

# Current State and Improvement Potential of Forestry Workers Training in Croatia

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## Abstract

*This paper discusses the key issues of forestry workers training in Croatia, especially dealing with the providers of vocational training, their profile, training procedures and measures necessary for training improvement. A combined approach of literature review, internet search and questionnaire of training providers was applied in order to collect data on training programs conducted in Croatia. The research was conducted during 2016, and it included 94 legal entities authorized for occupational safety training in the Republic of Croatia, with respect to safe working practice training and vocational training for operating machinery (chainsaw and/or skidder). The analysis used basic descriptive statistics.*

*Research results showed that 30.85% of the analyzed legal entities provide only training for safe working practice, 15.96% provide both trainings – safe work practice and vocational training for operating machinery, 5.32% of the analyzed entities provide only vocational training for operating machinery, 31.91% do not carry out any form of training in forestry, while 15.96% refused to answer questions. On the other hand, 15.56% of the legal entities, which do not carry out any training or did not answer these questions, have on their official website services posted for vocational training in operating machinery (chainsaw and/or skidder). The key findings of the conducted research have pointed out the great heterogeneity amongst providers of forestry workers training, and certain reductions or limitations in the current training programs, both from the aspect of duration of the theoretical and practical training, and the use of non-transparent criteria and standards in the assessment of training.*

*As an example of successful solution in forestry workers training, European Chainsaw Standard model (ECS) is shortly presented in the paper. Discussion and conclusion sections provide an overview of legislative and organizational requirements for the application of previously developed European model (ECS) in developing the certification system for training of forestry workers in Croatia.*

*Keywords: forestry, chainsaw worker, health and safety, vocational training, certification, Croatia*

## 1. Introduction

Forestry work is one of the most dangerous occupations with significant human and financial losses (ILO 1981, Bentley et al. 2005, Potočnik et al. 2009, Lindroos and Burström 2010, Adams et al. 2014, Marenčec and Krč 2016, Potočnik and Poje 2017). This is confirmed by research of (Driscoll et al. 1995, Bell 2002, Lefort et al. 2003, Cabeças 2007), which classifies forestry profession into the high-risk sector category, based on injury rates which are much higher than in

other sectors. A more detailed analysis of accidents in the forestry sector has shown that the work on wood utilization is far more dangerous than other forestry operations (ILO 1991). Relevant indicators on the level of safety between forestry and other sectors show even greater numerical disproportion when the workforce is not adequately qualified (Klun and Medved 2007) for forestry operations.

The safety level of forestry work has immense benefit from the implementation of professional training for forestry workers (Smith and Thomas 1993). Statistics

confirms that trained workers are less injured (Axelsson 1998, Stadlmann 1997) and rarely fatally hurt. At the very beginning of training, participants realize its importance and thus develop a culture of safety, starting from the constant use of personal protective equipment to more advanced security issues, such as the use of appropriate techniques to cut down the wind damaged trees on sloping ground, etc. (Tsioras 2012). In most European countries regulations oblige employers to provide appropriate training to each person using work tools and machines (Medved 1998). Also, through knowledge acquired by training, work techniques and skills need to be confirmed by a mandatory inspection and certification as evidence of acquired professional knowledge and skills for a safe forestry work (Martinić et al. 2011).

In the context of the current trends in training, it is important to emphasize modularization and introduction of training specialization where chainsaw workers and forest machinery operators represent important and often targeted group. Greater attention is given to entrepreneurship and economic aspects in the design of educational programs (Bernasconi and Schroff 2011). The content of courses is adapted to the social and technical achievements with a stronger emphasis on language skills, improving the entrepreneurial qualifications, increasing competence in the field of machinery and logistics, as well as expansion of methodological skills (Bernasconi and Schroff 2011). In parallel, the need for certification of training programs, and thereby also testing the skills acquired during training gained in importance. In Germany, the old »Waldarbeiterschule« (forest workers training school) has evolved into forestry training center, and introduced professional licenses i.e. professional certificates for education and training, for example, in Germany, Austria, France (Bernasconi and Schroff 2011).

