Journal of Environmental Protection and Ecology 20, No 4, 1717–1726 (2019)

Risk assessment

ANALYSIS OF WORKING ACCIDENTS RECORDERED DURING THE HARVESTING OF TREES, BETWEEN 2013 AND 2018, FOR WORKERS OF THE NATIONAL FOREST ADMINISTRATION ROMSILVA, ROMANIA

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Abstract. Occupational health and safety is a priority for employers, especially due to the fact that, in most cases, non-compliance leads to serious health problems. Many of the forestry activities, and in particular those from logging wood, are characterised by a high degree of risk. Thus, one mistake is sufficient that can lead to less serious accidents, disability or even death. The research analyses the working accidents that occurred during the period 2013–2018 in the harvesting activities in public forests of state, managed by the National Forestry Administration. Data analysis shows that experience is not a decisive factor in avoiding injuries, and that, in large part, the deaths have been caused by the fall of dead or tensed trees. Starting from the existing data, the risk factors generating accidents at work were identified for the two categories of forest workers, respectively those who harvest the trees and those who drive the machinery. Also, it were determined the frequency of produced accidents and the seriousness of the consequences as a result of non-compliance with security measures. Thus, the aim of the study it was to find solutions to limit risk factors and to improve safety and health at work for the activities taken into consideration.

Keywords: health and security, work accidents, harvesting, fatal accidents.

AIMS AND BACKGROUND

The safety and security in work have always been a subject of interest, especially from the moment when the work process has begun to be thought more on the basis of employee qualification and on the energy recovery from one day to the next and not from one generation to the another[1]. In addition, these concerns are manifested in a lot of countries, like Australia[2], Austria[3], Indonesia[4], Italy[5], Portugal[6–8], Sweden[9], Turkey[10], and in all fields of activity, including forestry, whether we are talking about harvesting[11], logging[12], related processes (forestry constructions[13], technological transport[7]), or equipment for the development of technological processes[14]. The importance of health in work is reflected even in the concerns

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that exist to ensure a proper working environment regarding the quality of light inside the workspace[15]. In addition, there are concerns for avoiding unforeseen situations, presumed by the specificity of the activity, as in the case of metering-regulation gas stations[16].

According to Law 319/2006 (Ref. 17), a work accident represent 'the violent injury of the body, as well as the acute professional intoxication occurring during the working process or in the performance of his/her duties and causing temporary incapacity to work at least 3 calendar days, disability or death'.

Thus, the work accident represents an unpleasant, unexpected event, often unforeseen, which results in the discontinuation of normal activity within the unit, in the context of the workers presence as part of the work system[18]. At first sight, accidents can be interpreted as a result of the hazard, but at a close examination they are the result of inappropriate behaviour against risk factors, dangers, and working procedures from the work process. Work accidents occur when the labour system interacts with a dangerous material component, with at least a human error[10,18]. In order to limit the meeting of the two actions, it is necessary to adopt security measures in the workplace. Thus, the knowledge of the workplace, of the risk factors specific to the production process, and the work equipment, leads to the possibility of developing robust strategies in the field of prevention of work accidents[19].

Harvesting is a complex activity, with multiple risk of injury, reason why the evaluation of each job, taking into account the profession specific, is both a legal obligation and an effective prevention tool. In addition, in the literature[11,19,20] it is mentioned that forestry activities lead to many fatal accidents, characterised by a frequency similar to those in the mining or construction industry, which is why in some countries (Finland and the US) the forestry sector is considered one of the most risky and dangerous[10]. Another author[6] considers the forestry sector to be the third most dangerous in European countries. For example, in U.K. (Ref. 6), the highest rates of fatal or major injuries/fatalities occur in the agricultural and forestry sectors, major accidents being considered those that requiring more than 24 h of hospitalisation.

