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The analysis of landscape development in the waste heaps area from Moldova Noua after their stabilization with forest species

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Abstract Resulted from flotation process of the cuprifer ore, the waste heaps from Moldova Noua is presented as a sterile sandy deposit, with an area of 120 ha and a height of 20 m.

The main forest species that were cultivated on waste heaps from Moldova Noua and have achieved the best results in terms of growth and development were locust and oleaster. In addition into the assortment of species introduced was also included the species: canadian poplar, american cherry, ash and willow thorn.

The research conducted on plantations from the waste heaps group "Boşneag" from the complex of waste heaps from Moldova Noua, targeted the analysis of landscape developments in this area, after the waste heaps stabilization of here, stabilization achieved with vegetation in general and with forest vegetation in particular.

I conducted the researches in three sample surfaces, totaling 300 square meters. Biometric characteristics were measured for all trees in these areas, for determinate the repartition of trees on diameters categories, growth and development of plantations and their density. We performed correlations between trees heights and diameters measured.

Correlations reveal a harmonious development of exemplars, especially for locust.

Growth and development of these plantations, the small number of exemplars in the lower diameter classes, good density and significant correlation between heights and diameters, are prerequisites for good development of the landscape in the waste heaps from Moldova Noua.

Key words

landscape, waste heaps, sterile, mining activities

The waste heaps are called "decanting ponds" thanks to the storage technologies of product from flotation process. This product as a mud is transported using high towers and steel pipes with diameters of up to 1 m, forming an arid landscape, the selenar type, impressed by the extent of deposits and by the size of deposits sand (fig. 1).

Fig. 1 - General aspect of waste heaps (foto: Cântar Ilie)

The waste heaps are situated on the left bank of the Danube, approximately near “Ostrov” island, where the river makes a meander. The town of Golubat (fig. 1) can be found on the Serbian shore. The total area, taking also into consideration the unoccupied spaces between the waste heaps, is of approximately 200 ha, and the geographic coordinates are 44 ° 44 'N latitude and 21 ° 27' E. longitude

In the case of preparation factories, as is the case of the Moldova Noua, dust is spread over a wide area around them, thus affecting the inhabited areas and therefore the health of inhabitants.

Fig. 2 - The waste heaps complex from Moldova Nouă (Google Earth)

A special situation occurs in S.C. "Moldomin" Moldova Noua. In the winter and in the spring time makes its appearance in the area, the eolian phenomenon, called Coşava, a phenomenon that consist in the movement of air currents at ground level, with very high speeds, often in gusts exceeding 100 km / h. This phenomenon is felt on a thick layer of air of 30-50 m from ground level. This air stream, move the grained sterile from slopes and platforms of the tailings dams, making an polluted atmosphere and transporting this steril far away, on the agricultural land, in neighboring villages and reaching over the Danube, thus leading to cross-border consequences.

The landscape that exist here during periods when the wind have a high intensity and the wate heaps are not wetted is like a desert landscape, showing the two main elements specific to the desert: sand (tailings in our case) and strong winds in the area.

As regards the effects on local residents we can say that they are accustomed to the existence of these huge landfill mining, because the storage in these waste heaps, the processing of copper ore and the removing the ore from the bowels of the earth - all these - accounted the sources of income. With the closure of mining activity, when these deposits are abandoned, are not wetted and are carried by the wind, when people have only lost from the existence of these waste heaps and especially with the appearance of new generations, we can conclude that these waste heaps need to be rehabilitated, the wounds of the soil must be cured, the landscape must be brought to a form as close to the natural landscape.

Material and Method

Research by the group of the waste heaps "Boşneag" were conducted to determine the evolution of plantations growth, installed here in the past and thus determine the success of improving the aesthetic and ecological caracteristics of these degraded lands.

Materials

Field activities conducted, have supposed the use of different specialized tools and equipment. These was used for determinate the biometric characteristics of trees and other elements that was necessary for data processing. The tools are enumerated bellow.

The forestry caliper was used to measure the tree diameters and the measured data was noted in the field notebook.

The trees height was measured using the device for measuring height, VERTEX, equipped with transponder to reflect the ultrasounds (Fig.3). For the delineation of sample surface was used roulette.

Fig. 3 – Materials used in conducting the field activities (foto: Cântar Ilie)

Research Methodology

The investigations were realized on 3 square sample areas of 100 mp each, areas that were realized with a tape measure. The layout of the surfaces was realized on horizontal field on a woody plateau near the slope.(Fig. 4).

Fig. 4 – Location of the three sample areas (Google Earth)

Thus we compared the biometric characteristics of the locust and oleaster measured now at the age is 16-17 years with the results of the last measurement that was realized with 10 years ago, when the plantations age was about 6-7 years.

