The impact of anthropogenic activities on components of the natural environment of the Titu Plain

Elena BOGAN[1]*, Doina STAN[2] and Daniela VĂRVĂRUC[1]
[1] University of Bucharest, Romania
[2] "Holy Trinity" School, no.160, Bucharest, Romania

* Correspondence to: Elena Bogan, University of Bucharest, Romania. E-mail: elena.bogan@yahoo.com.

doi: 10.4316/GEOREVIEW.2014.24.1.170

GEOREVIEW

Article history
Received: July 2014
Received in revised form: September 2014
Accepted: October 2014
Available online: November 2014

ABSTRACT: The anthropogenic activities on the environment cause topographic changes that have strong repercussions, some positive (afforestation, embankments) but other negative (deforestation, soil erosion, inning). The present study aims to analyze the current situation of the main anthropogenic activities in the area of Titu Plain, to highlight the negative impacts on the quality of the environment, and at the same time it proposes ways of reducing their adverse effect. Thus, there were studied the three essential components: water, air and soil, and were established the main problems that they currently acts as a result of the work carried out in this geographical area. It is also highlighted the human concern for the conservation and improvement of the quality of the environment, because the man begins to become more aware of the negative impacts of his activities on the environment.

KEY WORDS: anthropogenic activities, environment, water, air, soil, Titu Plain

1. Introduction

Over time, the geographical space studied was confronted with a series of economic, demographical and especially ecological changes required by the development of the society, changes that, most of the time, had negative effects on the environment of this space. We should mention the fact that the actions unfolded in the environment causes imbalances in the evolution of the lifeless parts of the environment, which it can transpose sometimes into ecological disturbances with serious effects on the environment of human and animal life, with serious implications on life and health, which can degenerate into degradation phenomena with a momentum increasingly higher. The impact concept refers to all the human activities (existing, potentials) acting on the environment, human health and well-being from a territory (Mac, 2003; Muntean, 2005).

That's why lately a number of concerns have emerged related to the adoption of the principle of sustainable development, and on the other hand the practice of ecological agriculture and increasing interest in environmental protection and conservation.

These measures can be taken only if the authorities and the population of this area are aware of the importance of these actions and that they provide a certainty that the future generations will be able to benefit from the resources that currently exist and have a supportive environment for life.

The sustainable development unfolds as a current trend increasingly present in all countries, including in Romania as a result of the awareness of the negative impact produced by the sources of pollution from an economical and ecological point of view over the industrial and agriculture production. In order to be able to take the most appropriate measures it is necessary to know the sources of natural and anthropogenic pollution and the effects they have on the environment.

For this reason we considered it is necessary to analyze the current situation of natural factors (water, air, soil) and then to highlight the main sources of pollution in the studied area, as well as the ways to reduce the impact on the environment (Figure 1).

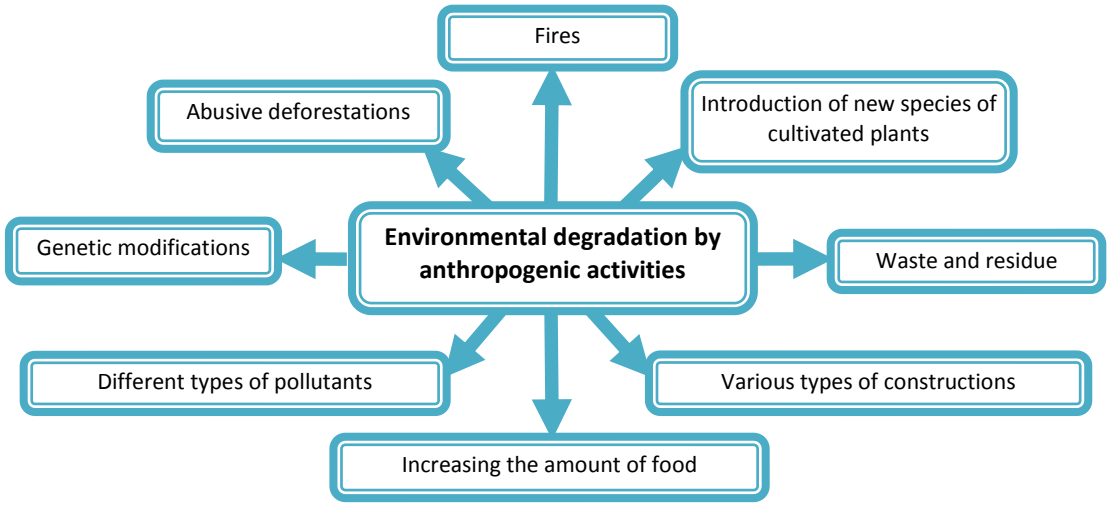

Figure 1. Sources of environmental degradation by anthropogenic actions (Source: authors)

