CONSIDERATIONS ON THE DAMAGE BROUGHT TO THE TREE FELLING WITHIN THE WOOD HARVESTING PROCESS

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Abstract

In this paper are presented the theoretical, legislative and practical aspects regarding the tree felling operation, the correct way of execution and the damages that may arise, in particular, by choosing a wrong felling direction.

As a case study, the felling area no. 156 was analyzed, part of Beliu Forest District, Arad Forest Administration. There have been measured some of the size-related elements of the felling with stumps (tree felling method that leaves stumps) in the case of 40 stumps within the exploitation felling area. It is noticed the high rate of trees that have been cut downstream and/or on a direction that is opposite to the tree collection direction, as well as the presence of high stumps and undercuts that are executed incorrectly.

Key words: timber logging, felling direction, exploitation damage, undercut, stump

INTRODUCTION

Of the wood harvesting operations, the cutting operation is the most dangerous and produces the greatest damage by the impact the tree causes in the fall.

In addition to damage to neighboring trees, the existing seed around the tree and the ground, the tree itself can be damaged by the cracking or even the breaking of the trunk or brace. From this point of view the damages can be forestry and economic.

Damage can also be avoided or inevitable. From a legal point of view, the rules for determining the terms, modalities and periods of operation of the wood table provided by Order 635/2002, Annex 1, the damage as a "partial or total damage of trees not exploited or of the useful seed from a forest". Order no. 815/2014 completed OM 1540/2011 as follows: In Article 1, after the letter e) a new letter, letter f) is inserted, with the following content:

"f) exploitation damage - trees not included in the act of valuation who have been injured or destroyed in the process of the approved exploitation process of the respective felling area".

The literature recommends applying the wood system in function and the applied forestry works or treatment, so that the damage is minimal.

Damage to seed and soil depends on the applied forestry treatment, the exploitation season, the average volume of the extracted trees, the average volume of the remaining trees, the conditions of the soil, the type of soil, the presence of herbaceous cover, and the tire pressure profile (Giurgiu, 2004).

The direct factors influencing the process of wood exploitation are: physico-geographic, forestry and technical-economic factors. Of these, technical and economic factors can be improved to minimize damage by:

- choosing the right technologies and wood system;
- design and organization of the exploitation works;
- the use of skilled and experienced workers;
- the use of modern equipment, machinery and equipment.

With regard to the tree felling operation, all work steps must be observed to ensure the safety of the workers' team and to achieve the fall of the tree of the desired technical direction in optimal conditions.

Treading large-volume trees is an operation for the professional chainsaw operator, so the machines recommended for such operations are becoming more and more complex, and if we refer to the chainsaw, there is at present a varied range with the engine power varies between 3.5 and 4.5 hp, all equipped with state-of-the-art engines (Brian, Jen, 2016).

Inappropriate execution of the dredging operation can lead to a significant qualitative depreciation of the wood, to the creation of difficult conditions of collection especially in the first stage of the process, as well as to the great prejudice of the standing tree and the seed usable (Ciubotaru et al., 2012).

These aspects were further analyzed, exemplified with the felling area no. 156, Beliu Forest District, Arad Forest Administration.

MATERIAL AND METHOD

Felling tree can be done with multifunctional machines or with chainsaw and/or forest axes to felling. When felling tree with a chain, the applied work method is based on the ratio between the diameter of the stump and the useful length of the blade of the chainsaw.

As long as the tree is felling on the desired direction, the damage should be minimal.

The choice of the felling direction should take into account the following aspects:

- for a lower impact on the soil, it is recommended that the felling be made downhill, oblique or at least on the contour line tree felling;
- the analysis of the natural direction of felling (due to crown asymmetry, trunk curvature, inclination of the tree), of the neighboring trees, the presence of seed mesh and other obstacles must be very serious;

- it will have in view as after the felling, the log's thick end to be oriented towards the direction of tree harvest to avoid the log turning.

Sometimes, it is recommended the usage of the felling wedges, levers and rods, winches and other devices for the orientation and determination of tree falling towards the technical felling direction.

An example of injury to an unmarked tree is shown in Figure 1.

Fig. 1. Damage caused to the standing tree due to an incorrect felling

Following measurements and observations on the ground, the following tables were prepared (Table 1). We measured 40 stumps, with diameters between 68 and 160 cm, the beech species.

The slope for the felling area was 32 degrees. The uphill tree felling is one of the important criteria for choosing the felling direction. The situation for this felling area is shown in Fig. 2. The Table 2 is drawn up for the verification of another felling criteria requirement: if the felling takes into account the subsequent direction of collecting the pieces after the trimming.

