SUMMARY

thesis:

MONITORING OF NITRATE POLLUTION AND MITIGATION MEASURES IN DEPRESSIONS OF AREFU - CORBENI AND CURTEA DE ARGEŞ

Developed by: TUDOR F. Denisa Elena
Coordinator: PhD. prof. CIONTU Costică

Key words: *nitrates, pollution, vulnerability, depressions, waters, soils, field bodies, fertilizer doses,* protection measures

This study was developed to assess the quality of surface water and aquifers on the basis of nitrate content in Arefu-Corbeni and Curtea de Arges sub-Carpathian depressions. The aim of the paper was to establish specific measures to prevent the pollution of these water sources and generally of all ecosystems. The thesis is so structured that it has continuity in content and contains seven chapters.

Introduction presents the main forms of pollution, sources, mode of action and effects on ecosystems and, ultimately, mankind. Emphasis has been placed on the deterioration of water and soil quality, two life-saving resources on the planet and virtually non-renewable.

The **first chapter** emphasizes the role of nitrogen in nature, starting with its contribution to the formation of the earth's atmosphere, until its presence in the soil. The most important chemical properties, participation in the composition of essential substances and its role in the maintenance of life on Earth are mentioned. There are researches and opinions of some reputed specialists on how nitrogen has reached the lithosphere and has become one of the most important elements that intervene in the so complex system represented by soil, playing a special role in the creation of his fertility status.

The nitrogen circuit in nature has been treated, ranging from precipitation deposits, soil storage, interaction with soil microorganisms, organic matter addition, plant consumption, leakage and vertical infiltration, processes in which it is trained. It is stressed the role of bacteria without which it would be impossible to transfer the nitrogen compounds to the plants and beyond until the trophic chain closure.

Next, we mention the sources of nitrogen, both natural and anthropogenic, the most used types of organic and synthetic fertilizers, the evolution and tendency of fertilizer consumption in Romania and at the planetary level.

Although nitrogen is a relatively inert chemical, under certain conditions it can become one of the most dangerous pollutants, by the formation of compounds such as nitrates and nitrites, that the next subchapter deals with the harmful effects of their excess on human health.

Part of the chapter mentions researchers' concerns about the impact of nitrates on aquatic ecosystems, not only in Europe but also on other continents, research carried out over a long period of time, where variants of land use, plant structures crops, fertilizer dosages, tendency to accumulate or decrease nitrate concentrations depending on the approached variants.

In addition, it is presented the European legislation, which has become mandatory in Romania, regarding the correct and efficient management of nitrogen and its compounds, nitrates and nitrites, with the declared aim of keeping the soil cover and the aquatic ecosystems with which it can interact in good condition.

The **second chapter** presents the objectives, methods, materials and timeframe for research. Details were given on the establishment of the limits of the investigated area, the methods of soil and water sampling, transport and specific laboratory analyzes. The preparation of this study was complex, as several stages overlapped. During 2012, 20 soil profiles were developed for the pedological characterization of the subcarpathian depression sector. In the period 2012-2014, soil samples were collected to determine the nitric nitrogen content, and 20 groundwater and surface water sources were monitored. The quality of the water in the Curtea de Arges depression and its surrounding areas was tested by multiple analyzes during the year 2016.

The **third chapter** presents the institutional and natural framework in which the research was conducted. Is described in detail the studied area, viewed as part of the large natural ensemble, represented by the Southern Carpathians and Getic Subcarpathians. The two depressions, Curtea de Argeş and Arefu-Corbeni have tangible boundaries due to the formation of the whole area, resulting from the local geological and tectonic structure. The lithological composition is broadly described, it contributes to the current modeling of the relief, the drafting of the watercourses, the use of the land and, last but not least, the formation of soils cover.

Far from being monotonous, the regional relief is represented by small depressions and prolonged ridges, descended from the crystalline or sub-Carpathian peaks, as observed by the Romanian and foreign geographers, mentioned in the chapter whenever it was the case. The boundaries of the depressions, with defining features of the landscape, represented by oronims, absolute altitudes, geomorphological continuity were treated in detail.

The hydrographic features were described further. Argeş, one of the important rivers of Romania, crosses the area from north to south, it is described with many details regarding the springs, the spectacular path through the mountain and the northern part of the Subcarpathians, the flow, the longitudinal slope, the arrangements made on its course, tributaries, human settlements, contribution to the particularly high touristic potential of the investigated area. The characteristics of the phreatic waters were also emphasized, depending on their location on relief forms and geological structure.

There follows the climatic definition of the studied region, with numerous parameters taken from the meteorological station in Curtea de Arges, where measurements have been carried out for more than a century. The average and extreme temperatures and precipitations, the frequency and intensity of the dominant winds, some climatic phenomena that can influence local economic activities are detailed.