So, the aim of the research is to find solutions to limit risk factors influence and to improve safety and health at work for the activities under review, respectively harvesting and logging wood. The importance of the goal lies in the fact that a careful examination of the risk of accidents and the development of accident prevention strategies has become increasingly important[10], especially since, for some employers, maintaining safety at work is in conflict with labour productivity, reason why often they deliberately choosing to take risks[5].

EXPERIMENTAL

The National Forest Administration – Romsilva administers the state forests, almost 3.2 million ha, and for other 134 993 ha of private forests it has concluded contracts for administration or for provision forestry services. Between 2013 to 2018 Romsilva has harvested and logged an average volume of 1665.48 thousand m^3/year, with their own employees. The exploitation teams have the skilled workers for this activity, respectively the chain-saw operator for the harvesting process (at felling, limbing and bucking) and the drivers/mechanics for the logging process.

The analysis was based on the data from 2013 to 2018, recorded in the work accidents reports from the National Forest Administration – Romsilva, for the two professional categories involved in the process of forest exploitation. The centralisation of data led to 59 work accidents, from which the chain-saw operators were involved in 52 work accidents and the drivers in 7 work events.

The analysed data include the identified risk factors, the severity of the consequences for the forestry worker (incapacity for work, invalidity, death) and the probability of their occurrence. This information provides the possibility to calculate the level of risk for each job and to establishment the security measures. The method of evaluation of the jobs developed by INCDPM Bucharest provides the assignment of each risk factor in a partial risk level, depending on the severity-probability couple. Depending on the likelihood of consequences, work accidents can be divided into six frequency classes and, depending on their severity, 7 grades of severity occur[18,21]. By combining those two indicators, it can be establish a level of risk for each activity profile.

On the basis of the INCPDM method, it is possible to calculate a global risk level. Because in the article were taken into account only the risk factors that have led to the occurrence of accidents, no real risk can be established (based only on of these factors), since the method has a predefined list of risk factors (occupational diseases, workplaces types, environmental factors, noise, vibrations, etc.), all provided by Law 319/2006 (Ref. 15) and regulated by the legislation subsequent.

RESULTS AND DISCUSSION

The research concerned work-related accidents, separately for harvesting and logging wood. In addition, to separate the implications in safety and security at work, for each technological process were analysed the risk factors that can lead to accidents. They belong to the following components of the work system: the performer, the work task, the working environment and the means of production – for the harvesting process, respectively the performer and the means of production for logging.

Concerning the produced accidents, it is found that the harvesting activity is more dangerous than the logging, since at the harvesting there were 52 accidents,

and only 7 at logging, both of them being reported at the same volume, which averaged 1665.48 thousand m^3/year. This could be translated into a frequency of 1.17 accidents/year and 0.0007 accidents/year/thousand m^3 for logging (drivers) and by 8.67 accidents/year and 0.005 accidents/year/thousand m^3 for harvesting process (chain-saw operators). A significant difference between those two occupational categories also appears in other studies[11], which states that the number of harvesting accidents is 4 times higher than that from logging process, both in Louisiana, and in Sweden. In addition, it is mentioned that with the increase in the level of mechanisation in forestry operations, the risk of accidents reduced and is registered a lower frequency of accidents[20].

Of the total number of work accidents, the highest share is encountered in trees harvesting (in 2018, 68% of the work accidents have occurred on this profile of activity). Causes that have led to accidents have been recorded in the research reports, and are often due to the action of several risk factors that have not been respected in the working process. Thus, at harvesting, there were recorded 52 accidents that were due to the cumulative action of 19 risk factors, which led to 65 injuries situations. At logging, there were 7 accidents produced based on 8 risk factors. For both professional categories, it can be noticed that work accidents are due to the combined action of at least two risk factors, maybe even three or four. Although in the present research the work accidents are analysed for two professional categories (chain-saw operators and drivers), the importance of harvesting sector is well highlighted also in other study[20], where is mentioned that in harvesting, and especially in the phase of tree felling, are produced a lot of accidents (Nigeria – 83%, New Zealand – 54.8%, Turkey – 41.2%).

