

ASPECTS REGARDING SOIL AND SUBSOIL POLLUTION IN THE PLAIN OF THE CRIȘ RIVERS

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Abstract

The study regarding soil and subsoil pollution was realized on contaminated sites as well as on potentially contaminated ones. The contamination of these sites occurred from different sources derived from various domains of activity, which have polluted the soil, or have a possible polluting potential by dumping used raw material, and/or storing finite products on the soil surface or in the proximity of water bodies. The pollution of the soil are phenomena and processes which manifested themselves from the very first years of the soil existence, along with the growth of population and the desire to extend the producible fields. Degradation and pollution made their presence felt by different natural forms of erosion, alluviation, coverage with sediments, excess of moisture, soil salinization, sloughing, compaction, chemical pollution, the weak provision of nourishing elements and microelements, due to the cultivation of all surfaces available, the drawing out from the agrarian circuit of all ploughable and wooded surfaces, the growth of the number of population, the increase of the industrialization degree, etc. These phenomena are hardly noticeable, less evidential and unexplored because of the natural capacity of the soil.

Key words: Pollution, contamination, soil, Plain of the Criș Rivers

INTRODUCTION

The phenomenon of soil and subsoil pollution appeared many years ago, knowing two aspects: historical and present pollution. The *historical pollution* refers to those sites which have been contaminated after the undertaking of past activities, and remained unrehabilitated, being therefore a real danger to the surrounding environment. The *present pollution* refers to those sites on which polluting activities are still currently taking place. The law regarding environmental protection describes as *polluting* any solid, liquid, gaseous or vaporous substance or any energetic form (electromagnetic, ionizing, thermal, phonic radiation or vibration), which once inserted in the environment alters the balance of its constituents and its living organisms, and causes material damage. The common definition of *pollution* states the following: the direct or indirect insertion of a polluting factor which may cause harm to human health or/and to the quality of the environment, material damage, deterioration or preclusion in the use of environment for recreational or other legitimate purposes.

In the area of the Criș Rivers Plain the sites classified as contaminated and potentially contaminated, are those which have suffered ecological consequences from past activities and were not subdued to a

rehabilitation process, or those which are present polluters. These types of pollution appear on all soil structures encompassed in the Criş Rivers Plain.

MATERIAL AND METHOD

The Environmental Protection Agency and the Office of Pedologic Studies of Bihor and Arad have supplied the necessary database for the creation of this study. Data was extracted from the National Database of the Contaminated or potentially Contaminated Sites, part of the National Agency for Environmental Protection Bucharest. This study will be focusing on analyzing the existing sources of pollution in the Plain of the Criş Rivers.

RESULTS AND DISCUSSIONS

Based on the studies made and the available information up to this date, approximately three million potentially contaminated sites have been identified in EU countries and 250 thousand contaminated sites, which are estimated to grow by 50% until 2025. In Romania, 1052 sites have been identified, with a total surface of over 98500 ha, derived from various fields of activity (fig. 1). The study of aspects concerning soil pollution is crucial for future investments in agricultural development. Also, a very important aspect is knowing the polluted areas or their polluting potential, in order to implement a series of European projects of national and international interest.

Fig. 1 Economic activities in Europe causing soil pollution. Source: The Minister of Environment (the seminary theme: Technical Assistance for the creating of a strategy and action plan regarding the rehabilitation of historically polluted sites, Sinaia, 2009.

In the context of the above stated, the Plain of the Criş Rivers was submitted to an analysis regarding the degree of soil pollution and degradation.

From the polluting domains present in the area of study the most important are the ones derived from the chemical, metallurgical, petroleum, and food industries, zootechnical activities, urban waste repositories, water treatment stations, daily excavation works, dangerous industrial repositories (ash, dross, sludge, etc. – see fig. 2). The pollution sources in the Plain of the Criş Rivers come from the chemical industry processing of toxic and non-toxic substances, such as lacquer, paint, diluter, dyestuff, pharmaceutical products for human use, herbicides, insecticides, pesticides, food colorants, mineral oil additives, and organic products of synthesis. The obtainment of calcined alumina by means of the Bayer bauxite processing method is a pollution factor due to the waste dumps C0 and I-III containing red sludge. These



Fig. 3 Aspects regarding soil and subsoil pollution with red sludge.

The food industry is another source of pollution present in the area of the Criş Rivers Plain. This pollution source derives from the processing of food products such as sugar, meat, etc. Another source of soil and subsoil pollution derives from the leather and tanning industry which utilizes in the technological process chrome compounds, and once they have penetrated the soil they become a real source of contamination.

The petroleum industry causes soil pollution in the area of oil parks due to the leak of oil residues and salty technological water used in the activity of oil extraction, producing harmful effects to the surrounding environment. It has been determined that soil and subsoil pollution affecting the inferior horizons of the soil, or the pollution of phreatic water in the perimeter wells operate, derives from the mishandling of machinery and cracking of transport pipes.



