Project: Partnership for the development of training standards for tree assessors in Central and Eastern Europe
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TREE
ASSESSOR

Basic and advanced tree assessment – guidelines for training professionals

TREE ASSESSOR
Valuation of trees

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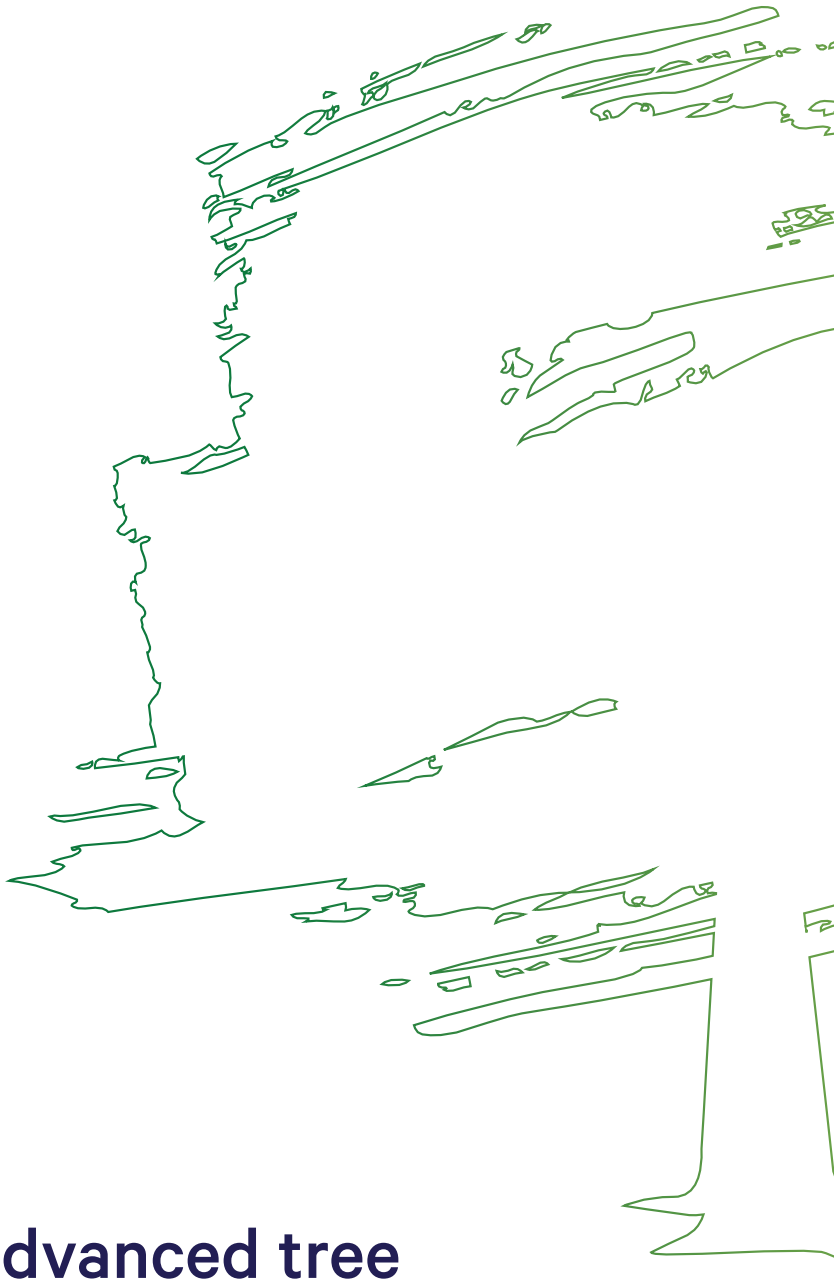

TREE
ASSESSOR

Basic and advanced tree assessment – guidelines for training professionals

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I.
Introduction

This publication is a part of a set of materials for educating people involved in tree assessment, developed within the project under the abbreviated title of TREE ASSESSOR. The project aims to improve the quality and increase the effectiveness and efficiency, of vocational training for people dealing with tree diagnostics by developing a comprehensive training programme and educational materials for tree assessment. The project area of interest includes the countries of Central and Eastern Europe primarily. Still, the results of the project work are universal and can also be useful in other parts of Europe or the rest of the world.

Tree assessment has become a dynamically developing area of green space management in recent years. Various social, legal and technical factors have contributed to this. The expectations of the general public towards services responsible for green space management are continually growing. In the era of climate change awareness, residents expect that city authorities plant and establish trees which reduce the urban heat island effect and mitigate the consequences of violent downpours. Trees also make the city an attractive place to live, have a beneficial impact on the physical health and mental wellbeing of citizens, can improve educational performance in children and deliver many other social, environmental and economic benefits.

City residents are increasingly demanding that tree felling be limited to those cases fully justified by the condition of the trees. The development and modernisation of infrastructure mean that more and more trees growing in cities and on roadsides are at risk of damage and require diagnostics. More and more victims of tree-related accidents are seeking compensation in court, making tree diagnostics and assessment an essential legal consideration. Tree managers are introducing tree inspection systems to cover entire cities to avoid legal problems with courts and insurance companies.

Despite the growing importance and significant social and financial responsibility of people performing tree assessment, a tree assessor is still not a formal profession. A review of its status, described in the second chapter, indicates that despite the similarity of the scope of tasks and expectations towards tree assessors, and the steadily improving offer of equipment and applications for tree assessment, the process of training and verifying their competence is very diverse, and in many countries does not exist at all. This profession has not been covered by any specific education process in Central and Eastern Europe, and in other European countries, it is also implemented mainly in non-formal education. At the same time, however, there is an obvious need to change and formalize

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the education system as well as to certify tree assessors. Therefore, the results of the TREE ASSESSOR Project respond to a pressing need and can contribute to a significant change in current practice.

The set of materials for the training of people dealing with tree assessment developed within the TREE ASSESSOR Project includes aids for trainers, aids for self-study for trainees and a set of textbooks, as well as this report. Below is a brief description of specific project results.

1. BASIC AND ADVANCED TREE ASSESSMENT – GUIDELINES FOR TRAINING PROFESSIONALS.

This part contains an overview of the methods and forms of education in the field of tree assessment in various European countries, guidelines for tree assessment specifying the necessary scope of competencies for tree assessors, the proposed education system including stages of education, forms and expected learning outcomes (according to the European Qualifications Framework) and proposed set of courses making up comprehensive tree assessment training at basic and advanced levels. It is supplemented with examples of syllabuses prepared for each proposed subject. This section also contains an index of terms.

2. BASIC AND ADVANCED TREE ASSESSMENT. MATERIALS FOR TRAINERS.

A set of materials for teachers and trainers contains aids to check the initial qualifications and knowledge of potential candidates to become a tree assessor. The guide for trainers is designed to walk the teacher through all the training materials and educational process and to indicate the methodological framework of education. It also contains a database of questions and tasks for knowledge tests and exams in tree assessment at the basic and advanced level.

3. BASIC AND ADVANCED TREE ASSESSMENT. MATERIALS FOR TRAINEES.

This section is an aid for candidates, trainees and self-study and contains examples of tests and tasks which allow them to evaluate their knowledge and prepare for tests and exams. It has been developed in the form of a database of questions and tasks and provides examples of online tests for self-completion.

4. BASIC TREE ASSESSMENT MANUAL.

A textbook devoted to tree assessment at the basic level, covering the content corresponding to tasks performed during tree inspection such as visual tree assessment, the impact of fungi important for predicting the risk of tree failure and death, assessing trees in relation to development, determining the monetary value of trees and ecological habitat valuation. This section contains information about tree biology and biomechanics at various stages of tree development. The textbook also contains necessary materials relating to tree species identification and measurement. It consists of a set of mini books illustrated with drawings and photographs helpful for self-study or when in the field.

5. ADVANCED TREE ASSESSMENT MANUAL.

A textbook for advanced tree assessors covering innovative content. It contains elements relating to on the use of specialist tools and calculators, advanced diagnostics involving

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tree crown inspection, tree security assessment, preparation of management plans for valuable trees, as well as a guide covering management processes, tree assessment, communication-related to it and preparation of documentation.

The intended audience for these materials can be divided into two groups:

- **Primary users** – tree assessment trainers and trainees, adults who want to develop professionally in the field of tree assessment, arborists who want to cooperate with tree assessors in tree crown diagnostics, training institutions already participating in tree assessment training or planning to develop in this field;

- **Secondary users** – citizens, formal and informal social groups interested in trees, green spaces managers, high schools and universities providing education in the field of green spaces (e.g. landscape architecture, forestry and horticulture high schools), decision-makers in the field of tree management, those commissioning tree assessment, law-making institutions, courts, insurance companies and citizens benefiting from the presence and function of trees.

Individual elements of the set of materials can also be used by teachers of formal and informal education in other related areas, e.g. forestry high schools, studies of landscape architecture, arborist training, as well as in the process of self-study for people interested in expanding their knowledge in this field.

A broad group of authors has participated in the preparation of this publication. In addition to the project team, we received support from local experts in reviewing the state of diagnostics in other countries – the content was consulted with the representatives of target groups in the project countries as well as international experts.

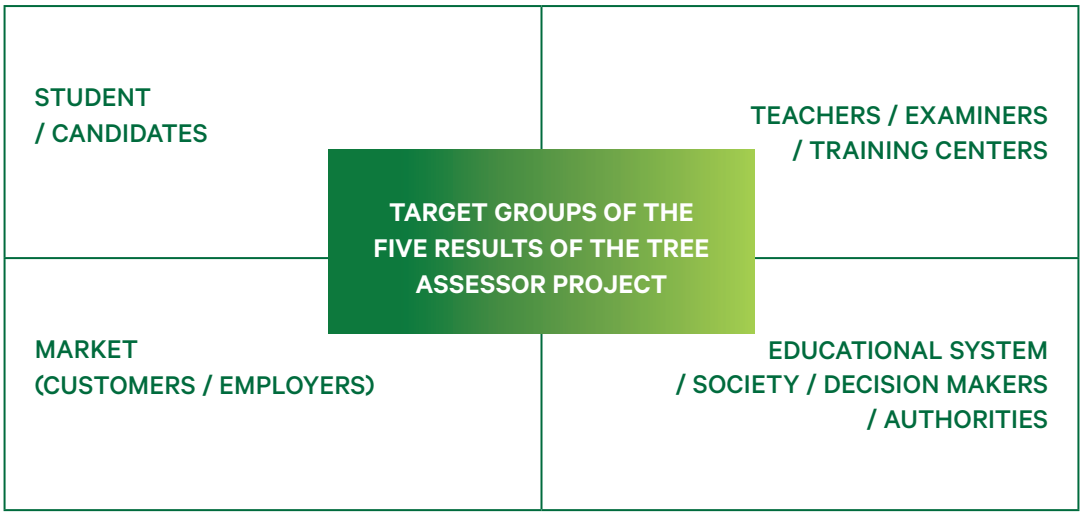

Fig. 1. Main target groups and stakeholders of the Tree Assessor Project results
Source: own work

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II. Review of existing educational procedures

Within the scope of the TREE ASSESSOR project, a review of existing educational procedures was carried out. This review aimed to provide an overview of research about teaching procedures and qualifications related to tree assessment. The primary research method used was a desk-based review of the evidence, practice and policy.

The objective of the review was to gather and evaluate information, including comparison among European countries. In total, representatives of 16 European countries provided a detailed overview; this includes Austria, Germany, Belgium, Bulgaria, Croatia, Czech Republic, Estonia, France, Hungary, Ireland, Italy, Latvia, Poland, Romania, Slovenia and the United Kingdom. Besides, procedures endorsed by the International Society of Arboriculture (ISA) originating from the United States of America were included in the review.

The review of existing procedures was based on desktop research and was composed mainly of survey questionnaires supplemented by online searches and a literature review. The poll was divided into two main themes:

I. **Tree assessment as a standalone discipline in the country;**

II. **The education system for tree assessors in the country.**

The main findings of the desk research are presented below.

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1. TREE ASSESSMENT AS A STANDALONE DISCIPLINE

Tree assessment is seen as a standalone discipline mostly where the evaluation of trees is recognised as a key element of arboricultural practice in a particular country. Existing technical standards related to tree assessment place it as a foundation of decision making for tree management, including a critical component of risk management.

Table 1. Guidance on the roles related to tree assessment

TREE MANAGER	TREE ASSESSOR	TREE WORKER
• Duty of care responsibility • Define and communicate tree assessment and management policies • Determine the need to inspect trees • Establish the budget • Identify the area of inspection • Specify level of assessment • Determine scope of work • Establish assessment frequency • Prioritize work • Choose among mitigation options	• Develop or accept scope of work, including time frame (shared with tree manager) • Identify tree and site conditions to inspect • Identify site conditions • Asses and classify potential hazards to public • Assess and classify potential hazards to tree's wellbeing • Analyse tree risk • Consider if advanced assessment is needed • Develop options for treatments • Recommend inspection frequency • Develop report • Send report to client and explain findings in needed	• Provide requested services: – Tree work safety review – Pruning – Removal – Support systems – Tree health treatment – Soil conditions improvement – Transplanting – Tree replacement • Identify the need for follow-up treatments

Source: own work based on ISA, 2017

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The ISA's Tree Risk Assessment manual includes guidance on roles related to tree risk management, with tree assessor playing a pivotal role (Table 1). It also presents a set of diverse responsibilities that the assessor may have.

