Food and Agriculture Organization of the United Nations

REGIONAL ASSESSMENT OF FOREST EDUCATION IN EUROPE

Creation of a Global Forest Education Platform and Launch of a Joint Initiative under the Aegis of the Collaborative Partnership on Forests

IUFRO
Interconnecting Forests, Science and People

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Mika Rekola, University of Helsinki
Anne Nevgi, University of Helsinki
Niclas Sandström, University of Helsinki

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Acronyms

ANAFE	African Network for Agriculture, Agroforestry and Natural Resources Education
AOAD	Arab Organization for Agricultural Development
BMEL	Bundesministerium für Ernährung und Landwirtschaft/Federal Ministry of Food and Agriculture
BS	Bachelor of Science
CBD	United Nations Convention on Biological Diversity
CEDEFOP	European Centre for the Development of Vocational Training
CPF	Collaborative Partnership on Forests
COVID-19	Coronavirus disease of 2019 (SARS-CoV2)
ECVET	European Credit System for Vocational Education and Training
FAO	Food and Agriculture Organization of the United Nations
FRA	Forest Resources Assessment
GDP	Gross Domestic Product
GFEP	Global Forest Education Project
GIS	Geographic Information System
ICFE	International Conference on Forest Education
ITTO	International Tropical Timber Organization
IUFRO	International Union of Forest Research Organizations
JI	Joint Initiative
LOtC	Learning outside the classroom
MS	Master of Science
NGO	Non-governmental organization
NWFP	Non-wood forest product
OECD	Organisation for Economic Co-operation and Development
PhD	Doctor of Philosophy
RECOFTC	Regional Community Forestry Training Center for Asia and the Pacific
RLP	Regional lead partner
SDGs	Sustainable Development Goals
TFRK	Traditional forest-related knowledge
TVET	Technical and vocational education and training
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

This regional report covers survey results, analyses, discussions and recommendations to help improve and enhance forest education in the European region. It aims to identify further action that will make forest education more relevant for current and future generations of students and professionals at different levels of education, society, and in different contexts of the labor market. This report is part of the Collaborative Partnership on Forests' (CPF) Joint Initiative on Forest Education, together with the Food and Agriculture Organization of the United Nations (FAO), the International Tropical Timber Organization (ITTO) and the International Union of Forest Research Organizations (IUFRO).

The regional reports, prepared in all of the six global FAO regions (Africa, Asia and the Pacific, Europe, Latin America and the Caribbean, Near East and North America) feed forward into the CPF Joint Initiative (JI). These reports serve to help address the gaps and weaknesses in forest education in the respective regions. Suggested approaches and concrete actions outlined in these reports can further help overcome the identified deficiencies and build structures and programmes that ascertain the quality and attractiveness of educational initiatives in the field.

This report show results drawn from a survey that covers all levels of formal forest education including, primary, secondary, technical and vocational education and training (TVET), and tertiary education. The target respondents were grouped into three through which the survey was administered according to priority:

1) Forest professionals working in government organizations, business organizations (the private sector), labor unions, forest owners' associations and environmental and other non-governmental organizations (NGOs);
2) Teachers in the respective levels of formal education; and
3) Students and recent graduates.

Participants provided data on a range of topics including education content and competencies, teaching approaches, educational resources and policy, workplace readiness and employability, digital readiness, and general development and trends in education.

The survey was administered online between July and October 2020. Seventeen countries from the European region were included as primary targets. Subsequently, additional countries in the region were included in the survey sample, based on a snowball-sampling approach. In many of the countries included in the regional survey, forests and forest-related industries play central roles in the economy, and provide a multitude of recreational opportunities that are important for physical and emotional well-being. Altogether, 453 responses were received in the European region, representing the afore-mentioned groups of respondents that were first approached.

Forest professionals, teachers, and students (including recent graduates) had rather similar perceptions of forest education. However, some systematic differences in their perceptions were observed. Compared with other respondents, professionals were more critical of several topics and skills which they saw were inadequately covered in the current programmes, amounting to an almost outdated picture of certain curricula. Several cultural and societal topics such as gender, ethnicity, traditional and indigenous knowledge were reported to be lacking in the curricula. Also, traditional forestry education topics such as silviculture and forest planning were perceived by many respondents to be excessively covered. A strong emphasis on outdoor learning and promoting students' opportunities to visit forests and for teachers to use forests as learning environments were identified in both the survey results and the outcomes of the regional consultations.

In conclusion, the regional assessment report offers several new vistas to enhance trans-disciplinary collaboration in the region related to forest education. The survey results, along with other relevant sources of information, recent literature, and outcomes from regional consultations are integrated in the discussion section. This focuses on how to enhance forest education, multi-stakeholder partnerships, and sustainable development at different levels of formal and informal education. The discussion also includes suggested policy changes that could promote gender and ethnic equality.

Table of Contents

1.0. BACKGROUND

1.1. The need to strengthen forest education

Forest education is the primary means of building the knowledge, skills and shared values that underpin sustainable forest management, and of contributing to the role of forests and trees to achieve environmental, social and economic development goals from local to global levels.

Over the past several years, however, various international fora have raised concerns that in many places, forest-related education is insufficient, deteriorating or outdated, leading these places to a lack of awareness and understanding of forests and to forest graduates who are insufficiently prepared to meet the changing demands of the workplace.

Various reports indicate that countries around the world have experienced variations in student enrollment across forest education programmes and have faced challenges in including forest-relevant topics within the curricula (van Lierop, 2003; Temu and Kiwia, 2008; Rekola *et al.*, 2017; Jegatheswaran *et al*., 2018).

FAO's Global Forest Resources Assessment (FRA) 2020 (FAO, 2020) includes information on forest enrollment trends in post-secondary levels of education between 2000 and 2015 gathered across 119 countries and territories. In those countries that provided information across all education levels and complete time-series data (representing approximately half of the global forest area), there has been a general increase in the number of forestry graduates and a marked advancement towards gender parity. While FRA 2020 warns that these trends should be treated with caution since the data are incomplete, the findings appear optimistic.

Forest education has been largely missing from the global forest policy agenda for nearly 20 years, marked by reduced efforts of the Food and Agriculture Organization of the United Nations (FAO) on the topic. Recently, however, attention on forest education has picked up due to activities of various research organizations and NGOs., and, notably, the inclusion of forest education on the agenda of the 14th session of the United Nations Forum on Forests in May 2019. This signals a growing realization that forest education can and must be part of the solution to many pressing needs such as reducing the rate of deforestation and forest degradation, protecting ecosystems, enhancing livelihoods and safeguarding human health and well-being, conserving biodiversity, and mitigating and adapting to climate change. There is greater awareness that forest education must adapt to the many challenges facing the forest sector. These challenges include:

- Changes in societal expectations related to the goods and services forests provide to communities, and on how forests are perceived;
- Changes in employment trends, and thus the need for further training and education within the forest sector to maintain a strong cadre of skilled foresters and environmental professionals;
- A lack of interest in the forest sector, which needs to be revamped and rebranded to attract the most talented and interested students to study and manage the world's forests and inter-dependent ecosystems;
- An aging workforce in many countries; and
- A curriculum that is often outdated, too narrowly focused and in need of broadening to integrate key emerging topics.

There is an urgent need to reinvigorate the interest in forest education, strengthen and expand existing programmes and tap into emerging opportunities, including those offered by modern digital communication and information technologies, and new types of jobs in the growing green economy.

Target 7 of the Sustainable Development Goals (SDG) number 4 – Quality Education — specifically underlines the need for improved education on sustainable development:

> *By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.*

Without a resurgence in forest education, it will be difficult to achieve sustainable forest management, to secure widespread recognition of the full value of forest goods and services, and to overcome the growing disconnect between people, nature and forests. Without robust and suitable forest education, it is unlikely that forests and trees will fulfill their potential contributions to the achievement of global development goals and targets. These include the SDGs, the targets of the United Nations Framework Convention on Climate Change (UNFCCC), the post-2020 Global Biodiversity Framework of the UN Convention on Biological Diversity (CBD), the UN Strategic Plan for Forests, and other global goals.

1.2. Global initiative on forest education

The Global Forest Education Project (GFEP), formally titled "Creation of a Global Forest Education Platform and Launch of a Joint Initiative under the Aegis of the Collaborative Partnership on Forests," was carried out between November 2019 and September 2021. It was funded by Germany's Federal Ministry for Food and Agriculture (BMEL). The project was implemented by three lead project partners, namely FAO, ITTO and IUFRO, in collaboration with other CPF members and regional lead partners that carried out regional-level project activities.

The regional lead partners by region were:

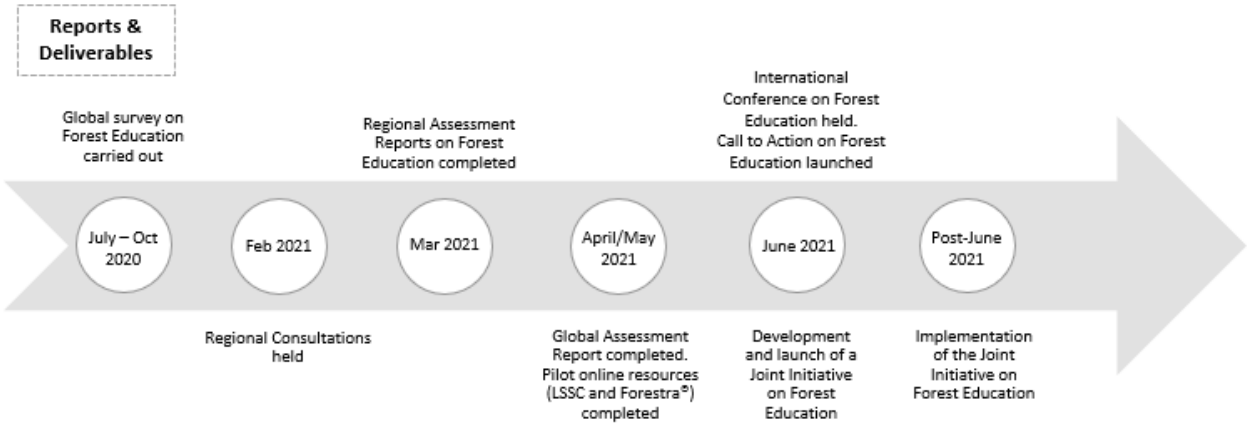
- Africa: African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE)
- Asia and the Pacific: Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC) and ITTO
- Europe and Central Asia: University of Helsinki, Forum4Edu and IUFRO
- Latin America and the Caribbean: IUFRO
- Near East and North Africa: Arab Organization for Agricultural Development (AOAD)
- North America: University of British Columbia (UBC), Michigan Technological University and Project Learning Tree

Within the scope of the GFEP, forest education was defined as education related to forests, other wooded land, and trees outside forests, including natural forests, forest plantations, woodlands, agroforests and urban forests. The project focus was on formal education. Even though informal, non-formal and continuing forest education and training, and indigenous and traditional forest-related knowledge (TFRK) were beyond the scope of the project, project partners considered these sources of education and knowledge to be critical to overall forest-related learning. Several questions that referred to informal and non-formal education and TFRK were included in the survey questionnaire with the expectation that they might be included in an eventual Joint CPF Initiative on forest education and other initiatives to strengthen forest education, training and knowledge.

The project consisted of several interrelated activities aimed at taking stock of the current status of forest education (see Figure 1). A global survey on forest education was carried out between July and October 2020. The survey results, supplemented with information from other sources informed six regional assessment reports and a global synthesis report on forest education. Each regional report assessed the status of forest education in the region and provided a set of recommendations to strengthen it. The reports served as background material for regional consultations on forest education which were convened in February 2021. The regional reports and findings of the regional consultations were used to prepare a global assessment of the status of forest education. In June 2021, an International Conference on Forest Education was held virtually, in which the findings of the global assessment and recommendations for action to strengthen forest education globally were discussed.

The project carried out two pilot activities to develop online resources aimed at enhancing forest education. Under the leadership of IUFRO, the prototype of Forestra®, an enhanced online platform for consolidating and making accessible forest education resources globally, was developed. As a pilot effort to explore new approaches and technologies for training and education, ITTO developed an online course on Legal and Sustainable Supply Chains (LSSC) for Tropical Wood and Tropical Wood Products.

Figure 1. Milestones of the Global Forest Education Project



A global framework for action on forest education culminated from the project preparation. This would form the basis for a multi-year, multi-partner initiative of the CPF. The proposed CPF Joint Initiative (JI) would address contemporary and emerging challenges facing forest education and its scope could encompass formal forest education, informal and continuing forest education, and indigenous and traditional forest-related knowledge.

1.3. Frame of reference

A frame of reference was adopted as the conceptual framework for the global forest assessment on forest education. It was also instrumental in defining the questions posed in the global survey on forest education. The frame of reference consists of four main components of forest education and their relationships (see Figure 2).

Figure 2. Frame of Reference for the Assessment of Forest Education

Needs and *demand* refer to the objectives for education. Needs are defined as general socially desirable objectives, for instance the SDGs. Demand refers to more narrowly defined (economic) requirements on how much and which kinds of skills and competencies are called for in the labor market.

Supply and *resources* are inputs needed to organize and implement educational programmes. There are direct and indirect links between *needs and demand* and *supply and resources*.

Teaching and *learning* are the essential and central components of education. They are mutually interacting activities, as two sides of the same coin. This way, in formal education, talking about learning without teaching is not meaningful. Learning takes place constantly. But in organized, structured learning environments, teaching is key to successful learning outcomes, or Intended Learning Outcomes (ILOs) (see for example Biggs and Tang, 2011).

Learning outcomes (or achievements) are the competencies of students upon graduation, including their knowledge and skills, but also their attitudes and values. Competences can be 1) subject-specific or related to forest-based knowledge and skills such as those related to ecological, technological, and economic aspects of forests and forestry; and 2) generic which are related to skills such as literacy and numeracy, communication, teamwork and leadership.

2.0. INTRODUCTION TO THE REGIONAL ASSESSMENT

2.1 Objectives and description of the regional assessment

The aim of the regional assessment was to appraise the current status of formal forest education at all educational levels, identify gaps and areas that need strengthening, provide information on key initiatives and actors working to evaluate or enhance forest education, and present recommended actions that could be taken to strengthen forest education in the region.

The levels of education analyzed were:

- Primary education (in most countries from age 5 or 6 to age 12 or 13);
- Secondary education (in most countries from age 12 or 13 to age 17 or 18);
- TVET; and
- Tertiary education in universities and colleges.

The regional assessment draws upon the following sources of information: the global survey on forest education carried out in July - October 2020, scientific and grey literature, and a regional consultation on forest education held virtually on February 10-24, 2021.

Some 65 experts and stakeholders participated in the regional consultation in the European region, many of whom took part in more than one of the consultation days to give invaluable insight and participate in fruitful discussions. The objectives of the consultations were to validate the findings of the regional assessment report, and to fine-tune the recommendations to strengthen forest-related education in the region. The reports of all six regional consultations are available on the project website at www.fao.org/forestry/forest-education/en/. (See Appendix 3 for a list of participants in the consultations.)

The European regional consultations were designed pedagogically so that they include engaging parts, ensuring anonymous participation in ranking participant-submitted challenges and recommendations in addition to the breakout group work sessions. The consultations had the following intended learning outcomes (Biggs and Tang, 2011):

- Participants gain a deeper understanding of the survey's contents and proposed recommendations;
- They are able to see and compare differences in the forest education-related perceptions between participating countries; and
- They can reflect on the results and hypothesise potential improvements and identify stakeholders that are relevant for the change initiatives to materialize.

The assessment covers education content and competencies, teaching approaches, educational resources and policy, workplace readiness and employability, digital readiness, and general developments and trends in forest education. These topics reflect the frame of reference that represents the conceptual framework for the assessment.

2.2 Forest education in Europe

Regional context

This study covers Europe including the Russian Federation, as defined in the Forest Resources Assessment (FRA) 2020, as well as Turkey from Western and Central Asia countries. Europe contains 25 percent of the world's forest area. Around 46 percent of its land area is covered by forests (FAO 2020). European forests' highest shares of forest land cover are found in the boreal zone in Finland and Sweden. The region's largest forest areas are located in boreal forests or in the taiga zone, particularly in Russian Siberia which alone occupies an area of 13.1 million km^2 (Figure 3). Growing stock is on average around 114 m^3/ha, however only 514 million hectares (ha) out of a total of 1 017 million ha forest are classified as having production purpose (FAO 2020).

Figure 3. MAP of Forest Coverage in Europe (Source: FRA, 2020)

Source: http://www.fao.org/forest-resources-assessment/fra-2020/maps/en/

Today, the forest sector's importance in European economy is limited in terms of gross domestic product (GDP) share of around 1.0 percent. Europe produces and consumes very large volumes of all kinds of forest products and is also a net exporter of forest products to the world market. Since the 2008 economic crisis, the European forest industry has changed profoundly due to technological and economic changes manifested by globalization.

On the political sphere, an important forest sector initiative is the concept of green jobs introduced by the EU Forest Europe Ministerial Conference in 2015. The concept of green jobs embraces manifold opportunities for the forest sector to diversify its activities and income, including the diversification of traditional forest management and new opportunities for more decent, inclusive and gender-balanced jobs creation. One of the concerns behind this initiative is demographic change, i.e., urbanization. As a result, there will be an increased need to ensure quality working standards to attract people to rural areas to manage forests (Draft of Pan-European Guidelines for the Promotion of Green Jobs in the Forest Sector, 2018).

Primary and secondary education

In all member states of the European Union, environmental education has been part of primary and secondary education for a few decades now either as an independent compulsory subject, as part of a compulsory subject area such as science, or as an interdisciplinary theme (Stokes *et al*., 2001). Different approaches to environmental education have been used in various European countries and regions. Briefly described here are three main approaches in primary and secondary level teaching practices related to forests and are based on the impacts that nature have on child development (Taye *et al*., 2019; Kenny, 2013).

First,"nature preschool and forest kindergarten are two distinct species of nature-based early childhood education that emerged in the United States and Europe in the latter half of the 20th century (Sobel, 2014). "They owe some of their genetic lineage to Froebel's creation of the kindergarten, with an emphasis on children in nature, in mid-18th century Germany." Knight *et al*. (2013) describes how the forest school concept originated from Scandinavia and has later been developed in the United Kingdom.

Second, forest pedagogy, promoted by the European Forest Pedagogic Network (http://forestpedagogics.eu/portal/objectives/), is mainly an informal way to teach and learn nature-related issues at the primary level and at a younger stage in childhood (Waller *et al*., 2017). This has been proven to have several positive effects on learning such as enhanced motivation and concentration, and an improved understanding of and connectedness to nature. Forest visits have strengthened familiarity and conscientiousness of nature (O'Brien and Murray, 2007; Roe and Aspinall, 2011; Lovell and Roe, 2009) (in http://forestpedagogics.eu/portal/2018/10/09/fp-veda/). Forest pedagogy includes several principles, such as active and cooperative educational methods and approaches; addressing all social, environmental and economic dimensions of sustainability; knowledge of forest ecosystems and experience in sustainable forestry; and esteem, promote and offer forests as healthy and excellent learning locations for outdoor education (http://forestpedagogics.eu/portal/).

Third, learning outside the classroom (LOtC) is a specific tool for teaching and learning which focuses on how to improve young people's cultural and environmental awareness (Waite, 2017). Places such as nature and forests where

learning happens can have a significant effect on how a young person engages with a subject or an idea (Council for Learning Outside the Classroom, 2021) (https://www.lotc.org.uk/what-is-lotc/).

Technical and Vocational Education and Training (TVET)

TVET has long roots in some countries such as Germany and Austria. Under the TVET system, learning through work during apprenticeship is a well-established teaching method used in several middle European countries. The length of TVET schooling is mainly three years. While each country implements its own TVET system, a cross-border cooperation framework among countries is also in place such as the European Credit System for Vocational Education and Training (ECVET).

In addition, the European Centre for the Development of Vocational Training (CEDEFOP), an EU agency for TVET, promotes lifelong learning. Several concrete CEDEFOP actions include a common qualifications framework, the Europass curriculum vitae, and an ePortfolio that connects different stages of education (European Commission 2005, https://www.cedefop.europa.eu/).

Apprenticeship systems vary among EU countries. However, 24 out of 30 countries in a 2018 study had a stable and legal basis for the systematic apprenticeship schemes (CEDEFOP, 2018). Schemes vary in terms of learning at an education and training provider. Traditionally, apprenticeship programmes are significantly less common in agriculture, forestry and fishing (Booth and Satchell, 1994).

In 2018, Eurostat showed that 10 million students enrolled in vocational upper secondary and post-secondary non-tertiary forestry education. Some 22 000 (0.2 percent) of them were in the field of forestry. Seven countries had more than 1 000 students, namely, Bulgaria, Czechia, Germany, Poland, Romania, Finland, and Sweden. Of these countries, the number of students has increased in Finland, decreased in Czechia and Romania, and remained the same in Bulgaria, Germany, Poland, and Sweden since 2013.
(https://ec.europa.eu/eurostat/databrowser/view/EDUC_UOE_ENRS10__custom_400161/default/table?lang=en).

An international survey on forestry training from 2010-2011 showed that the background and general conditions differed significantly in the individual countries. The common trend was an expansion of the expected skills and, correspondingly, of the training programmes. At the same time, training institutions faced a strongly competitive training market with limited financial resources. The main changes in the context of TVET were the modularization of training and the introduction of specialization lines. Course contents were adapted to social and technical developments, such as the increased emphasis on language skills, the improvement of business qualifications, and the increase of competences in the area of mechanization and logistics (Bernasconi and Schroff, 2011).

University and college education

University and college level forest education in Europe has recently faced a challenge from students' decreasing interest in pursuing forestry careers (Pohlschneider and de Lima, 2016; Draft of Pan-European, 2018; Gabay and Rekola, 2019). Changes in the curricula have been mainly similar to those in the United States and other western societies, such as the declining number of independent forestry/forest sciences programmes.

In education policy, the European Union launched a harmonization process upon the 1999 Bologna declaration concerning higher education (http://www.ehea.info/pid34248/history.html), which several non-EU countries such as Norway, Russia, and Turkey have signed. The Bologna process is a series of ministerial meetings and agreements between European countries to ensure comparability in the standards and quality of higher education qualifications. The basic framework consists of three cycles of higher-education qualifications: three-year bachelor's (BS), two-year master's (MS) and four-year doctoral degree cycles. The idea of harmonization defines the qualifications in terms of learning outcomes, i.e., statements of what students know and can do to complete their degrees. In describing the cycles, the framework uses the European Credit Transfer and Accumulation System (ECTS).

The effect of the Bologna process on several aspects of European forest education has been multidimensional (Silva, 2014). Thinking about the curriculum alone is a complex issue. One of the main concerns was that labor markets seem to be reluctant to accept new BS graduates. There was strict opposition against curricula specialization by the public sector which was more fixed on traditional career paths in governmental forest service. On the contrary, labor markets have been calling for more diverse study programmes, especially when it comes to the private sector. Lewark (2016) concludes

with the statement of the evolution of European forest curricula, “The times of forestry faculties with just one study programme, which were traditionally found in many European countries, are obviously over after the implementation of the requirements of the Bologna process.”

3.0. METHODS

3.1. Regional assessment overview

This assessment report summarizes the analysis of three surveys among professionals, teachers, and students which were designed to study the state of forestry education globally. Webropol, an online survey and reporting tool, was used to dispatch the surveys and manage the data received (Webropol.com). The procedures were done according to European Union security, ethics and data processing protocols.

3.2. Survey methodology and regional data analysis and reporting

Data were collected from three target groups using different questionnaires developed by the project team, as follows:

1. Forest professionals working in government organizations, business organizations (the private sector), labor unions, forest owners' associations and environmental and other NGOs (Questionnaire 1);
2. Teachers and administrators in primary schools, secondary schools, TVET institutions, and in universities and colleges (Questionnaire 2); and
3. Students who were currently enrolled or who recently graduated from forestry and forest-related programmes in TVET schools and in universities and colleges (Questionnaire 3)

For brevity, these groups are hereafter referred to in this report as '***professionals***,' '***teachers***' and '***students***.'

The questions asked in the survey covered a range of topics including education content and competencies; teaching approaches; educational resources and policy; workplace readiness and employability (of TVET and university and college students and recent graduates); digital readiness (for secondary, TVET and university and college students); and general development and trends in TVET and university and college education.[1] Most of the questions used the Likert scale in which several response options were provided. Some questions were open-ended, permitting the respondent to provide a written response.

Sampling of the target groups consisted of statistical sampling and snowball sampling. Within each country, sample units were chosen to whom the questionnaire was supposed to be sent. Sample units represented the target groups in this study. For the *statistical sample*, a subset of 17 countries in the region were selected including Austria, Belarus, Bulgaria, Finland, France, Germany, Italy, Norway, Poland, Portugal, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey and the United Kingdom. Individuals, organizations and institutions in the three target groups in these countries were identified and survey invitations sent. Central Asian countries were left outside the sampling frame due to resource limitations. As a result of both statistical sampling and snowball sampling, responses were received from a total of 41 countries (see Table 1). These countries represent 94 percent of total forest area in Europe (excluding Russia and Central Asia). Seventeen countries in the statistical sample represent 83 percent of all respondents. This is a rough indication that the survey was able to target the population in the most relevant countries in the region from the perspective of forest education.

Snowball sampling was applied by sending an open invitation to take the survey through social media channels such as Twitter; promoting the survey using the Global Forest Education hashtag #globalforesteducation and through web stories prepared by the project partners (e.g. FAO's web story upon the release of the survey on 15 July 2020

[1]Education content and competences were an essential element of the survey. These included more than 20 items; the number depended on the level of the respondent's education. The so-called gap in teaching and learning were measured directly using the wording "To what extent are the following topics and skills covered in education." This gap analysis and the way the questions were formulated assumes that respondents took into account the importance of topics and skills, their teaching and learning methods and learning outcomes. Due to the large amount of elements in the survey, it was not possible to measure these items separately. To add a measure, for instance, about "the importance of these topics and skills" would have made the survey too long (see gap analysis on Arevalo *et al.*, 2012).

http://www.fao.org/forestry/news/97465/en/), sending survey announcements to project partners' membership or contact lists, and encouraging survey respondents to forward the survey invitation to their contacts, networks and colleagues. The regional data analysis was based on the total responses received, combining both statistical and snowball survey responses (Table 1).

Table 1. Respondents by target group (statistical sampling in bold) and other countries (snowball sampling) in the European region

	Professionals	Teachers	Students	Total	% of total
1 Albania	2	1	0	3	0.7
2 Andorra	1	0	0	1	0.2
3 Austria	4	10	6	20	4.4
4 Azerbaijan	0	0	1	1	0.2
5 Belarus	0	4	0	4	0.9
6 Belgium	1	2	3	6	1.3
7 Bosnia and Herzegovina	0	1	0	1	0.2
8 Bulgaria	1	4	0	5	1.1
9 Croatia	4	1	1	6	1.3
10 Czech Republic	1	2	2	5	1.1
11 Denmark	0	0	2	2	0.4
12 Estonia	1	1	0	2	0.4
13 Finland	6	13	19	38	8.4
14 France	10	20	13	43	9.5
15 Georgia	1	0	0	1	0.2
16 Germany	31	18	15	64	14.1
17 Greece	3	1	0	4	0.9
18 Hungary	1	2	0	3	0.7
19 Iceland	1	0	0	1	0.2
20 Ireland	3	4	3	10	2.2
21 Israel	0	0	1	1	0.2
22 Italy	9	11	4	24	5.5
23 Kyrgyzstan	1	0	1	2	0.4
24 Latvia	0	0	1	1	0.2
25 Lithuania	1	4	0	5	1.1

26 Moldova	1	1	0	2	0.4
27 Netherlands	1	1	3	5	1.1
28 Norway	2	8	11	21	4.6
29 Poland	12	4	0	16	3.5
30 Portugal	6	5	1	12	2.6
31 Romania	2	2	5	9	2
32 Russian Federation	12	5	2	19	4.1
33 Serbia	0	1	1	2	0.4
34 Slovakia	1	0	0	1	0.2
35 Slovenia	2	2	1	5	1.1
36 Spain	15	15	2	32	7.1
37 Sweden	5	5	0	10	2.2
38 Switzerland	1	2	3	6	1.3
39 Turkey	9	5	2	16	3.5
40 Ukraine	4	2	0	6	1.3
41 United Kingdom	11	12	15	38	8.3
Total	166	169	118	453	100.0

The survey questionnaires were translated in 14 languages by the project team and made available on Webropol. Within each country, an equal number of sample units for professionals and teachers was selected using convenient sample (professionals) or randomly selected samples (teachers: primary and secondary units). Among professionals, ten sample units were selected per country, representing the most appropriate professional organizations in the country in the following categories:

- (Political and) Governmental organizations
- Employers, business organizations
- Labor unions
- Forest owners' associations
- Environmental and other NGOs

Among the teachers surveyed, ten primary schools were selected randomly in each country, however, equal strata between urban and rural was applied. All TVET schools and tertiary units were selected up to ten per country.

3.3. Respondents 'socio-demographic background

The survey targeted three groups using separate questionnaires: Q1 for professionals, Q2 for teachers and Q3 for students. These groups are referred to respectively in the succeeding tables. Responses from professionals and teachers outnumber the respondents since they were given the option to provide multiple answers to some questions, on as

many levels of education and degree levels as they wanted. Many teachers and professionals chose to answer the survey on more than one level. Students, on the other hand were only able to choose one level of education and one degree level in answering the survey. The number of responses in the student questionnaire is slightly smaller than the number of respondents due to a function in the Webropol survey tool. Respondents were able to redirect themselves to the next section of questions if they considered that the section of questions did not relate to their studies. Hence, even when a respondent was redirected to the next question without completing one section of questions, the survey tool counted that as a finished response. Table 2 shows the number of participants in each survey group who responded to questions about each level of education. Professionals responded based on their choice of different levels of education and their numbers do not represent a single person responding to the questions on different educational levels. Table 3 shows the socio-demographic background of each group of respondents, namely, the distribution of respondents in racial/ethnic groups, and age distribution among teachers and students (professionals were not asked to report their age). Among all three participant groups, a majority (59 percent) of respondents reported to be male while 49 percent of students who responded were female.

Table 2. Number of survey respondents for each level of education

	Primary	Secondary	TVET	Associate's	Bachelor's	Master's /PhD	All levels
Professionals	99	84	49	0	45	70	35
Teachers	21	27	43		30	85	
Students			7		30	75	

Note: No responses for Associate’s level were received

Table 3. Sociodemographic characteristics of the respondent groups: Professionals, teachers, and students

Baseline characteristic	Professionals (Q1)		Teachers (Q2)		Students (Q3)		Full sample	
	n	%	n	%	n	%	n	%
Gender								
Male	91	55.1	121	72.0	56	47.5	268	59.4
Female	65	39.3	44	26.2	58	49.2	167	37.0
Other	9	5.5	3	1.7	4	3.3	16	3.5
Total no. of respondents	165	100,0	168	100,0	118	100,0	451	100,0
Racial/ethnic group								
Majority	127	77.4	142	85.0	75	63.6	344	76.6
Minority	4	2.4	3	1.8	17	14.4	24	5.3
Non-applicable	17	10.4	12	7.2	19	16.1	48	10.7
Prefer not to say	16	9.8	10	6.0	7	5.9	33	7.3
Total no. of respondents	164	100.0	167	100.0	118	100.0	449	100.00
Age group*								
18-20 years			0	0.0	8	6.8	8	2.8
21-24 years			0	0.0	33	28.0	33	11.6
25-29 years			1	0.6	39	33.1	40	14.1
30-40 years			27	16.3	32	27.1	59	20.8
41-54 years			79	47.6	6	0.5	85	29.9
55-64 years			45	27.1	0	0.0	45	15.8
65+ years			13	7.8	0	0.0	13	4.6
Choose not to answer			1	0.6	0	0.0	1	0.3
A total of respondents			166	100.0	118	100,0	284	100.0

*Professionals were not asked to report their age.

Students were asked to report the country in which they were studying (See Table 4). Out of a total of 117 students who responded to the question, more than half reported that they were studying in their own home country while approximately a quarter of them reported that they were studying in a foreign country aiming to receive a degree or as an exchange student. Every fifth student reported that they were not currently studying.

Table 4. Students' current or planned place of studies

Country of studies	***n***	**%**
Home country	62	53.0
Foreign country (Exchange studies)	3	2.6
Foreign country (Degree studies)	28	23.9
Not studying currently	24	20.5
Total	117	100.0

Professionals were asked to report the organization they were working for. More than half of them reported that they worked for government organizations (see Table 5 below). Professionals were also asked to mention all formal forest-related education activities they hold as responsibilities in their work. They reported to be most involved with student training (70 mentions), employment of recent graduates from university and college institutions (70 mentions), and with guest lectures (67 mentions).

Table 5. Workplace background of professionals

Organization	Professionals	
	n	%
Governmental organization	95	57.6
Business organization	15	9.0
union	3	1.8
Forest owners' associations	10	6.1
Environmental and other NGO	20	12.1
Other	22	13.3
Total	165	100.0

4.0 SURVEY RESULTS

4.1. Primary education

The following results for primary education are based on responses from 99 professionals and 21 teachers. The analyses of data concerning forest education at the primary level include the following topics: forest-related content of curriculum and teaching competencies, teaching approaches in primary education and skills that forest education provide to students, and teaching approaches and educational resources and policy.

4.1.1. Education content and competencies

Respondents were asked to report which topics and skills related to forest knowledge and the use of forests, are covered in primary education. Majority of professionals and teachers reported that most of the topics and skills related to forest knowledge and the use of forests are inadequately covered in the primary education curriculum. The least covered topics include 'importance of conservation and sound management of forests and trees,' and 'traditional knowledge and rights of forest communities.' Only topics such as 'plants and animals that live in or around forests' and those on 'observing the environment' were sufficiently covered (see Table 6).

Table 6. Professionals' (*n* = 99) and primary education teachers' (*n* = 21) responses concerning the topics and skills covered in primary education

Topics and skills covered in primary education	**Inadequately covered**		**Sufficiently covered**		**Excessively covered**		**Unable to answer**		**Not applicable**		**TOTAL**	
	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2
Plants and animals that live in or around forests	37	9	**56**	**12**	3	0	3	0	0	0	99	21
Products that come from forests and trees	**73**	**17**	21	4	0	0	4	0	1	0	99	21
The contribution of forests and trees to local people	**80**	**17**	12	4	0	0	7	0	0	0	99	21
The value of forests and trees to the well-being of society	**68**	**13**	**25**	8	1	0	3	0	0	0	97	21
The risks and threats to forests and trees	**70**	**14**	23	6	2	1	4	0	0	0	99	21
The importance of conservation and sound management of forests and trees	**75**	**16**	17	5	1	0	6	0	0	0	99	21
Forests and climate change	**65**	**13**	26	7	2	0	6	0	0	1	99	20
Forests as a recreational space	56	8	34	**13**	3	0	6	0	0	0	99	21
Observing the environment	37	8	**56**	**13**	1	0	5	0	0	0	99	21
Respect for forests and nature	37	10	54	9	4	2	4	0	0	0	99	21
Cultural and social value of forests and trees	75	15	17	5	0	0	6	0	0	1	98	20
Forest role in providing clean water and air	53	11	36	10	6	0	4	0	0	0	99	21
Traditional knowledge and rights of forest communities	**79**	**16**	7	2	0	0	6	0	7	2	99	18

Other topics	16	2	2	1	0	0	7	0	3	1	28	3

Q1 = Professionals, Q2 = Teachers

Through an open-ended question, respondents were asked to provide suggestions on what topics and skills should be covered in the curriculum besides the topics mentioned in Table 6. Below are some of the responses which were selected for this report, based on the preliminary content analysis of open-ended responses. These reflect their most common suggestions as well as the variety of countries they come from. The importance of sustainability and sustainable development was strongly evident in the open-ended responses. The following quotes provide authentic evidence on the topics that professionals suggested to be included in teaching forest-related subjects at the primary education level. Highlighted in bold are respondents' verbatim answers in their respective language. Some quotes were edited for readability (i.e., punctuation) and an English translation provided underneath as needed.

> **"*Nachhaltigkeit im Lebensstil, Wirtschaften, Sozialem und Nutzung der Natur wäre wünschenswert als selbstständiges Fach"*** *(Q1, statistical sampling)*
> *"Sustainability in lifestyle, business, social affairs and the use of nature would be desirable as an independent subject." (Professional)*
>
> ***"Bioeconomía Circular, Territorio y selvicultura, Servicios medioambientales de los bosques, tipología de bosques locales, productos forestales y aplicaciones en la vida diaria" (Q1, snowball sampling)***
> *"Circular bioeconomy, Territory and forestry, Environmental services of forests, typology of local forests, forest products and applications in daily life" (Professional)*
>
> ***"Verstärkung der Anteile Nachhaltige Nutzung im Fach HSU, aber es wäre auch denkbar Beispiele aus dem Wald auch in anderen Fächern einfliessen zu lassen (Mathe, Religion, Kunst, sogar Deutsch)" (Q1, statistical sampling)***
> *"Increasing the proportion of sustainable use in the HSU subject, but it would also be conceivable to include examples from the forest in other subjects (math, religion, art, even German)"*
>
> ***"In Wales we talk about learning in, learning about and learning for the natural environment which if course includes forests and woodlands, so there are opportunities across all 6 AoLE's." (Q1, snowball sampling)***
>
> ***"Use of wood in everyday life, the importance of timber harvesting, the importance of forest protection, the relationship between the forest and: health, climate, consumption" (Q1, statistical sampling)***
>
> ***"Gestión forestal sostenible, uso de la biomasa forestal y sus beneficios, el problema de losincendios forestales, enfocado en la prevención" (Q1, statistical sampling)***
> *"Sustainable forest management, use of forest biomass and its benefits, the problem of forest fires, focused on prevention"*
>
> ***"O valor das florestas e das árvores para o enriquecimento económico de uma sociedade e fixação de população a regiões afastadas das cidades. Criação de emprego." (Q1, snowball sampling)***
> *"The value of forests and trees for the economic enrichment of a society and the settlement of populations in regions far from cities. Job creation."*

Respondents were asked to report on the extent to which they considered forest-related subjects were included in or should be included in the curriculum as individual subjects. Eighteen out of 21 teachers reported that forest-related topics were not included or only included to a limited extent as individual subjects in the primary education curriculum. However, less teachers (14) thought that these should be included in the curriculum as individual subjects. Professionals shared the teachers' perceptions, as nearly 80 percent of them reported that forest-related subjects are not included or only included to

a limited extent in the curriculum as individual subjects, while 80 percent of them thought that they should be included as individual subjects (see Appendix 1, Figure A1).

When asked if forest-related topics are included or should be included in *other* subjects of the curriculum, most professionals and teachers reported that forest-related topics are included in *other* subjects, but only to a limited or moderate extent. They highlighted that these topics should be included in other subjects in the primary education curriculum (see Appendix 1, Figure A3).

Regarding their perceived ability to teach forest-related topics, 17 teachers replied to the question, a majority of whom reported that they had sufficient knowledge. These topics include forest ecosystems and forest flora and fauna, forest and tree management, forests' roles in global sustainability issues (biodiversity, climate change, renewable energy, food security, water resources, etc.), and other forest related topics and skills. They also perceived that they had effective teaching approaches to guide students' thinking and learning about forests and related subjects. However, only half of the teachers reported to have sufficient skills in the use of digital technology. The other half reported a lack of digital technology skills or have skills of a limited extent (see Appendix 1, Figure A5).

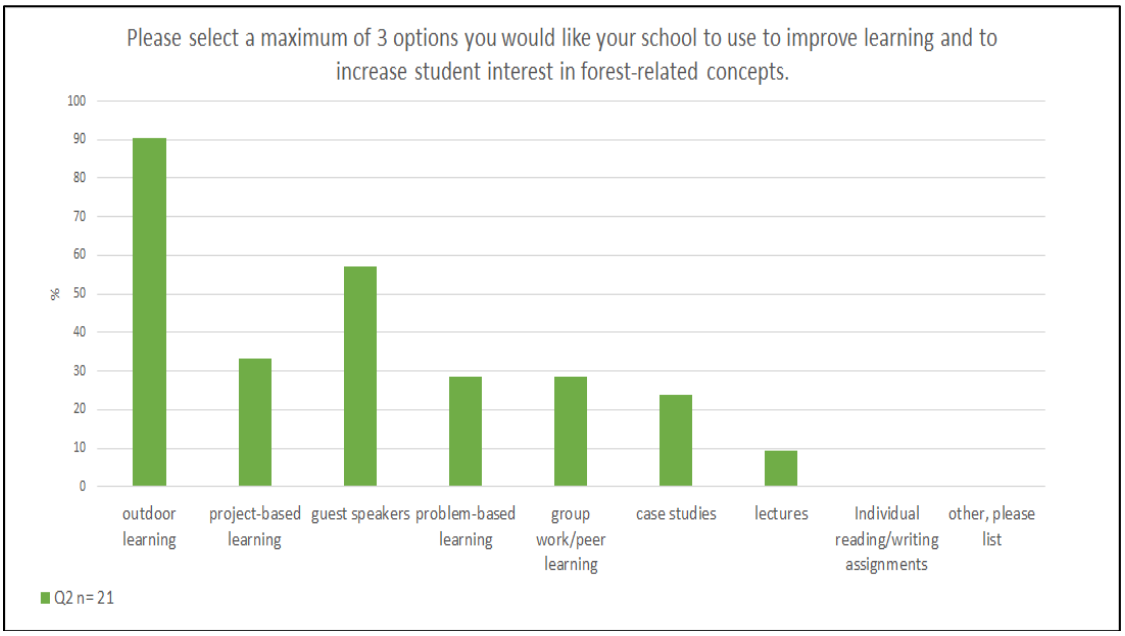
4.1.2. Teaching approaches in primary education

Concerning students' interest to study forest-related topics, primary education teachers were asked to select the most common teaching approaches that are used in their school to teach forest-related concepts. Furthermore, they were asked to reflect on what three teaching approaches they would like to use in their teaching to improve students' learning and to increase their interest in forest-related concepts. Some 21 teachers responded to these questions

Most primary education teachers reported that 'outdoor learning' and 'project-based learning' were the most commonly used approaches in teaching forest-related topics in their school (11 and 10 mentions, respectively). Nine teachers mentioned that 'individual reading and writing assignments' and 'group work/peer learning' were the most common teaching approaches used in their school. Only four teachers cited guest lectures and case studies as the most commonly used teaching approaches in their school.

