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THE PARTICULARITIES OF THE ECOLOGICAL REHABILITATION WORKS OF THE SESSILE OAK STANDS (*Quercus petraea* (Matt.) Liebl.), FROM THE SEED RESERVE

Ghiţă Cristian CRAINIC[1], Silviu Ioan SICOE[1], Flavius IRIMIE[2], Flavia IRIMIE (CIOFLAN)[1], Călin Ioan IOVAN[1], Marinela Florica BODOG[1]

[1]University of Oradea, 1 University Street, Oradea, Romania
[2]"Stefan cel Mare" University of Suceava, 13 University Street, Suceava, Romania

Corresponding author email: marinelabodog@gmail.com

Abstract

The sessile oak stands within the seed reservation that were affected by the extreme weather phenomena (windthrown and windsnapped trees) on the 17th of September 2017, from the forest fund of the U.P. VII Văratec, the Forest District Sudrigiu, County Forest Administration Bihor, presents a relatively low ecosystem stability, considering the impact suffered. After the identification of the sessile oak stands affected (by extreme weather phenomena), the assessment of the affected wood material was carried out and implicitly, its extraction and superior valorization. The necessary works, proposed for the ecological rehabilitation of the sessile oak stands that have been examined and studied, take into account their actual state, the regulations of the forestry management plan for the current decade, the provisions of the technical norms in force at the date of implementation of the study, and last but not least, the necessary logistical and financial possibilities.
Surfaces from which the wood material was extracted, will be delimited in separate management units, which will regenerate naturally from the seed coming from the remaining stands, thus preserving their provenance in-situ.

***Key words**: ecological rehabilitation, extreme weather phenomena, natural regeneration, sessile oak, seed reservation.*

INTRODUCTION

Since 2007, when our country became a member of the European Union, we have had the obligation to implement and comply with the provisions of EU Directive 1999/105/CE and other related regulations regarding the production, use and sale of reproductive forest materials (Pârnuţă et al., 2012).
As a result, in the new national and international context in this field, the complete revision of the 2001 edition Catalog was mandatory, and its completion, through new actions to identify and describe new source units for obtaining forest biological material, necessary for reproduction it introduces all the main basic, main mixed, main auxiliary and exotic forest species into the national forest fund (Pârnuţă et al., 2012).
The development of the National Catalog of the basic materials for obtaining forest biological reproduction materials by categories, species and regions of origin, was one of the main objectives of the EU directive, for the forestry sector.
Also, a set of 30 maps were made in the GIS system, at a scale of 1:3200000, for the location of the source units of reproductive genetic material, which were established for all species and artificial hybrids, by category of forest biological materials of reproduction and regions of origin by species, in accordance with MO No. 1028/2010 (Pârnuţă et al., 2012).
From the analysis of the data from the National Catalog of basic materials for the production of reproductive forest materials, 2012, it can be seen that in 2011 in our country there were 458 stands selected from the *Quercus petraea* (Matt.) Liebl. ssp. *petraea* (Liebl.) species, with an area of 8,341.41 ha, of which 15 stands, with an area of 285.10 ha, were tested (Pârnuţă et al., 2012).
Within the U.P. VII Văratec, O.S. Sudrigiu, D.S. Bihor, the *Quercus petraea* stands that are part of the S.U.P. "K" - respective seed reserves, occupy an area of 119.69 ha (Figure 1).

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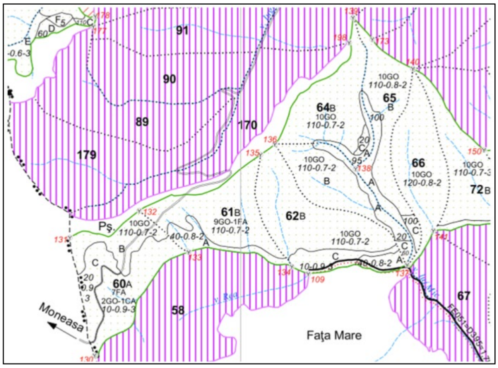

Figure 1. The location of *Quercus petraea* groves included in the seed reservation, from Production Unit VII Văratec, Forest District Sudrigiu, Forest Regional Board Bihor (extract from the forest map)

As a result, these stands aim to produce genetically controlled seeds, being included in the active type II. Consequently, these stands were excluded from the regulation of the wood production process (Table 1). Considering these aspects, silvotechnical interventions for these stands are represented by hygiene cuts and extracting accidental products when appropriate (when they are produced).