Today, vocational training is a basic requirement of modern forestry, where traditional forestry chainsaw worker/machinery operator can be translated into a competent associate in the management of forest resources. The complexity and specialization of forestry worker tasks have resulted in a general trend of increasing expansion of the expected skills and, accordingly, the training programs in the forestry sector. In accordance with the stated, this paper discusses the key issues of forestry workers training in Croatia, especially dealing with the providers of safe working practice training, and vocational training in operating machinery (chainsaw and/or skidder), their services and training procedures. Secondly, the paper presents the concept and implementation process of the European Chainsaw Standard model as an example of

good practice where, through forestry training centers, training knowledge and skills must be confirmed by the mandatory inspection and certification. Third, based on the conducted analysis, the paper also elaborates and proposes measures necessary for improvements in the Croatian forestry workers training system.

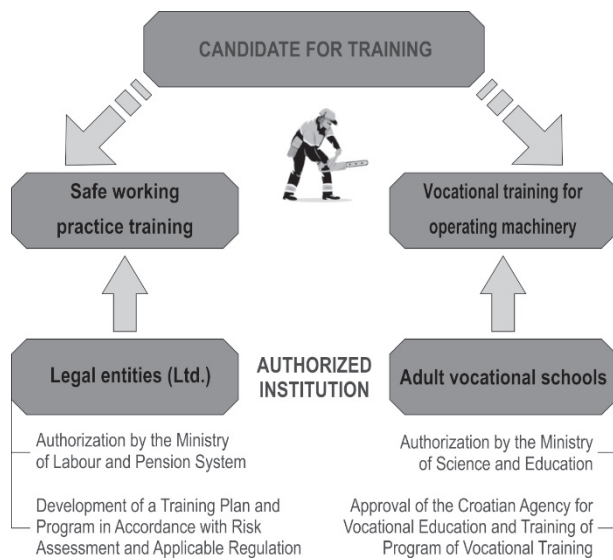
### 1.1 Legal framework of forestry workers training in Croatia

Requirements and framework conditions of training in European forestry have significantly changed in the last 15 years. The three main areas of change can be seen through: a) change in the socio-economic environment affecting the content of training, b) change in the technological environment with impacts on the use of labor and subjects of specialization and c) change in the systems of training through fundamental reforms, e.g. Copenhagen Process (Bernasconi and Schroff 2011). Copenhagen Process promotes mutual trust, transparency and recognition of competences and qualifications in order to increase mobility and facilitate access to lifelong learning for vocational education and training across Europe. Progressive processes of internationalization and globalization had an additional impact on the above-mentioned changes.

In operational forestry of the Republic of Croatia, the requirements of the legal framework oblige employers to train chainsaw operators/machinery operators (Fig. 1):

- ⇒ for safe work practice
- ⇒ for operating machinery (chainsaw and/or skidder, forwarder, etc.).

Article 27 and 28 of the Occupational Safety and Health Act (Official Gazette No. 71/14 and 118/14) obliges the employer to train workers to work in a safe manner on the basis of a risk assessment, as follows: 1) before starting work for the first time; 2) implementing changes in the working method; 3) introducing new work equipment or changes; 4) introducing new technology; 5) before assigning a worker to a new job or a new workplace and 6) in response to health damages caused by danger, harmfulness or strain working conditions. In accordance with the Ordinance on Certification of Occupational Safety and Health activities (Official Gazette No. 84/15), the above mentioned training can be conducted by a physical or legal person and by employers for their own use if they are authorized by the Minister of Labor (Ministry of Labor and Pension System) and if they meet the conditions prescribed by the Ordinance on Occupational Safety and Health Training and Professional Examination (Official



**Fig. 1** Entities authorized for forestry workers training in Croatia

Gazette No. 112/14) (Fig. 1). The aim of the training is to acquire knowledge and skills, and is carried out under the Plan and Training Programs derived from the content of hazard and risk assessment at workplaces. The Ordinance on Occupational Safety and Health Training and Professional Examination (Official Gazette No. 112/14) stipulates the duration of the theoretical training – at least 7 school hours (sh), the training being carried out by a health and safety expert. On the other hand, the duration of the practical training is not prescribed by the Ordinance, and the training process is carried out a) by the authorized person who directly manages the workers training and b) by health and safety expert who is responsible for the workers training.