When asked to identify three preferred teaching approaches to improve students' learning, 19 out of 21 primary education teachers reported that 'outdoor learning' would be their preferred approach to teaching, while 12 teachers reported guest lectures to be their chosen method. Seven teachers mentioned 'project-based learning' while six teachers chose 'group work' and 'problem-based learning' to increase students' interest to forest-related topics (see Figure 4 below and Appendix 1, Figures A9 and A10).

Figure 4. Recommended improvements to learning and increased student interest in forest-related concepts (primary education) (A10)



Professionals and teachers were asked to reflect whether forest education at the primary level increased students' interest in nature and to natural sources. Both groups reported that forest education increased students' interest in nature and to natural sources only to a limited or moderate extent. Professionals hold a slightly more positive perception, as 30 per cent of them reported that it strongly increased students' interest. Six of the teachers reported that their students did not participate at all in any out-of-school activities while ten reported this occurred to a limited extent (see Appendix 1, Figure A11).

Regarding using forests as teaching environment or as a classroom, nine teachers reported that they did not use forests as a teaching environment, eight used forests only to a limited extent and only three teachers reported doing so. Professionals hold a similar perspective and reported that forests were not used at all as a teaching environment (25 percent) or to a limited extent only (56 percent) Only several of them reported that forests are utilized as a teaching environment (17 percent) (see Appendix 1, Figure A6).

In addition, teachers were asked whether their students learn about forests through out-of-school activities such as joining clubs, after-school programmes and field trips. Of the 18 out of 21 teachers who answered this question, a majority reported that students do not participate in out-of-school activities to learn about forests (see Appendix 1, Figure A11).

Teachers reported through an open-ended question the kinds of forest-related, out-of-school activities that their students do participate in. They cited activities such as "beekeeping, scouts, recreation, hiking, and cycling" (responses from primary education teachers through snowball sampling).

Through an open-ended question, both professionals and teachers also mentioned three actions that would have the greatest impact on improving primary students' knowledge and appreciation of forests and forest-related topics. The respondents highlighted the activities that would increase students' knowledge about climatic or environmental issues of forests through project work or through weekly visits to forests:

> ***"Wertsvhöpfungsketten durch die Nutzung von Production aus dem (v.a. auch Holz) vorstellen. - die Klimarelevanz der Wälder durch Projekt-Arbeiten (z.B. Bäume pflanzen) im Wald verdeutlichen. - einfachen und häufigen Transport in den Wald sicherstellen***
> *"Introduce value chains through the use of products made from e.g. wood) — explain the climatic relevance of forests through project work (e.g. planting trees) in the forest. - ensure easy and frequent transport to the forest"*
>
> ***"Visitas semanais à floresta Ações de formação para professores Tema estudado/debatido na disciplina Educação e Cidadania"***

"Weekly visits to forests, Training sessions for teachers, Topic studied / discussed in the discipline Education and Citizenship"

"Environment-focused elements in the curriculum. STEM education linked to outdoor practical fieldwork. Extension of Forest Schools."

Furthermore, respondents were asked to comment on what the status of teaching forests and forest-related subjects had in primary schools, and to suggest ways in which it can be improved. Teachers suggested that it is necessary to revive the tradition of school forestry and to focus on natural foundations of life:

"В школах необходимо возрождать традицию школьных лесничеств. Мне кажется, не всем детям эта тема интересна и близка, надо выявлять тех детей. которых интересует тема лесного образования и предоставлять им возможности учиться по этой специальности." (Q1, statistical sampling)
"In schools, it is necessary to revive the tradition of school forestry. It seems to me that not all children are interested in this topic and close, it is necessary to identify those children. who are interested in the topic of forest education and provide them with opportunities to study in this specialty."

"Der Wald als Schlüsselressource für die natürlichen Lebensgrundlagen spielt eine viel zu geringe Rolle. Die Lehrpläne müssen überarbeitet werden. Es gäbe im Prinzip für alle Fächer thematische Anknüpfungspunkte zum Wald und zur Forstwirtschaft." (Q1, statistical sampling)
"The forest as a key resource for the natural foundations of life plays far too small a role. The curricula need to be revised. In principle, there would be thematic links to the forest and forestry for all subjects."

4.1.3. Educational resources and policy for primary education

To identify available resources for forest education at the primary education level, both professionals and teachers were asked to report on the availability of forest education resources in primary schools. Nineteen of the 21 teachers, and 94 of the 99 professionals answered this question. Most respondents from both groups reported that the resources for forest education were not at all available or only to a limited extent. Concerning the availability of learning materials, teachers' perceptions were polarized, as half of them considered that they were moderately to well equipped with different learning materials. The other half reported having limited or no materials (see Appendix 1, Figure A7).

Professionals and teachers were asked to report on how they perceived the kind of policies or strategies utilized to improve forest-related education in primary schools. They were asked to check all policies and strategies that applied Eighteen of the 21 teachers and 82 of the 99 professionals responded to this question. In general, approximately 60 percent of professionals perceived that governments had a policy or strategy to improve forest-related teaching in primary education. On the contrary, only about 38 percent of teachers held this perception. In general, teachers' perception of policies and strategies in various levels was less positive than professionals' perceptions (see Appendix 1, Figure A4).

4.2. Secondary education

The following is based on responses from 95 professionals and 28 teachers. The analyses of data concerning forest education at the secondary level include the following topics: forest-related content of curriculum, competencies and skills that forest education provides to students, teaching approaches and educational resources and policy.

4.2.1. Education content and competences in secondary education

Regarding the content of secondary education curriculum, professionals and teachers were asked to evaluate the extent to which forest-related topics and skills were covered in secondary education. Most secondary education teachers tended to perceive that topics related to sustainability and cultural issues are inadequately covered. Some examples include ‘wood as renewable energy,’ ‘forests and water supply and quality,’ ‘traditional and/or indigenous forest-related knowledge,’ and ‘cultural values of forests and trees. On the other hand, most teachers perceived that ‘forest ecology’ and ‘forest biodiversity’ were sufficiently or extensively covered. Professionals shared similar perceptions as teachers, however, they differed from teachers' perceptions regarding rights to the use of forests and trees, as more than 90 percent of the former perceived this as insufficiently covered in teaching (see Table 7).

Table 7. Coverage of forest-related topics and skills in secondary education

Topics and skills covered in secondary education	Inadequately covered		Sufficiently covered		Excessively covered		Unable to answer		Not applicable		TOTAL	
	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2
Forest ecology	59	10	21	13	0	2	4	1	0	1	84	27
Forest biodiversity (plants, animals, ecosystems)	42	10	38	14	1	2	3	1	0	0	84	27
Wood as renewable energy	65	16	14	9	0	1	5	1	0	0	84	27
Wood and non-wood forest products	69	13	11	10	0	2	4	1	0	1	84	27
Forest and water supply and quality	59	17	20	7	1	1	3	1	1	1	84	27
Forests and climate change	45	14	34	12	1	0	4	1	0	0	84	27
Recreational values	52	13	25	12	2	0	5	1	0	1	84	27
Traditional and/or indigenous forest-related knowledge	69	15	9	8	0	0	4	1	2	2	84	26
The contributions of forests and trees to people’s livelihoods	60	16	19	8	1	2	3	1	1	0	84	27
Deforestation and forest degradation	37	12	38	11	5	3	4	1	0	0	84	27
Forest conservation	51	11	28	12	1	3	4	1	0	0	84	27
Skills for observing the environment	56	11	22	11	0	3	4	1	1	1	83	27
Respect for forests and nature	47	8	30	13	3	4	3	2	0	0	83	27
Rights to forest use and products	67	14	8	10	0	1	6	1	2	1	83	27

Cultural values of forests and trees	65	16	9	9	0	0	5	1	1	1	80	27
Other	0	2	0	1	0	0	0	1	0	1	0	5

Q1 = professionals, Q2 = Teachers

Through an open-ended question, professionals and secondary education teachers were further asked to provide three topics that should be included in the curriculum. The following quotes provide examples of the most mentioned topics:

> ***"1. Segregation of rubbish 2. Renewable energy sources 3. Sustainable forest / nature management - deforestation and forest degradation wood and non-wood forest products wood as renewable energy"*** *(Professional, statistical sample)*

> ***"Auswirkungen des eigenen Konsums auf heimische und weltweite Ökosysteme" (****Professional, statistical sample****)***
>
> *"Effects of own consumption on domestic and global ecosystems" (Professional from statistical sample)*

Further, 79 professionals and 23 teachers responded to the question on to what extent are, and should, forest-related topics be included in the curricula as individual topics. Perceptions differed between professionals and secondary education teachers. Most professionals (86 percent) reported that they were included or only to a limited extent. However, both groups perceived that forest-related topics should be included in the curriculum of secondary education as individual subjects (more than 50 percent of professionals and almost 60 percent of teachers) (see Appendix 1, Figure A13).

Respondents expounded their answers through an open-ended question, quoted below verbatim with English translation:

> ***"Bildung für nachhaltige Entwicklung sollte in allen Altersstufen ein eigens Schulfach sein, mit dem nötigen und schwerpunktmäßigen Fokus auf den Wald." (****Professional from statistical sample****)***
>
> *"Education for sustainable development should be a separate school subject at all ages, with the necessary and main focus on the forest." (Professional from statistical sample)*

> ***"Mesmos que no Ensino Fundamental mais os seguintes pontos: Profissões florestais e sua importância Setor florestal e sua importância nacional e mundial Riscos e controlo de riscos para a florest" (****Professional from statistical sample****)****"Same as in elementary school, with the following points: Forestry professions and their importance Forestry sector and its national and global importance Risks and risk control for forestry" (Professional from statistical sample)***

Respondents were then asked whether forest-related topics are, or should be, included in *other subjects* in the curriculum. Both professionals and secondary education teachers reported that forest-related topics are included in other subjects only to a limited extent. Furthermore, the majority of both respondent groups agreed that they should be included in other subjects (see Appendix 1, Figure A14).

Regarding forests as teaching environments, respondents were asked to report on the extent to which forests are used as a teaching environment or classroom in schools. Perceptions between professionals and teachers significantly differed. Almost 30 percent of teachers answered that forests are used extensively as a teaching environment, whereas less than two percent of professionals agreed with this. One-third of secondary education teachers (n = 26) reported that they used forests often as learning environments, and one-fourth of them reported that they used them moderately. Six teachers did not use forests at all as a learning environment. Teachers' perceptions differed from the responses of professionals, of whom most reported that forests were used as learning environments only to a limited extent (53 percent) or not at all (32 percent) (see Appendix 1, Figure A18).

The survey further asked secondary education teachers to evaluate how sufficiently knowledgeable they felt to effectively teach forest-related concepts and skills to their students. They reported feeling most confident in teaching forest ecosystems, and flora and fauna. Half of those who answered the question reported that their knowledge was least sufficient inhalf using digital technology in teaching. The other half reported that they felt moderately or very much knowledgeable (see Appendix 1, Figure A17).

4.2.2. Teaching approaches in secondary education

Secondary education teachers were asked to reflect on the most common teaching and learning approaches in their schools and to select the ones they considered could enhance students' learning and interest in forest-related concepts. Teachers reported outdoor teaching and group working/peer learning to be the most common teaching method. The least-used teaching approach was problem-based learning (see Appendix 1, Figures A12 and A13).

Regarding teaching approaches, professionals and secondary education teachers were asked on the extent to which their students were exposed to forests by participating in out-of-school activities. More than 90 percent of professionals reported that students in secondary education only participated in out-of-school activities only to a limited extent or not at all. Secondary education teachers had a similar perception, as 18 out of 21 (about 72 percent) reported that students are exposed only to a limited extent or not at all to forests through out-of-school activities such as after-school programmes or field trips. Seven teachers (28 percent) reported that students had a moderate or extensive exposure to forest-related activities after school, however, only eight percent of professionals had the same view. More than 60 percent of secondary education teachers and about 50 percent of professionals perceived that these activities may increase students' knowledge and appreciation of forests (see Appendix 1, Figure A19).

Teachers were asked to list down out-of-school activities that their students participated in. The following quotes were the most typical answers:

> ***"Läger, olika sporter så som orientering, paddling, mtb, trail running mm" (Q1, statistical sampling)***
>
> *"Camps, various sports such as orienteering, kayaking, mtb, trail running etc. (Professional, from statistical sampling)*

> ***"Programa Eco-escolas (ligado ao ambiente, onde abordam alguns temas florestais) Projeto Rios: adopção de um troço de linha de água e, por conseguinte, uma zona ripícola. Celebração do Dia Mundial da Floresta (21 de Março) e do Dia Nacional da Floresta Autóctone (23 de Novembro)" (Q1, statistical sampling)***
>
> *"Eco schools program (linked to the environment, where they address some forestry themes), Projeto Rios: adoption of a stretch of water line and, therefore, a riparian zone. Celebration of World Forest Day (21 March) and National Autochthonous Forest Day (23 November)" (Professional, from statistical sampling)*

4.2.3. Educational resources and policy

Professionals and secondary education teachers were asked to evaluate the availability of forest education resources in secondary education. About 75 percent professionals perceived that teacher resources such as materials, support, quality and quantity are available only to a limited extent. On the contrary, about 65 percent of secondary education teachers reported that these resources are moderately or very much covered. Overall, secondary education teachers perceived that resources for forest education in schools to be available more extensively than professionals did (see Appendix 1, Figure A15).

Professionals and secondary education teachers were asked to evaluate educational policy strategy that could lead to improved forest-related education. More than half of professionals agreed that there is a government policy or strategy while more than 40 percent of them responded that there is a school policy or strategy. Secondary education teachers' perceptions concerning strategies were less optimistic than professionals' (see Appendix 1, Figure A16).

4.2.4. Readiness

More than half of secondary education teachers perceived that education in secondary schools increases students' interest to learn more about forests or forest-related subjects. On the contrary, more than 60 percent of professionals perceived that education in secondary schools does not increase students' interest towards learning about forests, or only increases interest to a limited extent (see Appendix 1, Figure A20).

Professionals and teachers were asked to give suggestions on how education in secondary schools would increase students' interest in pursuing further learning about forests-related subjects. These were the typical responses:

"Os alunos apenas reconhecem a importância da floresta a nível ambiental, não entendem como esta é importante a nível social e económico. Esta falta de informação leva à falta de procura de cursos florestais no Ensino Superior e ao desconhecimento da importância da gestão florestal sustentável e da certificação florestal para a valorização e conservação da floresta" (Q1, statistical sampling)

"Students merely recognize the importance of the forest at an environmental level, they do not understand how important it is at a social and economic level. This lack of information leads to a lack of demand for forestry courses in Higher Education and to a lack of awareness of the importance of sustainable forest management and forest certification for the valorization and conservation of the forest." (Professional from statistical sampling)

"It is far too limited, students are unaware of forestry as a potential career path. Most foresters in the UK are generational - a relative already works in the sector, Scotland may be the exception where at least in rural areas they see forestry operations happening. Urban students simply dont get involved, the diversity in the sector is very limited as a result" (Q1, statistical sampling)

"Wenn Waldthemen angesprochen werden, dann leider zu theoretisch. Die praxisnahe, besser noch die emotionale Heranführung zu Waldthemen ist aus Kapazitätsgründen (Personal, Zeit, Erreichbarkeit) kaum machbar." (Q1, statistical sampling)

"When forest issues are addressed, it is unfortunately too theoretical. The practical, or better yet, the emotional introduction to forest issues is hardly feasible for reasons of capacity (staff, time, availability)." (Professional from statistical sampling)

Teachers were more satisfied than professionals regarding the readiness and motivation of students to pursue forest education. The difference is especially high among students pursuing TVET education. Less than 2 percent of teachers felt that students are very much motivated to pursue forest-related higher education, whereas almost 30 percent of professionals answered so.

Slightly less than half of secondary education teachers reported that students are motivated to pursue forest technical and vocational education; and 10 out of 27 teachers perceived that students are motivated to pursue a forest programme at the university and college levels. Teachers' perceptions differed from professionals'— less than 20 percent of professionals perceived that secondary education students are motivated to enter forest education in vocational, university and college levels (see Appendix 1, Figure A22).

Professionals were asked to list three key actions that would have the greatest impact on improving secondary students' knowledge and appreciation of forests and forest-related subjects. Below are some of the typical responses:

"Programas de educação florestal com visitas semanais à floresta e contacto com os profissionais do setor florestal. Estágios anuais na floresta para promover e motivar a escolha de escolas profissionais com cursos florestais ou universidades." (Q1, statistical sampling)

"Forestry education programs with weekly visits to the forest and contact with forestry professionals. Annual internships in the forest to promote and motivate the choice of professional schools with forestry courses or universities." (Professional, statistical sampling)

"Акции по восстановлению лесов Гослесагентства Грантовая деятельность общественных организаций Учеба в лесных коледжах, школах, школьних лесничествах" (*professionals, snowball sampling****)***

"Actions to restore forests State Forestry Agency Grant activities of public organizations. Training in forest colleges, schools, school forestry units" (Professional, snowball sampling)

"charlas de profesionales forestales en las aulas, visitas a empresas y a propietarios forestales" (*professionals snowball sampling****)***

"talks by forestry professionals in classrooms, visits to companies and forest owners" (Professional, snowball sampling)

Professionals and teachers provided the following additional comments on secondary education including competences, limitations, gaps, effective teaching approaches and new initiatives:

"Lernen durch selber Machen. Möglichst viel Zeit draußen im Wald/ Natur in Gemeinschaft erleben fördert einen emotionalen Bezug und damit auch das Interesse am Wald." (Professional, statistical sampling)
"Learning by doing. As much time as possible outdoors in the forest / experiencing nature in community promotes an emotional relationship and thus also interest in the forest."

"potrebbe essere proposto un anno di servizi sociali/ambientali, sia per donne che per uomini, al posto del servizio militare" (Professional, snowball sampling)
"a year of social / environmental services, for both women and men, could be proposed instead of military service"

4.3. Technical and Vocational Education and Training (TVET)

The following is based on responses from 49 professionals, 43 teachers and seven students. The number of student responses is very low, as such, these responses are mentioned in the following sections only occasionally. The analysis focused on the following topics: forest-related content of curriculum, educational resources and policy, workplace readiness and employability in TVET, digital readiness and general developments and trends in TVET.

4.3.1. Education content and competences in TVET education

The respondents were asked to reflect on the extent to which forest-related topics are covered in TVET forest programmes. Concerning the coverage of topics related to forest resources and forest ecology, 57 percent of professionals and 58 percent of teachers reported that 'Forest genetic resources' are inadequately covered. On the contrary, four students who responded to this question perceived that this topic as extensively covered (see Appendix 1, Figure A28).

Regarding the coverage of topics related to 'Forests/tree planning and management' in TVET forest programmes, perceptions between professionals and teachers did not differ significantly. Both groups thought that 'Silviculture' and 'Forest planning' were sufficiently or even excessively covered in TVET forest programmes. Concerning the topic on 'Forests and climate change,' professionals' and teachers' perceptions differed, wherein 50 percent of professionals reported the topic as inadequately covered. On the other hand, 61 percent of teachers reported the topic as sufficiently covered. Four out of six students agreed that the topic is sufficiently covered; the two remaining students reported the topic as inadequately covered (see Appendix 1, Figure A29.1).

More than 50 percent of TVET teachers and professionals reported that 'Forest landscape restoration,' 'Range management,' 'Agroforestry' and 'Watershed management' are inadequately covered in TVET forest programmes. Ten TVET teachers reported that they were unable to answer this question, and half of those who answered the question considered that 'Range management' is inadequately covered. Around 62 percent of professionals and 69 percent of teachers reported that 'Sustainable harvesting systems' are sufficiently covered (see Appendix 1, Figure A29.2).

Around 70 percent of professionals and 66 percent of TVET teachers reported that 'Urban forestry' is inadequately covered in TVET forest programmes. Out of a total of four student responses, two reported this topic as inadequately covered, with one reporting it is sufficiently covered while the other reported that it is excessively covered. More than 60 percent of professionals and teachers reported that 'Watershed management' is inadequately covered. Concerning 'Wildlife management,' 'Forest health,' and 'Forest conservation,' most of the professionals and teachers reported that these topics are sufficiently covered (Figure A29.3).

When observing perceptions related to topics of forests/tree planning and management, similar responses were received across professionals and teachers. The highest 'sufficiently covered' and 'excessively covered' perceptions are related to topics of silviculture and forest health. The perceptions related to urban forestry and range management were evaluated with a high level of inadequacy.

Under the theme 'Forest services and cultural and social issues' there were two topics that both professional and teacher respondents considered as inadequately covered (more than 60 percent of respondents), i.e., 'Cultural values of forests and trees,' and 'Traditional and/or indigenous forest-related knowledge.' Both TVET teachers and professionals

(more than 55 percent of respondents) agreed that ‘Forest-based recreation’ and ‘Wood as renewable energy’ are sufficiently covered in TVET forest programmes (see Appendix 1, Figure A30.1).

Notably, a high percentage of professionals and teachers (85 and nearly 90 percent, respectively) thought that ‘Forest, trees and race/ethnicity issues’ are inadequately covered. More than half of the respondents from both groups reported that ‘Forests, trees and gender issues’ are inadequately covered. However, respondents were rather uncertain about gender and race/ethnicity topics which is evident in the high number of “unable to answer” responses (see Appendix 1, Figure A30.2).

When observing the topics related to the theme ‘Forest enterprise’ in TVET forest programmes, ‘Forest industry, Marketing and management’ and ‘Wood technology’ were covered sufficiently, according to more than 70 percent of the TVET teachers and more than 65 percent of professionals. ‘Small-scale forest enterprise’ and ‘Entrepreneurship’ were covered in a satisfactory way, however, approximately 30-40 percent of respondents perceived these topics as inadequately covered (see Appendix 1, Figure A31).

Topics of ‘forest policy and economics' and 'forest economics’ were rather well covered in TVET education. In both professionals’ and teachers’ groups, approximately 70 percent of respondents perceived the topic as sufficiently covered; a small share of respondents felt that this topic is even excessively covered. In TVET forest programmes, the topics of forest economics and forest policy and regulations are sufficiently covered according to both respondent groups (see Appendix 1, Figure A32).

Most professionals and teachers reported that ‘Basic science and numeracy skills’ and ‘Forest nursery management’ are sufficiently covered in TVET forest programmes. However, ‘Written and oral communication skills,’ were thought to be inadequately covered by about 50 percent of professionals and 42 percent of teachers. Between professionals and teachers, there seemed to be a great discrepancy concerning how the topic ‘Forest and agroforestry extension’ is covered. Around 60 percent of professionals thought that this topic was sufficiently covered while on the contrary, 65 percent of teachers reported that this topic is inadequately covered (see Appendix 1, Figure A33.1).

Most teachers and professionals (approximately 70-80 percent) reported that topics such as ‘Wood harvesting operations with manual tools,’ ‘Timber extraction and transport,’ and ‘Other mechanized work e.g. site preparation’ were excessively or sufficiently covered in TVET forest programmes. More than 60 percent of professionals reported that ‘Professional ethics’ is inadequately covered, whereas about 55 percent of teachers perceived that the topic is sufficiently covered (see Appendix 1, Figures A33.1 and A33.2).

The respondents were asked to list any additional topics and skills that should be covered at TVET level. Below are examples of typical answers:

> ***“Paying attention to the growth of timber harvesting on world markets. Learning about the diverse functions of the forest” (Professional, statistical sampling)***
>
> ***“Ergonomie in der Waldarbeit”***
> *“Ergonomics in forest work” (Professional, statistical sampling)*
>
> ***“Роль лесов в борьбе с глобальным потеплением Использование ГИС технологий в лесном хозяйстве”***
> *“The role of forests in the fight against global warming; The use of GIS technologies in forestry”*

Students studying in TVET forest programmes were asked to comment on what the most important subject-specific competencies they perceived to have learned or aimed to learn. Below are typical quotes from students’ responses to their preferred competencies:

> ***“Droit de l'environnement : Articles concernant les forêts”***
> *“Environmental law: Articles concerning forests”*
>
> ***“La sylviculture, la biodiversité, le travail de terrain, l'économie”***
> *“Forestry, biodiversity, field work, the economy”*

Students were further asked to assess what they considered as the most important subject-specific skill that they had learned or aimed to learn in TVET forest programme. Below are two quotes illustrating students’ typical responses:

"Programming, Research, Biodiversity" (Student studying in TVET forest programme)

"Communication Legislation Forestière Gestion durable des forêts"
"Communication, Forest legislation, Sustainable forest management" (Student studying in TVET forest programme)

Teachers shared their thoughts about the curriculum revision within the past five years (the TVET curriculum underwent a major revision). The nature and extent of the revision is as follows:

"Reviewing and updating UK Forestry Standards for Forest Operatives in both Harvesting and in Establishment and Maintenance"

"changes were made in line with government policy. changes were made in line with education standards and metrics new curriculum in mechanised forest harvesting, GIS and forest economics"

"The forestry apprenticeship provision was overhauled in consultation with industry and the Forest Operative Standard was introduced."

4.3.2. Educational resources and policy in TVET education

Around 44 professionals and 39 teachers responded to the question on the extent to which resources were available for the TVET forest programmes. Approximately 80 percent of teachers reported that there are enough resources in terms of educational environment and practical opportunities. Furthermore, more than 70 percent of teachers reported that the TVET forest programmes had good teacher resources (e.g., materials, support, quality and quantity). Concerning resources for educational environment, professionals had a more pessimistic view than teachers wherein about 45 percent thought that resources for educational environment were covered only to a limited extent (see Appendix 1, Figure A23).

Respondents were asked to evaluate if there were any policy or strategy that could lead to improved forest-related education at TVET level. Some 42 professionals and 39 teachers responded to this question. 80 percent of teachers reported the existence of governmental policy or strategy. On the contrary, only about 48 percent of professionals held this view. Less than 50 percent of professionals and teachers reported the existence of a school board policy or strategy, or school policy to improve forest-related education at TVET level. However, only less than 10 percent of both respondent groups reported that there is no policy or strategy (see Appendix 1, Figure A24).

Teachers had more positive perceptions of out-of school activities than professionals do. The majority of TVET teachers reported students to be moderately or extensively engaged in forest-related activities outside of school (cited by more than 70 percent of teachers), or engaged in activities that increase students' learning (more than 80 percent). Most teachers (more than 70 percent) also reported that students have possibilities to work as part-time employee in forest-related employment or for internships. Almost all TVET teachers also reported that part-time forest-related employment or internships moderately or extensively increased students' learning. Professionals had less favorable perceptions than teachers regarding out-of-school activities. Almost 70 percent of professionals considered that students were engaged to a limited extent or not at all in these activities. Professionals were also critical of students' engagement in forest-related employment and internship (see Appendix 1, Figure A26).

Respondents were asked to report if they knew of out-of-school forest-related activities their students most frequently engaged in. Typical answers included hunting, internships or collaboration with forest companies, as shown in the quotes below:

"Jagd Öffentlichkeitsarbeit Waldpädagogik/Waldbezogene Bildungsangebote" (Q1, statistical sampling)
"Hunt, public relations, forest education / forest-related educational offers"

"Actions regarding the protection of the environment within the forests and less management action for the support and protection of the forests." (Q1, snowball sampling)

"Stage e tirocini" (Q1, snowball sampling)
"Internships"

"Mitarbeit bei Forstunternehmen und in privaten wie staatlichen Forstbetrieben, Waldpädagogik, Projekt um Zusammenhang mit Forst & Kultur sowie Forst& Tourismus sowie Forst & Gesundheit; forstliche Öffentlichkeitsarbeit." (Q2, statistical sampling)
"Collaboration in forest companies and in private and state forest companies, forest education, project related to forest and culture as well as forest and tourism as well as forest and health; forest public relations."

4.3.3. Workplace readiness and employability in TVET

Respondents were asked to evaluate how the TVET forest programmes prepared students to enter the workforce. In general, more than 60 percent of all the respondent groups (professionals, teachers, and students) reported that TVET forest programmes moderately or highly prepared students to enter the workforce. However, it is somewhat concerning that around 35 per cent of professionals think that TVET programmes only prepare students to enter the labor market to a limited extent or not at all (see Appendix 1, Figure A34).

Existing learning gaps between the formal TVET schooling and the skills needed in the workplace were identified by respondents. The following were the typical responses:

"Nachhaltiges, schonendes Arbeiten im Ökosystem Wald. Erkennen und Abschätzen von biologischer Automation." (Professional, statistical sampling)
"Sustainable, careful work in the forest ecosystem. Recognizing and assessing biological automation."

"Maior conteúdo para a parte económica das florestas. Parte ambiental e paisagística. uso de TIC Idiomas Extensión y comunicación forestal" (professionals, Q1, snowball sampling)
"Greater content for the economic part of the forests. Environmental and landscape part.use of ICT Languages Extension and forest communication"

Respondents were asked to evaluate to what extent gender and race/ethnicity were factors that influenced students' transition to labor market. Almost 40 percent of teachers thought that gender was a strong factor, responding with 'moderately' or 'very much.' On the contrary, race/ethnicity was perceived as an influencing factor only by 15 percent of professionals and teachers.

More than half of all respondents reported that gender does not influence graduates' ability to find a forest job or influence what kinds of jobs they are considered for, or only influences these factors to a limited extent. A small minority (about 10 percent) of professionals viewed that gender influences the kinds of jobs that are offered to the graduates. Most of the respondents of both groups also reported that race and ethnicity is not a factor or may be a factor only to a limited extend, regarding what kind of jobs are offered to graduates or the ability to find a forest-related job upon graduation. However, a small minority of both groups (about 5-10 percent) considered that race may be a relevant issue and hinder graduates' possibilities to find a forest-related job (see Appendix 1, Figure A35).

When asked what respondents believed were the most important factors affecting employment opportunities, the following responses were reported:

"Not ethnicity, but language skills - Finnish language is often required due to safety issues. These "issues" can often be tackled if the employing company has resources to support possible employees who do not (yet) speak the local language." *(Professionals, statistical sampling)*

"Tradiertes Rollenverständnis in der Forstwirtschaft; Unterrepräsentanz von Frauen in Führungspositionen; fehlende Tarifverträge in vielen Bereihen" *(professionals statistical sampling)*
"Traditional understanding of roles in forestry; Underrepresentation of women in management positions; lack of collective agreements in many areas"

"Lack of apprenticeships and alternative routes other than degrees into the industry" (*Professionals, snowball sampling)*

"Rural issues around affordable housing and transport" *(teachers, snowball sampling)*

Teachers have somewhat higher perceptions of continuing education than professionals. About 65 percent of TVET teachers considered that continuing education offers possibilities to update and expand forest professionals' skills very well, with approximately one in three noting these possibilities as limited or as not at all offered. Professionals had a less favorable perception and considered that the possibilities to update and expand forest professionals' skills are very limited. (see Appendix 1, Figure A25).

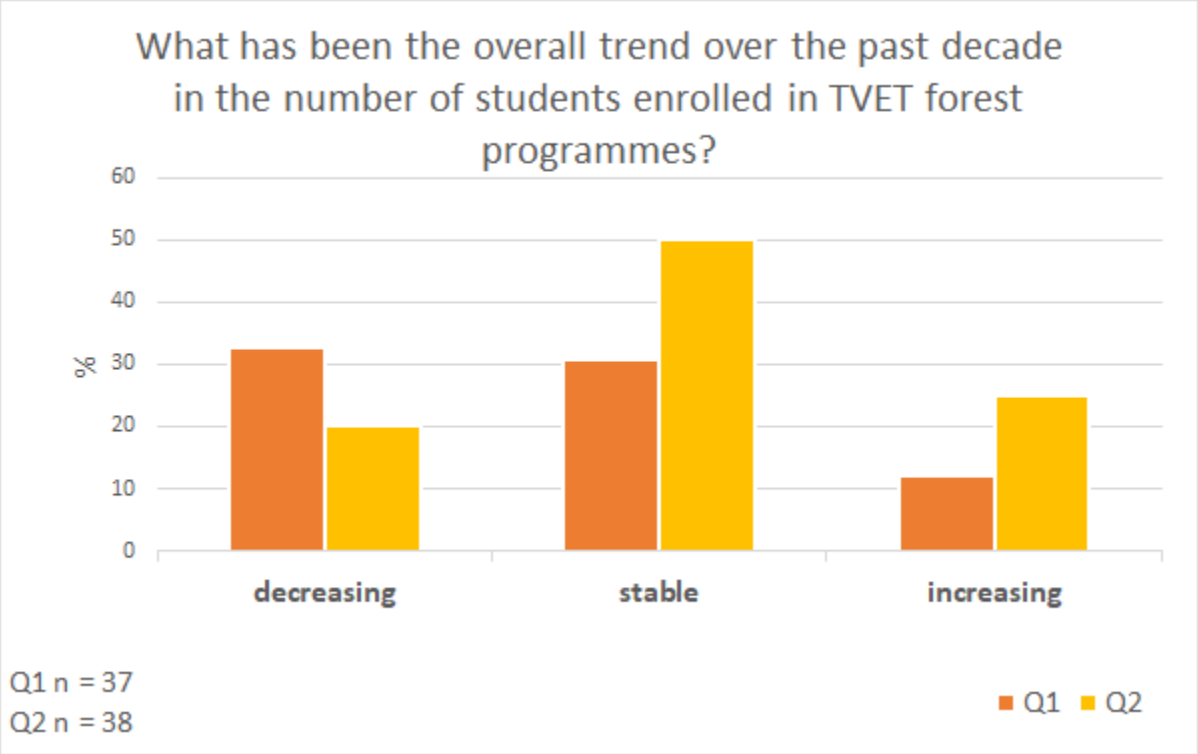
4.3.4. Digital readiness in TVET education

Perceptions regarding digital learning tools are almost similar across professionals and teachers. Both TVET teachers and professionals reported that digital learning tools are used moderately or extensively (more than half of both groups) in TVET forest programmes. They also shared similar positive perceptions regarding digital learning tools as at least a moderately or even extensively valuable supplement to forest education at the TVET level (see Appendix 1, Figure A27).

4.3.5. General developments and trends in TVET

Overall, the trend over the past decade in the number of students enrolled in TVET forest programmes was also an issue where professionals' and teachers' responses differed from each other. Professionals had less favorable perceptions as more than 30 percent of them saw that the trend has been decreasing, whereas only 20 percent of teachers did. However, around 25 percent of professionals were uncertain and unable to answer this question (see Figure 5 below).

Figure 5. Overall trend in student enrollment in TVET forest programmes over the past decade (2010-2020) (A36)



Q1 = professionals, Q2 = teachers

Furthermore, respondents were asked to provide three words that best described their TVET forest programme. Students responded with the following:

"- Aménagement Sylviculture Gestion durable" (Q3, snowball sampling)
"Forestry development Sustainable management"

"Out of date curriculum" (Q3, statistical sampling)

Students were asked to identify, in three words, what topics they preferred and issues in their forest education. The following were typical suggestions:

"Practical, technical, introductory" (Q3, snowball sampling)
"Modelling, machine learning, outreach" (Q3, snowball sampling)

Students added the following commentaries:

"Les professeurs nous met à disposition des cours en ligne mais je trouve dommage qu'il manque de vulgarisation forestière en ligne" (Q3, snowball sampling)

"The teachers provide us with online courses, but I find it unfortunate that there is a lack of online forestry extension"

4.4. University and college education

4.4.1. Bachelor's level

The following is based on responses from 45 professionals, 33 teachers and 30 students. The analysis focused on the following themes: education content and the coverage of forest-related topics in curriculum and competencies, educational resources and policy, workplace readiness and employability, digital readiness and general developments and trends in bachelor level education at universities and colleges.

4.4.1.1. Education content and competencies

All three respondent groups were asked to evaluate the curriculum coverage of the following themes: forest resources and forest ecology, forests/trees, planning and management, forest health, forest services and cultural and social issues, entrepreneurship, forest economy and small-scale industries, forest education, and generic skills.

The majority of all the respondent groups (more than 60 percent) reported that 'Forest biodiversity,' 'Forest soils, Forest ecology, and wood and NWFP' were sufficiently covered in bachelor's forest degree programmes. Around 35 percent of professionals and 40 percent of teachers and student reported that 'Forest genetic resources' is inadequately covered (see Appendix 1, Figure A55).

More than 60 percent of all respondent groups agreed that 'Forest and climate change,' 'Forest mapping,' 'Forest planning,' and 'Silviculture' are sufficiently or excessively covered in bachelor's degree programmes. More than 40 percent of all respondent groups reported that 'Forest landscape restoration' is inadequately covered (see Appendix 1, Figure A58).

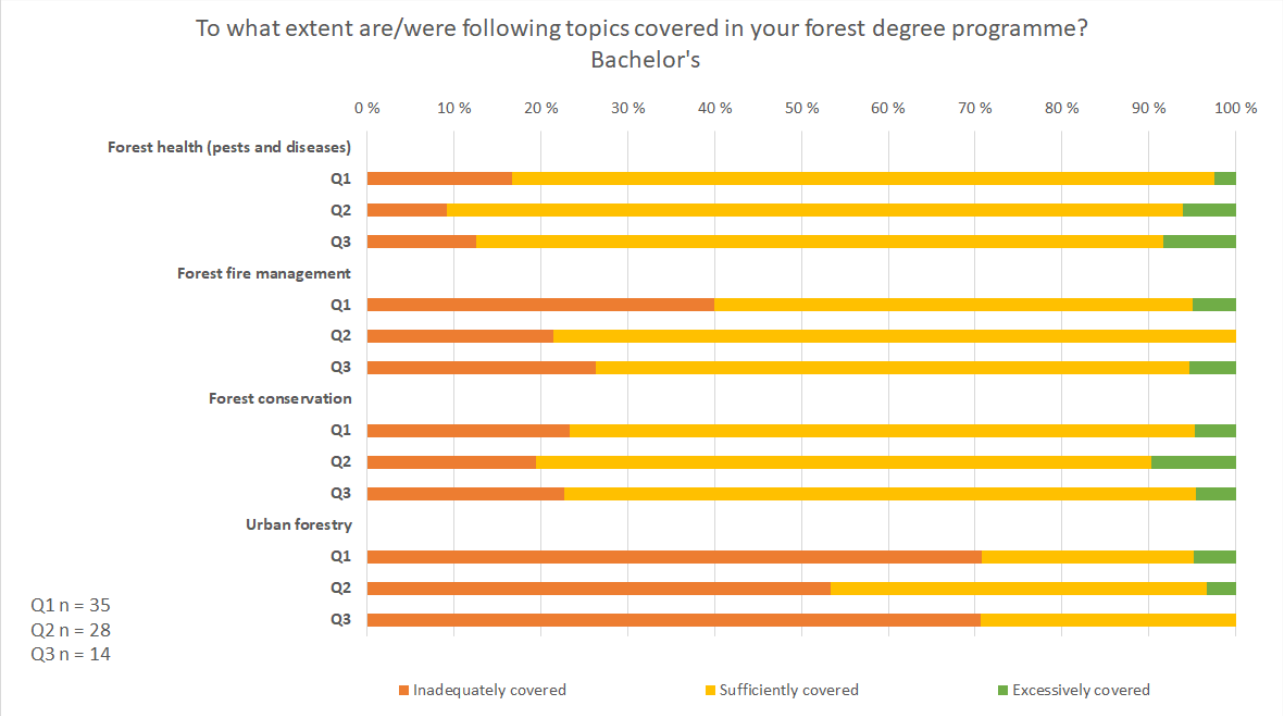
Professionals and students differed concerning how they evaluated 'Range management' being covered in bachelor's degree programmes. More than 55 percent of professionals reported the topic to be inadequately covered while on the contrary, more than 80 percent of students and more than 65 percent of teachers reported the topic to be sufficiently covered. Most professionals and teachers reported that 'Agroforestry' is inadequately covered (see Appendix 1, Figure A61).

In addition, more than 50 percent of all respondents reported that the following topics are inadequately covered: 'Forest and human health,' 'Forest, trees and gender issues' and 'Forest, trees and ethnicity issues' (Figure 6), 'Traditional and/or indigenous forest-related knowledge,' and 'Cultural values of forest and trees' (see Appendix 1, Figure A65).

Topics under 'Entrepreneurship' and 'Small-scale forest enterprise (wood and non-wood)' were seen as excessively covered by students but inadequately covered by professionals (see Appendix 1, Figure A70). Teachers and students reported that 'Forest industry, marketing and management' is sufficiently covered and about 15 percent of students reported that the topic is excessively covered. On the contrary, more than 40 percent of professionals reported that the topic is inadequately covered (see Appendix 1, Figure A70).

All respondent groups considered that one generic skill, i.e., 'Creative thinking,' was inadequately covered. Evaluations of other generic skills were not unanimous. Professionals saw that 'Critical thinking and analytical skills' and 'Leadership and management' were also inadequately covered, whereas teachers and students saw information management skills in this way. Professionals and teachers considered that scientific writing is also inadequately covered (see Appendix 1, Figure A65).

Figure 6. Coverage of forest-related topics in degree programmes (forest health) (bachelor's) (A63)



Q1 = professionals, Q2 = teachers, Q3 = students

Around 50 percent of professionals and students perceived that students studying in bachelor's degree programmes moderately or highly engaged in out-of-school activities. The other half reported the opposite, with students engaging only to a limited extent or not at all. Around 70 percent of teachers reported that students engaged in out-of-school activities moderately or very much (see Appendix 1, Figure A41).

4.4.1.2 Educational resources and policy

All three respondent groups evaluated the availability of educational resources. Of all respondents, the professionals group were the most critical. Around 35 percent of those respondents considered that teachers (quality and quantity of education) is available to a limited extent. On the other hand, the majority of teachers and students reported that teacher resources are moderately or very much available. The difference among groups is also evident in other resource evaluations. Professionals reported to have the least availability of learning resources compared with other respondent groups. Students, on the other hand, reported somewhat more resources than teachers did (see Appendix 1, Figure A37).