Table 1. Establishment of the management unit in which *Quercus petraea* stands are included in the seed reserve (extract from the forestry management in force)

Sub-unit production (S.U.P.)	Plots	
K	60B, 61B, 62B, 63B, 64B, 65B, 66	
Total	Surface: 119.69 ha	Number of plots: 7

Stand from plot 60B occupies an area of 8.11 ha, is a pure *Quercus petraea* species, 110 years old, production class II - a, with consistency k = 0.7, being obtained from natural regeneration. Accidental products were extracted from the tree in 2011, and hygiene products in 2013.

Stand from plot 61B occupies an area of 19.63 ha, is a practically pure *Quercus petraea* species, aged 110 years, production class II - a, with consistency k = 0.7, being obtained from natural regeneration. Accidental products were extracted from the tree in 2011, and hygiene products in 2013.

Stand from plot 62B occupies an area of 24.07 ha, is a pure *Quercus petraea* species, 110 years old, production class II, with consistency k = 0.7, being obtained from natural regeneration. Accidental products were extracted from the tree in 2011, and hygiene products in 2013.

Stand from plot 63B occupies an area of 13.63 ha, it is a pure *Quercus petraea* species, 110 years old, production class II - a, with consistency k = 0.7, being obtained from natural regeneration. Accidental products were extracted from the tree in 2011, and hygiene products in 2013.

Stand from plot 64B occupies an area of 18.69 ha, is a pure *Quercus petraea* species, aged 110 years, production class II - a, with consistency k = 0.7, being obtained from natural regeneration. Accidental products were extracted from the tree in 2012, and hygiene products in 2013.

Stand from plot 65B occupies an area of 15.00 ha, is a pure *Quercus petraea* species, aged 110 years, production class II, with consistency k = 0.8, being obtained from natural regeneration. Accidental products were extracted from the tree in 2012, and hygiene products in 2013.

Stand from plot 66 occupies an area of 20.56 ha, is a pure *Quercus petraea* species, 120 years old, production class II, with consistency k = 0.8, being obtained from natural regeneration. Accidental products were extracted from the tree in 2008 and 2012.

On September 17.2017, the western part of the country was affected by a very strong storm, which lasted less than an hour and caused numerous damages. Strong gusts of wind reached nearly 100 km per hour and uprooted trees, snapped power lines, and destroyed roofs from a number of buildings

The wind, due to its destabilizing and destructive effect on forest ecosystems, is considered to be the most important and dangerous (harmful) abiotic factor, with a destabilizing character. This can cause significant damage to forests, resulting in the uprooting and/or breaking of tree trunks, which causes imbalances at the ecosystem level and respectively considerable financial losses for forest administrators and owners (Ní Dhubhain & Farrelly, 2018).

Depending on the intensity and extent of the extreme meteorological phenomenon (the storm produced by the wind), two large categories of downfalls produced by the wind can be identified: catastrophic downfalls or mass downfalls. Due to, extreme meteorological conditions, with very high intensity winds, which affects a large area (at least 0.25 ha of the stand) and respectively isolated fellings - which occur frequently every year, as a result of the impact on forest ecosystems of medium-intensity winds, in which case the damage produced has economic effects reduced, but if repeated periodically, through accumulation they can become very important (Mitchell, 2013).

The factors that condition and respectively influence the evolution of windfalls can be classified into two categories: seasonal factors favoring falls (lithological substrate, soil, relief, slope, exposure) and respectively seasonal triggering factors, which are represented by climatic conditions - the variety of hydrometeors, temperature variations, wind speed and direction (Crainic et al., 2003).

To assess the risk of falls and/or wind breaks, three large categories of methods can be used, as follows: observational methods - which involve the analysis of specific risk indicators (Crainic & Dorog, 2003), mechanical experimental methods - which refer to testing the resistance of trees to the action of the wind, either through mechanical modeling and simulation techniques of the behavior of trees to the action (loading) of the wind or through specific experiments (Peltola et al., 2000). These specific experiments are mathematical methods, based on the principles of statics and material resistance (Fetea et al., 2003), and statistical methods, namely regression analysis in estimating the probability associated with windfalls, depending on stationery and tree factors (Popa, 2005).

