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Mendel University in Brno

Introduction

This document is a translation of the article published in French in the Silva Belgica journal, issued in February 2025.

Published for many years by the Royal Forestry Society of Belgium (SRFB), the bimonthly Silva Belgica journal is a valuable source of information on silviculture and forestry news in Belgium.

This article was written by Igor Blervaque, project manager for the SRFB. We also thank Diane Doucet (SRFB), Pavlina Pancova (MENDELU), and Pascaline Leruth (SRFB) for their proofreading and translation work.

Summary

The Royal Forestry Society of Belgium (SRFB), in partnership with Mendel University, Institut Genech, the Technical Horticultural Institute of Gembloux, and the Agroforestry Development Center of Chimay, launched a new Erasmus+ project in 2023 called "ForDiL" (Forest Digital Learning).

This three-year project (2023-2026) aims primarily to promote self-learning in tree marking and natural regeneration management in Continuous Cover Forestry (CCF) through the development of a digital application for tablets and smartphones.

In 2024, three marteloscopes were created for learning tree marking in CCF, and "travailloscopes" (designated learning areas) were established for training in natural regeneration management. The development of the digital application is planned for 2025.

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ForDiL : Forest Digital Learning
Independent learning of CCF approach

The aim of the ForDiL project is to promote independent learning of continuous cover forestry (CCF)approach using an innovative application. This application, linked to sites specifically dedicated to the project, will enable a wide audience to learn or improve their knowledge of CCF techniques. From students at all levels to forestry experts, learners are at the heart of the ForDiL project, developed as part of the European Erasmus+ programme.

Context and background

The European forestry strategy adopted by the European Commission in July 2021 promotes a transition towards more resilient forestry based on natural ecosystem processes which include :

- species mixing per tree or group of trees,
- natural regeneration or small-scale diversified planting,
- continuous forest cover that avoids clear-cutting and its drawbacks as much as possible,
- progressive irregularisation of the age structure of stands,
- management at the scale of the tree or group of trees,
- strengthening the capacity to support biodiversity.

These different objectives are at the heart of the CCF approach. In this regard, the current situation highlights several facts[1] :

- There is a lack of knowledge about CMCC among current and future professionals, and there are not enough specialised educational websites available.
- Teachers and students do not have a tool that will enable them to learn about CMCC in the field independently.

Picture 1: the ForDiL team in the Mendelova University Forest (Czech Republic)

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[1] Source : "Continuous cover forestry in Europe: usage and the knowledge gaps and challenges to wider adoption" : W.L. Mason, J. Diaci, J. Carvalho and S. Valkonen, Forestry An International Journal of Forest Research Forestry 2022; 95, 1–12.

So the Société Royale Forestière de Belgique (SRFB, Belgium), in partnership with the Mendel University in Brno (MENDELU, Czech Republic), the Institut Genech (UFA, France), the Institut Technique Horticole de Gembloux (ITH, Belgium) and the Centre de Développement Agroforestier de Chimay (CDAF, Belgium), has launched a new Erasmus+ project called 'ForDiL' for 'forest digital learning'. As Erasmus+ is a programme designed to support education, training, youth and sport in Europe, students play an important role throughout the project.The main aim of this 3-year project (2023-2026) is to promote independent learning of CCF approach via an application.

The educational partners involved in the ForDiL project offer a wide range of training courses, from qualification courses to university courses, via apprenticeships and higher education establishments (ITH in Belgium, UFA Bavay in France, Mendelova University in the Czech Republic). The challenge and the interest of the ForDiL project is precisely to create a modular and scalable application that can be adapted to different audiences. Adult training is not left out of this dynamic, thanks to the other project partners who offer regular and varied training courses for forest managers (SRFB and CDAF in Belgium).

The aims of the project

ForDiL has three main objectives:

1. to enable experience to be shared between the three educational institutions involved in the project.
2. to develop an application enabling any forestry learner to learn how to carry out tree marking according to the principles of continuous cover mixed silviculture (CCMS).
3. to enable these concepts to be learned independently.

To achieve these objectives, the project has installed a 'marteloscope' and a 'travailloscope' in each partner country.