Calculation of the volume of wood mass was made only for locust using the equation:

$$\log v = a_0 + a_1 \log d + a_2 \log^2 d + a_3 \log h + a_4 \log^2 h$$

(Giurgiu, V., Decei, I.), where the regression coefficients for the locust shall have the following values:

$a_0 = -3{,}37551$;
$a_1 = 1{,}80802$;
$a_2 = 0{,}02827$;
$a_3 = 0{,}512150$.

Fig. 5 – Appearance of a sample surface (Foto: Cântar Ilie)

Results

Results obtained from this research aims at the plantations knowledge in terms of biometric characteristics and their evolution in time from the last measurement performed in 2000. În sample surfaces was measured a total of 170 trees, with species proportion as follows:

- 52% locust;
- 48% oleaster.

Regarding the evolution of the **density** of the plantations, it was a natural and normal decrease in density, compared to 2000 as follows:

- from 12 000 trees / ha to 8800 trees / ha, in the case of locust
- from 13000 trees / ha to 8200 trees / ha, in the case of oleaster.

After processing the collected data, after comparison with 2000, resulted the following data on the average height, average diameter and growth. These data are presented in the following table:

Table 1

The biometric characteristics of the plantations

Species	Biometric characteristics (2010)		Biometric characteristics (2000)		Average growth	
	Average height (m)	Average diameter (cm)	Average height (m)	Average diameter (cm)	In height (m)	In diameter (cm)
Locust	5,9	6	0,9	1	5	5,1
Oleaster	3,2	3,8	0,8	0,8	2,4	3
TOTAL (average)	4,55	4,9	0,85	0,9	3,7	4,05

Regarding **the distribution of trees in the categories of diameters**, we can observe that, in the case of locust, due to larger size and due to more vigorous increases than the oleaster, the largest number of trees is included in category of 4-6 cm (Fig. 6).

The oleaster has registered the biggest number of trees in the 2-4 cm category (Fig. 7). In many cases the trunk was shrubby and ramified under 1,3 m, the height at which the diameter was measured.

The following table presents the tree's repartition on diameter categories.

Table 2

The repartition of trees on diameter categories

Species	Diameter categories (cm)									Total
	<2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	
Locust	2	18	26	20	9	6	4	2	1	88
Oleaster	8	38	23	9	4					82
Total	10	41	49	29	13	6	4	2	1	170

Graphically, the distribution of trees on categories of diameters are presented as shown below.

