

IMPACT OF AGRICULTURE ON PROTECTED AREAS

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Abstract:

This paper proposes an analysis of the impact that the agriculture has on the protected areas, affecting upon all the environmental resources: water, air, soil, flora and fauna, the most intense and rapid changes being recorded upon the ground. By analyzing and interpreting the data provided by the County Agencies for Environment Protection from the Northern part of Romania - Cluj and Bistrita-Nasaud, there were revealed important quantities of pollutant chemical substances used in agriculture. It can be said that this sector contributes significantly to the environment degradation and pollution.

The negative effects these substances have on the environment appear both inside and outside the agricultural area, as the soil, surface and underground waters quality modifies.

Key words: protected area, agriculture, pollution impact, pesticides, nutrients

JEL classification: N50, O13, Q15.

Introduction

The human activities as agriculture, industry, transport have an indirect negative and cumulative impact upon the biodiversity, through the air pollution of the soil and the water. A wide range of polluting chemicals, nutrients, medicines, pesticides industrial chemicals, metals reach in the soil, underground waters and surface waters, and together with atmospheric deposits and acidifying substances (nitrogen oxides, ammonia, sulfur dioxide) have a negative effect upon the environment (EEA REPORT).

Agriculture contributes to the environmental degradation (EEA REPORT). The impact of agriculture occurs on all environmental resources, the most intense and rapid changes being recorded upon the ground/ though significant alterations are found in the soil. The intensive agricultural practices, the agricultural works, the development of the inappropriate conditions of humidity, the elimination of vegetable residues, the lack of the protecting crops, the incorrect use of the water through the irrigation, lead to the degradation of the soil.

Concerning the flora and fauna, the development of agriculture on a wide range leads to the extinction of plant and animal species, through the degradation of the habitat. Owing to continued growth in population and per capita growth a continuing increase of farmland is being predicted (POSTOLACHE, 2012).

The impact of agriculture on protected areas is closely connected with the use of chemical and natural fertilizers, pesticides. Excessive use of fertilizers in or near protected areas, leads to a significant increase in the level of nutrients (chemical elements and components that the animals and plants need for a good development) and heavy metals in the environment (DOBROVOLSKI ET AL., 2011).

At the same time, intensification of agriculture through increased use of cheap and subsidized fertilizers, biocide products, land drainage, irrigation result in losses of fauna and flora, of the soil and water, changes in the habitat structure and animal

communities. These chemicals cause adverse effects outside the agricultural area by changing the quality of surface water and underground water (www.icpa.ro).

Another effect of agriculture upon the environment results nitrous oxide emissions owing to the use of chemical fertilizers or of animal origin, animal waste management and agricultural waste burning.

Therefore from the total nitrous oxide emissions from the atmosphere, more than 66.56% of the total nitrous oxide emissions come from agriculture (<http://data.worldbank.org>).

If, through the use of chemical or natural fertilizers, the use of mechanization, and also of the irrigations, the agricultural lands quality is improved, on the other to the important increase of agricultural production, and they have a directly negative impact upon the natural ecosystems.

This paper will make an analysis of pollutants coming from agriculture which has a direct impact on the environment, and thus on protected areas.

Material and method

In carrying out this paper were used data on pollutants coming from agriculture, in the Northern area of Romania, information taken from the 2011 reports of the Bistrita-Nasaud and Cluj County Environmental Protection Agencies, geographic location areas shown in *Figure no. 1*.

The total area of these two counties is 1,202,960 ha, from which 718,426 hectares represent arable land, which accounts for over 60% of the surface.



Figure no. 1 - Geographical location of the areas analyzed
Source: <http://www.harta-romaniei.ro>

The total surface area of protected areas is estimated at 246,277 ha - 20.5%, of which 114,408 ha represents approximately 17.15% of the total area of Cluj County and 131,869 ha representing 24.5% of Bistrita-Nasaud. A large part of the protected areas is used as agricultural land, being included in the total farmland area of Northern Transylvania (www.anpm.ro).

The statistical data published by the Environment Agency reveals the large quantities of chemical fertilizers and manure used to stimulate agricultural production, as in *Table no. 1*:

Table no.1. Quantities of substances used to enhance production

Chemical fertilizer (tones)	Natural fertilizers (livestock) (tones)	Plant protection products (pesticides) (tones)
11,337	808,203	261

Source: www.anpm.ro

The intensive agriculture which took place during the communist period as well as the current agricultural practices contributed to the acidification of land, so that approximately 62.2% of the surfaces are acid with reduced productive potential.

Results

The large quantities of fertilizers are used in the agriculture, and how they are used, made heady necessary to conduct studies to determine the impact of these substances upon the environment.