What are a 'marteloscope' and a 'travailloscope'?

The concept of marteloscopes was originally developed in France. The term is derived from the French word for tree selection ('martelage') and the Greek word 'skopein' (to look), which literally means 'to take a closer look' at a selection of trees. The concept was first applied mainly in private forests, but its potential was soon recognised for field training and education of forestry professionals and students. Marteloscopes are generally one-hectare rectangular forest sites where all the trees are numbered, mapped, characterised and recorded.

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In practice, this refers to an experimental area where trees are specifically marked (often with paint) and characterized (species, diameter, height, basal area, economic value, biological interest, etc.). This setup allows for the simulation of forest harvesting, particularly the selection of trees to be felled, without the need for actual cutting.

The objective is to enable forest managers, students, and professionals to visualize and analyze the effects of different management practices on forest structure and composition.

Initially, marteloscopes were mainly implemented in private forests, but their potential was quickly recognized for field training and the education of forestry professionals and students. Marteloscopes are typically rectangular one-hectare forest sites where all trees are numbered, mapped, characterized, and recorded.

The graph below, taken from the European Forest Institute (EFI) database, illustrates the growing interest of scientific and educational institutions in marteloscopes.

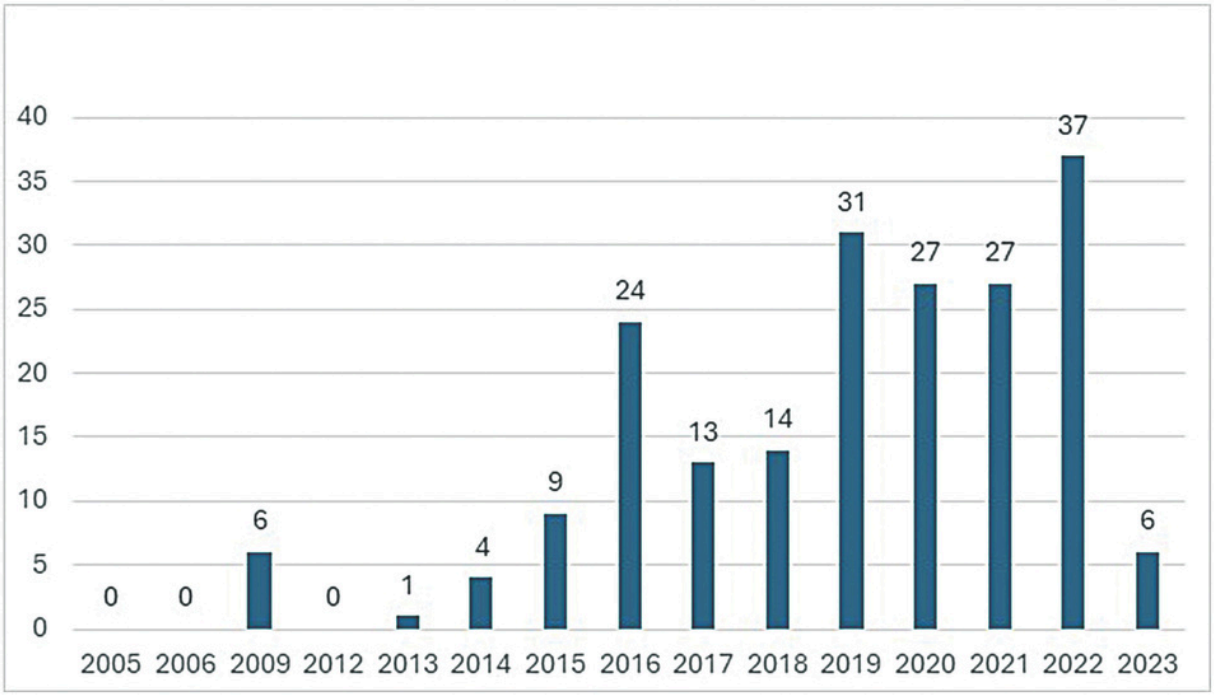

Figure 1: Number of marteloscopes over the years since 2015

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A travailloscope is a training setup focused on silvicultural operations related to forest regeneration. It consists of several small plots representing different regeneration situations.

