

CASE STUDIES TO ILLUSTRATE THE RISKS AND ACCIDENTS ASSOCIATED WITH FELLING IN URBAN AREAS

Renáta Zákányiné Mészáros 

senior research fellow, University of Miskolc, Research Institute of Applied Earth Sciences,
Chamber of Engineers of Borsod-Abaúj-Zemplén County Work Safety Group Chairman
3515 Miskolc, Miskolc-Egyetemváros, e-mail: afkzmr@uni-miskolc.hu

Attila Bereczky 

Sole proprietorship
3717 Alsódobsza, Rákóczi street 69. e-mail: bereczky78@gmail.com

Balázs Zákányi 

associate professor, University of Miskolc
Faculty of Earth and Sciences, Institute of Environmental Management
3515 Miskolc, Miskolc-Egyetemváros, e-mail: hgzb@uni-miskolc.hu

Abstract

About 4 decades ago, logging in populated areas was still an unknown concept, and tree care was a concept almost a decade old. It was simply felling or cutting back trees by competent or incompetent professionals, sometimes causing damage and accidents. The current legal regulations will be presented, followed by the commonly used and specific personal protective equipment. This will be followed by a series of case studies to illustrate the dangers of felling trees in populated areas. How these accidents could have been prevented and avoided will be described. The cases range from 1977 to the present day. The incidents that occurred were evaluated using statistical methods. This can be a great help for future proposals to amend the Forest Safety Regulations (Decree 15/1989 (8.X.)).

Keywords: urban area, tree felling, accidents

1. Introduction

Since ancient times, people have been taking care of trees, and tree-loving has been a part of religious cultures, in various Eastern cultures and in the beliefs of pagan Hungarians. Until the end of the 13th century, when the settlement system in Hungary was consolidated, forests were an obstacle to agriculture and settlement, and were therefore largely destroyed. The common forests became royal forest estates, and separate forest ispancies were organised to govern them. In later centuries, the royal forest estates were largely transferred to private landowners through donations. The first documentary evidence of forestry in Hungary comes from 1262, from the Csallóköz, and mentions forests grown from seed. The expansion of agriculture and the boom in mining and metallurgy led to the widespread destruction of forests towards the end of the Middle Ages. The Forest Order of 1769 imposed severe restrictions on free forest management. Act LVII of 1791, the first real forest law, provided for the compulsory protection of forests, while Act XX of 1807 provided for the afforestation of quicksand. In the second half of the 19th century, the economic importance of forests increased dramatically with the boom in

urban development and the development of modern transport networks. The correct principles of the 1935 Forest Act could no longer be enforced because of the war. The possibility of truly public interest forestry was brought about by Act VI of 1945, which nationalized forests (Kolossváry, 1975).

By this time, the field of wood care was well established in the United States of America and had been established by the late 1800s. The expansion of urbanization had exposed trees to new stresses, and the adverse consequences were already becoming apparent. Unfortunately, at that time scientific knowledge of the dysfunctions in plant organisms was still scarce and the reliable information available on plant protection was also scarce. In 1901, John Davey, founder of the Davey Tree Expert Company, wrote *The Tree Doctor*, in the introduction to which Mr. Davey writes: "The time has come when the planting, growing and breeding of trees must be studied in the context of plant life. If this is not done, misfortune will befall the inhabitants of fertile lands on a scale beyond the comprehension of the human mind." (Davey, 1907). Several conservationists throughout North America and Europe expressed similar views. The first conference for tree care professionals, called the Shade Tree Conference, was held in 1924. Businesses and individuals had been involved in tree care for some time, but the industry was unregulated, and researchers lacked the expertise to care for ornamental trees in public spaces.

As one of the most dangerous jobs in the world, logging has a large literature, even at national level. If you buy a saw, you can read in its instruction manual not only about the safe operation of the machine, but also about the different types of cuts that are taught in a chainsaw operator course (Czimer et al., 1990). The textbooks of the national forestry technician training only describe the forestry work, and do not cover the work in inhabited areas (Fibrás, 2010). The demolition of walls is much more dangerous, there is no national literature, no school, no established, written rules, each team works under different rules. There are already well-established courses abroad, especially in the USA and Germany, and there is a wider range of literature.