2. Study area

The Titu Plain is located in the central-southern part of Romania and together with Sarata, Targoviste-Ploiesti, Istrita and Vlasia Plains represents the central-eastern sector of the Romanian Plain called Ialomita Plain. It unfolds on the north-south direction between the contour lines of 192 m in the north and 110 m in the south (Figure 2). This geographical area is located between the lower courses of the Argeş and Dâmboviţa Rivers and is characterized by a number of hydrographic and morphological elements: broad meadow, marshes, grinds, ramble of water courses. Overall, the relief has the appearance of plain of subsidence and presents common processes by warping. The active subsidence phenomenon can be easily observed in the field especially in the hydrographic Titu-Potlogi convergence.

The natural conditions play a decisive role in the organization of a space so it is necessary to be given a special attention to them, to know through their characteristics, how they can sustain or block the actions unfolded for landscaping in an appropriate way, taking into account the resources offered by each component. If you want a sustainable development of ecosystem of Titu Plaine, you must take into account the increasing interdependence of the elements of the environment and human communities which they have changed over time. So, the goal is the

continuing struggle to improve the quality of life both for the present generation and for those to come.

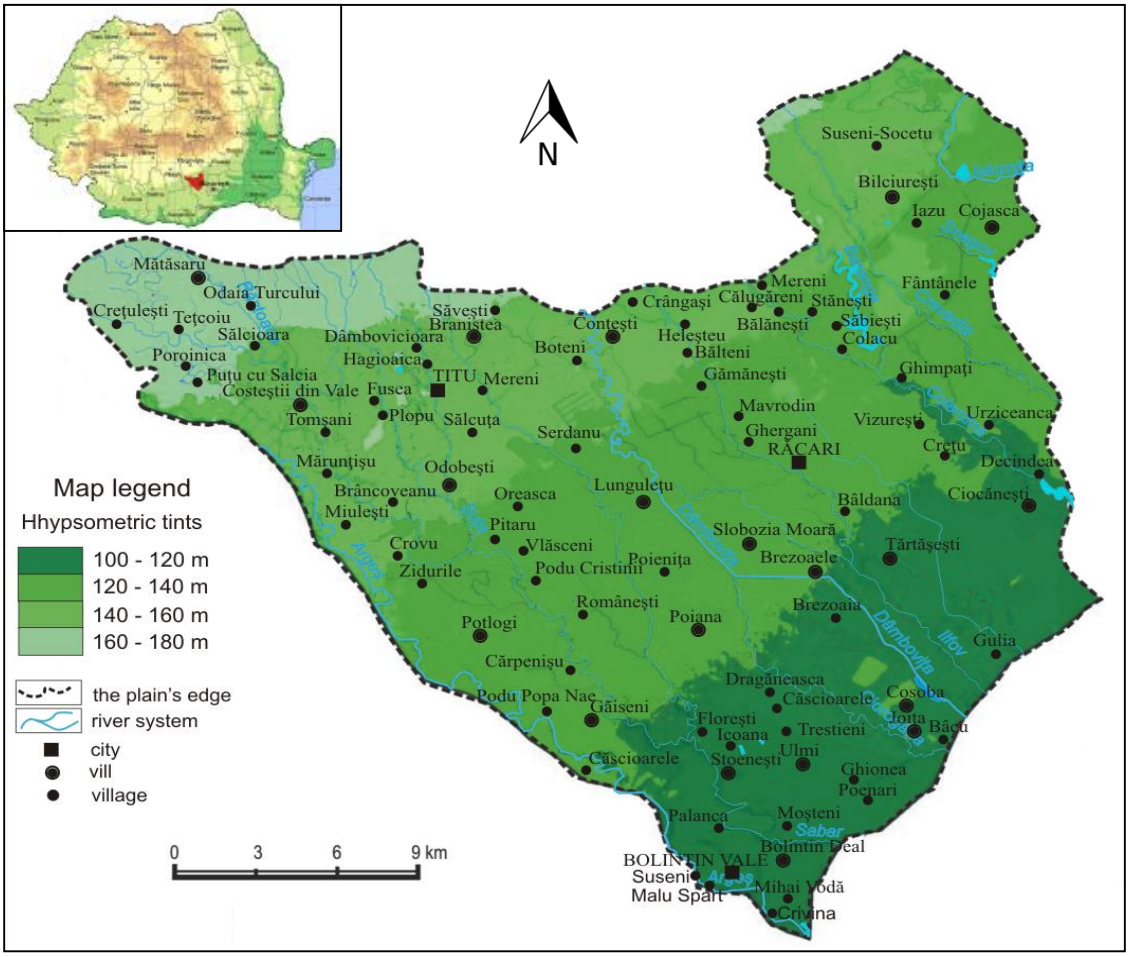

Figure 2. Distribution of hypsometric curve and of villages in Titu Plain (Source: authors)

3. Methodological aspects

The study was based on analysis of data sets collected from the National Meteorological Administration (NMA), National Institute of Hydrology and Water Management (NIHWM) and the National Environmental Protection Agency (NEPA), which focused on quality of groundwater and surface water, soil and air pollution levels for a period of 11 years (2000-2011), as well as the identification in the field of the current situation of the main anthropogenic activities in the area of Titu Plain, to highlight their negative impact on the quality of the environment.

Field observations were also made to correlate existing cartographic material and statistical data obtained with the reality on the ground, as well as knowledge in the smallest details of the phenomena analyzed.

