THE IMPLICATIONS OF APPLYING THINNINGS ON THE STRUCTURE OF STANDS FROM THE MIDDLE BAZIN OF CRIŞUL REPEDE RIVER

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Abstract

The structure of stands is the one which gives the more complex information about the programe of the stand and its following evolution if there are no esential (unexpected) modifications which can totally change the initial programe. This paper studied a mixed stand of sessile oak and european beech for which its characteristics were established and then, through successive simulations, different tipes of thinnings were pictured for which the characteristics of the stand were calculated afterwords.

Appling different sistems of silvotechnical mesures influences the size of growth and the quality of the wood, meaning the ratio between the volume of thick and thin trees, of different species and qualities.

Key words: structure, stand, distribution, intervention, thinning

INTRODUCTION

The structure of stands is the one which gives the more complex information about the programe of the stand and its following evolution if there are no esential (unexpected) modifications which can totally change the initial programe.This way, knowing the structure of the stands becomes extremely important also from the point of view of the interventions which will be made. For having a comparing term in this paper the experimental distributions obtained from the field data with the ones recomendded by the field literature were analised.

Appling different sistems of silvotechnical mesures influences not only the size of growth but also the quality of the wood production, meaning the ratio between the volume of thick and thin trees, of different species and qualities which are croped, and also the eficiency of the social ecological interest services which the stands have to accomplish. Being considered representative in this area even-aged or relatively even-aged sessile oak with european beech mixed stands a characterization of the stands in ratio with the proportion of the species but also with the structure of the stands on diameter categories will be tested (Bailey N.T.J., 1995).

Simulation the intervention gives information about the direction of the stand for optimising the composition, structure, the optimal exersation of the given functions and the direction towards management goals established through the management plan (Changhui Peng., 2000).

MATERIAL AND METHODS

For evaluation of sessile oak and european beech mixed stands structure the stands which vegetate in proper conditions concerning stational conditions for the two species mentioned above were chosen.

The stands were chosen in a way that the situations in which these are partly or totaly derived to be evoided. On the field, rectangular sample plots of 2.500 square metres were located. The location of the plots was choosed in a way that the structure of the stand to be captured as loial as possible.

On each plot the diameters of all stands on species and the hights of the stands arround centered medium diameter for each species were mesured. After collecting the data from the field the structure of the stands on species and diameter categories was registered. On the basis of this data, the structure of the stands on diameter categories using distributions recomended by the field literature: Gauss, Charlier type A and Beta distribution (Giurgiu V., 1972, Giurgiu V., 1979) was evaluated.

For evaluating the quality of experimental distribution adjustments after the theoretical ones, Hi-rectangulat criteria was applied. After knowing the structure of the stands, simulating some interventions (thinnings) having as goal promoting of the most valuable samples of the stand as species and quality, emproving quantity and especially quality production (Florescu I., Nicolescu N., 1998).

The simulation of some intervention was made on the basis of the data taken on the field and using the data obtained on the basis of adjusting experimental distributions with the ones recomended by the field literature (Leahu I., 2000). Testing the simulated intervention quality was made through calculating the dispersion and distribution indicators, the intervention intensities on tree number, basic plot and volume, Hart-Becking clues (spacing factor) before and after intervention. The calculation of the volume was made using relative volums method, recomended by field literature (Florescu I., Nicolescu N., 1998).

The structural differentiation in a stand is a consequence of integrality estate and at the end leads to natural elimination of the stands respecting self-reglation characteristic of biological sistems (Leahu I., 2001).

RESULTS AND DISSCUTIONS

For showing simulation and evaluation of an intervention in a stand some sintetical data which was calculated before and after simulated intervention in u.a. 78C U.P.III, O.S. Dobreşti is shown as follows.

Table 1

The calculation of medium diameter, dispersion indicators and distribution shape case 1