The vocational training of forest operators for work with mechanized machinery (e.g. a chainsaw, skidder, etc.) is governed by Article 3 of the Ordinance on Jobs with Special Working Conditions (Official Gazette No. 71/14). The basic requirements for the vocational training are primary school education, age (over 18), and physical and mental ability to perform the work operations. The training program is conducted by an adult vocational school under the authority of the Ministry of Science and Education, and with the prior approval of the Croatian Agency for Vocational Education and Training of the Vocational Training Program (Fig. 1). Organizational form of training for chainsaw and/or skidder operators generally contains regular (R) or consultative-instructive (C-I) teaching, which consists of a theoretical and practical part. The extent and duration of theoretical and practical train-

ing is not strictly defined by legal regulations. The practical part of training is usually defined in the company of training participants according to a special schedule.

In accordance with the above legal framework, safety precautions and safety rules for professional forestry work in Croatia are prescribed by the Ordinance on Occupational Safety and Health in Forestry (Official Gazette No. 10/86). On the other hand, according to the Forest Law (Official Gazette 94/14), non-professionals (the local population), who are trained in harvesting operations (safe work with a chainsaw), are allowed to buy and process for their own purposes up to 20 m<sup>3</sup> of firewood per year (self-processing), with the permission and under the supervision of the person who manages these forests. In state forests, the above mentioned self-processing works reach up to 650,000 m<sup>3</sup> per year (Annual Business Report CF Ltd. 2015). Due to the allowed volume of self-processing (20 m<sup>3</sup>), there are thousands of potential actors who need to be trained in safe work and appropriate use of forestry machines, all according to verified training programs. Deficiency of legal provisions gives an unclear picture of the level and type of qualifications that must be met by non-professionals, as well as of the qualifications of the supervisory staff when the harvesting works are carried out in private forests (Landekić et al. 2017).

Based on the above, the following sections of the paper provide information to forestry experts and practitioners about a) the state of professional training of forestry workers in Croatia and b) trends in the European model of forestry work certification.

## 2. Materials and methods

Collecting of research data was carried out by using a telephone survey with a pre-prepared questionnaire. The advantages of such approach are high accessibility, good quality control, quick data processing, etc. The telephone survey was conducted by a student of the Faculty of Forestry in Zagreb, wherein questioning of the legal entity lasted on average 5 minutes. A specific survey method is used for collecting data either from the general population or from a target population. In this case, the target population, the sampled one, consisted of 94 legal entities authorized for occupational safety training in the Republic of Croatia, with respect to a) safe working practice training and b) vocational training for operating machinery (chainsaw and/or skidder). The list of legal entities was taken from the official register of the Croatian In-

stitute for the Improvement of Occupational Safety, and the research response rate was 84%.

The questionnaire used was developed by the Department of Forest Engineering at the Faculty of Forestry, Zagreb University, and it consisted of three structural parts. The first part of the questionnaire refers to general characteristics of legal entities providing training for forestry workers with three questions. The second part refers to safe working practice training where, through four questions, participants need to give answers regarding the structure of the training program (duration of theoretical and practical part in school hours, where one school hour is 45 minutes), practical execution and assessment of the training. The third part refers to vocational training for operating machinery (chainsaw and skidder) where, through seven questions, participants also need to give answers regarding the structure, practical execution and assessment of the training. The research was conducted during autumn 2016, where parallel to the questionnaire, on-line website search and analysis of legal entities were conducted to determine their profile and services they provided. The above stated on-line search was also made to compare the accuracy of the key information obtained through the questionnaire.

Methods of analysis and synthesis, comparison and compilation were used in the processing of data and in drafting this paper. Analysis and synthesis method was used in drafting this paper, where various sources were ultimately summarized in a single text. Method of comparison was used in the practical part of the work to show the frequency of legal entities in categories defined according to theoretical and practical training as well as to display the implementation of the European Chainsaw Standard (ECS) for the member states of the European Forestry and Environmental Skills Council (EFESC). The input data basis, systematization and assessment of the entry and primary processing of the collected data were made in the software package Microsoft Excel. Theoretical part of the work was made using the compilation method.

Additionally, the results of Figs. 3, 4 and 5 are explained in terms of school hours for the theoretical and practical part of the training. In the legend of Fig. 3, 4 and 5, four time-defined categories for the theoretical part of the training are shown with the number of legal entities in brackets (e.g. in Fig. 3, there are 27 legal entities or 61.36% in the category 7 to 16 school hours of theoretical training). Five time-defined categories for the practical part of the training are shown on the x-axis of Fig. 3, 4 and 5, where 27 legal entities are in the category from 7 to 16 sh of theoretical training (Fig. 3), 20 legal entities provide less than 8 sh of prac-

tical training, two legal entities provide 9 to 16 sh, one legal entity provides 17 to 24 sh and four legal entities provide more than 33 hours of practical training.