Leaving aside the assessment methods used to assess the risk of windfalls, a number of other factors are of particular importance, such as: tree species (due to the type of rooting), soil type, lithological substrate and respectively the loads from wind, which acts on the trees and can cause them to topple. Also, an important influence is the relief, the slope and the altitude. They act synergistically, through their common resultant within the climatic elements, influencing the initiation and development of the falls (Coates et al., 2018). A product of the windfalls in the mountain area is the specific microrelief, known as the microrelief of the downfalls (Geambașu, 1984), an aspect that can also be frequently encountered in the hilly area. In storms with high intensity, the root system of forest species with trailing roots gives way, being dislodged from the soil together with a disk of earth retained between the roots, thus forming the slough. When the trees are overturned in the upstream to downstream direction, a characteristic micro-depression remains in the disc separation area, which fades over time but does not disappear definitively, as depicted in Figure 2.

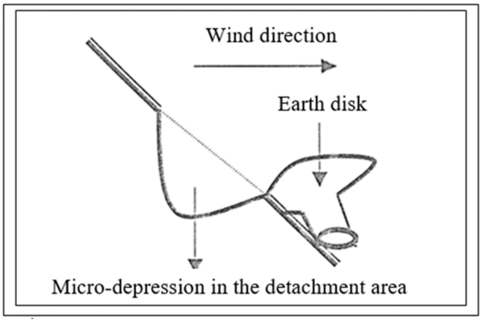

Figure 2. The appearance of a dislocated stump in the upstream-downstream direction, side view (from Crainic, 2002, after Geambașu, 1984)

Since the effects of landslides on the soil and relief are long-lasting, the microrelief of landslides can constitute a seasonal indicator (element), with a special indicative value, related to the frequency of wind landslides. The presence of the micro-relief of falls has a special importance for the station study, turning it into a real tool (indicator, coupon) for assessing (evaluating) the risk of the station in the event of falls.

Wind, on the European continent, is considered a major factor (the main factor) of destabilization and destruction of forest ecosystems, which produces consistent damage - more than half of the volume of all damage to forests (Gardiner, 2013). The increase in the frequency and intensity of storms caused by wind is currently considered to be influenced by climate change, including the number and intensity of these extreme weather phenomena, recently being on the rise (Sabău & Iovan, 2018; Constandache et al., 2018). The

increasing trend in the frequency and intensity of storms caused by wind in Europe has been highlighted since 1950, being also characterized by the quantification of the increasing damages produced in the forest fund. Between 1970 and 2010, damage caused by windstorms in the European forest fund doubled, increasing from about 50 million m^3 to about 100 million m^3 (Chirici et al., 2017).
The negative effects of windfall are also felt in Romania, especially in the mountainous area. The catastrophic windfalls, from November 1995, produced calamities on an area of over 140.000 ha, resulting in a total volume of approximately 7.9 million m^3 of accidental wood products. Also, the natural calamities, which occurred in March 2002, in Suceava county, resulted in the felling produced by the wind, estimated at over 7 million m^3 of accidental wood products (Popa, 2005).
The trees within Forest District Sudrigiu, Forest Regional Board Bihor, were affected by these extreme weather phenomena, namely a devastating storm, which produced the felling by uprooting and the breaking of trees on thousands of hectares. Within the Production Unit VII Văratec, a number of trees from the group of deciduous species were affected, including the seven gorun trees, which are included in the seed reserve. As a result, the total area of the affected trees is approx. 920 ha, of which 119.69 ha is represented by the surface of the seven *Quercus petraea* groves, from the seed reserve.
The gorun trees within the seed reservation were affected by the uprooting and breaking of the trees by the wind that reached speeds of over 28 m/s (100 km/h), thus resulting in a considerable volume of accidental wood products and respectively a series of surfaces on which quantities of soil and rock fragments were dislodged.
Also, access to the affected stands was blocked, and the natural landscape in that area was radically changed, becoming a desolate one.

