

Analysis of injuries in chainsaw operations in Slovak forest sector

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The paper presents injury analysis in chainsaw operations in Slovak forest sector. In the beginning of this study some basic facts (forest area, timber felling and workforce) are presented to provide some basic information. Then the state of officially kept databases about occupational injuries is observed. Analyse on injuries were prepared from available data, which could have been considered as reliable – the analysis shows structure of accidents in chainsaw operations. On the end of the study socially economical aspects and training (which affect health and safety in chainsaw operations) are described.

Background

Forest area in Slovakia

There are three different forest cover estimates available in Slovakia.

The first, given at $44.3 \pm 0.4\%$ what represents 2.17 million hectares ($\pm 1\%$) (21,700 km²), is based on the forest inventory data (National Forest Inventory and Monitoring 2005 - 2006).

The second estimate is derived from the area of forest holdings and at 40.9% (c. 2 million hectares).

The third is derived from the recorded area of forest crop land and at 39.4% (c. 1.93 million hectares)

(Green report 2009)

Timber felling and harvesting technologies

During the observed period 2000 – 2009, annual felling varied between 6.2 million m³ (in 2000, 2001 and 2002) to 10.2 million m³ (in 2005). The climax of annual felling in 2005 was caused by large wind-throw area from the end of 2004.

The total volume of timber felled in 2008 reached 9 467 100 m³. (Green reports 2002 – 2009).

The most widely used harvesting technology is felling with chainsaws. Harvesters are used only on minor harvesting area. Usage of harvesters is limited because of terrain conditions (most of the Slovak forests grow on more or less steep slopes) and socially economical aspects. Human work-force is significantly lower in Eastern European countries than in Western ones, while price of harvesters is the same. Expensive harvesters and cheaper human workforce give chainsaw technology an advantage over usage of harvesters. The harvesters are used preferably in wind-throw areas if the terrain is acceptable for this technology.

Work force in Slovak forest sector

Since January 1, 2008 come to the force new statistical classification of economical activities (SK NACE Rev. 2), prepared on the basis of common statistical classification of economical activities in European Community - NACE Revision 2:

- 02 Division Forestry and logging
- 02.2 Logging

Reorganisations in forest sector in Slovakia shifted the most of production operations to external environment. It meant decreasing number of own employees – mainly forest workers, who became self-employed contractors (see Table 1). This reorganisation started slowly in '90s and continued steady after 2000. However, the biggest changes in state organizations happened after 2000. Nowadays, chainsaw logging is undertaken mostly by self-employed contractors. This fact is important because of problems in evidence of injuries happened to self-employed contractors, who are the major group of chain-saw operators (described bellow)

Table 1: Decrease in number of employees in Forests of the Slovak Republic (state enterprise) which administrates approximately a half of Slovak forest area.

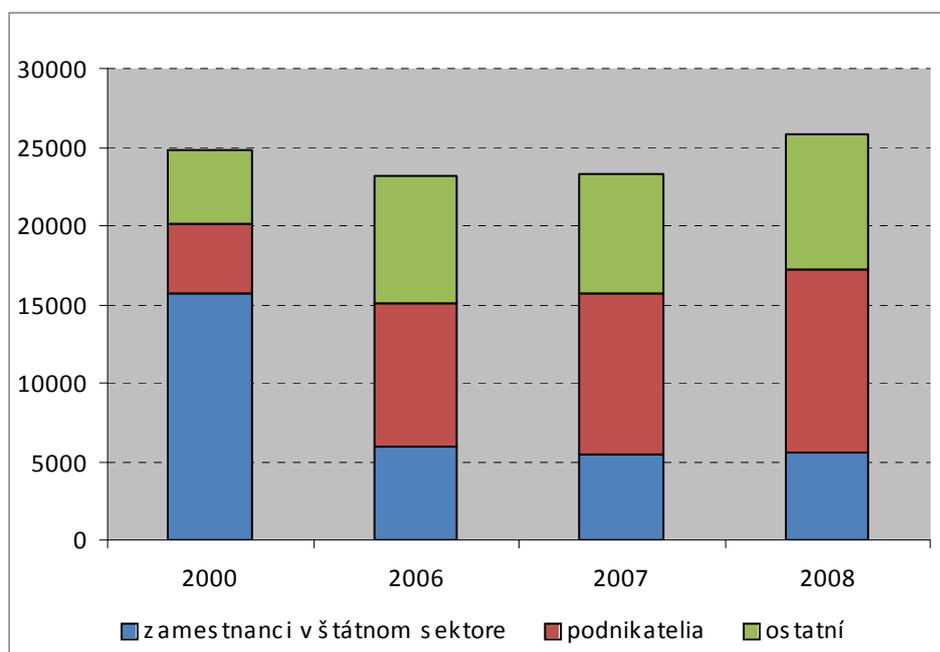
	2000	2005	2006	2007
Managerial, administrative staff and foresters	3,739	2,765	2,797	2,704
Forest workers	9,318	1,901	1,881	1,525

