Evolution of the Stands Established on Degradated Lands in the Diviciorii Mari Area

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Abstract

The introduction of some agricultural land which has partially or totally lost their production capacity is and will be a very important action of Romanian forestry. This extends the forest fund and improves the climatic conditions around the planting areas. The research was carried out in two improvement perimeters near Diviciorii Mari, which assumed measurements of tree diameters, heights and harvesting increment cores. After the analysis of the data and increment cores, the results were associated with climatic data and the stands were found to suffer from the effects of prolonged droughts. Also, these trees suffer from drying, windfalls and breaks of crowns due to the combination of droughts with slope and soil. The results obtained from the research were compared with the researches carried out at the Mineci-Ungureni Forest District between 1944 and 1955 and similarities were found regarding the influence of droughts on the radial and, implicitly, forest growths.

Keywords: degraded land, forest, increment core, inventories

Introduction

The introduction of some agricultural lands which has partially or totally lost their production capacity is and will be a very important action of Romanian forestry (Dîrja and Pepine, 2008). This extends the forest fund and improves the climatic conditions around the planting areas (Moţoc and Trăşculescu, 1959).

In the Transylvanian area, of the total of 3.756.426,850 hectares, 631.426,369 hectares are in functional group I (<http://roifn.ro/site/rezultate-ifn-2/>), these forests having the role of protection against various harmful environmental factors, including soil erosion (Bădescu, 1958).

Diviciorii Mari is located in the central area of the Transylvanian Plateau, characterized by wide valleys and peaks with heights between 250 and 640 meters (average 450 meters). Although most of the slopes are, in general smooth, there are steep

slopes, combined with superficial soils (lithosols), where surface and deep erosion phenomena occur easily.

In order to stop the erosion phenomena and implicitly not to lose their ecoproductive function, slopes have been planted and introduced into the forestry fund (Diana *et al.*, 2017). The choice of the technical solution at that time has been made in accordance with the technical rules for planting on degraded land associated with the need for raw material for the cellulose industry. The species chosen for the two reasons were pine and spruce, as majority species, mixed with various hardwood (maple and ash), where the resinous were not indicated.

At the time of planting, due to the secondary production function of cellulose raw material, the age until which the forest was to be maintained was 50 years. After 1989, with the legislative

Table 1. Subcompartment description

	49a	49b	73
Age	45	30	25
Consistency	0.8	0.8	0.7
Current stand composition	10 Pin	6 Pin 4 Mo	8 Pin 2Dt
Goal stand composition	10 Pin	6 Pin 4 Mo	5Pin 3 Pa 2 Fr
Surface (ha)	5.39	3.81	11.42
Functional group, subgroup	1-2A	1-2A	1-2E
Forest syte type	Hilly of Sessile oak stand (Go, Ce, StP), Pi, rendzinic, low edaphic	Hilly of Sessile oak stand (Go, Ce, StP), Pi, rendzinic, low edaphic	Hilly of Sessile oak stand (Go, Ce, StP), Pi, rendzinic, low edaphic
Forest type	Sessile oak stand with <i>Poa nemoralis</i> , inferior	Sessile oak stand with <i>Poa nemoralis</i> , inferior	Mix of Sessile oak, Turkey oak and Hungarian oak on skeleton soil, inferior
Soil	Rendzinic litosol	Rendzinic litosol	Rendzinic litosol
Slope	medium, wavy	lower, wavy	upper-strung
Exposition	southwest	northwest	southwest
Incline (degrees)	38	40	37
Flora	<i>Luzula albida</i>	<i>Luzula albida</i>	<i>Poa pratensis</i> , <i>Carex caryophyllea</i>

Figure 1. Compartment 49, subcompartments 49A (right), 49B (left)

changes, the production function of raw material for cellulose was no longer maintained, these forests being managed according to functional group I, namely until they can no longer assure the assigned protection function.

Materials and methods

The researches were carried out in two perimeters of improvement near the village of Diviciorii Mari, called the Diviciori 1 Perimeter (compartment 73) and the Diviciori 3 Perimeter (compartment 49), which is composed of two subcompartments 49a and 49b. The descriptions of the three stands from 2014 are made in Table 1.

The three stands were created to stop surface and deep erosion, being included in functional group 1 (Moțoc and Trășculescu, 1959). Although these forests were created to stop soil erosion (Biali, 2017), they also played a secondary role in producing raw material for cellulose industry. For this reason, the planting scheme adopted was 10,000 seedlings per hectare.

In the two compartments, 19 sample areas were located, according to the grid method, covering each surface statistically (Alexe and Milesu, 1983). Location was done in two steps (adapted from <http://roifn.ro/site/about-nfi/> the specificity of the research).