MATERIALS AND METHODS

The case study was carried out in the gorun groves belonging to the seed reservation (plot 60B, 61B, 62B, 63B, 64B, 65B and 66) within the Production Unit VII Văratec, administered by the Sudrigiu Forest District, subordinate to the Forest Regional Board Bihor.
For the characterization of the gorun stands, from the seed reserve, which were affected by the extreme weather phenomena of 17.09.2017, the forestry management, the management map, and a series of documents (inventory, valuation documents, centralizers, situations, etc.) within the Sudrigiu Forest District, regarding the affected stands, belonging to Production Unit VII Văratec. Also, observations were made on the itinerary, stationary observations, statistical-mathematical inventories, integral inventories and image recordings, with the objective reality from the field, on magnetic media.
The period in which the study was carried out was 2017-2022.
For the correct assessment of the state of the affected stands, observations were made successively, in different periods of the growing season and/or outside the growing season, in the plots analyzed and studied, thus analyzing all the identified peculiarities.
The recorded data were processed using appropriate work technologies, and the obtained results were interpreted accordingly, for the rigorous documentation of the technical solutions that will be proposed.
The establishment and respectively the adoption of appropriate (effective) technical solutions for the ecological rehabilitation of the analyzed and studied gorun groves, involves the evaluation (calculation) of their affected surface, the analysis of the respective groves's stability and the identification (establishment) of the necessary works (silvotechnical interventions).
In order to determine the affected area of the stands where the accidental products I were identified, the degree of damage of these stands was used - I_a, as a ratio between the volume of the accidental products and the volume of the stand, respectively, before their production, for the entire landscaping unit, the volume that was taken from the arrangement.

$$I_a = \frac{V_e}{V_a} \quad (1)$$

where:
I_a - the degree of damage to the trees;

V_e - the volume of accidental products, to be extracted, from the affected tree, from the plot analyzed and studied;
V_a - the volume of the arrangement related to the affected stand from the analyzed and studied plot.
The degree of damage to the stands (I_a) was applied to the area of the landscaping unit - the one presented in the arrangement, thus obtainning the theoretical area related to the volume of accidental products that were inventoried, generically called the affected area.

$$S_{af} = S_a \cdot I_a \quad (2)$$

where:
S_{af} - the affected surface, related to the volume of accidental products evaluated, from the landscape unit analyzed and studied;
S_a - the landscaped surface, related to the affected trees in the plot (landscape unit) analyzed and studied.
For the calculations, the volume from the arrangement was used, for each affected tree, which was analyzed and studied.
For the analysis of the stability of the stands to the destabilizing action of the dominant (or accidental) winds, the slenderness coefficient values related to these stands were calculated.
The slenderness coefficient was determined as the ratio between the average height and the average diameter of the stand (Florescu & Nicolescu, 1996) relation 3.

$$Z_{\%} = \frac{\bar{h}}{\bar{d}} \cdot 100 \quad (3)$$

where**:**
Z - slenderness coefficient;
$\bar{h}$ - the average height of the stand, in meters;
$\bar{d}$ - the average diameter of the stand, in centimeters.
The values of the slenderness coefficients were determined for the values of the heights and diameters from the acts of valuing the accidental products, but also for the values presented in the forestry management in force, for the affected stands, which were analyzed and studied. In this context, the slenderness coefficient values obtained for the data from the field (experimental data) and respectively for those from the forestry management, for the same trees, will be analyzed comparatively.
As a result, Z_a- represents the slenderness coefficient determined with the height (h_a) and diameter (d_a) of the arrangement;
Z_t- represents the slenderness coefficient determined with the height (h_t) and diameter (d_t) recorded in the field, which can be found in the valuation act.
The silvotechnical interventions corresponding to the stands included in the seed reserves are relatively restrictive, accepting the works necessary to improve and/or maintain an appropriate phytosanitary state (hygiene works/cuts) and, where appropriate, regeneration works, which ensures the in-situ conservation of the gene pool. As a result, the interventions that need to be analyzed in order to be implemented as technical solutions refer to the extraction of hygiene products, the removal of the negative effects of their exploitation process and, last but not least, the natural regeneration of the affected stands.

RESULTS AND DISCUSSIONS

The data recorded in the field, on the occasion of the complete inventories of the accidental products that occurred as a result of the extreme weather phenomena of 17.09.2017, in the *Quercus petraea* groves of the seed reservation within the Production Unit VII Văratec, were properly processed, with specialized work programs (FOND, SUMAL), obtaining the volume of the affected wood.
Table 2 shows the results obtained after processing the data from the affected stands, included in the seed reserve, within the Production Unit VII Văratec.