Analysing the components of the work system that may arise for the two production processes and the number of related risk factors (Fig. 1), it can be seen that in both cases, the performer is the one who, through his actions, leads to failure the health and safety work measures, finally leading to accidents. Thus, 82% of the risk factors that led to the occurrence of accidents at logging are due to the driver, that is to say, the performer, while at harvesting is meet the same component of the work system, only that the accidents occurrence depends only 69% to the performer.

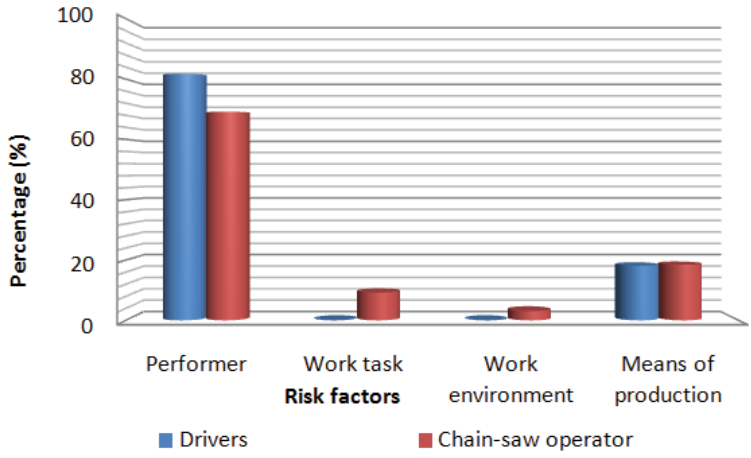

Fig. 1. Components of the working system in relation to accident-generating risk factors

In the case of drivers, an important number from the occurred accidents involves a loss of working capacity for a period of 3 to 45 days or 45 to 180 days, respectively 28 and 29% of them (Fig. 2). Also noteworthy is the fact that two deaths occur as a result of non-observance of health and safety measures, which means that for drivers, employees of the National Forest Administration – Romsilva, 28% of the accidents is soldier with the death of the performer (during the investigated period). In addition, it should be mentioned that these accidents occur as a result of the concurrent action of 8 risk factors, 6 of them belong to the performer as part of the work system, and other two depend on means of production, inappropriately used.

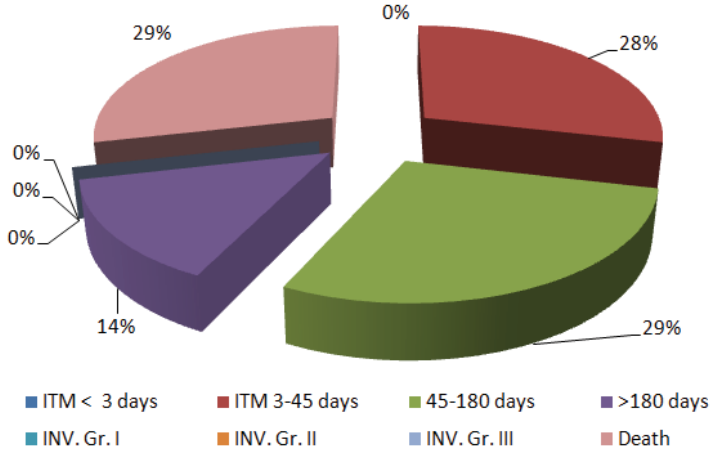

Fig. 2. Gravity of consequences for drivers (machine operators)

In some studies[11], it is considered that the maintenance and repair of the equipment and machines is leading to the most accidents from logging process.

It is also found that the performer is the one who can lead to accidents involving temporary work incapacity (ITM) for a period of 3 to 45 days or longer, of more than 180 days. There are no breaks of activity shorter than 3 days and there are no accidents leading to disability.