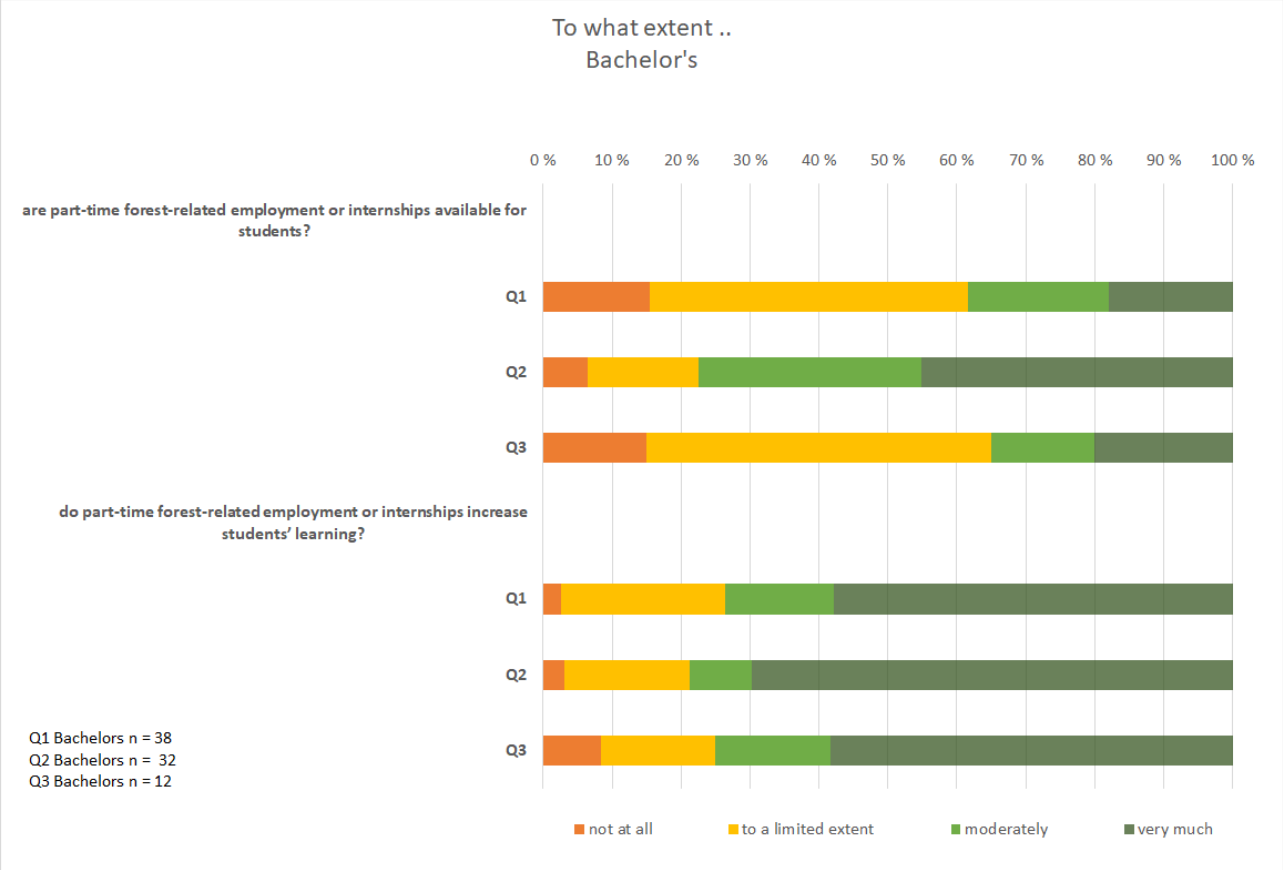
About 42 percent of professionals and 38 percent of teachers reported that a government policy or strategy at university and college level exists to improve forest-related education. Around 35 percent of professionals reported that a school policy or strategy exists, however, only 25 percent of teachers agreed with this. In general, teachers seemed to have a less favorable view than professionals regarding the existence of policies and strategies (see Appendix 1, Figure A40).

4.4.1.3. Workplace readiness and employability

There were large differences among the three respondent groups in terms of part-time forest-related employment or internships. All teachers reported that there were no open possibilities for students for part-time forest-related employment or internships. More than 70 percent of students shared the same perception, and only 25 percent of them reported that there are moderate possibilities for part-time employment or for internships. Professionals held a more positive perception as about 60 percent of them reported that possibilities for part-time forest-related employment or internships are available to a

limited extent, and around 15 percent of them considered that these are moderately or very much available. Most professionals (more than 80 percent) reported that part-time forest-related employment or internships may increase students' learning. Meanwhile, 50 percent of teachers considered that part-time forest-related employment or internships could very much increase students' learning, while 50 percent of students considered that these activities will increase students' learning moderately (Figure 7).

Figure 7. Availability of forest-related internship or part-time employment and effect on learning (A76)



Q1 = professionals, Q2 = teachers, Q3 = students

Respondents were asked to report to what extent they considered bachelor's degree programmes prepared students to enter the workforce. Nearly 90 percent of teachers reported that these programs moderately or highly prepared students to enter the workforce. Professionals (more than 60 percent) and students (around 60 percent) held the same view (see Appendix 1, Figure A78).

Of professionals and teachers, 60-80 percent considered that gender was, to a limited extent or not at all, a factor in a graduate's ability to find a forest-related job. Results were to a great extent similar among professionals and teachers, when asked on the extent to which gender influences the jobs graduates are considered for. There were too few respondents from the student group (n = 10) to report any results (See Appendix 1, Figure A81).

Both professional and teacher respondent groups provided similar kinds of responses to the question about continuing education and training. Around 40 percent of them considered that affordable continuing education and training was available to a limited extent, or not at all available. Students' results are not reported because of the low number of respondents (n = 14) (see Appendix 1, Figure A87).

4.4.1.4. Digital readiness

Perceptions of digital learning tools at bachelor's level were rather similar across all respondent groups. Around 30 percent of respondents in all groups considered that digital learning tools are not at all or to a limited extent, used at the university and college level (see Appendix 1, Figure A44).

Use of digital learning tools were evaluated in more detail, applying seven different categories of tools (see Appendix 1, Figure A47). Generally, teachers' perceptions were more positive than those of other two groups' with the exceptions being 'Digital tools for field and mill operations' and 'Geospatial tools and technology.' In these two categories, professionals had slightly higher perceptions than those of teachers'. However, teachers' perceptions were considerably higher than the other two groups' in three categories, namely, 'Tools for managing, editing and sharing documents, 'Conference meeting tools,' and 'Net-based research tools.' Of all tools, enhanced media such as augmented or virtual reality or multimedia, was at least perceived to be in use (see Appendix 1, Figure A47).

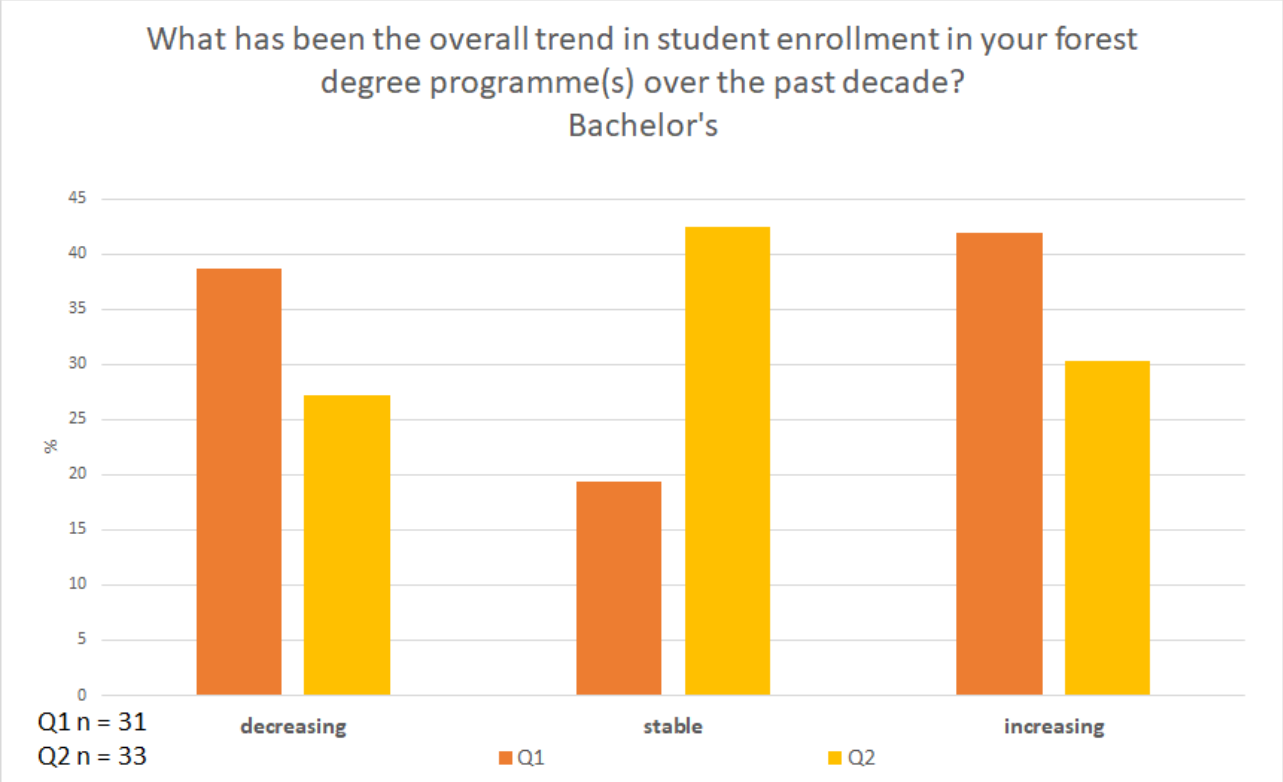
All respondent groups were asked whether they are familiar with certain digital learning tools (Figure A52). In general, students and recent graduates were not so familiar with these tools than professional and teacher respondents. The difference of familiarity between students and other two groups was the largest, with FAO eLearning Academy and FAO SFM toolbox. On average, the Global Forest Information System (GFIS) was the most well-known among all groups: more than 50 percent of teachers were familiar with GFIS, as well as nearly half of professionals and around one-third of students. (see Appendix 1, Figure A52).

More than 40 percent of teachers would like to use more online platforms and study tools, enhanced media and digital tools for field and mill operations. The difference is especially large between teacher and student respondents in enhanced media where only around 10 percent of students would like to have more of these tools. Students also stated they would like to use more digital tools for field and mill operations (more than 30 percent) and geospatial tools and technology. (see Appendix 1, Figure A50).

4.4.1.5. General developments and trends in university and college level forest education

Most of the teachers saw that the overall trend in student enrollment was stable, whereas professionals' responses were divided between two different perceptions. Four out of ten professionals considered the trend in student enrollment either decreasing or increasing, and only 2 out o10 saw it was stable (see Figure 8 below).

Figure 8. Overall trend in student enrollment in forest-related programme (10-year period) (bachelor's) (A90)



Q1 = professionals, Q2 = teachers

4.4.2 Master's and doctoral level

The following is based on responses from 70 professionals, 80 teachers and 75 students. The analysis focused on the following themes: education content and competencies, educational resources and policy, workplace readiness and employability, digital readiness and general developments and trends in master's and doctoral levels of education at colleges and universities.

4.4.2.1 Education content and competencies

All three respondent groups were asked to evaluate curriculum coverage of the following themes: forest resources and forest ecology, forests/trees, planning and management, forest health, forest services and cultural and social issues, entrepreneurship, forest economy and small-scale industries, and forest policy and legislation.

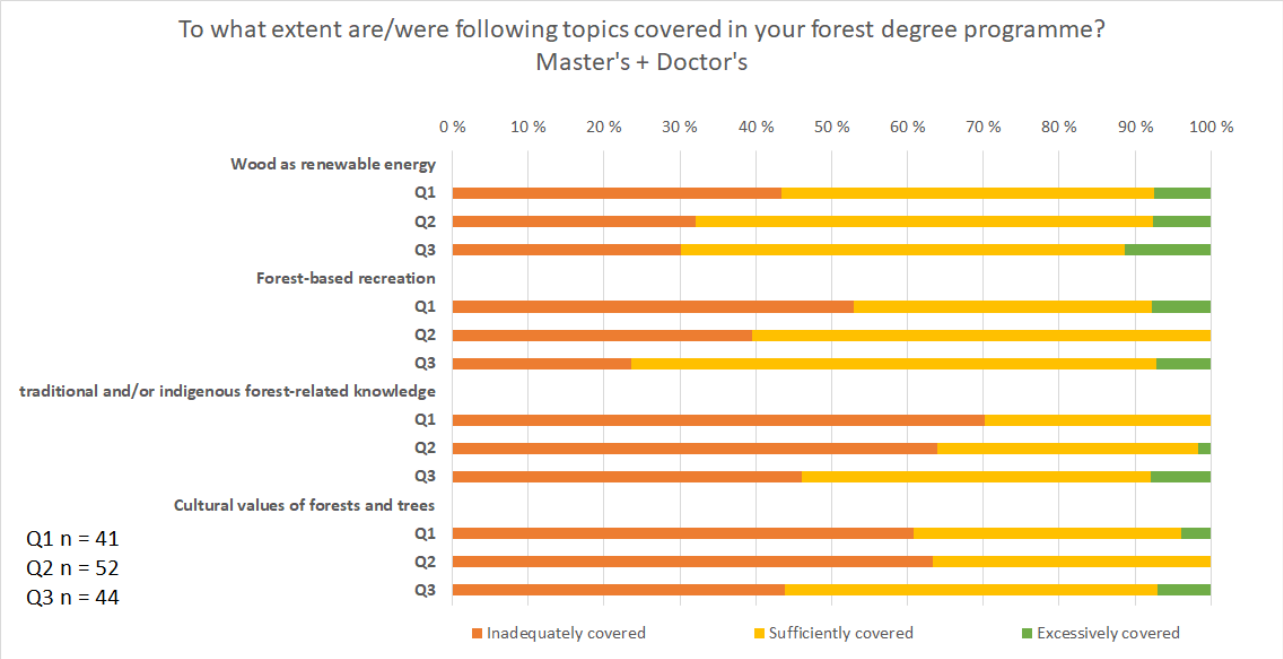
Under the theme forest resources and forest ecology, the majority of all respondent groups reported that 'Forest biodiversity (plants, animals, ecosystem),' 'Forest soils' and 'Forest ecology' are sufficiently or excessively covered. Around 40 percent of professionals reported that 'Wood and non-wood products' is inadequately covered. Nearly 50 percent of students reported that 'Forest genetic resources' is inadequately covered (see Appendix 1, Figure A56).

Under the theme forests/trees, planning and management, the majority of all respondent groups reported that 'Forest and climate change,' 'Forest mapping, inventory, remote sensing,' 'Forest planning' and 'Silviculture' are sufficiently or excessively covered. About 40-50 percent of all respondent groups reported that 'Forest landscape restoration' is inadequately covered in master's or doctoral degree programmes, and half of all the respondent groups reported that the topic is sufficiently covered (see Appendix 1, Figure A59). Concerning the topic 'Urban forestry,' the

majority of all respondent groups reported it to be insufficiently covered (professionals' 65 percent, teachers' 57 percent and students' 54 percent) (see Appendix 1, Figure A64).

Concerning the coverage of the theme forest services and cultural and social issues, the majority of all respondents (55-70 percent) reported that 'Wood as renewable energy' is sufficiently or excessively covered. The majority of professionals reported that 'Forest-based recreation' is inadequately covered. On the contrary, the majority of students perceived that the topic is sufficiently covered. Majority of all respondent groups reported inadequate coverage of 'Traditional and/or indigenous forest-related knowledge' (professionals' 70 percent, teachers' 64 percent, students' 46 percent), 'Cultural values of forests and trees' (professionals' 61 percent, teachers' 60 percent, students' 42 percent) (Figure 9).

Figure 9. Coverage of forest-related topics in degree programmes (Wood as renewable energy, Forest-based recreation, Traditional and/or indigenous forest-related knowledge, Cultural values of forests and trees) (A66)



Q1 = professionals, Q2 = teachers, Q3 = students

'Entrepreneurship' and 'small-scale forest enterprise (wood and non-wood)' topics were seen inadequately covered by professionals (60 and 70 percent, respectively) and by most teachers (50 and 61 percent, respectively). Students were again more satisfied than the other two groups, however, more than 40 percent of them considered 'Entrepreneurship' as an inadequately covered topic (see Appendix 1, Figure A72).

There were no generic skills that more than 50 percent of all respondent groups evaluated inadequately covered. Professionals were the most critical and they considered the following skills as inadequately covered: 'Critical thinking and analytical skills,' 'Creative thinking,' 'Leadership and management,' and 'Communication.' Half of teachers also saw 'Leadership and management' inadequately covered (see Appendix 1, Figures A50.1 and A50.2).

Professionals were also the most critical respondent group regarding other skills. They considered 'Scientific writing' and 'Professional ethics' as inadequately covered. As with generic skills, students were the most satisfied among all the respondent groups regarding other skills.

Students and professionals were critical of students' engagement in forest-related activities outside of school. Among professionals, more than 50 percent saw that these are available only to a limited extent or not at all. Students' perceptions on this were polarized as about 50 percent reported that students are moderately or very much engaged in out-of-school activities. The other half reported the opposite. The majority of teachers (about 60 percent) reported that students moderately or very much engaged in forest-related activities outside the school (see Appendix 1, Figure A52.1).

4.4.2.2 Educational resources and policy

Students were the least critical towards availability of resources in degree programmes whereas professionals were the most critical respondents. All groups were especially critical of practical opportunities such as experiential learning, practical training, and field visit. More than 40 percent of professionals saw that these were, to a limited extent or not at all, available. Nearly every fifth of teachers and students had similar perception as professionals had (see Appendix 1, Figure A53). The perceptions on other resources — teachers, learning materials, and education environment — were less critical. However, teacher resources were seen as available to a limited extent or not at all by 40 percent of professionals and 20 percent of students.

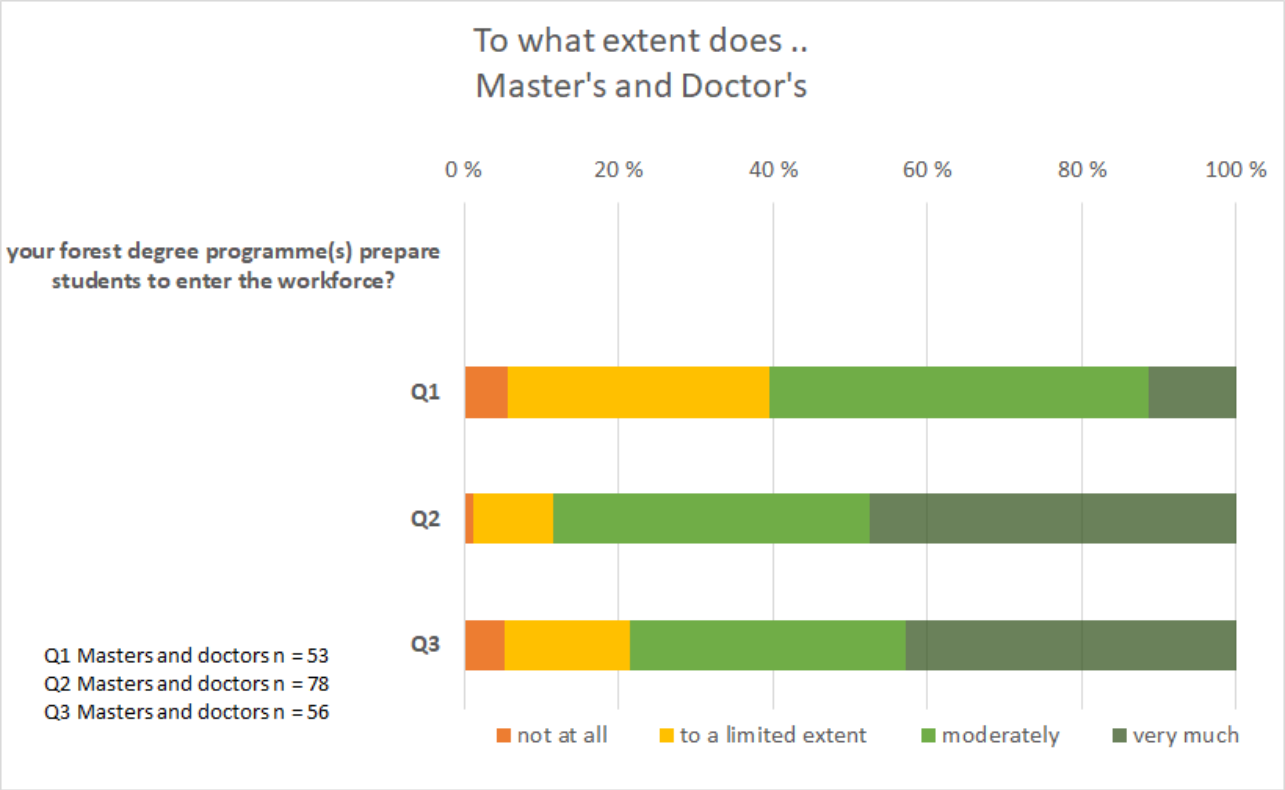
Professionals, more often than teachers, considered that there are government policies or strategies that could lead to improved forest-related education. A limited number of professionals (7 percent) and teachers (17 percent) considered that no policy or strategy exists (see Appendix 1, Figure A40).

4.4.2.3. Workplace readiness and employability

Nearly 50 percent of students responded that part-time forest-related employment or internships are not at all or to a limited extent available for students. Of professionals more than 60 percent and of teachers around 45 percent had a similar answer (Figure A77). Both professionals and teachers provided positive responses to the statement 'To what extent do part-time forest-related employment or internships increase students' learning.' Students were more negative which is evident from the fact that they did not see that these opportunities were available in the first place (see Appendix 1, Figure A76)

All respondent groups responded positively to forest master's and doctoral degree programmes' capacity to prepare students to enter the workforce. Professionals were the most critical, with approximately 40 percent responding that programmes are not successful in preparing students to enter the workforce. For teachers the same figure was around 10 percent and with students somewhat over 20 percent (Figure 10).

Figure 10. Workforce readiness within degree programme (A79)



Q1 = professionals, Q2 = teachers, Q3 = students

Gender as an issue in employment was evaluated in two aspects. First, it was asked whether gender is a factor in a graduate's ability to find a forest-related job. Second, it was asked to what extent gender influences the kinds of jobs graduates are considered for (see Appendix 1, Figure A82). The first questions received similar responses by all respondent groups, that is, around 30 percent of all respondent groups (professionals, teachers and students) saw that gender moderately or very much influences ,graduates' ability for forest-related employment (see Appendix 1, Figure A82). In the second question, responses were more diverse. Among professionals, almost 50 percent considered that gender moderately or very much influences the kinds of jobs. The same figures for teachers and students were around 30 percent and 25 percent respectively (see Appendix 1, Figure A82).

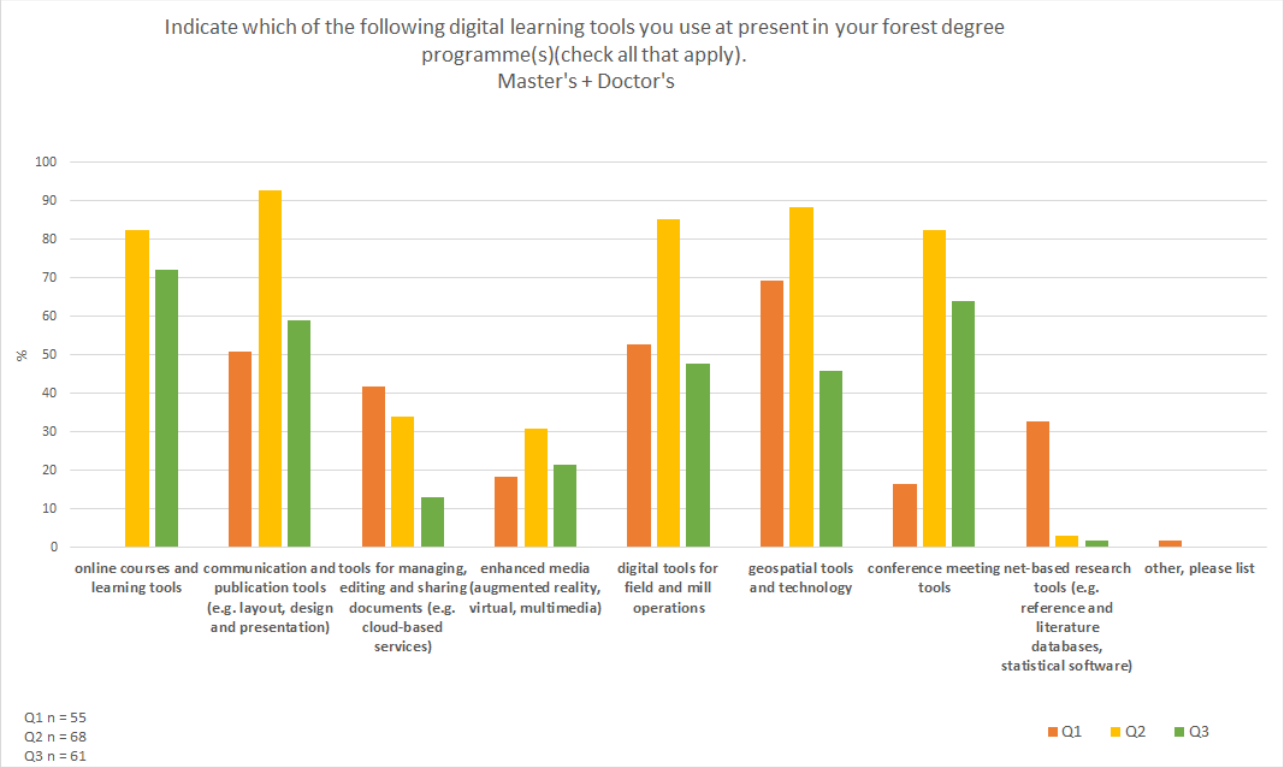
All respondent groups have rather similar perceptions regarding the extent of the availability of affordable continuing education and training. Approximately 10 percent off all groups responded that is not at all available for master's and doctoral level professionals. However, more than 30 percent of all groups considered that it is available to a limited extent (see Appendix 1, Figure A88).

4.4.2.4. Digital readiness

Respondents were asked to evaluate to what extent digital learning tools are used in master’s degree programmes or in doctoral studies. Most respondents (63-74 percent) reported that digital tools are moderately or very much used. However, nearly 40 percent of professionals, 25 percent of teachers and 30 percent of students evaluated that digital tools are used only to a limited extent or not at all. All groups also considered that those tools would be a moderately or very much valuable supplement at university and college level studies (see Figure 11 below).

Teachers responded the most on the use of digital tools. Of all the tools, 'Communication and publication tools' and ‘Net-based research tools’ were the highest voted tools. Only very few teacher and student respondents (5-7 percent) reported that net-based research tools are utilized in the programme. Also, the figures for enhanced media such as augmented or virtual reality were relatively low (see Appendix 1, Figure A49).

Figure 11. Use of digital learning tools in degree programme (master's and doctor's) (A48)



Q1 = professionals, Q2 = teachers, Q3 = students

Teachers' and students' desire to use these digital learning tools was also investigated. Tertiary education teachers of master's and doctoral programmes reported that they especially prefer to increase the use of online learning platforms (nearly 60 percent of teachers), enhanced media such as augmented reality (50 percent of teachers), and digital tools for field and mill operations (approximately 45 percent of teachers). On the contrary, students also had a high desirability to use learning platforms (nearly 40 percent) and digital tools for field and mill operations (over 60 percent). However, only about 25 percent of students reported that they would like to use more enhanced media in learning (see Appendix 1, Figure A51)

Of all the digital learning tools, the FAO e-learning Academy and Global Forest Information System (GFIS) were the most used. Overall, 4 out of 10 respondents saw that these two systems are in use. Of all the digital learning tools however, it was identified that teachers use GFIS more than any other learning tool and are almost two times more likely to use GFIS compared to professional and student responses at this level (see Appendix 1, Figure A53).

4.4.2.5. General developments and trends in university and college level forest education

More than 50 percent of teachers perceived that student enrollment in forest study programmes had remained stable, however, less than 20 percent of professionals held the same perception. Approximately 40 percent of them reported that student enrollment in forest study programmes had been increasing (see Appendix 1, Figure A91).

4.4.3. All University and College levels

The following is based on responses from 35 professionals. These responses concern all university and college levels without specification. The following results are reported as far as they provided anything new to results already reported in bachelor's, master's and doctoral levels.

4.4.3.1. Education content and competencies

Curriculum coverage of 34 substance-specific topics were evaluated. Most of the results are similar to those at the bachelor's, master's' and doctoral levels. All levels that professional respondents highlighted more than others include 'Forest landscape restoration' (78 percent) and 'Agroforestry' (77 percent) (see Appendix 1, Figure A60). Professionals also stressed 'Entrepreneurship' (more than 60 percent) and 'Small-scale forest enterprise (wood and non-wood)' with more than 70 percent of respondents considering this as an inadequately covered topic (see Appendix 1, Figures A60 and A72).

About student engagement in forest-related out-of-school activities, professionals were particularly critical of all levels of education responses. Three out of four professionals perceived that students were engaged to a limited extent or not at all in forest-related activities outside of school (see Appendix 1, Figure A43).

4.4.3.2. Educational resources and policy

Professionals evaluating all levels (see Appendix 1, Figure A39) show that they were especially critical of practical opportunities wherein close to 50 percent saw that they are available only to a limited extent. This figure is more than double than their responses at the bachelor's, master's and doctoral levels.

When asked to list the forest-related activities outside of school (also including employment opportunities or internships) in which students most frequently engaged, the respondents listed the following:

"University societies in the UK play a large role Bangor and UHI are great examples and arrange trips and field visits" (Q1, statistical sampling)

"Voluntary placements in industry; Part-time employment in industry" (Q1, statistical sampling)

Regarding the most important factors related to employment opportunities, the following were revealed:

"1. Level of practical knowledge of the students 2. Exposure to different aspects of forestry 3. Quality of educational curriculum 4. Class of degree e.g. distinction or ordinary pass" (Q1, statistical sampling)

"Utbildning och kontakter. Skogsindustrin bygger till stor del på kontakter och därför måste man få in en fot innan man kan få en anställning." (Q1, statistical sampling)
"Education and contacts. The forest industry is largely based on contacts and therefore you have to get a foot between the door before you can get a job."

4.4.3.5. General developments and trends at the university and college level forest education

Most professionals see that the overall trend in student enrollment has been decreasing when all forest degree programmes over the past decade has been evaluated (see Appendix 1, Figure A92). This is a more pessimistic view than what respondents provided on the bachelor's, master's and doctoral levels.

Recommendations for all university levels:

1. Produce guidance in standardized core curricula models for forest education. Actors: FAO, IUFRO, regional education networks
2. Conduct curriculum coverage (gap) analysis survey platforms for educational institutes to easily do surveys on their own programmes. Actors: IUFRO, CPF joint initiative

5.0 DISCUSSION

5.1 Primary and secondary level

Both professional and teacher respondents provided similar perceptions about curriculum coverage in primary and secondary education. Most respondents in both groups reported that forest-related topics and skills are inadequately covered, and about one-third of the respondents perceived that topics are sufficiently covered in the curriculum of primary and secondary education.

However, primary education teachers perceived that some topics such as 'Plants and animals that live in forests,' 'Forests as a recreational place' and 'Observing environment' to be sufficiently covered. It is understandable that teachers highlighted these topics due to the proximity of schools to the environment (cf. Turtle, Convery I., and Convery K., 2015).

Both professionals and teachers suggested that the share of forest-related topics and skills should be increased in the curriculum both as individual subjects and as included in other subjects.

Only 17 primary education teachers reflected on their competence to teach forest-related subjects and most of them perceived that they had sufficient competence. The only exception was their competence in using digital technology in teaching, which is in line with previous research (Gill, Dalgarno and Carlson, 2015; Björk Gudmundsdottir and Hatlevik, 2018; Napal Fraile, Peñalva-Vélez, and Mendióroz Lacambra, 2018). Compared with responses of primary education teachers, secondary education teachers more often perceived their competence to teach forest-related topics as moderate or at an expert level. This finding may reflect that these secondary education teachers are also subject matter teachers who are qualified to teach science and natural sciences.

Both primary and secondary education teachers reported that they used various teaching activities for forest-related topics such as outdoor learning and problem-based learning. They also suggested that outdoor learning would be the best teaching approach to increase students' motivation and interest to study forest-related topics (cf. Kangas,Vuojärvi and Siklander, 2018).

Professionals' and teachers' perceptions concerning resources on forest-related education and strategies and policies of forest education in primary schools varied. Most professionals reported that such resources are covered only to a limited extent whereas teachers perceived that these were moderately or extensively covered in schools. However, this finding may not reflect the real situation in schools as only 20 teachers responded to this question. In this case, professionals' perception, at least to a certain degree, may better reflect the situation in schools.

Hence, one of the most important conclusions could be that the survey instrument measuring curriculum coverage of several topics seems valid, as evident in the similarity of responses across target groups.

Input from regional consultations at the primary and secondary level

A two-day regional consultation at the primary and secondary levels were held in February 2020 wherein a total of 31 experts participated. An additional 18 experts participated in a separate consultation on all levels. The survey results were presented during the consultation. Further discussions were held during breakout sessions, after which, all groups presented their main conclusions. Through an activity using the Innoduel™ tool, participants were able to identify the main challenges in forest education at the primary and secondary levels. Participants were also asked to reflect on the seven recommended teaching approaches including the use of digital tools, outdoor learning, inquiry-based teaching, continuing professional development (CPD) for primary and secondary education teachers, OECD Pisa studies, information dissemination of policies to teachers, and a common platform for teachers and other stakeholders, based on the survey results and outcomes of the first day of consultation. The experts decided to focus on outdoor learning, inquiry-based teaching and CPD.

Participants proposed concrete actions that would help develop the quality of teaching and learning in forest-related subjects and activities at the primary and secondary levels. The following are the recommendations and conclusions based on the regional consultations:

- Forest education should start during early childhood education, i.e., in kindergarten and other day-care units for children under school-age;

- Forest-related topics should be included in the national curricula of basic and secondary education, both as separate individual subjects and integrated in other subjects;
- Enhance teacher education through in-service teachers training on forest-related topics and on pedagogical skills to engage students in learning and improve teachers' competence to teach forest-related topics; and
- Improve systematic support for outdoor learning and use of forests as learning environments.

A strong emphasis on outdoor learning and promoting students' opportunities to visit forests and for teachers to use forests as learning environments were evident in both the survey results and the outcomes of the regional consultations.

5.2 TVET level

Reflecting on the main results of the survey on TVET level entails taking into account the small number of respondents since the results give only a rough overview of the situation. Furthermore, there were very few responses from TVET students in the data. Students' responses can be found in Appendix 1 figures but these need to be interpreted with great care because of lack of data and were thus, excluded from formal analysis.

Professionals and teachers similarly identified that the topics most insufficiently covered were 'Forest, trees and race/ethnicity issues' and 'Forests, trees and gender issues.' Additionally, 'Urban forestry,' 'Agroforestry,' 'Forest landscape restoration,' 'Watershed management,' 'Cultural values of forests and trees,' and 'Traditional and/or indigenous forest-related knowledge' were also considered insufficiently covered by both respondent groups.

Furthermore, the perceptions related to some topics had many 'unable to answer responses.' This indicates uncertainty in perceptions as evident in responses related to the following topics: 'Forest, trees and gender issues' and 'Urban forestry.' In particular, 'Range management evaluations' showed a high level of uncertainty in teachers' responses.

Meanwhile, silviculture and forest health were deemed sufficiently covered and excessively covered. This is consistent with observations from literature on tertiary education (Bullard *et al*., 2015, Ketlhoilwe and Jeremiah, 2010; Sharik *et al.*, 2015). Hence, traditional topics should be partly set aside to make room for social, economic, and cultural-related topics.

'Digital readiness' was seen almost similarly across respondent groups professionals and teachers, as well as students, especially taking into account the small number of respondents in the students group. Altogether, responses were more positive than those at the primary and secondary level.

Teachers and professionals had highly different perceptions of students' engagement in out-of-school forest-related activities such as joining societies, and getting employment or internships. Majority of both groups considered that students are moderately or highly prepared to enter the workforce. Again, teachers were more optimistic than professionals. There is a need to further explore these divergent perceptions in further studies.

Perceptions on work life and employability were, again, somewhat different across teachers and professionals. Teachers, more often than professionals, saw that gender is a factor in a graduate's ability to find a job. Teachers also had a somewhat more optimistic view of the possibilities in continuing education than professionals did.

Meanwhile, perceptions on the trend over the past decade in the number of students enrolled in TVET forest programmes was seen differently by professionals and teachers. Majority of teachers considered that numbers are either stable or increasing whereas majority of professionals saw that they are either stable or decreasing. However, quite many professionals were uncertain and unable to answer this question. At this point this study has no official records on this trend but it is worthy of further analysis. There has been a lot of concern over TVET enrollment numbers in some European countries. For instance, some stakeholder groups in Finland, especially employers, have been running a campaign targeted towards high-school students to increase enrollment rate in forest TVET.

To summarize, it can be concluded that TVET education in Europe might be performing quite well in terms of learning outcomes and employability. This has not always been the case (see Bernasconi and Schroff, 2011). The situation in Europe might also be better than in some other regions (c.f. Marope *et al*., 2015). However, when making conclusions, it has to be kept in mind that there was a relatively small number of respondents in the survey data received, i.e., 49 professionals, 43 teachers and seven students.

Input from regional consultations at the TVET level

Two regional consultations at the TVET level were held in February 2020 wherein 17 experts participated. Another 18 experts participated in a separate regional consultation on all levels. The survey results were presented during the consultation. Further discussions were held during breakout sessions, after which, all groups presented their main conclusions. Through an activity using the Innoduel™ tool, participants were able to identify the main challenges in forest education at the TVET level.

Discussions during the breakout sessions included themes on enhancing interest in TVET forest education among high-school students, gender, race and minority issues in TVET forest education, enhancing awareness of TVET forest education among youth and young people by global competition on forest skills, a common forum for teachers and other stakeholders to help two-way communication, and creation of new education materials for insufficiently covered topics.

The following are the main conclusions and outcomes from these regional consultations on the TVET level:

- The reputation and image of forestry and forest-related jobs and professions among high-school students and young people is poor and not lucrative enough for them to study forestry and forest-related topics at TVET schools.
- The number of students is decreasing at the TVET level on forest education.
- Financial and economic challenges of educational units remain, along with decreasing resources to maintain the quality of education.

Experts also included comments on additional policies, initiatives and particular programmes that can either be adopted as good practices or addressed as an issue:

- Adopt good practices from British Columbia, Canada wherein students live in hostels made from wood. Students also use learning tools here which they can apply once employed.
- Provide information and training for decision-makers (networking and legal anchoring).
- Enhance the content of forest education at the TVET level since topics such as forests as ecosystem, and especially as a soil system and the concept of evolution, are lacking. These relate to the SDGs.
- Use teachers who have professional knowledge on forest-related topics which they gained by practical experience.
- Adopt policy changes that would promote gender equality.
- Urge TVET institutions to stop cutting resources, especially financial resources, and hold a higher view of forestry as a reputable vocation rather than as a ‘low-tech’ one.

Experts in the consultations were mainly satisfied with the results and how they presented the realities of forest education in the region. In particular, the following countries were touched upon in the comments: Austria, Croatia, Germany and Switzerland as well as Nordic countries. Experts felt that the report adequately captured the success and strengths of forest education in the region. They also agreed with the main conclusions of the report. However, it was mentioned that the situation may vary in large countries with many states such as Germany and Austria.

5.3 University and college level

Discussions on university level forestry curricula revisions have focused on socio-economic and cultural aspects for a long time (Barrett, 1953; Bullard et al., 2014; Sample *et al.*, 2015; Sharik *et al*., 2015; Innes and Ward, 2007; Kanowski 2001, 2015; Ketlhoilwe and Jeremiah, 2010; Rouleau *et al*., 2017). These studies found that many of the topics are sufficiently covered today in Bachelor of Science degrees which include some of the relatively new issues such as climate change and biodiversity. However, other topics are not covered well enough. New topics are also emerging, such as gender, race and ethnicity issues.

New emerging topics such as forests and human health, gender, race, and ethnicity could be better taught if high quality teaching materials are available. Teachers and/or researchers specializing on these topics are rare and hardly exist in most universities and colleges. Therefore, there is more than an average need to have international cooperation to produce relevant learning materials on these topics.

When new topics have emerged and have been integrated into the curricula, it would seem that some older content has not been reduced enough. Excessively covered items were partly related to traditional topics such as silviculture. Surprisingly, students perceived entrepreneurship to be excessively covered while professionals thought that it was inadequately covered. Entrepreneurship is the topic where the biggest differences between respondent groups were seen. In fact, entrepreneurship has already been a topic of interest in European forestry for some time (Rametsteiner *et al.*, 2005). It seems that its education forms are still under modification and is not an established topic yet, especially in post-communist countries. This could explain the mixed results (Varblane, U., and Mets, T., 2010).

Generic competences in forestry curricula have been under discussion for a long time (Sample *et al*. 2015; Rekola *et al.*, 2017; Rekola *et al*., 2018; Villarraga-Flórez *et al.*, 2015; Lee *et al*., 2011). In this report, generic competencies were not inadequately covered. All respondent groups considered that only one generic skill — creative thinking — was inadequately covered. Also, the use of digital tools was particularly emphasized. It was found that these were not as frequently used as expected as teachers assumed they were used more often than students perceived them to be. Teachers are much more willing than students to apply more online learning and enhanced media. These differences could be attributed to the fact that students do not simply recognize all applications they are using and the potential worth of new tools. A certain level of digital fatigue during excessive remote studies and work due to the pandemic might explain some of the perceptions.