A more general picture of the arboricultural industry is presented by the Arboricultural Association in the UK (www.trees.org.uk). It broadly divides arboriculture into four main areas: contractor, consultancy, local authority and training and education. Tree assessment here is represented mostly within the consultancy and tree officer (local authority) areas but is not limited to them. In contrast, for example, to a tree worker that is mostly limited to a contracting role, a person assessing a tree might represent a consultancy as well as other areas. Tree assessor is, therefore, a cross-cutting discipline present in all areas of the UK arboricultural industry. This is even more true in countries where arboriculture is less developed compared to the USA or UK, where the diversity of roles might be present to a lesser extent.

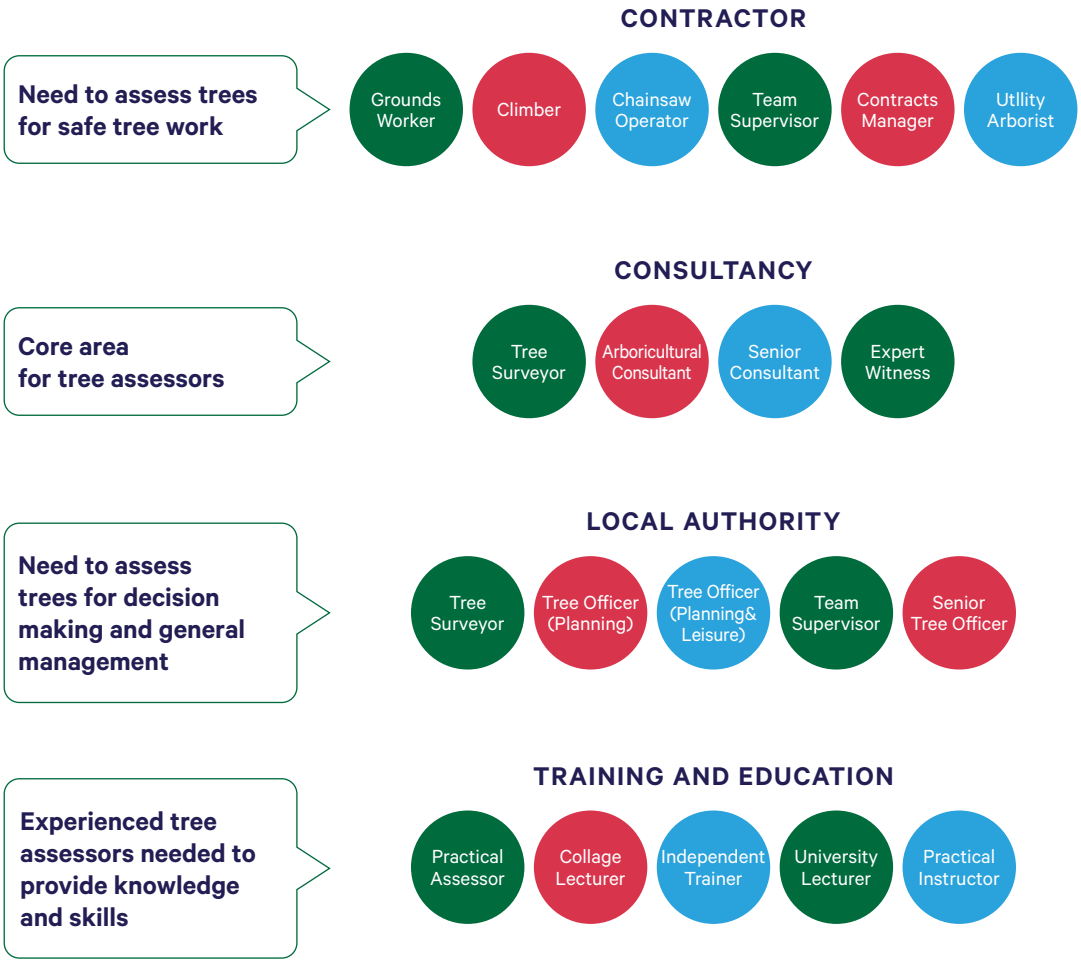

Fig. 2. Tree assessor roles in four main areas of arboriculture
Source: own work based on information from www.trees.org.uk

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Although tree assessment is practised in all countries which were surveyed for this project, almost 60% of them do not yet consider tree assessment as a separate discipline. It is viewed to be part of the multidisciplinary field of broadly defined arboriculture, especially related to the area of arboricultural consultancy or tree pruning and maintenance. However, the trend of an arborist specializing in tree assessment and thus, tree assessment becoming a more independent discipline is increasing.

Among those countries that do recognise tree assessment as a separate discipline, there are Austria, Germany, Estonia, France, Hungary, Latvia and Poland. Out of them, the most recognized and established system comes from Germany which was copied into Austria. Beyond Europe, the most recognized and well-established method of tree assessment was developed by the ISA within the scope of tree risk assessment.

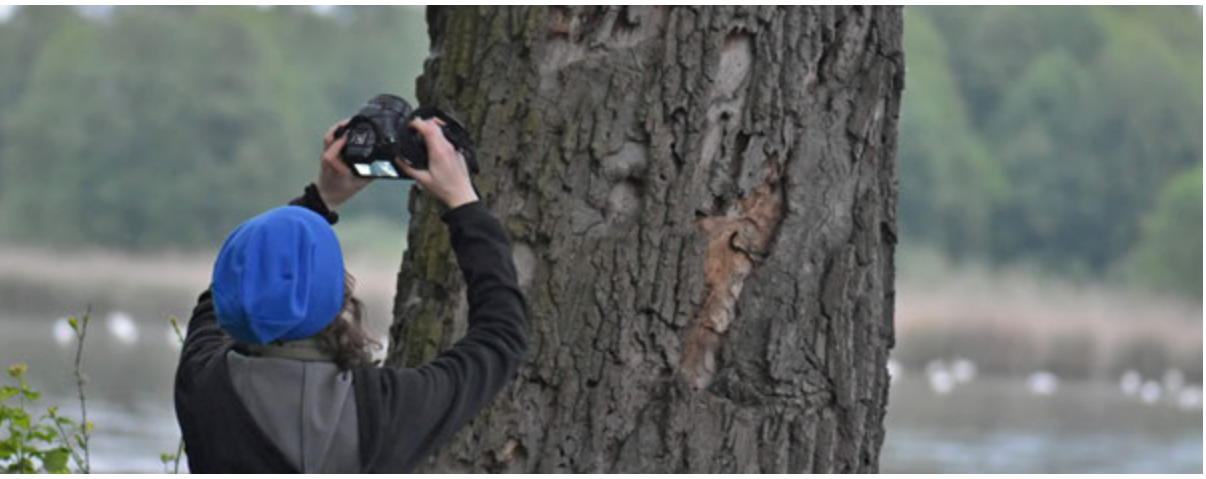
Some of the most commonly used names for this specialist profession include terms such as 'tree inspector', 'tree examiner' and 'tree surveyor'. In most countries where tree assessment is not distinguished as a separate area, those conducting tree assessments tend to be described as 'consultants'.

2. LEVELS OF TREE ASSESSMENT

Trees are assessed for many reasons, including the assessment of condition and health, and risk management, routine management and valuation. Although the survey/inspection scope may vary depending on the work specification and purpose of inspection, it is generally accepted that tree assessment is carried out at two levels: basic and advanced. The presence of a division in the levels of tree assessment is strongly correlated with national recognition of tree assessment as a discipline. Countries that have already established a tree assessment framework usually divide tree assessment to these two levels.

2.1. BASIC TREE ASSESSMENT

Generally, there is a common understanding among surveyed countries of tree assessment at the basic level. Although it is not recognized as a separate discipline or job, it is commonly used in all surveyed countries. In countries



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where tree assessment is still an emerging discipline, it has been used in practice for a more extended period under different names and variable specifications.

The primary method used in basic level is based on the visual method, usually aided with simple tools (probe, mallet, binoculars, etc.). This method of assessment is used in all surveyed countries. It is included in standards and well described in the literature.
There are several approaches to basic tree assessment based on the visual method. Among them, there are three mostly mentioned concepts:

- VTA (Visual Tree Assessment);
- Baumkontrolle (tree inspection) method in Germany, also used to some extent in other countries;
- ISA Tree Risk Assessment (used for example in Croatia, France, Slovenia, Italy).

A slightly different approach is presented in the UK, where the names 'basic tree inspection' and 'professional tree inspection' are typically used regarding specific qualifications. In comparison with other methods and divisions, both of these levels would fall within more general basic tree assessment.

Additionally, a basic tree assessment is usually required also before any kind of tree work and is also commonly used in the application for tree felling approval. However, a detailed analysis of these practices shows vast diversity and inconsistency in the scope and methods used.

2.2. ADVANCED TREE ASSESSMENT

Generally, within surveyed countries, the term 'advanced assessment' is interchangeably used with 'instrumental/device-supported assessment'. It is essential to point out that most of the existing standards and literature distinguish between advanced and instrumental assessment, with the latter being one part of the advanced assessment. Advanced tree assessment goes beyond instrumental assessment and may include pest and diseases diagnosis, aerial inspection, soil analysis, site assessment, root detection and other specialist tasks.

Fig. 3 Basic vs. advanced tree assessment approaches
Source: own work

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3. ENTRY REQUIREMENTS

Tree assessment is a multidisciplinary activity requiring a specific skill set and broad knowledge base. In existing standards, tree assessment is described as a 'specialist task', hence only people with necessary skills and knowledge should be allowed to undertake it. Additionally, some experts consider tree assessors as a profession in a position of public trust due to their role in public risk management related to trees.

The review of existing procedures reveals broad diversity in entry requirements ranging from none to a higher level of education.

For basic level assessment, the German Baumkontrolle FLL standard pre-requisite for attending the certification exam is to have at least one year of practical experience in tree assessment with appropriate training. Deviating from this, admission can also be granted to those who, by submitting certificates or in some other way, demonstrate that they have acquired knowledge, skills and experience that justify admission to the examination.

The high-level 'Registered Consultant' scheme operated in the UK by the Arboricultural Association requires the candidate to qualify as NVQ (National Vocational Qualification) Level 5 or above and at least five years relevant experience at an advisory level (this must cover the assessment core subject areas and may include experience as a local government officer). On the other hand, the LANTRA Basic Inspection course that is aimed for the identification of hazardous trees does not include any pre-requisites for attendance. There is no exam after the training, and only a certificate of attendance is issued. It is essential to point out that these two schemes are complicated to compare as they have different scope, importance and level of required knowledge and skills. However, they do both include tree assessment.

Table 2 presents the comparison of different requirements for recognized and widely-accepted qualifications. These are mainly associated with countries where tree assessment is performed on a large scale, or at least has been for the last few years. The division between basic and advanced level was based on the judgement of the authors after reviewing the available information on each training course.

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Table 2. Comparison of prerequisites in tree assessment training schemes

NAME OF QUALIFICATION	LEVEL BASIC/ADVANCED	EDUCATION	RELEVANT EXPERIENCE
AA Registered Consultant – UK	advanced	EQF Level 5	5 years
Baumkontrolleur – Germany and Austria	basic	no requirement	1 year
Certified arborist ISA – USA and international	advanced	Completed College/ University Accredited Degree Programs – equals to EQF level 5	3 years (one full year equals to 2080 hours)
Certified tree inspector – PL	basic	no requirement	6 months
Czech certified arborist – consultant – CZ	advanced	no requirement	5 years
European Tree Technician ETT – Europe	basic	diploma in green industry – equals to EQF level 3	3 years
Hungarian Tree Assessor specialist	basic	BSc or MSc in relevant field	–
Professional tree inspection – the UK	basic	EQF level 3	Experience required without specification
TRAQ ISA – USA and international	advanced	professional qualification (a list is provided) including a degree in arboriculture, urban forestry and similar – equals to EQF level 5	Experience required without specification
VetCert consulting – route 1 – Europe	advanced	diploma in green industry – equals to EQF level 3	5 years (including 3 in consulting)
VetCert consulting – route 2 – Europe	advanced	EQF level 3 outside of the green industry	10 years (including 5 in consulting)

Source: own work

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This comparison shows a significant increase in requirements at the advanced level. This level of assessment often requires education at EQF level 3-5 and between 3–10 years of experience. Requirements for basic tree assessment are accordingly lower. In many cases, there is no requirement related to education level; however, it is common to require at least one year of practical experience in tree assessment.
It is worth pointing out that during this research, the authors came across qualifications awarded purely on attendance only, but these are rather rare. There is also a large number of training courses in tree assessment which are offered without any pre-requisites. Still, these tend to award a certificate of attendance rather than a formal qualification.

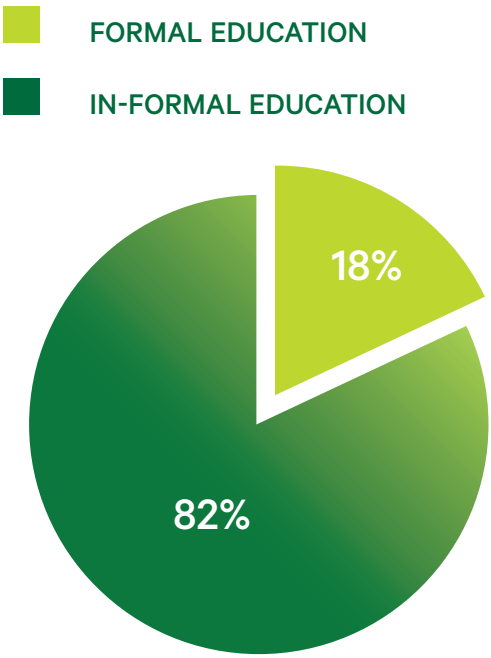

Fig. 4. Structure of types of education currently offered for tree assessment
Source: own work

4. EDUCATIONAL PROCESS

4.1. FORMAL EDUCATION

Formal education is based on training with a specific and desired outcome, often associated with the presence of curricula and a syllabus. This type of learning is mainly associated with schools, colleges and universities.