4. Results and discussion

4.1. The current state of natural components and the sources of pollution

Anthropogenic activities including agriculture, industry, urban development, and increasing exploitation of water resources, and atmospheric input also play an important part in determining water quality (Qin et al, 2013).

The groundwater and surface waters are affected by the human activity, and their quality is increasingly modified because in studied area there are not enough wastewater treatment plant (Ulmi, Bolintin Deal, Bolintin Vale, Odobeşti, Floresti-Stoenesti, Cojasca, etc., to the year 2011, 15 companies were registered for collection and treatment of wastewater - Figure 3), and the contamination occurs both with pollutants from landfills or from manure and from domestic sources because there are few urban installations. They can change the ph of the water, but they can be presented as suspended particles or residue (tables 1 and 2).

Figure 3. Wastewater treatment plant Titu - Sălcuţa (Source: authors)

Table 1. Average and extreme values of the fixed residue and suspended sediments quality (2000-2011)

No.	River	Control point	Fixed residue (mg/l)			Suspended sediments (mg/l)		
			Minimum	Medium	Maximum	Minimum	Medium	Maximum
1	Colentina	Colacu	100,8	344,1	856,8	14,1	134,9	754,9
2	Dâmboviţa	Conţeşti	171,2	288,7	721,3	31,2	465,3	3234,8

Source: I.N.H.G.A

Table 2. Specific values of pH (2000-2011)

No.	River	Section	pH		
			Minimum	Medium	Maximum
1	Colentina	Colacu	6,2	7,4	8,9
2	Dâmboviţa	Conţeşti	6,3	7,7	8,5

Source: I.N.H.G.A

Currently, the groundwater and the surface waters are affected in terms of quality by the pollution with various pollutants which have harmful effects for a limited period or sometimes with irreversible effects. Water has a vast number of environmental, economic, social and cultural

values. There is no more important commodity or natural resource than water; it is basic to human life and to global ecosystems (Crabb, 1997).

The chemical fertilisers (pesticides, herbicides, phosphate, compounds of nitrogen) used for soil fertilization or destruction of pests, they can also end up in the surface waters during rainfall or infiltrate into aquifer and thus alter the quality of the waters and even their potential of being drinkable, extensive purification action being needed for regaining the natural properties.