There were also some differences between respondent groups about gender issues and labor market. Gender issues have been gaining ground recently in many sectors, particularly as some research has shown critical issues exist around forest education (Grubbström and Powell, 2020). Unfortunately, in this study the lack of responses was evident to make any conclusions.

Educational topics discussed above are mainly manifested in the curricula. Curriculum revision process itself might be useful as it links academia, employers and other stakeholders together and strengthens their mutual relationships. This study has shown that perceptions of education is surprisingly unique among respondent groups, however, wherever distinctions exist, an appropriate curriculum revision process might help increasing common understanding about education among all stakeholders. This process is also a place for using a research-based approach in developing forest education (Bullard *et al*., 2014, Bullard, 2015, Brack, 2019).

Since results of this study are region-based, a local/national level gap analysis should be conducted. The study also highlights the fact that research on forest education is lacking and there is an urgent need for topical research on forestry education.

Some of the most insufficiently covered topics, especially at the master's and doctoral levels, are closely related and will be discussed in three clusters in the following. The first cluster which includes gender and ethnicity issues in forestry and forest education have been under discussion for a while amongst scholars. Based on the survey results here and earlier literature, forestry and forest education still face challenges on gender and minority equality. These groups are under-represented both in the current workforce and among students (Follo, 2002; Arevalo J., Mola-Yudego *et al*., 2012; Gharis *et al.*, 2017; Sharik *et al*. 2015; Gharis *et al*., 2017). A recent study from the United Sates shows how university communication is biased in terms of minorities (Bal and Sharik, 2019). In Europe, Grubbström and Powell (2020) showed how gender inequality persists in forestry education despite the #MeToo movement. To the knowledge of authors of this report, no European research has been conducted on ethnicity and/or minority issues education related to forests and trees.

The second cluster, consisting of traditional and/or indigenous forest-related knowledge and cultural values of forests and trees, is discussed here from two perspectives.

First, the content of traditional and/or indigenous forest-related knowledge is based on highly different forest management and meanings across the European region. This ranges from Portugal's traditional cork production, to the northern part of Nordic countries where the only indigenous group of Europeans, the Sami people, live and still practice traditional open access reindeer husbandry in forests (Cogos *et al*., 2019, Wolpert *et al*., 2020). Most of the literature about indigenous forest knowledge and forest resources management are within the context of tropical forests (see e.f. Brosius, 1997; Tanyanyiwa, V. I. and Chikwanha, M., 2011). For European and western traditional knowledge and forest management, see Parrotta and Agnoletti (2007) and Barthel-Bouchier (2016).

Second, even though traditional forest utilization forms vary a lot across Europe — and in most places do not exist anymore — some cultural meanings still exist. For most of the Europeans living in highly urban areas such as the Netherlands, traditional and indigenous forest knowledge has only limited or no meaning today. However, among urban people, cultural meanings are frequently implicit and without everyday subsistence context. For example, the saying "knock on wood" is commonly known in most places. Keeping green leaves outside one's door is another example. Such are part of forest cultural history and are evidently lacking in current education (Schmithüsen, 2008; Paaskoski, 2014; Hiltunen *et al.*, 2020).

The third cluster of curriculum items includes urban forestry, forests and human health, and partly, forest-based recreation. The role of urban forests has been recognized in Europe for a long time (Konijnendijk *et al.*, 2007) and urban forests as an education topic has been recognized and already discussed to some extent (Konijnendijk, 2003; Vukovic, 2017; Van Herzele *et al*., 2005). In the beginning of this century, urban forestry has been an expanding element in European tertiary forest education, however, the number of students learning these have been small (Andersen *et al*., 2002).

Forests and human health is a multidimensional issue covering a wide range of ecosystem services from forests (Karjalainen *et al.*, 2010). It includes any impact of forests and air quality on human health (Antonelli *et al.*, 2020; Fowler 2001; Nowak *et al.*, 2014) and medical plants from forests (Balick *et al.*, 1996). A relatively new research topic is about health effects of forest recreation (Park *et al.*, 2009) and so-called forest bathing (Mao *et al.*, 2012). No studies were found on how these issues are taught in tertiary education.

Silviculture and forest planning — considered traditional topics in tertiary education of forestry — were seen excessively covered by all respondent groups. It seems that there is still some room to change the focus from traditional, excessively covered topics to new ones which were seen insufficiently covered.

However, it seems obvious based on the survey results that master's and doctoral programmes have been under curricula renovation in the last few decades. Forest and climate change was perceived among students as the most excessively covered topic of all. On the contrary, this was one of the least excessively covered topics among almost 4 out of 10 professionals who considered these as insufficiently covered. It is possible that these topical coverage evaluations by professionals and students are based on curricula perceptions of different time periods. It is also likely that these kinds of evaluations by stakeholder groups outside the academia are biased because stakeholders do not have updated knowledge on the current curricula, but their evaluation is based on perceptions coming from those days when they were students.

Educational resources were seen differently by respondent groups. Professionals saw the largest shortages in the availability of resources. The most critical resource was practical opportunities, such as experiential learning, practical training, and field visit. These perceptions are straight-forward to interpret. However, the critical responses on the availability of teacher resources seem to call for further studies on whether it is about issues related to the quantity and quality of teaching.

The widest gap in perceptions between students and the other two respondent groups appear to be on the question of part-time forest-related employment. The issue of employment is highly personal for students and the current period of the COVID-19 pandemic might have had affected the large discrepancy in responses. It is likely that professionals are commenting more from the perspective of having worked for a longer time period than students who are still looking for employment.

Out-of-school activities were not well-organized. Research by interviews and observations may increase knowledge on activities that could motivate students, teachers and professionals (Stuart, *et al.*, 2011).

Digital readiness was under closer investigation in this study. Surprisingly, up to 50 percent of the respondents reported that the use of digital tools for learning was helpful and valuable only moderately or to a 'limited extent.' Three out of four students were using communication and publications tools, a result that is all too low when competency needs for master's and doctoral level students are considered. Teachers would like to use more enhanced media as a learning tool but students do not. This is somewhat problematic. Most likely, students have little or no experience on enhanced media in learning that they cannot envisage its potential yet (Domingo and Bradley, 2018).

Since 4 out of 10 professionals responded that programmes are not successful in preparing students to enter the workforce, this topic needs more investigation. It is possible that professionals are unsatisfied with the so-called day one skills of recent graduates or it could be something else such as unrealistic expectations about the graduates.

Input from regional consultations at the tertiary level

Two regional consultations at the tertiary level were held in February 2020 wherein a total of 32 experts participated. Additionally, 18 experts participated in a separate regional consultation at all levels. The survey results were presented during the consultation. Further discussions were held during breakout sessions, after which, all groups presented their main conclusions. Through an activity using the Innoduel™ tool, participants were able to identify the main challenges in forest education at the tertiary level. The consultations sought to find concrete ways to develop the quality of teaching and learning on forest education at the tertiary level. Discussions during the breakout sessions covered the differences in curricula and different perceptions of stakeholders, curriculum revisions, and pedagogical education for teachers and students concerning diversity issues such as gender, race and ethnicity. The topic of new content in curricula was also offered for experts to discuss, however, the topic did not arouse their interest.

The following are the main conclusions and outcomes from regional consultations at the tertiary level:

- There is a strong need to balance practice and theory in forest education. For students, there should be systematic possibilities for practices both in the country of residence and abroad.
- Diversity of forestry in Europe in not sufficiently covered in tertiary education. The findings of the survey do not reflect the diversity of forest education at tertiary level as European countries forests' differ greatly. Challenges in forest management and in forestry are also varied, e.g., the challenges in the Balkan peninsula are not at all represented in the results of the survey.
- Climate change and sustainable forest management represent the strengths of European forestry education, however, these subjects are not present in all European countries.

Participants at the consultations reported that the survey lacked questions that focus on representation of the forests in different regions and countries. They were also critical towards collecting data only by survey and recommended that interview (both individual and group interviews) could have produced a more realistic picture of the current situation in forest education at the tertiary level. Furthermore, some participants criticized the way that the survey questions asked about the importance of the topic in curricula. Concerning the presentation of the results of the survey, participants commented that there is a lack of an easy comparison between the strengths/successes and weaknesses/challenges in the region. Such a table or figure could have improved the readability of the report.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Forests are a crucial element in achieving the SDGs globally and in Europe. There is a great potential for forests to contribute to the SDGs and forest education needs to be harnessed for improving forest management practices. It important to understand that this change needs human resources with a wide spectrum of skills and competences. The challenge facing forest-related SDGs should be taken seriously when planning and carrying out formal, informal, and non-formal education. As a part of this challenge, SDG 4 (quality education), sets certain aims for forest education. As defined in this study, forest education is related to forests, trees outside forests, and other wooded land (i.e., natural forests, forest plantations, woodlands, agroforest systems and urban forests). This broad definition includes education delivered through programmes on forestry and forest sciences as well as programmes of broader scope such as natural resource management and environmental science.

One of the main conclusions of this regional assessment report is that a wide variety of actions is needed due to the wide coverage of forest education. For instance, one cannot assume that a tool or online application that works for primary school teachers might also be suitable for tertiary education.

All respondent groups, professionals, teachers, and students painted a rather similar picture of forest education in different levels of formal education. At the primary and secondary levels, forest education is not in focus. Wise strategies are needed to bring forest-related substance into the primary and secondary education curricula and to out-of-school activities. It is not always the best strategy to propose that forest substance as such should have more time and emphasis within a curricula. A more efficient way could be to provide the substance to other existing and more established school discipline. For instance, forests and forest sciences provide a lot of excellent material around climate change for science teaching in primary and secondary schools. Another example is that the current period of COVID-19 is an opportunity to increase forest-related outdoor activities during school hours and during leisure time.

TVET education has been a challenge to the forest sector in many parts of Europe. According to this study, the picture is not unanimously clear for professionals and teachers when it comes to the number of enrolled students. However, and what could be more important, is that learning outcomes, employability, and readiness for entering the workforce is not poor. These conclusions are unfortunately caveated by the small number of respondents in the TVET stratum.

At the university and college levels, substance teaching is sufficiently covered, resources are available and actions taken are appropriate. Some of the long remaining shortage areas in curricula still seems to exist. Additionally, new topics emerge such as gender, race, and ethnicity issues. At the same time, traditional topics are excessively covered. However, it is satisfying to see that many new topics, namely climate change, were seen sufficiently, even excessively covered in university and college forest education.

In general, the survey revealed that in many aspects, the respondent groups — professionals, teachers, and students — seem to share different realities. Therefore, to take the steps towards planning and executing improvements, more co-creation from all stakeholders is needed. Based on this discussion, intervention experiments need to be run. An upper-level policy and global guidelines are needed. Apart from these, there must be a vital link to grassroots actors. Otherwise, concrete actions are difficult to take and might be untimely.

6.1 Recommendations to improve forest education at primary and secondary levels

Based on the survey results, regional consultations and wider sources, the following recommendations can be formulated (these include the actor to which the proposal is made):

1. Develop *outdoor learning* and other out-of-school activities to improve students' learning of forests. Concrete initiatives could include the following (see also Rodríguez-Piñeros *et al.*, 2020)**:**

    1.1. Introduce the concept of 'green school,' i.e., taking children living in cities to three weeks of school in the countryside;

    1.2. Introduce education projects like 'Junior Range' in UNESCO Biosphere areas or in national parks;

    1.3. Create authentic learning 'places' between schools and non-formal institutions;

1.4. Establish positions for ‘outdoor coach’ in schools to build a bridge between teachers and out-of-school activities (e.g. The IDée Network support service at https://www.reseau-idee.be/accompagnement/);

1.5. Establish school networks between schools for sharing experiences and knowledge of forest education;

1.6. Reserve tiny forest places in urban areas for outdoor activities and implement activities such as Frei-day in schools (https://frei-day.org); and

1.7. Create teaching and learning materials that are apt for outdoor learning environments. The materials should be disseminated within and between networks.

(Actors: Ministries of education and educational agencies in each country, regional bodies such as the European Forest Institute, Forest pedagogy network in Europe, IUFRO Working Group in Forest Education)

2. Include principles of *inquiry-based teaching and active learning* in primary and secondary education curricula. Some good examples of changes in the national curriculum are Scotland’s Curriculum for Excellence (https://scotlandscurriculum.scot/5/) and Finland’s National Curriculum for Basic Education (https://www.oph.fi/en/statistics-and-publications/publications/new-national-core-curriculum-basic-education-focus-school). Besides implementing changes in the national curricula, teachers should be supported to implement the principles of inquiry-based teaching and active learning in their everyday teaching practices by arranging for in-service teachers pedagogical training (see next recommendation concerning CPD).

   (Actors: Ministries of education and educational agencies in each country, municipalities, and teacher education institutions faculties of educational sciences and pedagogy)

3. Develop *Continuing Professional Development (CPD)* for primary and secondary education level teachers. The CPD could include following topics and issues:

   3.1. Workshops on the cultural and societal values of forests and forest management to change teachers’ understanding of forests and forest management;

   3.2. Pedagogical courses and workshops to show teachers how to use trees and forests in everyday teaching such as playing in the woods, how to include the basic principles of ecology in teaching, and others;

   3.3. Workshops and pedagogical courses on how to use urban forests, forest areas in teaching by out-of-school activities and outdoor learning; and

   3.4. Introducing and including principles of sustainability and the goals of sustainable development in CPD programs for primary and secondary education teachers.

   (Actors: National level bodies responsible for basic/primary education, e.g., Ministry of Education, national agencies of education, regional bodies such as the European Forest Institute, forest pedagogy network in Europe, and IUFRO Working Group in Forest education).

   The following recommendations are based on the survey results. Participants in the regional consultations did not discuss about these recommendations.

4. *Information dissemination and/or implementation of policies* — school-level actors such as teachers and administrators need to be better informed about governmental level policies that may have an impact on improved forest-related education.

   (Actors: National level education agencies, national forest(ry) associations)

5. *Platform for teachers and other stakeholders* —these platforms are most likely digital and could help in two-way communication.

(Actors: National forest(ry) associations, Ministries in charge of forest issues)

6. *Digital tools* — create digital tools that help integrate teaching indoors and outdoors. These could be partly based on an open-source Geographic Information System (GIS) data on environments including forests.

   (Actor: Researchers and commercial teaching materials publishers)

7. *OECD Pisa studies on primary level education* — **t**he surveys and studies should include forest education and the human-nature relationship (PISA: https://www.oecd.org/pisa/).

   (Actor: OECD, researchers)

8. Launch an International Competition of Forest Knowledge for high school students (e.g. Finnish Forest Association's Metsävisa/Forest Quiz: https://smy.fi/en/forestquiz/)

   (Actor: FAO, IUFRO)

Several NGOs and extra-curricular actors provide valuable input to forest- and nature-related education. For instance, in Finland, the OKKA Foundation (https://okka-saatio.com/the-okka-foundation/) promotes learning and education, arts education and sustainability. One of the activities is also awarding sustainability certificates for innovative school and network accomplishments. Also ALO (https://www.alofinland.com/news/environmental-education-finland-whole-village-learning-environment/) introduces environmental education (EE) and sustainable development. Teachers can read, learn and experiment with the best practices in an award-winning environmental school via videos, text and photos. By including sustainability among key competencies required in K-12 education, Finland is paving the way for nationwide access to EE (https://thegeep.org/learn/countries/finland). The extra-curricular activities and service providers could and should be more intensively integrated also in formal education.

6.2 Recommendations to improve forest education at the TVET level

Based on the survey results, regional consultation, and wider sources, the following recommendations can be formulated (including the actor to which the proposal is made):

1. *TVET campaigns.* Set up or continue forest TVET campaigns among high-school students to keep and enhance their interest. The reputation of forest-related jobs and professions should also be improved. Participants in the regional consultations suggested the following concrete actions to promote this:

   1. Run positive media campaigns to change the reputation of forestry and forest-related jobs and professions to become lucrative for young people. Messages should say that the forest sector provides meaningful and varying jobs under the context of "bio," "eco," and "green jobs" or "IT." Forest jobs are not only hard physical work but offer numerous opportunities for people with different interests.

   2. Organize activating campaigns for young people, such as forestation/planting events to get a 'sneak peek' of jobs in forestry and help spread knowledge.

   3. Support environmental education and forest pedagogics at a young age and promote possibilities of outdoor learning at schools such as W5 projects for eco-schools (https://www.ecoschools.global/alcoa-w5). Forests should be used as a main place for sustainable education and of learning more about the SDGs.

   4. Modify the national curricula on all levels, especially at the primary level, so that more outdoor teaching and learning takes place.

(Actors: Forest sector interest groups mostly at the national level)

2. *Gender, ethnicity, and minority policy briefs***.** These need to be written and communicated among the forestry sector and forest education. Furthermore, pedagogical training about diversity issues and training materials should be developed. Participants in the regional consultation suggested the following concrete actions:
    1. Prepare a guiding document (a policy brief) for TVET schools on how to take gender, ethnicity and minorities into account in enrollment and everyday teaching and learning.
    2. Run media campaigns to promote the current contributions of ethnicities, minorities and all gender to TVET forest education, including stories of women working in the forestry and developing descriptions of professions in the forestry sector for females.
    3. Organize short courses on gender, ethnicity, and minority aims in mind.

    (Actors: CEDEFOP, national education agencies, (consortia of) TVET schools)

3. *Forum for school teachers, TVET institutes and other stakeholders*. Future long-term projects could be more likely than before on online platforms. These could help in two-way communication and in creating a common knowledge and understanding around TVET.

    1. Establish partnership programmes between TVET institutes and organizations that have a large interest on forests. For instance in some areas, churches could be a relevant partner as they own lots of land in forested areas.

    2. Establish partnership programmes between TVET institutes and other educational organizations that have interest on forests but do not have much forest-related content in their curricula (e.g., carpenter education).

    3. Develop orientation classes and enhance teachers to develop pedagogical skills and to gain knowledge of forests.

    4. Hold training seminars for schoolteachers organized by TVET institutes and other stakeholders. A potential topic could be Education for Sustainable Development (ESD).

    (Actors: Ministries in charge of forest issues, national forest(ry) associations, (consortia of) TVET schools)

The following recommendations are based on the survey results. Participants in the regional consultations did not discuss these.

4. *Enhance youth awareness of forest TVET by including students' forestry skills in international Worldskills competition.* An existing Wordlskills Europe competition promotes vocational, technological, and service oriented education and training and is a biannual event that gathers thousands of young people, see https://worldskillseurope.org/ It is highly recommended to include forestry skills into this competition.

    (Actors: National-level bodies responsible for TVET education, e.g., Ministry of Education, national and European/regional interest groups)

5. *Produce educational learning materials on insufficiently covered topics.* These topics include gender, ethnicity and minority topics. In addition, urban forestry, agroforestry, forest landscape restoration, watershed management, cultural values of forests and trees, and traditional and/or indigenous forest-related knowledge were insufficiently covered.

    (Actors: National education agencies, researchers and teachers, commercial learning material publishers)

6.3 Recommendations to improve forest education at the university and college level

Recommendations based on the results of this survey from bachelor's, masters' and doctoral level education and from the regional consultations of tertiary level education are listed below.

1. *To reduce the differences in perceptions of curricula and other education-related issues* across professionals, teachers, and students, education unit leaders should promote more *stakeholder engagement.*

   (Actors: Education unit leaders)

2. *Curriculum revisions* are needed in terms of adding new content (traditional knowledge, ethical and gender issues, ethnicity) and in changing pedagogical approaches towards constructive alignment (Biggs and Tang, 2011), active learning (Niemi and Nevgi, 2014; Virtanen, Niemi and Nevgi, 2017) as well as inquiry-based learning and knowledge creation approaches (Paavola and Hakkarainen, 2018). Further, educational facilities and learning landscapes require extensive transformations (Sandström, Nevgi and Nenonen, 2019; Sandström *et al*., 2016; Sandström and Nevgi, 2020; Sandström, 2020).

   (Actors: Educational programme leaders)

3. *New content for curricula needs new teaching materials*, teachers and professionals should produce and publish this material.

   (Actors: Regional networks and university consortia)

4. University *pedagogical education about diversity issues* in general such as gender, race, and ethnicity.

   (Actors: University consortia in education)

5. *Produce regional and especially sub-regional* (e.g., Mediterranean, and Nordic) education materials on traditional and/or indigenous forest-related knowledge, cultural values of forests and trees and urban forestry.

   (Actors: Silva Network, polytechnic university networks and education providing consortia)

6. *Organize workshops and pedagogical training about diversity issues* and produce pan-European study materials on gender and forest education.

   (Actor: IUFRO, Silva Network)

7. *Gender, ethnicity, and minority policy briefs* need to be written and communicated among the forestry sector and forest education.

   (Actors: Silva Network, EU commission)

8. Establish an association to organize an International Conference on Forest Education (ICFE).

   (Actors: CPF partners such as FAO, IUFRO, ITTO)

9. Organize a network to discuss the *core content of forest education curricula***,** including references and guidelines of core curriculum.

   (Actors: FAO-IUFRO, Forestra)

10. *Develop a survey methodology on monitoring forest and forest-related education.* For instance, some survey results of this study hint that even considerably small sample sizes could produce robust results. Whether this is the case could be studied further.

    (Actors: IUFRO, researchers in educational science)

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Appendix 1. Data figures and tables

Figures

Figures are in sequential order. The code names in the figures refer to the three respondent groups:

Q1 = Professionals
Q2 = Teachers
Q3 = Students

Figure A1. Inclusion of forest-related subjects in the curriculum <u>as individual subjects</u> in primary education

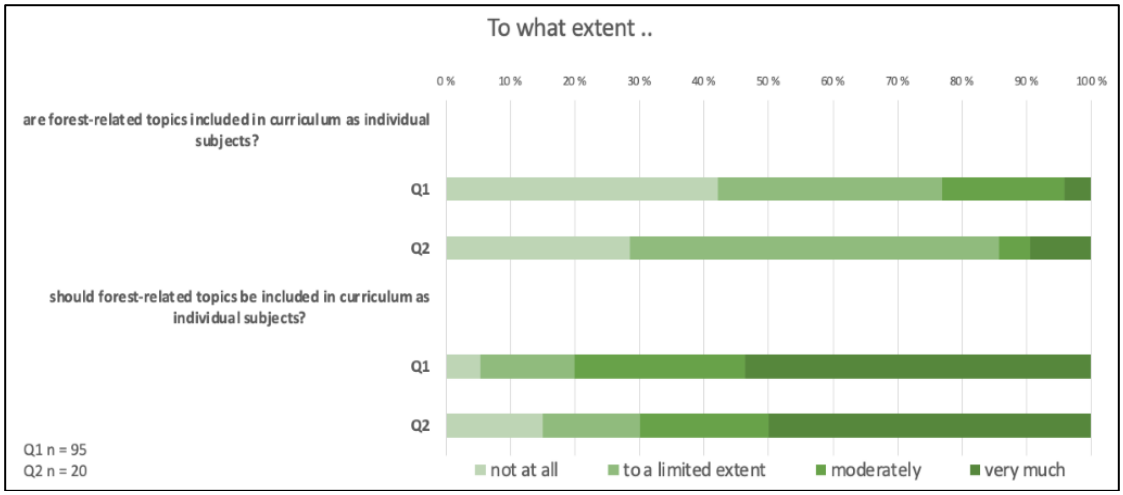


Figure A3. Inclusion of forest-related topics <u>in other subjects</u> of the curriculum in primary education

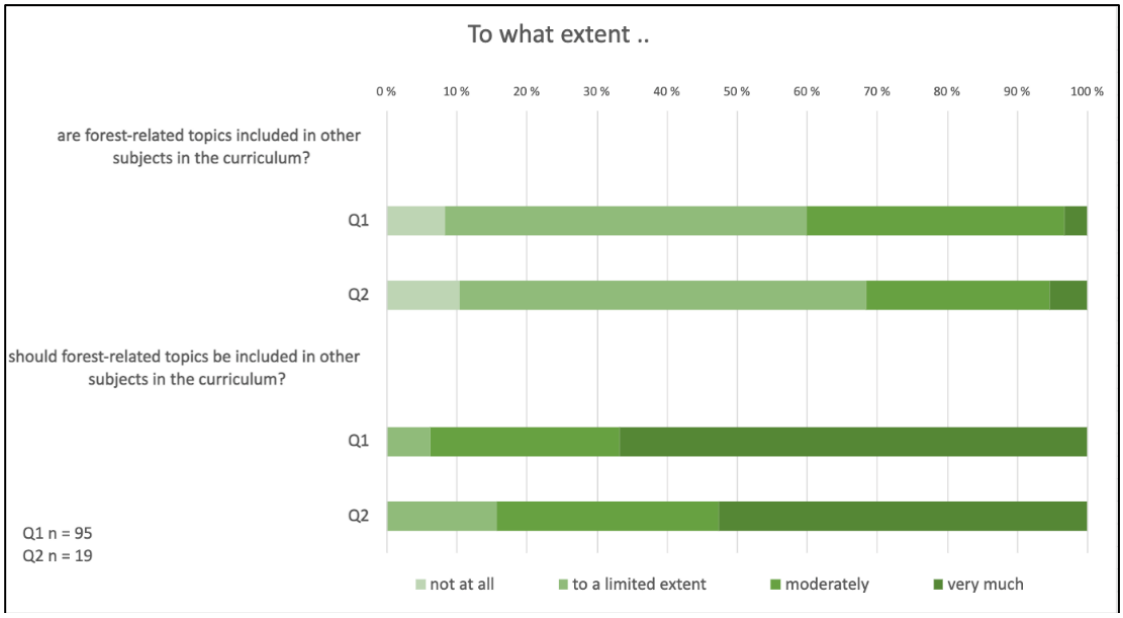


Figure A4. Policies or strategies leading to improved forest-related curriculum in primary schools

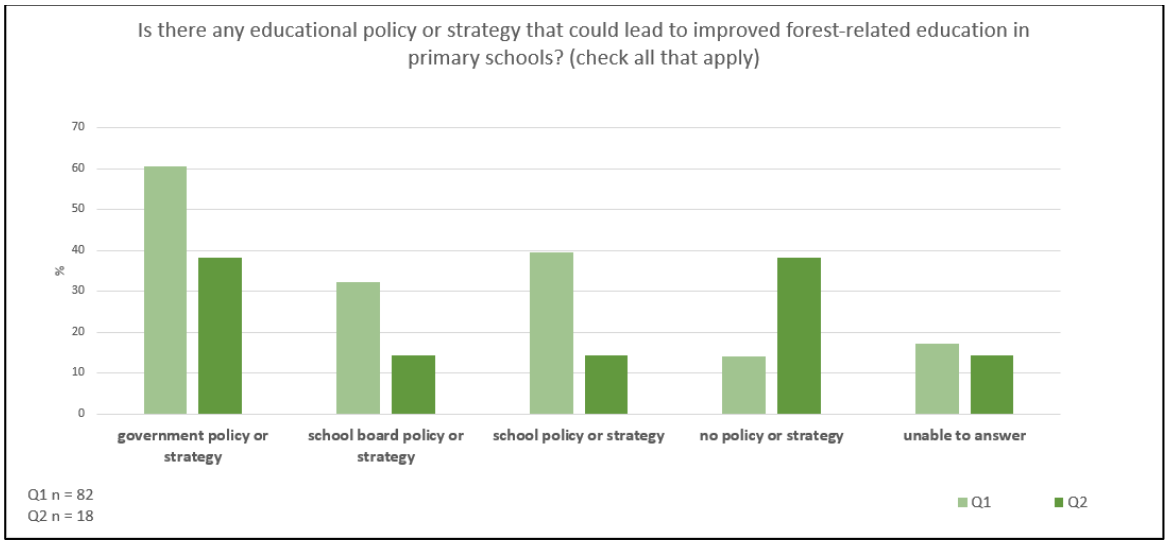


Figure A5. Forest education teaching knowledge and skills (primary education)

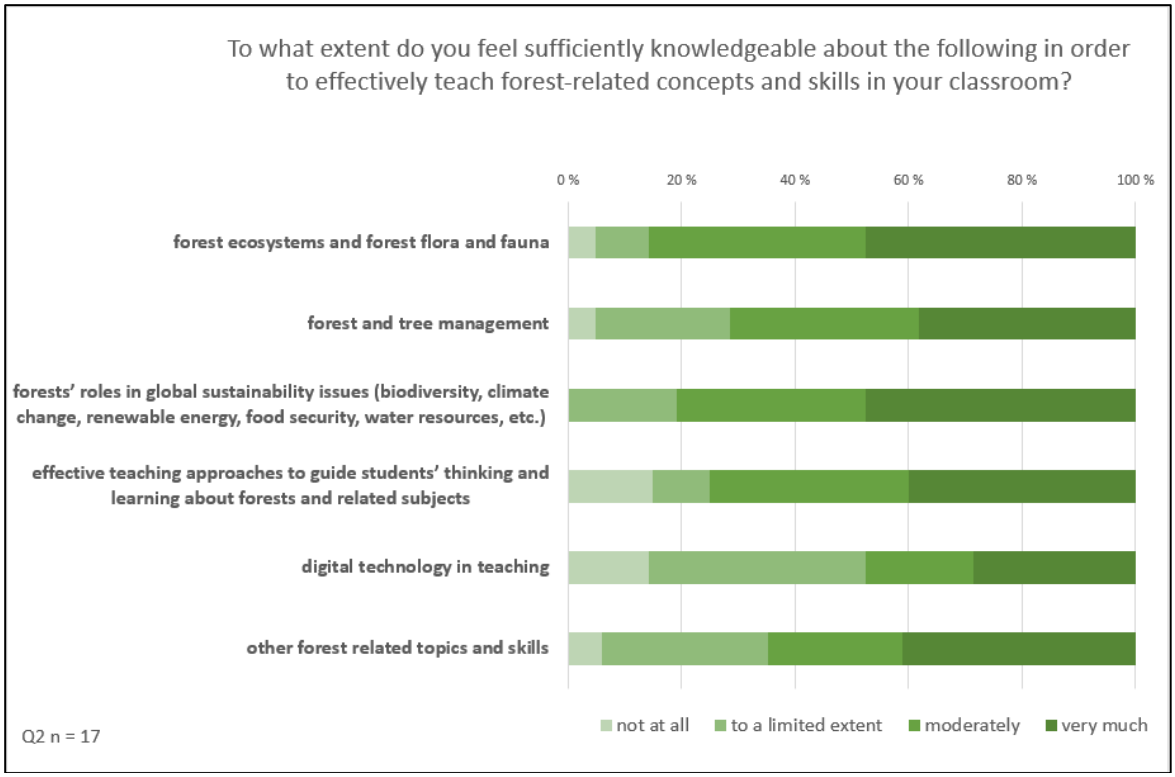


Figure A6. Forests used as a teaching environment or classroom (primary education)

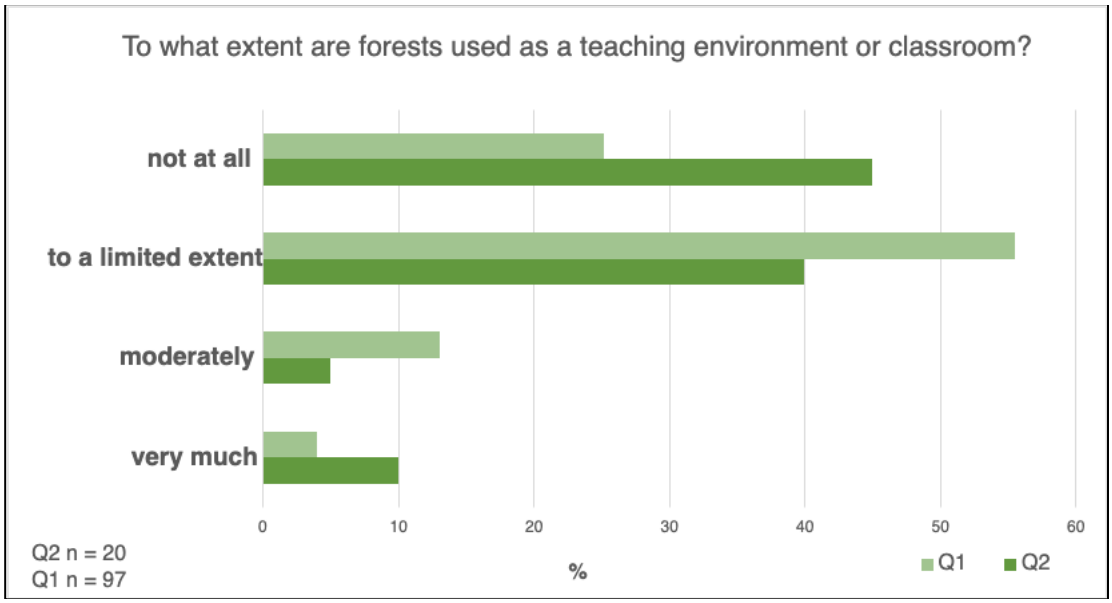


Figure A7. Availability of forest education resources in primary schools

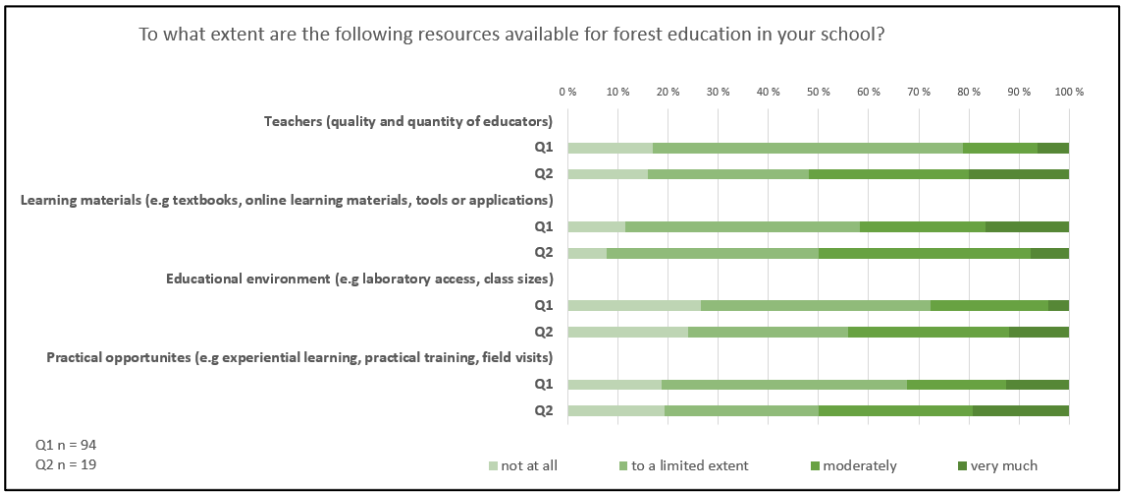


Figure A8. Impact of forest education at the primary level to increase student interest in nature and natural resource (primary education)

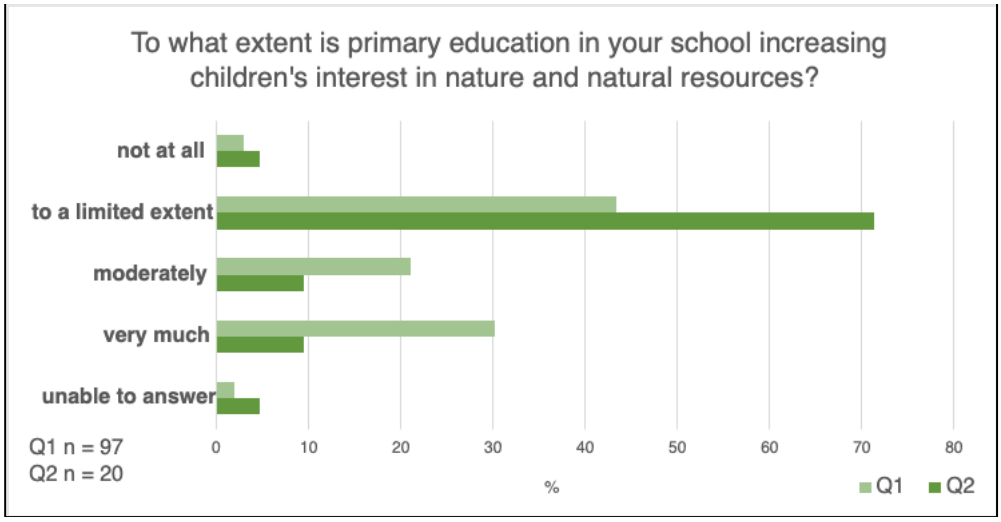


Figure A9. Common teaching and learning approaches (primary education)

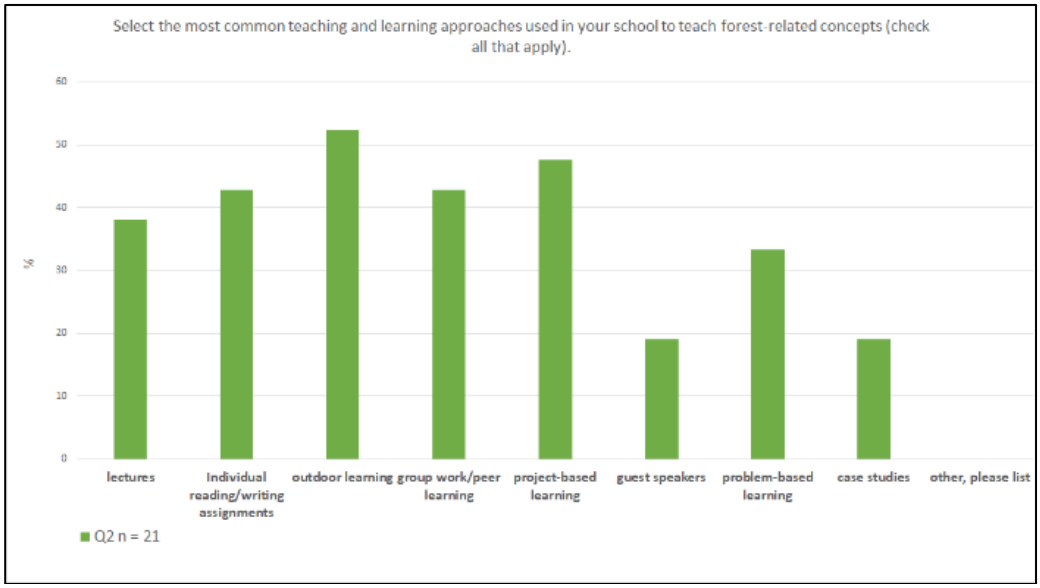


Figure A10. Recommended improvements to learning and increased student interest in forest-related concepts (primary education)

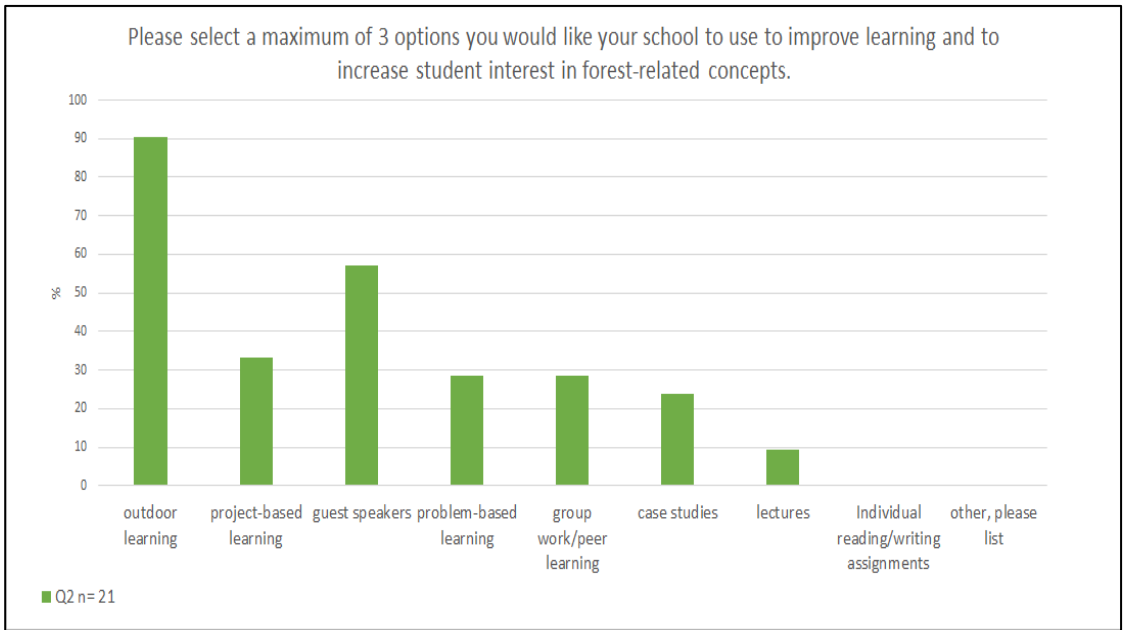


Figure A11. Forest learning through out-of-school activities (primary education)

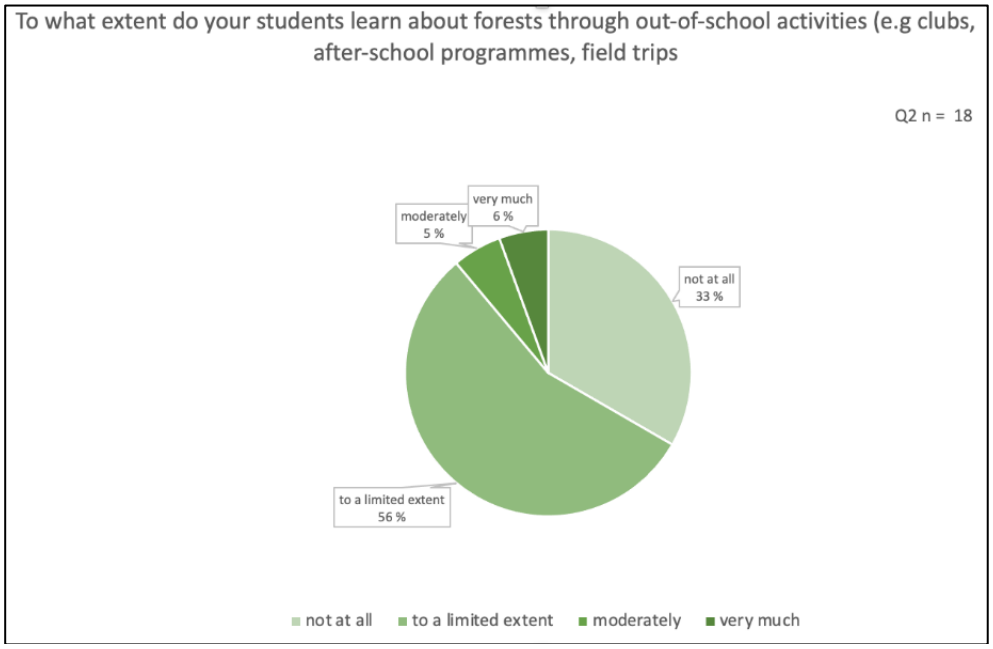


Figure A12. Secondary education teachers' perceptions of common teaching and learning approaches utilized in secondary schools