In 14 out of 17 surveyed countries, tree assessment qualifications are not available through formal education. In the minority of states where formal education includes tree assessment topics, it is limited mainly to visual tree assessment and tree inventory. In most cases, these are among the subjects that are included in educational programs at universities (EQF level 4-5). Mostly these falls within forestry and/or urban forestry degrees.

4.2. NON-FORMAL AND IN-FORMAL EDUCATION

Non- and in-formal education is based on activities which tend to have to have an agreed learning purpose which takes place in or focuses on the context. Examples would include expert-led events such as training courses. In the assessment of trees, this is the most common way of providing qualification. Certification centres and arboricultural organizations provide a rich offer of training and qualifications. At the same time, the number of available courses directly related with presence of technical standards.

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5. CERTIFICATION PROCEDURES

Most of the tree assessment qualifications currently available include certification procedures. In all surveyed cases, the method used for assessing knowledge and skills of candidates is examination. These exams are usually divided into two parts: written and practical (including tree assessment and oral exam). In some cases, these are further divided into predefined key components, for example, tree identification and fungi identification etc. (see table 3).

Exam passing rate varies between 50-80%. Usually, candidates are required to pass each part separately, and in addition, there is an overall pass mark. This review indicates that again there is a difference between basic and advanced levels, with the first one having a lower pass rate (usually 50%) and advanced requiring between 70-80%.

Usually, recertification is defined in the qualification procedures. Here again, it is dependent on the level of assessment. Basic level assessment such as Baumkontrolle in Germany or Certified Tree Inspector in Poland at the time of writing have no recertification procedures, and the qualification is granted for a lifetime. Recertification is common within the advanced level. Usually, to prolong the validity of the qualification one needs to pass a new exam or submit evidence of continuous professional development. Recertification usually takes place between 3–5 years after initial qualification was gained.
For some qualifications and certifications, it is necessary to be a member of a particular organization or awarding body, sometimes involving the payment of a fee.

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Table 3. Comparison of certification procedures

	EXAM PARTS	PASS SCORE	RECERTIFICATION
Baumkontroller – Germany and Austria	1. Written exam – 50 questions (60 minutes) 2. Practical-oral exam (45–60 minutes)	50% from each part	N/A
Certified Arborist ISA – USA and international	1. Written exam – 200 multiple choice questions (3,5 hours)	76%	Valid for 3 years, then passing exam OR accumulate 30 continuing education units
Certified Tree Inspector – Poland	1. Written exam – 50 open questions (60 minutes) 2. Practical tree assessment – 3 trees (30 minutes)	50% from each parts	N/A
Czech Certified Arborist – Consultant	6 exam parts: – written theoretical exam (1h) – test format – tree identification (30 mins) – fungi (diseases) identification (30 mins) – pest identification (30 mins) – tree protection during build development project (60 mins) or – tree valuation (economical) (60 mins) + wind load analysis (60 mins) • practical exam, tree survey – 10 trees (180 mins)	Written exam – 60% Field exam – 70% Oral exam – 70%	Candidates need to recertify every 3 years: • administrative recertification (pay a recertification fee) • requiring a minimum of 3 (5 days) of educational activities per 3 years • second option: passing written part
European Tree Technician ETT	1. Written Examination (180 min) 50% short questions (duration about 60 minutes) and 50% longer, essay type questions (duration about 120 minutes). This exam is supervised and should take no longer than 180 minutes 2. Management Exercises in Tree Inspection (60 min) 3. Management Exercises in Economy, Law and Social Studies (180 min)	Each part of exam – 50% Written exam – both short and essay questions – each 50%	N/A

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	EXAM PARTS	PASS SCORE	RECERTIFICATION
Hungarian tree assessor	Thesis and oral defense of thesis plus oral exam	50%	2 years – submit evidence of continuous professional development
Professional Tree Inspection – UK	1. Written (1,5 h) 2. Fungi ID (20 min.) 3. Practical tree inspection – 2 trees	Overall pass mark – 70% and must achieve min 70% in practical inspection	N/A although refresher training is recommended
TRAQ ISA – USA and international	Written exam: 100 multiple-choice questions. Each question has four answer choices, and only one is correct. You will have two hours to complete the written exam. Performance-based exam: An actual, outdoor tree assessment tests one's ability to apply tree risk principles to a tree at the training site. One hour to complete the performance-based exam.	75% for the written component and 80% for the performance-based component.	5 years, one-day refresher course and exam
VetCert consulting – Europe	• 2-hour written exam • 2-hour outside exercise including oral questioning • management report on the trees the candidates surveyed on-site – 2 hours. The overall time of the exam, including breaks, is around 7 hours.	overall mark of at least 75% and no less than 50% in any one section	3 years – submit evidence of continuous professional development

Source: own work

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6. CONTROLLING INSTITUTIONS AND QUALITY ASSURANCE

To make sure that the educational process adheres to the required standards, some countries have developed quality assurance methods. Among them is the German Standard for Tree Inspection, with FLL (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V.) being the controlling institution:

1. delivery of exam questions comes in sealed envelopes, and the set of questions is taken from a central database of the FLL,
2. a control person from the FLL can supervise each exam,
3. the external part of the exam is always carried out under the presence of two examiners.

Exam supervision is the most common method of quality control. It is also used in the European Tree Worker scheme. There is rather a positive attitude towards this method of control, especially with more extensive international programmes. Also, some programmes such as the VetCert tree specialist as well as the FLL Baumkontrolle include a central database of exam questions and tasks. In comparison to other international schemes lacking such a database, it is assessed to be important in maintaining the universal standard.

7. NEEDS FOR STANDARDIZATION OF TRAINING AND CERTIFICATION OF TREE ASSESSORS

The review of standards and practices indicates a lack of common standards in educating tree assessors, and this applies both internationally and within individual countries. The key findings of the review of existing tree assessment standards include:

1. Lack of standard educational process for tree assessment – although tree assessment has been performed for a few decades and technical standards in some countries were published almost 15 years ago, there is no standard of education. During data collection, this was identified as a critical aspect for improving the quality of tree assessment.

2. Tree assessment may be performed at different levels with their specificity and limitations – although assessment of trees might seem like a simple activity, it involves many methods and tools. Developing further this profession needs more explicit guidance on levels of assessment with regard to their possibilities and limitations.

3. Standards indicate the minimum requirements in relation to the scope of works and tasks – one of the key advantages of having a standard is that it brings closer the common understanding of a task between different stakeholders. It is also valid with tree assessment where standards present and to some level regulate responsibilities of institutions involved in tree management.

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4. Tree assessment may be aided with the use of tools ranging from simple to sophisticated technological methods – technological development also brings new ways into the area of tree assessment. These new tools may help in making the right decision for tree management. Increase in new technologies also brings the challenge of a better understanding of how these can be used properly to avoid misinterpretations leading to wrong decisions.

5. Tree assessment is a complex task that requires an appropriate level of knowledge and skills – assessment of trees is a multidisciplinary profession that influences public health and safety. Due to growing risk-averse expectations, it is crucial to have competent tree assessors to provide the best result. This can only be achieved with substantial and well-structured training.

6. Tree assessment is usually based on local legal requirements – although there are differences in legislation related to tree management between countries tree assessment is becoming an international profession. Therefore international cooperation in shaping educational standards is needed to accommodate these differences.

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III.
Standards of tree assessment – a basis for creating guidelines for the training of tree assessors

Trees are managed in urban and other public areas for their multiple benefits. Tree assessment in relation to general tree management is one of the key tasks. Existing tree assessment standards present the maintenance of public safety through the identification of hazards and structural weaknesses present on a tree as the crucial area. Nowadays, there is also a trend towards the increasing importance of a tree's health and wellbeing, hence the set of features and characteristics that a tree assessor should include is expanding.

Tree assessment standards are becoming more common in many parts of the world. In Europe, the first tree assessment standard was developed in Germany by the FLL in 2006 and was revised twice since then. Other countries such as the UK, Czech Republic and Slovakia published their standards later. These documents set out the minimum requirement related to the assessment of trees and therefore influence the educational process that one has to follow to be qualified for the task. The work on the preparation of the Tree Assessment Standard carried out as part of the Trees for Green Infrastructure of Europe project[1] has revealed that currently there are no uniform and international guidelines for tree assessment. In Poland, an effort was undertaken to develop a national tree assessment standard[2], with objectives, levels and methods of performing tree assessment, specifying the boundary conditions of the requirements for tree assessment contractors.

The assessment of trees should be carried out in a structured, systematic and adequately documented manner. Tree assessment is usually carried out individually for each tree. In some cases, the assessment of tree groups is also performed. Tree assessment can be carried out at various levels of detail depending on the needs and tools used. The grade should be appropriate to the grade level. If the features of a given tree cannot be correctly assessed at the selected level, a higher grade should be recommended. In the event of a direct threat related to the identified features on the tree, regardless of the type of assessment, you should immediately report this state of affairs to the manager/owner of the tree.

1 "Trees for Green Infrastructure of Europe" (LIFE15 GIE/PL/000959) Project financed by the European Commission under the LIFE + Financial Instrument. www.drzewa.org.pl

2 Tree Inspection And Assessment Standard - created in the above mentioned project.

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1. LEVELS OF TREE ASSESSMENT

Tree assessment may be conducted at different levels of detail, including various tools, methods and procedures. Commonly there are two main levels distinguished: basic and advanced. Most standards include detailed information on the basic level of assessment. Advanced assessment due to its complexity may be presented in a separate standard or included in a general tree assessment standard with less detail. Some countries also use other levels such as tree inventory or limited visual assessment. Although a person commonly performs tree assessment, remote tree surveys that use modern technology are also becoming more popular. The analysis of the scope of work and the content of the standards also allows distinctions to be drawn between the two main different types of tree assessment – **inventory or survey**. The three levels of tree assessment one can illustrate as on figure 5 below.

Desk research was made for various countries, to prepare guidelines for the education of people performing tree assessment. Table 4 summarizes the levels of tree assessment together with specific terminology for basic and advanced assessment.

1.1. TREE INVENTORY

Tree "survey" or "inventory" in many countries are still interchangeably used with "inspection". Countries that have already established tree assessment standards usually clearly draw the distinction line to avoid misunderstanding and misuse in works specifications. For this reason, in the scope of TREE ASSESSOR project, tree inventory is defined as a gathering of information and tree's parameters without assessing their role and importance. Therefore tree inventory is composed of two main tasks:

- species recognition,
- measurement of trees (commonly: diameter/ circumference, tree height, crown height, trunk height, crown spread etc.).

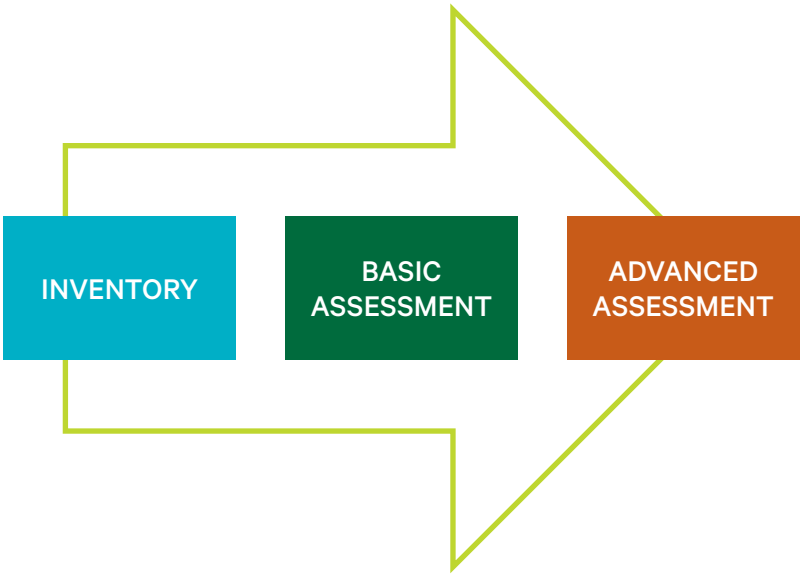

Fig. 5. Tree assessment levels as stages of tree assessment
Source: own work

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Tree inventory requires the use of measuring tools, and in case of mapping, proper equipment and software include a description of the trees in question, including species, basic dimensions, location data, and – although not always – associated notes to help to identify or influence the further investigation or remedial works. An inventory does not include tree assessment, but it is a necessary first step before the proper assessment is conducted.

1.2. BASIC ASSESSMENT – TREE INSPECTION

The basic assessment is a full visual assessment of the entire tree, carried out from ground level. The assessor is required to walk around the tree, assessing the surroundings, trunk base, trunk, branches, branches, shoots and leaves. Basic assessment may require the use of simple tools (binoculars, probe, mallet, etc.). The main limitation of the basic assessment is the limited or no possibility to assess the internal parts of the tree, the root system or the upper parts of the crown.

Based on the basic assessment, one can select and design appropriate management methods for maintaining trees, reducing the risk in their surroundings. If the basic assessment is not sufficient to assess the features identified, a specialist assessment should be recommended.

As part of tree inspection, one can use simple tools to acquire or deepen knowledge of the tree and its potential diagnostic features. The use of additional devices is not mandatory, except where such a requirement is formulated in the task specification. The main tools used in tree inspection include:

- Binoculars can be used to inspect the top of the tree crown, identify hollows, cavities, bird nests, cracks, weak bifurcations and other factors,

- Mallet can be used in the assessment of trees to identify areas of the trunk with internal decay. The tree trunk is tapped with a mallet, while the person performing the test listens for different tones to identify defects.