Wood climbing with climbing irons has been practiced for a long time by woodcutters, seed collectors and solo hunters alike. It is essential for bird protection work, and a special chapter in a book on bird of prey protection published in Hungary deals with it as tree climbing (Haraszthy, 1993). In America and Canada, there has been a tradition for decades of pole-climbing competitions, where climbing is timed, the task being to climb a 30-metre-high pole with a climbing pole and a waist belt as quickly as possible (usually 30 seconds) and ring the bell at the top (Philbrick and Philbrick, 2006).

In America, the term "tree care" was introduced in the 1930s, in order to separate the field of tree care from forestry (Web_1). Of course, there were still trees on public land that needed to be cared for, but this was usually done by forestry staff. In the Forestry Safety Regulations of the Decree 15/1989 (X. 8.) of the Ministry of Forestry, Forestry and Environment, logging in inhabited areas is already a separate concept, which discusses the safety requirements for the work in paragraphs 4.1-4.18 of the Decree (Web_2). Mountaineers also mention tree felling as a particularly special and highly dangerous work among the work activities using mountaineering techniques (Pátkai et al., 1993).

At the time the Forest Safety Code was issued, stunting was perfectly acceptable. There was an older use of a rope ladder and then a climbing iron to get up to the nest in the slimmest circles, which also spread from America, and attempts to create similar things in domestic forges, resulting in completely unique models for each landscape. Thanks to the modernization of rope technology, there are now a number of methods of climbing and transporting in the canopy that do not damage the tree at all. These methods are used when it is not possible to work from a lift basket. The technology is evolving rapidly, and it is testimony to this that an article written 15 years ago is now more of a laughing stock than a safety guide (Bereczky, 2007).

In 2010, a handful of professionals decided to take action for urban trees. The founders agreed on a set of goals and values that led to the creation of the Hungarian Tree Care Association. The aims of the association include protecting the health of trees in the urban environment, increasing the safety of people and property, and providing future support, regulation and scientific backing for related expert and tree care activities. Its main objective is to provide advice on this subject to individuals, businesses, and the public sector (Web_3).

Tree care is a young branch of horticulture and ornamental gardening, a bridge between forestry and horticulture (Web_4). It was just starting to sprout overseas when one and a half million Hungarians were staggering out (Lukács et al., 2017). The great undertaking of the Hungarian Tree Care Association, following the example of foreign countries, is to describe the craft of tree care in the form of professional guides, which can be found on the Association's website.

2. Selection of appropriate clothing and equipment, personal protective equipment

For working in the woods, there are already workwear with cut protection on the market that is lightweight and can be used in the woods, making it easy to move around in. The price is high, but it is worth the investment. When choosing clothing, it is important to choose breathable, body-safe materials. As underwear, functional underwear, underwear that regulates moisture. Mountaineering underwear is also excellent for such work as an underlayer, which is most recommended in winter. For boots, it is a requirement that they also have cut protection, over the ankle. Nose reinforcements with steel or plastic inserts should be resistant to impact and crushing and puncture. EN ISO 20345-46 requirements. Protective gloves shall be made of a close-fitting, non-slip material.

The equipment must be in perfect condition and comply with the relevant standards and legal requirements, manufacturer's instructions and inspection times must be strictly observed. Alpine equipment is an exception, as other standards apply.

Non-exhaustive list of the most essential personal protective equipment for timber harvesting.:

- safety helmet (with Y-strap, hearing protection, face shield, Plexiglas),
- body harness,
- job positioning,
- climbing iron,
- rope,
- carabiners, descender device,
- rope bag, drum bag, drum line,
- cut-resistant work trousers,
- boots,
- gloves.

Other alpine equipment, fall factor

The most important is the rope, which both protects the feller from falling and is used to lower the felled tree parts. In the latter case, it makes a difference which rope is used. In tree felling, the rope is not the same as the dynamic rope used by rock climbers. There is a very wide range of ropes to choose from, including woodworking, tree care and load ropes. Climbing ropes must comply with the European EN 892 standard or the even stricter UIAA specifications. In tree felling operations, static working ropes with a minimum diameter of 10.5 mm are required as a minimum. They usually have a load capacity of 15-34 kN. If particularly heavy logs or branches are to be retained, special work lashings with a diameter of 12-18 mm and a load capacity of 34-77 kN can be selected. When working with ropes, it is necessary

to be aware of the fall factor. In the event of a fall, the rope elongates, absorbing the energy of the fall to a greater extent the longer the section of rope that elongates. The hardness of the fall depends not only on the height of the fall but also on the length of the rope released (Winkler et al., 2011).

Fall factor = length of fall/length of rope let go. So, if the load falls 8 meters into a 5 meter rope, the fall factor is 1.6 (Figure 1).