The polluting products in the industry that end up in the surface waters as a result of discharges of wastewater resulting from the production processes influencing water properties, chemical composition, plants and animals that live in water.

The petroleum products from oil exploitation near the Titu town and from Lunguleţu or natural gas exploited from Bilciureşti infiltrate into the soil and the aquifer along with the water from rainfall and alter the composition of the water, raising serious issues about how potable the water is (Figure 4 and 5).

Figure 5. Potlogi Oil Field (Source: authors)

The household products and products from farmsteads (Bolintin Valley, Lunguleţu, Cojasca, Tărtăşeşti, Cosoba and close to the Titu town - in 2011, 21 livestock farms were registered) represent a special category among pollutants because they are increasingly present due to the specifics of the area, and their impact is increasingly visible in the last period. This type of pollution is noted in the waters of Sabar River where the wastewater from the nearby farmstead is discharged for leading to exceeding the permissible limits of ammonia, nitrates and chlorides (table 3).

All of these sources of pollution ended up in the water and mixed with it can frequently leads to reduction of the bodies who live in the water, and on the other hand they do like water becomes

unfit for any use in the people's alimentation, or in other activities because of the taste, smell and heavily modified content.

Table 3. Average and extreme values of the main mineral compounds (mg/l) (2000-2011)

No.	River	Section	Studied indicator	Minimum value (mg/l)	Medium value (mg/l)	Maximum value (mg/l)	Medium Ionic content (mg/l)
1.	Colentina	Colacu	Ca^{++}	22,1	67,8	110,1	391,2
			Mg^{++}	1,7	12,1	43,2	
			Na^{++}	5,5	25,3	88,4	
			SO4	18,2	67,1	298,6	
			Cl^{-}	4,8	35,7	172,1	
			HCO3	51,2	187,9	312,1	
2.	Dâmboviţa	Conţeşti	Ca^{++}	20,6	51,1	88,7	311,8
			Mg^{++}	2,0	19,1	47,5	
			Na^{++}	0,9	24,3	105,2	
			SO4	5,1	47,5	155,4	
			Cl^{-}	4,3	30,1	121,2	
			HCO3	33,8	165,9	996,6	

Source: I.N.H.G.A

The air is a natural factor less affected due to the fact that there are not many polluting industrial units and no heavy traffic. That's why the level of atmospheric pollution is low, the major pollutants being represented by SO2, NO2 and NH3 coming from industrial or agricultural units and less of the exhaust gas. They add the particulate matter and the sedimentables ones but in small quantities.

The analyses carried out on the precipitation in order to determine the content of acid rain (with Ph value below 5,6) have shown their absence demonstrated by the high values of PH, upper limit of 5, 6. For this analysis, there were used data from the meteorological station of Titu (table 4).

Table 4. The value of different indicators of the acid rain (2011)

Weather station	The amount of rainfall	pH	Conductivity	NO_3	NO_2	Ca^{2+}	Mg^{2+}	SO^{2}-4	NH4-	Cl-
Station Titu	29,81	6,21	101,22	0,28	0,11	11,77	11,98	4,89	0,18	7,67

Source: A.N.M

By analyzing the values of these constituents it can be concluded that the overall atmosphere is clean, the air is not filled with harmful substances and it does not affect the health of the population as part of the natural environment which has suffered the fewest negative changes brought by the progress of civilization.

The soil is a support for humans and animals as well as the main means of production for agriculture. Although the whole of Titu Plain soils are suitable for a wide range of agricultural crops, they have lately suffered a reduction in their qualities which led to decreased production.

Among the main current problems of soils it can be mentioned:

- ❒ debasification and acidification of soils from areas where the rainwater stagnants for a long time at the soil surface;
- ❒ sandy texture that has a low water absorption power and retention of nutrients;

- ❒ low depth of the alluvial soils used mainly for meadows;
- ❒ soil degradation because the meanders of rivers and removing them from the agricultural circuit (Figure 6);
- ❒ soil degradation because the excess of the air humidity and gley soil formation with different subtypes that make the agicultural work been difficult and the land are covered with pastures and hayfields (on Sabar River Valley);
- ❒ the excessive grazing on degraded soils;
- ❒ alluvial soils degradation from the meadows of Argeş River by lateral erosion because the gravel pits;
- ❒ presence of knolls and draws in loess in southern of Sabar which remove those lands from the agricultural use;
- ❒ appearance of abandoned lands after replace the river's courses with soils whose properties are deficit (coarse-textured, low fertility, low thickness of the soil, intense erosion);
- ❒ disappearance of some areas with fertile soils suitable for agricultural crops by building housing.