- Metal probe is a rigid rod with a handle that is used to examine the condition of the root base and major roots.

The tree inspection process includes the following tasks:

- identify and locate tree,
- identify and assess the tree's surroundings in relation to potential targets and the site conditions,
- inspect the tree visually considering typical inspection features, tree's development phase, species characteristics,
- identify associated organisms,
- assess risk to public safety,
- assess the tree's health,
- provide tree management recommendations,
- record observations,
- develop and submit a report.

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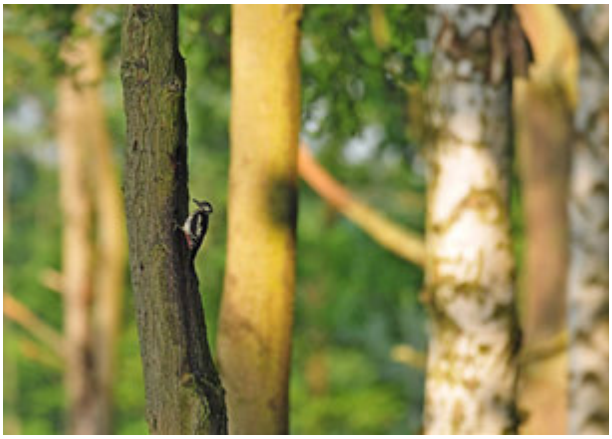

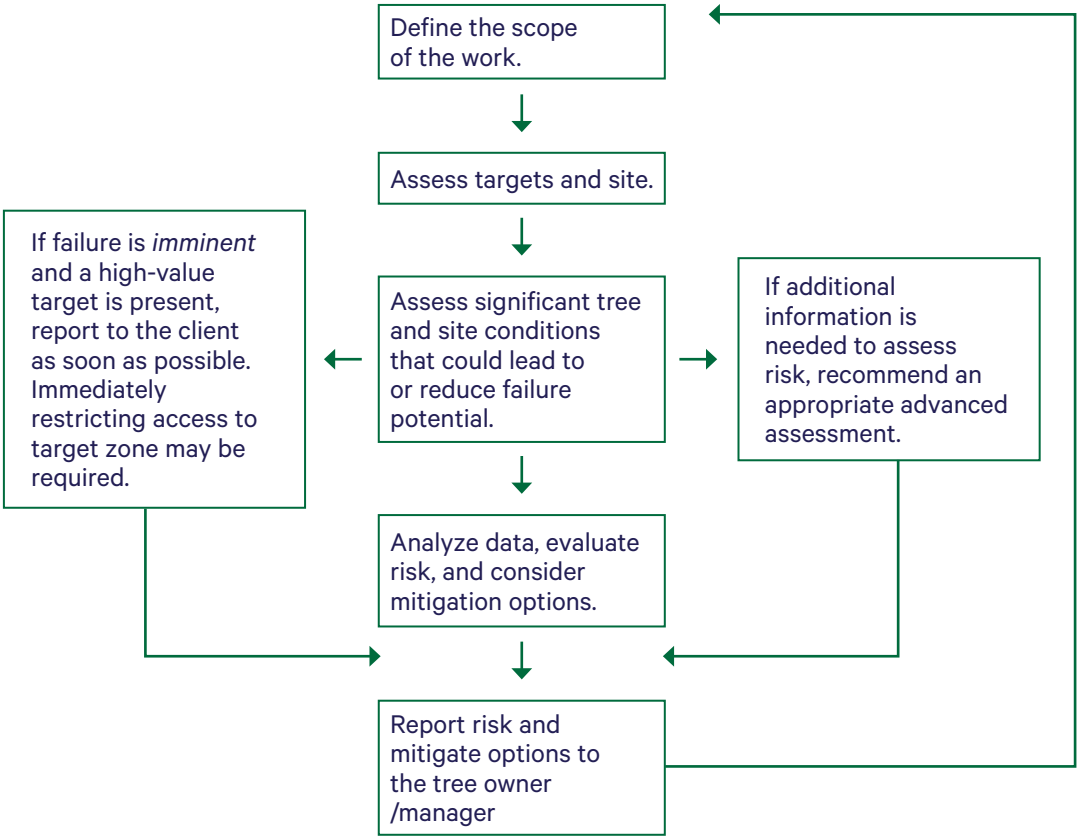

Fig. 6 Flow Chart of Level 2: Basic Assessment Procedures
Source: own work based on own work based on ISA, 2017

1.3. ADVANCED ASSESSMENT

Advanced assessment is performed for detailed analysis of individual parts of the tree, identified features or environmental and habitat conditions. Often it is implemented as a recommendation of basic tree assessment. Usually, advanced assessment requires specialized tools and/or methods. The choice of assessment method and diagnostic tools should be adapted to the scope of the assessment. Specialist assessment of trees is an expert assessment, the purpose of which is a detailed analysis of the state of the whole tree or its individual parts.

Based on the specialist assessment, it is possible to select and design appropriate treatments related to the maintenance of the tree and reduction of risk in its surroundings.

Advanced assessment may include gathering specific information about trees with several techniques. Standard advanced assessment techniques include:

- aerial tree inspection – requires the use of access techniques and tools,
- assessment of mechanical support systems,
- instrumental tree assessment – decay detection, stability testing,

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- use of calculators for tree statics,
- assessment of ancient and other veteran trees,
- detailed site conditions analysis,
- detailed assessment of soil conditions,
- specialized examination of associated organisms (including protected species),
- investigation of the root system of the tree (e.g. soil layer removal, loading methods),
- biomechanical analysis and assessment of tree stability/security,
- tree valuation,
- pest and diseases analysis.

Specialist assessment may also indicate tree work recommendations in detail and more precisely in comparison to the basic level. Based on specialized research, further recommendations related to improving the stability of the tree and its parts and maintaining the tree (e.g. improvement of habitat conditions, including fertilization, mulching, etc.) can be modified or adapted accordingly. Some situations may require the use of several methods and instruments to obtain a comprehensive assessment.

It should be remembered that individual diagnostic tools (including calculators) have their limitations and serve different purposes of assessment. Therefore their use requires a high level of knowledge and expertise in their use and interpretation of results.

Table 4. Tree assessment levels

LEVEL OF ASSESSMENT	TYPE OF ASSESSMENT
Tree inventories	
Primary/basic inventory, e.g. for tree stand management purposes	Inventory
Basic assessment	
Quick/simplified primary inspection	Tree inspection
Quick/simplified secondary inspection	Tree inspection
Full inspection (basic diagnostics)	Tree inspection
Tree value assessment	Tree inspection or specialist tree valuation
Advanced assessment	
Assessment of tree condition – trunk condition (wood decomposition), physiological parameters	Instrumental diagnostics
Assessment of tree stability in the soil	Instrumental diagnostics
Evaluation of existing protective measures	Specialist assessment
Assessment of other tree aspects, e.g. the root system	Instrumental diagnostics
Aerial crown assessment	Specialist assessment

Source: own work

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The above-listed works consist of 5 main stages:

1. Communication with the commissioning party – preparation of the offer, designing the scope of diagnostics;
2. Collecting data in the field using appropriate tools;
3. Data analysis and development of analysis reports;
4. Conclusions and recommendations;
5. Preparation of submission of documentation.

2. TOOLS, INSTRUMENTS AND APPLICATIONS USED IN TREE ASSESSMENT, AND REQUIRED COMPETENCIES

Analysing the scope of used tools and competencies also provides a set of differences in the requirements of persons describing and assessing trees at distinguished levels. The most important of them are listed in Table 5.

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Table 5. Tre assessment levels, tools usually used and competencies required

LEVEL OF ASSESSMENT	TYPICAL TOOLS, INSTRUMENTS/APPLICATIONS	REQUIRED COMPETENCIES AND TRAINING
TREE INVENTORY		
Primary inventory, e.g. for tree stand management	Measuring tapes, tree callipers, traditional and digital maps, altimeters, rangefinders, a GPS, GIS applications, editing, and calculation programs.	Ability to operate specific equipment according to its manual and standard guidelines. General digital competencies (e.g. operation of MS Office). Usually no specialised training and certification, except for GIS.
BASIC ASSESSMENT – TREE INSPECTION		
Quick/simplified primary inspection	A camera or digital camcorder – stand-alone or on a mobile device (smartphone, tablet), binoculars.	Ability to operate specific equipment according to its manual.
Quick/simplified secondary inspection		
Full inspection (basic diagnostics)	Wooden or rubber mallets, metal probes, increment drills, binoculars.	Basic training in the use of equipment. No certification.
Tree value assessment	Proprietary models based on spreadsheets or programmed in specialised applications.	Open-access – ability to use it according to the manual or general guidelines (e.g. Hungarian application Fáérték, i-Tree). Proprietary models may require training and certification.
Habitat valuation of trees	Usually no tools; guides, identification keys and photo/video documentation tools.	Specialist knowledge about protected species, usually training is required. In most cases certification is not carried out.

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ADVANCED ASSESSMENT – SPECIALISED/INSTRUMENTAL DIAGNOSTICS		
Assessment of tree condition – trunk condition, physiological parameters	Sonic tomography, electrical resistivity tomography, resistance drills. Equipment for measuring physiological processes: a spectrophotometer for measuring chlorophyll content, gas analyzers for measuring gas exchange and transpiration, a pressure chamber (a pressure bomb) for measuring water potential.	Ability to operate specific equipment according to its manual and standard guidelines. Specialist training provided by the producer or training centre, often certified.
Assessment of tree stability in the ground	Equipment for load testing, equipment for dynamic wind load testing, calculators/ software for analysing and processing results.	Ability to operate specific equipment according to its manual and standard guidelines. Specialist training provided by the producer or training centre, often certified.
Assessment of existing protective means – cabling, bracing, props	No specialist tools	Conducted as advanced diagnostics
Assessment of other tree aspects, e.g. the root system	Root detectors (e.g. TreeRadar, root ultrasound tomography), devices for excavating roots with compressed air (e.g. AirSpade).	Ability to operate specific equipment according to its manual and standard guidelines. Specialist training provided by the producer or training centre, often certified.
Crown assessment	Equipment suitable for access methods and access techniques	Specialist training provided by the producer or training centre, often certified.

Source: own work

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3. TREE ASSESSMENT LEVELS AND REQUIRED COMPETENCIES

The purpose of separating 'tree inventory' from 'tree assessment' within the scope of the TREE ASSESSOR Project is to emphasise the significant differences between these activities. In countries where tree assessment is a developing field, tree inventories are often mistakenly described as assessments. The authors appreciate that this may seem like an unnecessary division in those countries where terminology and rules around tree assessment are more established and understood, however it is important for the purposes of this report.

By analysing the scope of activities, equipment, processes and scope of decisions, one can notice significant differences in the requirements for knowledge, skills and social competencies of people assessing trees at individual levels. The most important of them are listed in Figure 7. More detailed description one can find in chapter IV.

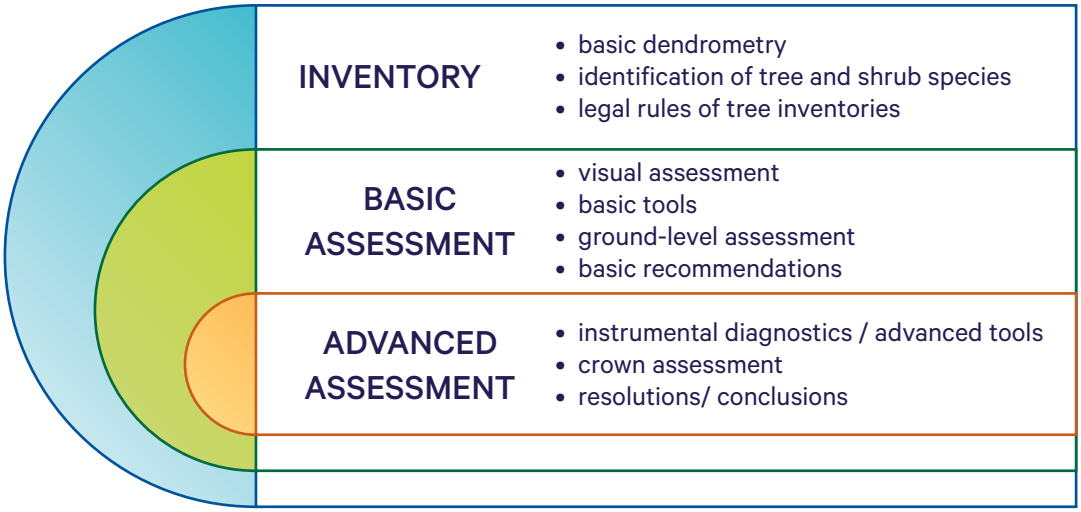

Fig. 7. Selected scopes of competencies at different levels of tree description and assessment
Source: own work

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IV.
The Tree Assessor – profession and competencies

1. GENERAL DEFINITION OF THE PROFESSION

A tree assessor conducts and carries out works related to identification, inventory, measurements as well as the assessment of the condition and stability of trees and woody shrubs. These activities can be accompanied by guidelines and recommendations concerning works related to in-depth assessment, maintenance or removal of trees. A tree assessor is also responsible for preparing the results of these works in the form of documents.

2. INITIAL REQUIREMENTS FOR CANDIDATES WHO WISH TO PARTICIPATE IN TRAINING IN THE FIELD OF TREE ASSESSMENT FOR PROFESSIONALS

The training programme for tree assessors assumes that candidates will have basic competencies connected with trees and general knowledge necessary to master the very process of assessment.

