THE IMPACT OF BUILDING THE "MOTORWAY OF THE SUN" ON THE GEOGRAPHICAL ENVIRONMENT FROM THE SOUTHERN BĂRĂGAN PLAIN

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Abstract. The impact of building the "Motorway of the Sun" on the geographical environment from the Southern Bărăgan Plain. Following the construction of this national objective, changes were made in the plain over: relief, waters, biogeography elements, settlements and anthropic activities. In order to establish the changes produced by the use of the motorway on the environment, measurements and data processing are done. Such studies allow us to make a scientifically grounded picture on the degree of pollution in the region.

Key-words: motorway, environment, pollution, impact, anthropogenic changes.

1. INTRODUCTION

The construction of the "Sun" motorway involved crossing from the west to the east the Southern Bărăgan Plain, approximately in its middle part. This fact led to the creation of a "barrier" that diveded the existing relationships between the components of the geographical environment, both at the level of the natural and the human - anthropic components. In addition, the intensity of road traffic leads to excessive pollution, by burning emissions, as well as by accidents, or activities around gas stations and stalls. The influence of the highway's construction on the environment of the Southern Bărăgan is carried out in the form of an elongated strip on one side and the other of the highway (a band), where the effects are maximum, the limits are difficult to set, but in some cases the air pollution reaches up to 10 km, and the effects on the fauna and the hydrographic network are more pronounced.

2.DATA AND METHODS

In order to carry out the present study, a series of data and graphical materials, from the institutions that had a role in the construction of the motorway, were used to measure parameters, such as the chemical ones of the air, soil and groundwater, as well as on other elements. The history of the construction of the highway required a series of investigations, regarding the stages of work, the sectors used, the choice of the construction route and the working parameters (Dobre R., 2016).

In establishing the impact characteristics, there was taken into account the elements of the natural environment, such as the faunal elements, which were directly affected by the sectioning of the displacement routes, which led to the

separation of the existing populations, a process followed by separate and different evolutions.

In this paper it can be observed the statistical mapping processing applied to the processing of data strings, and as a result, diagrams have been made, of different types (Săndulache, I., 2016).

3.RESULTS AND DISCUTIONS

3.1.The impact on the faunal ecosystem

The construction of the motorway introduced changes to the fauna in the plain area, especially on their travel routes, cutting their habitat. The effects have been observed on all the faunal elements of this space.

The analysis of the deer herds (*Capreolus capreolus*) showed their removal from the alignment of the highway and a reduction in number, from about 9500 deers existing before the construction of the highway, to only 4500 at present. It is known that these animals travel great distances in search of food, which can reach up to 25 km per day. Depopulation was done by animal migration to the neighboring relief units, as well as by decreasing the birth rate. The most important changes were observed in the plain on the north side of the highway, where crossings over the Ialomita watercourse were detected, so that the remaining animals can be found especially in the existing forest portions.

In the first years after the construction of the highway, the number of deer trapped in car accidents was higher, decreasing in the following years (Fig. No. 1), even against the background of the degradation of the protective fences, being a clear sign of the depopulation of this plain strips.

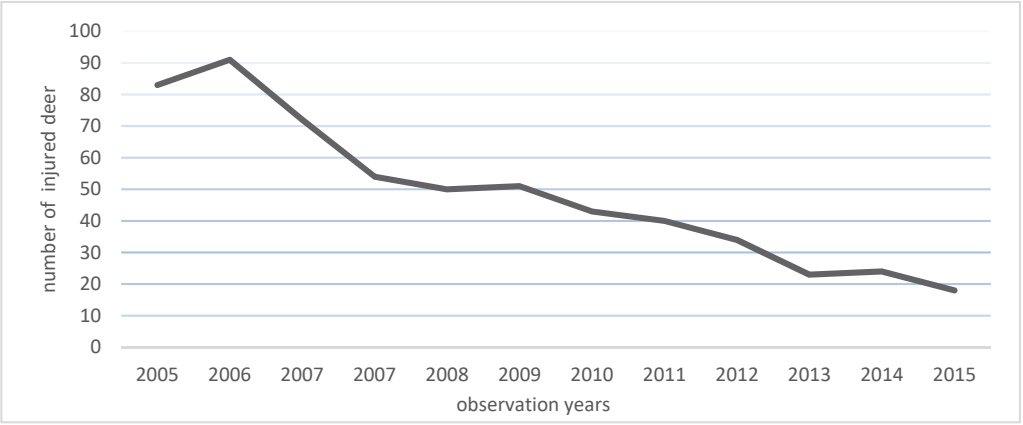

Fig. 1. The record of injured deer number during the period 2005 – 2015

The effects of highway construction are also felt on other faunal elements, such as the: the wild boar (*Sus scrofa*), the fox (*Vulpes vulpes*), the rabbit (*Lepus europaeus*), the ferret (*Putorius putorius*), the weasel *(Mustela nivalis*), the gopher (*Citellus cittelus* or *Spermophiullus citellus*), harrier (*Cricetus cricetus*), gray-tailed