<table>
<tr><th colspan="7">Characteristics of the stand case 1</th></tr>
<tr><th colspan="2">Calculated characteristics</th><th colspan="2">Before intervention</th><th colspan="3">After intervention</th></tr>
<tr><td colspan="2">Medium diameter(cm)</td><td colspan="2">22,04</td><td colspan="3">26,00</td></tr>
<tr><td colspan="2">Variancy</td><td colspan="2">67,44</td><td colspan="3">65,92</td></tr>
<tr><td colspan="2">Standard deviation</td><td colspan="2">8,21</td><td colspan="3">8,11</td></tr>
<tr><td colspan="2">Variation cofficient</td><td colspan="2">0,37</td><td colspan="3">0,31</td></tr>
<tr><td colspan="2">Asimetry</td><td colspan="2">-0,14</td><td colspan="3">-0,92</td></tr>
<tr><td colspan="2">Exccess</td><td colspan="2">1,89</td><td colspan="3">2,55</td></tr>
<tr><th colspan="7">Proportion on species</th></tr>
<tr><td rowspan="2">Species</td><td colspan="2">Proportion on basic plot</td><td colspan="2">Proportion on volume</td><td colspan="2">Proportion on tree number</td></tr>
<tr><td>Before intervention</td><td>After intervention</td><td>Before intervention</td><td>After intervention</td><td>Before intervention</td><td>After interventio n</td></tr>
<tr><td>FA</td><td>33,60</td><td>45.34</td><td>35,32</td><td>39.91</td><td>27,96</td><td>45.24</td></tr>
<tr><td>GO</td><td>42,29</td><td>43.69</td><td>43,74</td><td>49.06</td><td>26,88</td><td>38.89</td></tr>
<tr><td>CA</td><td>20,51</td><td>7.23</td><td>17,37</td><td>7.01</td><td>43,01</td><td>12.70</td></tr>
<tr><td>ST</td><td>3,60</td><td>3.75</td><td>3,56</td><td>4.02</td><td>2,15</td><td>3.17</td></tr>
<tr><td>CE</td><td>0,00</td><td>0.00</td><td>0,00</td><td>0.00</td><td>0,00</td><td>3.97</td></tr>
<tr><td>CI</td><td>9,95</td><td>0.00</td><td>8,30</td><td>0.00</td><td>2,69</td><td>0,00</td></tr>
<tr><th colspan="7">Calculation of intervention intensity and Hart-Becking index</th></tr>
<tr><td colspan="3">Calculated characteristics</td><td colspan="4">Values</td></tr>
<tr><td colspan="3">Intensity on tree number</td><td colspan="4">32,25</td></tr>
<tr><td colspan="3">Intensity on basic plot</td><td colspan="4">9.32</td></tr>
<tr><td colspan="3">Intensity on volume</td><td colspan="4">11,48</td></tr>
<tr><td colspan="3" rowspan="2">Spacing factor (Hart-Becking index)</td><td colspan="2">Before intervention</td><td colspan="2">After intervention</td></tr>
<tr><td colspan="2">14,27</td><td colspan="2">17,34</td></tr>
</table>

From the data obtained above it can be noticed that an intervention which means extracting the trees from inferior diameter categories, mostly white beech trees but also dying sessile oak and oak trees which remain in in the inferior content. The intensity on tree number is close to 32% value which indicates a moderate to strong thinning while the intensity on volume is somewhere at 11% which indicates a weack intensity thinning. From here it can be concluded that a low thinning was simulated in the stand. The spacing factor also modifies, meaning the experimental value grows after intervention with 3%.

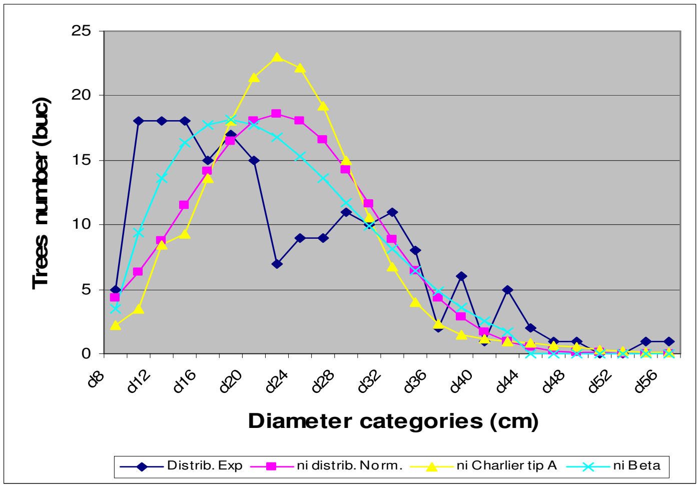

Fig. 1 Experimental distribution, distribution after simulation of intervention and adujstment according to normal law, Charlier type A and Beta, case 1

Another possible intervention simulated in the stand from u.a. 78C is the one which operates on the stands from inferior diameter categories an also on hte stands from medium and superior categories. So, the obtained data is shown as follows:

Table 2

Calculation of medium diameter, dispersion indicators and distribution shape case 2