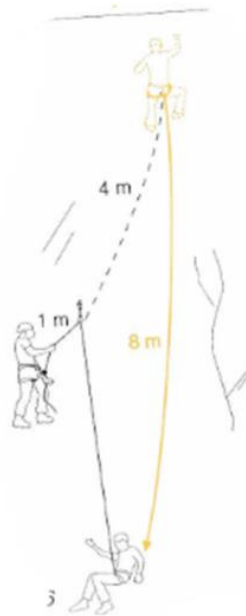


Figure 1. Fall factor 1.6

Based on the experience of more than two decades and the information gathered, it is well known in professional circles that the current Forest Safety Code on logging in populated areas is outdated, does not keep up with modern requirements and does not describe the possibilities of using modern equipment. It is currently the only legislation that a logger in an inhabited area needs to know. In my own opinion and that of my colleagues in the profession, this knowledge is very limited, and even the application of certain chapters can be dangerous.

Based on the experience gained in recent years, we make proposals for amending and reconsidering the Forest Safety Code. For the sake of clarity, the current chapters of the EWC are written in italics, our comments are written in normal, upright type, and at the end we make suggestions as to which chapters should be added to the already limited scope of the Code.

The Forest Safety Code consists of 5 chapters, the content of which is as follows:

- General requirements;
- Safety requirements for forestry work;
- Safety requirements for logging operations outside forests and other populated areas;
- Safety requirements for logging operations in residential areas;
- Safety requirements for forest timber handling and stockpiling.

Although it was written just as long ago, and the other chapters have shortcomings, in this work we only discuss the safety requirements for logging operations in inhabited areas.

3. Transfer of risks, balances - elements of duties and balances from any other balances

In the following lines, we present the accidents related to the profession outlined, describing in detail, and then how the problem could have been prevented and avoided. As far as the date is concerned, we have limited the case to the year, we do not mention names or company names, and we have given the town or, in the case of a municipality, the nearest large town as the locality. As far as the date is concerned, we consider it necessary to give at least the year of the incident because of the enormous changes that have taken place in the field of protective equipment and the working methods used in just a few years. In the original study (Bereczky, 2022), 20 studies were examined (Table 1), three of which are highlighted below due to space limitations.

Table 1.

NO.	LOCATION	YEAR
1.	<i>Tatabánya</i>	1997
2.	Sajólad	1998
3.	Tatabánya	2000
4.	Miskolc	2002
5.	Boldva	2004
6.	Nyíregyháza	2005
7.	Nyíregyháza	2006
8.	Tiszaújváros	2007
9.	Miskolc	2007
10.	<i>Budakeszi</i>	2007
11.	Budapest	2009
12.	Érd	2009
13.	Tatabánya	2012
14.	Tiszalúc	2014
15.	Bükk-hegység	2015
16.	Miskolc	2016
17.	Miskolc	2017
18.	Bicske	2018
19.	<i>Miskolc</i>	2020
20.	Tiszalök	2021

Tatabánya, 1997.

The logger was felling a tree withered on its legs using alpine techniques. Once the trunk was cleared of side branches, as in all normal cases, the top of the tree was left behind, which was then roped in to protect the built environment from damage. This is when the tree receives its greatest load, with no side branches to dampen the vibration, a static jolt suddenly follows in a straight column. The trunk of the tree broke and fell, the worker escaped with a concussion and a fractured hand, with minor property damage (Figure 2).

The incident could have ended much more seriously. As a precautionary measure, in such cases, climbing on dry wood should not have been done from a lifting basket. It was rare or inaccessible at that time, not to mention the fact that the site could not have been reached by a lift truck anyway. In such

cases, one has to weigh up what matters, material damage or human life. We know the latter cannot be replaced, but everything else can.