### 3. Results

The research conducted on 94 legal entities, authorized for occupational safety training, included the situation and procedure analysis of forestry workers training in Croatia. Research results in Table 1 show that 30.85% of the investigated legal entities provide only training for safe working practice, 15.96% provide both trainings – safe work practice and vocational training for operating machinery, 5.32% of the investigated entities provide only vocational training for operating machinery, 31.91% do not carry out any form of training in forestry, while 15.96% refused to answer questions. On the other hand, 15.56% of the legal entities, which do not carry out any training or refused to answer this question, have on their official website services posted for vocational training in operating machinery (chainsaw and/or skidder). Also, from 29 legal entities (Table 1), which carry out only safe working practice training, 13.79% have on their official website services posted for vocational training in operating machinery.

Research results show that 49 legal entities carry out a certain type of training in forestry (Table 1 and Fig. 2). From the total number of active legal entities, 81.63% have one or two branch offices (Fig. 2), employ on average 11 to 15 employees and half of employees are specialized in the forestry sector. 3 to 6 branch offices within national borders have 16.33% of legal entities

**Table 1** Number of legal entities versus type of provided training

Category	Answers from telephone survey	Information from official website*
Safe working practice training	29 (30.85%)	4 (13.79%)
Safe working practice training and vocational training in operating machinery	15 (15.96%)	–
Vocational training in operating machinery	5 (5.32%)	–
No training in forestry	30 (31.91%)	4 (13.33)
Refused to answer	15 (15.96%)	3 (20%)
In total	94 (100 %)	11 (11.7%)

\* related to providing services for vocational training in operating machinery (chainsaw and/or skidder)!



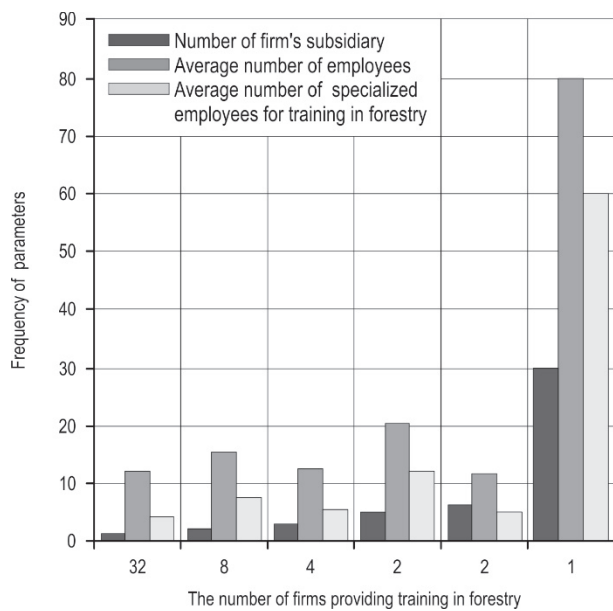


Fig. 2 Profile of firms providing workers training in forestry (N=49)

employing on average 11 to 21 employees (Fig. 2). Only one company has 30 branch offices and employs 80 workers, of which 75.00% are specialized for training in the forestry sector (Fig. 2).

### 3.1 Situation and procedure analysis of forestry workers training in Croatia

A more detailed analysis of the duration of theoretical and practical part of training for ensuring safety at work and in operating machinery (chainsaw and/or skidder) within the time-defined category is shown in Figs. 3, 4 and 5. In addition, for each type of training, the frequency response is given for the question »Who conducts the training program« and »Who performs final assessment of participant training«.

#### 3.1.1 Safe Working Practice Training

In the present research of the training legal entities, it was established that, out of 94 duly authorized legal entities, 44 legal entities conducted training of workers for safety at work in the forestry sector (Table 1 and Fig. 3). Frequency response to the question on duration of safe working practice training (Fig. 3) shows that 61.36% of legal entities provide 7 to 16 school hours of theoretical training, while practical training consists of 8 school hours or less. 18.18% of legal entities are classified in the category of 6 school hours or less (Fig. 3) of theoretical training, and 8 school hours or less of practical training. On the other hand, 13.64% of legal entities stated to provide more than 17 hours of theoretical training and more than 33 hours of practical training (Fig. 3).