Emissions of acidifying gases

Emissions of acidifying gases consist of ammonia (NH₃), sulfur dioxides (SO_x) and nitrogen oxides (NO_x).

The total quantities of ammonia released from agricultural activities and their distribution areas are represented in Table no.2 and Figure no.2.

Table no.2. Amounts of acidifying pollutants released into the atmosphere

Quantity / year	Cluj	Bistrita-Nasaud
Total quantity of pollutants (tones)	9617.94	4684.87
Quantity NH ₃ (tones)	5554.40	2538.88

Source: www.anpm.ro

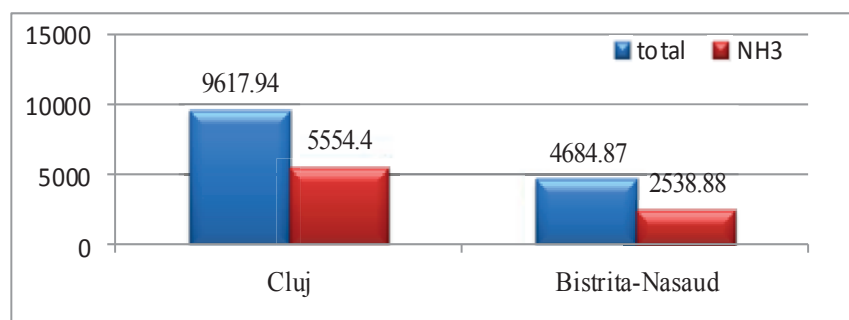


Figure no. 2. Amounts of acidifying pollutants released into the atmosphere

As Figure no. 2 shows, the total polluting quantities with acidifying effect, recorded in both regions, an important part is represented by the ammonia (No separate tests for sulfur oxides and nitrogen oxides were performed).

Excess fertilizer as ammonium nitrate (NH₄NO₃) leads to soil acidification, to the accumulation of nitrate nitrogen in plants, pollution with nitrites / nitrates of the underground water. The uptake of NH₄⁺ prevents excess of Ca₂⁺, Mg₂⁺, K⁺ (POSTOLACHE, 2012).

Particulate matter

Amounts of particulate matter are due to the application of chemical and natural fertilizers on crops. Owing to the fact that there are no measurements for the quantification of the particulate matter quantities, it will use information only from Cluj county, and they are represented in Table no.3 and Figure no. 3.

Table no.3. Quantity of particulate matter

Quantity / year	Total quantity particulate matter (tones)	Quantity of products derived from nutrients (except natural fertilizers) (tones)	Amount derived from natural fertilizers (tones)
Cluj	622.79	243.65	149.5

Source: www.anpm.ro

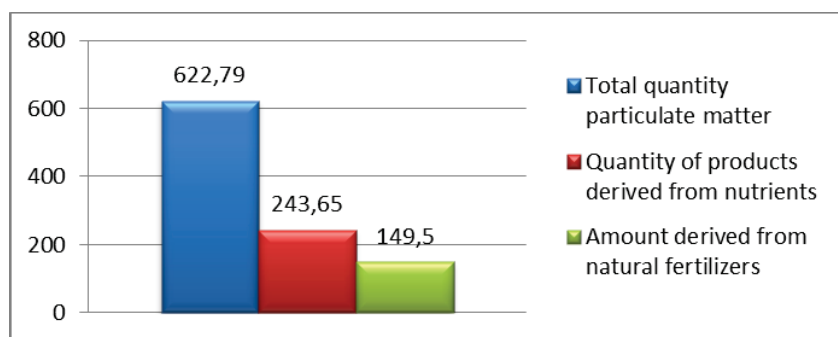


Figure no 3. Quantity of particulate matter

As it is noticed in the Figure no.3, important quantities of the particulate matter are provided by the fertilization of agricultural lands activities, through the chemical and natural fertilizers.

Excessive manure used as fertilizer amends soil properties. They may contain stimulators, urea, NaCl, drugs, pathogens, leading to chemical and biological pollution of soils and can get into the underground water, turning into hotbeds of chemicals, viruses etc. (BORZA, 1997).

Plant protection products

The plant protection products are those aimed to the protection of the plants against to the harmful organisms, the destruction of unwanted plants, the influence of the vital process for the growing and development of the crops, and also for the control or prevent of the undesired growing of them (www.europa.eu).

The quantities of plant protection products, use in agriculture, in products categories, consumed annually, also the total quantity of products, consumed annually and by hectare are shown in *Table no. 4*. In *Figure no. 4* are represented the plant protected products, as geographical areas and products categories.