Source: Questionnaire of Ministry of Agriculture of the Slovak Republic, 2008 in Green report 2008

According to the Companies Registry (held by Statistical Institute of the Slovak Republic), there were 15,399 bodies active in NACE 02 – Forestry and logging in 2008. 10,513 of them were registered as self-employed contractors.

In 2009, there were 11,100 bodies all together, and 8,500 of them were active self-employed. Other 800 natural persons are so called “Individually entrepreneuring farmers” (which is kind of self-employed farmers).

According to the statistical analysis of the work-force carried out by Statistical Institute of the Slovak Republic, there were about 25.8 thousands people working in Division 02 “Forestry and logging” (SK NACE Rev.2 02) in 2008 (see Picture 1). According to the most recent data, there was a decrease in 2009 - approximately 19.7 thousands people working in Forestry and logging.



Picture 1: Work-force in forestry and logging

Note: Category “others” includes employees of private (non-state) forest companies and employees of companies which provide services in forestry.

Source: Statistical Institute of the Slovak Republic

Injuries in Slovak forest sector

State of available data

Data about occupational health and safety (recordings about injuries and illnesses) are collected by National Labour Inspectorate (NLI), Institute of Public Health (IPH), and some evidence is held by Forests of the Slovak Republic (state enterprise). The most comprehensive database is that one held by National Labour Inspectorate, however even its statistics are incomplete and in inappropriate structure.

- Incompleteness

Incompleteness of the data is caused by the fact that the Institute has not collected data about injuries of self-employed contractors (who are the major part of forest workers) since second half of 2006. Moreover, even data on injuries of self-employed workers until 2006, are poor and represent just a small part of the actual accidents (problems how to gain data from huge number of unorganized self-employed contractors).

Furthermore, there are about 100.000 of forest owners (shareholders in cooperatives and owners of private forests) in Slovakia. A part of them work in their forests (at least occasionally). However, their potential injuries are not considered as occupational, and there are no recordings about them.

Above mentioned facts cause incomplete data in statistics (data about employees only) and significantly decrease number of recorded injuries of all forest workers. Taking into account the fact that self-employed contractors are the major group of chainsaw operators, it is impossible to gain exact data on number of the injuries from official sources.

- Inappropriate structure

Inappropriate structure of the databases is due to the fact that the accidents are recorded and sorted not by actual activity during which the injury occurred, but by economical activities of the companies. E.g. if an accident was happened in a company which has “Forestry” (code 02) or “Timber harvest” (code 02.2) registered among its activities in the Companies Registry, the recordings on the accidents come to the group of “Forestry” or “Timber harvest”, regardless of the actual activity of the injured employee. Then, if the company runs the business not only in “Forestry”, but also in other sectors (e.g. agriculture), all accidents happened in the company are recorded in “Forestry” or “Timber harvest” although they could be happened during non-forestry activities.