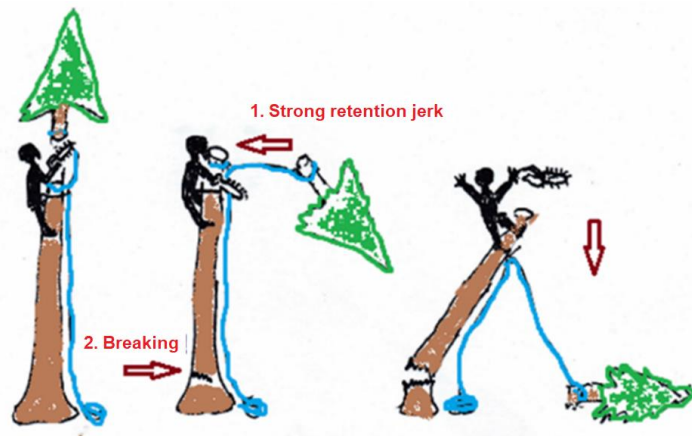


Figure 2. Illustration of the Tatabánya accident (authors' own editing)

The easiest prevention method in such cases is to simply cut the tree down, even on the house. Of course, it's good to have liability insurance for such cases, and the deductible can be discussed with the client. Minor damage is caused if the aforementioned tree toppling is not tied into a rope but falls freely and breaks what breaks. A much more expensive solution is a crane with a work basket on it, and it will lift you in. The other, most expensive method, which was first used by a company in Hungary in 1998, is helicopter tree felling. Inappropriate choice of working method.

Budakeszi, 2007.

The logger wanted to cut down the top 5 meters (about 1 meter) of the 15-metre-long yew tree (about 1 meter, with leaves). After making the branches, the final cut is made, considering the wind and wind direction. At that moment, the wind has stopped, and the cut falls down about 30 degrees in a different direction. He was able to pull to one side, but his hand is pressed against the tree, the rope slides on him with the weight of the tree for about 1 meter before he manages to free it (Figure 3). He burned his wrist to the bone by the time he got his hand free. Working in unsuitable weather conditions.

Miskolc, 2020.

The incident happened in the morning hours in December, in foggy, humid and limited visibility conditions. A new tool was introduced to handle the cut wood, for which the man downstairs was not adequately trained, and there was inadequate communication with the worker above. The man downstairs was expecting to catch a smaller log, but he had to catch a large log weighing several hundred kilos. The weight could have been properly grasped with the tool, but was not adequately rewrapped on the rope restraint, so the tool pulled the worker's hand (Figure 4), which was saved by the glove, but still resulted in radial tearing of 3 joint capsules. In all such cases, a clear indication should be given by pointing to the belayer below as to which branch or log will fall into the rope.

The insurance man should indicate with a clear reason hand that he understood, the person above should also indicate with a reason hand that a cut will follow. Visual conditions, inadequate communication, lack of training.



Figure 3. Illustration of the accident in Budakeszi



Figure 4. Incorrect use of rope brake

4. Case studies, summary of accidents

From the descriptions of the 20 case studies selected, there is some overlap, where more than one type of injury occurred, or more than one cause contributed to the accident. Thus, they have been included as separate case numbers in the following table and figure.

Table 2.

Type of accident	Cause of accident	Case number
Tearing of the joint capsule	Inadequate communication	1
	Unsuitable weather conditions	1
Concussion	Lack of site closure	1
	Inappropriate working method	1
	Inexperience, lack of training	1
Burn injury	Lack of personal protective equipment	1
	Unsuitable weather conditions	1
Breakdown	Inappropriate working method	2
	Lack of insurance	1
	End of day fatigue	4
Bruising	End of day fatigue	1
	Cutting through the breakstrip	1
	Inattention	1
	Lack of insurance	1
	Alcohol	1
Cutting injury	Inappropriate device	1
	Lack of personal protective equipment	2
	Incorrect use of the tool	1
	Catch	2
	Alcohol	2
Fracture or injury to the pelvic cavity	Inappropriate working method	1
Psychic shock	Inappropriate working method	1
	Lack of site closure	1