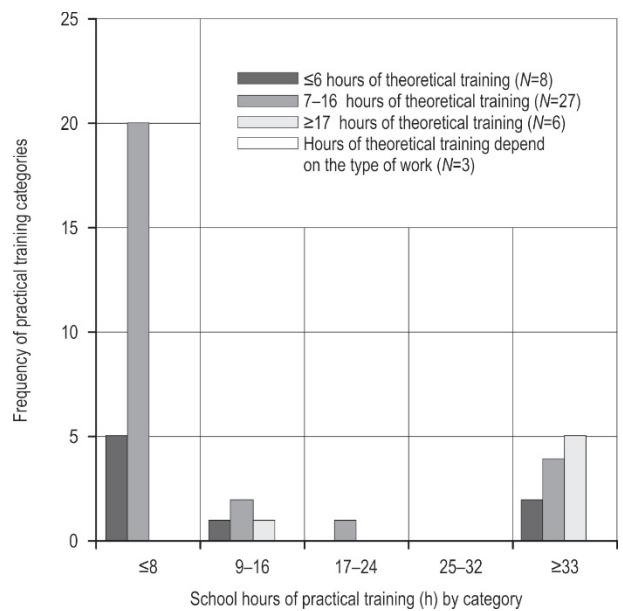
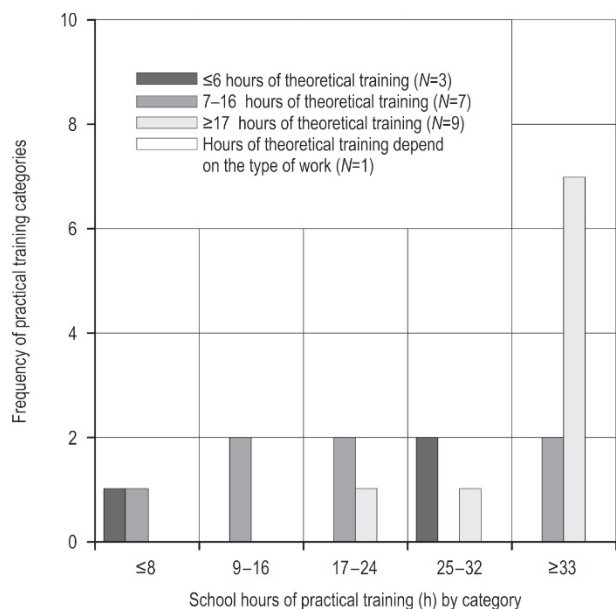


Fig. 3 The structure of safe working practice training (N=44)

To the question »Who conducts the training for safe working practice«, 90.90% of legal entities pointed out that the training program was carried out by their own employees, 4.55% stated that the training was carried out by their own employees in collaboration with external partners (colleges, universities, etc.), and only 4.55% pointed out that the training program was conducted only by external collaborators. On the other hand, to the question »Who performs final assessment of participant training«, 86.36% of legal entities pointed out that final assessment was carried out by an employee of the company i.e. examiner, and 6.82% claimed that final assessment was carried out by an employee of the company i.e. company’s examiner in cooperation with external examiner. Also, 6.82% of legal entities indicated that for the practical part of the training, the final grade was given directly by the employer’s trustee on site where the practical training was carried out, and for the theoretical part of the training, the final grade was given by the employee of the company who carried out the training for safe working practice.

#### 3.1.2 Vocational training for operating forestry machinery

Another aspect of the training is work with forest machinery where, out of 94 duly authorized legal entities, 20 legal entities carry out training of workers to operate with chainsaws (Fig. 4), and 19 of them also carry out, at the same time, the training of workers to operate with skidders (Fig. 5). Frequency response to the question on duration of vocational training in