This fact causes that injuries happened in other economical activities may be recorded in the group of “forestry” (code 02) or its subgroup “timber harvest” (code 02.2). And vice versa, if the company is registered only with “Forestry” activities (without specification to “timber harvest”), the chainsaw accidents are not included in “timber harvest” group – only in “Forestry”.

Despite of the above mentioned facts about incompleteness and inappropriate structure of the databases, these data are basis for official statistics presented in annual reports of Slovak forest sector (Green reports) and make basis for reporting for MCPFE purposes. These sources say about incompleteness of the statistics too (lack of evidence about self-employed contractors).

Trend of occupational safety (number of injuries – see table 2) is in line with reorganisations in forest sector – shifting production operations to external environment (self-employed contractors). Decrease in occupational injuries is more or less corresponding

decrease in number of own employees on positions of forest workers – the most dangerous jobs in forest sector (see table 1).

Table 2: Occupational accidents according database of National Labour Inspectorate – Division 02 – Forestry and logging

Year	Work-force category	Occupational injuries Total	Injuries					
			Fatal		Serious		Other	
			Male staff	Female staff	Male staff	Female staff	Male staff	Female staff
2000	Own employees	612	2	0	3	1	534	72
	Contractors (self-employed)	2	1	0		0	1	0
2001	Own employees	571	7	0	7	0	512	45
	Contractors (self-employed)	8	3	0	3	0	1	1
2002	Own employees	507	1	0	10	0	451	45
	Contractors (self-employed)	3	2	0	1	0	0	0
2003	Own employees	382	4	2	7	1	318	50
	Contractors (self-employed)	2	2	0	0	0	0	0
2004	Own employees	206	1	0	5	0	178	22
	Contractors (self-employed)	5	3	0	2	0	0	0
2005	Own employees	176	1	0	7	0	146	22
	Contractors (self-employed)	3	2	0	1	0	1	0
2006	Own employees	137	8	0	16	0	95	18
	Contractors (self-employed)	0	0	0	0	0	0	0
2007	Own employees	121	4	0	29	2	70	16
2008	Own employees	122	2	0	5	0	99	16
2009	Own employees	87	0	0	3	0	74	10

Source: National Labour Inspectorate

Table 3: Forests of the Slovak Republic (state enterprise) keep evidence on fatal and serious accidents of they contractors – self-employed workers, and fatal and serious accidents of people who are preparing fire-wood for they wood supply (wood residues after logging or wood from cleaning operations) on area administrated by the state enterprise.

The state enterprise administrates only a half of the Slovak forest area (52 % in 2000, 47 % in 2009), but the numbers of serious and fatal injuries are higher than all injuries of self-employed contractors in the table 2 (data for whole Slovak forest area). These differences show incompleteness of official statistics on injuries of self-employed contractors.

	2002	2003	2004	2005	2006	2007	2008	2009
serious health damage	0	7	3	5	4	15	7	8
fatal injuries	1	4	1	11	6	5	10	2

Source: Forests of the Slovak Republic, Green reports

Another view at occupational injuries in Slovak forest sector could be provided by relative numbers shown in table 4.

Table 4: Number of occupational injuries per 1000 employees in forest sector

Year					
2000	2001	2002	2003	2004	2005
3.49	3.36	3.54	2.94	1.97	1.82

Source: Labour union Forest-Timber-Water, Statistical Institute

Forest sector belongs among sectors with high risk to human health and safety of the workers. This fact is caused by nature of the forestry operations, climatic conditions, terrain, and mechanisms. The most hazardous operations are felling, timber extraction, and timber transport. National average for the Slovak republic varies from 0.96 up to 1.07 injuries per 100 employees. (Green reports 2002-2009). However, even these indicators shown in table 4 are influenced by shifting production operations to external environment (self-employed contractors) and therefore decreasing number of own employees in the most dangerous job positions. This fact results in decreasing number of occupational injuries per 100 employees, and increasing number of injuries in category of the self-employed contractors (which are not coming to the statistics). Therefore, the most reliable data in the table 4 are those for 2000, when there was the smallest share of external contractors in observed period 2000-2009 (see picture 1).