One of the most important components of the biotope is the soil, defined during the work as a "ground-based system" because it can not function by itself; as such, all the soil types encountered in the two depressions are presented below. In correlation with the relief, geological structure and hydrography, the soils have a presence relatively in line with the latitude and altitude area. It has gone from fluvisoils, young soils specific to the young relief forms, such as the meadows and low terraces of Argeş and the most important tributaries. It follows, on more stable relief, the eutricambosoils, a more advanced soil type and perhaps one of the best that can be found here. As the altitudes increase, other types of hill-specific soil, thee pre-luvosoils and districambosoils, have been found in the areas without pronounced slope and regosoils, on the surfaces exposed to erosion. Depending on parent materials with fine granulometry, pelosoil is the type of soil that appears in the form of enclaves.

For each soil type, the main morphological, physical and chemical traits were highlighted by native layers or horizons, according to the observations made during field study and interpretation of laboratory analyzes. Among the most important elements found in the datasheets are the texture, the reaction, the current fertility status given by the weight of the macroelements. The processes in which soils are involved due to groundwater interference, morphometry, morphodynamics, specific human activities have not been omitted. In this way were treated 20 soil types, all in accordance with the official methodology used in Romania.

In the **fourth chapter**, according to the methodology used by pedologists in Romania, 76 soil types have been subjected to bonitation and have been analyzed from the point of view of the degree of favorability for the use as orchards of the surfaces they characterize, as well as from the point of view of favorability for two species of trees more widespread in the region, apple and plum.

In the **fifth chapter** are presented the results of the three-year survey between 2012 and 2014. Seven bodies of surface water and 13 bodies of groundwater were monitored. The network has been established to include the most representative and most important bodies of running, standing and groundwater. The 20 water samples are characterized by basic chemical parameters, as well as by location, location on the relief, type of water source, altitude and geographical coordinates. The study was conducted in two annual series, with 120 tests of nitrate concentration. The obvious causes and the virtual causes of the increase or decrease of the nitrate content from some sources who experienced significant fluctuations throughout the years have been mentioned. Nitrate content ranges between 0.44 mg/l NO_3 and 169.51 mg/l NO_3. During this period, only three groundwater sources showed oscillating values that at some point exceeded the safe limit for consumption.

By testing 51 water sources in the summer of 2016, three water bodies showed values higher than 50 mg/l NO_3, and five groundwater had concentrations close to the maximum allowable threshold. In the autumn, there was an appreciable decrease in values. However, three sources out of 54 did not meet the drinking condition.

Nitric nitrogen content in soils varied greatly over the three years of research. On a depth of 90 cm, the lowest recorded average was 0.6 ppm (2014) and the highest was 7.9 ppm (2012). The maximum concentration of nitrate was usually noted in the first 30 cm.

In **chapter six**, measures are proposed to try to limit water pollution with agricultural products. Depending on the pedo-climatic conditions, the systematization of the agricultural lands was carried out in three classes of vulnerability to nitrate pollution. Among the conditions that contribute to nitrogen losses that are likely to produce nitrate pollution are soil features, including the texture and depth of the profile, the relief conditions, with reference to the slopes, the density of the surface hydrographic network, the depth of the groundwater aquifers, the unevenness of the earth surface, the main features of the climate regime, especially with regard to precipitation. For the normalization of the doses of chemical and organic fertilizers, the agricultural perimeters were organized into eight bodies of land divided in 36 subcategories.

The measures to limit the pollution of water with nitrates from agricultural sources are presented in extenso, such as the protection of watercourses and drinking water supplies, sloping landscapes, fertilizer preservation and management, the establishment of a fertilization schedule according to the climatic conditions and the geography of each agricultural area.

By quantifying the number of animals in the year 2016, out of the six localities that belonged fragmentarily to Arefu-Corbeni and Curtea de Argeş depressions have a total value of 8811,3 EB. They were determined the annual nitrogen yields from livestock manure (717487 kg) and the average pressure on agricultural land.

Finally, **chapter seventh** sets out the findings of the research and some additional recommendations for avoiding contamination with nitrate and other harmful substances. Water sources with a high nitrate content were reported isolated, the pollution being punctual. From the observations, these pollution was generated by the incorrect management of manure, to which the an incomplete service of the sewage system contributed.

Considering the relatively low content of nitrates from most water sources in relation to the geographic location of the studied area, the suitable crops for environmental conditions and quantified livestock, we can conclude that the waters of the sub-Carpathian Arefu-Corbeni and Curtea de Argeș depressions are poorly polluted with substances from agriculture.