The soil can be degraded at different stages and in case of water deficit due to high temperatures during the summer when water evaporation increases. Correlated with the low levels of rainfall, they can raise serious problems for soil and its quality for agricultural production, which is why it is necessary to use irrigation systems.

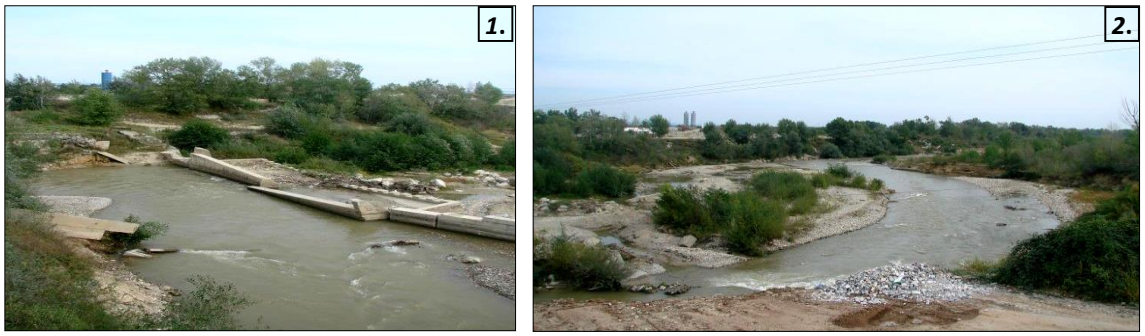

Figure 6. 1. Land degradation as a result of Arges River's meanders; 2. Meandering of Dâmboviţa river course (Source: authors)

These natural causes that alter the soil properties are added the anthropogenic factor which showed and still has a significant influence on this extremely important natural component. Of negative human interventions on the soil we can mention:

- ❒ inappropriate application of chemical fertilizers to increase the production capacity led ultimately to the change of soil type;
- ❒ improper storage of garbage, industrial and agricultural waste;
- ❒ soil pollution with substances from perforated pipes or oil extraction and transport(as in Potlogi where 40 hectares of agricultural lands were removed from the circuit);
- ❒ inappropriate agricultural practices (plowing the same depth several years in a row) with negative impact on the plant growth;
- ❒ subsidence and compaction of soils as a result of the movement and stagnating industrial and agricultural heavy machinery (Moţoc et al., 1975);
- ❒ soil degradation as a result of the abandonment of some works and preserving the excavations;

- ❒ soil erosion due to inadequate agricultural works: ploughing across the inclined plane, ploughing with heavy ploughs etc.

An anthropogenic cause on which we must insist is the action of deforestation that influenced significantly the initial development of the soil over time. Being made to expand the accommodation area, in order to obtain agricultural surfaces or for placing industrial units, the impact on the soil was obvious since the cutting trees occurred according to the whim of the people and not because of the specialized analysis.

The soil started to degrade thereby increasingly faster, the erosion being present on the extensive surface and it is limiting the productive potential of the soil because the fertility of the soil was lost, which is why these areas are covered by pastures and hayfields or are removed from the agricultural circuit.

The agricultural and industrial activities currently practiced negatively influences both the natural components of the environment (water, air, soil) and also the human and animal health. We can use the example misuse of pesticides that can be harmful if they get into the body through ingestion with food or drinking water when they are inhaled or when skin comes into contact with them directly or through clothing.

They may have major implications both for humans and animals, thus, it has reported a higher risk for various cancers which may occur particularly at the growers and animals as well as other forms of illness.

Current situation of natural components in the Titu Plain should alarm the authorities and the population which must realise that the desire and the possibility of obtaining high harvest currently may reflect long-term in a degradation of the natural environment that can be difficult or even impossible to stopped so it is necessary to adopt correct measures designed to restore the natural balance of the environment and leaded to improve its quality.

