

## DISTRIBUTION OF NUTRIENT LOAD FROM LIVESTOCK COMPLEXES IN BASINS OF THE RIVERS OF THE REPUBLIC OF TATARSTAN'S PHYSIOGRAPHIC REGIONS

Elena Minakova and Anatoliy Shlychkov

Received: 20.08.2014 / Accepted: 17.06.2015

**Abstract:** The paper presents the results of the evaluation form of the nutrient load from farms in the basins of the Republic of Tatarstan. The contribution of nutrients from livestock is among the factors that determine the level of nutrient impacts in river basins.

**Keywords:** biogenous, pollution of river, surface flow

### Introduction:

Biogeochemical cycles of phosphorus and nitrogen - essential nutrients that determine the productivity and structural-functional organization of ecosystems are currently experiencing significant anthropogenic transformation. One of the major types of human intervention in the cycle of nutrients was the use of mineral fertilizers, in particular, the use of the nitrogen and phosphorus fertilizer, which makes adjustments to the historical cycles of these elements in the biosphere. Only a portion of biogenic elements in the fertilizer remains in

the surface circulation. The largest share of nitrogen (34-60%) and a significant proportion of phosphorus (9-25%) of the fertilizer enters the ponds and accelerates the production of organic matter in the water bodies and the development of the global process of anthropogenic eutrophication of water bodies, which entails a significant disturbance to the functioning of water system (Coplan and Stravinskaya 1993). Today the eutrophication of water bodies is one of the most pressing problems of surface water. At the XXII Session of UNEP in 1984, the process of eutrophication of water bodies of land was the uppermost regarding the degree of danger of the global anthropogenic impacts on the environment (Hirsanov and Osipov 1993).

Russia ranks second in the world in terms of gross freshwater (after Brazil), and on water availability per capita - the third place among the major countries (after Canada and Brazil) (Danilov-Danilian 2009). As for water use in Russia, very serious problems may arise as a result of global climate change. Changes in precipitation due to the global climate change will most likely

---

### Elena Minakova:

Kazan Federal (Volga) University  
Russia  
e-mail: ekologyhel@mail.ru

### Anatoliy Shlychkov:

Institute of Environmental Problems and  
Subsurface Use  
Academy of Sciences of the Republic of  
Tatarstan  
Russia  
e-mail: anatoliy.shlychkov@yandex.ru

be adverse for Russia. The corresponding calculations have been done by the Intergovernmental Panel on Climate Change (IPCC) for greenhouse gases and aerosols (Meleshko et al. 2004). According to these calculations, in the European part of Russia it has been predicted a deterioration of the water supply. However, more disturbing are the projected changes in precipitation. The expected significant increase in non-uniformity of rainfall means at the same time posing a threat of both floods and droughts.

In the context of climate change, both on global and regional levels (Perevedentsev 2006) it is important to consider the influence of climatic factors on the moisture and heat transfer surface run-off from agricultural land substances in the hydrosphere. And, no doubt the necessity and the possibility of solving the problem of flow control agents on regional level (Latypova et al. 2002).

In continuation of previous studies (Latypova et al. 2001, 2004; Shlychkov et al. 2001; Minakova et al. 2003, 2004; Latypova et al. 2003), this work is devoted to the rationing of nutrient loading in nature - orographic areas in the basins of the rivers of the Republic of Tatarstan.

### Materials and methods:

As objects of research is the basins of the rivers in the nature - orographic areas of Republic of Tatarstan. The territory of Predvolzhya is characterized by a high level of agricultural loading, that of Predkamyie distinguishes by a high degree of loading from the industrial enterprises, Zakamyie stands for an oil production and oil processing region with problems typical for similar influences (Fig. 1). Statistical data processing is carried out with the help of the tabular MS Excel processor.

As anthropogenic factors cause significant changes in the existing geochemical background of nutrients in the river waters, consider the following factors:

- plowed farmland;

- the impact of livestock complexes;
- the use of fertilizers and plant protection products;
- erosion of the soil;
- waste water discharge.

