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CHOOSING THE OPTIMAL SOLUTION FOR REINTRODUCTION DEGRADED LAND SURFACE INTO THE FOREST CYCLE

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Abstract

The aim of this study is to determine the ecotop parameters used for restoration of degraded lands, which are not recommended to other uses. Afforestation reduces the extreme values of climatic factors (temperature, Evapotranspiration, wind speed): improves the air humidity and soil moister; and favors site conditions for maintaining herbaceous and forestry vegetation development. The decreasing of land degradation and the gradually restoration of productive capacity under the direct effect of forest cultures could be analyzed by variation of precipitation retention by canopy. The results regarding canopy retentions were obtained by placing in situ several rain gauges with height of 25 cm and 100 cm2. The precipitations retentions by canopy values were computed by the difference between the amount of rainfall recorded in open grounds and average values recorded at rain gauge installed in land cover with trees (in forest). Rains were grouped into classes, and the rainfall for each class being calculated as mean value of precipitation retained. The data obtained were highlighted with correlation between rainfall inside the forest and rainfall outside the forest. The curves of retention in the canopy layer were plot according to the height of rainfall and some characteristics of trees (species, age, consistency).The frequency of days with precipitation ranged from one month to another and from one season to another. The data set analyzed showed that rainfall triggered surface runoffs in seven day (5% of the total days computed). The slope of regression between monthly average rainfall index and the amount of rainfall previously recorded expresses an increase from a drought year to a rainy year. The average rainfalls per square meter inside the stand increased with the amount of rainfall quatity, the highest values were registered over 70 mm. Maximum discharge coefficients, determined by class of precipitation, highlighted the influence upon runoffs: the maximum value (0,219) being achieved by precipitation from 0 to 10 mm, although the maximum rainfall is obtained in the precipitation of more than 50 mm. Based on the computed data were determined regression equations between the runoffs amount and precipitation quantity, also, between rainfalls quantity and standard deviation of previous monthly.

Key words: *Degraded land, rainfall, surface drain, the canopy retention.*

INTRODUCTION

The situation of the degraded lands is a current issue, especially in the context of the decrease of surfaces covered with forest vegetation at national level. The re-introduction of these lands in the forest cycle is a priority in current and future actions of foresters, the importance of these actions resulting from: preventing soil erosion and its degradation; maintaining the category of use, the wood biomass production capacity, which is a very important element in the economy; the retention capacity of the carbon; the production of oxygen; creating the specific microclimate of the forest, which is a particularly important factor from the socio-economic point of view.

In order to choose the optimum solution for the re-introduction in the forest cycle of the degraded land surfaces, one of the research methods is the study of water retention in the canopy, which represents the amount of water retained in stands' canopy, the latter depending on one hand on the structure and characteristics of the stand (species, age , consistency, quality of crown, surface of foliage) and, on the other hand, on the characteristics of rainfall (quantity of precipitation, duration and intensity of variation) and atmospheric conditions when rain occurs.

MATERIAL AND METHOD

The present study was carried out within the improvement perimeter of Vaida Camaras, which covers a total area of 46 ha; a total number of 25 sample surfaces were set-up, covering an area of 2,000 square meters, the total area subject of the study being of 5 ha, which is about 11% of the surface of the Vaida Camaras improvement perimeter. The settlement of the sample plots was carried out using the grid method.

The types of stands taken into study were mixed stands, pine and acacia, their proportion of participation being in varying percentages in the content of the stand. Species were planted on bio-groups.

In order to quantify the amount of precipitation, a number of handicraft rain-gauges made of plastic bottles with a receiving surface 100 cm2 were placed on the studied perimeter.

For the determination of the amount of precipitation retained by the canopy, one also placed rain-gauges in open field to be used as control.

Measurements were carried out during two growing seasons (2013 - 2014), between 15 March and 15 November, so as to quantify only the amount of liquid precipitation. The value of the retention in the canopy was obtained as difference between the amount of rain registered in the open field and the average of values recorded by the rain-gauges installed on the experimental plots within the forest.

In order to determine the variation of retention in the stands with different structural characteristics: composition, age, consistent, the experimental plots were installed as it follows:

- the first set of experimental surfaces, consisting of 7 sample surfaces, in the W of the improvement perimeter, where the stand has a composition of 7Pine 3Acacia, age 50, consistency 0.8.
- the second set of experimental surfaces, consisting of 6 sample surfaces, were placed in the N of the perimeter, being characterized by a composition of 8Pine 2Acacia, age 80, consistency 0.6.
-the third group of experimental surfaces, consisting of 6 sample surfaces, were positioned in the E of the perimeter, having the following characteristics: 7Acacia 3Pine composition, age 70 and consistency 0.7.
- the fourth set of experimental surfaces, consisting of 6 sample surfaces, were located in the S of the perimeter, area characterized by a 6Pine 4Acacia composition 6, age 80, consistency 0.6.