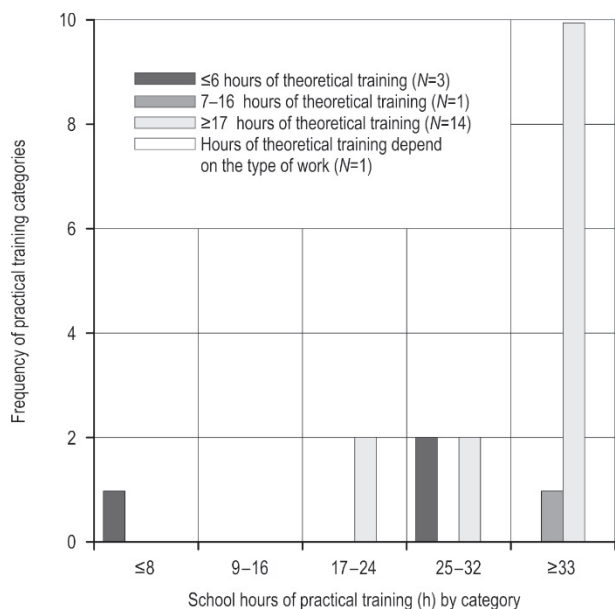


**Fig. 4** The structure of vocational training in operating chainsaws ( $N=20$ )

operating chainsaws (Fig. 4) shows that 45% of legal entities provide more than 17 school hours of theoretical training, while for a significant number of legal entities the practical part of the training consists of 33 school hours and more. For 35% of legal entities, the theoretical training consists of 17 to 32 school hours (Fig. 4), whereas practical training hours are heterogeneously grouped within the defined categories. Only 15% of legal entities pointed out that the theoretical part of the training for operating chainsaws consisted of less than 16 school hours (Fig. 4).

At vocational training in operating skidders, 73.68% of legal entities stated to provide more than 17 school hours for theoretical training and more than 33 hours for practical training. Only 15.79% of legal entities stated to provide less than 16 school hours for theoretical training (Fig. 5).

The credibility of the implementation of the vocational training for operating forest machinery and the final assessment of participants training is shown by a frequency response to the three questions ( $N=20$ ). Within the first question »Who conducts the vocational training program«, 60% of legal entities stated that the vocational training program was carried out by external partners (colleges, universities, etc.), and 40% stated that the training was conducted by employees of the company. The second question referred to the realization of practical training with the forest machinery in terms of technical requirements i.e. availability of adequate infrastructure such as polygons, instruc-



**Fig. 5** The structure of vocational training in operating skidder ( $N=19$ )

tors, mechanization, etc. In accordance with the above, 95% of legal entities pointed out that the practical part of the candidate training was conducted in cooperation with the company that met the technical requirements, and only one legal entity claimed that the company that sent employees on training also issued a certificate to the candidates who completed the practical training. As regards the third question, »Who performs final assessment of participant training«, 80% of legal entities pointed out that the final assessment was carried out by a company examiner, while only 20% stated that the final assessment of the training was carried out by an independent examiner.

### 3.2 European chainsaw standards implementation – example of good practice

A positive step forward in the training of forestry workers at the level of Europe occurred in 2009 with the establishment of the European Forestry and Environmental Skills Council (EFESC), whose mission is to simplify the mobility of workers in forestry and arboriculture within the EU through the processes of accreditation and promotion of individual national qualifications between the partner countries at European level. The motive behind the development of EFESC was to develop a universal qualification standard for chainsaw users throughout Europe, with the primary aims to: a) reduce accidents and fatalities, b) reduce associated economic and personal costs related to accidents, c) improve and enhance operator skills

and efficiency in the workplace, d) enhance operator mobility and employability throughout Europe, e) improve and expand delivery of existing vocational training and assessment standards, and f) encourage and promote life-long learning and continuous professional development (source: <http://www.european-chainsaw.eu/>).

The first minimum standard developed by the EFESC, partially implemented in EU member states, is the European Chainsaw Standard (ECS). It consists of five modules / levels (Fig. 6). The developed standard is not legally binding, but is a set of minimum standards that are considered »best practices« with professional and/or semi-professional use of chainsaws with the focus on the safety aspect of the use of operating machinery. In the implementation of the certification of minimum working competence, i.e. authorization and auditing (control) of national training providers, EFESC relies on the national centers, which issue the accreditation, through the process of accreditation, for the certification of training programs to the institutions registered for that activity. Based on the obtained accreditation, such institutions can use, in their own arrangement, the ECS certificate and/or can use the ECS logo on certificates, if they comply with the criteria set by the EFESC general assembly, and if everything is reviewed and approved by the national agency.