Figure 2. Compartment 73

Figure 3. GPS

Figure 4. Vertex

In the first step, the area was photointerpreted with the help of Google Earth photoplanes, on which the grids and test surfaces were placed

In the second stage, the sample areas were inventoried in circles with a radius of 7.98 meters (200 square meters). Diameters, total heights, live crown heights were measured and increment cores were harvested.

The increment cores were harvested from trees outside the circle, from medium-diameter trees without obvious defects in the first third from the ground (Silvestru-Grigore *et al.*, 2018).

For the measurements to be as accurate as possible, a modern technique was used as follows:

- GPS for the location of sample surfaces (Fig. 3);
- Vertex IV to measure heights (Fig. 4);
- The forest caliper for measuring diameters (Fig. 5);
- Pressler drill for increment core harvesting (Fig. 6).

Results and discussions

In subcompartment 49a, 103 trees were identified and measured, of which 96 were black pines, 6 walnuts and 1 nettle-tree.

As a result of data processing on black pine, an average diameter of 189 mm and an average height of 150 dm and a standard deviation of 66.96 mm in diameters and 26.14 dm in heights were obtained, suggesting that the trees have quite varied in growth, although they are part of a planted forest.

In subcompartment 49b, 53 trees were identified, out of which 25 spruce and 22 black pines, with an average diameter of 193 mm for spruce and 196 mm for pine. The calculated average height is 167 dm in spruce and 165 mm in pine. The calculated standard deviation is 52.95 mm in diameters and of 24.24 dm in heights.

The development of forests in the two subcompartments is quite uneven, although in terms of soil and climate are identical, the

Figure 5. Forest caliper

Figure 6. Presler drill

Figure 7. Variation of annual ring (horizontal axis) length (vertical axis, mm) in subcompartment 49a

Figure 8. Variation of annual ring (horizontal axis) length (vertical axis, mm) in subcompartment 49b

element that has led to this different development being the exhibition. Thus plot 49a is located on the southwest exposition, where the effects of droughts are felt much more strongly than in the northwest exposition, where 49b is located.

In compartment 73 were identified 125 trees, from which 103 black pines, 21 false acacia and 1

ash. The average diameter calculated for black pine is 154 mm and the average height is 139 dm, and the standard deviation is 49.62 mm in diameters and 22.92 dm in height.

From each subcompartment increment cores were harvested from medium-diameter trees and after analysis there has been observed that length

Figure 9. Variation of annual ring (horizontal axis) length (vertical axis, mm) in compartment 73

Figure 10. Average annual temperatures

Figure 11. Average annual precipitation

of the annual rings were very uneven (Fig. 7, 8 and 9).

After the cores were measured and analyzed, the average length of each annual ring was

calculated and the normal equation of the increases was established using the logarithmic function. Analyzing the average annual ring length in relation with the climatic data from 1990-2010

Figure 12. Number of days with rainfall per year

Figure 13. Deviation of the average length of annual rings from normal in 49a

Figure 14. Deviation of the average length of annual rings from normal in 49b

(Fig. 10, 11 and 12, source <https://en.tutiempo.net/climate/ws-151200.html>), it is noted that the lengths vary greatly from the normal.

The most drought in the above interval is the 1998-2003 period and the rings formed in this

range are: in the 49a rings 28, 29, 30, 31, 32 and 33 (Fig. 13), in the 49b rings 13, 14, 15, 16, 17 (Fig. 14) and in 73 the rings 15, 16, 17, 18, 19 (Fig. 15)

formed during the 1998-2003 drought. The length

Figure 15. Deviation of the average length of annual rings from normal in 73

of the annual rings for this period is small, due to the multi-annual drought.

The stand from 49a has reached the age of 50, and due to the lack of management work associated with the extended drought from 1998-2003, it suffers from isolated windfalls, crown breaks and tree drying.

Conclusion

Following the analysis of the increment cores, there is a large variety of annual ring length. Comparing the models obtained with those elaborated in the studies performed at the Mineci-Ungureni Forest District between 1944 and 1955 (Giurgiu, 1967) regarding the radial growths, it has been found that the forests in 49a and 73 suffered and continue to suffer from the droughts corroborated with the poor retention of water in the soil due to the high slope and the low soil volume.

Also the annual rings were compared with the climatic data from 1990-2010 and it was found that during 1998-2003, when it was an extended drought period, the rings lengths are below the normal line calculated with the logarithmic function.

Due to a defective performance of the maintenance works, the stands suffer from isolated windfalls, crown and trunk breaks even dryings.

In subcompartment 49b, radial elevations are more homogeneous than in 49a and 73, but the effect of droughts on growth is quite obvious.

Recommendations

Tending operations should be done in time and with intensity stipulated in the technical regulations available or according to forest specialists.

Promoting natural regeneration.

Protection of grazing shafts, fires.

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