Table 2. The records of the affected stands, included in the seed reserve, within the Production Unit VII Văratec

Plot	Volume (m^3/u.a.)		Surface (ha)			
	$V_{arrangement}$	$V_{extract}$	$S_{arrangement}$	S_{affect}	$S_{to\ regenerate}$	$S_{regenerate}$
60B	2984	390	8.11	1.06	0.36	0.70
61B	7655	802	19.63	2.06	0.56	1.50
62B	9460	634	24.07	1.61	0.31	1.30
63B	5016	317	13.63	0.86	0.16	0.70
64B	7345	2266	18.69	5.77	1.20	4.57
65B	6735	2664	15.00	5.93	1.93	4.00
66	9231	2855	20.56	6.36	1.36	5.00
Total	48426	9928	119.69	23.65	5.88	17.77

From the analysis of the results presented in Table 2, from the surface, the total surface of the *Quercus petraea* seed reserve within the Production Unit VII Văratec of 119.69 ha, an area of 23.65 ha was affected by the extreme weather phenomena on September 17, 2017.

Of the affected area of 23.65 ha, natural regeneration is being installed on an area of 17.77 ha, and on an area of 5.88 ha, completion works and/or installation of forest vegetation are needed.

Analyzing the data presented in Figure 3, of the surface of the seven affected trees, included in the seed reservation, 80% is unaffected, 15% is undergoing regeneration, and 5% requires works to install forest vegetation.

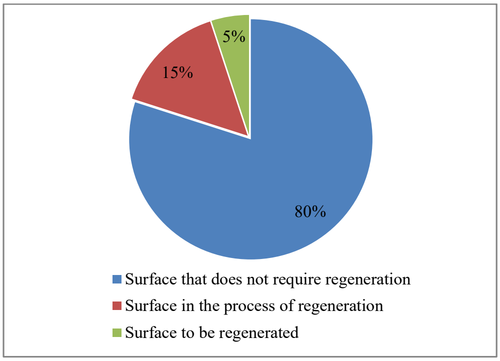

Figure 3. The situation of the affected areas and in the process of regeneration from the analyzed stands, which are included in the seed reservation within the Production Unit VII Văratec

The values of the slenderness coefficients of the gorun stands, within the seed reservation, which were analyzed, are presented in Table 3.

Table 3. The slenderness coefficient values for the gorun stands in the seed reserve, which were analyzed and studied

Plot	Capitalization act		H (m)		D (cm)		Z (%)	
	Nr.	V_{act} (m^3)	H_a	H_t	D_a	D_t	Z_a	Z_t
60B	500	390	27	26	40	46	68	57
61B	500	802	28	27	40	44	70	61
62B	500	634	28	26	42	38	67	68
63B	537	215	27	25	40	36	68	69
64B	537	1574	28	25	42	36	67	69
65B	570	2664	28	25	42	36	67	69
66	567	1800	28	25	44	40	64	63

The values of the slenderness coefficient Z, in stands with high ecosystem stability under the action of destabilizing dominant winds and with optimal thicknesses, are generally in the range of 60-90% (Florescu & Nicolescu, 1996).

From the analysis of the data presented in Table 3, the values of the slenderness coefficients, which were calculated for the studied gorun stands, fall within the range of 64-70% for the data from the forestry management, and respectively in the range of 57-69% for experimental (field) data.

Although the affected *Quercus petraea* stands have a corresponding thickness and slenderness coefficients with values that indicate a high ecosystem stability, they were nevertheless differently affected by wind blows, on compact surfaces of different sizes.

The possible cause of these windfalls, (disregarding meteorological conditions) as a predisposing factor, can be represented by the relatively low thickness of the soil and the presence of rock on the surface, on considerable surfaces.

The objective reality on the ground (situation on the ground) of the *Quercus petraea* stands in the seed reservation, which were affected, presents itself relatively differently, as the affected area and respectively, as the state of the remaining stands.

From the analysis of the data in Table 4, it is found that the cumulative surface, on which ecological rehabilitation works were proposed, in the affected stands, is 83.49 ha.