The goal is to explain which interventions should or should not be carried out on the identified regenerations within the plots. The setup allows for the simulation of decision-making, followed by analysis and comparison based on objective criteria.

As part of the ForDiL project, the focus is mainly on natural regeneration.

Both marteloscopes and travailloscopes are therefore small designated forest areas that will serve as physical supports for the project's scientific and educational approach, ultimately leading to the development of a self-learning application for a wide audience of forestry professionals.

Diverse, coherent and complementary sites for learning about CCF approach

As part of the ForDiL project, we canvassed the plots of land owned by landowners who were kind enough to open their doors to us. The ForDiL team would like to take this opportunity to thank them once again!

For a site to be suitable for use with a marteloscope, it is essential that it has a sufficiently dense stand, with a significant standing volume and a high basal area. In concrete terms, the plot must not have been worked on for at least half a rotation, or even a full rotation, which corresponds to a period of 6 to 12 years for hardwoods.

The plot must also be around 1 hectare in size, and be sufficiently accessible for the public to visit and practise.

It is also necessary for the stand to be in good overall state of health to avoid any unscheduled felling during the closed season, which is the period during which the designated plot will not be harvested.

These few criteria are sufficient to install a standard marteloscope, provided that the owner agrees not to carry out any felling for at least one rotation or an half rotation.

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As part of the ForDiL project, the designated plots needed to encompass a variety of situations to address all issues related to CCF approach.

With this in mind, it was essential to select plots with heterogeneous composition, allowing the study of different tree species. The stand structure also had to exhibit a certain level of heterogeneity, in transition towards irregularisation, in order to provide concrete learning scenarios.

This is a crucial aspect: the plots must have a minimum degree of heterogeneity in terms of species and structure but should not be fully irregular. One of the key objectives is to teach techniques that guide the stand towards irregularisation, in line with CCF principles.

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Belgium: Lauzelle Wood

The Bois de Lauzelle is a private woodland belonging to the UCLouvain and lies in sandy-loam Brabant, on the northern edge of the Ottignies-Louvain-la-Neuve conurbation. Covering an area of around 230 hectares, it is a reminder of the former coal mining forest that once covered a large part of the region. The terrain is fairly hilly, with a maximum altitude of just over 120 m, and the soil is mainly composed of Bruxellian sands.

The marteloscope is located on a diversified stand. Native oak is the dominant species, accompanied by species such as ash, maple, cherry, beech, spruce and grey poplar. It is a stand that is in the process of irregularisation.

The forests and woods chosen for each partner are well suited to the objectives of the project, as they are representative of the stands found in each country, while at the same time highlighting their diverse compositions and structures. They can therefore be used to put forward a range of ideas suitable for tree marking with CCF approach.

Picture 2 : Lauzelle Wood's marteloscope

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France : Mormal forest

Bordering the Pays de Mormal to the east, Mormal Forest, covering 9,135 hectares, is the largest forested area in the Nord department. It is managed by the National Forestry Office (ONF).

Notably, it is home to the department's only red deer population. The forest did not escape the damage of World War I, and as a result, a large part of its area is now occupied by century-old oak forests (6,000 hectares), originating from remarkable acorn crops, particularly that of 1917. In addition to pedunculate oak, the forest is home to sessile oak, beech, hornbeam, ash, as well as alder, birch, maple, wild cherry, and several other species.

The marteloscope was established in a pedunculate oak-hornbeam stand 20 to 25 meters high, managed as high forest. The stand is dominated by pedunculate oak, sometimes mixed with sessile oak, with hornbeam in the understory.

A one-and-a-half-hour drive separates the Belgian and French sites, allowing learners to train in a single day on two stands with different compositions and structures.

Picture 3 :Mormal's marteloscope

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Czech Republic: Mendelova University Forest (MENDELU)

The MENDELU lands cover an area of 10,500 ha (including 10,200 ha of land dedicated to the productive function of the forest) and form a continuous complex directly adjacent to the northern boundary of Brno and extending as far as the town of Blansko along both banks of the Svitava river.

