

**Title:** Research on the condition of small rivers in the middle taiga of the northwestern federal district of Russia in areas of continuous harvesting activities.

**Authors:** Aleksei Krasilnikov

**Affiliations:** Foundation for Sustainable Development «Silver Taiga»

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**Keywords:**

monitoring systems; harvesting; small rivers;  
heavy metals; environmental monitoring.

## Problem Statement

Any anthropogenic impact on the environment requires constant monitoring of the condition of various natural objects. For example, timber harvesting requires special attention to the condition of watercourses flowing through the forest area. In Russia, such activities are complicated due to large volumes of logging and extremely difficult accessibility of territories. For logging companies, it is important not only to conserve nature, but also to be resource efficient, which is why simplified monitoring methods are required. The best solution may be to develop a primary assessment method, the essence of which would be to identify negative changes in watercourses by analyzing external signs. To develop such a system, we turned to the experience of European scientists who are already applying their development in this area, Blue Targeting, in forest management. The study was conducted in August 2020.

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## Research Objective:

- To examine the null hypothesis, according to which deforestation exposing the soil leads to leakage of heavy metals from the top layers of the soil into small rivers.
- Evaluate the possibility of applying the Blue Targeting monitoring system in the conditions of middle taiga.
- Identify visually observable signs indicating the deleterious effect of harvesting for small rivers.

Studies were conducted on nine small rivers flowing through the territory where harvesting takes place

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## Results

### *Applicability of Blue Targeting[3]*

The Blue Targeting monitoring system was developed for the territories of the Baltic Sea water basin and takes into account the peculiarities of climate, landscape and species composition of the ecosystems of the studied territories. Also, logging is carried out in an intensive way, as opposed to the extensive way in Russia. And one of the most important differences is the difference in the legislation of the European Union and Russia concerning forest management. In the Russian Federation, mandatory water protection zones are established for all permanent watercourses and strictly enforced.

During the study in the Komi Republic, the Blue Targeting inspection forms were filled in parallel to the sampling to analyze the parameters regarding their relevance to other geographical conditions. Subsequently, it was concluded that the differences are too great and the applicable points for the conditions of the middle taiga in the Blue Targeting monitoring system are less than 20% of all questions.

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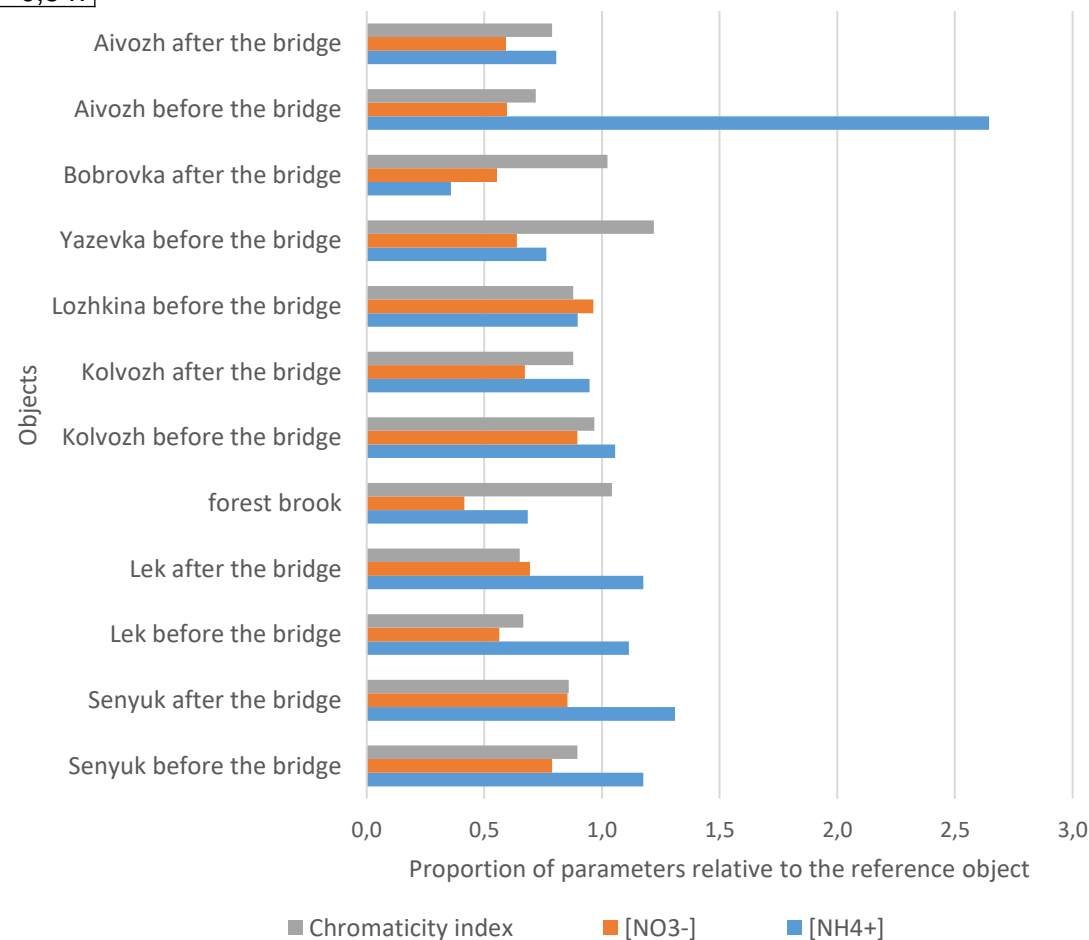
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**Results**  
*Water*