For minimization of errors of the calculations caused by rounding of basic data, their formalization was carried out to dimensionless sizes by the rationing of reference values on the corresponding average values. The assessment of the influence of the livestock complexes making a contribution to the loading of nutrient elements is carried out within some interval of points. Studied values changed in unit shares (the values close to unit testify to the high anthropogenic load, close to zero - about the low anthropogenic load).

### Results and discussion:

We calculated the distribution of the anthropogenic load engendered by the influence of livestock complexes on nature - orographic regions of Republic of Tatarstan (Tab. 1).

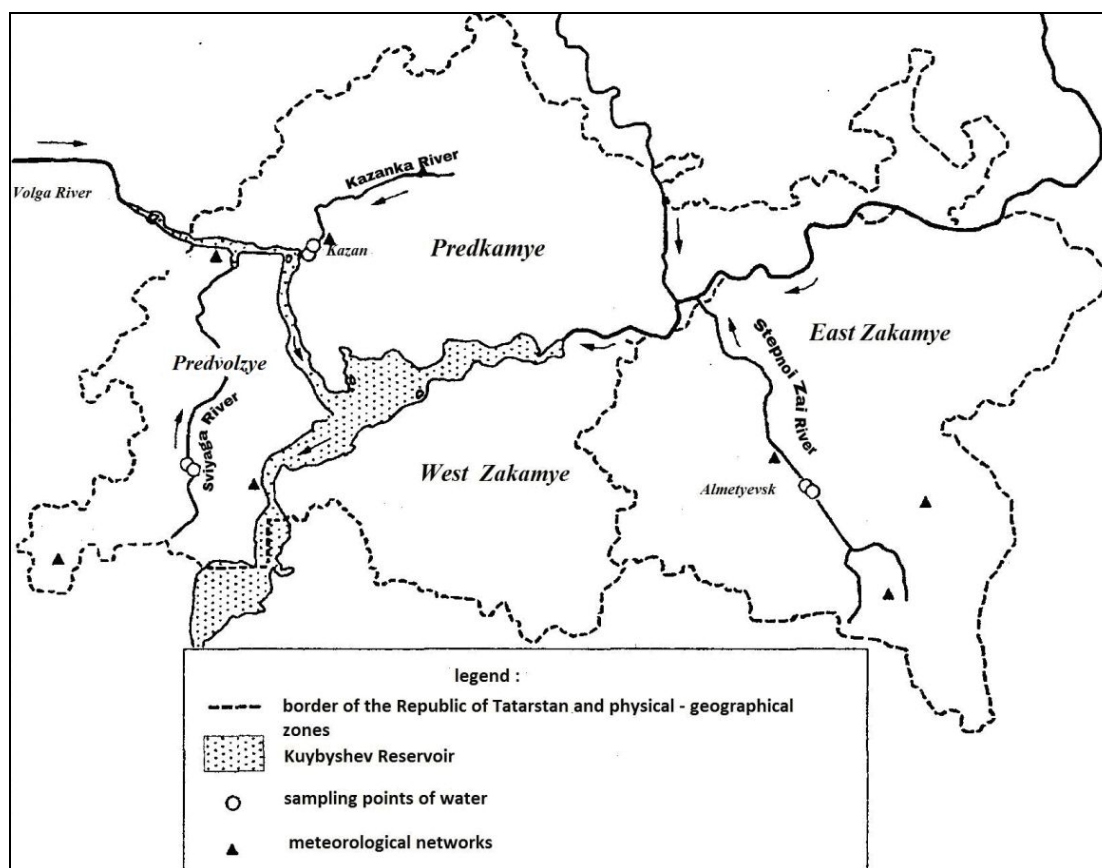
In Western Predkamyie the level of the anthropogenic load above an average is observed for 50.2% of the territory. Besides, in Western Predkamyie the average level of anthropogenic load is noted for 46.1% of part of the territory. In East Predkamyie throughout all territory the level of the anthropogenic loading is noted as below an average, higher than an average or average are absent. In Western and Eastern Zakamyie in the territory respectively 52.2% and 39.1%, are registered as the average values of the level of anthropogenic loading. As a whole, for 30.8% of the territory of Republic of Tatarstan level of anthropogenic loading of the influence of livestock complexes is observed as above average value. The average level of anthropogenic loading from influence of livestock complexes is noted for 43.4%, and below an average on - 25.8% of the territory of Republic of Tatarstan.