Moreover, the relative numbers are calculated using the data about whole forest sector. The indicators shown in table 4 would be even higher if the statistics are prepared using data about forest workers only (relative numbers shown in table 4 decreased by high number of managers, administrative staff, and foresters, who do not work in such hazardous jobs as forest workers)

Injuries in chain saw operations

Due to heterogeneity of the accident recordings and too general information that are provided in the official databases, would be very difficult (or impossible) to extract injuries of chainsaw operators out of all injuries in forest sector.

We have extracted injuries happened in chainsaw operations out of accidents in “Logging” subdivision (code 02.2) for years 2000 – 2009 (Data provided by National Labour Inspectorate) – these figures are shown in table 5. We have identified the accidents in chainsaw operations on the basis of accident descriptions (see annex 1).

However, we do not consider these figures as reliable due to following reasons:

- the database includes mainly data on accidents of employees (incomplete evidence on injuries of self-employed contractors) – see chapter State of recordings - incompleteness
- some accidents of chain-saw operators are probably registered only in “superior” division “Forestry and logging” (code 02), and did not come to its inspected subdivision 02.2 – “Logging” – due to reasons described above in Chapter State of recordings – inappropriate structure

Table 5: Number of injuries happened in chainsaw operations extracted from accidents in “Logging” (subdivision 02.2). However, we do not consider this numbers as reliable due to above mentioned reasons – incompleteness (missing data on self-employed) and inappropriate structure of the databases. Actual numbers of the accidents can be significantly higher – see next table – database of serious and fatal injuries held by Forests of the Slovak Republic.

Total number of accidents in “Logging” subdivision for 2000-2009 was 454, but chainsaw operations in this subdivision contained only 113 injuries for the same period due to inappropriate structure – some of accidents in non-forestry activities come also to “Logging” subdivision.

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
registered and other reported injuries*	21	18	19	12	8	11	6	4		4
serious health damage			2		1		1		1	2
fatal accidents	1			1		1				

Source: National Labour inspectorate

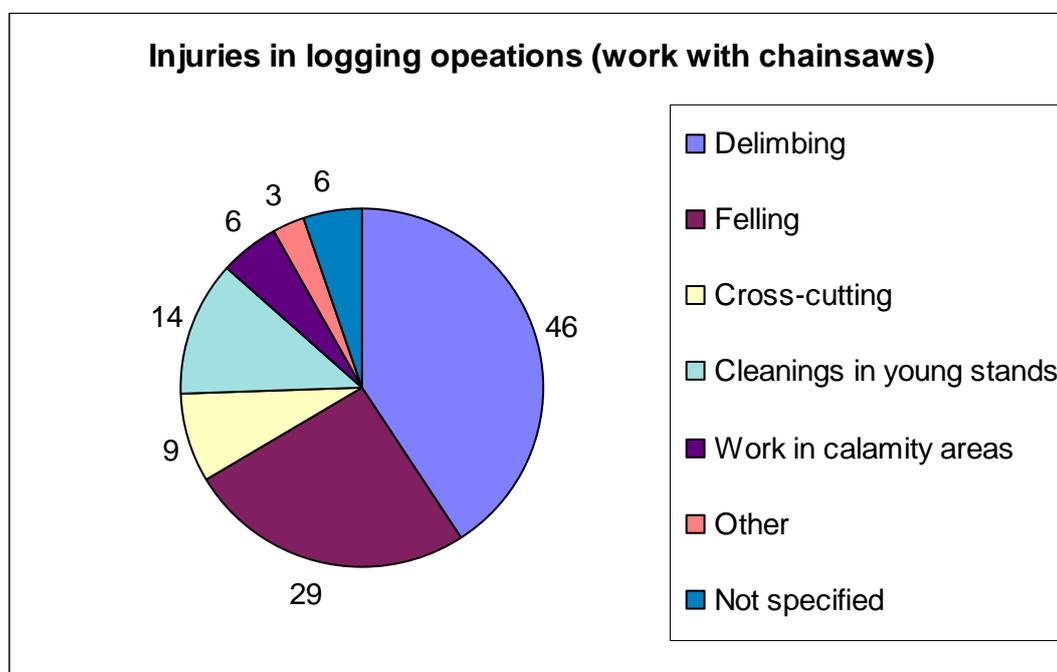
* registered injury – injury, which requires 3 or more days of sick-leave