Table 4. Evidence of technical solutions, proposed in the affected stands, which are included in the reservation of gorun seeds

The proposed work		**S (ha)**
The symbol of the norm	The specifics of the work	
C.1	Land clearing for afforestation	5.88
C.2	Cleaning the land of stones and pebbles	5.88
C.51	Manual soil mobilization around seedlings in plantations, direct sowing and natural regeneration	0.78
C.46	Review of plantations and direct sowing	23.65
C.56	Reception of natural and artificial seeds	17.77
C.58	The discovery of forest species of herbaceous and woody species	23.65
C.75	Supplementing natural regeneration through direct seeding	5.88
Total		**83.49**

It is worth noting that in 2019, there was abundant fruiting of the *Quercus petraea* species in the Production Unit VII Văratec, and as a result, there are premises for the installation of a natural regeneration, from the seed, ensuring in this way the in-situ conservation of the respective provenance and implicitly of the gene pool, for the affected gorun stands from the seed reservation, which were studied (Figure 4).

Figure 4. Abundant fruiting in the gorun species, in the stand in plot 64B (Crainic, 11.X. 2019, Production Unit VII Văratec)

Proposed works in the affected stands included in the gorun seed reservations - S.U.P. K
In the stand in plot 60B, the surface on which it is necessary to install forest vegetation, by direct sowing, was approx. 0.36 ha.
In the image from Figure 5, we can see the presence of the regeneration of the gorun species and respectively the presence of the black bilberry - *Vaccinium myrtillus* L., a species that indicates a relatively acidic soil. It should be noted that this species is not specified in the plot description, under the indicator flora heading.

Figure 5. Surface affected by felling and wind breaks, on which it is necessary to install regeneration, in the stand of u.a. 60B (Crainic, 11.X.2019, Production Unit VII Văratec)

For plot 60B we recommend the following regeneration composition: 70% Q*uercus petraea* +20% *Fagus sylvatica +10% Prunus avium*.
The necessary works are represented by: C.1 on an area of 0.36 ha, C.2 on an area of 0.36 ha, C.75 on an area of 0.36 ha (because in the current year there is abundant fruiting of the *Quercus petraea* species), C.46 on an area of 1.06 ha, C.51 on an area of 0.05 ha, C.56 on an area of 0.70 ha and C.58 on an area of 1.06 ha.
In the stand in plot 61B the surface on which it is necessary to install forest vegetation: by direct sowing approx. 0.56 ha (Figure 6).

Figure 6. Biogroups with regeneration from the *Quercus petraea* species, with black bilberry, which settled on the surface affected by felling and wind breaks, in the stand of plot 60B (Crainic, 11.X.2019, Production Unit VII Văratec)

For plot 61B we recommend the following regeneration composition: 70% Go + 20% Fa + 10% Ci.
The necessary works are represented by: C.1 on an area of 0,56 ha, C.2 on an area of 0.56 ha, C.75 on an area of 0.56 ha, because in the current year there is abundant fruiting of the *Quercus petraea* species, C.46 on an area of 2.06 ha, C.51 on an area of 0.10 ha, C.56 on an area of 1.50 ha, C.58 on an area of 2.06 ha (Figure 7).
In the stand in plot 62B, the surface on which it is necessary to install forest vegetation: by direct sowing approx. 0.31 ha.
For plot 62B we recommend the following regeneration composition: 70% *Quercus petraea* + 20% *Fagus sylvatica* + 10% *Prunus avium*.
The necessary works are represented by: C.1 on an area of 0.31 ha, C.2 on an area of 0.31 ha, C.75 on an area of 0.31 ha, C.46 on an area of

1.61 ha, C.51 on an area of 0.08 ha, C.56 on an area of 1.30 ha, C.58 on an area of 1.61 ha (Figure 8).

Figure 7. Biogroups with regeneration from the gorun species, which settled on the surface affected by felling and wind breaks, in the stand of plot 61B (Crainic, 11.X.2019, Production Unit VII Văratec)

Figure 8. Surface affected by felling and wind breaks, on which it is necessary to install regeneration, in the stand of u.a. 62B (Crainic, 11.X.2019, Production Unit VII Văratec)

In the stand in plot 63B, the surface on which it is necessary to install forest vegetation: by direct sowing approx. 0.16 ha.