We have calculated the contribution of livestock farming in the complex, the anthropogenic stress factors affecting the leaching of nutrients on nature - orographic regions of Republic of Tatarstan (Fig. 2).

The analysis of Figure 2 shows that livestock complexes make the main contribution to complex loading biogene elements in nature - orographic areas of Republic of Tatarstan. At the same time it should be noted that water disposal makes

the smallest contribution to complex loading biogene elements in nature - orographic areas of Republic of Tatarstan. The greatest size of a contribution of livestock complexes in complex loading is observed due to the biogene elements in Zakamye. In Predvolzhye and Predkamye the size of the contribution of livestock complexes in complex anthropogenous loading is slightly lower and is practically on one level.

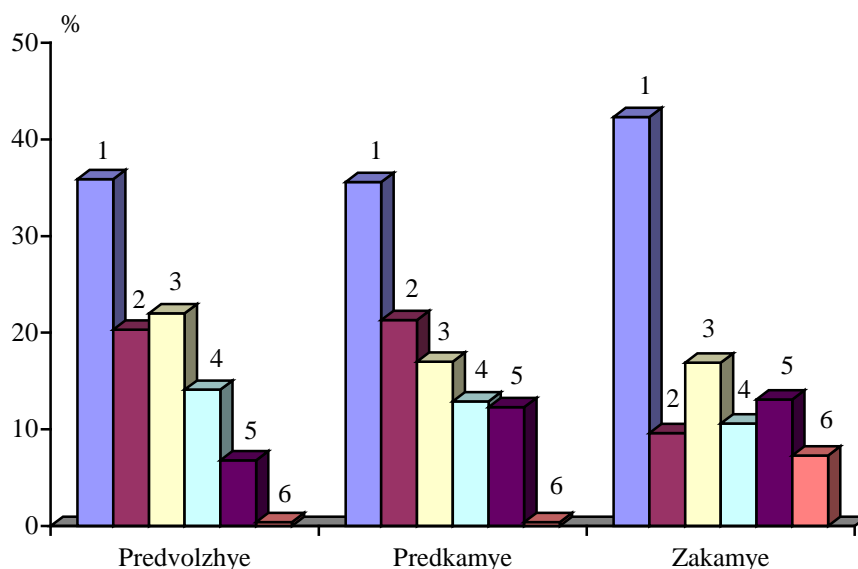
**Figure no. 1** Schematic map of the nature - orographic areas of Republic of Tatarstan



**Table no. 1** The distribution of the anthropogenous loading prompted by the influence of livestock complexes on nature - orographic regions of Republic of Tatarstan

Natural regions of Republic of Tatarstan	Level of anthropogenic load		
	below average (< 0.96)	average (0.96 – 1.38)	higher than the average (> 1.38)
Predvolzhye	28.6	53.9	17.5
Western Predkamye	3.7	46.1	50.2
Eastern Predkamye	100	-	-
Western Zakamye	31.5	52.2	16.3

**Figure no. 2** The contribution of anthropogenic factors in the complex load on the nature - orographic areas of Republic of Tatarstan (1 - livestock; 2 - erosion of the soil; 3 - plowed; 4 - introduction of pesticides; 5 - mineral fertilizers; 6 - nutrients in the components of waste water/sewerage)



### Conclusions:

The level of the anthropogenic load on the impact of livestock in the Republic of Tatarstan is distributed in a non-uniform manner throughout the territory. On average, in the territory of the Republic of Tatarstan the contribution of livestock to the complex human pressure is 38.2%.