Up to November 2016, nine accredited national centers were established in nine different countries in Europe. Those national centers have different legal organizational forms - from economic associations, training centers and network platforms to ministries and other bodies of state administration. Table 2 shows

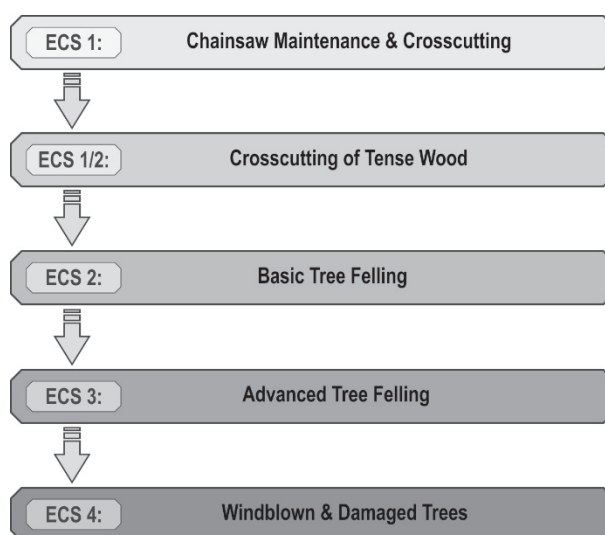


Fig. 6 European chainsaw standards levels

the process of applying the concept of universal European standards for operating chainsaws within countries that have national centers accredited by the EFESC. Belgium and Germany have issued the highest number of certificates, followed by Spain, Austria and Romania (Table 2). The lowest number of certificates issued was recorded in Italy and the Netherlands. The only country that has established the national agency, but has not started the process of implementation of the ECS, is the United Kingdom.

According to EFESC, the European certification for chainsaw operator (ECS) is not legally binding either for professionals or non-professionals (amateurs),

Table 2 Implementation of European chainsaw standards within EFESC countries (Landekić et al. 2017)

	Country							
	Austria	Belgium	France	Italy	Netherlands	Germany	Romania	Spain
Starting year of implementation	2015	2012	2015	2015	2014	2014	2015	2015
Number of Assessment Centers	3	2	12	7	1	2	1	1
Number of certificate holders*	152	645	124	35	83	474	170	118
Number of certificates issued	ECS 1 = 152	ECS 1 = 645	ECS 1 = 124	ECS 1 = 30	ECS 1 = 83	ECS 1 = 474	ECS 1 = 170	ECS 1 = 117
	ECS 2 = 152	ECS 2 = 209	ECS 2 = 73	ECS 2 = 9	ECS 2 = 56	ECS 2 = 462	ECS 2 = 170	ECS 2 = 68
	ECS 3 = 152	ECS 3 = 31	ECS 3 = 9	ECS 3 = 13	ECS 3 = 15	ECS 3 = 462	ECS 3 = 169	ECS 3 = 9
	ECS 4 = 115	ECS 4 = 6	ECS 4 = 0	ECS 4 = 0	ECS 4 = 0	ECS 4 = 433	ECS 4 = 0	ECS 4 = 0
Number of certified assessors	5	14	44	18	5	28	1	4

\*holder who has e.g. NTPC (National Proficiency Test Council) recognized industry qualification for chainsaw operator can directly attend the third level of European Chainsaw Standard (ECS 3)!

who use chainsaw occasionally. The standard is consistent with the aspect of work quality and forestry work safety, and the need of implementation of the above standard and certification system for forest chainsaw workers is explained by the following assumptions:

- ⇒ transparency of skills and competences throughout detailed description of the required qualification for each level
- ⇒ enhancement of operator mobility and employability throughout Europe and presence of uniform certificate that vouches for the holder's skills, independent of language and country
- ⇒ quality and traceability of the licensed certificate holder through a registration at the European organization EFESC (source: <http://www.europeanchainsaw.eu/>).

#### 4. Discussion

Technological advancement and specialization of workers, through various forms of education and vocational training in forestry, is highly beneficial for both workers and employers from the technical, safety and professional aspect (Landekić et al. 2017). On the other hand, as Bernasconi and Schroff (2011) stated, there are certain restrictions for training providers that apply on: a) cost demands of training related to the number of hours of field work, polygon infrastructure and specialized tools, b) limited market, i.e. a small number of potential participants, and c) lack of interest of young generation for the so-called »Black Collar« 3D (Dirty, Dangerous and Demanding) jobs – forest chainsaw operators being classified into this category. The above limitations indicate the reduction of the operating portfolio of forestry workers in near future.

