CAUSES AND EFFECTS OF NATURAL ENVIRONMENT DEGRADATION IN THE HYDROGRAPHIC BASIN OF RIVER NEAJLOV

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Abstract
The paper deals with acute problems of pollution sources and the pressures that these put on the natural environment in a traditionally degraded area due to the development of polluting industries and agricultural activities that operate with overused and outdated equipment.
The case study presents an overview of the hydrographic river basin Neajlov by describing its characteristics and an assessment of the consequences caused by intensive development of agriculture and the industry of oil extraction and processing on the structure and function of ecological systems in the basin.
The grave pollution of the Dambovnic, a tributary river to Neajlov river, is emphasized as a consequence of the discharge of wastewater containing high concentrations of pollutants created by the industry of the area, but also produced by accidental pollution. This greatly impacts the ecological status of the water system Dâmbovnic.
This paper is a first evaluation in finding solutions for the environmental damage created in the past, to ensure sustainable use of natural resources in the future.

Keywords: hydrographic basin, wastewater treatment, ecosystem, effluents and pollution

1. INTRODUCTION

As outlined in the conference in Rio (Earth Summit - Rio de Janeiro -1992, Agenda 21), environmental protection is a prime issue for all nations of the world and aims to ensure a sustainable co-development between socio-economic systems and components of natural capital through a rational use of natural resources and by preventing and combating pollution and their consequences [7].
If until recently, the development of socio-economic systems took place only in the direction of achieving a higher comfort, without taking into account the production and support capacity of the natural capital, in the current period, more than ever, there is a emphasis on achieving a more stable balance between nature and society to ensure a harmonious development of human community in terms of improving the surrounding environment and its conservation.
Environmental protection and improvement, the implementation and continuous improvement of environmental management techniques are priority directions of sustainable development programs at national and European level [3].

2. MATERIAL AND METHOD

In this context, we have studied Neajlov hydrographic river basin, an area characterized by the dominance of agricultural practices but also by the pressure applied from human population congestion and highly developed industrial objectives.
Neajlov river basin is located in the south of the country, has an area of 3720 square km and its basin integrator is the Arges river basin[4].
The Neajlov Basin is a slightly elevated plain, fragmented by a network of valleys oriented parallel on the NW-SE direction. Its altitude decreases from 300m (north side) down to 55 m (south). The geological substrate is represented by an accumulation of Quaternary origin, covered by alluvial deposits.
The classes of predominant soils are: luvisols (60%), chernozem (9.5%), cambisols (7.8%), vertisols (6.2%) faeozems (5%) and fluvisols(4%).

The climate is temperate continental region, with influences from sub meridian that provoke transitions to aridity. Multi-annual average temperature is 10 degrees Celsius (North), 11grade Celsius (South). Rainfall is measured as 400-600 mm / year, being more abundant in the North. Annual deficit periods are recorded in terms of rainfall associated with the phenomena of dryness.
From a hydrological point of view, the region is characterized by the presence of four major rivers: Neajlov, Dâmbovnic, Calnistea, Glavacioc and a network of small streams, some of non-permanent nature.

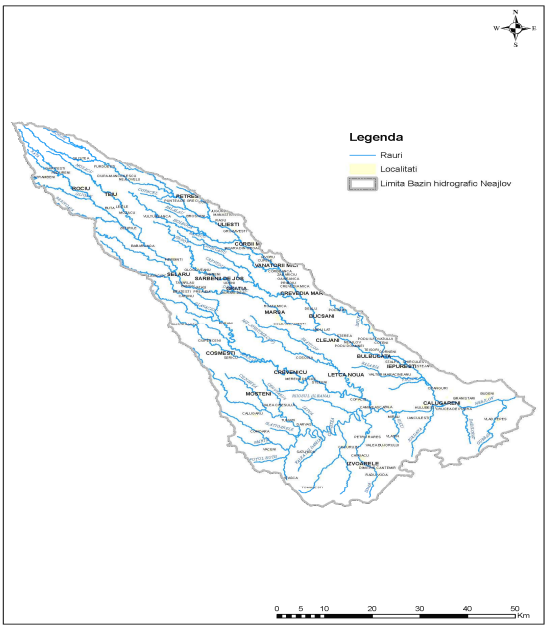

Figure 1 The Hidrographic network for basin Neajlov

The hydrographic basin comprises of 45 sub-basins with areas ranging from 10.41 to 663.61 sq km. The registered annual average flow gauging station for the period 1964-2001 is Calugareni 8.8 m/s, while Neajlov is responsible for about 8% of the total multi-annual stock of river Arges (69.5 m/s in the section of the river mouth).
Groundwater, in particular the ones of notable depth, constitute valuable sources for feeding the population and represent approx. 40% of total water resources.

