SOME CHARACTERISTICS OF THE STANDS INSTALLED ON TORRENTIAL BEDLOAD DEPOSITS INSIDE THE MANAGED HYDROGRAPHIC NETWORK FROM THE UPPER SOMEŞUL MIC WATERSHED

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Abstract: *Observations and measurements achieved in twelve experimental plots - inside five valleys (Valea Soponii, Pârăul Brădet, Pârăul Răşca Mare, Pârăul Negruţa şi Valea Leşului) - have demonstrated that the grey alder is the species that installed with the highest frequency on the siltations, created or during the creating process, along the managed torrential hydrographic network from Upper Someşul Mic Watershed. The age of the stands varies between 5 and 20 years, the density from 5 000 to 9 500 trees per hectare, the collar diameter (d_c) between 25.5 and 203.5 mm, the breast height diameter (dbh) from 17.6 to 165 mm, the height (h) between 3.7 and 12.5 m.*

Key words: *torrential bedload deposit, siltation, stand, grey alder.*

1. Introduction

As it is well-known, the installation of forest vegetation under the shelter of hydrotechnical works (Figure 1) is one of the main goals of any torrential watershed management project [1], [3], [6], [8], [11].

Indeed, by the sediment storage both directly - by the transverse hydrotechnical works (small dams and dams) - and indirectly, by the cover of beds with all types of works, and also by the reciprocal support of traverses, there can be ensured not only the protection of objectives against torrential floods, but also an important ecological effect, as a result of the installation and development of forest vegetation inside the torrential bedload deposits of the managed hydrographical network [2].

First of all, we deal with the atterations which are created by the tansverse hydrotechnical works. Here, the grey alder, willow and the spruce tree are installed with great easiness, because of a high degree of humidity of the torrential bedload deposits and because of a supplement of nutritious substances.

Consequently, they can achieve an important improvement of conditions inside the torrential bedload deposits soil.

From the hydrological point of view, the most interesting directions of our research are [7]:

- the degree of installation of the natural forest vegetation inside siltations;

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- the composition, age and density of the developed stands;
- the statistical variability and distribution of the most important biometrical characteristics: the collar diameter (d_c), the breast height diameter (*dbh*) and the height (*h*).

With regard to all the research aspects, our experimental observations and measurements in two stages were developed as follows:

- in a first stage, in a visual way, we estimated the percentage of forest vegetation installation inside the siltations of all the 38 managed torrential valleys and for all the small dams and the dams achieved during the last four decades inside Upper Someşul Mic Watershed (starting from 1964).
- in the second stage, biometrical measurements were carried out inside 12 experimental plots; these were placed along five torrential valleys with direct flow in the water storage lakes.

Fig. 1. *Forest vegetation installed on the accretion of the 5B1.5 sill on Leşu Brook* (*Photo: F. Lupaşcu, 2005*)

The work operations were the following: painting and numbering of all trees, inventory of trees regarding the species and measurement of three biometrical characteristics: height (*h* in meters) and collar diameter (d_c), when $h \leq 1.3$ m, and height (*h* in meters), collar diameter (d_c in milimeters) and basic diameter (*dbh* also in milimeters), when $h \geq 1.3$ m. Only for some trees, by probing, yearly rings were numbered in order to tell the age. The diameter was measured with the sliding callipers, while the height was measured with a stake having a ten-centimetre gradation.

2. Proportion of Forest Vegetation Installation inside Siltations

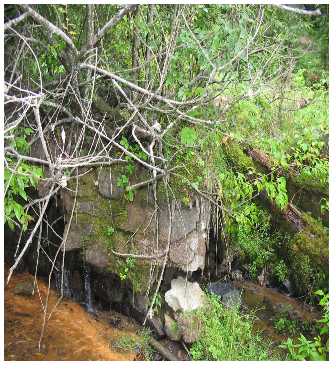
The experimental data have shown there is a very large variability regarding the percentage of the forest vegetation installed inside siltations (from 0% to 100%) depending on: bed sizes, period of works exploitation, their siltation degree, humidity and granulometrical composition of deposits, supplement of nutritious substances and others.