For plot 63B we recommend the following regeneration composition: 70% *Quercus petraea* + 20% *Fagus sylvatica* + 10% *Prunus avium*.

The necessary works are represented by: C.1 on an area of 0.16 ha, C.2 on an area of 0.16 ha, C.75 on an area of 0.16 ha, C.46 on an area of 0.86 ha, C.51 on an area of 0.05 ha, C.56 on an area of 0.70 ha, C.58 on an area of 0.86 ha (Figure 9).

In the stand in plot 64 B, the surface on which it is necessary to install forest vegetation: by direct sowing approx. 1.20 ha. For plot 64 B we recommend the following regeneration composition: 70% *Quercus petraea* + 20% *Fagus sylvatica* +10% *Prunus avium* (Figure 10).

Figure 9. Biogroups with regeneration from the gorun species, which settled on the surface affected by felling and wind breaks, in the stand of plot 63 B (Crainic, 11.X.2019, Production Unit VII Văratec)

Figure 10. Surface affected by felling and wind breaks, on which it is necessary to install the regeneration, in the stand of u.a. 64B (Crainic, 11.X.2019, Production Unit VII Văratec)

The necessary works are represented by: C.1 on an area of 1.20 ha, C.2 on an area of 1.20 ha, C.75 on an area of 1.20 ha, C.46 on an area of approx. 5.77 ha, C.51 on an area of 0.15 ha, C.56 on an area of approx. 4.57 ha and C.58 on an area of approx. 5.77 ha (Figures 11 and12).

In the stand in plot 65B, the surface on which it is necessary to install forest vegetation: by direct sowing approx. 1.93 ha. For plot 65B we recommend the following regeneration composition: 70% *Quercus petraea* + 20% *Fagus sylvatica* + 10% *Prunus avium*.

The necessary works are represented by: C.1 on an area of 1.93 ha, C.2 on an area of 1.93 ha, C.75 on an area of 1.93 ha, C.46 on an area of approx. 5.93 ha, C.51 on an area of 0.15 ha, C.56 on an area of approx. 4.00 ha, C.58 on an area of approx. 5.93 ha (Figure 13).

Figure 11. Surface affected by felling and wind breaks, on which it is necessary to mobilize the soil, to facilitate the regeneration process, in the stand in plot 64B (Crainic, 11.X.2019, Production Unit VII Văratec)

Figure 12. Biogroups with regeneration of the *Quercus petraea* species, overwhelmed by shrubby vegetation, in the stand of plot 64B (Crainic, 11.X.2019, Production Unit VII Văratec)

Figure 13. Compact area affected by windthrow and windthrow breakage, on which soil mobilisation and regeneration is required, in the stand of plot 65 B (Crainic, 11.X.2019, plot 65B, Production Unit VII Văratec)

In the stand in plot 66, the surface on which it is necessary to install forest vegetation: by direct sowing approx. 1.36 ha.
The necessary works are represented by: C.1 on an area of 1.36 ha, C.2 on an area of 1.36 ha, C.75 on an area of 1.36 ha, C.46 on an area of approx. 6.36 ha, C.51 on an area of 0.20 ha, C.56 on an area of approx. 5.00 ha, C.58 on an area of approx. 6.36 ha (Figures 14 and 15).
For plot 66 we recommend the following regeneration composition: 70% *Quercus petraea* + 20% *Fagus sylvatica* +10% *Prunus avium*.

Figure 14. Blowdowns and wind breaks on compact surfaces, in the stand in plot 66 (Crainic, 08.VIII.2020, Production Unit VII Văratec)

Figure 15. Compact surface affected by felling and wind breaks, on which it is necessary to mobilize the soil and install regeneration, in the stand of plot 66 (Crainic, 08.VIII.2020, Production Unit VII Văratec)

The cumulative area on which ecological rehabilitation works have been proposed for each gorun tree within the seed reservation is different, varying depending on the affected fence and implicitly depending on the affected area (Figure 16). As a result, it can be seen that that the gorun groves in plots 66, 65B and 64B have the highest degree of damage, and the stands in plots 63B and 60B show a relatively low degree of damage.
Due to the fact that in the gorun stands within the seed reservation, the consistency at the time

of applying the current forestry management, respectively at the beginning of 2014, had values in the range of 0.7-0.8, on a series of portions of the surface of the plots, was installed usable seed, due to the fruitings prior to 2014 and, respectively, the conditions created for the initiation and development of this ecosystem level process.

