015-2020 including the presented results will make it possible to comprehensively assess the influence of anthropogenic factors on the geoecological state of the river basin, to study the modern ecological state of the studied area, to identify the main impact factors, as well as to assess the degree of pollution, to conduct zoning of the studied area according to the degree of the anthropogenic impact and to develop a detailed geoecological passport of the Osetr river basin.

Due to the fact that the geoecological passport is at the stage of development, the territory of the Osetr river basin within the Moscow Region from Serebryannye Prudy village to Akatyevo village is taken as the area for study, the middle and lower section of the Osetr river basin from Zaraysk village to the river mouth zone/area (confluence with the Oka river – Akatyevo village) – as the screening area. The dates of additions and changes to the river geoecological passport are 2020-2022.

Yurova, Y.; Shirokova, V. Geoecological Assessment of Anthropogenic Impacts on the Osetr River Basin. Geosciences 2020, 10, 121.

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