Romanian hammster (*Critulus migratorius*), dwarf mice (*Micromys minutus*), field rat (*Apodemus agrarius*), gray rat (*Rattus norvegicus*), field mouse (*Talr*ot), European field rat (*Microtus*)) etc. Basically the movement of animals between the two parts of the plains was interrupted, which is valid in the case of surface mammals. The places of passage are few, they correspond to the spaces under the bridges over the hydrographic network, given that this is very rare. Of the faunal elements, an important part has the specific underground life, within the galleries dug in the soil horizon. Through the construction works of the highway foundation, this habitat was destroyed, without the possibility of restoration, which also led to the reduction of populations, an effect that is felt on a strip with a width of up to one kilometer from the highway.

3.2.The impact on surface water flow

The hydrographic network presents a low density, having the aspect of valleys that run from north to south, organized as hydrographic basins, with valleys having their outskirts on the broad fields of the Southern Bărăgan (Achim, F, 2013).

The valleys crossed by the motorway are: Mostiștea, Vânăta, Argova, Gălățui and Jegălia, to which is added a space with endorheic drainage (Achim F., 2015). Each of them corresponds to a river basin from which the waters are gathered. Basically the impact of highway construction has spread on the hydrographic network, by dividing the basins, with implications on surface runoff, especially of the waters that come from rainfalls. As the surface runoff has a predominant north-south direction, a "dripping" of it is observed, by concentrating on the bridges that cross the valleys. Channeling of water flow from the interfluvium near the highway is done through channels parallel to it.

One of the effects of the highway's construction is observed in the level increases of the water flowing through the river sections. Thus, the Moștiștea level increased by an average of 15 cm, of the Vătata by 18 cm and Argova by 5 cm. In the situation of Gălățui, the construction of the highway divided its springs, through the tributary of Furcitura, with the most northern position. As a result, a small accumulation lake was formed upstream, with an elongated shape along the valley floor, with an oscillating level depending on precipitation. Jegălia Valley presents a temporary course, and at the intersection with the highway there are level increases during periods with precipitation, much higher than before construction (Pișota, I., Achim, F., 2004, 2005).

Another effect of the construction is visible on the slopes and the intersections downstream the motorway. The fact that the flow from the interfluviums has been sectioned is manifested on the surface geomorphological processes, especially the surface washing, diffuse and concentrated flow. The action of these processes was greatly reduced over a length of about 5 - 8 km downstream. In the north of the objective, these processes are manifested by a dynamic different from the previous period, with an increase of the accumulation process for fine sediments near the highway. This fact was observed in certain

perimeters, such as those of Dor Mărunt, Bogdana and Drajna, where at the level of the agricultural cultivated field, "thin layers" of fine sediments were deposited, which led to a slight clogging of the wheat crops. Basically, the water from precipitation, loaded with sediments, was stopped by the elevations produced by the anthropic works, which led to this sedimentary accumulation.

3.3. Impact on settlement processes

The fact that in the Southern Bărăgan Plain, immediately below the soil horizon, there is a layer of loess deposits, covering the largest surface of the fields, leads to the appearance of the compactation process (Loghin, V., 1996). Naturally, compactation in these areas is slow, under the action of precipitation, especially under the weight of snow and crov lakes (Mac, I., 1996).

For the construction of the motorway, compactation works were carried out for these warehouses, in order to increase the density and the vertical stability, thus preventing the "sagging" of the motorway as time went by.

In this way an additional weight was created on the loess deposits, which was also reflected on the neighboring space on the field. We must also take into account the fact that for the construction there was an intense activity in the area, for several years, and for the works were used heavy equipment, which caused movements inside the warehouses.

All these works left traces in the landscape, which influenced the subsequent evolution of the processes specific to the loess.