Elevations range from 210 to 574 metres above sea level. The limiting factor is the average annual temperature of 8.5°C and average annual rainfall of around 600 mm.
In total, 65% of the plant cover is deciduous, with beech 41%, oak 12%, hornbeam 6%, lime 2%, ash 2%, maple 2% and other species also represented.

Conifers account for 35% of the vegetation, with spruce dominating at 14%, larch at 9%, pine at 7%, Douglas fir at 3%, fir at 2% and other more marginal species.
The ForDiL marteloscope is located in a stand dominated by beech (65%) and coniferous (35%).

The stand is in the process of being converted to irregular with a mixture of hardwoods and softwoods.

Picture 4 : Mendelu's marteloscope

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ForDiL, an Erasmus + project: students in action!

In 2024, students from the partner schools helped to set up the marteloscopes. They painted numbers on each tree, so that they are clearly visible. These numbers also make it possible to assign an identity to each tree and record a wealth of data about it.

The numbers were oriented so that the learners could identify the trees in the direction of travel on a tree marking trip.

Picture 5 and 6 : The students from the Bavay vocational high school of the Institut de Genech in the marteloscope of Mormal Forest.

Students from MENDELU in the Czech Republic travelled to France and Belgium to geolocate each tree in the marteloscopes.

Geolocation is crucial for a marteloscope, as it gives the user of the application a geospatial representation of the trees around him. It also enables them to visualise the trees they have chosen to cut.

Picture 7 : geolocalisation ef trees by students of MENDELU

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Learning CCF approach independently: a challenge

There are several ways of approaching the subject of tree marking during a training course. To date, two main applications, which we will discuss later in this article, are commonly used as teaching tools, both by learners and by trainers in the field.

These applications provide invaluable information about the way in which the learner has hammered. However, you still need to know how to interpret them! That's why they are used during tree marking training courses supervised by one or more trainers. The trainers guide the trainees, explaining the final results and going back over certain areas to correct any mistakes or go into more detail on certain points.

The ForDiL project is taking on a major challenge: designing an application that works without the support of an instructor. The learner must be able to find his or her way around the settlement, understand the mechanisms behind the choices he or she is going to make, and above all be able to understand the final results and assess himself or herself.
The aim is for the application to provide, as effectively as possible, the information that a trainer would transmit in a traditional training course. It is therefore necessary to be effective and clear in tackling all the situations of the CMCC, taking into account the needs of the learner, whether a student or a professional forester.

The ForDiL project aims for autonomy to make learning accessible to as many people as possible. Indeed, access to these training courses is not always easy: they have to be organised by a structure once or twice a year, and the learner has to be available on those specific dates. The ForDiL application will offer unprecedented flexibility: learners will be able to go to the site themselves, following an online calendar and reserving their place on the day that suits them. They will also be able to repeat the experience as many times as they like: several times a year, a month or even a week.

Picture 8 and 9 : students from “Institut technique horticole” in Lauzelle wood’s marteloscope.

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Two inspiring applications

There are two major applications that use hammer scopes to simulate tree marking: Sylvothèque (Forestry Department of the Bern University of Applied Sciences HAFL) and I+trainer from the Integrate+ project (2013-2016) (http://iplus.efi.int/software-store.html), which will be presented in this article.