The rainfalls were grouped into classes of precipitation, for each class of precipitation being calculated the average of precipitation retained in the canopy. The results obtained were used to draw graphs and to make correlations between the precipitation in open field and the ones inside the forest.

RESULTS AND DISCUSSIONS

According to data, the frequency of days with precipitation is approximately equal for the two years taken into consideration, the lowest number of precipitation (88 mm) being registered in 2014, while the highest (90 mm) was registered in 2013. Concerning the distribution of precipitation on months, this varies from one year to another. As shown in Figure 1, in 2013 the months with the highest number of precipitation were March, June and September and the months with the fewest number precipitation registered were April and July. In 2014, the months with the highest number of precipitation were April, May and July and the fewest in June and November.

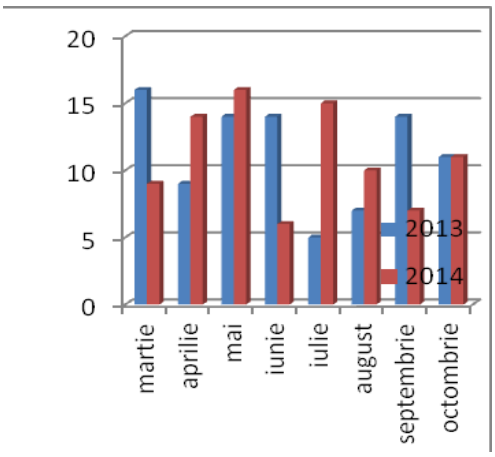

Figure 1. Number of days with precipitation

Analyzing the data regarding the amount of precipitation during the two years period,

when the research was carried out, one reached the following conclusions:

-for 2013, daily, the maximum amount of precipitation was registered on the 25th of June, when it reached 23 mm, while the rainiest month was June, the value of precipitation totalling 104 mm; the driest month was July, registering only 5 days with precipitation (28 mm)

-for 2014, the maximum daily level of precipitation was registered on the 23rd of July - 48 mm; from the month point of view, the rainiest month was July, with a value of approximately 118 mm, while the lowest amount of precipitation was registered in September and it was about 26 mm.

The retention of precipitation in the canopy was studied for the mixed stands, pine and acacia. Due to the fact that the duration of the observations was different (depending on the periods of setting the experimental surfaces), in order to compare and interpret the results, the rainfalls were grouped into classes of precipitation, establishing both average values (mm) of retention and the retention percentage for each class.

Table 1. Number of rainfalls registered and the retention in the stand consisting of:

Class of precipitation (mm)	Number of rainfalls registered and the retention in the stand consisting of:								
	Pine consistency/ age						3 Acacia and 7 pine consistency/ age		
	0,8/50			0,6/80			0,7/70		
	Nr. of events	Retention		Nr. of events	Retention		Nr. of events	Retention	
		mm	%		mm	%		mm	%
0-5	216	1.7	34	216	1.5	18	222	2.2	20
5-10	12	2.2	22	12	2.1	16	10	1.8	19
10-15	9	3.1	20.8	9	2.8	15	12	4.8	20
15-20	4	4.4	22	4	4.1	11	6	2	14
20-25	2	4.8	19.2	2	4.4	8.5	5	1.8	19
25-30	3	5.9	19.6	3	5.3	9.2	3	1	18
35-40	0	0	0	0	0	0	3	1,7	11
Total perioda	246	446	21	246		24	246		27

In pine stands, where the interception was characterized by the same number of events, differences were registered due to the age and consistency of the stand. Thus, the pine stand of smaller age (50 years) and consistency (0.8) retained only 14% of precipitation, as compared with the 16% registered by the pine stand aged 80 years and with consistency 0.6. The lower values registered in the first case can be explained by the fact that in this stand no tending was carried out until now, the stands' canopy being unevenly developed and, in terms of the presence of foliar mass, it suffers due to its under-development. The mixed stand (acacia and pine) retained 19% of the precipitation. This high percentage is due to both a greater number of rainfall events registered and the presence of acacia that has characteristic foliage, determining a large area of retention.