These competencies include:

a. Basic knowledge of biology, including the basics of botany and zoology, and basic biological terminology.

b. Basic knowledge of mathematics, physics and chemistry.

c. Basic competencies in the use of measuring instruments.

d. Some knowledge of dendrology – ability to identify common species of trees and shrubs growing in a given country, both native and non-native.

e. Good reading and writing skills, the skills of using a computer and basic editing software as well as the knowledge of the Internet; the understanding of foreign languages is recommended.

f. Basic knowledge of tools and techniques of digital photography and editing performed with the help of popular graphics or editing software.

g. Ability to read and use traditional and digital maps as well as GPS systems.

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Candidates for this profession should demonstrate knowledge and preparation in the above-listed areas, showing evidence of their education or hands-on experience. It is advisable to conduct a competence test checking the required knowledge and skills. In the absence of the indicated competencies, it is necessary to supplement a candidate's knowledge and skills in this field, for example, by offering specialist training courses.

3. COMPETENCIES: KNOWLEDGE AND SKILLS

Professional competence is a set of knowledge, skills and social competencies necessary to perform, within a defined scope of work, a set of professional tasks. Possessing one or several professional competencies should enable employment in at least one job position in the profession.

Competencies can be obtained through various forms of formal, informal and non-formal education (see chapter five).

The required competencies of a tree assessor can be divided into two main areas.

A. **General professional competencies** – related to the performance of work in the field and the use of technical tools, instruments and equipment. They are presented in Table 6.

They cover the areas of occupational health and safety, premedical first aid, general knowledge of the law, project management and organization of fieldwork. This publication does not include any guidelines for education in these areas. However, information about them may appear as part of individual proposals for core curricula and in the content of textbooks.

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Table 6. General professional competencies of a tree assessor

GENERAL PROFESSIONAL COMPETENCIES: KNOWNS AND UNDERSTANDS:	SKILLS: IS ABLE TO DO:
• Rules and regulations of occupational health and safety, fire prevention and ergonomics; • Rules for securing the area and preparing information for specialist services; • Rules of premedical first aid; • Rules for using electro-technical tools and equipment; • Biosecurity rules.	• Comply with the rules and regulations of occupational health and safety, fire protection and industry standards; • Prepare and secure the site of work against the entry of unwanted persons using measures required by the law or health and safety rules; • Prepare information for specialist services; • Provide premedical first aid and perform activities necessary for providing medical help by specialists if the need arises; • Use technical tools and equipment in accordance with their instructions; • Use biosecurity measures and tools necessary for work related to tree assessment, e.g. disinfection of tools.

Source: own work

B. Specialist competencies – related to tree assessment at different levels of advancement. They are described in sections 3.1, 3.2 and 3.3 below.

They include both basic competencies related to tree inventory necessary to perform inspections or tree assessment, as well as a wide range of specialist competencies.

3.1. BASIC TREE DATA

As mentioned above, tree inventory is not included in the tree assessment area, but the competencies associated with it should be used in the assessment of trees.

For every level of tree assessment, it is necessary to possess specific skills of identifying tree species and most common shrubs, especially the woody ones, performing necessary dendrometric measurements, finding individual trees for assessment in the field and on a map, and marking them in the field (e.g. with special marks) and in documentation/on a background map. It is also necessary to know the legal regulations and standards applicable in a given country defining the framework for measuring trees, usually connected with decisions on protecting or cutting them down, or their valuation. Table 7 presents knowledge and skills essential for specialists assessing trees in these areas.

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Table 7. Competencies considered necessary for the tree assessor in the scope of collecting basic tree parameters

BASIC TREE DATA GATHERING: **AREA OF COMPETENCIES**	KNOWLEDGE: **KNOWS AND UNDERSTANDS**	SKILLS: **IS ABLE TO DO**
Dendrometry	K.0.1. Main methods, tools and their application in tree measurement. K.0.2. Standard measurement procedures and legal requirements.	S.0.1. Conduct proper measurement of trees and shrubs. S.0.2. Use correct measurement tools.
Main rules of tree Identification	K.0.3. Tree features in relation to species identification by leaves and leafless. K.0.4. Characteristics that allow recognition of the species (varieties, forms, cultivar).	S.0.3. Recognise and name (using the common and scientific name) common tree species both by leaves and leafless.
Mapping and marking trees	K.0.5. Types of maps, their relevance, applicability, acquisition and use. K.0.6. Methods and tools for marking trees. K.0.7. Tools and methods for recording, cataloguing and processing data.	S.0.4. Select and use appropriate maps. S.0.5. Indicate trees on mapping layer. S.0.6. Locate trees in the field based on inventory data.
The legal framework for gathering basic tree data	K.0.8. Basic regulations related to the inventory of trees including measurement of trees, tree ID, mapping and marking trees.	S.0.7. Find and apply appropriate regulations.
Gathering basic tree data in practice	K.0.9. Methods and tools for tree inventory. K.0.10. Types and methods of data gathering and presentation.	S.0.8. Gather, review and prepare documentation for tree inventory. S.0.9. Perform tree inventory.

Source: own work based on the content of syllabuses for the subjects of Inventory Tree Assessor

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3.2. BASIC TREE ASSESSMENT

The basic level of tree assessment covers a significant range of knowledge and activities necessary to assess the condition of the tree, identify risks to the tree and surrounding area, determine the potential causes of these risks and decide on further actions including remedial work and further investigations. This will include an assessment of the tree taking into consideration species, position in the landscape, stage of growth etc. This level of assessment might also include a basic ecological assessment with regard to habitat potential. To perform basic tree assessment, one should possess the knowledge and skills necessary to assess the condition of the tree and identify any features and associated health and safety implications.

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Table 8. Basic tree assessment – competencies considered necessary for the tree assessor at the tree inspection level

TREE INSPECTION AREA OF COMPETENCIES	KNOWLEDGE: **KNOWS AND UNDERSTANDS**	SKILLS: **IS ABLE TO DO**
Tree biology and biomechanics – basics	K.1.1. Foundations of anatomy, physiology, ecology, and architecture of a tree. K.1.2. Tree's developmental phases. K.1.3. Foundations of tree biomechanics.	S.1.1. Explain basic biological and ecological processes influencing tree stability and vitality. S.1.2. Recognize and explain basic disturbances of tree biomechanics. S.1.3. Apply the acquired knowledge in tree biology, ecology, and biomechanics in tree assessment.
Analysing tree's history in tree assessment	K.1.4. Biotic and abiotic factors that influence the tree's functioning. K.1.5. Importance of historical events to tree's wellbeing. K.1.6. Mechanisms and responses of trees to past changes.	S.1.4. Identify in the field historical changes that influence the tree's development. S.1.5. Recognise and analyse the importance of these changes. S.1.6. Assess tree's response to past changes.
Identification of threats to trees	K.1.7. Characteristics of the most common factors affecting the threat to the functioning of trees, including diseases, pests, and habitat factors. K.1.8. Basics of diagnostic methods in this regard, including the principles and methods of collecting evidence and samples.	S.1.7. Identify and assess the significance of the feature. S.1.8. Collect materials and prepare samples for further analysis.
Biodiversity survey of trees – protected species	K.1.9. Basic legal provisions in the field of nature protection regulations. K.1.10. Biology and ecology of selected obligatorily /optionally protected species associated with trees.	S.1.9. Assess the habitat value of tree habitat for protected species. S.1.10. Recognize signs of protected species on trees. S.1.11. Document symptoms of protected species on trees.

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	K.1.12. Methods to minimize /compensate for adverse effects on protected species.	
Introduction to wood-decaying fungi	K.1.13. Biology of fungi and identification criteria. K.1.14. Relationship between wood-decaying fungi and their hosts. K.1.15. Influence of relevant species on tree stability.	S.1.12. Identify species/genera most relevant to tree stability. S.1.13. Assess the influence of fungi on the stability of trees accounting for their species and condition.
Valuation of trees	K.1.16. Main factors of the tree valuation. K.1.17. Tree value calculation methods.	S.1.14. Conduct a proper valuation of trees. S.1.15. Use calculation apps. and other software.
Identification of hazard trees in tree assessment and categorisation of trees	K.1.18. Typical diagnostic features and their importance in tree health evaluation. K.1.19. Methods to identify and assess the main diagnostic features. K.1.20. Relations between the diagnostic feature and health problems of trees. K.1.21. Effects of the observed diagnostic feature on tree safety.	S.1.16. Recognise common diagnostic features. S.1.17. Indicate the obvious diagnostic feature on the tree. S.1.18. Assess the relevance of the given diagnostic feature.
Simple tools in tree assessment	K.1.22. What is a simple tool for assessing trees and what information do they provide K.1.23. What limitations do individual simple tools have in assessing trees K.1.24. How to interpret the results provided by simple tools during the assessment of trees	S.1.19. Evaluate trees using simple tools

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Tree assessment by taxon	K.1.25. Biology and life strategies of most common tree genera and species. K.1.26. Biomechanic characteristics of most common tree genera and species. K.1.27. Resistance of most common tree genera and species to factors affecting tree stability and condition.	S.1.20. Assess trees with regard to genera and species. S.1.21. Formulate tree care and risk management recommendations with regard to genera and species.
Assessment of trees at various development stages	K.1.28. The functioning of trees (physiology and morphology) in different life stages of trees. K.1.29. Transition periods between different life stages. K.1.30. Standard care practices in relation to the life stage of a tree.	S.1.22. Assess trees with regard to their life stage.
Tree risk management	K.1.31. Definition and factors influencing risk. K.1.32. Methods of tree risk management.	S.1.23. Perform basic assessment of risk related to tree and its surroundings.
Review of instrumental tree assessment	K.1.33. The specificity of the most popular instrumental diagnostic methods of trees – their applications, limitations, **extensions**. K.1.34. The idea of calculators to assess the safety of trees and the possibility of their use.	S.1.24. Indicate the purpose of instrumental diagnostics of the tree recommended for the given problem detected during the tree inspection. S.1.25. Determine the diagnostic method appropriate for an in-depth tree assessment, based on problems identified at the tree inspection stage.
Tree care and maintenance methods	K.1.35. Tree care and pruning standards. K.1.36. Advantages and limitations of commonly used tree maintenance methods. K.1.37. Mechanical support systems for trees.	S.1.26. Recommend tree maintenance method based on previous tree assessment. S.1.27. Justify and discuss various solutions.

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Documentation /reporting in tree assessment	K.1.38. Rules for collecting and processing collected data. K.1.39. Ways to prepare written documentation. K.1.40. Methods and tools for creating digital databases.	S.1.28. Collect, sort and present tree inspection results. S.1.29. Create high-quality written materials in the form of clear, factual and concise reports. S.1.30. Use digital tools to collect and manage tree data.
Legislation related to tree management	K.1.41. Basic legal provisions in the field of nature protection related to issues related to tree inspection. K.1.42. Basic legal provisions regarding the protection and care of nature and historic monuments relevant to tree inspection. K.1.43. Basic provisions of the civil law relevant to tree inspection. K.1.44. Other provisions relevant to tree inspection.	S.1.31. Explain the legal principles related to tree operations. S.1.32. Inspect trees in conjunction with legal provisions.

Source: own work based on the content of syllabuses for the subjects of Tree Inspection Tree Assessor

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3.3. ADVANCED TREE ASSESSMENT

The advanced level of tree assessment involves mainly instrumental assessment of trees. Still, the teaching guidelines also include special assessments, e.g. assessment of mechanical support systems, soil, as well as the evaluation of tree condition based on the crown aerial assessment. A tree assessor performing advanced diagnostics should also be aware of less frequently used methods and techniques, and keep up to date with modern technologies. One of the important elements in the preparation and training of a tree assessor at this level should be proper project management, communication and development of documentation. The ability to prepare action plans and advanced recommendations is also the domain of tree assessors performing more advanced tree assessment. Advanced diagnostics is not only about the knowledge and skills of using more specialised techniques or tools. It is also about competencies in a holistic and long-term understanding of the tree and its surrounding area on a strategic level, as well as the ability to provide the recipients of tree assessment with specific recommendations. As a result, the set of competencies necessary for advanced tree diagnostics presented in Table 9 covers a much broader scope of knowledge and skills than for the basic level.

They can be grouped into several categories connected with primary areas of advanced diagnostic of trees:

- Extended knowledge about trees.
- Chosen aspects/features of trees, assessment of a group of trees, assessment of trees ecosystem and environment.
- Usage of advanced tools, equipment and software/applications.
- Reports/documentation, communication and management.

Table 9 contains a set of competencies in each of the categories mentions divided into main subjects.

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Table 9. Advanced tree assessment –competencies considered for the tree assessor at the advanced level

ADVANCED TREE DIAGNOSTIC AREA OF COMPETENCIES	KNOWLEDGE: **KNOWS AND UNDERSTANDS**	SKILLS: **IS ABLE TO DO**
Tree biology and ecology – advanced	K.2.1. Anatomy, physiology, ecology, and architecture of tree. K.2.2. Tree's mutual relationships with biotic and abiotic elements of the environment in changing conditions.	S.2.1. Explain biological and ecological processes influencing tree stability and vitality. S.2.2. Apply the acquired knowledge in tree biology and ecology in tree assessment, recommendations and tree care plans.
Tree biomechanics – advanced	K.2.3. Compression, bending and shear stress calculation as well as pulling test principles. K.2.4. Wind load calculation, breaking and uprooting safety factor calculation.	S.2.3. Determine safety factors. S.2.4. Use safety factors based on the static and dynamic load on trees to assess current and future behaviour of tree.
EXTENDED KNOWLEDGE ABOUT TREES		
Tree physiology assessment	K.2.5. Most important and widely used methods of measuring physiological parameters in trees and common tools used for it.	S.2.5. Chose, use and recommend the use of physiological measurement in tree assessment and interpret results.
Soil assessment	K.2.6. Physical, biological and chemical properties of soil (soil components, vertical profile, conditions, limitations). K.2.7. Soil sampling and analysis parameters. K.2.8. Soil management and modification. K.2.9. Soil conservation.	S.2.6. Indicate visual signs of soil properties in relation to tree stability and physical condition. S.2.7. Collect soil samples using diverse sampling tools. S.2.8. Give a conclusion of soil condition and limitations by analysing soil parameters.