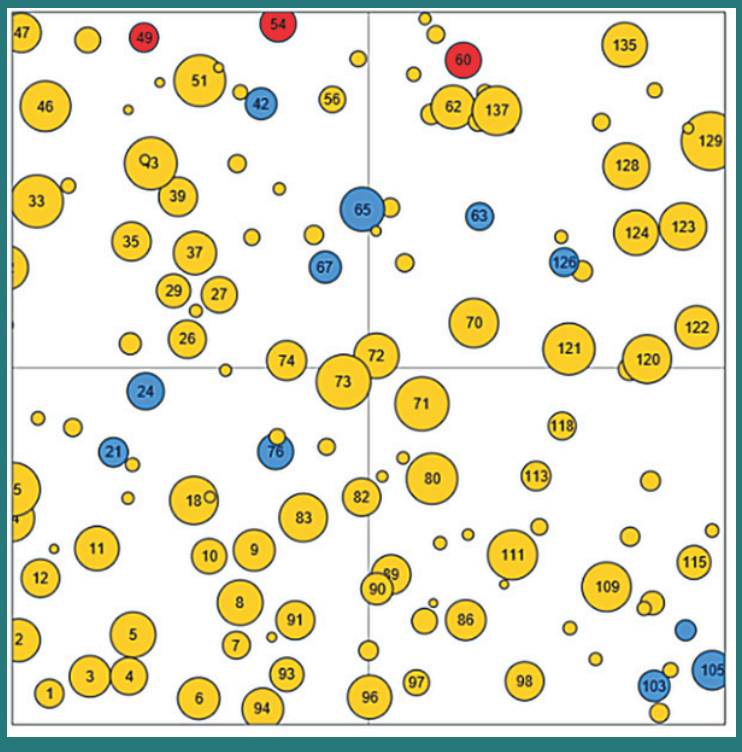
Although I+trainer does not incorporate the notion of autonomy that we wish to implement in the ForDiL project, this application nevertheless highlights the basics of how a marteloscope works. That's why we're giving a brief presentation of how it works, to familiarise you with the concept.

The Integrate+ project focused on education for integrating biodiversity conservation into managed forests. Through a detailed ecological and economic assessment of each tree inventoried in a marteloscope, the project aims, through digital applications, to test practical approaches and their impacts both on wood production and on the maintenance and development of biodiversity.

The content of the application

The application represents on a screen the layout of trees geolocated on the site. Each circle corresponds to a tree with a number allocated to it. The colours are used to distinguish species, and the diameter of the circles changes according to the size of the trees.
However, not just any tree can be marked for tree marking.

The application displays a range of information for each tree: its species, size, height, basal area, presence of dendrohabitats, quality per log, and also shows the competing trees around it.



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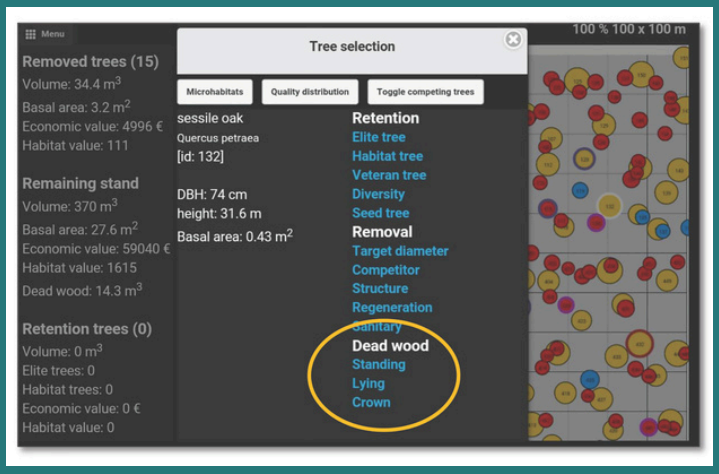
The exercise