Regarding the means of production, it is found that a worker/driver dies due to inappropriate design of the collection routes (too high slope, inappropriate profile, lack of lateral protection in risk areas), but this component of the work system is closely related to the performer, because his actions are in fact those which, in conjunction with the means of production, lead to this fatal situation.

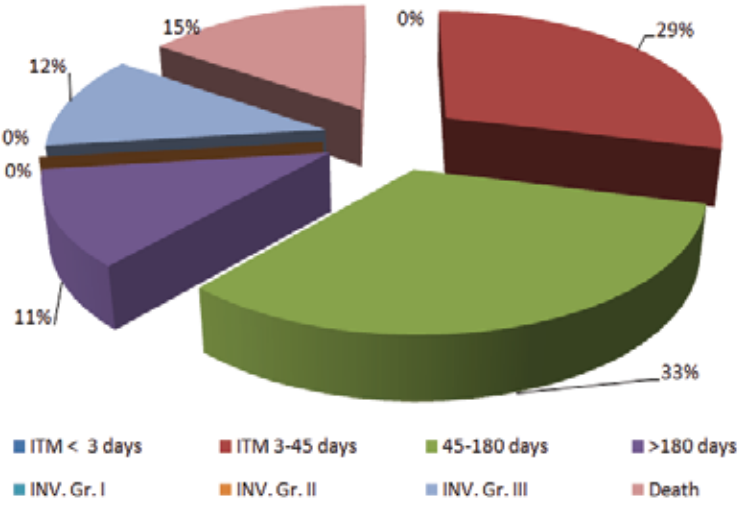

Fig. 3. Gravity of consequences for chain-saw operators

Concerning the risk factors and the severity of consequences for the chain-saw operators, it is observed that there are no situations that impose the temporary work incapacity for less than 3 days, grade I and II invalidity (Fig. 3). All the consequences of non-observance of the working protection measures leaded to temporary work incapacity of 3–45 days (29%), 45–180 days (33%), more than 180 days (11%), to grade III disability (12%) and death (15%).

According to Albizu-Urionabarrenetxea and his collaborators[11] in the tree harvesting from Germany and New Zealand are often reported injuries at feet (53%).

It is worth mentioning the importance of the performer actions in maintaining a safe working environment, because the combination of the 11 risk factors corresponding to this component of the work system led to the emergence of 45 critical situations, which represent an important share (70%) of the total number of cases that led to accidents (65 cases/actions for this activity profile).

Concerning the work task, by the two specific risk factors, it can be said that it influences the number of accidents only in a low proportion (9%, of course, the claim based on the available data). The accidents occurred either from a poor organisation of the phases of limbing or bucking, or from carrying out some tasks not specific to the job post, but always combined with other components of the work system. These activities lead to temporary work incapacity of 3 to 45 days, 45–180 days or more than 180 days.

The work environment has a lesser influence on the direct production of accidents, but it is more important to monitor the implications for the human body over a longer period of time. The assertion is based on the fact that the risk of accidents from this point of view refers, on the one hand, to the direct contact that workers can have with wild animals, insects, bacteria, fungi and snakes, and on the other hand, at the fact that the body is subject to the influence of noise, vibrations and climatic peculiarities of the work environment[20]. In the analysed situation, the working environment, in conjunction with other risk factors, leads to the occurrence of two instances of injury, resulting in temporary work incapacity of 3–45 days. However, the work environment is considered in other studies[6,9,10] as a possible risk factor for forestry workers as it involves very varied working conditions that can be additional stressors on the human body[20], already required by work.

The means of production contribute to work-related accidents in proportion of 18%. Thus, means of productions in conjunction with other risk factors could lead to temporary work incapacity of 3 to 45 days or 45–180 days. This combined action of the risk factors corresponding to the means of production and those specific to other components (executor, work load or work environment) leads to the registration of a third degree disability case and a death.