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CHOSEN ASPECTS/FEATURES OF TREES, ASSESSMENT OF GROUPS OF TREES, ASSESSMENT OF TREES ECOSYSTEM AND ENVIRONMENT		
Assessment of ancient and veteran trees	K.2.10. Characteristics, needs and significance of ancient and veteran trees. K.2.11. How the trees grow, grow older and change with age in the context of ancient and veteran tree care. K.2.12. Methods for assessing ancient and veteran trees, including recommendations for caring for them.	S.2.9. Recognize, characterize and evaluate a veteran tree, taking into account its history, form and environment. S.2.10. Describe the development and ageing process of trees and indicate what mechanisms allow for their long life. S.2.11. Perform an assessment tailored to the characteristics, values and needs of veteran trees.
Assessment of groups of trees	K.2.13. Provisions regarding the valuation of trees and the management of municipal stands. K.2.14. Determining the value of trees in terms of replacement value, ecosystem services, nature and landscape value. K.2.15. Equipment and instruments that can be used to perform specialized research in the context of the value of trees. K.2.16. Possibilities of using computer programs and applications for forest management with particular emphasis on statics.	S.2.12. Assess the value of trees taking into account all relevant aspects. S.2.13. Choose the right method /equipment for assessing the statics of the tree. S.2.14. Choose the right approach in the field of stand management depending on the local specificity of the area.
Assessment of threats to trees – advanced	K.2.17. Range of local and invasive pests and diseases of trees. K.2.18. Relation of climate changes and trees' pests and diseases. K.2.19. Influence of the factors on tree's health and stability. K.2.20. Methods, tools and products to control the factors and minimize their negative influence on a tree.	S.2.15. Identify species/genera of pests/diseases and other biotic threats most common locally and invasive. S.2.16. Recognise the influence of climate change or other abiotic threats important for tree health or stability.

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Assessment of cabling and bracing – ground level	K.2.21. Value, purpose, method of ground-level and aerial assessment of mechanical support systems of trees. K.2.22. Method of recording and documenting the results of mechanical support systems assessment. K.2.23. The use of mechanical support systems assessment results for further decisions on trees and the security itself.	S.2.17. Determine the purpose, scope and techniques of assessing the tree's security and how to save the assessment results. S.2.18. Identify problems and determine the indication for further action based on documentation collected during the crown inspection.
Assessment of cabling and bracing – aerial level	K.2.24. Types of tree support systems and problems requiring assessment with entering the crown. K.2.25. Specification for the assessment of crown security systems – techniques, assessment areas, documentation. K.2.26. The use of assessment results for further decisions on trees and the support system itself.	S.2.19. Specify the purpose, scope and technique of the tree security system assessment, and how to record the assessment's results. S.2.20. Perform a crown security system assessment. S.2.21. Identify problems and provide indications for further action based on documentation collected during crown inspection.
USAGE OF ADVANCED TOOLS, EQUIPMENT AND SOFTWARE/APPLICATIONS		
Instrumental assessment: decay	K.2.27. Basics about acoustic and electric signal penetration in wood materials. K.2.28. Operation principles of resistance drill and fractometer. K.2.29. The performance of time-of-flight (1D) measurements, acoustic and impedance tomography. K.2.30. Usage of increment borer, resistance drill and fractometer. K.2.31. Calculations of wind loads and self-loads of the tree as well as safety factors.	S.2.22. Explain the operation principles of the methods used for decay evaluation. S.2.23. Choose the proper instrument. S.2.24. Measure with acoustic tools, especially tomography. S.2.25. Perform impedance test. S.2.26. Perform wood material tests. S.2.27. Evaluate safety with the help of software and interpret safety factor.

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Instrumental assessment: tree stability	K.2.32. Principles behind pulling test. Practical application of tree statics. K.2.33. Wind load as dynamic load, converting static pulling test to a dynamic test.	S.2.28. Measure and interpret the safety factors. S.2.29. Perform pulling test and dynamic test.
Tree assessment calculators	K.2.34. Possibilities and limitations in the use of applications, programs and calculators for tree assessment. K.2.35. The use of calculation and simulation results for further decisions on trees.	S.2.20. Identify the tools available to help assess trees, including their capabilities and limitations. S.2.21. Identify problems and determine indications for further actions based on calculations and simulations.
Root detection systems	K.2.36. The importance of localization of roots. K.2.37. The methods to find the main roots.	S.2.22. Map the main roots.
Dendrochronology	K.2.38. Fundamentals of tree intra-annual and full-life-cycle growing patterns as a response to variation in environmental conditions. K.2.39. Analysing of past climatic conditions and disturbances.	S.2.23. Properly link the long-term variability in success of wood formation in relation to changes of tree growing conditions. S.2.24. Predict the intra-annual tree growth as a function of upcoming weather conditions and past growing success.
Remote tree surveys	K.2.40. Range of scanning methods of trees. K.2.41. Drones usage and technologies useful for assessing trees.	S.2.25. Find and use in tree assessment data delivered by scanning technology by common resources (paid and unpaid). S.2.26. Use drones to assess tree parameters and gathering additional information for tree assessment.

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Aerial crown assessment – for ground assessors	K.2.42. Value, purpose, ways of aerial crown assessment and limitations for this method. K.2.43. Methods of recording and documenting tree aerial crown assessment results. K.2.44. Qualifications and requirements for those performing an aerial crown assessment or collecting data for a tree diagnostician.	S.2.27. Indicate the purpose and scope of the tree assessment from the crown level. S.2.28. Determine requirements for the tree aerial crown assessment. S.2.29. Identify problems and determine indications for trees and species living on them based on photographic documentation collected during crown inspections.
Aerial crown assessment – for aerial assessors	K.2.45. Non-invasive access techniques for aerial crown assessment. K.2.46. Methods of aerial crown assessment.	S.2.30. Recommend the tree and scope of the tree aerial crown assessment. S.2.31. Collect tree crown inspection data.
REPORTS/DOCUMENTATION, COMMUNICATION AND MANAGEMENT		
Long-term tree management plan	K.2.47. Physiology, architecture and development of trees in different age phases. K.2.48. Techniques to improve site conditions. K.2.49. Care and stabilisation techniques of valuable trees.	S.2.32. Understand and implement recommendations for a long-term management plan.
Tree assessment reports	K.2.50. Rules for preparing documentation from the assessment of trees, taking into account applicable legal provisions, including professional liability, copyright and personal data protection. K.2.51. Available data, tools and sources of information helpful in creating documentation.	S.2.33. Specify the scope of documentation and design the process of its preparation. S.2.34. Make documentation of tree assessment based on collected data at the basic level and using the results of advanced diagnostics.

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Communication and management in tree assessment	K.2.52. Various stakeholder groups relevant to the tree assessment process and its effects as well as their requirements and communication specificity, and the typical problems encountered by tree assessors at work. K.2.53. Methods and techniques for managing the process of assessing trees from the offer inquiry to the receipt of work.	S.2.35. Recognize the information needs of various stakeholder groups relevant to tree assessment. S.2.36. Use appropriate knowledge and arguments to convey and explain the importance of tree assessment, techniques and tools used, and effects relevant to a given group of stakeholder.

Source: own work based on the content of syllabuses for the subjects of Advanced Tree Assessment – Tree Assessor

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4. SOCIAL COMPETENCIES

A person working as a tree assessor must have social competencies necessary for the proper and effective performance of professional tasks in relation to the subject of work, and people who commission that work, as well as employees and co-workers. Key competencies are listed below.

- Sense of responsibility for the effects of undertaken actions (safety and health of people) as well as for entrusted machines and tools used at the workplace.
- Adaptation of behaviour to circumstances related to the work of a tree assessor.
- Individual work while performing tasks related to tree assessment.
- Teamwork while performing tasks related to tree assessment.
- Taking action and cooperation during the implementation of tasks related to tree assessment.
- Self-evaluation and verification of own actions and the evaluation of people whom one manages during performance of professional tasks in tree assessment.
- Evaluation and verification of the actions taken by people whom one manages in implementation of professional tasks appropriate for tree assessment.
- Following the professional and ethical principles in line with professional ethics and applicable regulations.
- Continuous improvement of professional competencies in the context of legal changes and new technological and organisational solutions in tree assessment.
- Rational evaluation of a threat to human health and life and taking actions adequate to the degree of risk while performing tasks in tree assessment.
- Accepting the limits of competencies – knowledge and skills – of one's own and other people.

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V.
Guidelines for training tree assessors at particular levels of tree assessment

1. TYPES OF TRAINING – THE LEVEL OF FORMALIZATION OF EDUCATION FORMS

The arboricultural industry offers different forms of education. The process of acquiring knowledge, skills and competencies may take place in a formal environment, but in most cases, it is held in a non-formal and informal one (see Figure 8).

2. FORMS OF EDUCATION IN RELATION TO COMMUNICATION CHANNELS

When providing education in the natural sciences and situations requiring direct contact with an object, it is crucial to conduct classes in the field. Therefore, traditional channels and stationary classes prevail in classrooms, but when in the field, it is possible to have physical contact with the objects of assessment.

NON-FORMAL EDUCATION	• Own experience • Apprenticeships / internships • Media / own reading
INFORMAL EDUCATION	• Educational institutions, associations offering training, courses, workshops and seminars • Certification centres
FORMAL EDUCATION	• Vocational schools and high schools • 1st and 2nd degree studies • Dedicated or as a subject / specialty within general fields of study

Fig. 8. Training opportunities for people involved in tree assessment
Source: own work

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The digitization of various areas of our lives and the dissemination of new communication technologies allow us to implement education not only traditionally, but also with the help of remote solutions. A review of currently used solutions indicates that it is possible to combine traditional forms of education with remote ones, depending on the content and educational form. When it comes to e-learning, it is possible to teach both online and offline, using different methods of communication, e.g. live lectures or webinars. It is also possible to perform self-study using online materials available on carriers or for downloading which trainees can use in their independent work.

In the education of tree assessors, it is worth considering using a mixed form, that is, blended learning, which combines traditional teaching methods with modern technologies (see Fig. 9).

When discussing the subjects, it was indicated which of them could be conducted in a remote form, and which should be taught traditionally. The latter include all practical subjects and workshops that require unique aids such as live trees, wood samples, fungi, or the use of tools.

The decision to implement distance learning requires careful consideration. It must take into account concerns such as the suitability of topics for online education, the accessibility to the technology of both students and trainers, the level of additional support required to supplement online learning and the different ways in which different students feel able to learn most effectively.
Experiences from the coronavirus epidemic that broke out during the preparation of this publication have shown how vast the opportunities of remote teaching and contact are today, but also

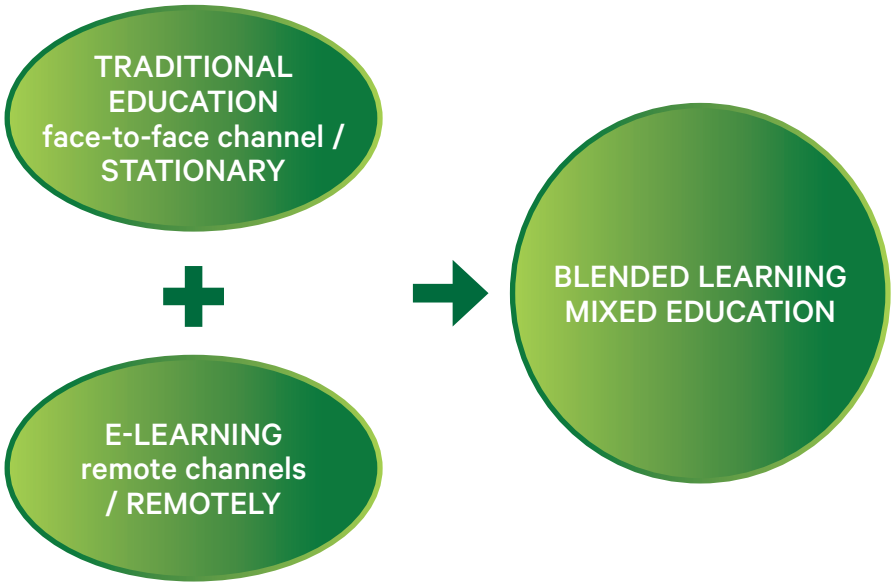

Fig. 9. Forms of education taking into account communication channels
Source: own work

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how flexible both teachers and students can be, as well as the market offer which supports them. This allows us to significantly extend current standards of training, also in the tree industry, where more traditional face-to-face meetings and training sessions have prevailed until now.

When it comes to remote training (e-learning), one can choose from many forms and spaces:

a. In real-time, in the trainer-participant relationship, e.g. webinars, live presentations with streaming from the lecture room or in the field, also using instant messengers.

b. In non-real time – usually, as self-study using previously prepared materials available to the participant on an educational platform at any time.

In terms of training with personal participation in a given space (face-to-face), appropriate conditions are usually required in the room or in the field, as well as proper equipment:

a. The room should be equipped with multimedia devices, traditional or digital visualization equipment (e.g. boards, flipcharts), computers or laptops. As a rule, activities conducted in the room include lectures, practical classes and workshops with computer equipment, smaller technical devices and samples that require careful discussion,

b. Field activities should be conducted in a safe and accessible place, where trees which meet the requirements of the given topic. As a rule, operations performed in the field include practical classes and workshops with the use of special equipment, trial diagnostic activities or demonstrations performed by specialists experienced in diagnostics or related industries (e.g. arborists).

c. Usually, when conducting practical classes, workshops or demonstrations, it is necessary to use specialist aids, e.g. samples of tree parts, soil, fruiting bodies of fungi, assessment sheets, tools and equipment, as well as software being the subject of training.