The results obtained underline a fairly large variation of the percentage of retention in relation to the total amount of precipitation. Obviously, this variation (from 8.5% to 34%) is due not only to the amount of precipitation, but also to other characteristics of the stands (intensity, duration, composition of the canopy, age, consistent, etc.). However, the influence of the quantity is considered to be essential, especially since, after the increasing of the class interval from 0 to 5 mm, one could achieve the differentiation between the three types of compositions from the experimental surfaces in terms of water retention capacity in the canopy .

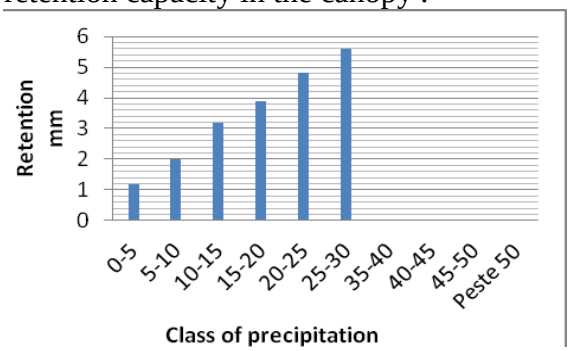

Figure 2. Distribution of retention in the canopy on classes of precipitation

It can be seen that the highest amount of precipitation retained by the canopy was registered in the class of precipitation 25-30 mm, followed by the class of precipitation 20-25 mm and the lowest value was registered in the class of precipitation 0-5 mm. It is to be noticed the fact that for the classes of precipitation over 30 mm the retention was 0, because during the period of time taken into

study, no values of precipitation over 30 mm were registered.

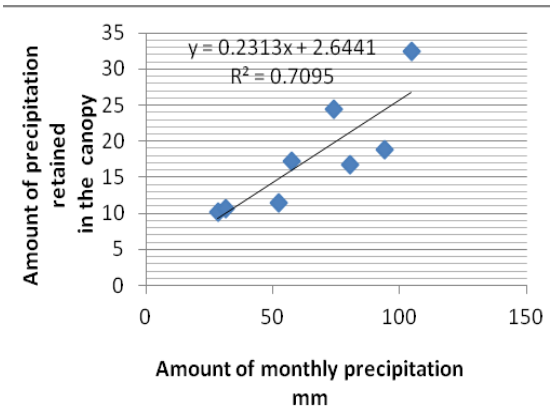

Figure 3. Correlations regarding the amount of monthly precipitation and the retention in the canopy

Analyzing figure 3, it can be concluded that between the amount of precipitation retained in the canopy and the amount of monthly precipitation in 2013, a direct and significantly distinct connection (r2 = 0.7095) can be established, according to the regression equation for each 10 mm of rainfall registered in 2013, the level of retention in the canopy was 2.4128 mm, respectively a rate of approximately 24% for the entire stand taken into study.

CONCLUSIONS

For the two years during which the experiences were carried out, the precipitation registered variations both in terms of monthly quantities and intensity, as well as in terms of their frequency.

For the period between March 2013 and October 2013, the cumulative period of time with precipitation was of 90 days, when this event was reported, 84% of them being short term precipitation. In pine stands, the differences registered were induced by the age- and consistency of the stand.

The pine stand of smaller age (50 years) and consistency (0.8) retained only 14% of precipitation, as compared with the 16% registered by the pine stand aged 80 years and with consistency 0.6.

The lower values registered in the first case can be explained by the fact that, in this stand, no tending was carried out the work up to the present moment.

Within the portions of the stand where the composition was a fine mix of pine and acacia, the amount of precipitation was significantly higher in the studied interval, mainly due to the increased surface for the retention of the foliage in the acacia canopy, characteristic to deciduous species.

The installed stand is managed in the high-forest system, all trees fitting in the same class of age, the variables being represented by the composition and consistency. Within the perimeter studied and analyzed during the two experimental years, the exponential regression equations established a direct and significantly distinct connection between the amount of precipitation retained in the canopy and the amount of precipitation registered.

In the present study, the percentage of precipitation retained in the canopy registered an average of 20% for the portion of the pine stand aged 60 years and consistency 0.8; 23% on the portion of the pine stand aged 80 years old and consistency 0.6, and the highest value retention was recorded in the portion of mixed stands, where the composition was 7Pine 3Acacia, with values of 26%.

The optimal solution concerning the regeneration composition of the stand taken into study is the one which states the introduction of acacia; according to the carried out research, the amount of water that reaches the ground is able to generate erosion processes, which in the present situation is the lowest.

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