Table 1

Data measured in the felling area

No. crt	Stamp diameter, (cm)	Stump height, (cm)		Undercut, (cm)	Crests or pulling offs from the stump or tree trunk (cm)	Rot, (cm)
		measured upstream	measured downstream			
1.	160	32	60	36	-	-
2.	90	13	47	20	-	-
3.	85	21	55	35	52	-
4.	75	16	57	40	90	-
5.	128	24	75	34	43	-
6.	90	24	54	32	-	-
7.	144	21	40	45	-	-
8.	50	13	34	20	-	-
9.	100	42	80	40	-	-
10.	105	30	62	33	-	-
11.	70	18	53	28	-	-
12.	112	19	100	30	-	-
13.	80	22	62	30	-	-
14.	85	22	45	26	-	-
15.	120	16	65	32	-	-
16.	106	17	86	30	-	38
17.	107	19	80	37	40	-
18.	110	15	81	30	15	-
19.	120	45	75	27	85	-
20.	68	30	69	21	-	-
21.	90	16	55	22	15	41
22.	120	35	130	26	-	60
23.	124	18	51	28	-	52
24.	105	10	44	30	-	42
25.	92	36	52	35	-	-
26.	64	23	50	37	-	-
27.	96	20	38	32	-	20
28.	60	15	32	17	-	40
29.	90	9	32	20	-	-
30.	92	14	37	24	-	52
31.	116	14	60	24	-	-
32.	82	15	41	30	-	-
33.	98	25	35	32	-	-
34.	104	12	50	30	-	-
35.	76	19	34	27	-	-
36.	72	12	50	30	-	-
37.	86	10	25	24	-	-
38.	80	15	18	20	-	-
39.	70	36	52	35	-	-
40.	120	35	56	26	-	25

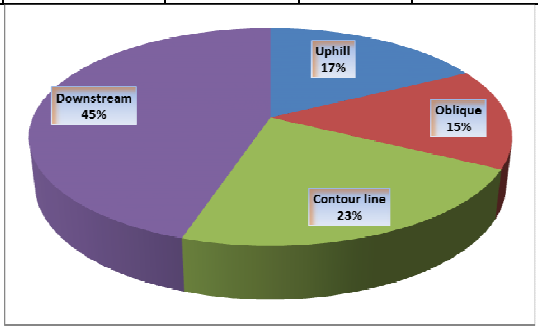

Fig. 2. Complying with the felling direction on the slopes

Table 2

Complying with the felling direction according to the collection direction

Complying with the collection direction	No. of samples
Yes	21
No	13
Oblique	6
Total	40

As for the depth of the undercut (at) to the stump diameter (dc), the recommendations are as follows: 1/4 dc ≤ at ≤ 1/3 dc.

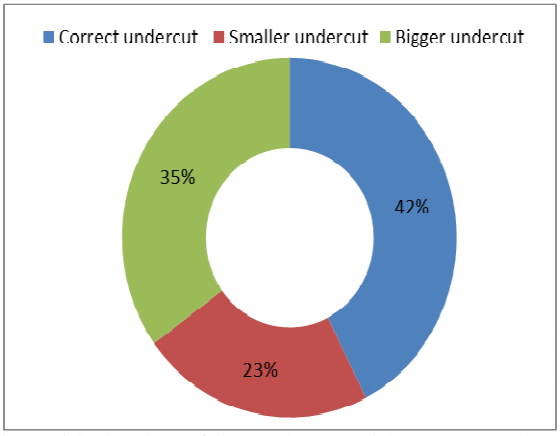

Fig. 3. Complying with the size of the undercut with respect to the stump diameter

CONCLUSIONS AND PROPOSALS

The wood exploitation process must be carried out on the basis of the principle of forestry and exploitation, in compliance with the regulations of the Forestry Code (Law 46/2008, republished), so that the damages resulting from the application of the felling are minimal.

Because of working conditions, inevitable damage sometimes occurs. They appear on the occasion of the exploitation of a felling area authorized for felling, but their production could not be avoided due to the field and tree conditions, although the approved method and working technology such as the forestry rules of operation were observed.

The current legislation specifies, by MO 2121/2016 Art.10, (2): "The technology for the exploitation of the wood mass in the felling area as well as the location of the ways of collecting wood and the related facilities will be differentiated according to the treatment applied and the way felling so as not to damage the regeneration beyond the permissible limits, the standing trees, the degradation of the soil and water banks."

For the case study considered, the recommended felling direction was not respected for 45% of the trees analyzed. From the point of view of respecting the felling direction according to the direction of subsequent collection of the pieces, 32.5% of the trees were felling in the direction

opposite to the collection direction, which means their return and additional damage to the seed in particular. Analyzing both of the above requirements, the felling direction was not adequate for 27.5% of the trees analyzed, a very high percentage.

This felling area was chosen because it was a very difficult one for the felling direction due to the large and very large diameters of the marked trees, the age being 180 years. For large trees, it is recommended to use a stepped undercut, and in order for the technical felling direction to be carried out without harming or endangering the workers' team it is recommended to use the felling wedges, the means of impulse the fall and even the winches. The braking area may be asymmetrical; the chainsaw must be of high power, with a useful blade length as large as possible.

Another question that is debatable is the height of the stump (hc). With MO 606/2008, for the maximum height of the stump, it is only foreseen that it should not exceed 1/3 of the diameter of the stump (dc), without specifying a clear limit in cm (for example 10 cm, as it was previously provided by Order 635/2002). From this point of view, for the studied felling area:

- hc ≤ 10 cm for 5% of the trees
- hc ≤ dc / 3 for 85% of the trees

Noteworthy is that for 58% of the trees the depth of the undercut was not the one recommended by the specialists, and the effects may sometimes be serious: labor accidents and/or damage of the trunk due to its longitudinal cracking.

Timber harvesting is a complex operation in the forest exploitation system. When tree harvesting takes place in extreme conditions such as: the large trees and the high slope relief, the staff involved must be well trained for such situations, and the use of specific performance chainsaws for harvesting can contribute considerably so that the share of depreciation for both biomass and usable seed is as low as possible.

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