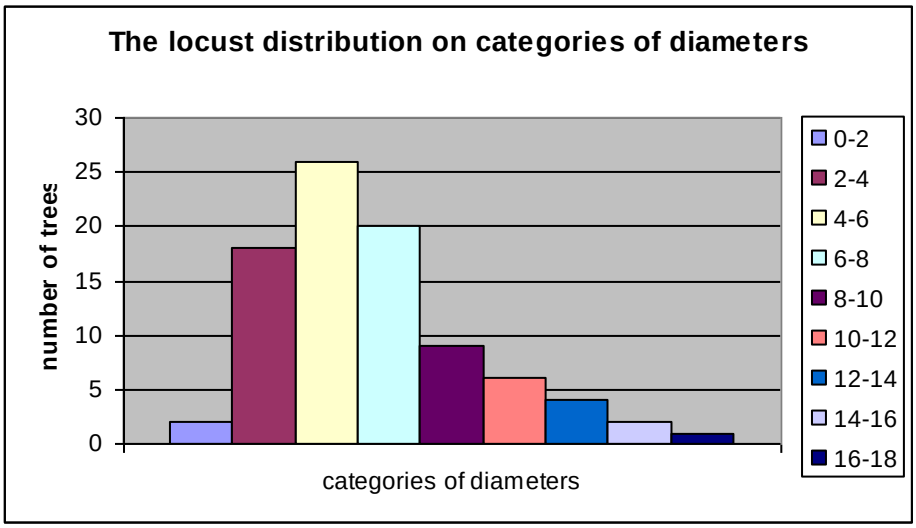

Fig. 6 – The locust distribution on categories of diameters

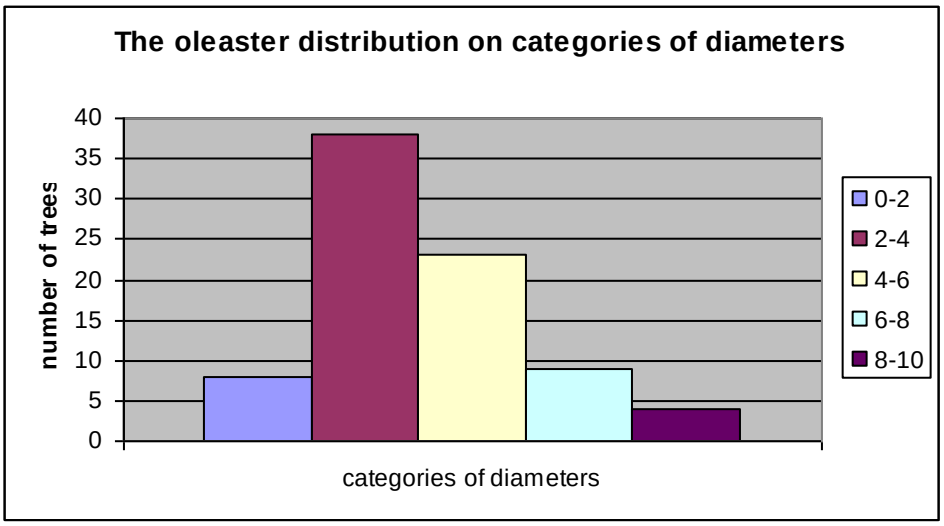

Fig. 7 – The oleaster distribution on categories of diameters

Although age is the same in all sample surfaces and for all exemplars measured, their size varies depending on the conditions of competition between individuals, depending on biotic and abiotic factors.

The heights curves on species (Fig. 8, Fig. 9) are polynomials curves of degree 4, with a significant correlation between height and diameter for locust (R2 = 0.758) and insignificant in the case of oleaster (R2 = 0.6965) because he has the smaller sizes and shrub development.

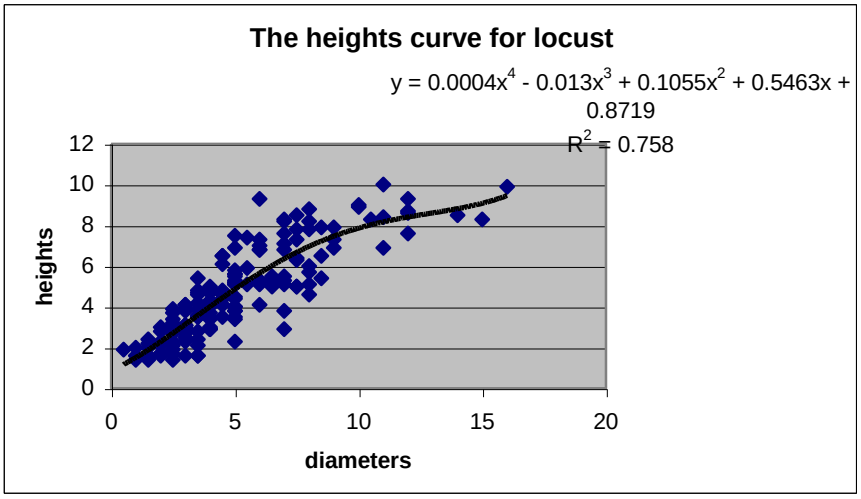

Fig. 8 – The heights curve for locust

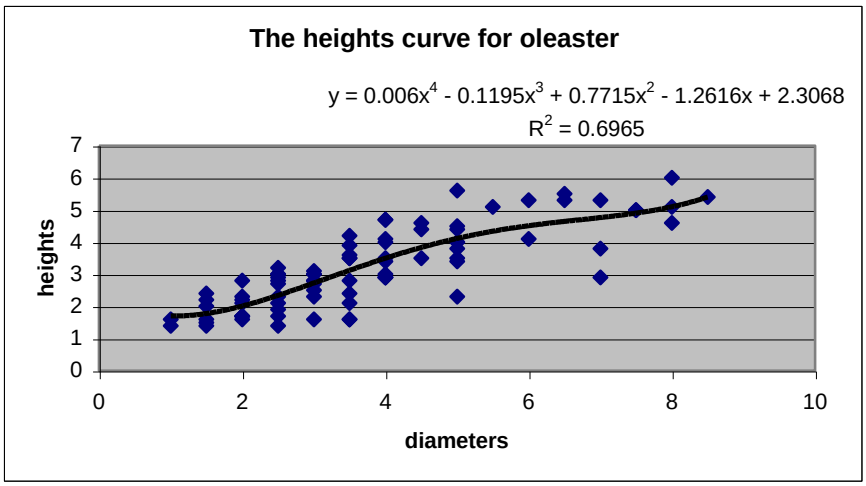

Fig. 9 – The heights curve for oleaster

Calculation of the volume of woody mass, was made using the equation:
$log\ v = a_0 + a_1\ log\ d + a_2\ log^2\ d + a_3\ log\ h + a_4\ log^2\ h$ (Giurgiu, V., Decei, I.), where the regression coefficients for the locust shall have the following values:
a_0 = - 3,37551;
a_1 = 1,80802;
a_2 = 0,02827;
a_3 = 0,512150.