Detailed guidelines for training in individual competence areas are described in the following chapters. Full information combined with competencies is included in the syllabuses prepared for each training area, in the form of annexes. As a rule, it was assumed that training courses should be performed traditionally. Still, each syllabus contains information whether it is possible, after appropriate adaptation and preparation, to conduct a given training course remotely.

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Following Alex Shigo rule for learning from trees by touching them, we recommend in most areas workshops with samples – indoor and with real trees – outdoor.
Small groups are recommended with the following trainer:students max ratio:

- for lecture 1:40. groups up to 40 participants. (lecturer),
- for indoor workshops and Q&A: 1:20 (lecturer and an assistant trainer, one per max 20 trainees),
- for outdoor workshops: 1:10 (1 trainer per group of 10 trainees).

3. SUBJECT SCOPE OF TRAINING – PROPOSED SUBJECTS

According to the previously identified levels of competencies in tree assessment, we suggested a set of training courses divided into three main areas. Each of them contains subjects which make it possible to deliver/get the knowledge and develop skills essential for a given specialist at a given level of advancement. How these subjects will be combined into one course depends on the training institution. However, we recommend following the order and the set of subjects as presented in the table below.

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Table 10. Subject scope and recommended form of training

LEVEL 0. BASIC TREE DATA
1-DAY FULL COURSE – INITIAL
0.1. Tree measurement 0.2. Rules for tree ID 0.3. Mapping and marking trees 0.4. Legal basis of tree inventories. 0.5. Gathering basic tree data – field session
LEVEL 1. BASIC TREE ASSESSMENT – TREE INSPECTION
A FULL COURSE LASTING SEVERAL DAYS WHICH CAN BE CONDUCTED IN SEVERAL STAGES
1.1. Tree biology and biomechanics – basics 1.2. Analysing tree's history in tree assessment 1.3. Identification of threats to trees 1.4. Biodiversity survey of trees – protected species 1.5. Introduction to wood-decaying fungi 1.6. Valuation of trees 1.7. Identification of hazard trees in tree assessment and categorisation of trees 1.8. Simple tools in tree assessment 1.9. Tree assessment by taxon 1.10. Assessment of trees at various development stages 1.11. Tree risk management 1.12. Review of instrumental tree assessment 1.13. Tree care and maintenance methods 1.14. Documentation in tree assessment 1.15. Legislation related to tree management
LEVEL 2. ADVANCED TREE ASSESSMENT – INSTRUMENTAL/SPECIALIST
A FULL COURSE WITH ALL OR SELECTED SUBJECTS – LASTING SEVERAL DAYS, CONDUCTED IN STAGES OR A SET OF INDEPENDENT 1 OR 2-DAY COURSES
2.1. Tree biology and ecology – advanced 2.2. Tree biomechanics – advanced 2.3. Tree physiology assessment 2.4. Soil assessment 2.5. Assessment of ancient and veteran trees 2.6. Assessment of groups of trees 2.7. Assessment of threats to trees – advanced. 2.8. Assessment of cabling and bracing – ground level 2.9. Assessment of cabling and bracing – aerial level 2.10. Instrumental assessment: decay 2.11. Instrumental assessment: tree stability

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2.12. Tree assessment calculators
2.13. Root detection systems
2.14. Dendrochronology
2.15. Remote tree surveys
2.16. Aerial crown assessment – for ground assessors
2.17. Aerial crown assessment – for aerial assessors
2.18. Long-term tree management plan
2.19. Tree assessment reports
2.20. Communication and management in tree assessment

Source: own work based on the content of syllabuses of Tree Assessor training programme

4. BASIC TRAINING PROPOSAL

Examples of a basic course covering initial training in basic tree measurements and tree inspection are described below. The description includes training subjects, suggested time and form of classes.

4.1. BASIC TREE DATA TRAINING PROPOSAL

Preliminary assumption: the participant has knowledge of tree inventory and related skills obtained as a result of formal, informal or self-education/work.

Aim of the course: to check, organize and supplement knowledge and skills in the field of collecting basic tree data in accordance with current legal conditions.

Proposal: a two-day course covering the main topics of tree inventory. Day one devoted mainly to knowledge, day two to skills.

Exam: practical field exercise according to previously prepared tasks[3], e.g.:

- Find a tree for further assessment in the field according to the map attachment and a fragment of the old inventory.
- Update and complete the existing inventory.

3 Examples of tasks are included in the Materials for trainers that are the effect of the O2 of the TREE ASSESSOR project.

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Table 11. Content of Basic tree data training proposal

NO OF THE DAY	SUBJECTS	EDUCATIONAL AIMS OF THE COURSE TO REMIND AND IMPROVE KNOWLEDGE AND SKILLS (K&S)	NO OF TEACH-ING HOURS	PLACE /CIRCUMSTANCES /FORM
1st day	0.1. Tree measurement	0.1. Check, structure and develop knowledge and skills necessary for the course participant to perform dendrometric measurements.	1	Indoor day Lecture room Samples – visuals Sample of tools
	0.2. Rules for tree ID	0.2. Provide knowledge necessary for the course participant to correctly recognize trees/shrubs.	2	
	0.3. Mapping and marking trees	0.3. Check, structure and develop knowledge and skills necessary for mapping and marking trees.	2	
	0.4. Legal basis of tree inventories.	0.4. Check, structure and develop knowledge on regulations related to tree inventory and their practical implications.	1	
	Sum up: Q&A	Check and discuss subject areas.	1	
2nd day	1.5. Gathering basic tree data – field session	0.5. Apply knowledge and skills of tree inventory in practice.	6	Outdoor workshop: Location with diverse trees: common species. Tools for every participant: tree ID guides, maps, tapes, cameras, altimeter, rangefinder, GPS, laptop, tablet, digital or P&P documents Recommended location: old urban park with mixed species, arboretum.
	Sum up: test tasks		1	

Source: own work based on the content of syllabuses of Tree Assessor trainings

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4.2. BASIC TREE ASSESSMENT – TREE INSPECTION – TRAINING PROPOSAL

Preliminary assumption: the participant has the knowledge and skills required to take the basic tree diagnostics course (see IV.3 i IV.4.1)

Aim of the course: prepare participants for self-assessment at the basic level (inspection) of the condition and stability of trees growing individually or in a group, using visual assessment, hand tools and paper or electronic diagnostic sheets.

Proposal: six-day course covering full knowledge of the basic assessment of trees ended with an exam of knowledge and skills.

Exam: written exam checking knowledge of the course and field test checking practical skills[4].

4 Examples of questions, exam tests and guidelines for preparing an exam in the field can be found in the Materials for trainers that are the effect of the O2 of the TREE ASSESSOR project.

Table 12. Content of Basic tree assessment training

SUBJECTS	EDUCATIONAL AIMS OF THE COURSE	NO OF TEACHING HOURS	PLACE /CIRCUMSTANCES /FORM
1.1. Tree biology and biomechanics – basics	O.1.1. Provide basic knowledge in tree biology, ecology, and biomechanics and develop skills to use this knowledge in tree assessment.	3	Lecture Specimens illustrating physiological and biomechanical processes in trees
1.2. Analysing tree's history in tree assessment	O.1.2. Provide knowledge and develop skills related to the identification of historical changes in the tree's environment, works and other events and their influence on its condition and stability.	3	Lecture Outdoor workshop Samples showing historical pruning cuts
1.3. Identification of threats to trees	O.1.3. Provide knowledge about the main factors affecting the functioning of a tree. O.1.4. Learn basic skills to collect data and samples for further analysis.	2	Lecture Pictures and samples of diseases and pathogens Microscope /binocular

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1.4. Biodiversity survey of trees – protected species	O.1.5. Introduction to bionomy of selected protected species associated with trees. O.1.6. Provide knowledge on how to perform an inventory of trees for protected species. O.1.7. Indicate methods of nature compensation.	2	Lecture Indoor workshop Entomological display cases Inventory form for protected species GPS receiver Binoculars Blade/knife
1.5. Introduction to wood-decaying fungi	O.1.8. Provide knowledge necessary for course participant to assess the influence of relevant wood-decaying fungi on tree stability.	4	Lecture Indoor workshop Specimens of perennial fruiting bodies of relevant species and genera
1.6. Valuation of trees	O.1.9. Provide knowledge necessary for the course participant to perform a valuation of trees.	4	Lecture Indoor workshop Outdoor workshop Smartphone/tablet
1.7. Identification of hazard trees in tree assessment and categorisation of trees	O.1.10. Provide knowledge about the identification of tree diagnostic features. O.1.11. Provide knowledge about identification of problem trees based on established diagnostic features.	7	Lecture Outdoor workshop Specimens with diagnostic features Inspection forms PAPI/tablets with data collection application Binoculars Real trees (different species, age, state) – for practising
1.8. Simple tools in tree assessment	O.1.12. Provide knowledge about the use of simple tools in tree assessment. O.1.13. Provide knowledge needed to interpret the information provided by simple tools when assessing trees.	1	Outdoor workshop Simple tools for assessing trees: diagnostic mallet, diagnostic probe

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1.9. Tree assessment by taxon	O.1.14. Provide knowledge and skills needed to assess trees of most common genera and species.	5	Lecture Outdoor workshop Specimens illustrating reaction of trees to factors affecting stability (lecture) Real trees (different species, age, state) – for practising Tree assessment forms Probe, mallet, and binocular
1.10. Assessment of trees at various development stages	O.1.15. Provide knowledge and develop skills for assessing trees in various life stages.	2	Lecture
1.11. Tree risk management	O.1.16. Provide knowledge and develop skills necessary to perform basic tree risk assessment.	2	Lecture
1.12. Review of instrumental tree assessment	O.1.17. Provide knowledge about the methodology and tools of selected methods of instrumental diagnostics of trees and calculators and the relevance of their results. O.1.18. Provide the ability to determine the purpose of instrumental diagnostics and the selection of a method suitable for an in-depth assessment of the tree, based on problems identified in tree inspection.	5	Lecture Outdoor workshop Sonic tomograph Resistance drill Pulling-test equipment Cross-section of a tree – a stump or plaster with a diameter of 40-60 cm Standing tree – alive, but with problems, e.g. fruiting bodies of fungi at the base
1.13. Tree care and maintenance methods	O.1.19. Provide knowledge about methods and practices used in tree maintenance. O1.20. Develop skills of preparing recommendations in tree care area	4	Lecture Indoor workshop Outdoor workshop Standing tree – alive in different life stage and protective means

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1.14. Documentation in tree assessment	O.1.21. Provide knowledge and develop skills necessary to create a concise, clear, factual report and digital databases.	2	Lecture Indoor workshop Tablet Tree data management software Inspection form Report Form
1.15. Legislation related to tree management	O.1.22. Provide knowledge about basic provisions of law relevant to tree inspection.	2	Lecture

Source: own work based on the content of syllabuses of Tree Assessor trainings

5. ADVANCED TREE ASSESSMENT TRAINING PROPOSAL

Examples of a more extensive course covering the preparation of specialists in instrumental tree diagnostics and – as an alternative solution – 1(2)-day(s) training covering specific areas of specialist competencies are described below. The basic descriptions of the subjects, their purpose as well as the suggested time and form of classes are also included there.

The table below shows the recommended minimum number of hours for a given topic and obtaining the basic required competencies in a given area. In most of topics teaching in the form of extended specialized courses is recommended.

Preliminary assumption: the participant has knowledge and skills at the level of at least basic tree assessment (see IV.3 and IV.4.1) demonstrated by an appropriate certificate or initial test.

Aim of the course: prepare participants for self-assessment at the advanced level (specialist diagnostics) of the condition and stability of trees growing individually or in a group, using advanced diagnostic methods, compiling their results into a comprehensive tree assessment and preparing a tree action plan.

Exam: written exam checking knowledge of the course and field test checking practical[5] skills appropriate for the type of course/training.

5 Examples of questions, exam tests and guidelines for preparing an exam in the field can be found in the Materials for O2 trainers as a result of the Tree Assessor Project.