Characteristics of the stand case 2		
Calculated characteristics	**Before intervention**	**After intervention**
Medium diameter (cm)	22,04	21,33
Variancy	67,44	50,10
Standard deviation	8,21	7,07
Variation cofficient	0,37	0,33
Asimetry	-0,14	0,17
Exccess	1,89	2,20

Proportion on species						
Species	Proportion on basic plot		Proportion on volume		Proportion on tree number	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
FA	33,60	33,26	35,88	35,15	27,96	35,43
GO	42,29	43,40	44,43	45,70	26,88	29,92
CA	20,51	20,46	16,08	16,23	43,01	33,07
ST	3,60	2,88	3,62	2,92	2,15	1,57
CE	0,00	0,00	0,00	0,00	0,00	0,00
CI	9,95	0,00	8,43	0,00	2,69	0,00

Calculation of intervention intensity and Hart-Becking index		
Calculated characteristics	Values	
Intensity on tree number	31,72	
Intensity on basic plot	36,49	
Intensity on volume	36,99	
Spacing factor (Hart-Becking index)	Before intervention	After intervention
	14,27	17,27

In this so said intervention it can be noticed that medium diameter is not artificially encreasing as in the first case, which enphasizes the fact that interfearing in all diameter categories, the medium diameter of the stand remains aproximatelly constant. Plus, in this case, there are not much bigger differences concerning intensities on tree number, basic plot and volume.

Table 3

Calculation of medium diameter, dispersion indicators and distribution shape case 3

<table>
<tr><th colspan="12">Caracteristici ale arboretuluri caz 3</th></tr>
<tr><th colspan="4">Calculated characteristics</th><th colspan="4">Before intervention</th><th colspan="4">After intervention</th></tr>
<tr><td colspan="4">Medium diameter (cm)</td><td colspan="4">22,04</td><td colspan="4">23,17</td></tr>
<tr><td colspan="4">Variancy</td><td colspan="4">67,44</td><td colspan="4">65,02</td></tr>
<tr><td colspan="4">Standard deviation</td><td colspan="4">8,21</td><td colspan="4">8,06</td></tr>
<tr><td colspan="4">Variation cofficient</td><td colspan="4">0,37</td><td colspan="4">0,34</td></tr>
<tr><td colspan="4">Asimetry</td><td colspan="4">-0,14</td><td colspan="4">-0,20</td></tr>
<tr><td colspan="4">Exccess</td><td colspan="4">1,89</td><td colspan="4">2,00</td></tr>
<tr><th colspan="12">Proportion on species</th></tr>
<tr><td colspan="2" rowspan="2">Species</td><td colspan="4">Proportion on basic plot</td><td colspan="2">Proportion on volume</td><td colspan="4">Proportion on tree number</td></tr>
<tr><td colspan="2">Before intervention</td><td colspan="2">After intervention</td><td>Before intervention</td><td>After intervention</td><td colspan="2">Before intervention</td><td colspan="2">After intervention</td></tr>
<tr><td colspan="2">FA</td><td colspan="2">33,60</td><td colspan="2">34,62</td><td>35,32</td><td>35,73</td><td colspan="2">27,96</td><td colspan="2">36,23</td></tr>
<tr><td colspan="2">GO</td><td colspan="2">42,29</td><td colspan="2">47,54</td><td>43,74</td><td>48,55</td><td colspan="2">26,88</td><td colspan="2">34,78</td></tr>
<tr><td colspan="2">CA</td><td colspan="2">20,51</td><td colspan="2">13,51</td><td>17,37</td><td>11,49</td><td colspan="2">43,01</td><td colspan="2">26,09</td></tr>
<tr><td colspan="2">ST</td><td colspan="2">3,60</td><td colspan="2">4,33</td><td>3,56</td><td>4,23</td><td colspan="2">2,15</td><td colspan="2">2,90</td></tr>
<tr><td colspan="2">CE</td><td colspan="2">0,00</td><td colspan="2">0,00</td><td>0,00</td><td>0,00</td><td colspan="2">0,00</td><td colspan="2">0,00</td></tr>
<tr><td colspan="2">CI</td><td colspan="2">9,95</td><td colspan="2">0,00</td><td>8,30</td><td>0,00</td><td colspan="2">2,69</td><td colspan="2">0,00</td></tr>
<tr><th colspan="12">Calculation of intervention intensity and Hart-Becking index</th></tr>
<tr><td colspan="6">Calculated characteristics</td><td colspan="6">Values</td></tr>
<tr><td colspan="6">Intensity on tree number</td><td colspan="6">25,80</td></tr>
<tr><td colspan="6">Intensity on basic plot</td><td colspan="6">16,79</td></tr>
<tr><td colspan="6">Intensity on volume</td><td colspan="6">15,80</td></tr>
<tr><td colspan="6" rowspan="2">Spacing factor (Hart-Becking index)</td><td colspan="3">Before intervention</td><td colspan="3">After intervention</td></tr>
<tr><td colspan="3">14,27</td><td colspan="3">16,57</td></tr>
</table>