If the data are centralised on phases of the harvesting process (Fig. 4), it can be noted that 40% of the accidents occur as a result of the activities related to the harvesting process but not specific to it, followed by those from felling (31%), bucking (15%) and limbing (14%). In Sweden[9,11], it is considered that fatal accidents in harvesting are due to head blows caused by falling trees or falling some part of them.

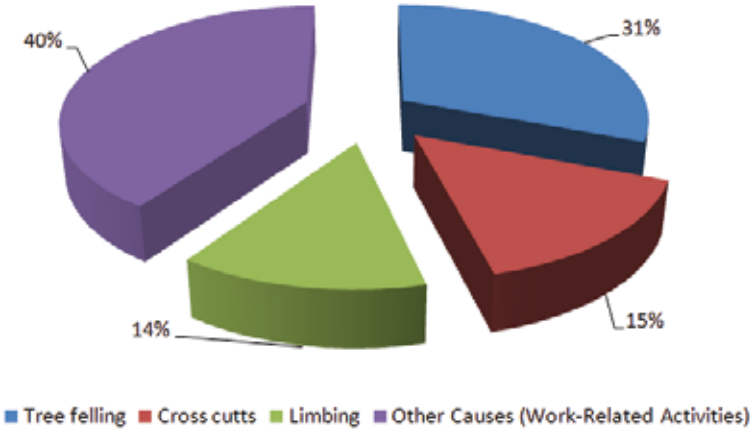

Fig. 4. Proportion of accidents according to the phases of the harvesting process

Based on all of the above and on the risk factors identified as a result of the centralisation of data from the work accidents, a number of measures have been established to reduce the number of accidents produced. In this respect, for the two professional categories considered, it is recommended:

- employing the persons who are with a suitable qualification, specific to the job concerned, with an appropriate number of training hours, and having a thorough training for the activity profile, both theoretical and practical;
- to keep discipline at work and to comply with the specific rules from its own instructions;
- protective equipment must be available and worn throughout the working hours;
- each employee should have a risk identification sheet, individual and customised for the job he/she occupies, to make him/her more accountable and to make him/her aware of the danger at which he/she is exposed if the specific prevention and protection measures are not respected;
- the conduct of the work process to be conditioned upon compliance with minimum health and safety requirements at work, e.g. wearing protective equipment and observing the working technology.

CONCLUSIONS

The risk factors and recommended measures to minimise the number of accidents are valid only for the two categories of occupation considered, namely chain-saw operator (in harvesting) and drivers (in logging process), who have a range of tasks, specific to the activity profile.

The work carried out by chain-saw operator and the specificity of the production process implied a greater number of risk factors that can lead to accidents. In

most cases, the accidents occur as a result of the cumulative action of several risk factors (7 accidents to logging, generated by 8 combined risk factors, respectively 52 accidents at harvesting as a result of the action corroborated of 19 risk factors).

For both jobs, chain-saw operators and drivers, the main risk factors in accidents occurrence are related to the inappropriate actions of the performer. At harvesting, the means of production, through the quantified risk factors, show a considerable increase in the level of risk.

Concerning the severity of the consequences, it is noted that the accidents produced always require more than three days of interruption of the working process, most of them over 45 days (over 30%).

In terms of invalidity, it is noted that there are not encountered first degree and second degree disabilities at chain-saw operators, while the drivers do not experience such situations.

Activities related to wood harvesting and logging are very dangerous, because often have serious consequences for workers, many of them ending in death. In other words, work accidents that may occur in forestry operations may be due to poor professional training, lack of experience, occupational diseases, and of course to the working equipment.

Acknowledgements. This research was supported by the Transylvania University Scholarship Program in Brasov (2017), through which has set a collaboration the Univerita Degli Studi di Padova (Italy), Territorio di Agro-Forestali Territorio. The authors acknowledge the full support of the aforementioned institutions and also of Mr. Professor Stefano Grigolato. We are grateful to the National Forest Administration – Romsilva for providing data on work-related accidents for the period 2013–2018.

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Received 10 October 2019
Revised 15 November 2019