Reference Object	[NH4+] mg/dm3	[NO3-] mg/dm3	Chromaticity index
Suran	0,0207	0,0289	0,547

During studies of watercourses in late summer, during the summer low water period, we can observe not the pollution of the watercourse, but the way the ecosystem reacts to the impacts and accumulates pollutants. Thus, the absence of exceedances of nitrates and ammonium content may indicate a sufficient protective capacity of ecosystems and a small pollutant impact on watercourses.

Values of parameters in the investigated watercourses in comparison with the reference object, where the values for the reference object are taken as a unit



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## Results

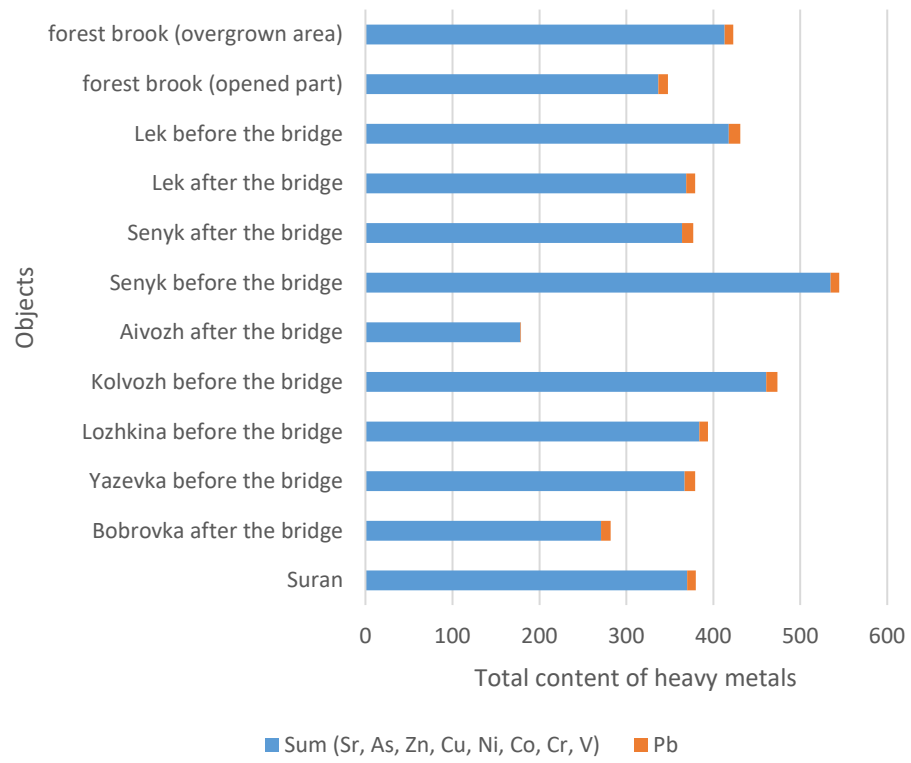
### Heavy metals

Content of heavy metals in bottom sediments is within background values[2], excessive accumulation of heavy metals in plants is not observed. Measurements of heavy metals in coastal soils are required to find correlation between content of pollutant in soil and bottom sediments.