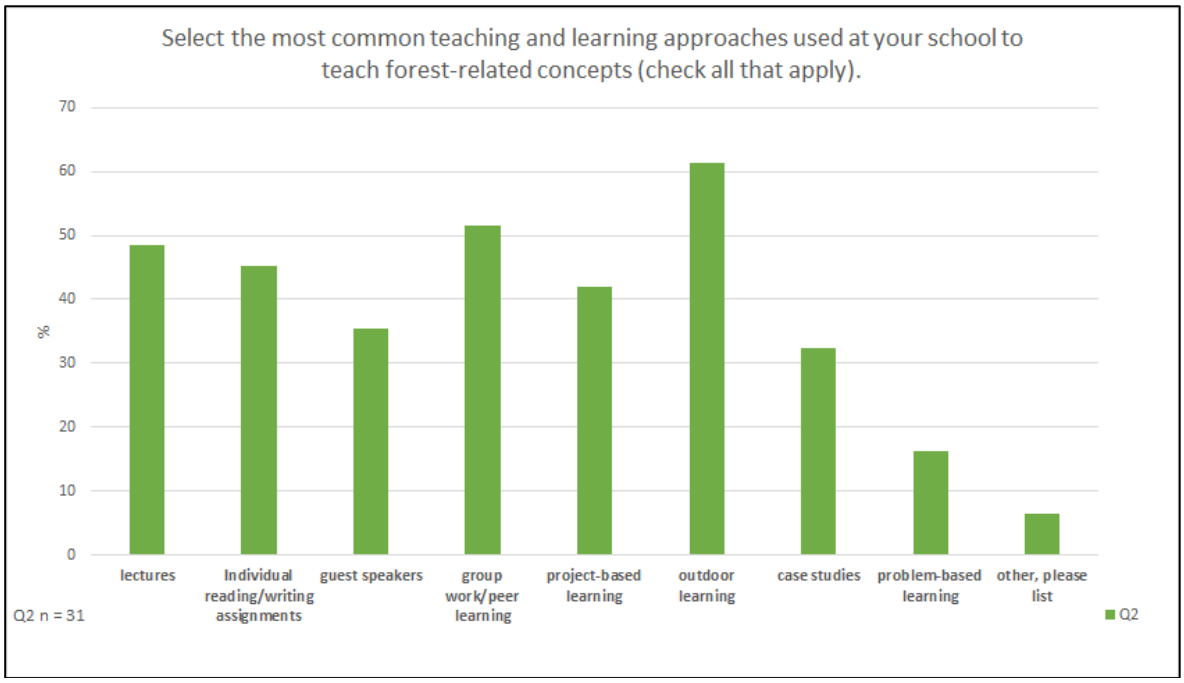


Figure A13. Inclusion of forest-related topics as individual subjects in the curriculum of secondary education

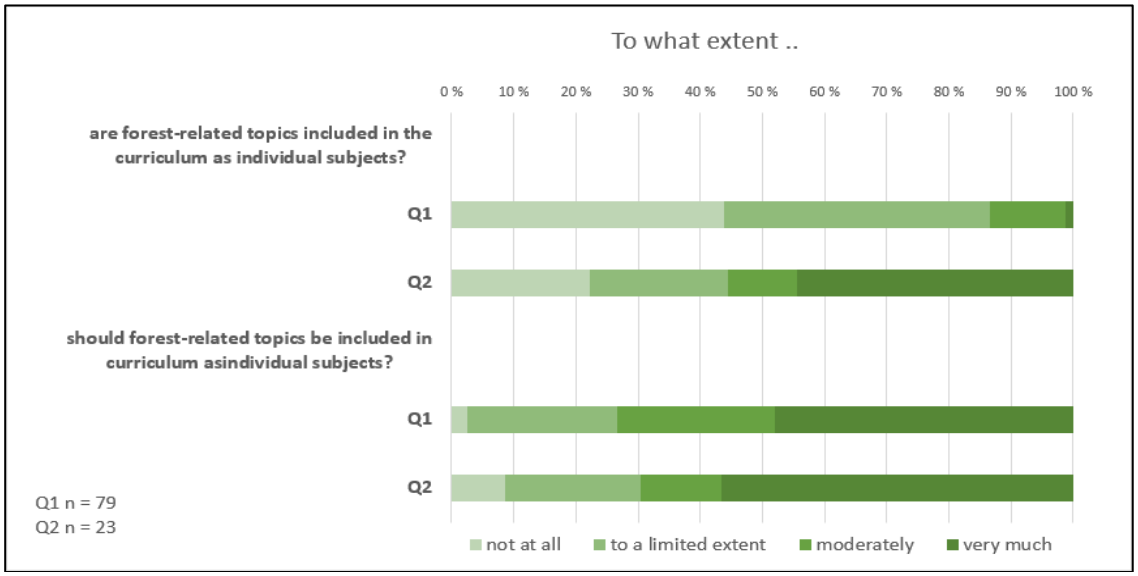


Figure A14. Inclusion of forest-related topics as other subjects in the curriculum of secondary education

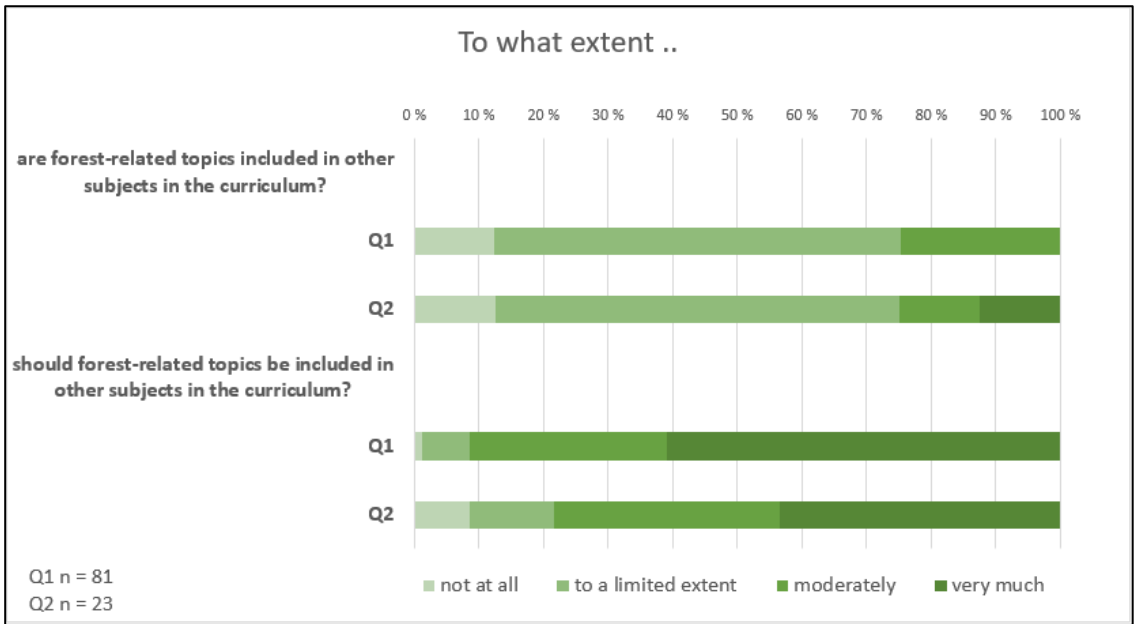


Figure A15. Perceptions concerning availability of forest education resources in secondary schools

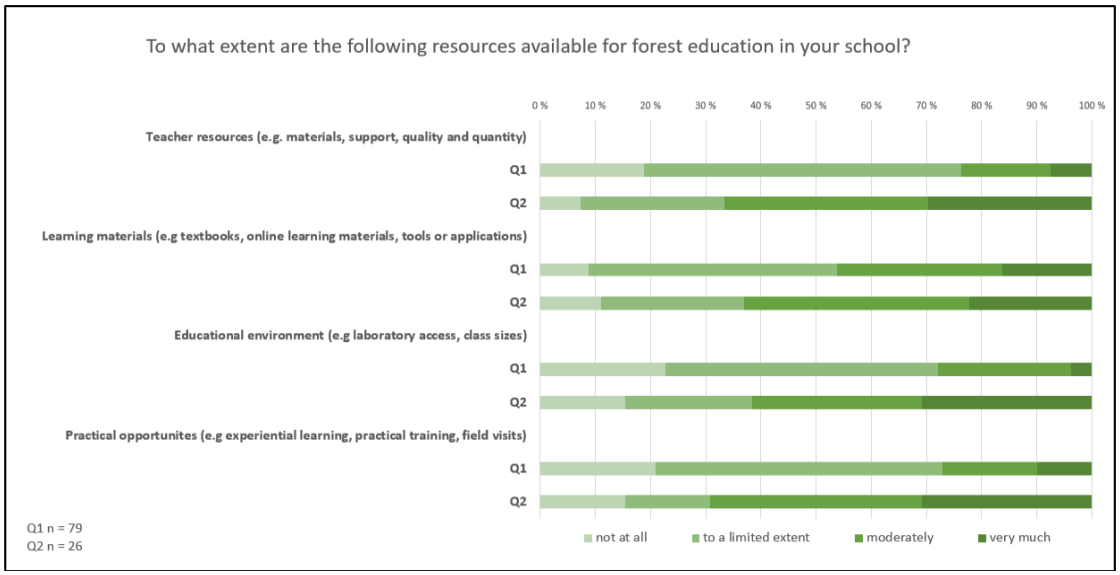


Figure A16. Perceptions concerning the existence of policies or strategies leading to improved forest-related curriculum in secondary schools

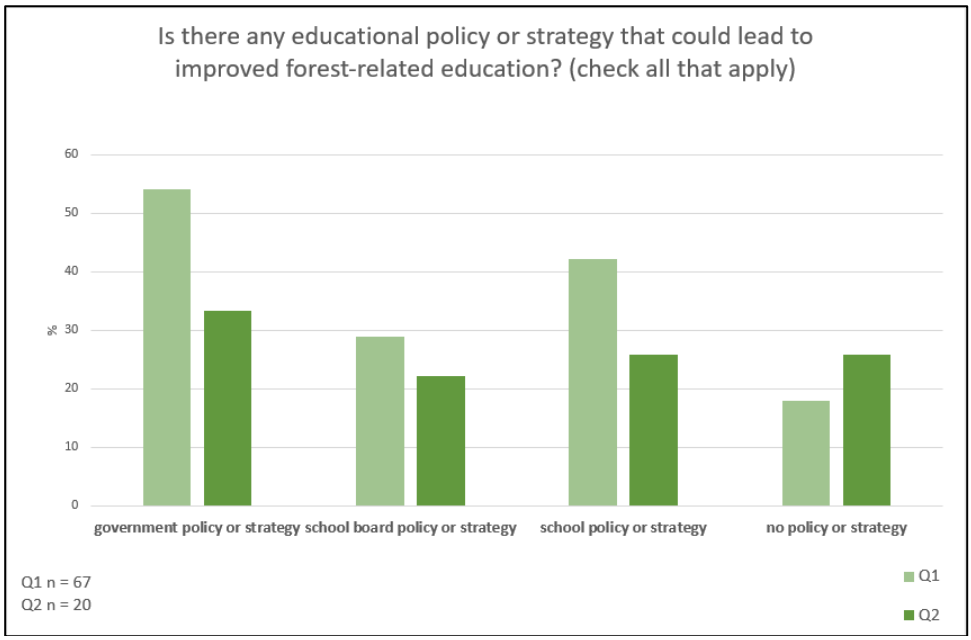


Figure A17. Forest education teaching knowledge and skills (secondary education)

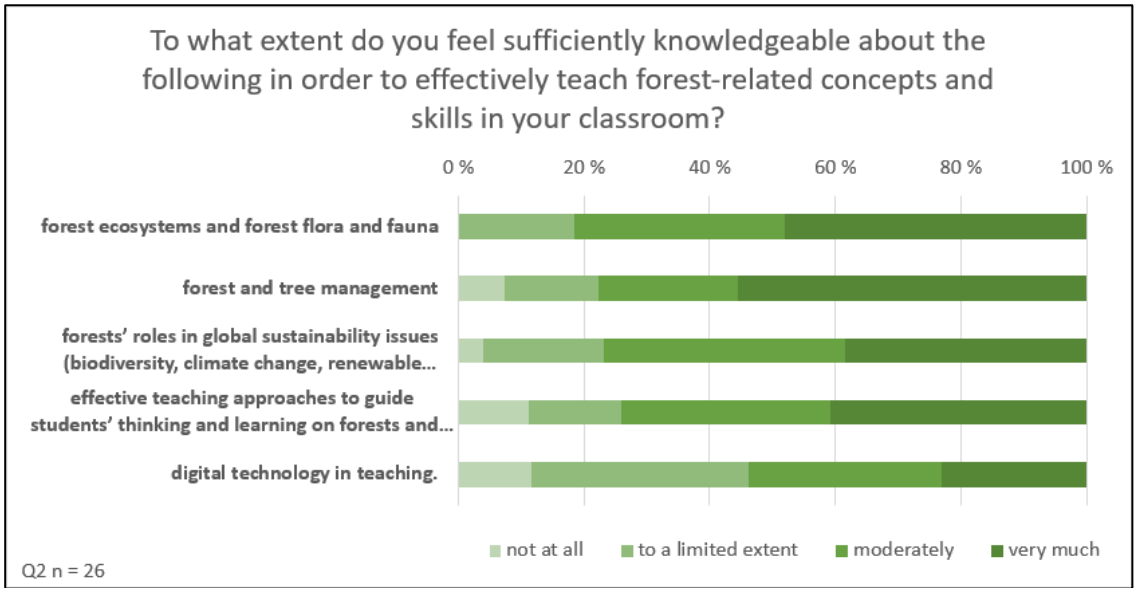


Figure A18. Forests used as a teaching environment or classroom (secondary education)

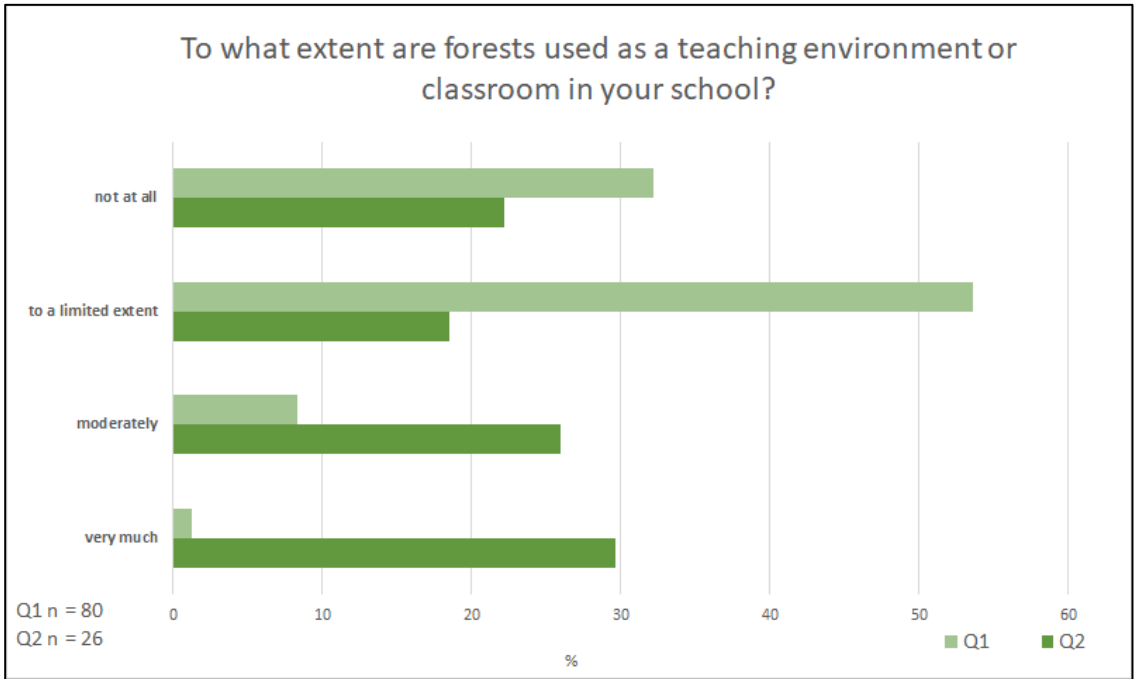


Figure A19. Students' exposure to forests through out-of-school activities and impact on forest knowledge and appreciation

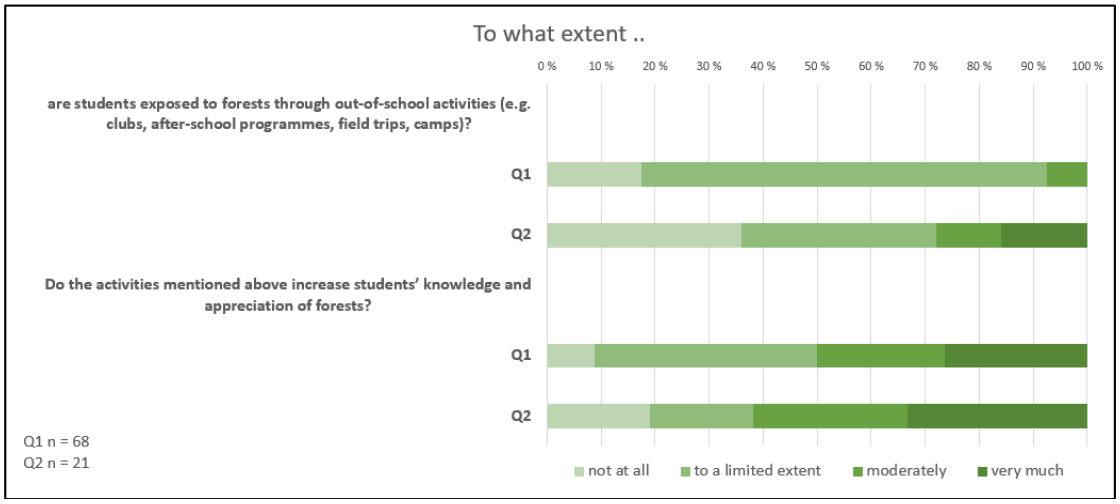


Figure A20. Impact of forest education at secondary school to increase student interest in nature and natural resources

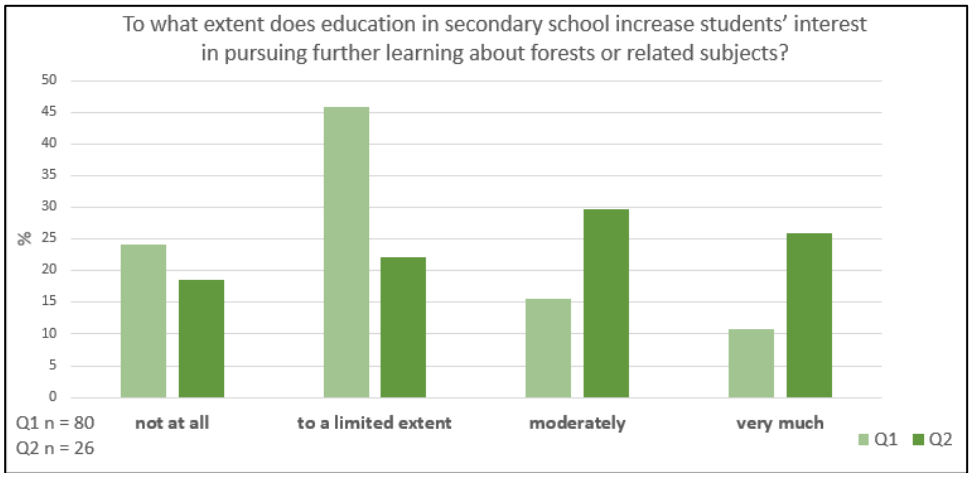


Figure A22. Student motivation to enter higher-level forest course or programme following secondary education

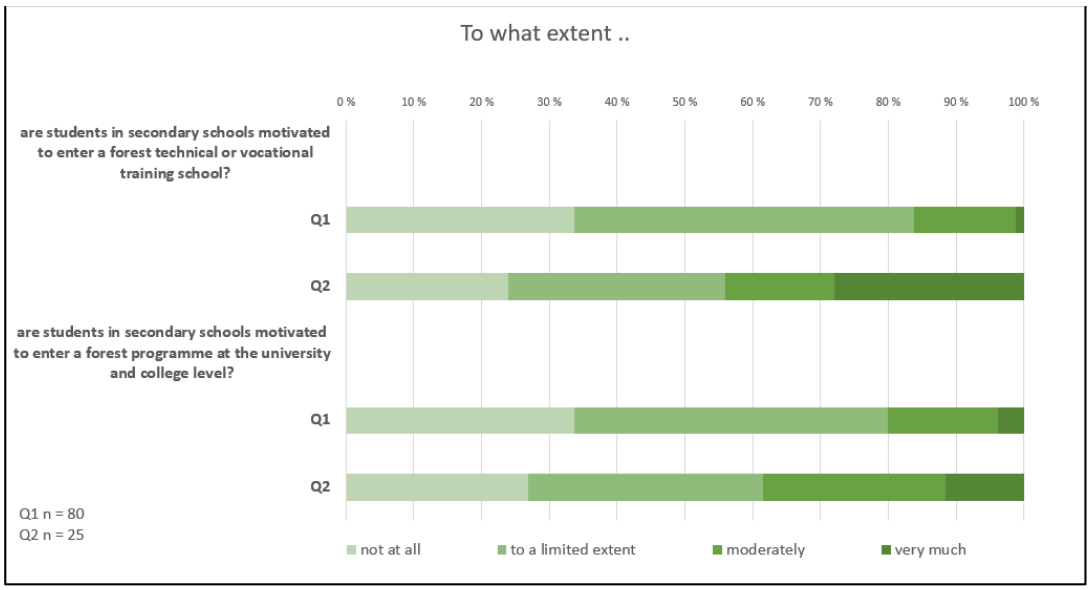


Figure A23. Availability of resources in TVET forest programmes

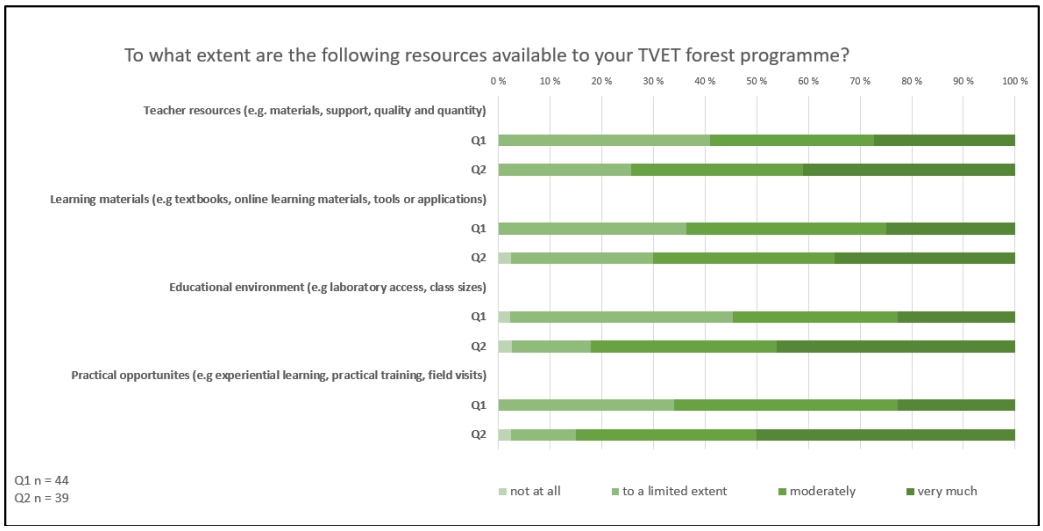


Figure A24. Availability of policy or strategy for improvement of forest-related education at TVET level

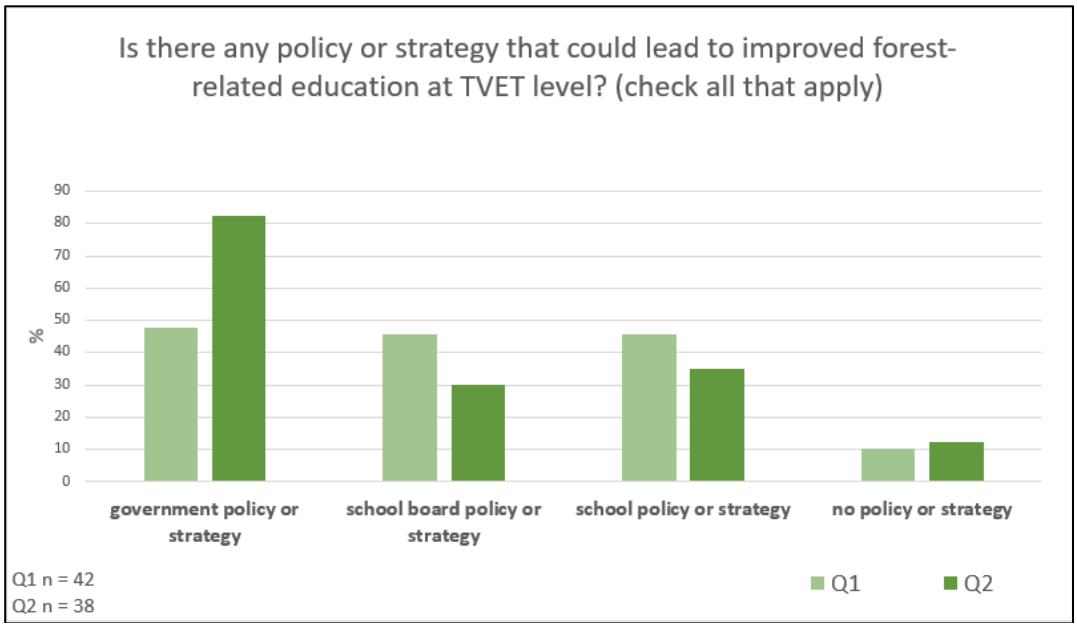


Figure A25. Availability of continuing education and training

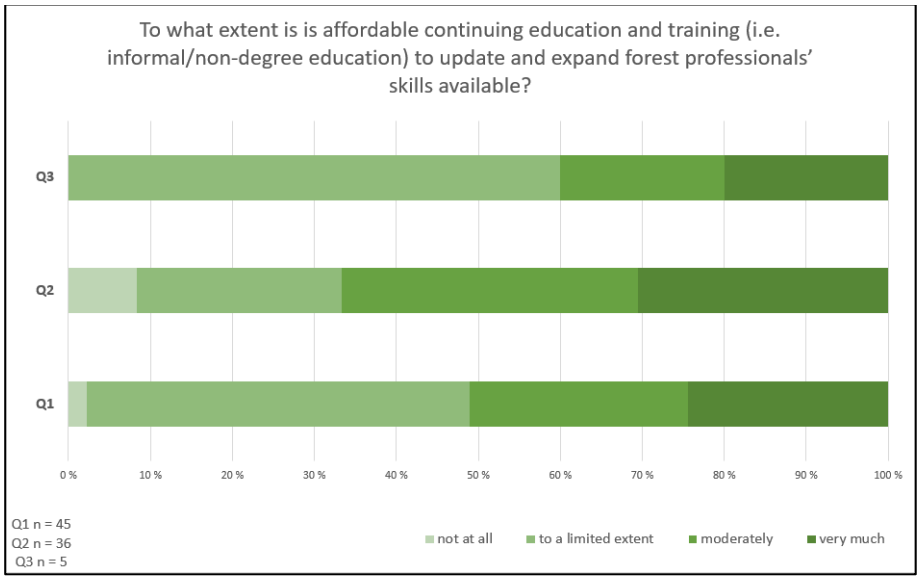


Figure A26. Student engagement in forest-related out-of-school activities and wider educational and professional impacts (TVET)

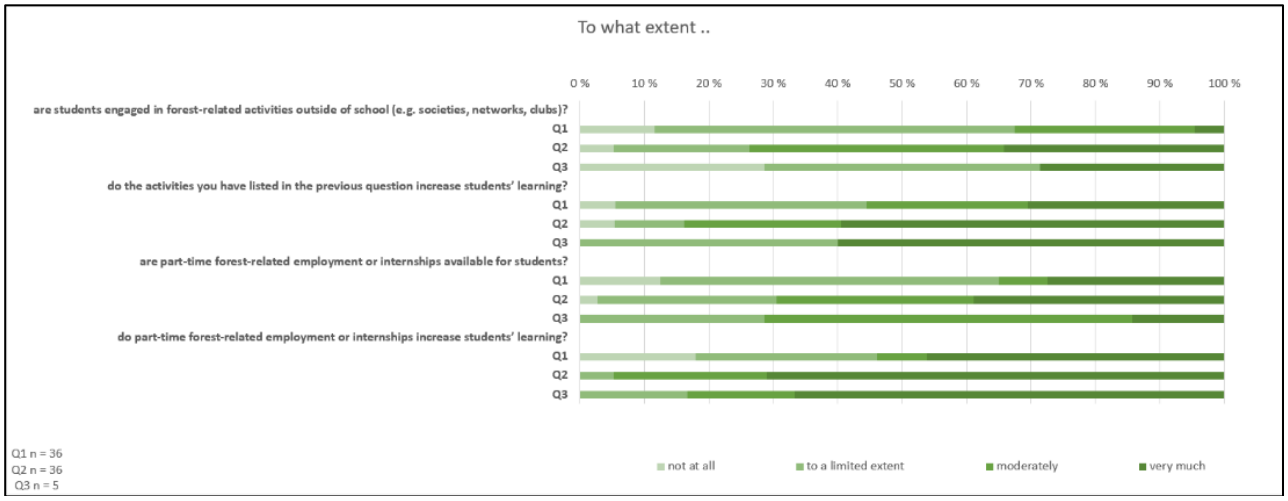


Figure A27. Use and benefit of digital learning tools within TVET forest programmes

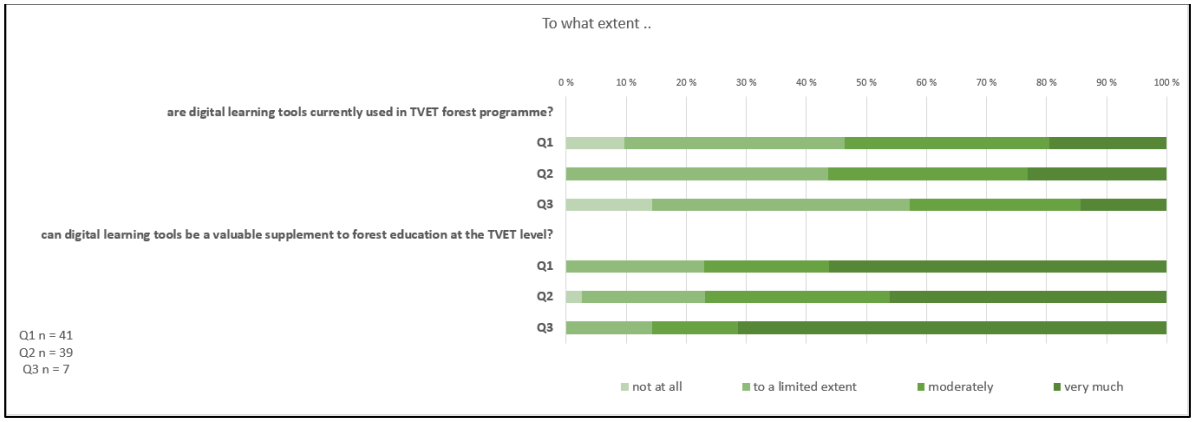


Figure A28. Coverage of forest-related topics in TVET forest programmes (Forest resources and forest ecology)

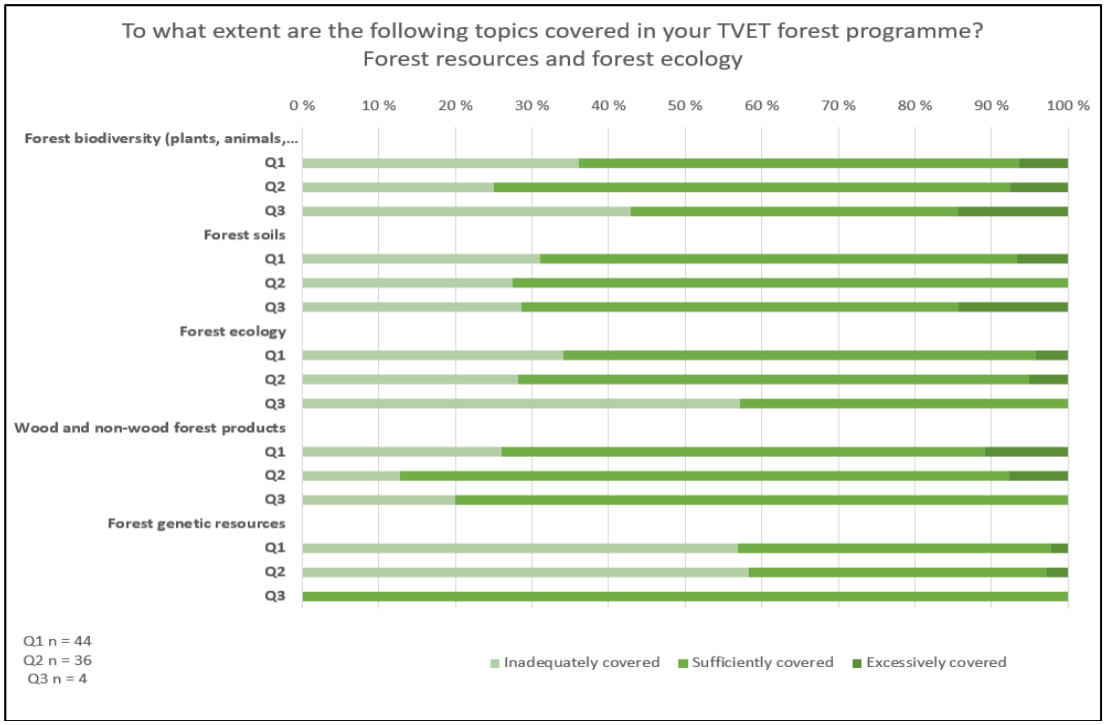


Figure A29.1 Coverage of forest-related topics in TVET forest programmes (Forest/tree planning and management)

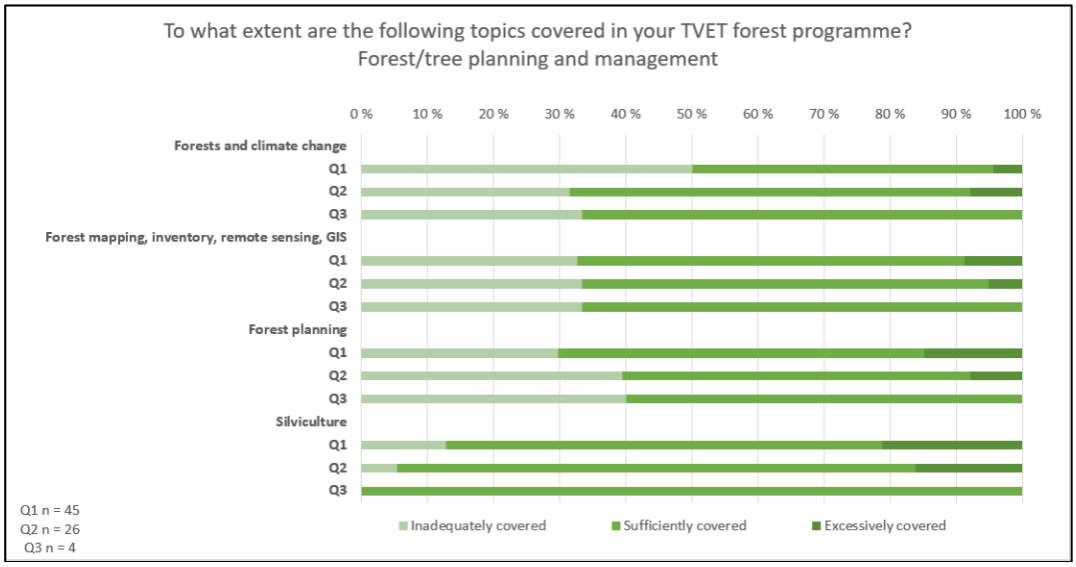


Figure A29.2. Coverage of forest-related topics in TVET forest programmes (Forest/tree planning and management)

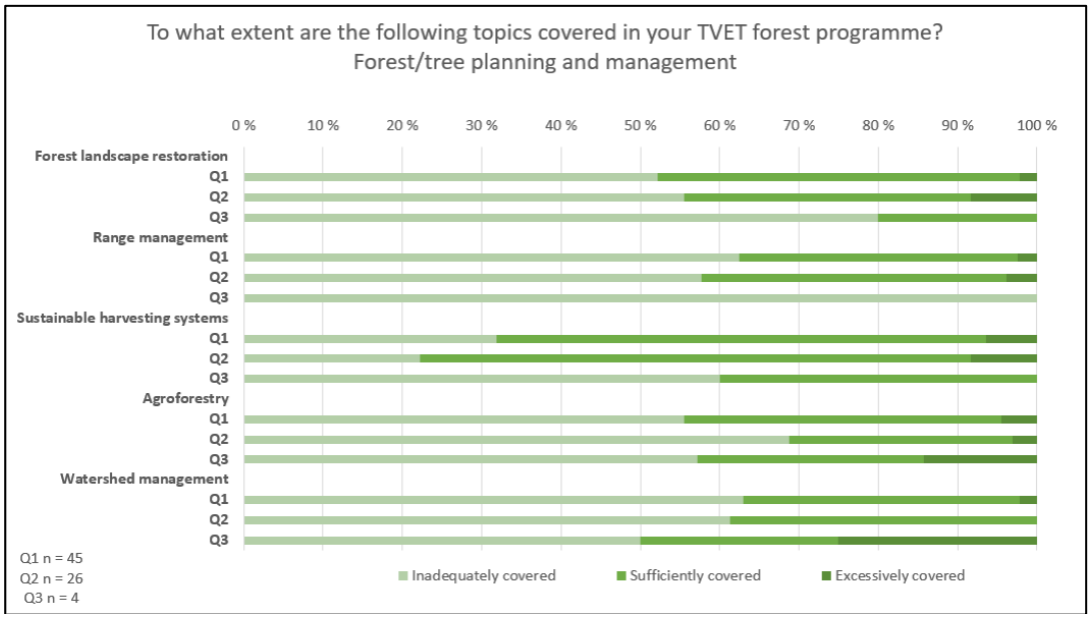


Figure A29.3 Coverage of forest-related topics in TVET forest programme (Forest/tree planning and management)

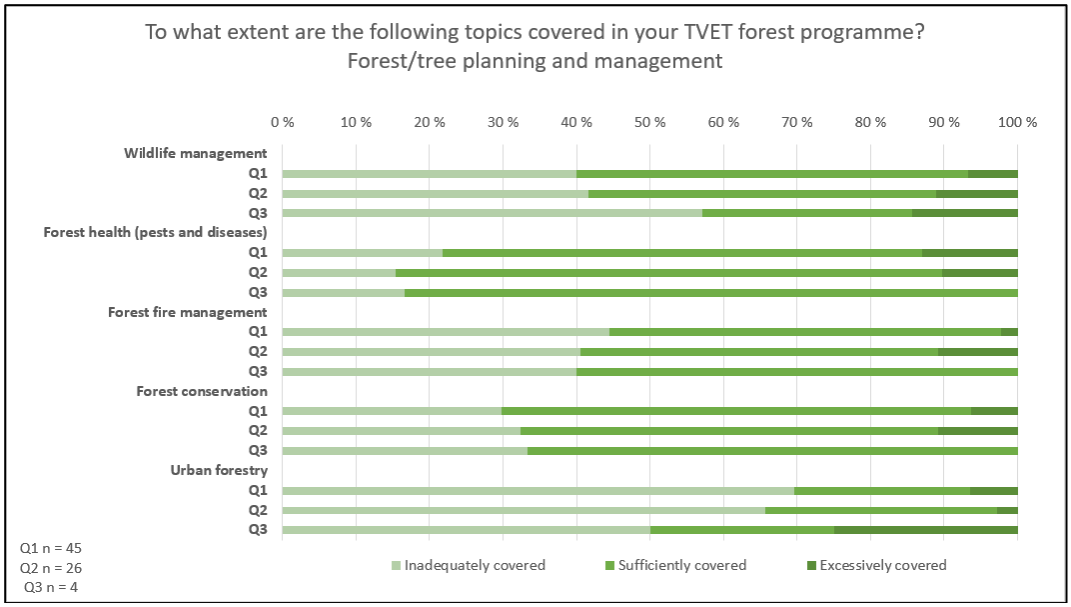


Figure A30.1 Coverage of forest-related topics in TVET forest programme (Forest services and socio-cultural issues)