Table 6: Forests of the Slovak Republic (state enterprise) keep evidence on fatal and serious accidents of they contractors – self-employed workers, and fatal and serious accidents of people who are preparing fire-wood for they wood supply (wood residues after logging or wood from cleaning operations) on area administrated by the state enterprise.

These data could help create an approximate imagination on actual number of lethal and serious injuries in chain-saw operators. Of course these numbers contain accidents not only for chain-saw operations but also for timber extraction, timber transport etc. However, on the other hand the state enterprise administrates only a half of the Slovak forest area (52 % in 2000, 47 % in 2009).

	2002	2003	2004	2005	2006	2007	2008	2009
serious health damage	0	7	3	5	4	15	7	8
fatal injuries	1	4	1	11	6	5	10	2

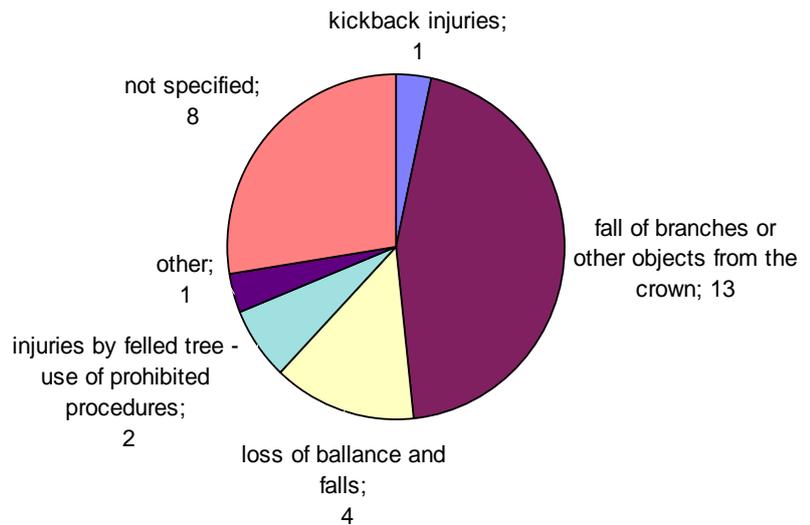
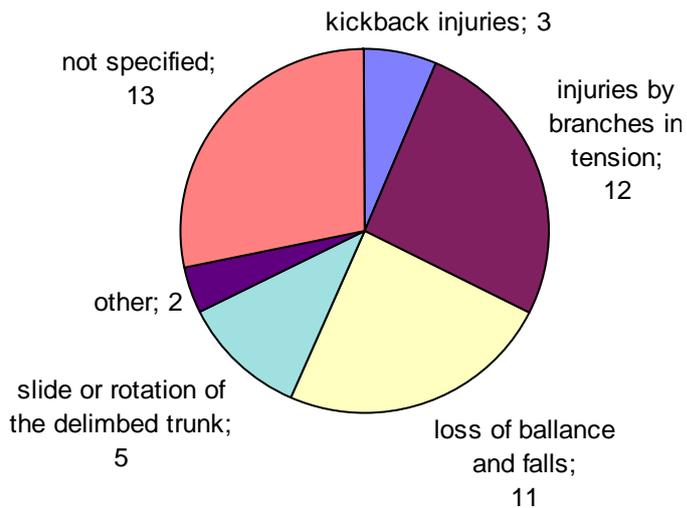
Despite the fact that these official databases cannot provide reliable data on number of accidents due to its incompleteness, they may provide interesting view into inner structure of the injuries in chain-saw operations (picture 2)



Picture 2: Number of accidents during various chainsaw operations. Total number of observed accidents is 113

Most of the accidents in chain-saw operations occurred during delimiting. However, according these data, the accidents happened during felling were more serious (see annex 1). Basically, all fatal injuries were happened during felling operations.