Calculation of woody mass volume was did only for locust, because the calculation of woody mass volume for oleaster with this equation is not eloquent because it is mostly shrub.

In the case of locust, the woody mass volume for the three sample surfaces is 1.57 mc. By reporting to one hectare we obtain a total volume of woody mass per hectare for locust of about 52 cm / ha.

Conclusions

Activities done on the waste heaps from Moldova Noua, had aim the stabilization them with vegetation in general and with forestry vegetation in particular, to reduce the pollution effects with dust. These activities had aim the introduction in the economic and ecological cycle of these sterile land, unfit for culture. Not least, these activities was aimed the improvement of environmental conditions, through the influence exerted by the presence of vegetation and the another important aim was to give a landscape value to the entire area affected and surrounding again these area in the nature of this landscape, in the wonderful landscape of the Danube defile.

The researches realized now were achieved with the purpose of comparing them with the measurements realized in the year 2000. This comparison furnishes important conclusions from an ecological and landscape point of view, conclusions that are rendered here.

Approximately equal proportion of locust and oleaster species in the plateau area studied, the slightly higher proportion of locust in comparison with the original proportion, supplemented by richer assortment of species from the slope of the waste heaps, gives us an image of young locust forest, with undergrowth of oleaster shrubs, well framed into the area.

Reduced density in the normal range during the ten years since the last measurement, gives to the landscape the image of a forest that surrounds the reed, "caught" in the middle of it and allowing the passerby acces.

Around arrangement of the plantations, can isolate the visitor. Once arrived in the middle of the stabilized waste heaps, in inside with herbaceous vegetation and reed and in around with forest vegetation, the visitor receives a removal sense of town, he can not see cars running on arround roads and surrounding noise is reduced by these plantations.

Litter produced and different vegetal species contribute to enriched the soil, stabilizes the sand tailing and provides shelter to various species of invertebrates and more.

Heights and diameters measured shows that development and growth is good. In the sample surfaces are trees with the diameter of 16 cm and heights of up to 10 m. This decreases the intensity of wind on the plateau and allowed to cover a pretty good rate of him with different species of reed and herbaceous species. Thus, on these surfaces were the slopes of waste heaps was stabilizated with forest vegetation, wind erosion is practically stopped.

The average growth in height (5,1 m) and diameter (5,2 cm) for the locust in the last 10 years is very good taking into consideration the harsh environment conditions offered by the waste heaps. The locust has enriched the soil through the production of biomass and through its shading, fending it from drought. This fact favours the introduction of more valuable species from an ecological and productive but also esthetical and landscape point of view.

Good correlation between the height and diameter of trees in plantations studied revealed that most trees are well conformed and they have a good development of the crown, they are not broken, this conformation ensuring the achievement of landscape and ecoprotectiv role in the area.

The volume of woody mass of the locust of 52 mc / ha is good for the low age and adverse conditions of vegetation. The growth for the last 10 years is good and growth potential are becoming better. We can estimate that this plantation can produce volume of wood in the future increasingly more, storing atmospheric carbon increasingly more.

Analysing overall the evolution of these plantations ecoprotective and for beautification the selenar landscape existing in the past here, we conclude that their success is complete. In the future the extension of these plantations is imperative to make on the unstabilized areas. On the stabilized areas is necessary the introduction of more valuable species, with a higher growth, with a greater production of biomass and superior aesthetic qualities. Renaturation is needed in these waste heaps and why not, bringing these areas in a form as close to natural form and natural type of forest from the vicinity of these surfaces.

References

1.Căbulea, P. – 2005 – Amenajarea şi protejarea mediului în zona haldelor de steril Roşia-Poieni, Editura Viaţa aradeana, Timişoara;

2.Cântar, I. – 2010 – Lucrare de dizertatie, U.S.A.M.V.B.T, Fac. de Horticultura si Silvicultura;

3.Drăguţ, L. – 2000 – Geografia peisajului, Presa Universitară Clujeană;

4.Fodor, D., Baican, G. – 2001 – Impactul industriei miniere asupra mediului, Editura Infomin, Deva.

5.Fodor, D. – 2001 – Influenţa exploatării şi preparării zăcămintelor de minereuri metalifere asupra factorilor de mediu, Revista Minelor nr.8,9,12/2001;

6.Giurgiu, V., Decei, I. – 1997 – Biometria arborilor din România, Editura Snagov, Bucureşti;

7.Iliescu, Ana - Felicia – 2003 – "Arhitectura peisajului", Editura Ceres;

***** IMPACTUL ACTIVITĂŢII MINIERE ASUPRA MEDIULUI – 2006 – Buletinul AGIR nr. 3/2006, iulie-septembrie;