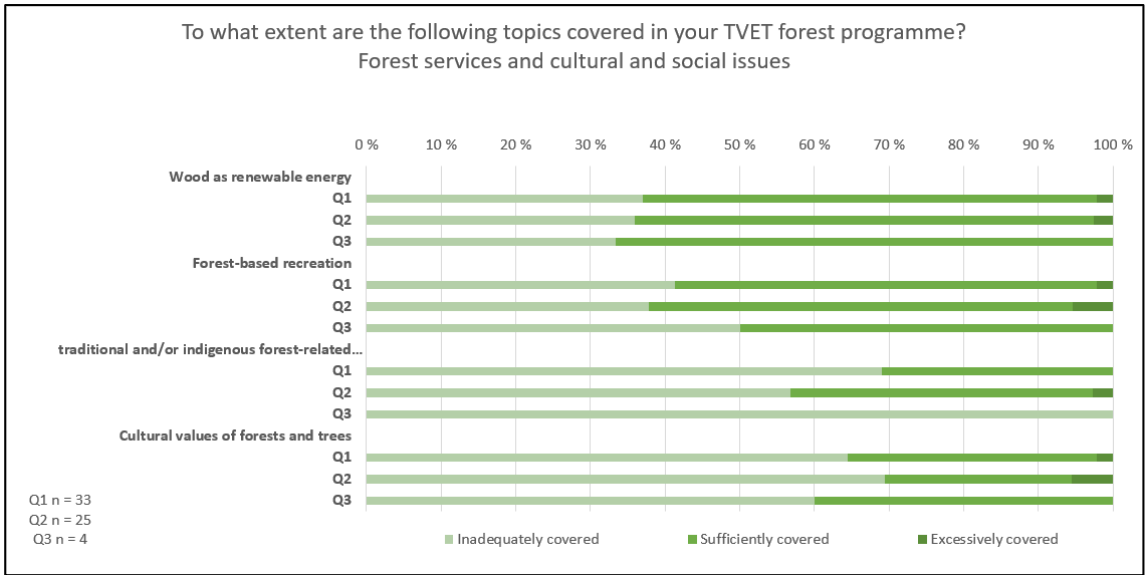


Figure A30.2. Coverage of forest-related topics in TVET forest programme (forest services and socio-cultural issues)

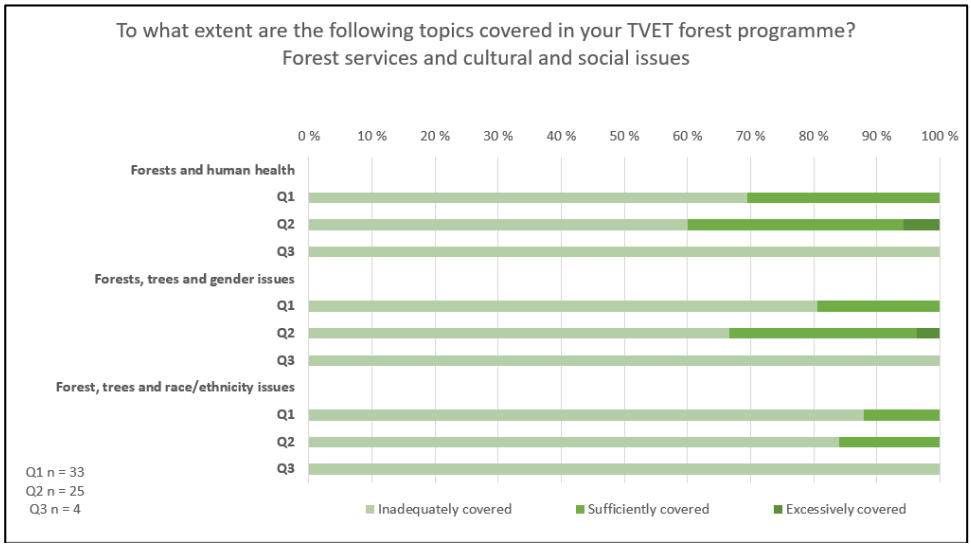


Figure A31. Coverage of forest-related topics in TVET forest programme (forest enterprise)

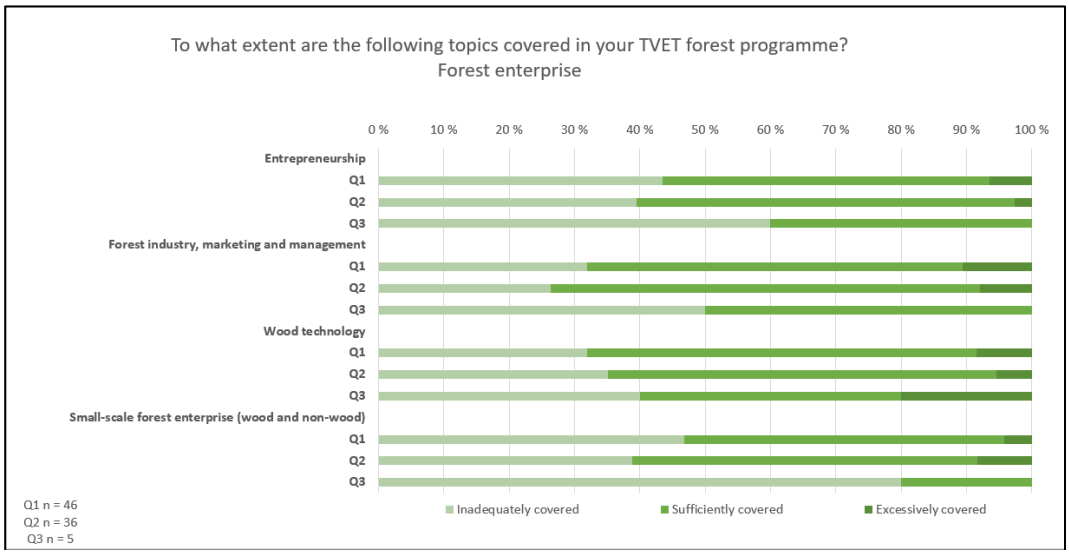


Figure A32. Coverage of forest-related topics in TVET forest programme (Forest policy and economics)

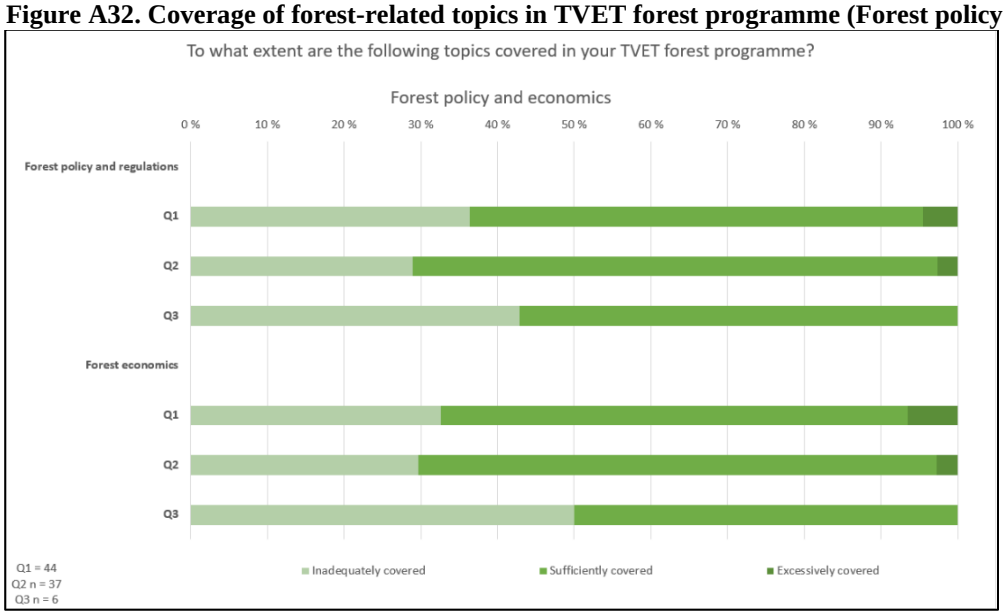


Figure A33.1 Coverage of forest-related topics in TVET forest programme (Other skills)

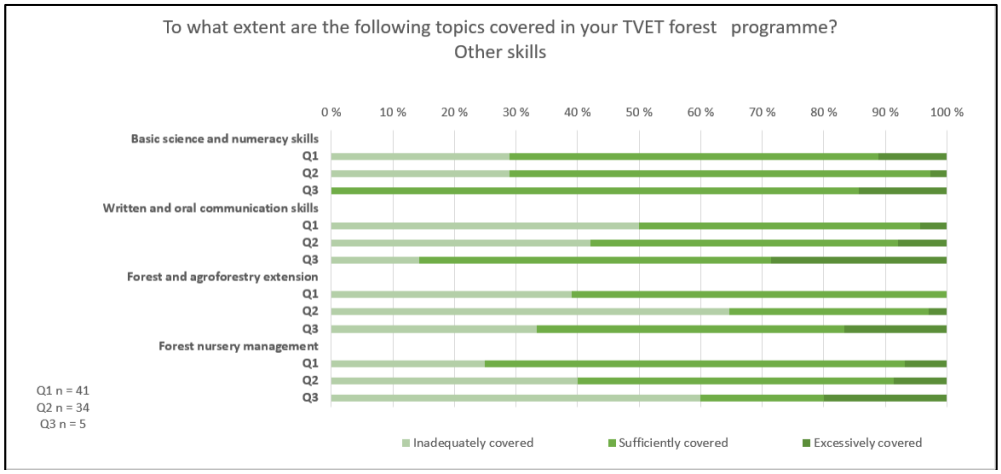


Figure A33.2 Coverage of forest-related topics in TVET forest programme (Other skills)

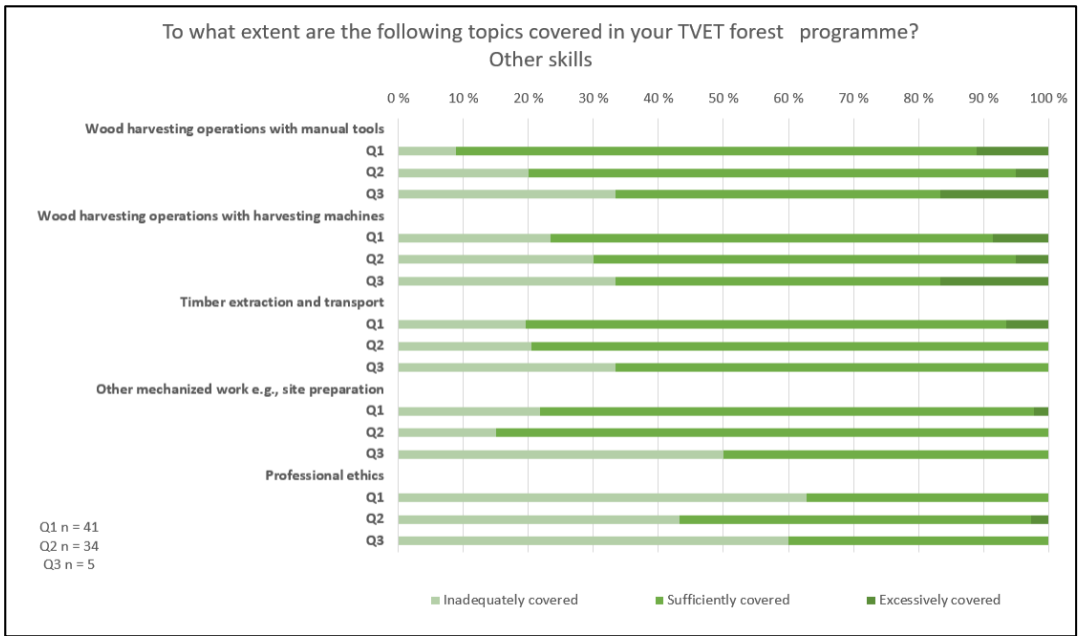


Figure A34. Workforce preparation within TVET forest programmes

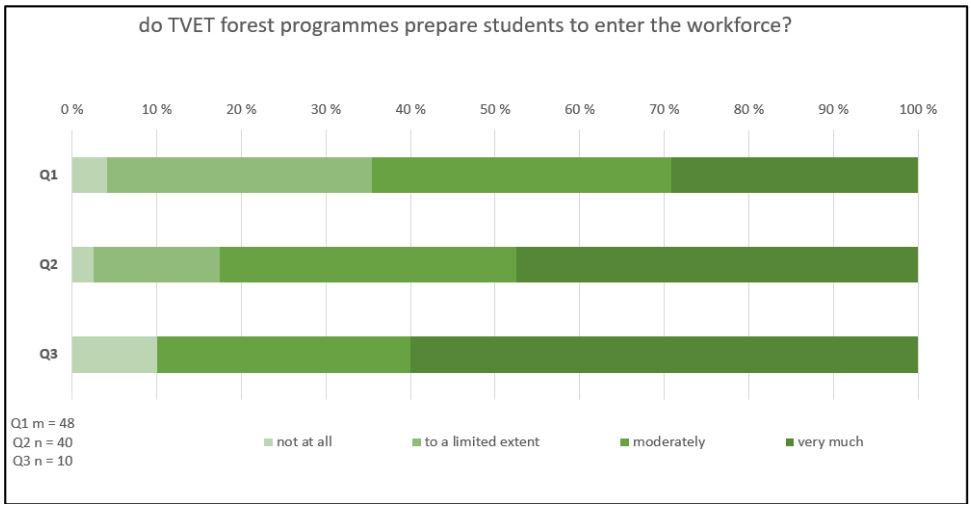


Figure A35. Gender, race and ethnicity as factors influencing students' transition to labor market (TVET education)

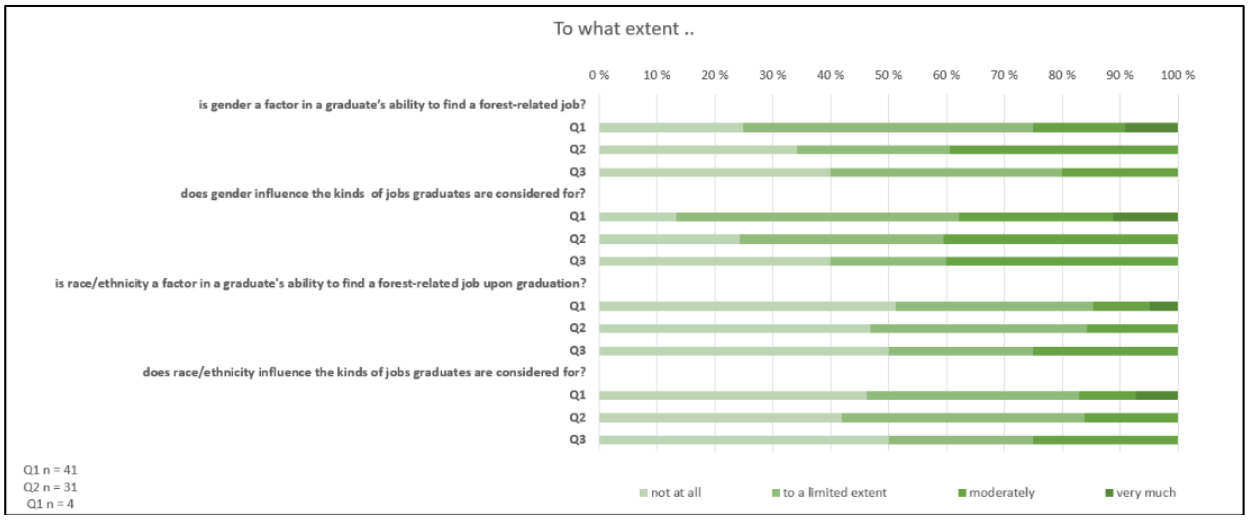


Figure A36. Overall trend in student enrollment in TVET forest programmes over the past decade (2010-2020)

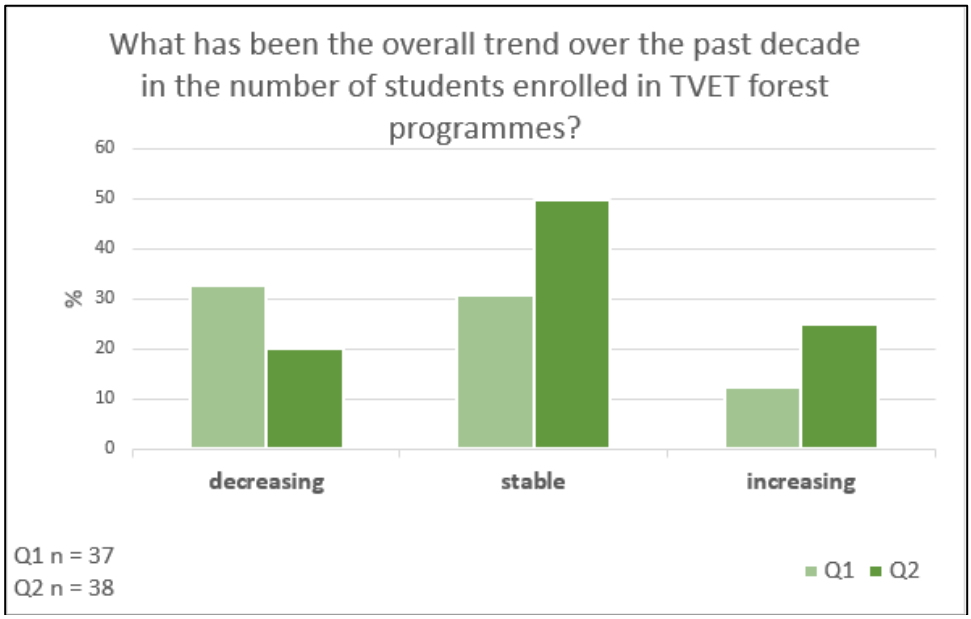


Figure A36.1. Coverage of forest-related topics in degree programme (Generic skills) (Bachelor's)

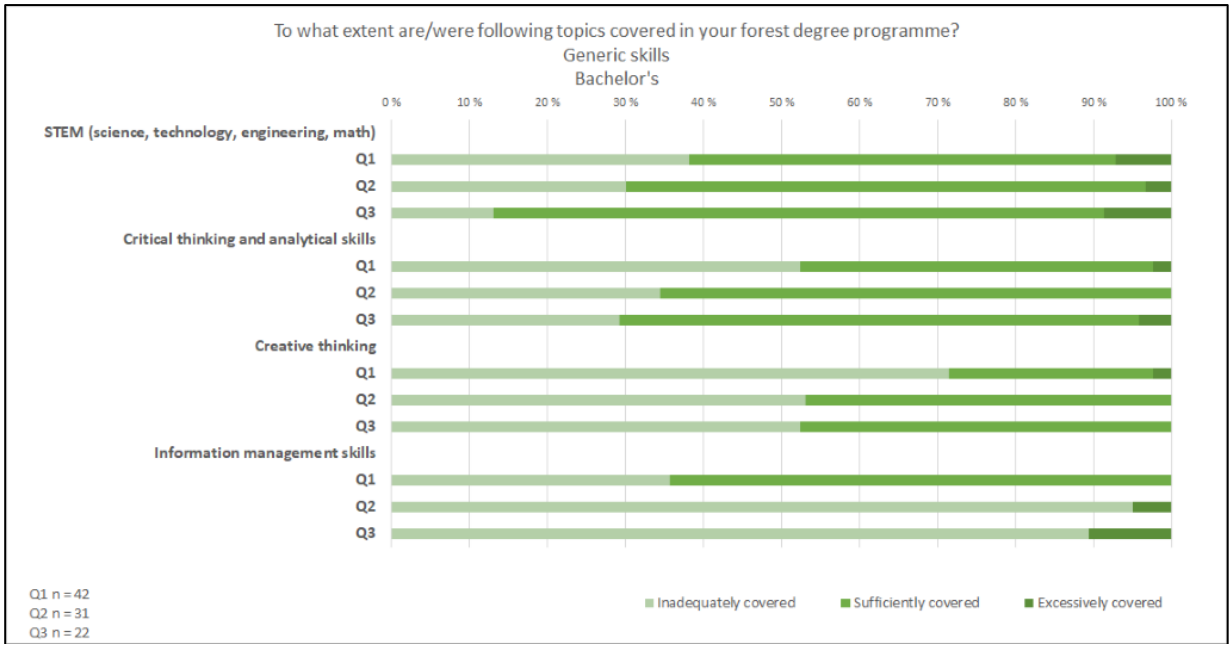


Figure A36.2 Coverage of forest-related topics in degree programme (Generic skills) (Bachelor's)

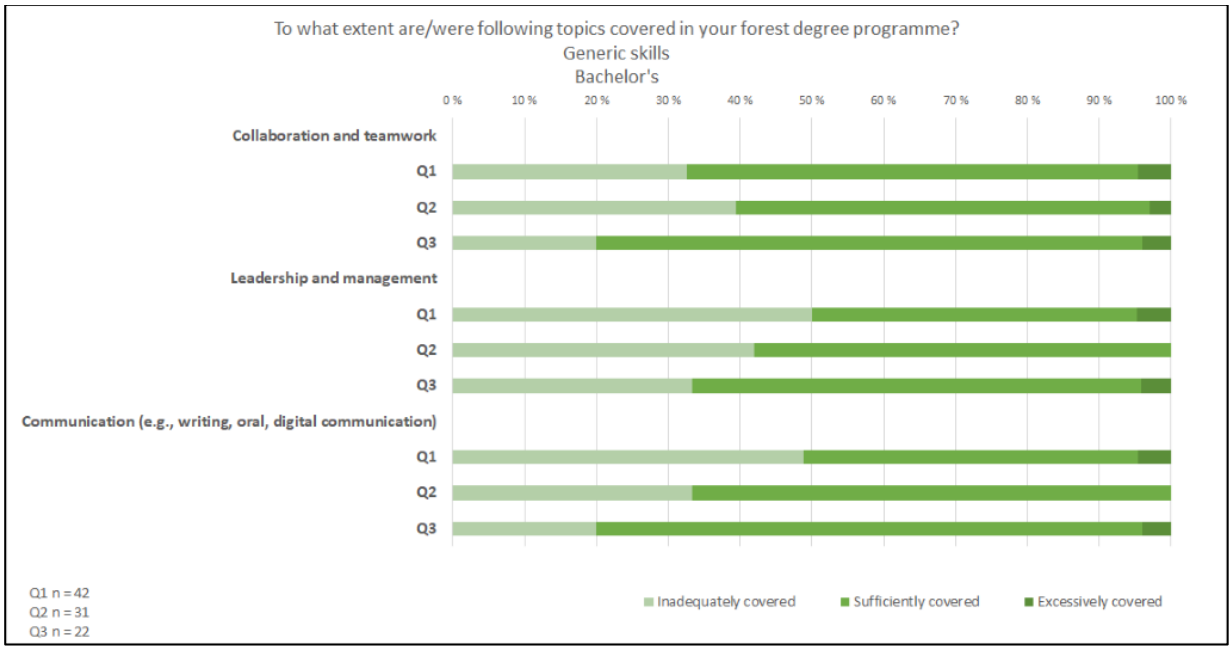


Figure A37. Availability of resources in forest degree programmes (Bachelor's)

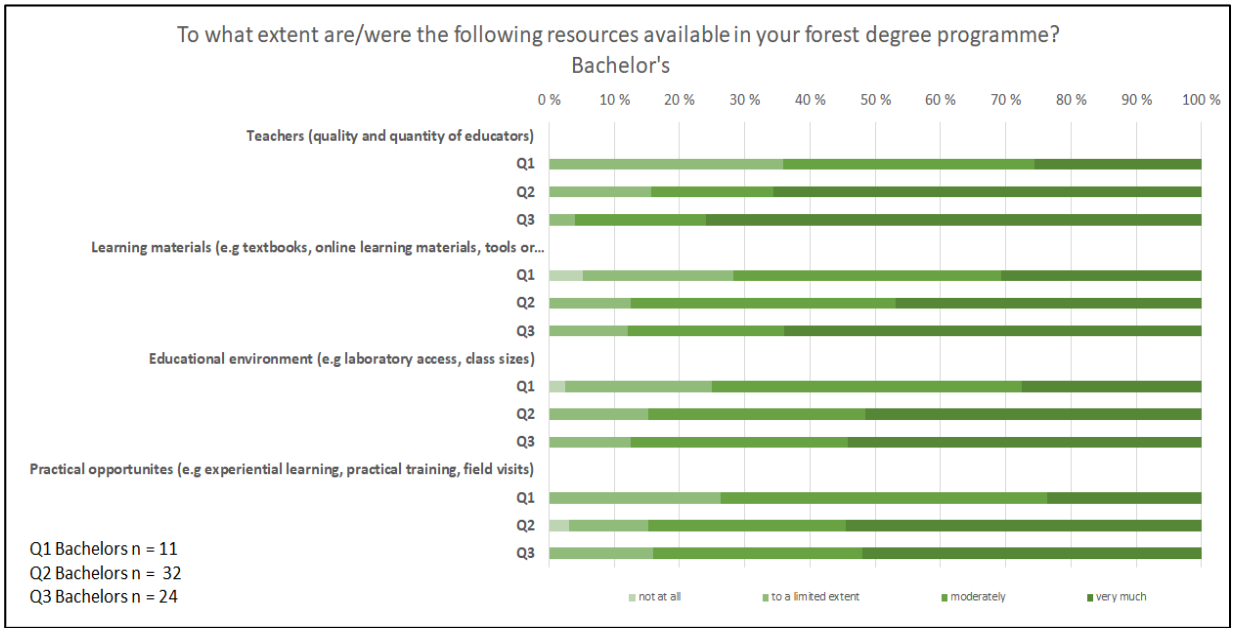


Figure A39. Availability of resources in forest degree programme

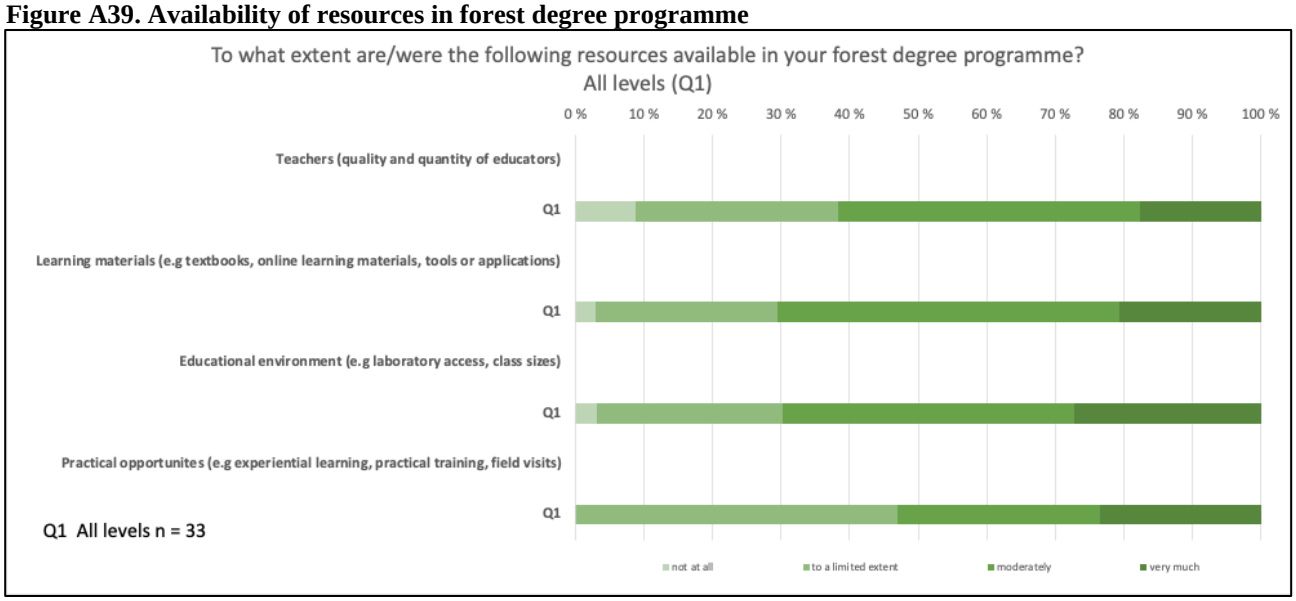


Figure A40. Policies or strategies leading to improved forest-related education at university and college level

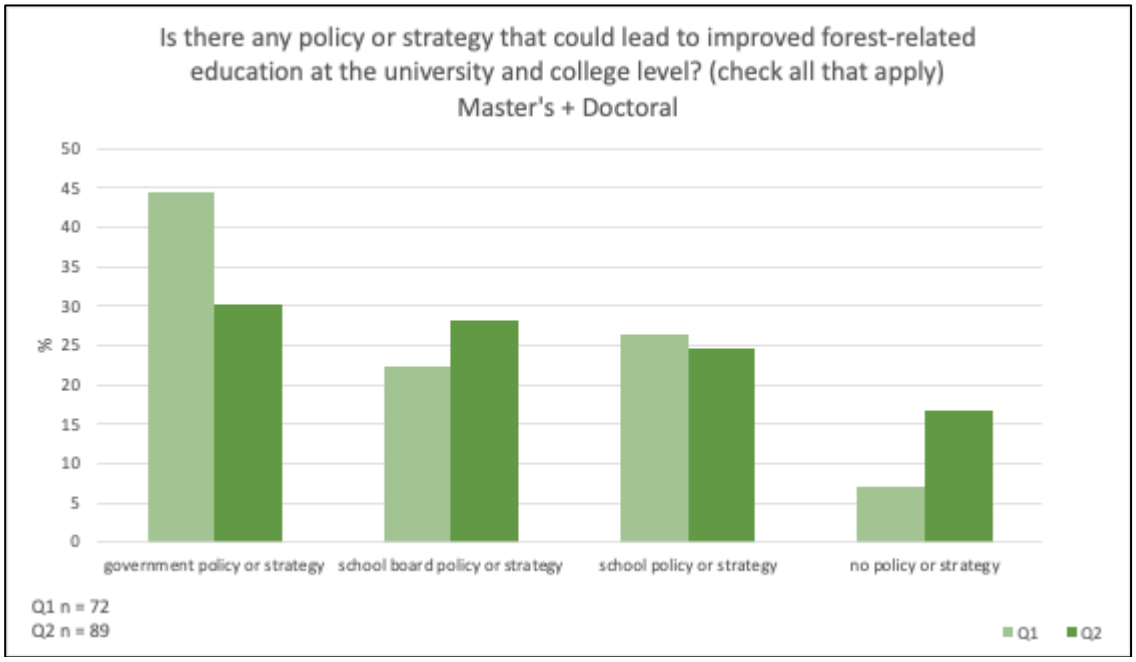


Figure A41. Student engagement in forest-related out-of-school activities (Bachelor's)

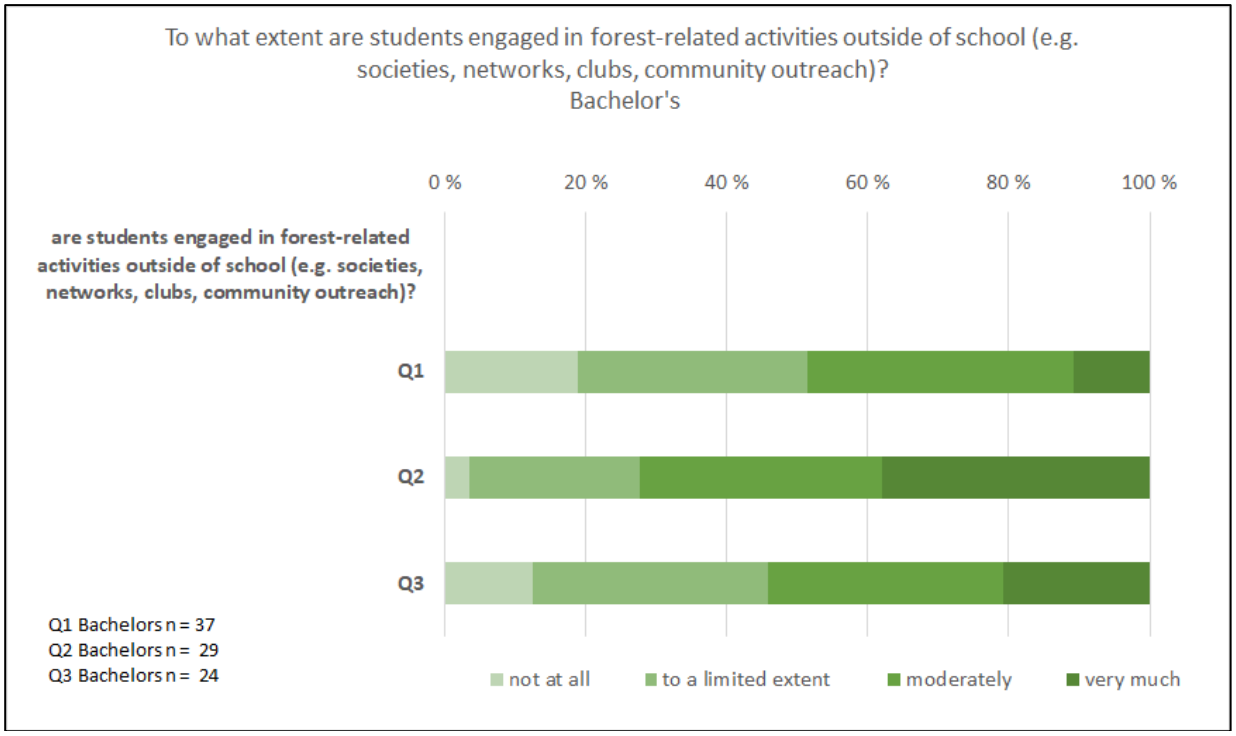


Figure A42. Use of digital learning tools at university and college level (Bachelor's)

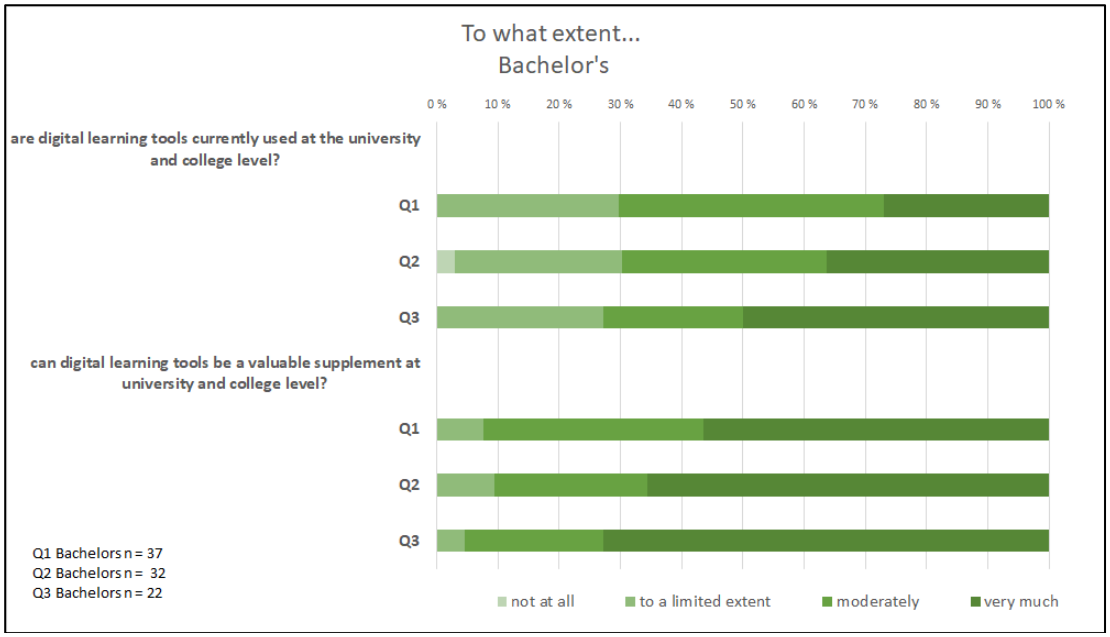


Figure A43. Student engagement in forest-related out-of-school activities (All levels)

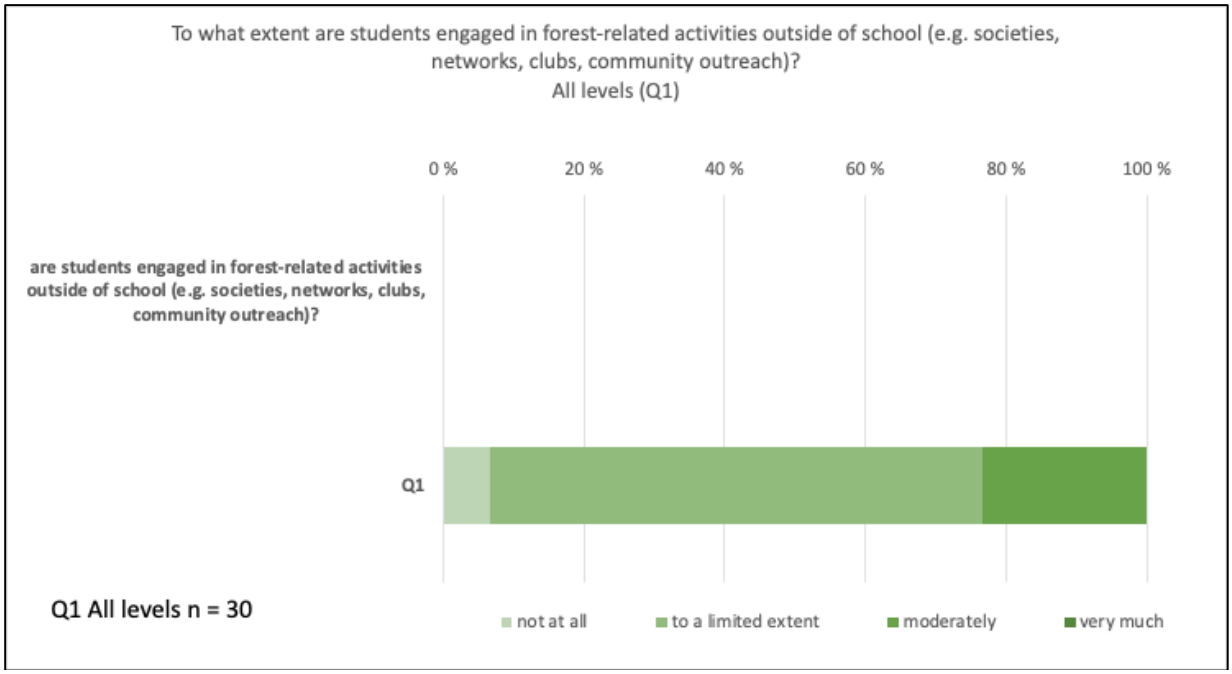


Figure A47. Use of digital learning tools in degree programme (Bachelor's)

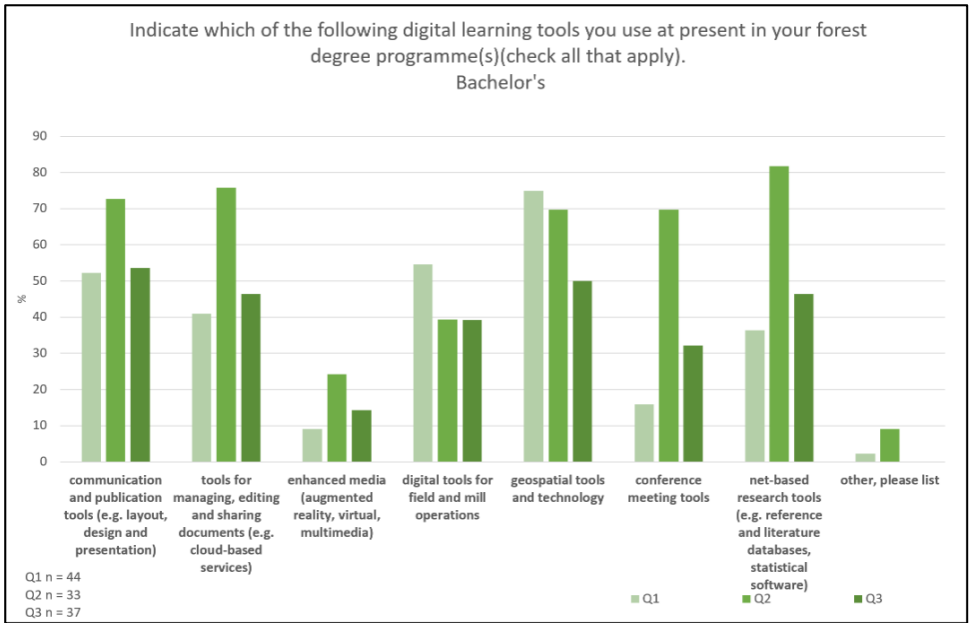


Figure A48. Use of digital learning tools at university and college level

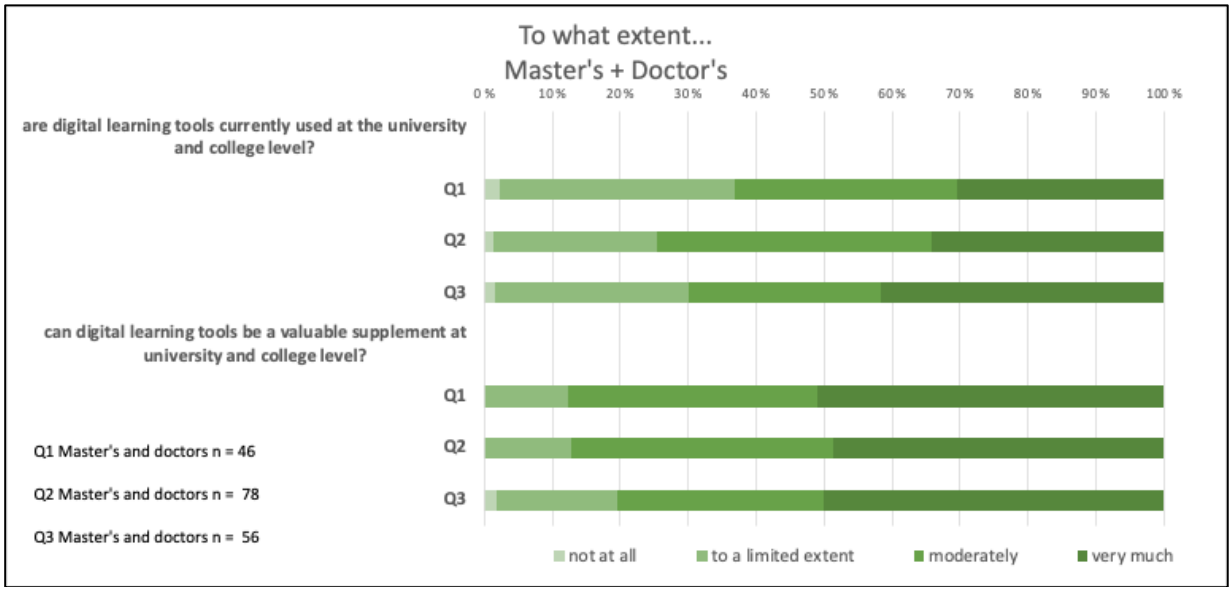


Figure A49. Use of digital learning tools in degree programme (Master's and doctoral)