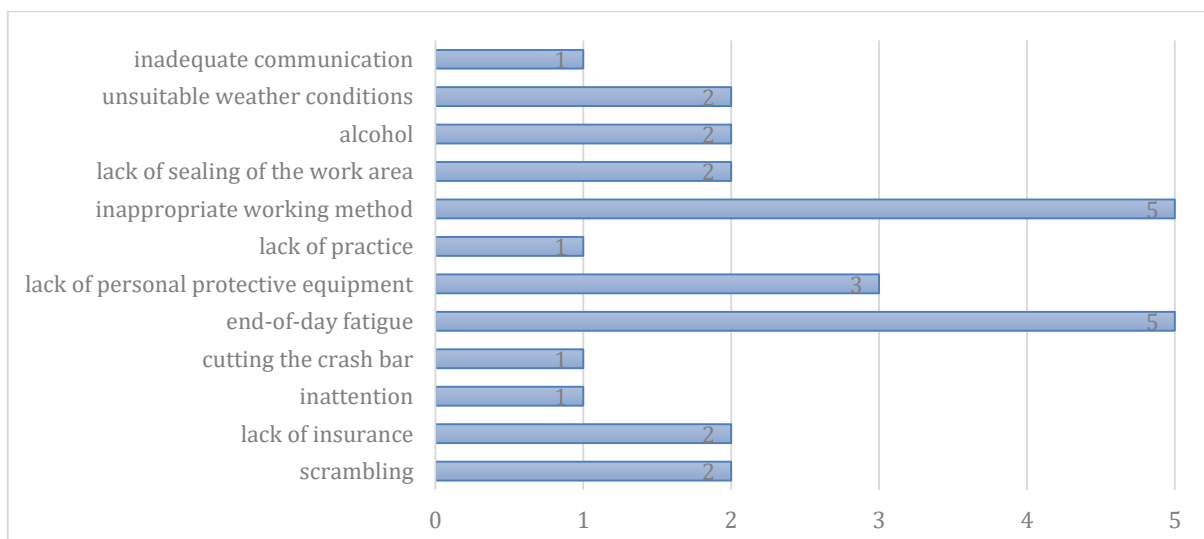


Figure 5. Distribution of causes of accidents

5. Summary

The 20 selected accident case studies highlighted what to look out for. Tiredness, hurrying, rushing at the end of the day is one of the most common causes, not only from our own experience but also from the experience of others. I would like to use this as an opportunity to point out that we should not work more than the prescribed time limit, leave it for tomorrow, work can wait. Work is replaceable, but our health, our safety, our lives are irreplaceable. More often, the wrong choice of working method or equipment and the lack of personal protective equipment are also reported.

This study also highlights the fact that an update of the Forest Safety Regulations is essential for the safe practice of felling in populated areas, and that a well-formulated literature on the subject is needed.

References

- [1] Kolossváry, Sz. (1975). *History of forestry in Hungary*. Akadémiai Kiadó, Budapest.
- [2] Davey, J. (1907). *The tree Doctor: The Care of Trees and Plants*. New York; Akron, Ohio; Chicago: The Saalfield Publishing, Co, pp. 1-94.
- [3] Czimber, B., Farkas, I., Ferenczy, T., Gulyás, I., Horváth, I., Molnár, V., Solt, T., Vizárdy, J. (1990). *Maintenance, maintenance and use of the woodworking machine, maintenance and maintenance of the woodworking machine*. Falco timber combine, Sopron.
- [4] Fibrás, O. (2010). *Forest Utilization I*. Textbook for Forest Technician Training. FVM Institute for Rural Development, Training and Expert Advice Budapest, Hungary.
- [5] Haraszthy, L. (1993). *Practical bird of prey conservation*. Hungarian Ornithological and Nature Conservation Society, Budapest, pp. 1-123.
- [6] Philbrick, F., Philbrick, S. (2006). *The Backyard Lumberjack. The ultimate guide to felling, bucking, splitting and stacking*. Storey Publishing, pp. 1-177.
- [7] http://dendrocomplex.hu/common/uploads/article_item/faapolastortenete
- [8] <https://net.jogtar.hu/jogszabaly?docid=98900015.mem>
- [9] Pátkai, B., Babcsán, G., Megyeri, I., Meggyes, Á., Merza, I., Neidenbach, Á., Sárközi, A., Schmatz, B., Singer, J., Valcsák, M. (1993). *Hungarian mountaineering instructors association*. Budapest, pp 1-159.
- [10] Bereczky, A.: *Climbing safely*, Heliaca 2007, vol. 5. Joint Yearbook of the MME Raptor Conservation Section, Budapest, pp. 1-121.
- [11] <https://faapolok.hu/celok/>
- [12] <https://magyarmezogazdasag.hu/2019/04/15/faapolas-fa-szeretetenek-muveszete>
- [13] Lukács, Z., Szaller, V., Divós, F., Kelemen, G. (2017). *Guidelines for the visual and instrumental examination of trees*. Publication of the Association of Hungarian Tree Nurseries, Budapest, 2017.
- [14] Winkler, K., Hans, P., Haltmeier, J. (2011). *CSER publishing house and MHSSZ*. Original title: Bergsport Sommer. Budapest 2011.
- [15] Bereczky, A. (2022). *Javaslatok a lakott területi fakitermelésre vonatkozó Erdészeti Biztonsági Szabályzat megújítására*. Szakdolgozat, Miskolci Egyetem.