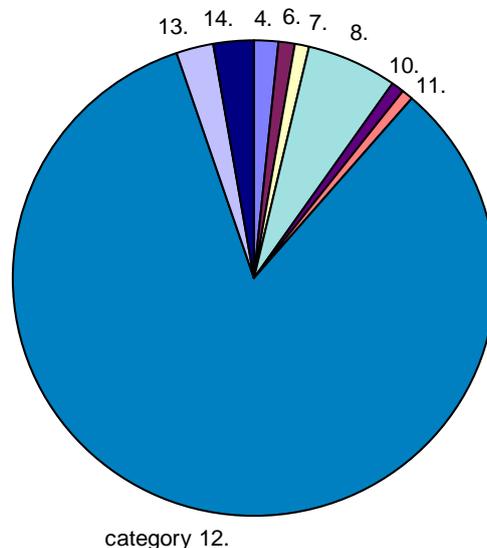
On the basis of brief accident descriptions we have tried to identify causes of the accidents (see annex 1). For two kind of operations (delimiting and felling) see the graphs bellow (pictures 3 and 4)



Picture 3 (left one): Causes of accidents during delimiting identified on basis of injury description. Total number of observed accidents during delimiting was 46.

Picture 4 (right one): Causes of accidents during felling identified on basis of injury description. Total number of observed accidents during felling was 29.

Moreover, the database has own classification of the accident reasons. According this classification, 83 % of all accidents are due to lack of personal competences for proper work procedures (category 12 – see picture 5)



Picture 5: the database (see annex 1) provide also “official” reasons of injuries (codes of reasons are listed bellow). Lack of personal requirements for proper work procedures is the most common reason of the injuries (94 out of 113). However, an accident may be caused by more combined reasons (not only by single reason) – reliability of such straightforward identification of reasons could be therefore questionable, and influenced by subjective information given by injured worker or his co-workers.

Codes of the reasons:

4. Bad state or wrong disposition of a workplace or road
6. Inappropriate work organisation
7. Lack of information on safe work practices and lack of qualification (theoretical knowledge, skills, practical training, etc.)

8. *Use of dangerous practices or work procedures including activities beyond competences; against instructions or prohibitions; going into prohibited area*
10. *Not using (or using in wrong way) personal protective equipment*
11. *Endangering by other persons*
12. *Lack of personal competences for proper work procedures (physical requirements, malfunctions of sense perception, bad personal characteristics, momentary psycho-physiological affections, etc)*
13. *Endangering by animals and natural risks*
14. *Unknown reasons*

The database (annex 1 and 2) has also own classification of “sources” of the injuries – however these “sources” are defined too generally and therefore do not provide any valuable information.

Occupational illnesses

Use of chainsaws is linked with health problems caused by vibrations. Wrong work habits may increase the risk of health damage. Official statistics provide information on newly diagnosed illnesses each year. The official statistics indicate from 37 (2000) to 14 (2006) newly diagnosed vasoneurosis occurrences each year. These data are of course influenced in the same way as injuries – incomplete information about self-employed chain-saw operators. So, the most reliable data for the period of 2000-2009 come from 2000 when there was the lower number of chainsaw operators working as self-employed.

Chainsaw training and socially-economic aspects

Skills and competences of chainsaw operators significantly affect health and safety in chainsaw operations. However there is high variability in quality of chainsaw operators in forestry practice.

