EMERGENCY SITUATIONS IN SOIL POLLUTION BY ANIMAL WASTES

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ABSTRACT
The analysed indices were identical during the entire research period, and so were the measurement methods used in the laboratory (pH, total humus, total nitrogen, mobile phosphorus, potassium). The evolution of the soil pollution by animal wastes from the farm animals in the Arad area point out a high level of soil pollution because of the low values of the pH, of the low soil bonitation scores, of the secondary compaction in the first genetic horizon. After a poultry farms ceases to operate, soil pollution persists, with a slight tendency to decrease naturally.

Keywords: *management, emergency situation, pollution, soil, animal wastes*

INTRODUCTION

Increasing pollution worldwide, critical ecological accidents in the 1970s, and the oil crisis, deforestations and desertification have resulted in more and more literature on the "global issues" human civilisation is confronted with in the second decade of the 3rd Millennium. These issues have a considerable impact on social life: not solving them prevents us from approaching and solving other issues worldwide and ask, more than ever, for a global solution.

The main cause of biodiversity loss (DUMESCU 2006, DUMESCU 2007, PAICU, PETROMAN AND COSTACHE 2010, PLATON 1997) are the **changes of natural habitat** because of the intensive agricultural production systems, of the construction and extractive industries, of the over-exploitation of forests, oceans, rivers, lakes and soils, of the foreign invasive species, of pollution, and of climate changes worldwide. Biodiversity should be conserved worldwide, since it generates, on one hand, goods and services directly usable by the human socio-economic system, and, on the other hand, it maintains ecological processes at local, regional, and global levels. Only 17% of the habitats and species assessed have a favourable conservation status, most ecosystems being no longer able to supply optimal services qualitatively and quantitatively such as crop pollination, clean air and water, controlling floods and erosions, etc. In addition, about 25% of the European animal species (mammals, amphibians, reptiles, birds, and butterflies) are threatened, and 88% of the fish reserves are overexploited or extinguishing.

To **stop biodiversity loss**, we can rely on the following arguments and motivations:

- economic motivations: potential use of animal species as a source of food, medicines, or raw materials in biotechnology;
- scientific aspect: interrelations between the different components of the ecosphere and the possibility of understanding how it works;

- aesthetic aspect: irreversible loss of some unique forms of life, of some categories of ecosystems and landscapes, is equivalent of human expertise and horizon loss;
- ethical considerations: negation of the prerogatives of the human species of destroying other animal species and support for the right to existence of all forms of life;
- **degradation of land and desertification (**DUMESCU 2008, HELD 2004) as a result of the complex interaction between global climate and anthropic factors are critical climate issues that affect the ability of using sustainably land areas. To support international conventions, scientific activity analyses the trends, results, and dynamics of the phenomenon and the development of strategies, methods, and instruments for a better management of the environment. We should also encourage the constructive dialogue between scientists and decision-makers or their representatives.

MATERIAL AND METHOD

To establish the level of soil pollution around the animal farms in the Arad County, we monitored the results in analyses bulletins issued by the institutions habilitated to supervise environmental factors through specific methods or we made analyses in specialised laboratories such as that of the Arad Agency for Environmental Protection.
Soil sampling points at the basis of our analysis of soil evolution under the impact of animal waste pollution and of soil and agro-chemical characterisation indices is located in the area of animal waste pits.
We compared our results with results of other researchers who carried out research in the reference area.