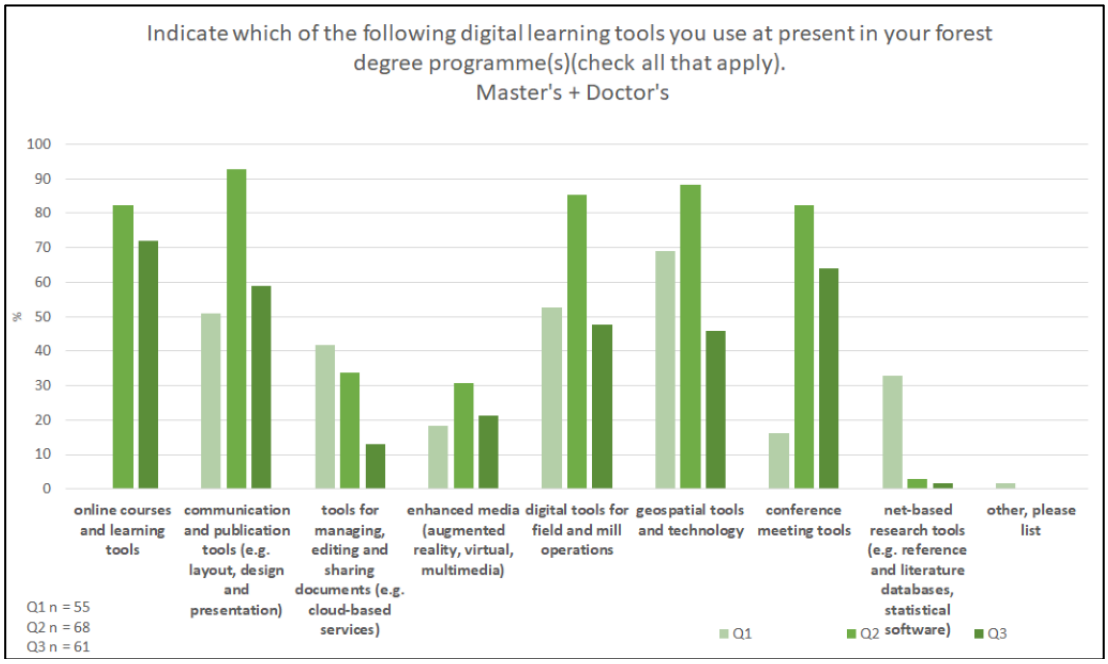


Figure A50. Desired digital learning tools for use in degree programme (Bachelor's)

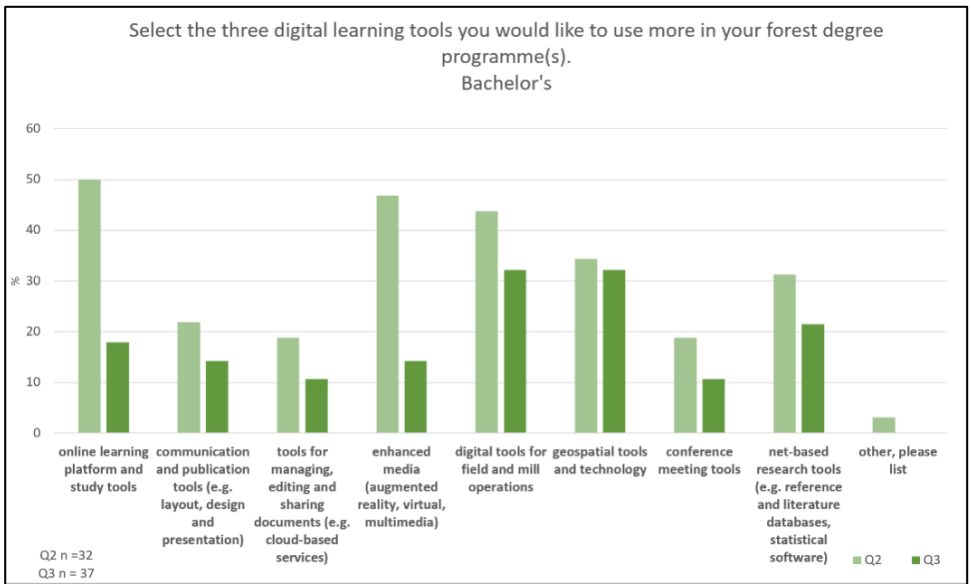


Figure A50.1 Coverage of forest-related topics in degree programme (Generic skills) (Master's and doctoral)

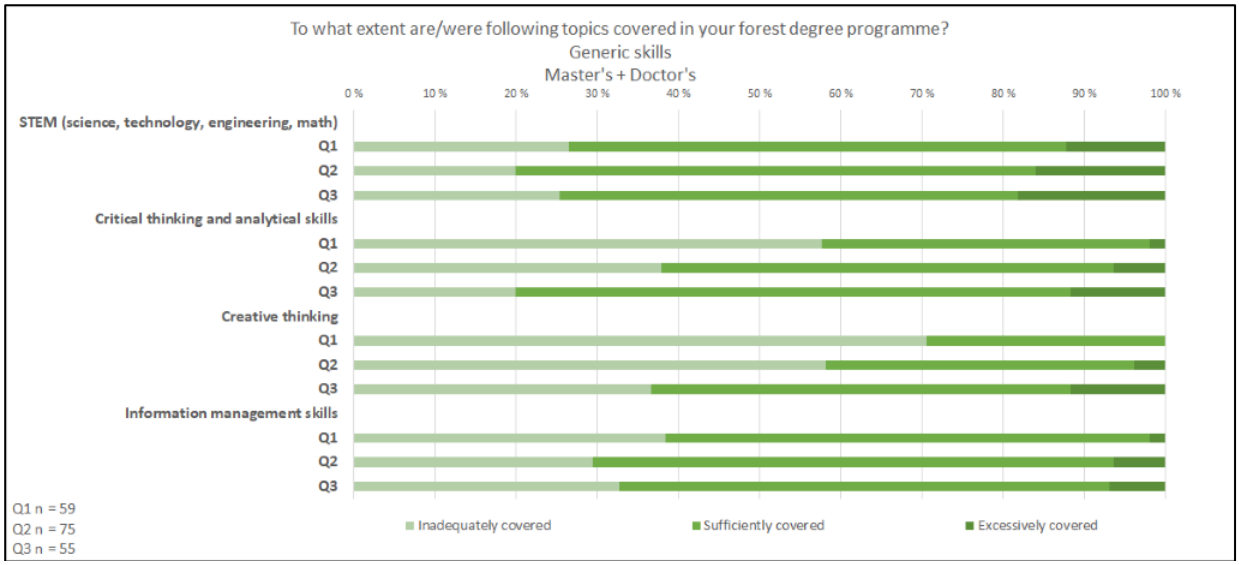


Figure A50.2 Coverage of forest-related topics in degree programme (Generic skills) (Master's and doctoral)

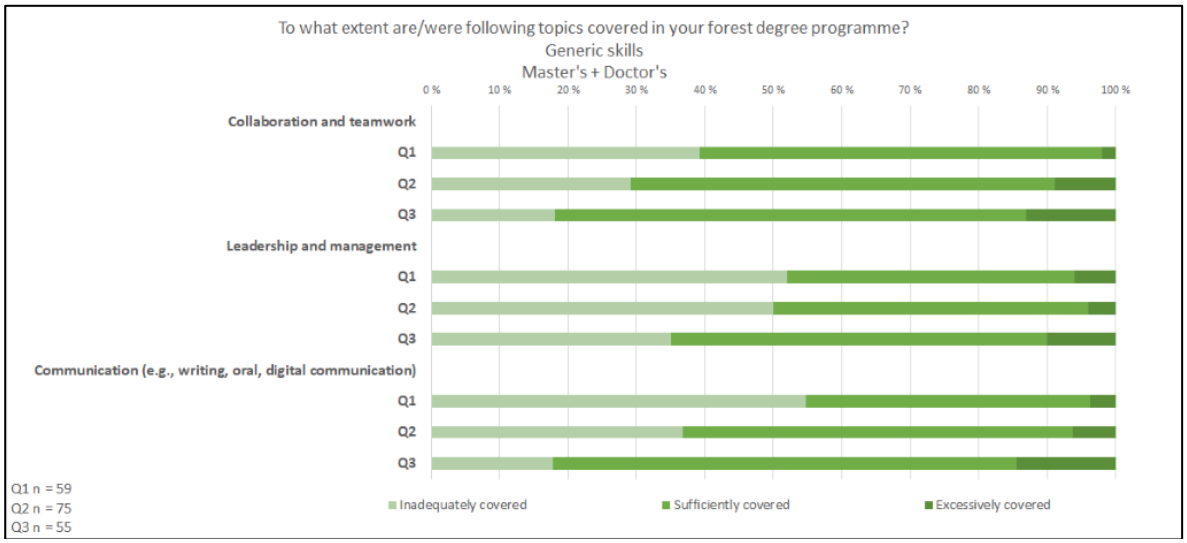


Figure A50.3 Coverage of forest-related topics in degree programme (Other skills) (Master's and doctoral)

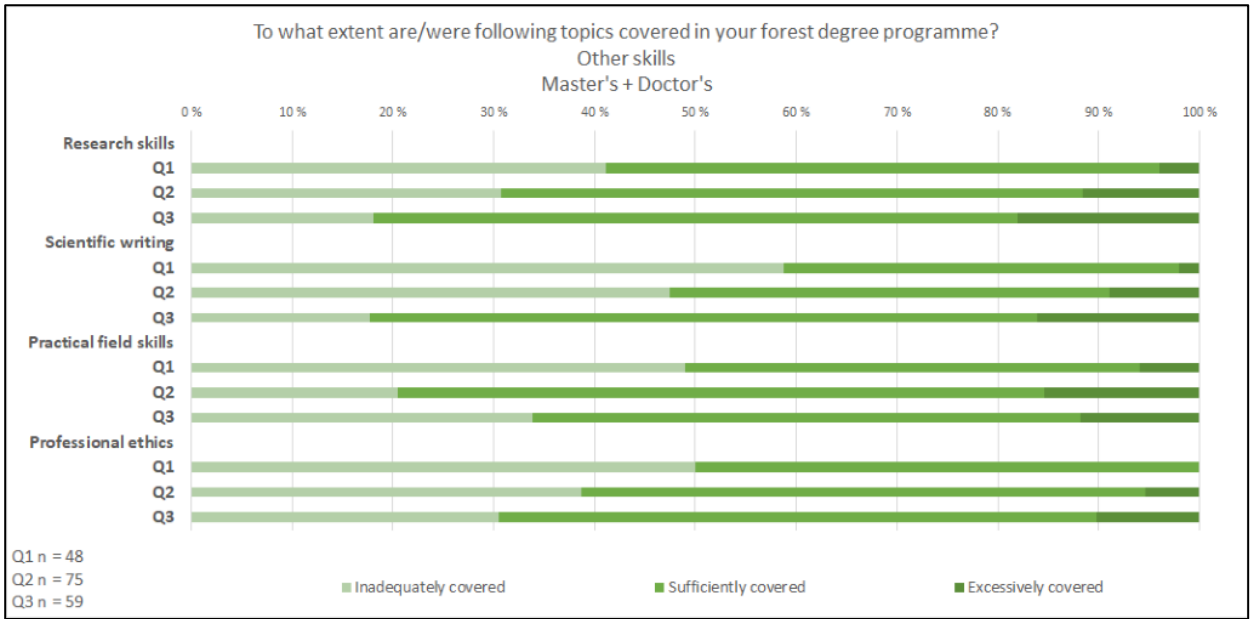


Figure A51. Desired digital learning tools for use in degree programme (Master's and doctoral)

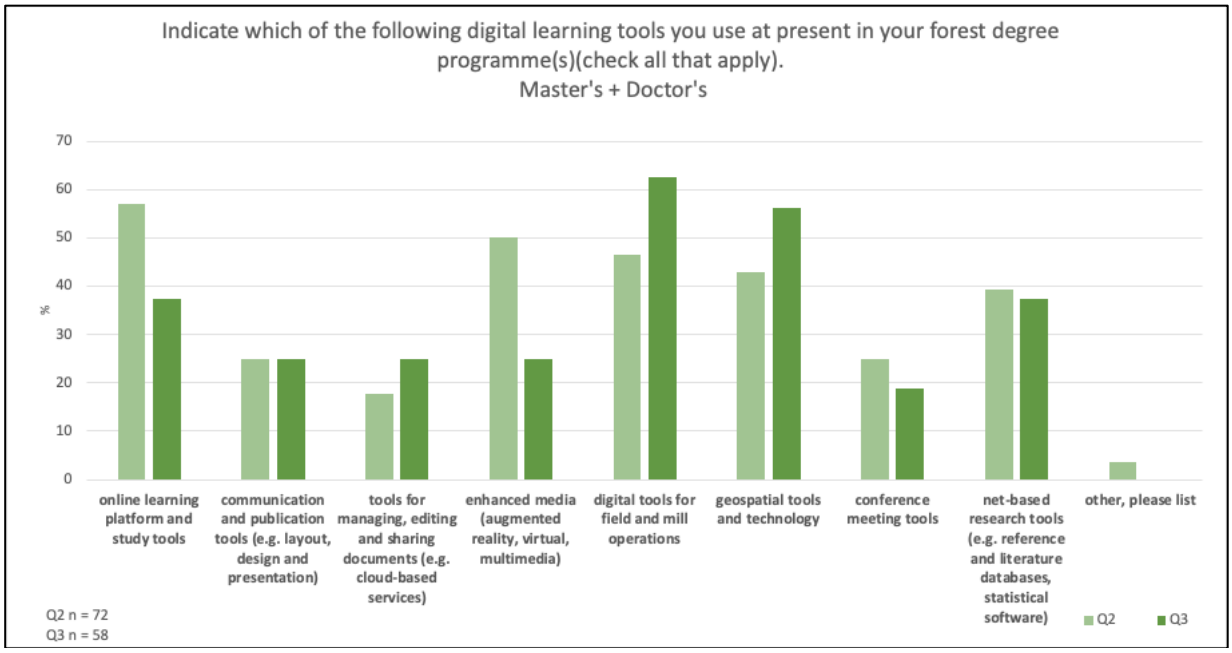


Figure A52. Familiarity with digital learning environments (Bachelor's)

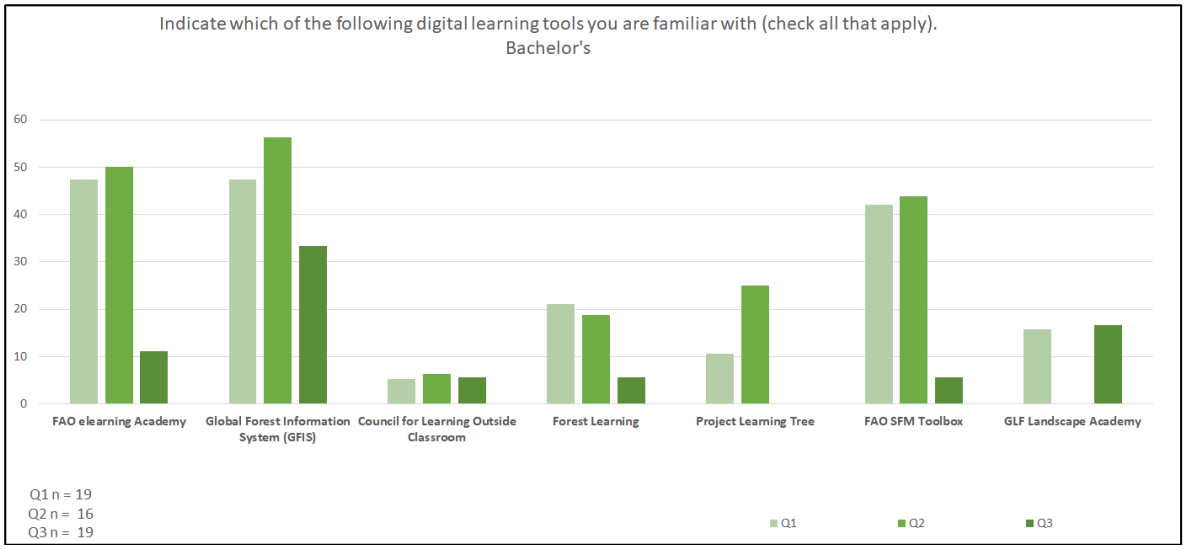


Figure A53. Familiarity with digital learning environments (Master's and doctoral)

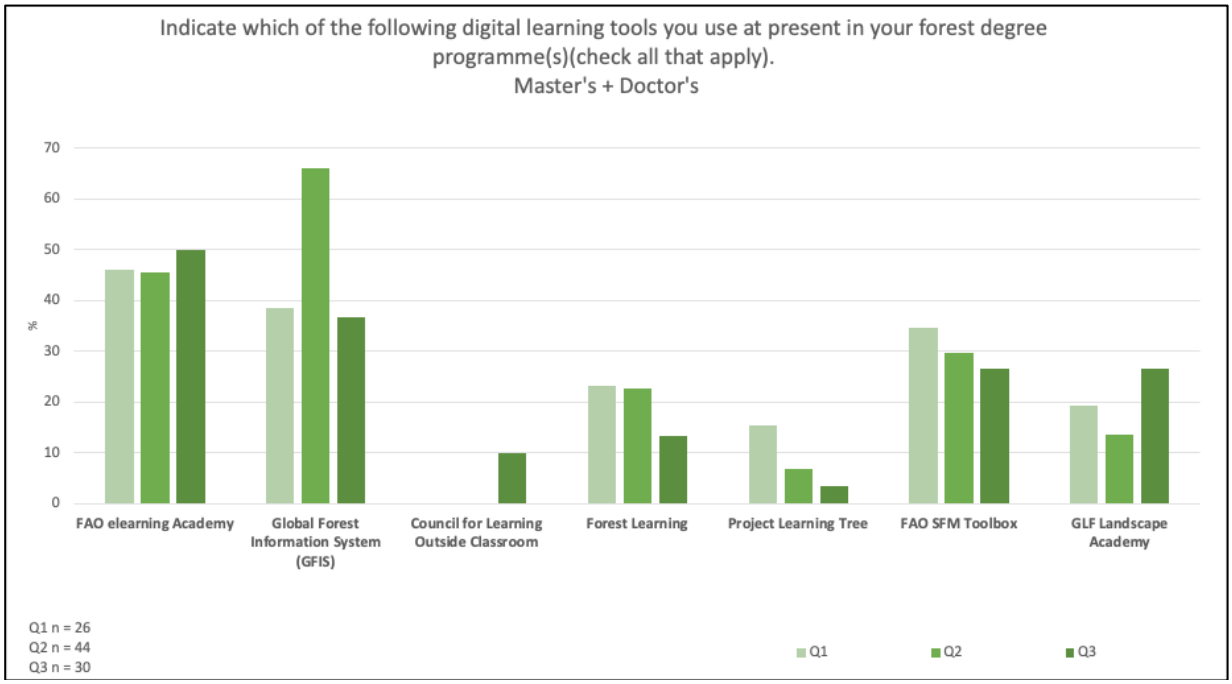


Figure A52.1. Student engagement in forest-related out-of-school activities (Master's and doctoral)

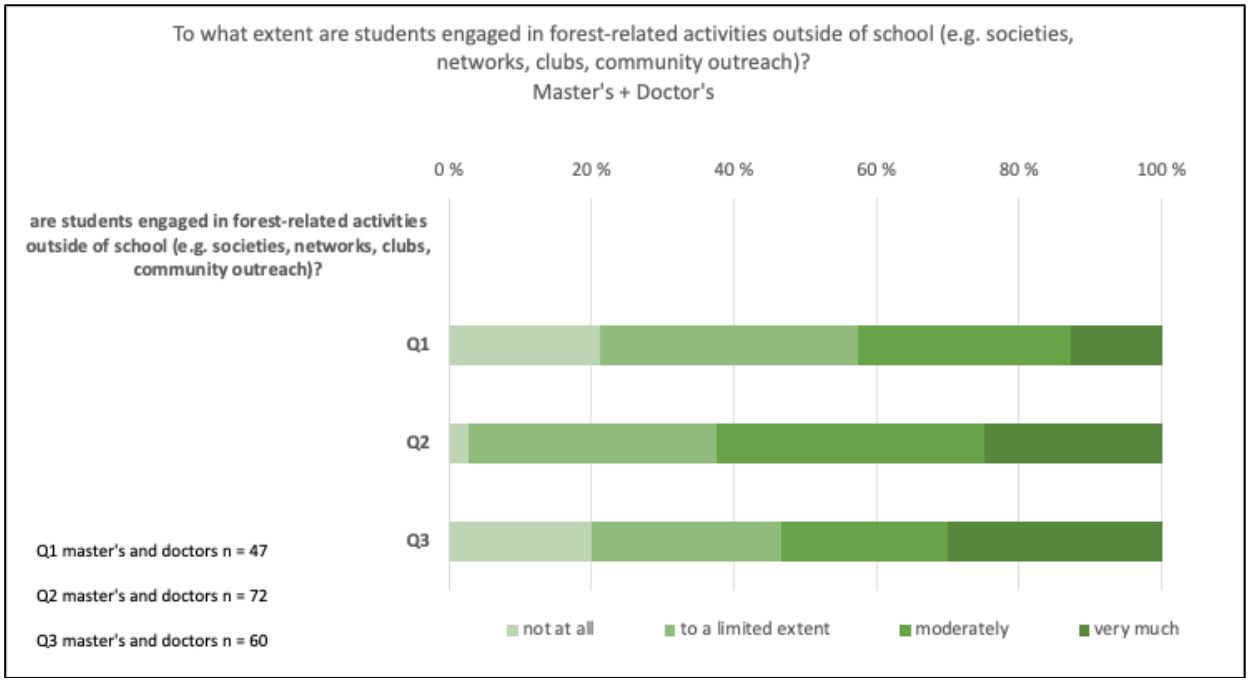


Figure A53. Availability of resources in forest degree programme

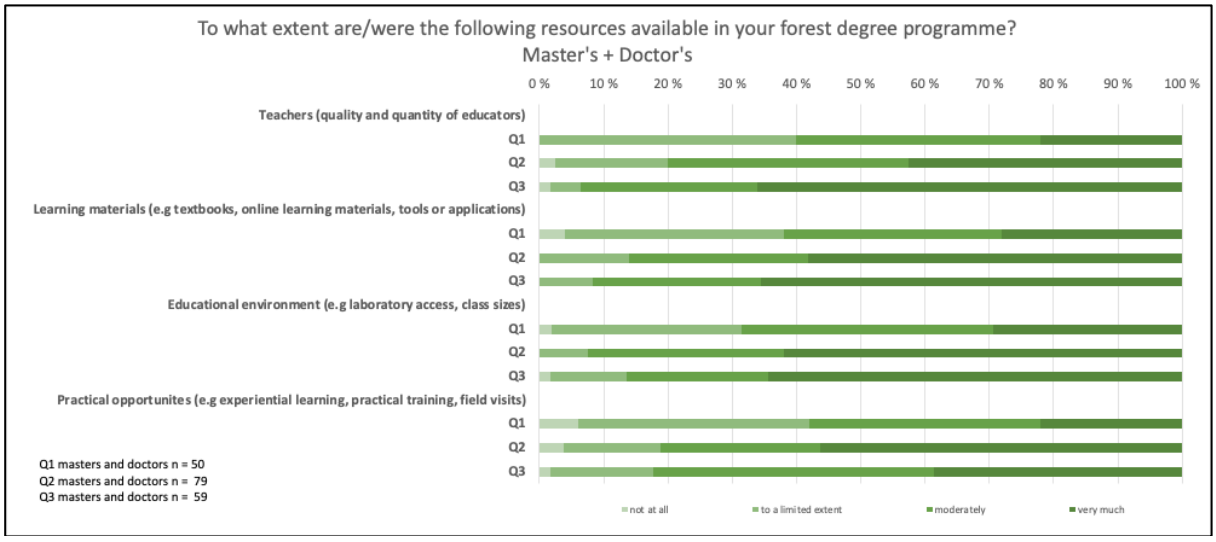


Figure A55. Coverage of forest-related topics in degree programme (forest biodiversity, forest soils, forest ecology, wood and NWFP, forest genetic resources) (Bachelor's)

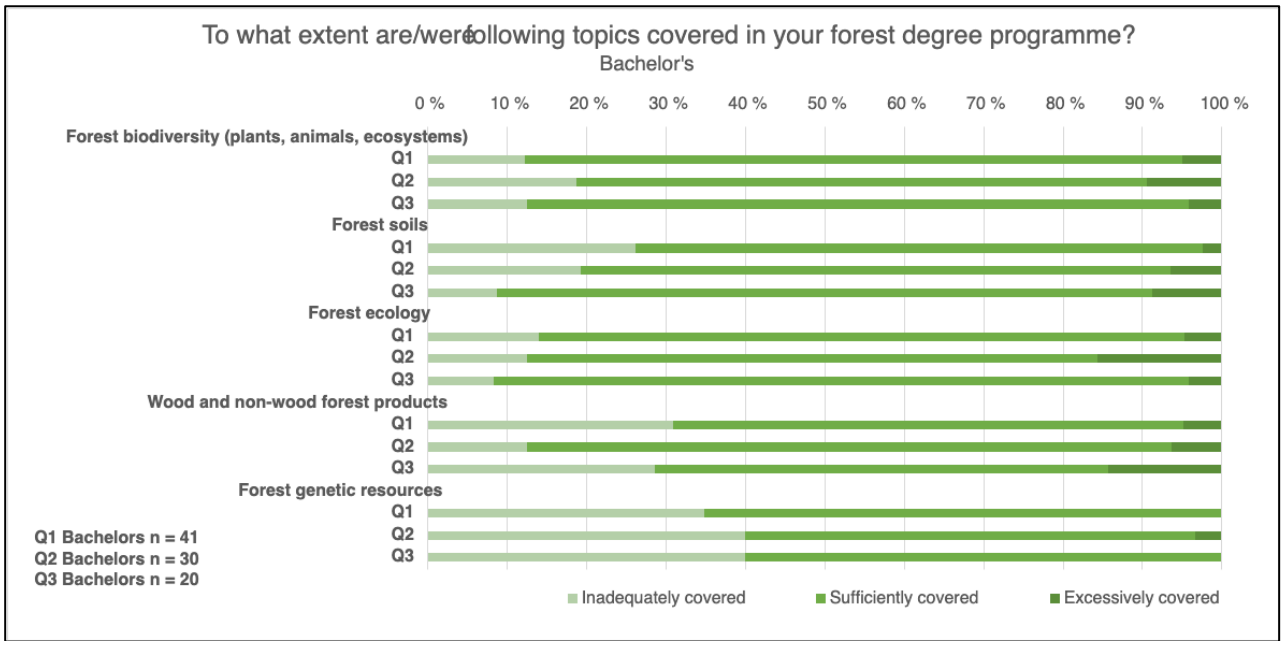


Figure A56. Coverage of forest-related topics in degree programme (forest biodiversity, forest soils, forest ecology, wood and NWFP, forest genetic resources)

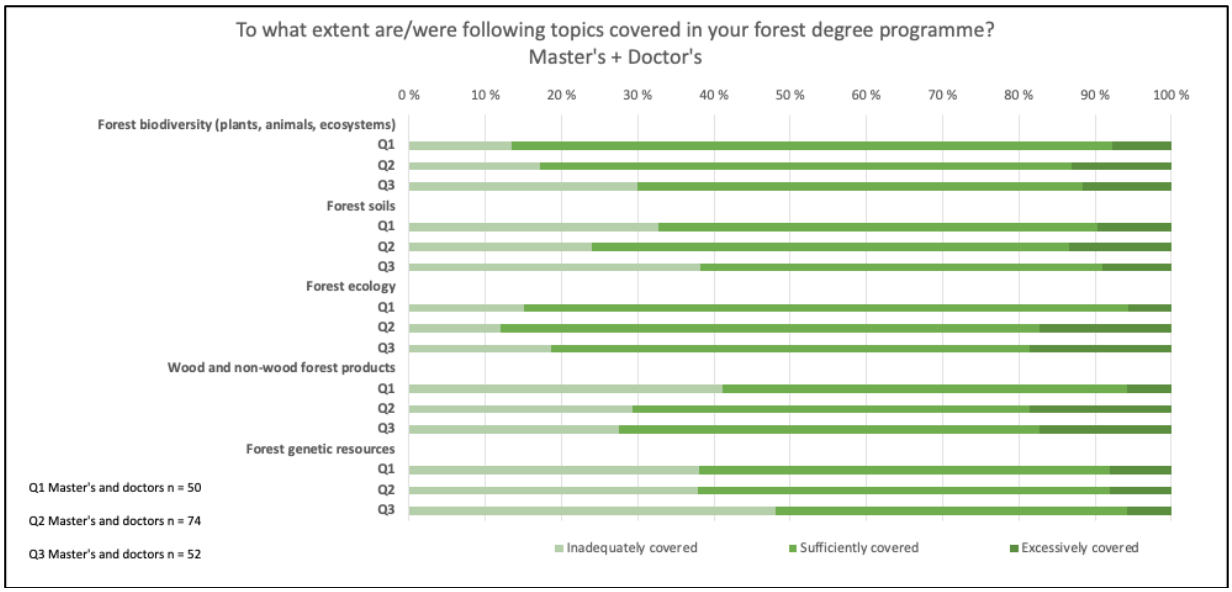


Figure A58. Coverage of forest-related topics in degree programme (forest and climate change, forest mapping, forest planning, silviculture, forest landscape restoration) (Bachelor's)

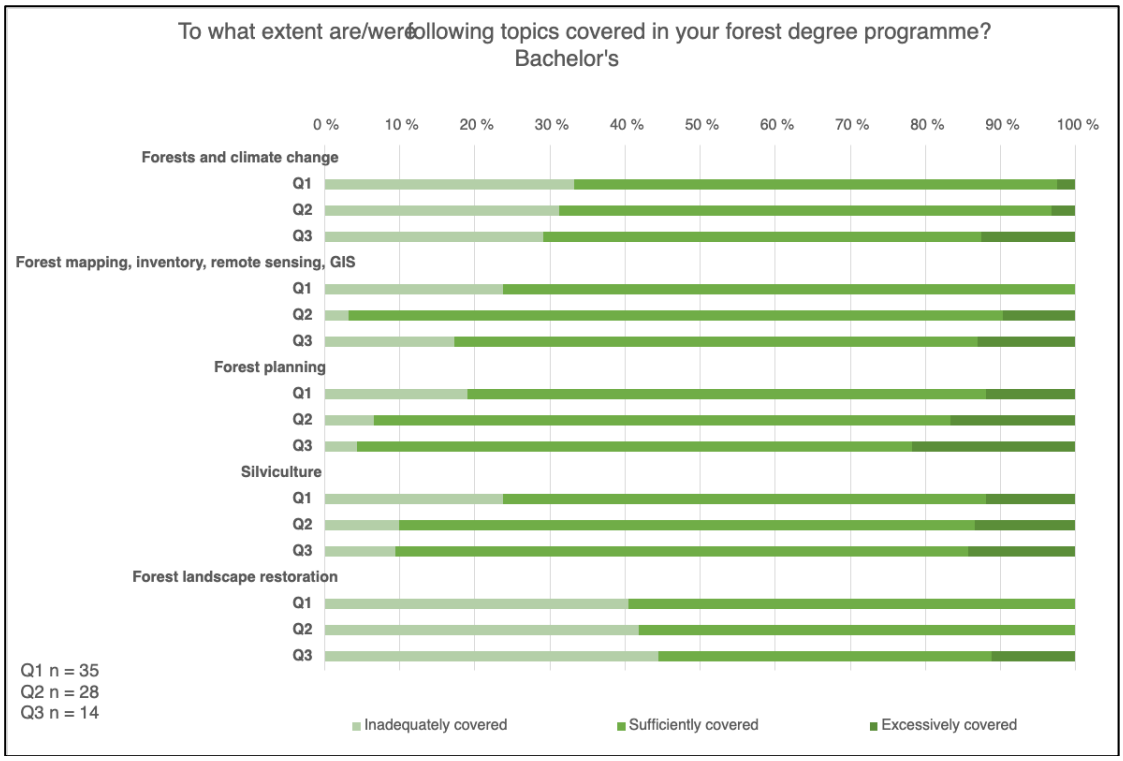


Figure A59. Coverage of forest-related topics in degree programme (forest and climate change, forest mapping, forest planning, silviculture, forest landscape restoration)

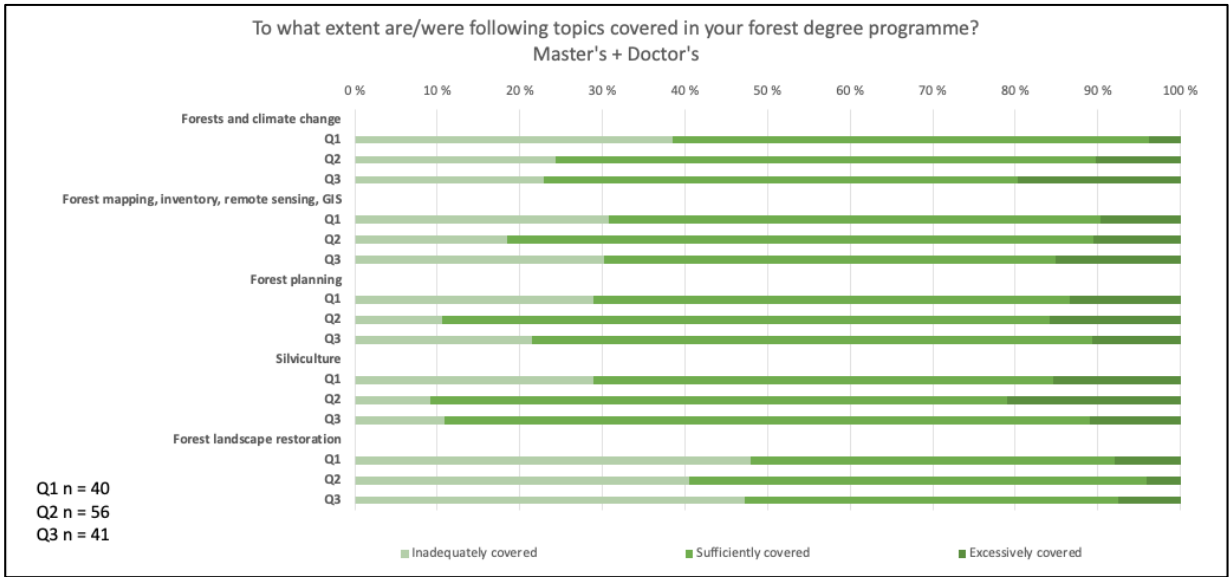
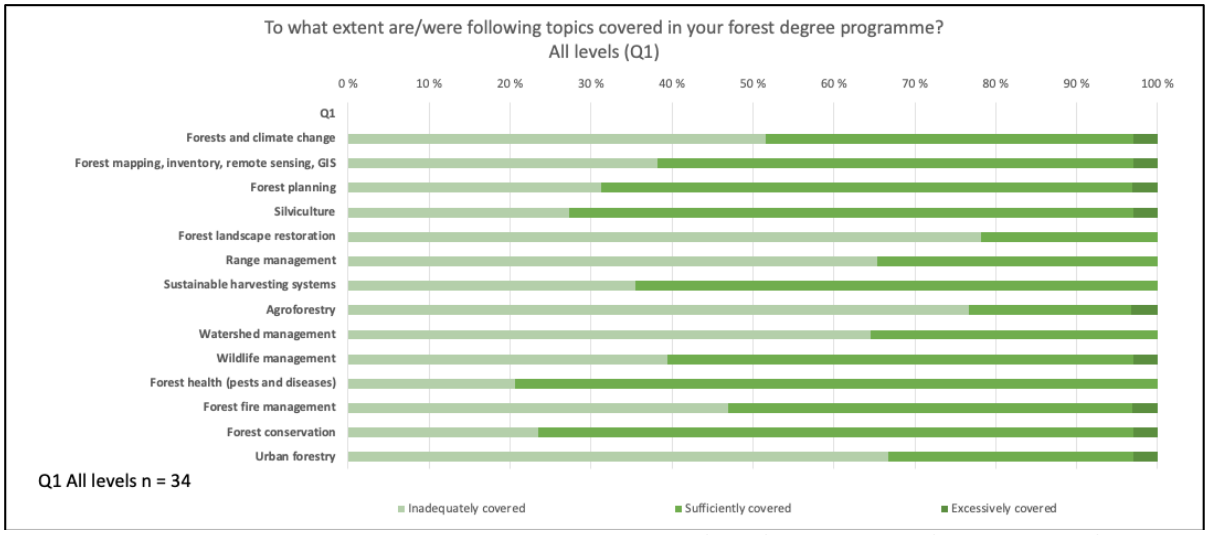


Figure A60. Coverage of forest-related topics in degree programme (forest and climate change, forest mapping, forest planning, silviculture, forest landscape restoration)



Note: The Online courses and learning tools option were not in the questionnaire for professionals and therefore bar is missing from Figure A60

Figure A61. Coverage of forest-related topics in degree programme (range management, sustainable harvesting systems, agroforestry, watershed management, wildlife management) (Bachelor's)

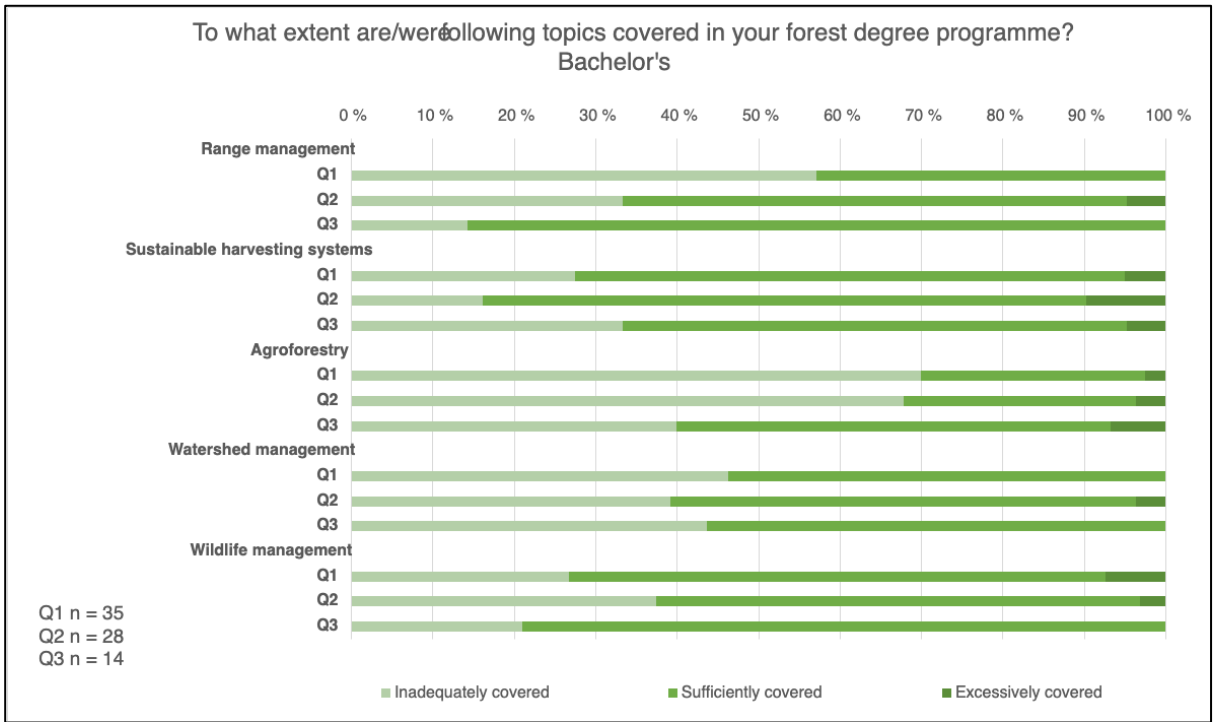


Figure A63. Coverage of forest-related topics in degree programmes (forest health) (Bachelor's)

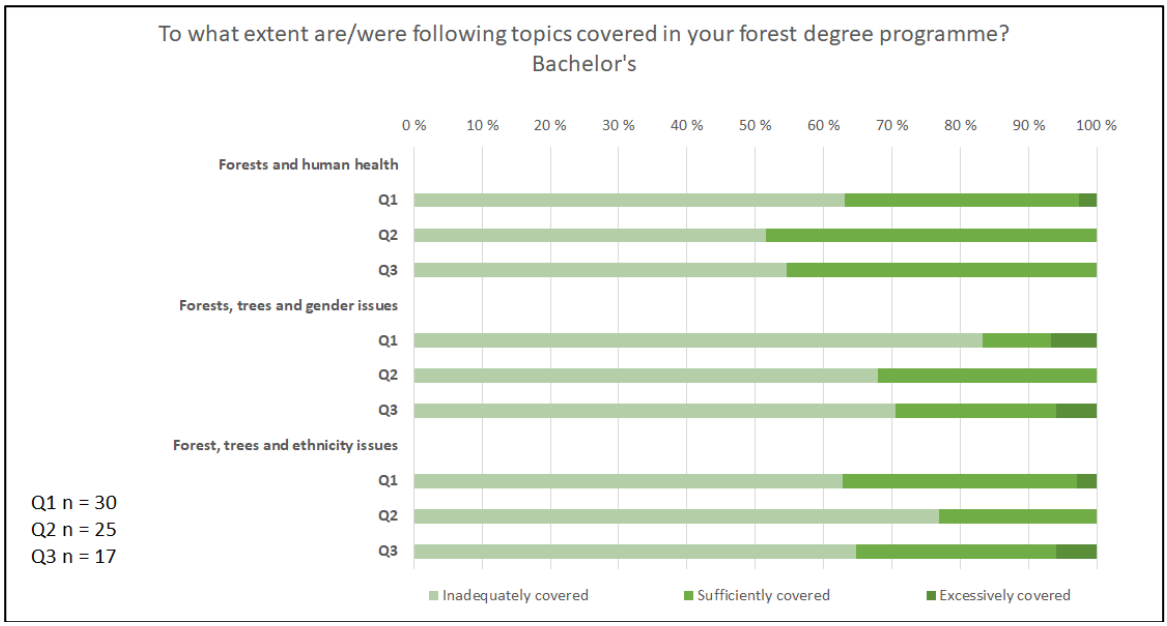


Figure A64. Coverage of forest-related topics in degree programme (Forest health – pests and diseases, Forest fire management, Forest conservation, Urban forestry)