The region is dominated by man-controlled ecosystems with agro-ecosystems covering 78.5% of the basin area.
Human settlements cover 5.8% of the total area of the basin, with a population density of 70 inhabitants per square kilometer.

2.1 Pollution Sources

In order to implement the national economy policy, prior to 1990, a series of specific activities were developed and implemented at the river basin Neajlov that had significant consequences on the structure and function of the ecological system.
a) **Intensive agriculture development** was achieved in the region through the following means:
–establishment of state farms and large agricultural production cooperatives with technologies based on the use of large amounts of chemical and organic fertilizers. This has led to increased flows of nutrients (nitrogen, phosphorus) in surface waters and underground, in the form of fugitive emissions;
–establishment of large agricultural buildings for livestock (especially pigs) in the Oarja, Cateasca and Slobozia, which added a lot of pressure and constituted a source of diffused pollution for the water courses.
The state farms and livestock complexes that were created proved deficient in advanced technologies and equipment for manure storage and liquid manure with non-waterproof coating that was used for storage allowing the infiltration of wastewater into groundwater. This is one of the reasons for the designation of sensitive areas from pollution by nitrates from agricultural sources.
Wastewater treatment plants were outdated in terms of technology, being themselves major sources of pollution, mostly requiring expansion and modernization of facilities.
An example in support of the statement are the results of monitoring data quality indicators of treated wastewater resulting from Suintest Oarja zoo technical complex and discharged into the river Dâmbovnic.

According to monitoring carried out by specialists A.B.A.Arges-Vedea, the majority of indicators have reported exceeded values.(Table1, Table2) We considered the following indicators as relevant for characterizing the ecological status of aquatic ecosystem Dâmbovnic: CCO-Cr, total phosphorus, nitrates, ammonia.

Table 1: Characteristics of wastewater discharged in 2007

Quality indicators	Threshold values (t/an)	Average measured values (t/an)	Over threshold values (%)
CCO-Cr	26500	180823	582,4
Total fhosphorus	159	2736	1620,8
Nitrates	106	299	182,1
Ammonia	1590	52411	3196,3

Table 2: Characteristics of wastewater discharged in 2008

Quality indicators	Threshold values (t/an)	Average measured values (t/an)	Over threshold values (%)
CCO-Cr	4500	28085	524,1
Total fhosphorus	27	774	2766,7
Nitrates	16	43	138,9
Ammonia	270	3880	1337

Given the need to comply with environmental requirements imposed by European legislation which transposed into Romanian legislation and the performance of investments implicitly calling for substantial financial resources that society was not able to sustain, 2008 marked the closing of the business.

b) **The fast industrial development** has been directed mainly to the energy sector, based on the exploitation of natural resources (oil) and overgrowth of their processing capacity.

These practices have led to important changes in the ecosystem's ecological pool.

- development of the oil extraction industry was made in many cases without the proper upgrading of transport facilities and operation, which resulted in accidental release of waste oil (oil and salt water) in receiving water courses and adjacent soils. The area of degraded land in the basin with oil is 63 ha (source-OSPA) [6].
- development of oil processing capacity has led to the founding in 1967, of Compound Petrochemical Pitesti (now OMV Petrom SA – Arpechim point of work).

The impact of wastewater discharges from Arpechim was a large-scale for the Neajlov basin, firstly because of marked volume of wastewater discharged into the river Dâmbovnic and secondly due to high load in the synthesis of organic compounds. Annually, Arpechim generates about 12 million cubic meters of wastewater.

All the wastewater from the treatment plant, conventionally clean water and rainwater from the Platform Arpechim are discharged into the river channel Dâmbovnic for a length of 5.8 km, after crossing lakes Dâmbovnic and Suseni. These serve the role of buffer lakes and contribute to the mechanical and biological treatment of wastewater discharged from the compound [1, 2].

c) **The inadequate management of municipal waste** in the cities constitutes a diffuse local pollution source.

One of the most pressing environmental problems in the Neajlov basin is represented by waste generation in large quantities and their improper management.