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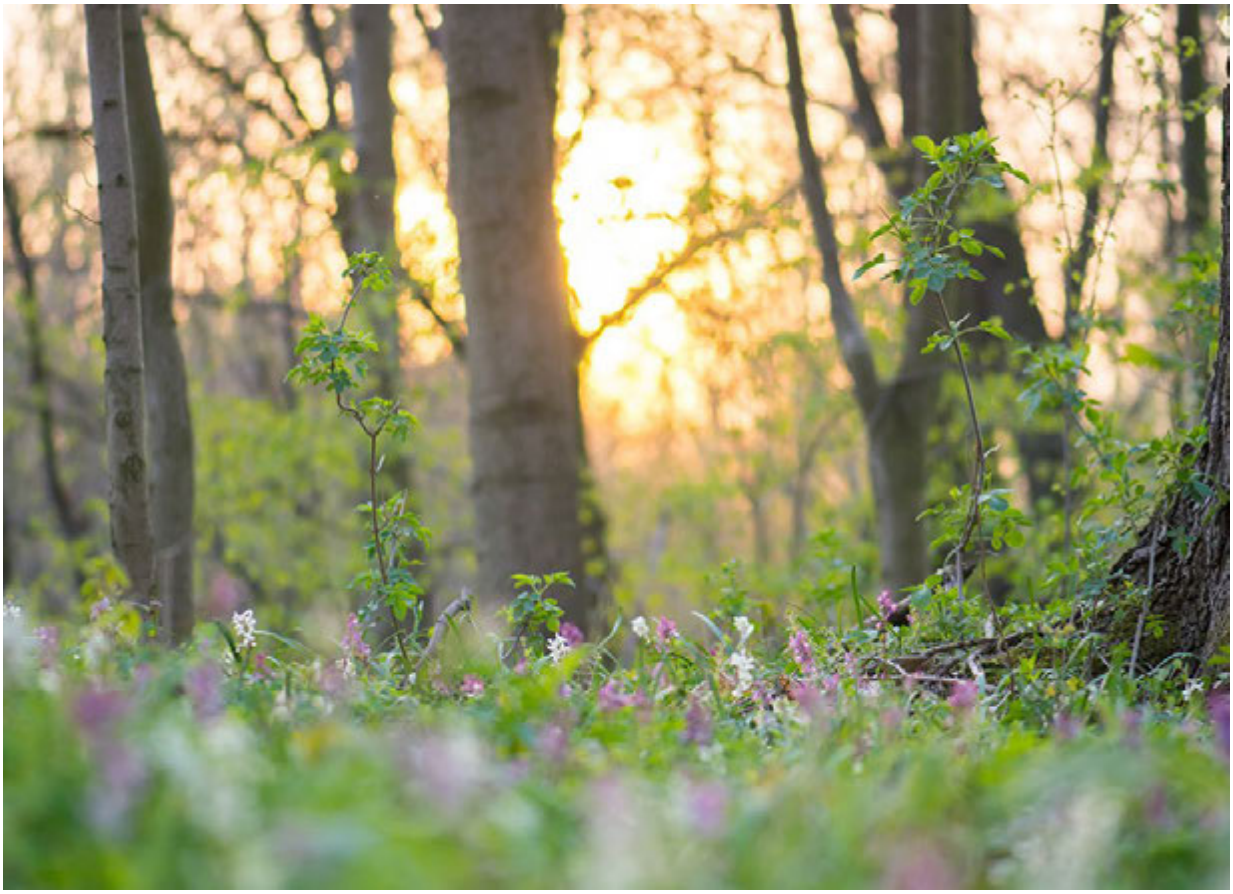

Table 13. Content of Advanced assessment training

SUBJECTS	EDUCATIONAL AIMS OF THE COURSE	NO OF TEACH-ING HOURS	PLACE /CIRCUMSTANCES /FORM
2.1. Tree biology and ecology – advanced	O.2.1. Provide wide, advanced and newest knowledge in tree biology and ecology. O.2.2. Develop skills to use this knowledge in tree assessment, recommendations and tree care plans.	4	Lecture
2.2. Tree biomechanics – advanced	O.2.3. Provide knowledge necessary to describe current biomechanical state of a tree. O2.4. Develop skills to calculate and use in tree assessment safety factors based on static and dynamic models.	3	Lecture presentation of basic formulas, sample calculations
2.3. Tree physiology assessment	O.2.5. Teach about selected methods (methodology and tools) of measuring tree physiological parameters and interpretation of their results. O.2.6. Provide the ability to determine the purpose, select a specific tree physiology parameter, and interpret measurement results as part of tree assessment.	2	Lecture Samples of instruments to measure physiological parameters: chlorophyll content, gas exchange (photosynthesis, respiration, transpiration) and water potential
2.4. Soil assessment	O.2.7. Provide knowledge for detailed soil assessment, including analysis of components, vertical profile, conditions and limitations. O.2.8. Developing skills in soil sampling methods. O.2.9. Provide knowledge and skills for soil modification and soil conservation methods.	8	Lecture Outdoor workshop Computer, projector, stereo microscope (up to 40X magnification), soil sampling probe, penetrometer, soil pH meter, soil auger, plastic or polythene bags for soil samples. handouts of basic information

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2.5. Assessment of ancient and veteran trees	O.2.10. Transfer of knowledge about the characteristics, value and importance of ancient trees and other veteran trees. O.2.11. Develop skills in assessing ancient trees and other veteran trees, including recommendations for further care.	6	Lecture Indoor workshop Outdoor workshop Ancient and/or veteran tree Forms for assessing aged trees and veterans
2.6. Assessment of groups of trees	O.2.12. Teaching methods of valuation of trees – reconstruction, ecosystem services, nature and landscape value. O.2.13. Adjusting tree statics assessment methods to values. O.2.14. Learning the principles and methods of managing a stand.	3	Lecture Tree identification cards
2.7. Assessment of threats to trees – advanced.	O.2.15. Provide knowledge necessary to recognize and assess the influence on tree health and stability coming from the impact of the most common local pests, diseases, as well as climate changes and other common threats.	4	Lecture Indoor workshop Outdoor workshop Samples and visuals of relevant species and genera of pests and diseases
2.8. Assessment of cabling and bracing – ground level	O.2.16. Provide knowledge about the main goals, methods and techniques for assessing the mechanical support systems of trees. O.2.17. Developing the skills of commissioning/outsourcing and supervising the assessment of mechanical tree security and using the results of this type of assessment for further decisions and work on trees.	4	Lecture Indoor workshop Outdoor workshop A set of case studies with examples of tree protection assessment from ground level and with crown entry Examples of elastic bindings and their markings (so-called ends)
2.9. Assessment of cabling and bracing – aerial level	O.2.18. Provide students with knowledge about the main goals, methods and techniques for assessing mechanical support systems for trees requiring assessment with access to the tree crown.	7	Lecture Indoor workshop Outdoor workshop

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	O.2.19. Develop the ability to assess the mechanical support systems of trees mounted at height.		Climbing equipment – access; Protective equipment; Work platform with an operator; Ladders with a height of min. 4 m; Documentation equipment; Trees with installed support systems, .g.crown cabling, bolting, props ; Climbing helper – arborist with the ability of high-altitude rescue; First aid kit
2.10. Instrumental assessment: decay	O.2.20. Provide knowledge necessary for the course participant to understand the operating principals of instrumentals used for decay evaluation. O.2.21. Provide knowledge and develop skills necessary for the course participant to perform instrumental investigations on decayed parts. O.2.22. Provide knowledge necessary for the course participant to evaluate the safety of the examined tree.	14	Lecture Indoor workshop Outdoor workshop Smartphone 1D acoustic device Acoustic tomograph Impedance tomograph Calliper Pulling test kit Dynamic test kit case studies
2.11. Instrumental assessment: tree stability	O.2.23. Provide knowledge necessary for the course participant to perform safety factor determination, including static and dynamic models.	3	Lecture
2.12. Tree assessment calculators	O.2.24. Provide knowledge about major computer programs, applications and calculators for assessing the statics and value of trees. O.2.25. Development of skills for independent use of programs and applications and the use of results for further decisions on the tree.	2	Lecture Indoor workshop Tablet/laptop with software installed (possibly internet access for online applications

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2.13. Root detection systems	O.2.26. Provide knowledge about the methods to find roots in the ground.	2	Lecture Outdoor workshop Root detector
2.14. Dendrochronology	O.2.27. The increase of professional educational background necessary for sufficient evaluation skills of tree-environment interaction.	8	Lecture
2.15. Remote tree surveys	O.2.28. Provide knowledge about new remote technologies and their outcomes to enrich data used to assess trees.	4	Lecture Indoor workshop Outdoor workshop Drones with an operator, laptop with an application for picture reviewing /editing, SD cards Laptops with an internet connection to review LIDAR etc. resources
2.16. Aerial crown assessment – for ground assessors	O.2.29. Provide knowledge about the main goals, methods and techniques for aerial crown assessment. O.2.30. Developing the skills of commissioning and supervising tree aerial crown assessment and using the results of this type of assessment for the overall tree assessment.	4	Lecture Indoor workshop Outdoor workshop A case study set with examples of ground-level trees assessments and aerial crown assessment
2.17. Aerial crown assessment – for aerial assessors	O.2.31. Transfer of knowledge about tree aerial crown assessment techniques. O.2.32. Acquiring the skill of assessing a tree crown by various access techniques.	14	Lecture Indoor workshop Outdoor workshop Tree-climbing equipment; Protective equipment; Aerial platform with operator; Ladders with a height of min. 4 m Documentation equipment; Instrumental diagnostic equipment, .g. resistance drill, tomograph; Mature trees of various height and structure /habit; Helper climber – arborist with the ability to rescue at height

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2.18. Long-term tree management plan	O.2.33. Provide students with the knowledge and skills needed to prepare a long-term management plan for an ancient or other veteran tree. O.2.34. Provide students with the knowledge and skills required to use tree assessment outcomes to build the long term tree management plan.	5	Lecture Indoor workshop Outdoor workshop Standing trees of various height and structure/habit
2.19. Tree assessment reports	O.2.35. Providing students with knowledge on the principles of preparing documentation from tree assessment, taking into account applicable legal provisions, including professional liability, copyright and personal data protection. O.2.36. Transfer of knowledge about available tools and sources of information helpful in creating documentation. O.2.37. Equipped with the ability to determine the scope of documentation, design the process of its preparation and implementation for various levels of tree assessment and types of recipients.	7	Lecture Indoor workshop: Examples of documentation from tree assessment – at various levels (electronic and printed versions). Positive and negative.; A set of data for preparing a tree assessment document (tree measurement results, photo documentation, completed tree assessment form). Laptops with text and picture editor, internet access
2.20. Communication and management in tree assessment	O.2.38. Transfer of knowledge about various groups of stakeholders relevant to the tree assessment process and its effects, as well as their requirements and communication specificity and typical problems encountered by the tree assessor during work. O.2.39. Transfer of knowledge about the management of the tree assessment process from the request for proposal to the receipt of work. O.2.40. Developing the ability to communicate the importance of tree assessment, techniques and tools used, and effects in various groups of stakeholders.	7	Lecture Indoor workshop Case study – an example of tree assessment, involving many stakeholder groups Case study – an example of the process of assessing trees from the offer inquiry to the acceptance protocol

Source: own work based on the content of syllabuses of Tree Assessor trainings

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VI.
Appendix
– see the separate part

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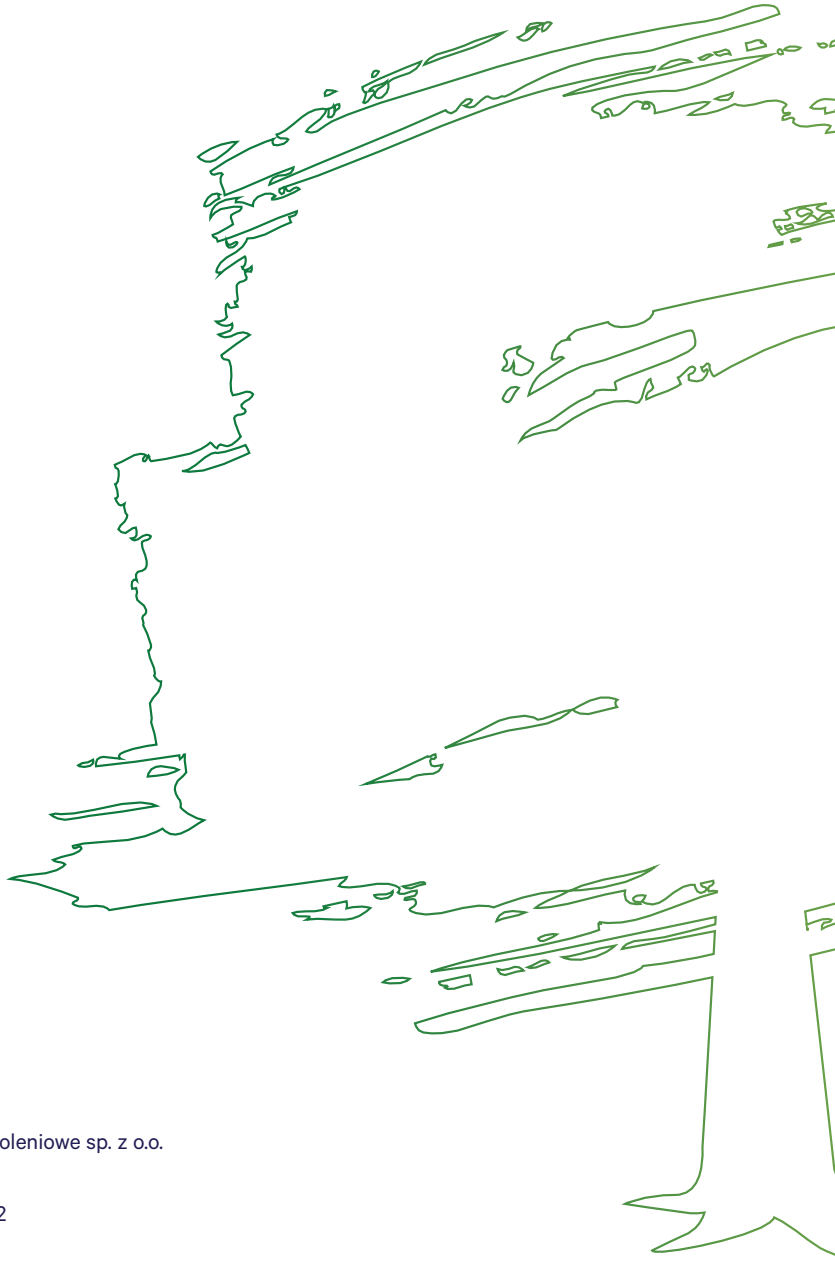
Project: Partnership for the development of training standards for tree assessors in Central and Eastern Europe

PROJECT NUMBER - 2019-1-PL01-KA202-065670



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