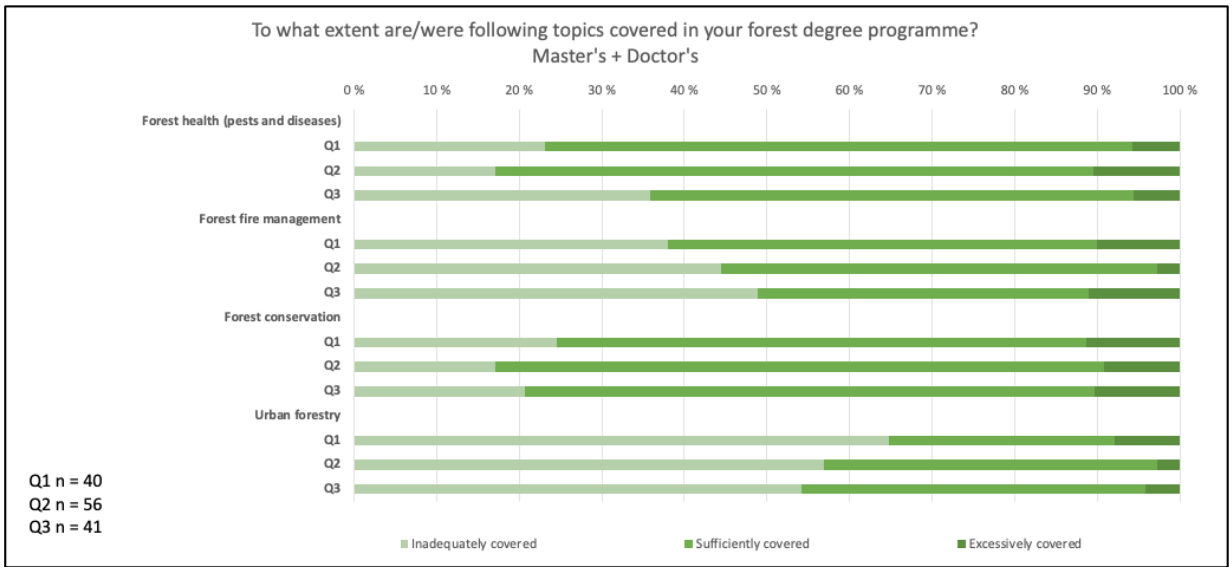


Figure A65. Coverage of forest-related topics in the degree (wood as renewable energy, forest-based recreation, traditional and/or indigenous forest-related knowledge, cultural values of forests and trees) (Bachelor's)

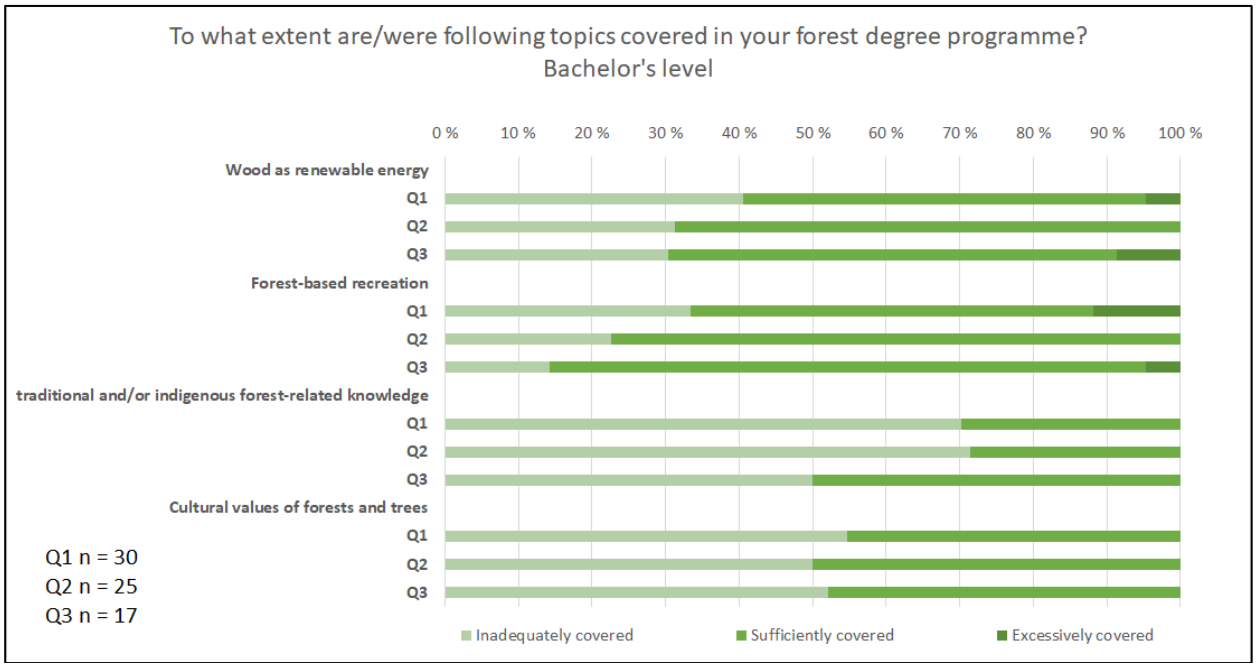


Figure A66. Coverage of forest-related topics in degree programme (Wood as renewable energy, Forest-based recreation, Traditional and/or indigenous forest-related knowledge, Cultural values of forests and trees)

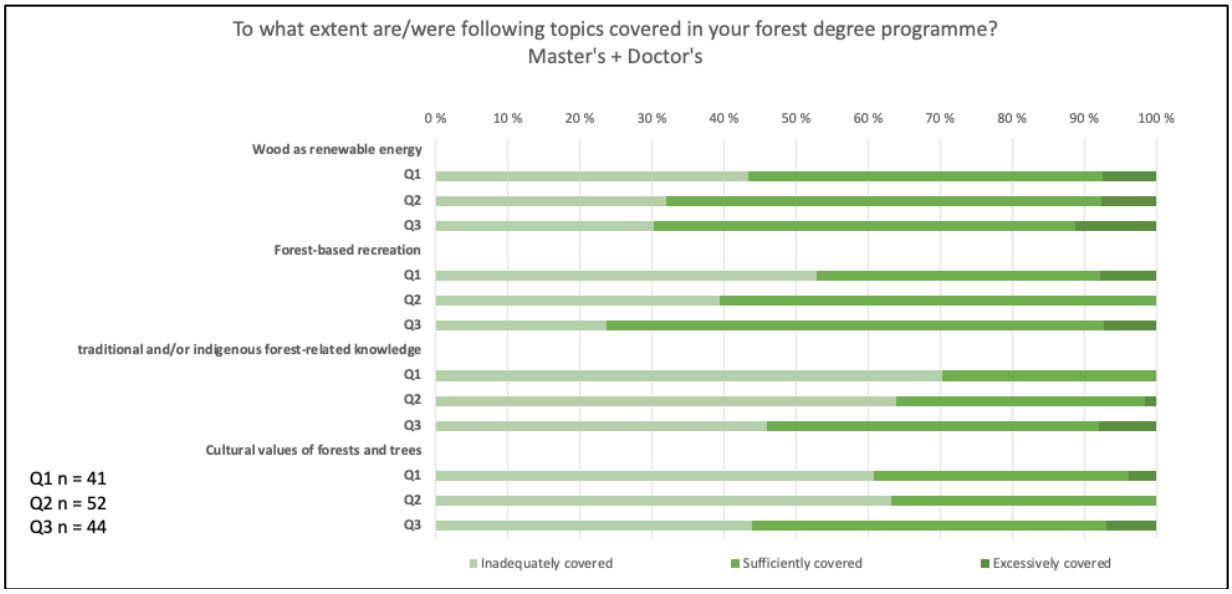


Figure A70. Coverage of forest-related topics in degree programme (entrepreneurship, forest industry, marketing and management, wood technology, small-scale forest enterprise) (Bachelor's)

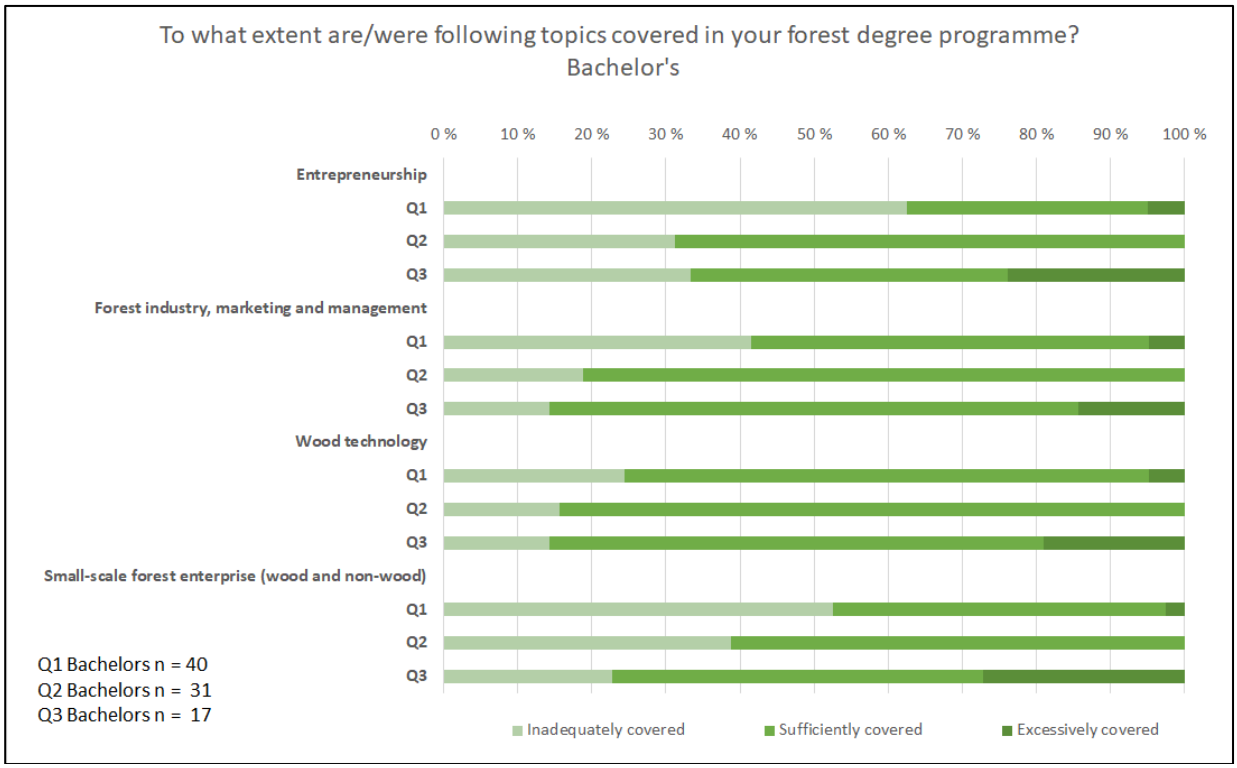


Figure A72. Coverage of forest-related topics in degree programme (entrepreneurship, forest industry, marketing and management, wood technology, small-scale forest enterprise — wood and non-wood)

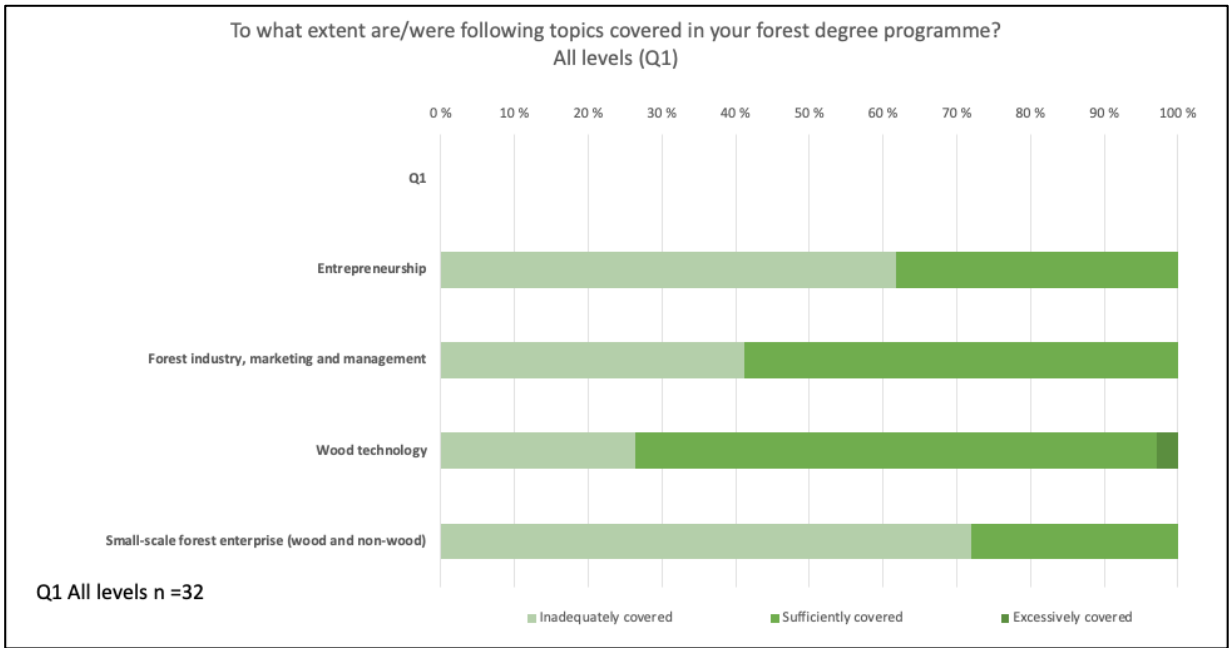


Figure A76. Availability of forest-related internship or PT employment and effect on learning

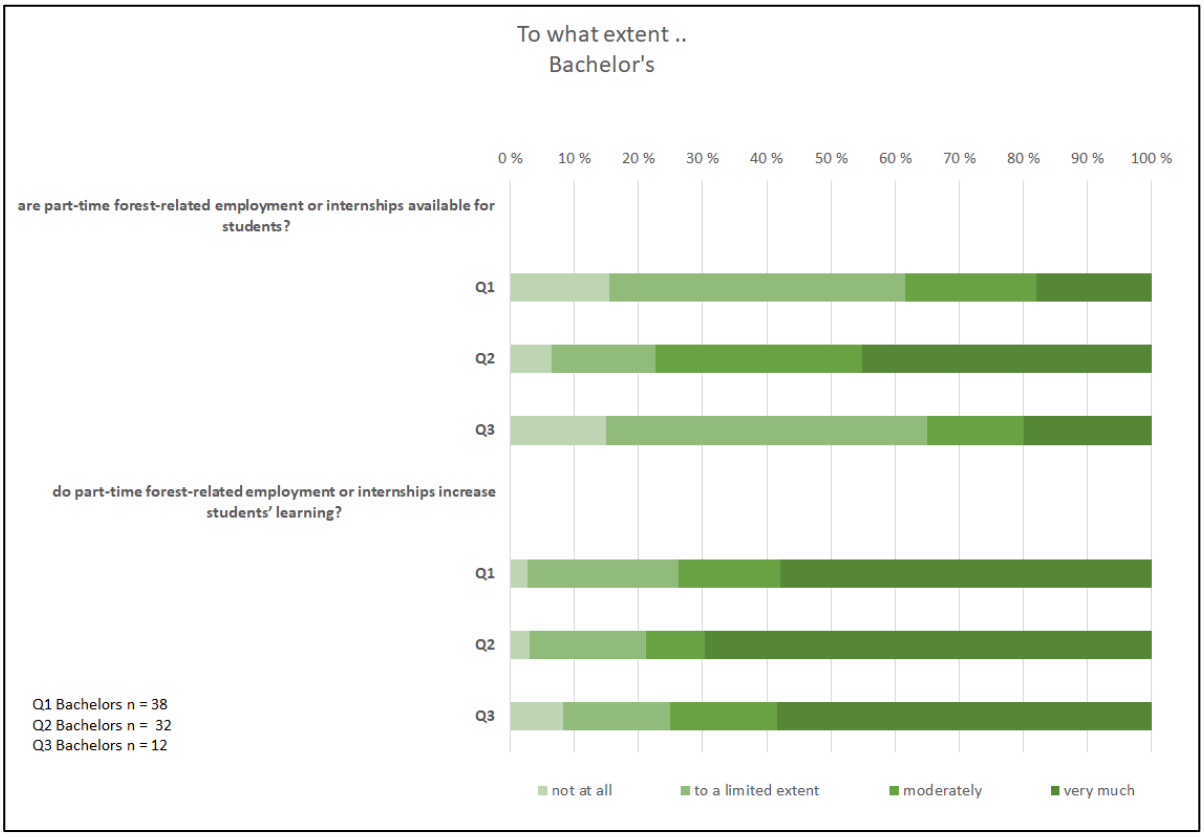


Figure A77. Availability of forest-related internship or PT employment and effect on learning (Master's and Doctor's)

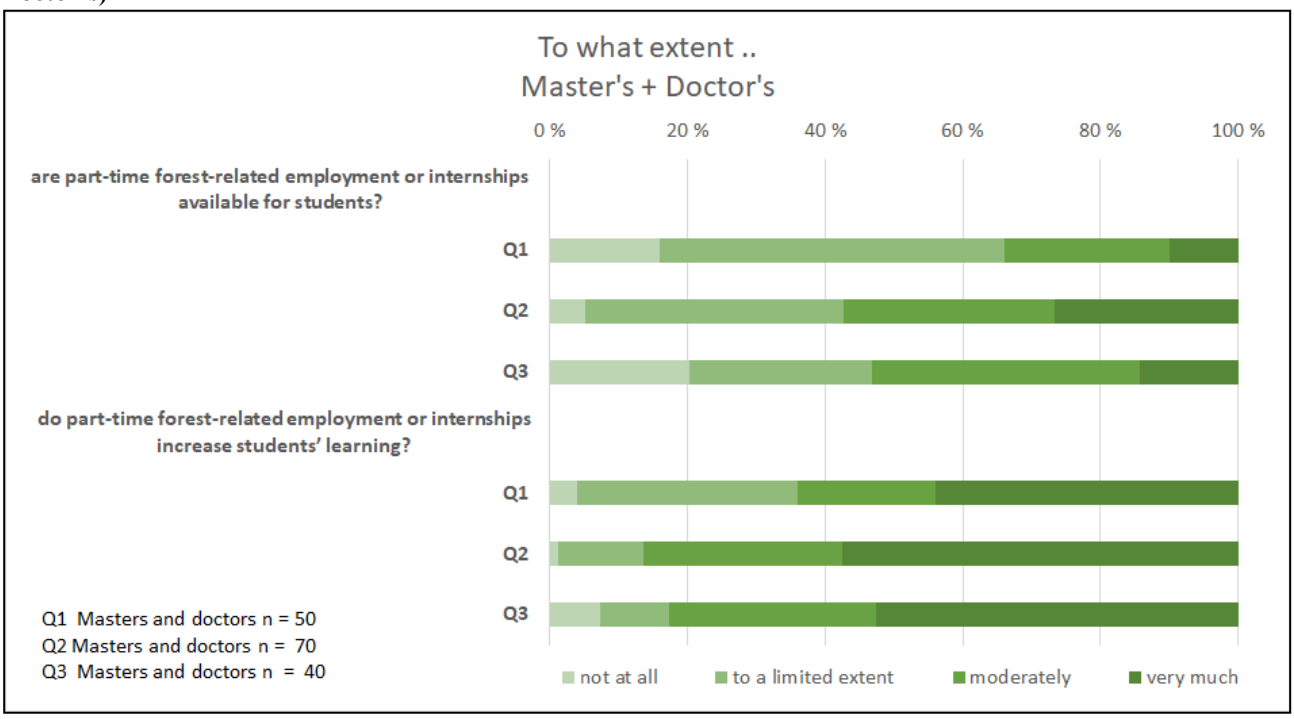


Figure A78. Workforce readiness within degree programme (Bachelors')

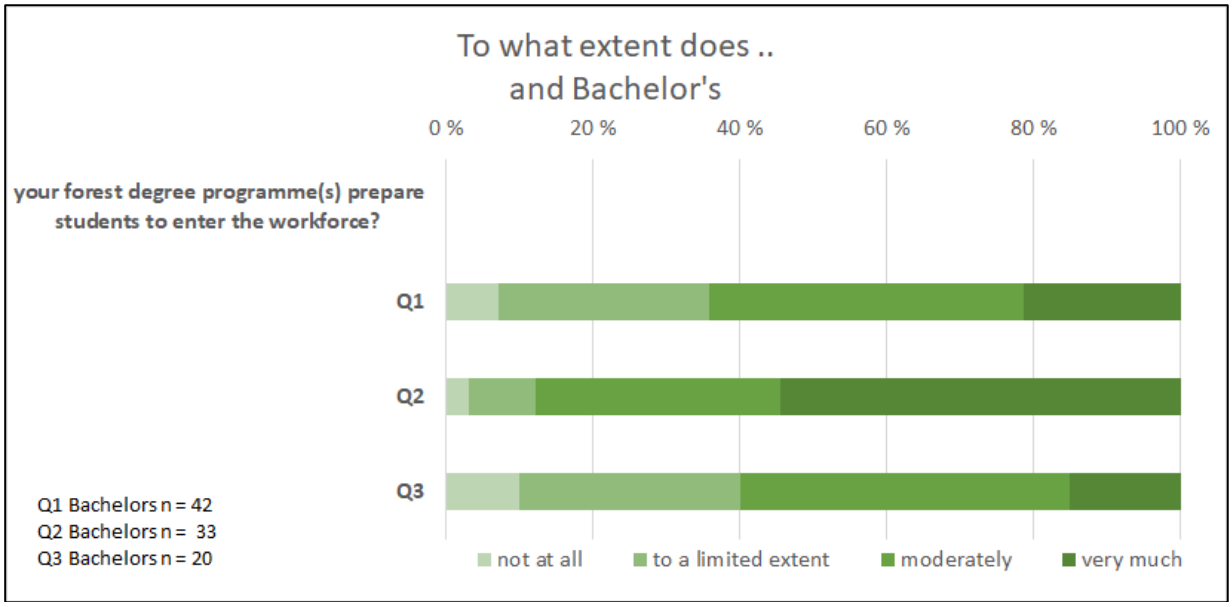


Figure A79. Workforce readiness within degree programme

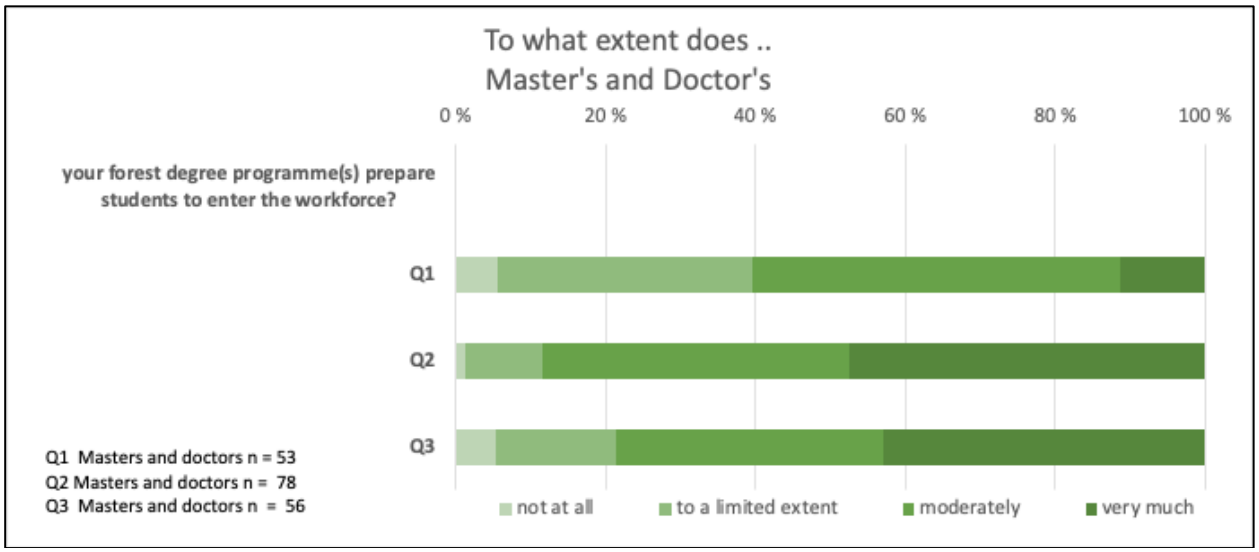


Figure A81. Gender as a factor and influence in forest-related employment

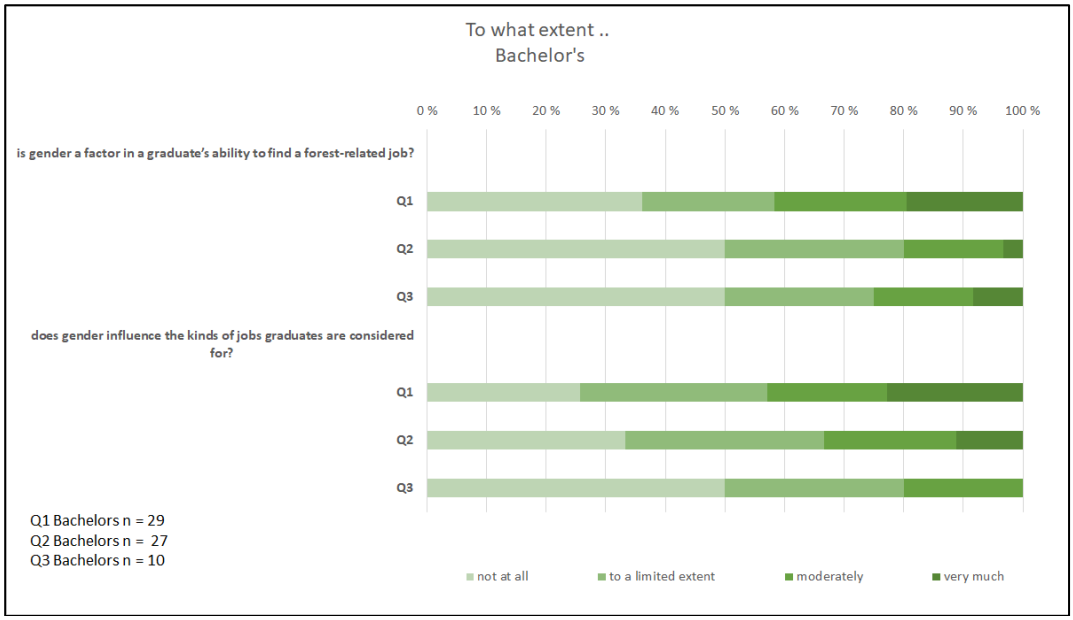


Figure A82. Gender as a factor influencing forest-related employment

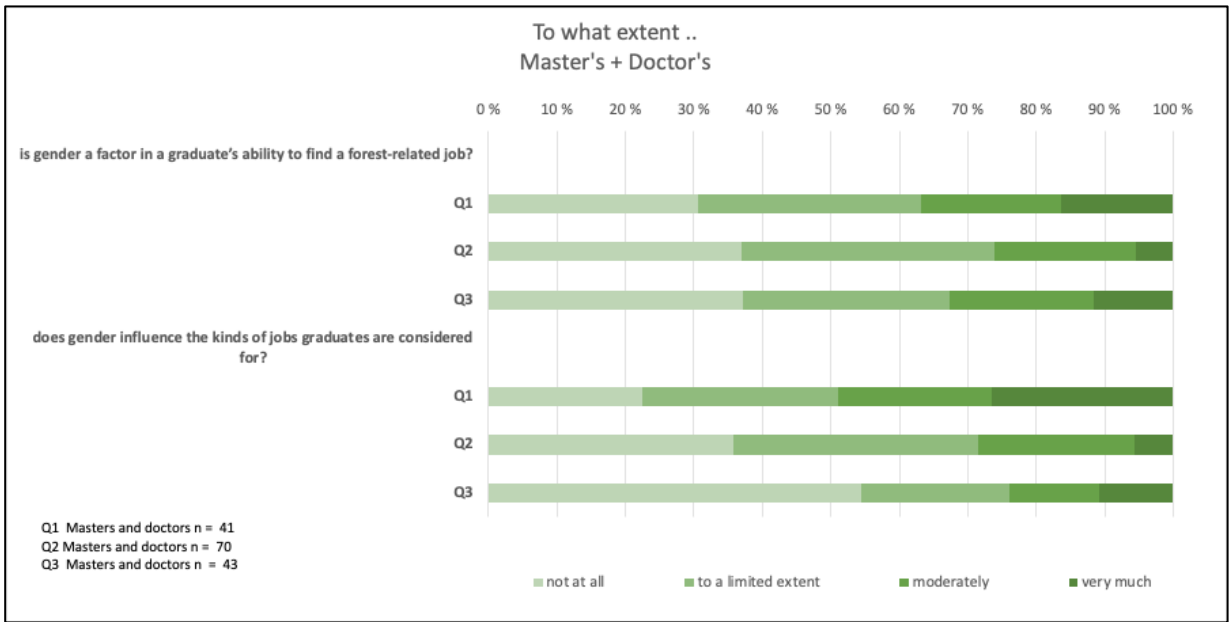


Figure A87. Availability of affordable continuing non-formal forest education

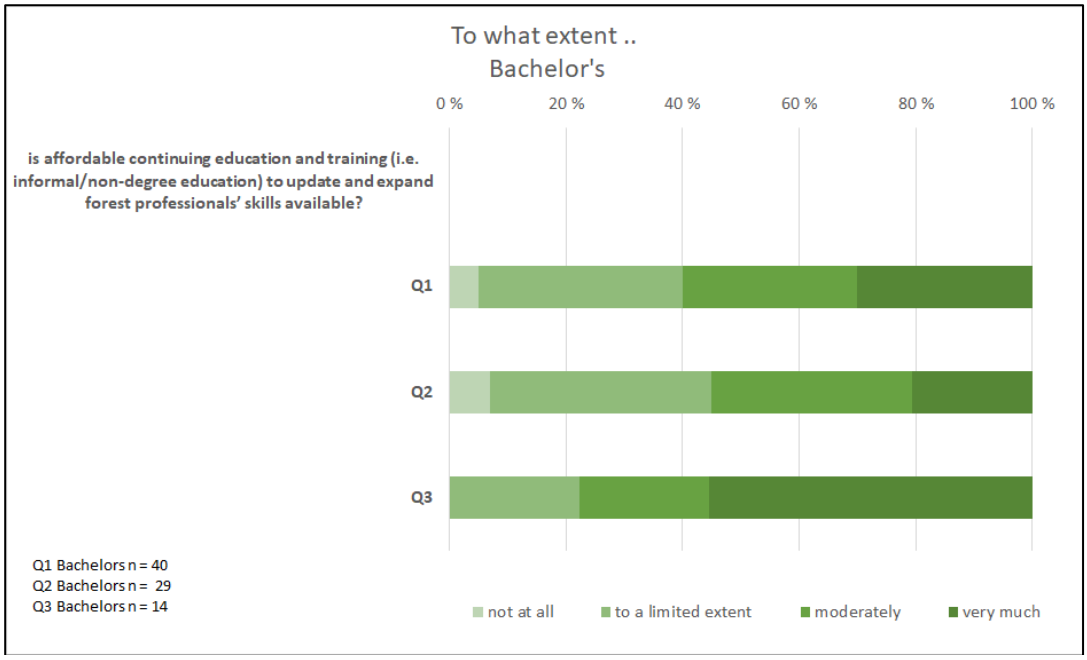


Figure A88. Availability of affordable continuing non-formal forest education

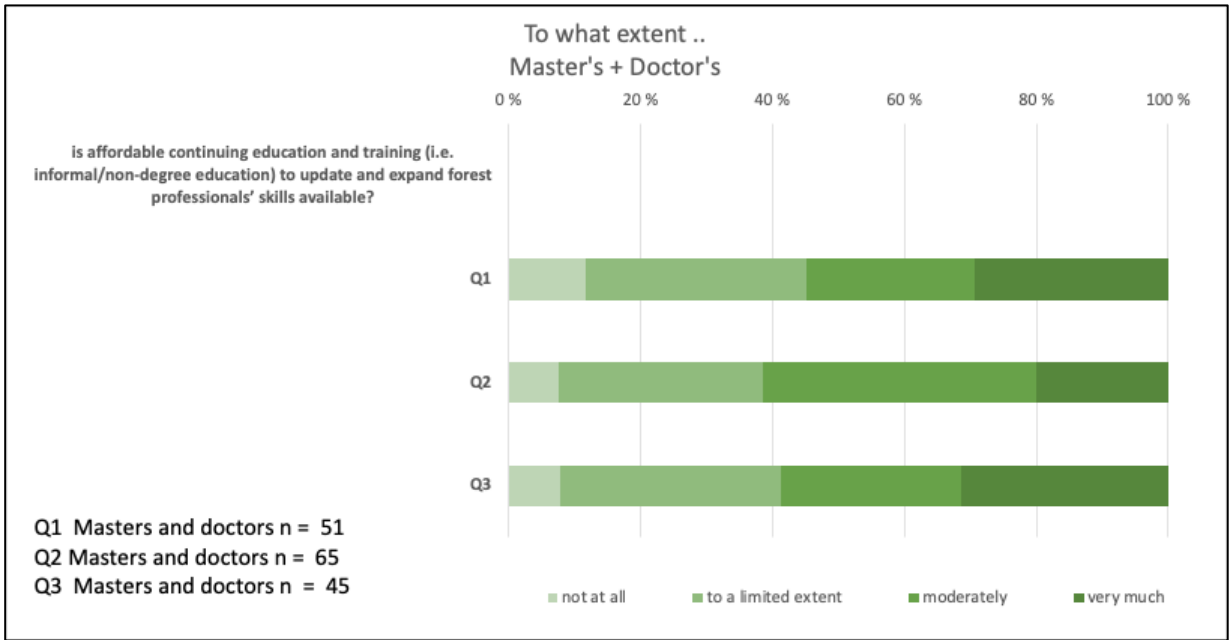


Figure A90. Overall trend in student enrollment in forest-related programme (ten-year period) (Bachelor's)

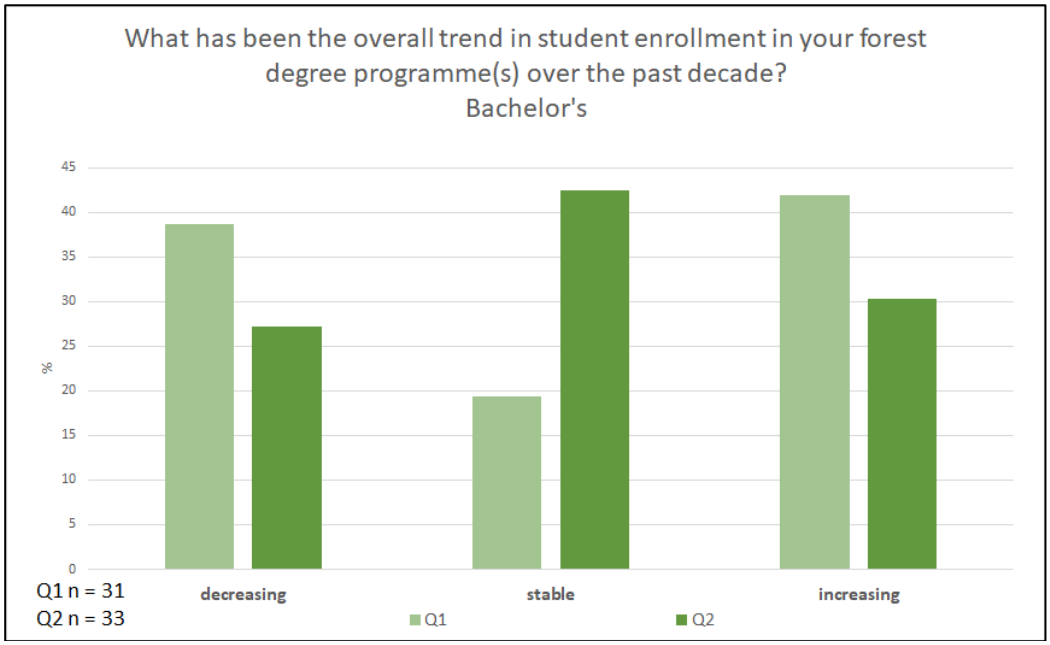


Figure A91. Overall trend in student enrollment in forest-related programme (10-year period) (Master's and doctoral)

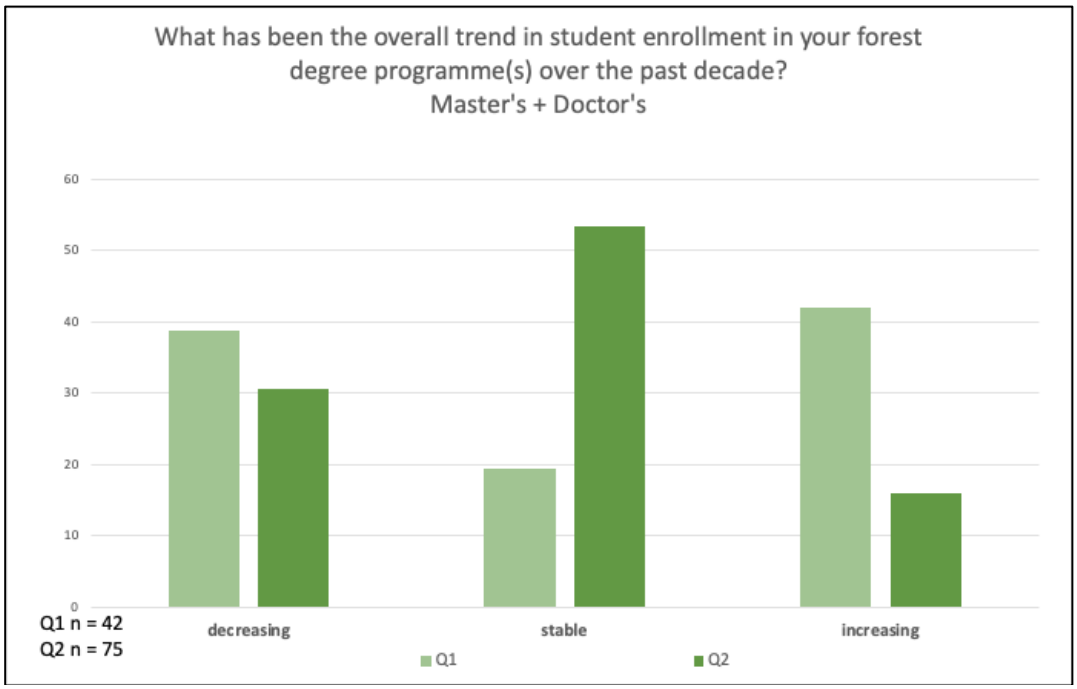
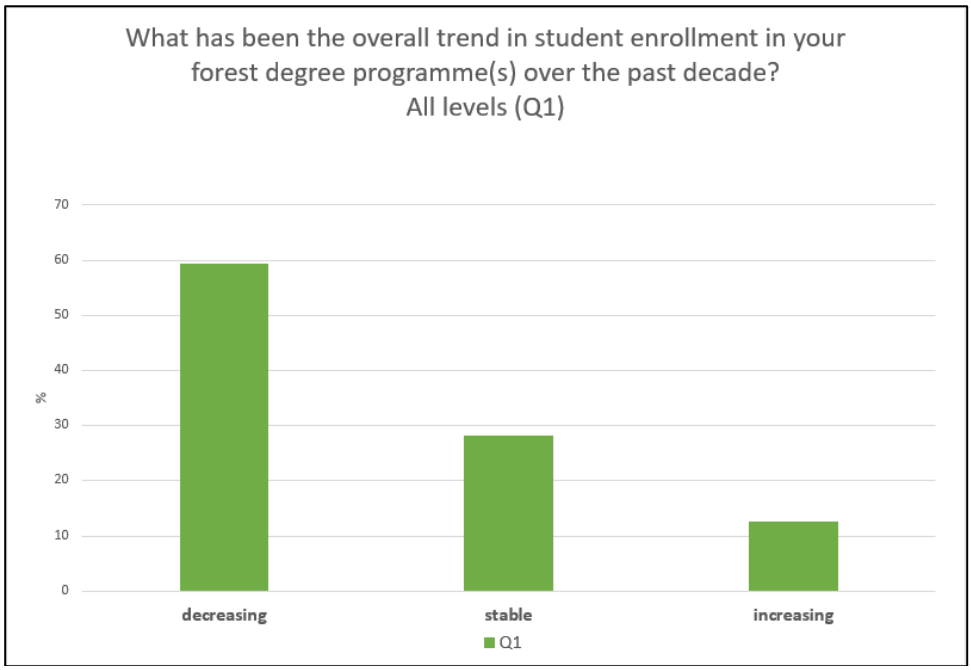


Figure A92. Overall trend in student enrollment in forest-related programme (10-year period) (All levels)



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