Given the numerous challenges facing the forestry sector of the EU, as an area of highly specialized niche, international cooperation and cluster formation becomes increasingly important, with the focus on transfer of knowledge related to training programs. Development and implementation of universal European standards for chainsaw operators is a positive example of cooperation within the EU countries. In developed European countries, in the past decades, specialized institutions have been established, the so-called »forestry training centers« that provide comprehensive training in the technical, safety and vocational aspect. Training is carried out through the idea of »dual system«, meaning that a combined approach of theoretical learning and practical training can provide the best education possible. With this approach, a high level of

knowledge and skills is achieved relating to the proper use of personal protective equipment, operating machinery, auxiliary equipment and procedures in compliance with safety operating procedures. Medved (1998) and Martinić et al. (2011) stated that training and periodical checking of competences of forestry machinery operators have been key factors for work quality and safety in operational forestry in Western Europe in the past decades. Training knowledge and skills are confirmed by the mandatory inspection and certification (e.g. European Chainsaw Certification) as evidence of certain professional knowledge and skills for safe forestry work, which is highly beneficial for both the employee and the employer (Martinić et al. 2011).

Previous research (Martinić et al. 2011, Martinić and Landekić 2012, Landekić et al. 2016, Landekić et al. 2017), dealing with the training of workers in the forestry sector of Croatia, has shown a lesser degree of satisfaction. The above is supported by a recent research, according to which 11.70% of legal entities (N=94) provide training services for operating machinery in forestry at the official web site (Table 1), while in the questionnaire, a negative answer is given to this question. In addition, from a total of 94 interviewed legal entities, 15.96% refused to give any information regarding the provision of forestry workers training in Croatia. The results suggest that a significant part of training for safe forestry work in Croatia is carried out by programs that are not adequately verified nor independently evaluated by the relevant institutions (the Agency and the Ministry). Furthermore, the Ordinance on Occupational Safety and Health Training and Professional Examination (Official Gazette No. 112/14) stipulates the duration of the theoretical part of the training for safe work of at least 7 school hours, while Fig. 3 shows that, from a total of 44 legal entities that applied to perform this type of training, 18.18% did not meet the requirements. As for the practical training, 25 legal entities are classified in the category of 8 school hours or less (Fig. 3), and 72% of them admitted that their practical training for safe work in forestry consisted of only one school hour. The analysis of professional training programs for operating machinery in forestry (chainsaw/skidder), according to the defined categories, shows significant diversity in the duration of theoretical and practical training (Fig. 4 and 5). The frequency of answers for the three key questions (Who conducts the training program; Who conducts the practical part of the training; and Who performs final assessment of participants training) resulted in discordance in both types of training. The following deficiencies were identified: lack of clearly defined criteria and of control over the fulfillment of human and technical



preconditions/requirements and resources of training holders, as well as lack of transparency in the final assessment of the candidates and questionable quality of the practical training.

## 5. Conclusions

The most acceptable way of increasing safety in the Croatian forestry, for professional workers and amateurs, is the application and implementation of the achievements of the developed forestry countries, where in the sphere of forestry work safety, the implementation of certification for all aspects of forestry work training is highly emphasized. Considering all the above, the accession of the Republic of Croatia to the European process and programs related to health and safety in forestry is possible by implementation of international best practices through:

- ⇒ strong promotion of safety system and awareness of all stakeholders in the supply chain of forestry works: licensed forest contractors, educational and medical institutions, equipment manufacturers, professional societies, professional associations, etc.
- ⇒ partnership and cooperation of Croatian forestry sector key organizations in selecting the most relevant organization/institution for acquiring authority of the national accreditation center for the implementation of the European Chainsaw Certificate program, which includes the adoption of a uniform curriculum for the particular type of training
- ⇒ amendments and/or preparation of new regulations (acts, ordinances, regulations) to ensure standardization of training for forestry work, including the establishment and functioning of the national accreditation center
- ⇒ verification by the national accreditation center of optimally two regional forestry centers for training and evaluation (one for eastern and central part and the other for pre-mountain and Mediterranean part of Croatia) with adequate infrastructure for theoretical and practical training, verified programs, lecturers, trainers, assessors and others.

To conclude, the above measures for the improvement of health and safety of forestry work should be elaborated in detail and implemented through the legislative, structurally organized and educational concept, by using a multidisciplinary research team and a special operational working group in the framework of the national project relevant for the forestry

sector. This should be a key measure in the field of economy and sustainability of forest production, contained in the National Development Strategy of Forestry and Wood Technology in Croatia.

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