Currently, at the level of 2018, on the route located on one side and the other of the motorway, there have appeared numerous spaces for sagging the land, with the appearance of elongated ridges, or with a shape indicating a perimeter of alignment type to the motorway. Such situations are frequently visible, an example being that of Lehliu Gară, where during the rainy periods temporary lakes appear, at the ends of the bridge crossing the highway. In these cases, the water from precipitation is stationed in crovs whose appearance was caused by the additional compactation produced by the anthropic activity, a process that continued after the completion of the works, being stimulated by the water stagnation on the groundwater horizon, which rose in these spaces.

When the motorway crosses the main valleys (Moștiștea and Vânăta), we observe the appearance of another process specific to the loess, namely that of suffosion. This process works where the deposits have been sectioned by the anthropic works, through debris and earth quarries, along with the construction of parallel ditches with the highway, necessary to drain the water from precipitation. In the case of ditches, there is a flow of water below or next to them, which led to their suspension or separation from the loess support on some portions. At the same time when crossing the slopes you can see the formation on the nearby fields of some funnels, even inside the newly created crovs, which leads to a faster drainage to the underground galleries that open into the ground and valleys.

3.4 The impact of highway construction on the secondary road network

The fact that the highway crosses the Southern Bărăgan Plain about halfway through it, has led to a sectioning of it, including on the local network of agricultural and local roads, practically separating activities that were carried out from historical times in this area. In order to cross this space, 18 passageways were constructed, all in the analyzed plains. There are too few and at a considerable distance between them. Thus, the transport of agricultural equipment was difficult, the one with harness did not reach all the spaces, and the movement of sheep and cattle was greatly reduced, so that the zootechnical field of animal husbandry began to acquire aspects of separation between the two spaces of the plain, including at the level of the existing herd.

It is noted that during the construction of the highway, a number of roads appeared, so-called dirt roads, necessary for the transport of material from the quarries, which were opened even at 10 - 12 km distance, to the construction site. These roads were "paved with yellow earth", in fact loess, which at present remained in place, generating major unevennesses on the road, with traces of wheels passing through agricultural machines and pits, all of which were more visible during rainy periods, when they are filled with water for several days.

3.5.The expansion of anthropic objectives

Another effect of the construction of the highway on the geographical environment of Bărăgan, with visibility in the landscape, is that of increasing the anthropic objectives, in fact the constructions on several categories of public or private utilities.

In this way, modifications were made, even important on the whole, on this plain area, which was otherwise little used anthropically, during the period before the construction, except for agricultural use.

The expansion of the anthropic objectives was made through the following:

- Fuel filling stations;
- Car parks and shelters;
- Construction of agro-industrial premises, near the motorway exit points, with facilities related to the rapid transport of products;
- Housing construction and extension of villages and towns near the motorway;
- Placement of parks with solar mirrors, to take advantage of the extended duration of the sun's brightness in Bărăgan.

Thus the fuel filling stations overlap with some of the car parks, which generates a certain pressure on the environment, with multiple effects. At these points, car traffic is much more intense, with cars permanently stopping for fueling, repairs, driver rests and so on. Tanker trucks bring petroleum products to supply oil

reserves. This results in high consumption of local water, groundwater and deep water resources, the emission of pollutants, wastewater and waste etc. It should not be neglected that such anthropic objectives occupy quite large areas of land, reaching ten hectares for such an element.

3.6. Pollution from vehicles

With the use of the motorway, new environmental elements appeared on the plains area, represented by the noxae eliminated by vehicles, which led and continues to lead to air pollution, soil, groundwater, watercourses and especially on the local communities existing along the aisle located on one side and the other of the construction (Irimuș, A., 2006).

The analysis of the way of pollution shows us a series of manifestation characteristics, as well as quantitative elements of the pollution. Thus one of the most polluted elements is the air, by eliminating toxic gases, resulting from the burning of fossil fuels of the type: gasoline, diesel and liquefied gas (LPG), when the electric vehicles are not used enough.

The traveling measurements, carried out by the environmental agency, showed that the air pollutants travel through the air even up to distances of 15 km, as is the case south of Vâlcelele commune. The most intense atmospheric pollution is about 1 km wide, on both sides of the highway, with numerous variations imposed by the air currents and the general circulation of the atmosphere (Bogdan, Octavia, 1980), along with some local conditions, related to the presence of trees, localities and valleys.