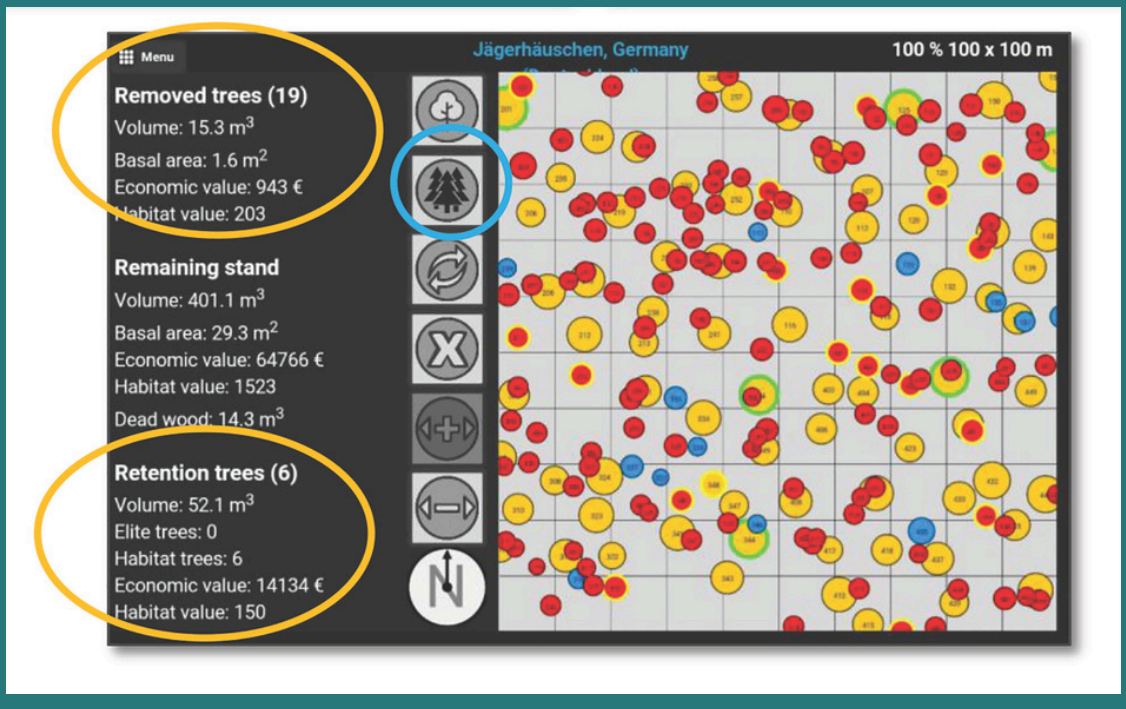
Once the tree has been selected, the user has 2 possible silvicultural choices:

- either to leave it in retention for different reasons: objective tree, habitat tree, seed tree, tree contributing to biodiversity. Represented by a green ring.
- or to cut it down (removal), also for different reasons: tree of harvestable size, competitor, hindrance to regeneration, health, or to improve the structure of the stand.

Note that the application can also identify deadwood in the stand (yellow circle).

Once the choice has been made, the user can view the evolution of the stand in real time as the choices are made: (removed trees, remaining stand trees, retention trees).





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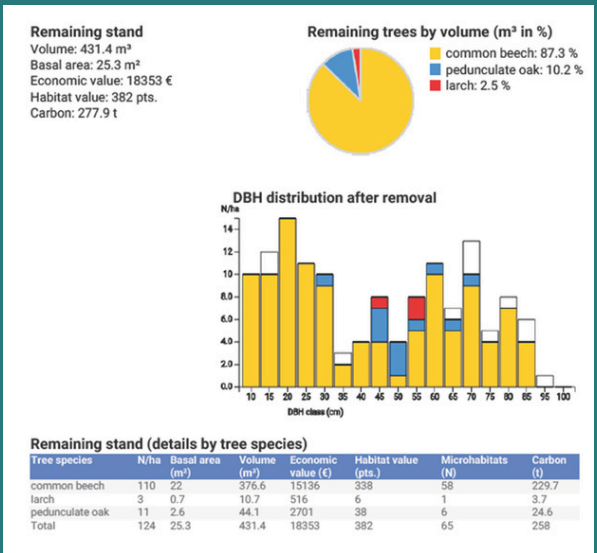
Results

Once the exercise has been completed, the user can visualise the effect of their tree marking by means of various graphs showing the changes made before and after tree marking.



Next stage: developing the application

In 2024, to design an application that meets the objectives set, the ForDiL team has studied and selected a series of relevant data and indicators. However, in order to validate these choices, it was essential to gather external and professional opinions. To this end, meetings were held with forestry experts, forest wardens and university lecturers from France, the Czech Republic, Slovakia and Belgium. These meetings provided an opportunity to present the concept of the application and to discuss the envisaged functionalities together. These constructive discussions made a major contribution to the project, enabling us to make a number of relevant adjustments. These experts will be called upon again at the end of 2025 to test the first version of the application.

In 2025, the application will be developed over a period of nine months. Close collaboration between the developer and the ForDiL team will be put in place to ensure optimum monitoring of its design.

At the beginning of September 2025, a beta version of the application will be released. A test phase will then be launched, involving a varied forestry audience: from young students to more experienced professionals, from beginners to seasoned foresters. This stage will enable the ForDiL team to gather concrete and diverse feedback in order to make adjustments to the application's functionalities.

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