4.2. Ways to reduce the impact of environmental pollution sources

Besides the natural factors whose action often does not take the will of man because the natural hazards occur spontaneously and sometimes cannot be prevented or stopped, the man being a witness to their effects on the environment, the anthropogenic factors have a much harmful involvement because the louder desire of a quantitative growth of production in agriculture or industry does no longer take into account the pressure exerted on the environment.

Therefore, the negative results of the irrational human actions are easily visible but hardly dimmed, requiring willpower, the effects awareness and involvement as well.

Starting from the idea that man can destroy what is still useful for its existence, it has manifested lately increased attention of the society for the preservation and conservation of the quality of the environment. The environmental protection consists of actions triggered by man aiming to maintain or restore the ecological balance so that it can maintain an environment of human existence in the present but also for future generations. The human intervention has become a necessity when the environment has lost the ability to adjust itself.

Regarding the impact of agricultural activities on air, water and soil as the only viable solution is to switch to ecological agriculture practice that would "disturb" the natural environment the least.

Ecological agriculture allows achieving high quality products based on very fertile soil, excluding artificial fertilizer, but supporting land reclamations works, and also the adoption of clean technologies. Ecological agriculture interacts with the sustainable agriculture that can protect the

environment by using the fertilizers according to the needs of plants grown; by proper drainage of water into the soil in order to avoid sloughing, soil salinization and erosion; rotation of crops for avoid the soil erosion; pest control of the agricultural crops (Cândea et al, 2011).

These conditions are fulfilled by a small number of producers (in Lunguleţu, Potlogi, Mătăsaru, Bilciureşti etc.) because of lack of financial resources, the subsistence agriculture is still practiced on a large scale which ensures a minimum low-quality production, but that can satisfy the needs of the local population.

To protect the resources used in agriculture over time have been written a few laws, such as:

- ❒ Law no. 5/1982 refers to the concern of reducing the environmental effects caused by the use of artificial fertilization (pesticides, artificials, nitrogenous fertilizers);
- ❒ Land Fund Law no. 18/1991 amended later by law No. 173/1997, which provides support for the ecological reclamation of degraded lands but that it can form the basis for the practice of organic farming;
- ❒ Law No. 137/1995 regarding the reclamation of degraded lands as well as the protection of ecosystems of plants and wild animals.

Considering the industry, the impact of this economic sector on the environment can be reduced if they adopt safety measures for environmental components (The environment in Romania; The National Institute of statistics, 2001).

The surface water protection can be achieved by improving the quality of rivers for this being necessary that the wastewater to be collected and treated and not discharged into the water of the rivers, it is also required to decrease the eutrophication, to increase the level of oxygen in the water, to reduce the amount of pollutants with different sourcing (pesticides, chlorides, petroleum products etc.).

The surface water quality is improved through the collection and wastewater treatment in 15 specialized points from administrative units: Ulmi, Bolintin Valley, Odobeşti, Floresti-Stoenesti, Cojasca etc. They are designed to "clean up" the waters of noxious substance and to return them to the consumership with no risk for the population.

As a tendency for the coming years they must adopt clean technologies and discover some new and more effective control techniques for the pollution. Among these measures, we can mention: the discovery of techniques that decrease the consumption of raw materials and amount of residue, the setting of anti-pollution filters and drainers. We can also use industrial plants which consume a smaller amount of water and the wastewater to be decanted and purified right on the spot.

The soil and underground waters protection involves avoiding inappropriate storage of garbage and industrial waste, rational using of fertilizers in agriculture, irrigation, which allows increasing soil moisture and the amount of humus and reduces wind erosion. In order to protect the soil there were built drainage systems that consist of open channels that are designed to remove excess water from the soil due to how the groundwater is being close to the surface (under 2,5 m).

All these measures have allowed the introduction of some areas with fertile soils in agricultural use, but affected by excess moisture. Although the results were positives along with this an acceleration of ground subsidence that is specific to Titu Plain has occured. A beneficial part in soil protection and soil formation is represented by the embankments which are created through the dams which eliminate the flooding risk, stop the alluvation, ensure the agricultural production. Such works were carried out on the two major rivers Dimbovita and Arges that cross the region, along Conţeşti and Boteni communes.