As a result, a series of silvotechnical interventions is necessary for these surfaces, specific to the stage and respectively the stage of development of biogroups with usable seeds. Although in the seed reserves the silvotechnological interventions recommended by the technical norms in force and proposed by the forestry management are represented only by the hygiene works and the extraction of accidental products, for the regeneration of the surfaces from which the trees were extracted for justified reasons, a series of specific works.

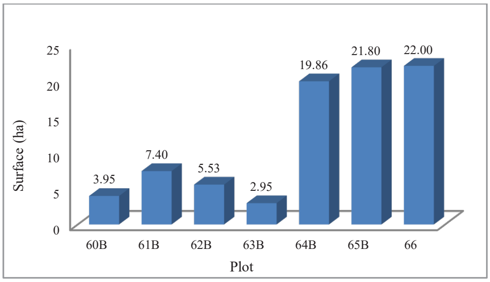

Figure 16. The cumulative surface area of the proposed ecological rehabilitation works on plots

Table 5. The centralizer of the proposed technical solutions, specific to works, surfaces and landscaping units, in the affected stands included in the seed reservation within the Production Unit VII Văratec

Nr. crt.	u.a.	The work (the symbol of the norm)							
		C.1	**C.2**	**C.75**	**C.46**	**C.56**	**C.58**	**C.51**	**Total**
1	60B	0.36	0.36	0.36	1.06	0.70	1.06	0.05	**3.95**
2	61B	0.56	0.56	0.56	2.06	1.50	2.06	0.10	**7.40**
3	62B	0.31	0.31	0.31	1.61	1.30	1.61	0.08	**5.53**
4	63B	0.16	0.16	0.16	0.86	0.70	0.86	0.05	**2.95**
5	64B	1.20	1.20	1.20	5.77	4.57	5.77	0.15	**19.86**
6	65B	1.93	1.93	1.93	5.93	4.00	5.93	0.15	**21.80**
7	66	1.36	1.36	1.36	6.36	5.00	6.36	0.20	**22.00**
Total		**5.88**	**5.88**	**5.88**	**5.88**	**17.77**	**23.65**	**0.78**	**83.49**

From the analysis of the data presented in Table 5, we find that the works that have the highest weight, depending on the surface on which they are recommended, are represented by C.46 and C.58, followed by C.56, C.1, C.2 and C.75. Works C.51 have the lowest weight.

CONCLUSIONS

From the analysis of the results obtained in the research carried out in the gorun stands affected by extreme meteorological phenomena, it can be concluded that the wind is the main natural factor, with a destabilizing character, in the forest ecosystems, in the hill and mountain areas.

The negative effects of extreme weather phenomena, on the forest ecosystems in the researched location, influence the structure and stability of the stands, as well as the possibilities of higher utilization of wood, due to the losses of value recorded in the process of utilization of accidental products.

The defective exploitation of the wood from accidental wood products, in the affected stands, especially the way in which the parquets (exploited surfaces) were cleaned, represents a limiting factor in the research and ecological rehabilitation processes in these stands.

Also, due to the fact that in the period from the occurrence of ruptures and windfalls until the year 2022, the meteorological conditions favored the growth and development at an alert rate of grassy, shrubby, subshrubby and woody vegetation, the collection of data from the field, the analysis and study of the affected stands, as well as a series of works necessary for the installation and management of natural and/or mixed regeneration, was relatively difficult.

In 2019 within the Production Unit VII Văratec there was abundant fruiting of the gorun species, and in 2020, abundant fruiting of the beech species was also reported. As a result, thanks to these abundant fruiting, the premises for natural and artificial regeneration are ensured - especially through direct sowing, in the stands that were affected by the extreme weather phenomena of September 2017.

The works to complete the natural regeneration through direct sowing, in the gorun calamitate groves, from the seed reservation, are much more effective compared to plantations with seedlings, due to their superior technical and economic efficiency, if the acorns harvested from these groves are used, preserving - thus the local origin of the gene pool, in situ.

It is necessary to carry out these works in the spring, because during the winter, the direct sowing can be affected and even destroyed by the herds of wild boars and/or by the rodents.

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