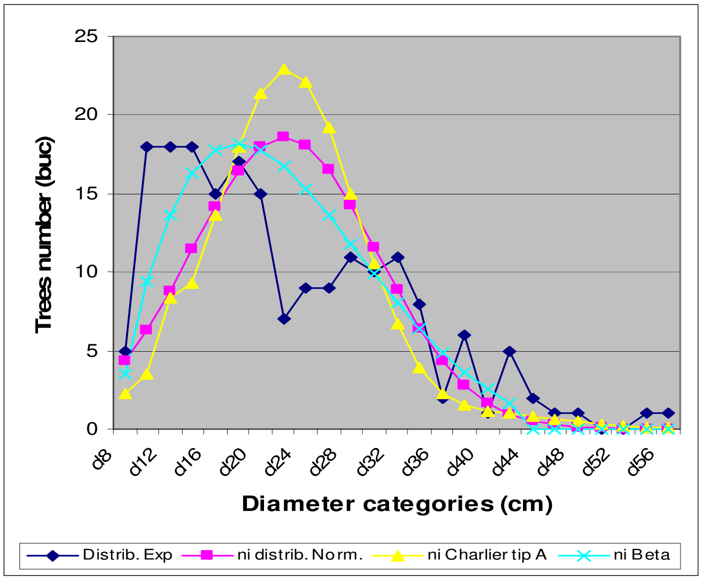

Fig. 2 Experimental distribution, distribution after simulation of intervention and adujstment according to normal law, Charlier type A and Beta, case 2

The last case shows a strong thinning (5), recomanded in this concret situation because a bigger intensity might unstabilise the internal structure of the stand.

This type for simulating and evaluating intervention gives the user also a comparancy of experimental distributions with the ones recomended to be normal by the field literature (Chițea Gh., 1997, Chițea Gh., 2001). As follows, the distribution formulas of tree number on quality classes will be showed for the examples above:

- Experimental distribution according to Beta

$$y = 0{,}01592 \times 10^2 (x-7)^{1{,}0446} (57-x)^{3{,}7517}$$

- distribution after intervention case 1

$$y = 436{,}064 \times 10^2 (x-7)^{2{,}0153} (57-x)^{3{,}9197}$$

- distribution after intervention case 2

$$y = 10{,}3337 \times 10^2 (x-7)^{1{,}0706} (43-x)^{2{,}1281}$$

- distribution after intervention case 3

$$y = 2{,}9207 \times 10^2 (x-7)^{1{,}0882} (49-x)^{2{,}3354}$$

in which x represents diameter categories and y tree number for each diameter category.

CONCLUSIONS

From the data converted in mixed stands of european beech and sessile oak appear interesting aspects concerning the interspecific competition between the 2 species and also between them and white beech, lime tree or other species of mixed hardwood stands (Dorog S., 2004). For the leading of the stand according to management goals established by the management plan, interventions with silvotechnical character will supervise the modification of composition and structure of the stands in the way indicated by the social economic and ecological established goals (Dorog S., 2005).

The type for evaluating and simulating intervention in a stand shows the advantages of the fact that before intervention it can be obtained information concerning the structure on tree number, basic plot, volume, species proportion, values of Hart-Becking coefficient which gives the possibility for analising and optimising intervention in accordance to the goals established through management plan (Kevin O.L., 1998).

The value of spacing factor encreases with each thinning, its value being adjustable up to 5% in each intervention. Data showed as examples in the data showed in the last case is eloquent.

Simulation of a low thinning is recognised due to intensities on tree number over 25 – 30% while on the basic plot and volume they are between 5 – 10% which is normal concidering that trees from inferior categories are being extracted trees wich remained behind with growth, placed on an inferior level. Sessile oak and turkey oak stands remained on an inferior level are dying standing first recomended to be extracted through carring works. The combined thinning means extracting trees from all diameter categories and its recognised through the fact that intensities on tree number, basic plot and volume are aproximatelly equal or not much different then 4 – 5%.

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