RESULTS AND DISCUSSION

Animal farms have left behind, after ceasing to operate, **environmental effects** consisting of large amounts of animal wastes which, if not valorising as organic fertilisers, **pollute the soil and the waters and generate discomfort because of the foul smell**. We refer to the pig farms in Arad – Ceala, Felnac Semlac, Nadlac, Şicula, and Cermei, as well as the poultry farms in Arad and Vladimirescu. Pollution caused by these animal farms is the result of hydraulically removed animal wastes or of animal wastes mixed with water resulting in large amounts that cannot be valorised as fertilisers and that are stored in basins, on the soil, or reach the water courses. In addition, this type of animal wastes, unlike bovine wastes, is not agreed as organic fertiliser because of its negative impact on the soil and crops.
The animal farm in Vladimirescu is located outside the locality, on the DN 7 Arad – Deva, in an area that is expected to turn into a residential area. The industrial, administrative, and utility buildings were built before 1990. The ex-poultry farm had a total useful area of **6,500 m^2** and it was made up of 3 chicken houses, 2 administrative buildings, heating system, and animal wastes pits.
We used laboratory analyses, analytic data, and measurements made during the period 1992-2010. These data cover both the period **the farm operated** (1992-1994), and the period **the farm ceased to operate and store animal wastes**. Taking into account these

aspects, we consider the data extremely significant both for the assessment of the soil pollution level and for the later evolution of the soil processes in the research areas.

General Characterisation of the Characteristic Soil Type

In the research area, there is a wide variety of soils, from typical gleyic soils to molic alluvial or mollic-cambic soils, or to anthropic protosoils. In the research area, the largest area is covered by the typical anthropic protosoil, poorly gleyed, on fluvial, clayish-argylous-dusty deposits representative for the area described below.

According to the Romanian System of Soil Taxonomy, anthropic protosoil is part of the unevolved and little evolved soil categories at the debut of their formation and development with an incomplete differentiated profile, with poorly contoured, and unclearly defined genetic horizons. These soils have, in general, a gross texture with a low gleysation level. Sometimes, they can be slightly salinised.

Presentation of physic-chemical and geo-morphological features of the analysed soil

Soil type:

- Typical anthropic protosoil, poorly gleyed on fluvial deposits, clayish-argylous-dusty;
  - soil genetic horizons: Am 0-28 cm, A/D 28-50 cm, and D 50-78 cm.
- Texture classes: clayish-sandy in the first horizon, clayish-sandy-dusty in the second horizon and sandy in the third horizon (fluvial sands).
- Nutrient supply status:
  - in general, humus content is moderate to very well supplied;
  - phosphorus supply is moderate;
  - potassium supply is good to very good.

Table 1. Not potentialised mean bonitation scores (calculated according to the methodology developed by the Soil and Agro-chemistry Institute in Bucureşti)

Reference years	1992	1992	1994	1995	1996	1997	1998	1999	2000
Mean bonitation score	0	0	2	-	-	4	6	5	7
Soil quality class (*)	X	X	X	-	-	X	X	X	X

Reference years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mean bonitation score	7	8	8	14	14	19	19	25	26	28
Soil quality class (*)	X	X	X	IX	IX	IX	IX	VIII	VIII	VIII

*soil quality classes according to the agricultural land bonitation methodology (on a scale from I to X)

Evolution of the soil pollution level by animal wastes from animal farms

Analysing physical and chemical data as well as the evolution of the bonitation scores of the agricultural lands in the research area, we can note the following significant aspects:

- during the period of intense activity of the animal farm (1992-1994), there was a **high level of soil pollution** (soil quality class - X) represented by the low values of the pH, of the bonitation scores (0-2), strong secondary compaction at the level of the first genetic horizon;
- after the farm **ceased to operate** (after 1994), **soil pollution persisted**, but there was a slight tendency to natural improvement favoured by the relatively abundant precipitations that resulted in pollutant percolation on the soil profile

and, subsequently, their significant diminution, this situation continued until 2004 when land was part of a higher quality class (soil quality class - IX) ;

- **soil quality improvement level is directly proportional with time lapse**: at present, the bonitation score values (25-28) and the quality class was VIII, were comparable with those of lands in similar soil areas,

CONCLUSIONS

At present, there is a tendency to climax in soil evolution, with a low pollution level, but there are still traces of pollutants in the soil, which points to a high level of pollution in the past, depollution being a long-lasting phenomenon. There is also translation of the soil pollution (a phenomenon that is slow at present) to the pollution of the water table with nitrites: the most affected is the upper horizon (a phenomenon activated in the second part of the interval).

We estimate that in the future the phenomenon of nitrite migration towards lower horizons will activate.

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