Fig. 4 Pollution caused by petroleum products and the repository of domestic waste in the Plain of the Criş Rivers

One of the main problems faced by the the administrative, sanitary and environmental authorities, especially in the urban areas, is the storage of domestic waste. The polluting effects caused by domestic repositories are: the pollution of the soil from beneath the repository and its proximity, and the pollution of the ground water with compost, therefore poisoning the drinkable water on large surfaces, in comparison with the repository location; the contamination with pathogenic agents and parasite germs as a result of the gushing and infiltration processes, and the emission of unbearable smells felt from kilometers away, causing discomfort to the general population and altering the taste of agricultural products cultivated in the area. Dangerous waste repositories like dross and ash repositories stretch over a considerable surface of land, polluting the soil in an almost irreversible manner. The soils located inside ash waste dumps or in their proximity, suffer from partial polluting effects such as the transformation of their natural layer, causing the appearance of anthropic protosoils due to the fact that solid and gaseous polluting substances such as dust, powder, or smoke are stored on the surface of the soil, or on plants, from where they breach the soil with the aid of precipitation water.

Soil pollution may be also derived from the uncontrolled periodic storage of vegetal waste and residues referring to the materials resulted from agricultural and forestry production processes. The periodic operations of drainage canals declogging result in the accumulation of waste and residues containing mud, large quantities of vegetal waste derived from hydrophilic plants developed in areas with humidity excess, located on the nearby fertile lands.

Soil pollution may also occur due to domestic waste and residues derived from the cleansing of yards and gardens. The same category includes the waste and residues derived from forestry exploitation. Deforestation results

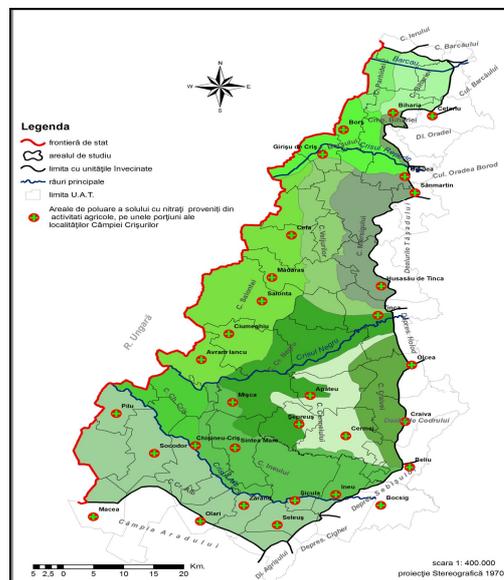
in large quantities of wood stored temporarily on the productive lands located nearby the forestry exploitation area.

The polluting effects caused by vegetal, agricultural and forestry waste occur due to the fact that deposited material constitutes a nitrate pollution source for the soil and phreatic water, as the organic vegetal remains stored on the land surface or on the soil/subsoil, decompose and generate nitrates which infiltrate the ground water. These repositories of waste are frequently found in rural areas.

Pollution caused by daily extraction works (quarry) is another important pollution source present in the beds and terraces of the Criş Rivers, particularly in the beds and terraces of the Crişul Repede, Crişul Negru and Crişul Alb rivers. This form of pollution was classified in the SRCS 1980 (Romanian System of Soil Classification) as a pollution source, and in the 28th indicative of the SRTS 2000, this notion is replaced with “degradation caused by daily excavation activities”.

Water treatment stations are also present sources of pollution in the area of study, through the activity they perform, due to the fact that they collect waters from numerous sources with contamination potential.

The zootechnical activities produce large quantities of dejection mixed with salt, bio stimulators, sanitizing substances, pesticides, and substances for disease treatment and neutralizing of pathogenic agents. These sources of pollution have determined the classification of some areas as vulnerable at a national scale.



Source: Shuttle Radar Topography Mission (SRTM) model (<http://www2.jpl.nasa.gov/srt/>), modified at a grid step of 30 meters and supplemented with the Order 1552/743/2008 of the Minister of Environment and Durable Development and the Minister of Agriculture and Rural Development.

The soil pollution with agricultural chemicals and pesticides derives from the excessive use of these substances. In the absence of a professional study in this matter, the use of these substances has undesirable results including the pollutions of water, soil and subsoil. Used over a long period of time, the chemical substances may cause a long halt to the natural regeneration of the organic substances from the cultivated soils, seriously threatening the soils' fertility.

CONCLUSIONS

The study of this phenomenon is of great importance for the implementation of European projects in the field of agricultural and economical development.

The growth risk of the soil pollution phenomenon leads to the disabling of many new surfaces of land from the agricultural circuit, which is contrary to the durable economic development of each country.

The soils in the studied area were formed on a pedogenetic background relatively uniform in what the parental rock concerns, represented on the interfluvial regions by deposits of loess, and in the river grasslands by alluvial deposits which overlapped the monotonous relief, two benches being predominant (100–180 m and 80–100 m), a climate with reduced variations of the climatic elements, but with an increased vacillation of the depth of ground waters, with a weak drainage and a strong interference of the anthropic factor.

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