For all the managed torrential valleys, the part of siltations surface with installed forest vegetation is almost 5.3 hectares (out of a total of 17.8), which means a percentage of 30%.

Among the torrential valleys with the most important consolidated surface by means of natural afforestation there are: Bătrâna Brook (100%) and Crucii Brook (92%). At the opposite pole range: Custurii Brook, Petrii Brook, and Fânaţelor Brook, where the installation percentage is about 0%. In one case (Râşca Mare Valley) - pursuant to the new carried out works - the formed siltations were scattered by the building equipments, so that the natural installed vegetation was, to a large extent, dislocated or destroyed.

3. Species, Age, Density

The inventories carried out in the 12 experimental plots have shown that white alder is the species with the greatest capability in the forest vegetation installation process. The frequency identified for this



a)

b)

c)

d)

Fig. 2. *Without the created or during the creating process siltations, the grey alder developed: properly in the execution zone of the works, sometimes precisely on certain components, on the crown of the leading walls* (*a, c*), *on the spillway* (*b*), *including on the torrential bedload deposits inside the aprons* (*d*). (*Photos: F. Lupaşcu, 2005*)

species is about 58%. Sporadically, willow and common spruce were installed.

Due to a very active growth in the first 10-15 years after installation, due to its system of strong ramified roots and also to a very vigorous capability in the suckering and shooting out process [6], [9], [10], [11], the grey alder was recorded as the species with the most important contribution to the consolidation, by forest means, of the torrential bedload deposits from the Upper Someşul Mic Watershed (Figure 2).

In terms of age, the installed stands are relatively even-aged stands, the age of trees varying from a few years to 15 years. For age estimation purposes, in three out of

Fig. 3. *Aspects that illustrate the testing plots set up for the research of the biometric characteristics of the trees: plot no. 9* (*Negruţa Brook*). (*Photo: f. Lupaşcu, 2005*)

the five experimental plots (Figure 3), sectionings of the trees were made and their yearly rings were numbered, in case of 2-5 trees for each plot. As an example, in the following figure, correlation and regression between age and basic diameter, for all experimental plots, are illustrated.

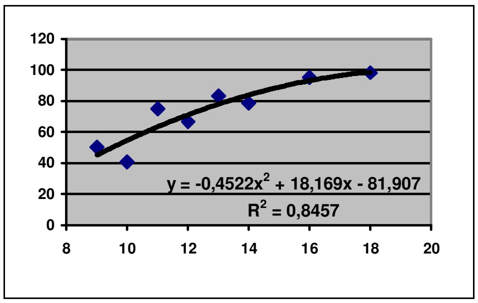


Fig. 4. *Correlation and regression between age* (x) *and dbh* (y) *for the white alder*

Further on, with the inventoried trees number and the surface of each plot, estimations regarding the density of trees number per hectare could be made. The average density is nearly of 7 667 trees / ha, while the range is defined by 5 000 (in case of plot no V - Soponii Valley) and 9 500 (recorded in case of plot no VI - Brădet Brook).

4. Main Biometrical Characteristics of the Stands

The data centralized in the experimental plots index have shown that the collar diameter (d_c) varies between 25.5 and 203.5 mm, the basic diameter (*dbh*) from 17.6 to 165 mm, and the height (h) between 3.7 and 12.5 m.

For methodological reasons in the development of research, all experimental plots were selected and biometrical characteristics were processed and analyzed with the aid of mathematical statistics methods [4], [5]. Average, variance, standard deviation and variation coefficient were determined, for each characteristic. Also, the simple correlation coefficients were calculated and only for two of these correlations, regression equations were established. Finally, for one of the experimental distributions, its fitting by the most well-known theoretical distribution (i.e. the normal distribution) was made. Statistical indicators were determined for the measured values (expressed in milimeters or in meters). For two cases, parallel calculations were developed: with ungrouped data into classes and with grouped data into classes.