Considering the negative role of deforestation, there have been taken measures to improve the soil quality. Among these we mention: afforestation and land reclamation actions and works to combat soil erosion. The improvement works are fulfilled along some improvement areas especially demarcated for this purpose which are made for skimming, soil fertilisation, supplementary sowing, bank consolidation, road works etc. The soil erosion can be combated through ploughing in reverse slopes, through offsets or other means of land consolidation.

The list of improvability measures may be supplemented with: the afforestation, the drought control by irrigation, because it is known that the lands affected by drought are eroded, the avoidance of excessive grazing, the improving crop plants.

The soil protection for the studied region requires above all practicing sustainable agriculture suitable to "bother" as least as possible the soil and the underground waters and which takes account of the fact that the soils have different structure, texture, and fertility that is why the agricultural techniques must comply with these criteria.

The air protection is asserting more and more by reducing the emission of pollutants into the air from agriculture or industrial units, by adopting of clean technologies and laying out the aerosols.

This way it is detected an improvement of reducing the emissions of nitrous oxide in the atmosphere from used for fertilizers because of the reduction of the areas where the intensive agriculture was practiced, due to the lack of financial support. Considering that the air is a natural component where pollutants are dispersed most rapidly they can be taken some measures against pollution such as: laying out of enterprises outside the areas of concentration of the population, the use of equipment which does not pollute, the use of clean technologies.

These lines may add a number of other activities aimed at improving the environment quality such as: conservation of natural resources, adoption of clean technologies, biodiversity conservation, waste management (collection, transport, regeneration, treatment and exclusion, reducing noise and vibration).

All these measures shall be imposed as a necessity given the fact that for the studied area, land, water, natural resources, especially oil are the most important exploitation sources. That's why we need to pay attention to their use as well as the conservation or the improvement of their qualities.

5. Conclusions

For a harmonious development of the region it is necessary to pass the practice of ecological agriculture on modern principles that would bring the least damage to the environment and at the same time to pay more attention to the protection of all its natural components. We can also practice an intensive modern agriculture, which combines various methods, which correlated lead to the proposed objectives. These methods include: mechanization, using artificials, irrigation, pest control, increase soil fertility, crops protection, agro-technical works.

The beneficial effects are reflected both in the natural estate of the environment factors and the health of the population. Even if the region is at the beginning of this process, and currently there are difficulties in adopting these principles on the one hand because of the lack of interest of the population maintained by the lack of information, on the other hand due to the lack of financial resources, the local authorities have begun to guide and adhere to these methods by knowing the long-term beneficial effects.

References

Bogan E., Stan D. 2010. The premises of ecological agriculture development in the Titu Plain region, *Quality – access to success Journal*, Romanian Society for Quality Assurance, Bucharest, vol. I (118): 178-183.

Cândea M., Bogan E., Simon T. 2011. *Așezările umane și organizarea spațiului geografic*,University Publisher, Bucharest, p.123.

Crabb P. 1997. *Impacts of anthropogenic activities, water use and consumption on water resources and flooding*, Australia: State of the Environment Technical Paper Series (Inland Waters), Department of the Environment, Canberra, p.10

Mac I. 2003. *Ştiinţa mediului*, Europontic Publisher, Cluj-Napoca 466.

Muntean O.L. 2005. *Evaluarea impactului antropic asupra mediului*, Casa Cărţii de Stiinţă, Cluj-Napoca, p.129.

Moţoc M., Munteanu S., Băloiu V., Stănescu P., and Mihai G. 1975. *Eroziunea solului şi metodele de combatere*, Ceres Publisher, Bucharest, p.301.

Qin Ronggao, Wu Yanqing, Xu Zengguang, Xie Derrick, Zhang Chi. 2013. Assessing the impact of natural and anthropogenic activities on groundwater quality in coastal alluvial aquifers of the lower Liaohe River Plain, NE China, *Applied Geochemistry* 31(2013): 142-148.

**** 2000-2011. Institutul Național de Hidrologie și Gospodărire a Apelor (I.N.H.G.A.)*

**** 2011. Administrația Națională de Meteorologie (A.N.M.)*