Nowadays there are six “apprenticeship” schools in Slovakia, which provide training for teenagers – future forest workers – forest machinery operators. These training courses take from 2 up to 4 years (initial vocational training). The successful leavers of these courses are well trained chainsaw operators and usually they have excellent qualifications to become leaders of forest-workers groups.

A big part of chainsaw operators are people who have been trained in short courses for chain-saw operators. These short courses should provide a trainee with theoretical knowledge on structure, maintenance and work with a chainsaw as well as provide him with practical skills to enable him to perform safe work with a chainsaw. In the past, these courses were separated to two parts: (i) maintenance, cross-cutting and felling trees up to 15 cm in diameter, and (ii) felling trees without limitation. Current legislation, defines requirements for training for (i) chainsaw operators in logging and for (ii) chainsaw operators in other sectors. The problem of this system is that due to changes in legislation we lost control and evidence of training providers (basically everyone who had required years of practice and took a course for lecturers could have become a chainsaw trainer). Because of the current state (no control of training providers) quality of these sort courses cannot be assured.

However, the legislation requires a certificate for work with a chainsaw (and regular revisions, too) there are chainsaw operators, who are not certified or who have not undergone the obligatory certificate revision. If forest companies contract group of forest workers they

usually make an agreement just with a leader of the workgroup. The leader subcontracts other workers and control of these subcontracted workers is quite questionable.

Self-employed people in rural areas, where is lack of work opportunities, could therefore apply for work in forestry even without qualification, or with very poor training. These workers could gain wrong work habits or work without sufficient knowledge about safe chainsaw procedures. Then the naturally high risk of chainsaw operations could be even increased.

Conclusion

The analysis shows incompleteness of injury databases for whole forest sector. However, these figures are used for preparation of national statistics (Green reports) as well as reporting for MCPFE issues (Ministerial Conference on the Protection of Forests in Europe - Improved Pan-European Indicators for Sustainable Forest Management), because these data are only available data at national level.

Similarly, because of inappropriate structure of official databases, there is a problem how to separate “chainsaw injuries” out of the overall forestry statistics. Moreover, the most of chainsaw injuries do not come into the statistics due to missing reports on injuries of self-employed contractors (major group of chain-saw operators). Therefore the actual number of injuries in chainsaw operations is several times higher than the figures identified from the official sources.

However any figures or statistics cannot represent either human aspects of the tragedies or economical aspects and increased costs for health care. We analysed the data which we considered as reliable (those with description of the accident). The inner structure of the injuries (picture 2) shows that most of accidents is happened during delimiting, and the second most risky operation is felling. However, the accidents happened during felling were more serious. Basically, all fatal injuries were happened during felling operations (within the observed data set). Chainsaw operations in young stands – cleanings, and cross-cutting have got third and fourth position respectively.

Most of injuries in delimiting were caused by (i) branches in tension and (ii) loss of balance and falls (picture 3). Most of injuries in felling were caused by (i) falls of branches or other objects from the tree crown and (ii) loss of balance and falls (picture 3).

More detailed analysis probably would not be reliable due to small data set of analysed injuries.

Competency level (skills and knowledge) of chainsaw operators is very diverse in Slovak conditions. There are perfectly trained apprentices as well as chainsaw operators with no or very poor training, who can get into use dangerous work procedures. Disobedience to health and safety procedures can significantly increase probability of an accident and even increase high risk of the chainsaw operations. One of the facts, which cause this situation, is missing quality assurance system in certification process (chainsaw operator certificates gained in short training courses and revisions of the certificates). Therefore, application of a new certification with good quality assurance system (for short chainsaw courses) could significantly increase competency level of chainsaw operators.

References and sources of information

1. Green reports 2001 – 2010 – annual reports of Slovak forests sector
<http://www.land.gov.sk/sk/index.php?navID=123>
2. Annual reports of Forests of the Slovak Republic, state enterprise
<http://www.lesy.sk>
3. Databases of National Labour Inspectorate
<http://www.nip.sk/en/>