Uncontrolled waste disposal procedures lead to waste often found on the banks of waterways and lakes, leading to numerous cases of contamination of soil and water, with effect on the health level of the population.

Drainage channels located in the coastal villages and urban areas have also become household waste storage and waste water discharge areas in smaller households.

d) **Accidental pollution** can significantly influence the quality of surface water resources, groundwater and soil by sudden alterations of

physical, chemical, biological or bacteriological, above the permissible limits.
Annually, the river basin hydrographic Neajlov, records pollution incidents that cause damage to pipelines responsible for oil and salt water transport (very old and corroded pipelines).
The technological accident in 25/02/2007, produced by Arpechim Pitesti influenced the entire river course.
The consequence of breaking the sealing elements from the maneuver tower of Suseni accumulation was the rapid and uncontrolled loss of the entire volume of stored water, which also disturbed the material deposited in the reservoir, causing major pollution of the river Dâmbovnic and long-term environmental effects of the affected area (L = 69km) [5].
Significant overruns were recorded in suspensions (peste14000mg / l), CCO-Cr (7000 mg / l), extractable substances, phenols.

Figure 2 Lake Suseni, after the incident.

Figure 3 River Dambovnic, after the pollution wave.

Arpechim company with all institutions involved in environmental protection have intervened to remove the effects of pollution on the zone.

3. RESULTS AND DISCUSSIONS.

The combined effects produced by overlapping in timeframes and space and sometimes in different forms of pollution, have led to degradation of soil quality, surface water and groundwater.
Natural drainage of land determined by lithography has determined that the pollutants in soil and stagnant water from land can surface to reach, by percolation along the river, where they are gathering over the pollution caused by the traditional spills.
Studies on global pollution of the Neajlov basin have determined the classification category of the basin as being “vulnerable area” as a result of the level of nutrients [5].

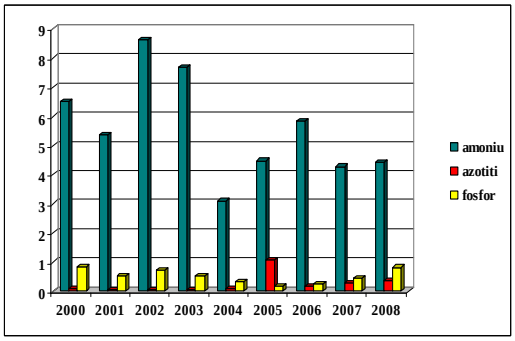

Figure 4 Dynamics of average annual concentrations of nutrients in the section Suseni, Dambovnic river.

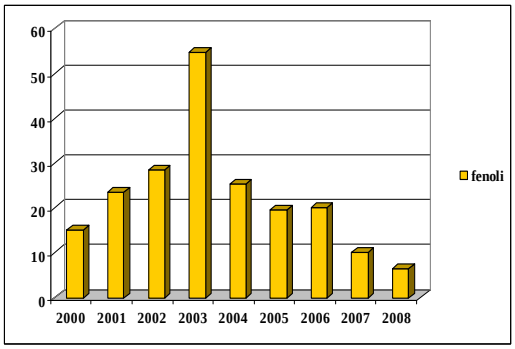

Figure 5 Dynamics of average annual concentrations of phenols in section Suseni, Dambovnic river.

The diversity and diffuse sources of pollution that have affected the Neajlov basin presented in the paper, led to the deterioration of surface water and groundwater quality.
Given the results of the partial, and afterwards integral, monitoring of the water quality in the 2000-2008 period, the overall quality of the Dambovnic river is classified in class 4 quality, relative to the laws in force (Monitoring - ABA Arges Vedea).
Note that the most critical situation occurred in 2002-2003, when the environmental law was more permissive and addressing environmental issues was at the sector level.
The introduction of an integrated quality monitoring system of aquatic ecosystems determined firm actions from the Environment Guard and Environment National Administration "Apele Romane", by which users and potential polluters of water were determined to take measures in accordance with EU requirements.

4.CONCLUSIONS AND RECOMANDATIONS

The initial evaluation of the overall environmental condition of the hydrographic Neajlov basin highlights the high degree of degradation of the environment factors, determined by the abusive exploitation of natural resources, water and soil.
The serious state of degradation requires the application of environmental measures, to restore the ecological quality of soil and surface water for a healthy environment.
Techniques and technologies available for this action can be accessed by both investors and local governments, whose role in sustainable development in areas in which they act is very important.

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