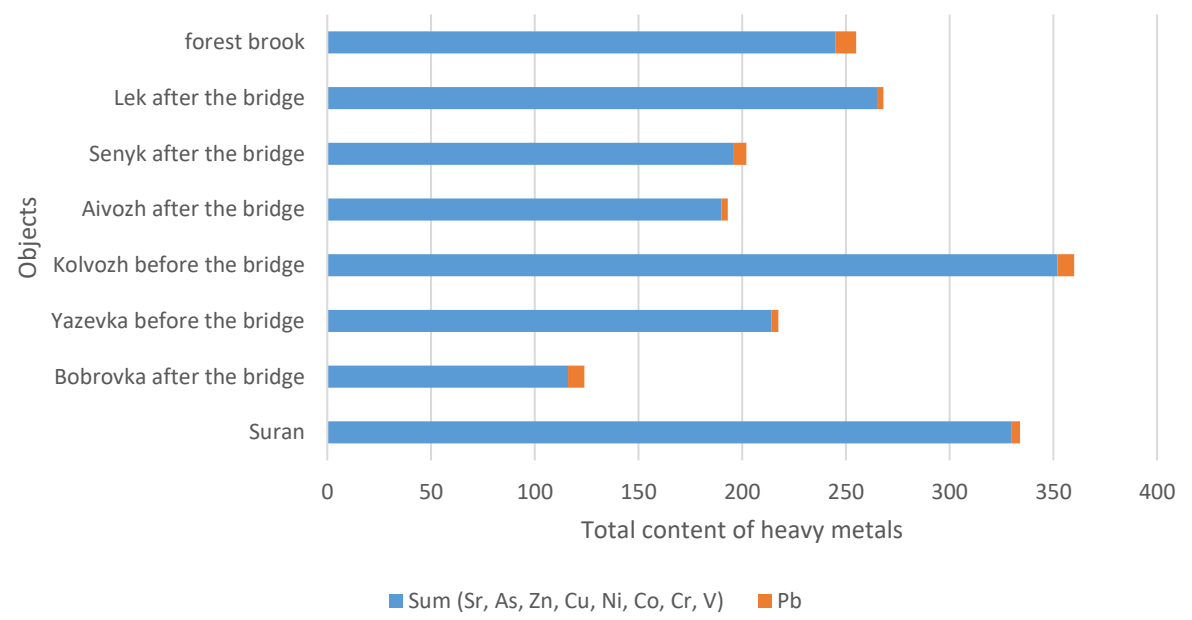
Background lead content for soils in the investigated territory [2]

Soil horizon	Content of Pb [mg/kg]
A0	18±14
A2	3,0±0,7
A2B	3,3±1,4

Content of heavy metals in bottom sediments



Content of heavy metals in aquatic vegetation



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## Conclusions

According to the results of the study, it was found that the approach to the analysis of the state of small watercourses used in the Blue Targeting monitoring system is not suitable for the study of watercourses in the Middle Taiga zone. For the most indicative analysis, it is also required to study the causes of meandering of small rivers in the investigated areas. Also, for a complete picture it is required to carry out measurements during the flood period. Carried out measurements and observations can become the basis for the search of the most indicative parameters and the establishment of their correlation with external signs of pollution.

Also, the conducted study draws attention to the problem of mechanical and chemical pollution of watercourses in places where they are crossed by bridges for transporting timber.

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## Acknowledgement

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# Thank you for your attention!

Authors: Aleksei Krasilnikov

Affiliations: Foundation for Sustainable Development «Silver Taiga»

Contact details: [288044@niuitmo.ru](mailto:288044@niuitmo.ru) ;  
[rabindranattagorpeace@gmail.com](mailto:rabindranattagorpeace@gmail.com)