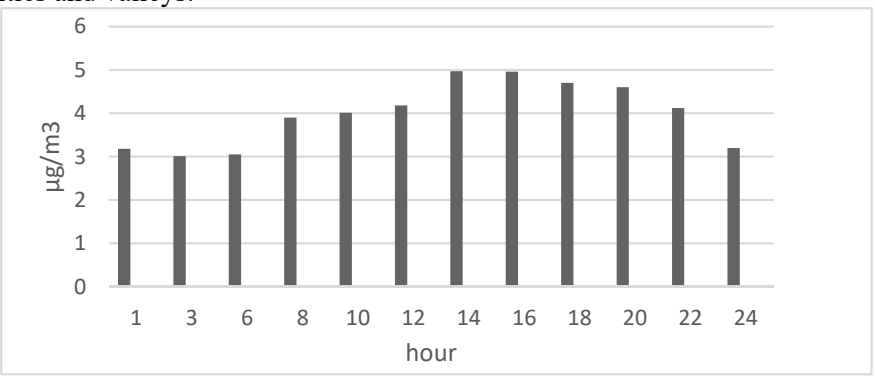

Fig. 2. Mean air concentration of SO_2 particles throughout the day

From the analysis of the graph above (Fig. no. 2), an increase of SO_2 concentration is observed, starting at 14.00 hours, as the pollutants eliminated by vehicles accumulate, against the background of atmospheric conditions based on temperature increase and atmospheric pressure modification. Practically only in the hourly range from 3.00 to 6.00, the SO_2 concentration is lower.

3.7. The evolution of the main chemical indicators, from the Quaternary aquifer

The aquifer layer is very sensitive to the presence of the chemical elements introduced by the man, in order to correct the productivity of the soil, as well as a result of the use of the plain space for the construction of settlements or other elements (Sorocovschi, V, 2016). A factor of pollution, newly introduced into the landscape is the motorway, from where pollutant particles come, which reach the ground, and then are taken up by the waters of precipitation and by infiltration they come to feed the groundwater.

From Fig. no. 3, fluctuations of these chemical parameters are observed, taking into account, on the one hand, the change of agricultural technologies and the reduction of chemical elements penetrated into the soil, and on the other hand, the increase of the emissions from road traffic.

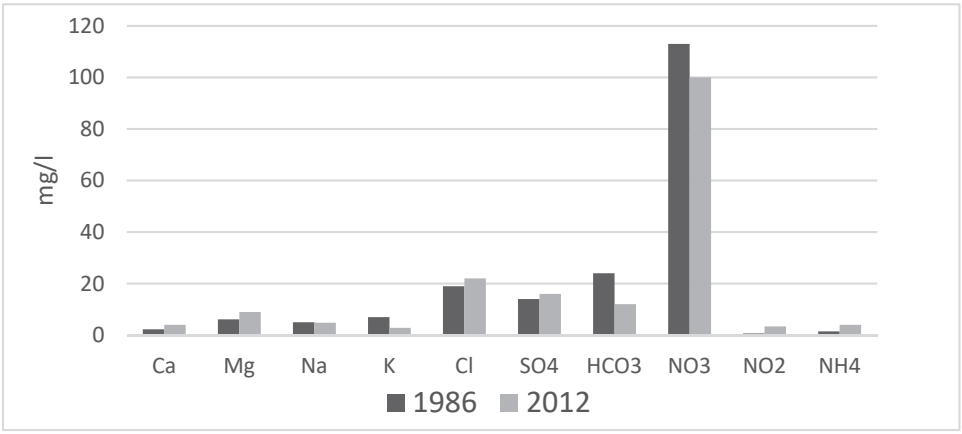

Fig. 3. The average values of the main chemical indicators in the aquifer layer, from the perimeter of the localities along the motorway, compared between 1986 and 2012.

4.CONCLUSIONS

The construction of the Bucharest – Constanța highway produced a major impact on the environment of the Southern Bărăgan Plain. We could say that after the extension of agriculture to the level of the surface of this field, which represented a major intervention within the steppe environment specific to the place (Josan, N., 2014), the construction of the highway represents a second human intervention in the environment, being practically a very active circulation "artery", throughout the day, throughout the year. At present, impact studies have begun to take place, which mainly concerns the pollution produced by traffic.

The presence of the highway has an impact on the relief, surface and underground waters at the level of the groundwater, vegetation, fauna, anthropic activities, air circulation, topoclimate, pollution and other elements with local development (Gâștescu, P, 1998).

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