The use of such indicators improves the control process of the eutrophication of surface waters, as well as determining the

priority of environmental protection, and optimizing budget expenditures.

### Rezumat:

DISTRIBUȚIA NUTRIENȚILOR DIN  
COMPLEXELE DE ANIMALE ÎN  
BAZINELE RÂURILOR DIN REGIUNILE  
GEOGRAFICE ALE REPUBLICII  
TATARSTAN

Articolul prezintă rezultatele evaluării nutrienților scurși din fermele de animale în bazinele râurilor din Republica Tatarstan. Contribuția nutrienților din fermele de animale se numără printre factorii care determină nivelul impactului nutrienților în bazinele râurilor.

### References:

- COPLAN DIX I.S., STRAVINSKAYA E.A. (1993), *Anthropogenic redistribution of organic matter in the biosphere*, Saint - Petersburg, Science, 206 p.
- DANILOV - DANILIAN V.I. (2009), *Water resources of the world and the prospects of water sector in Russia*, Moscow, Institute for Sustainable Development, 88 p.
- HIRSANOV N.I., OSIPOV G.K. (1993), *Management of eutrophication of water bodies*, Saint - Petersburg, Gidrometeoizdat, 278 p.
- LATYPOVA V.Z., SELIVANOVSKAYA S.Y., STEPANOVA N.Y., VINOKOUROV R.I. (2002), *Regional valuation of anthropogenic pressure on the natural environment*, Kazan, Publisher Academy of Sciences of the Republic of Tatarstan, 372 p.
- LATYPOVA V.Z., YAKOVLEVA O.G., MINAKOVA E.A., SEMANOV D. A. (2001), Role of meteorological factors in pollution of the small rivers, Saint - Petersburg, *Ecological chemistry*: 115-123.
- LATYPOVA V.Z., MINAKOVA E.A., PEREVEDENTSEV Y.P. (2003), Anthropogenic pressures on aquatic ecosystems, in: *Ecological problems of the small rivers of the Republic of Tatarstan (for example, Mesha, Kazanka and Sviyaga rivers)*, Unit 2, Yakovlev V.A. ed., Publisher Academy of Sciences of the Republic of Tatarstan, Kazan, p. 38-59.
- LATYPOVA V.Z., SELIVANOVSKAYA S.Y., STEPANOVA N.Y., MINAKOVA E.A. (2004), *Development of biogeochemical approaches to environmental valuation chemical load on the environment*, Kazan: Kazan University Press, Scientific Notes of the Kazan State University: 159-170.
- MELESHKO V.P., GOLITSYN G.S., MALEVSKY-MALEVICH S.P., MOKHOV I.I. (2004), Possible anthropogenic climate change Russia in XXI century: assessing the ensemble of climate models, *Meteorology and Hydrology*: 38-49.
- MINAKOVA E.A., LATYPOVA V.Z., PEREVEDENTSEV Y.P. (2003), Approaches to regional standardization phosphorus load - and nitrogenous fertilizers on the catchment area of the river, Moscow, *Health and Safety*: 36-40.
- MINAKOVA E.A., LATYPOVA V.Z., STEPANOVA N.Y. (2004), Environmental regulation of anthropogenic pressures on aquatic ecosystems, Kazan, *Environmental Consulting*: 3-10.
- PEREVEDENTSEV Y.P. (2006), *Climate of Kazan city and its changes during the modern period*, Kazan: Kazan University Press, 215 p.
- SHLYCHKOV A.P., IGONIN E.I., MINAKOVA E.A. (2001), *The influence of organized discharges and diffuse sources on the level of pollution of the river water, problems of environmental management*, V International Scientific Conference: 148-151.