Table no.4. Quantity of pesticides used

County	Herbicides (kg/year)	Fungicide (kg/year)	Insecticides (kg/year)	Total quantity of pesticides (kg/year)	Quantity of pesticide/ha agricultural
Cluj	42,687	71,369	21,749	135,805	0.1 kg/ha
Bistrita-Nasaud	20,660	26,249	78,130	125,039	0.26 kg/ha

Source: www.anpm.ro

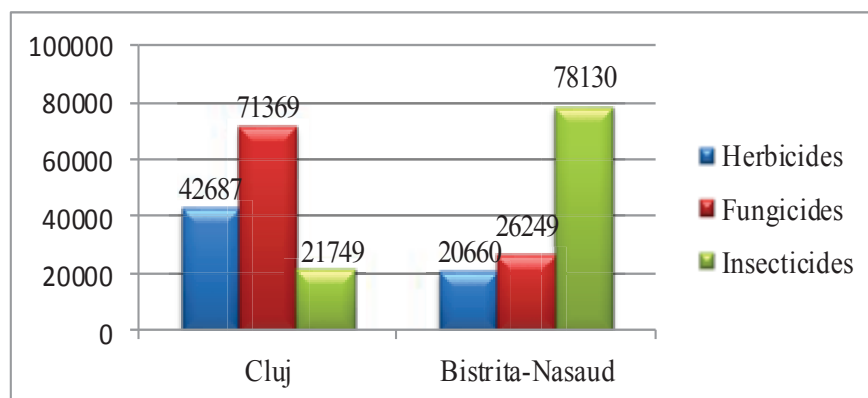


Figure no. 4. Quantity of pesticides used

Table no. 4 and Figure no. 4 show changes in the plant protection products consumption from an area to another, of course depending on the crops of the areas. The consumption of the pesticide per one hectare from Cluj county (0.1 kg/ha) is less than from Bistrita-Nasaud county (0.26 kg/ha).

The effects of the insecticides have on the environment is a major concern for professionals. The purpose of these products is to kill pests, but they can have a deadly impact on non-target organisms as well as food contamination for the wild birds and livestock herbivores.

Often, the effects the insecticides have on birds or animals are not direct or, lethal, but they reduce lifespan and fertility and change their behavior (DEVINE ET AL., 2007).

Nutrients effects on water quality

The presence of the nutrients in water is normal, the pollution being given by the overcharge of nutritive substances beyond the necessary concentration the ecosystems. Among the nutrients which lead to the negative effects upon to the environment, there are different forms of the nitrogen and phosphate - nitrites, nitrates, organic nitrogen in plant debris, phosphates (STOATE, 2009).

The nitrates which infiltrate in the surface and underground waters from the outside and inside protected areas are the contamination source of the surface waters, having the consequences upon aquatic and terrestrial creatures.

The required quantity of water associated with the irrigation practices affect directly upon the river debits in some areas from Cluj and Bistrita-Nasaud counties, due to the takeover of the important quantities of water from lakes and rivers. Many rivers from regions with low precipitation amounts have a low flow during periods in of irrigation. The same is true for the underground water reservoirs that are in a real decline (FOLEY, 2005).

The amount of water used for irrigation in the two areas is 90.10 thousand cubic meters, or 59.62 cubic meters in Cluj county, or 30.48 cubic meters in Bistrita-Nasaud (www.anpm.ro)

Due to the rainfall and irrigation waters the underground and surface water are infested with important amounts of pollutants from chemical fertilizers or manure from livestock.

Parameters monitored in 2011 in Cluj county, specific to the group "nutrients" indicate a state of moderate quality determined by the values obtained for indicators NH_4^+ (1.131mg/l), NO_2 (0.206 mg/l), N_{total} (6059 mg/l), $(\text{PO}_4)^{3-}$ (0.5288 mg/l) and P_{total} (0.6394 mg/l).

In the year 2011, the surface waters of Somes-Tisa catchment for the county of Bistrita-Nasaud identified 10 areas likely to be vulnerable to nitrate pollution. In none of them was revealed a value above that provided in the regulations (50 mg NO_2 /l). Indicator values measured NO_2 -authorized monitoring sections were ranged from 2.231 mg NO_3 /l in Bistrita on Bistrita River to 6.526 mg NO_3 /l at Sintereag Sieu River. The highest value recorded on the river in Sintereag Sieu represents only 13% of the maximum value.

Conclusions

Knowing the quantity of pollutants that are released into the environment from agricultural activities we can infer the effect that they have on the environment. Because monitoring, evaluating and determining the effect that pollutants have on protected areas in Romania is an activity still in its infancy.

Assessing, monitoring and managing the effects that pollutants have on the environment in general and protected areas in particular are a challenge for authorities, international organizations and nongovernmental organizations, these procedures implying of significant material resources, human and time.

In-depth knowledge of the factors that can damage habitats and biodiversity of protected areas is of great importance in establishing management plans for these areas.

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