Among all the measured characteristics, the greatest statistical variability is shown by the basic diameter, for which the variation coefficient is about 51%.

Applying to all three researched variables, taken two by two, the simple analysis of correlation ended with a significant coefficient for all the situations, for study option “measured values” (Table 1).

From the point of view of regression, the regression between basic diameter (*dbh*) and collar diameter (d_c) was studied (Figure 5). For regression type selection, we used the facilities provided by the computer, which automatically lists the determination coefficient value (r^2), indicating the quality of estimation, as well.

Table 1

The simple correlation coefficients

Specification of variable	d_c	***dbh***	***h***
d_c	-	0.967^{***}	0.848^{**}
dbh	-	-	0.866^{***}
h	-	-	-

For $\alpha = 0.001$ and $f = n - 2 = 107 - 2 = 105$ freedom degrees: $r = 0.321$.

The best estimation of experimental data was offered by the linear function, the regression equation being:

$$dbh = 0.8231\, d_c - 3.6792.$$

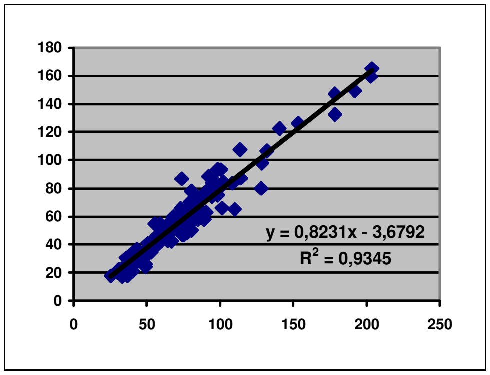


Fig. 5. *Regression between basic diameter (dbh = y) and collar diameter (d_c = x)*

Finally, resorting to an adjustment test (χ^2), for only one of the measured biometrical characteristic (i.e. the collar diameter), the observed distribution has been compared with one of the well-known theoretical distributions: the normal distribution (Figure 6).

Because the calculated χ^2 < theoretical χ^2, the null hypothesis was accepted, that means the collar diameter follows the normal distribution.

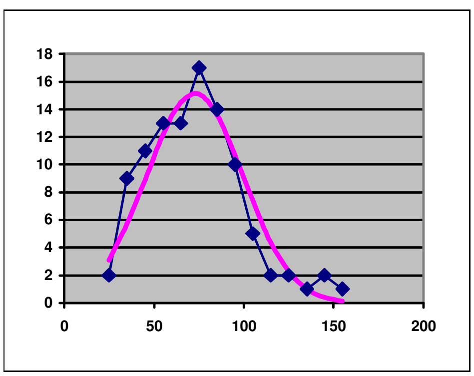


Fig. 6. *The frequency curve for alder at the collar diameter and its fitting according to the normal curve*

5. Conclusions

The development of the information referring to the forest vegetation that installs on the torrential hydrographic watersheds managed network is necessary from two points of view:

- in the first instance, to estimate the consolidation effect carried out after constructing the management works on the torrential hydrographical network and to take this into consideration to decide the continuing or stopping of the interventions in the watershed;
- in the second instance, to organize the monitoring and maintenance activity of the constructed works on the torrential hydrographical network, knowing that, due to the very heterogenic conditions in this area of the watershed, the installation of the vegetation is made in an uncontrolled manner. Indeed, the vegetation installs not only on the existing siltations or on those in creating process, but properly in the execution zone of the works, sometimes precisely on certain components, on the crown of the leading walls, on the spillway, including on the torrential bedload deposits inside the aprons.

This is why the proportion of the forest vegetation installation inside siltations, species, age, density and the main biometrical characteristics of the stands, including the correlations and regressions between these characteristics, represent elements that can support the practicing engineer to assume the best decisions connected to monitoring the managed torrential watershed.

It is a matter of planning the best moment when to carry out the maintenance operations and of optimization, in time, of the junction between the hydro-technical work on the torrential hydrographical valley and the installed vegetation as a result of this practice.

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