TWENTY YEARS AFTER THE BOLOGNA DECLARATION

CHALLENGES FOR HIGHER FORESTRY EDUCATION

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PREFACE I

The SILVA Network originally aimed at facilitating student exchange between universities with a forestry education. During the years, this objective changed more toward improving forestry education at these universities. The Network does that though facilitating discussions and contacts between teachers and learners at these educative institutes. The means the Network employs are the annual meetings, where teachers and learners present their experiences, and the proceedings based upon these presentations.

In 2019, the Department of Forest Sciences of the Technische Universität Dresden organized the annual meeting in the forest-town Tharandt, where this Department is located. The proceedings of this meeting are presented here. The 27 participants listened to and discussed 13 contributions. Three group discussions and a general discussion concluded the meeting. The editors are sure each of the participants was presented during the meeting with some important aspects of forestry education, which can be of use for them at home.

The excursion, traditional part of the annual conferences, guided the participants in the Tharandter Wald (Tharandt Forest) with its nice traces of forestry history, among them an active charcoal kiln and a burial place of forestry icon Heinrich Cotta. We do thank the staff of the Department of Forest Sciences for organizing this meeting, making the participants feel at home.

Many thanks are due to the authors of the papers below, without whom no proceedings could be presented, and to the reviewers Jörg Brunet, Gijs Elkhuizen, Mauro Masiero and Gerhard Müller-Starck, who, together with the editors, reviewed the papers.

The editors

PREFACE II

The Department of Forest Sciences, since 1929 belonging to Technische Universität Dresden and situated in the Forststadt Tharandt, has been dedicated to Forest Sciences since 1811. It was Heinrich Cotta (1763-1844) who proposed this place for the Forest Academy, very close to the forest and far enough from the city of Dresden that provided, according to his view, too much distractions for students. There is a famous a saying from Heinrich Cotta that displays his conviction regarding forest education:

> *Der Beruf des Forstmannes ist halb Kunst, halb Wissenschaft und nur die Ausführung macht hierbei den Meister.*
> (The forester's profession is half art, half science and only the application of it makes him master.)

Although this perception might still be valid today, many things have changed in forest education since the beginning of the 19th century. Today, with 9 institutes and 17 professors the Department of Forest Sciences offers four modern study programmes (forest sciences BSc and MSc, wood science and technology, tropical forestry) and contributes to the Master programme of spatial development and natural resource management organized by the Faculty of Environmental Sciences. In combination with a famous library of more than 125,000 volumes, including bibliophilic treasures from the 17th and 18th century, and the large Tharandt Botanic Garden and Arboretum, students encounter a supportive surrounding for imparting knowledge, skills and abilities to master the challenges of today.

For many years, several lecturers from Tharandt have been participating in and supporting SILVA Network activities. That is why we are very proud that in 2019, 20 years after the Bologna Declaration, we could host this important annual conference.

Norbert Weber

Participants of the annual conference of the SILVA Network in Tharandt, Germany, June 2019.

CONTENTS

SUMMARY

PIETER SCHMIDT[1]

The meeting opened and hence also these proceedings open with a keynote describing some relevant, personal observations on the Bologna process Europe wide. This keynote is followed by two papers from German universities describing the more special developments after Bologna at their universities. These first three papers cover the content indicated by the title of this meeting, which does not mean that no Bologna aspects are treated in the following papers. Next, one university in Central Europe depicts, reasoning from its history, prospects of education at Prague university, including some Bologna aspects. Then, a description of the Erasmus Mundus programme MEDfOR precedes the paper on activities of IFSA students in Tharandt, to blend the higher forestry education with international aspects. A presentation on best practices in forestry education on all levels in Europe end the series of papers on education. The next section combines a paper on successful attempts in Germany to link students and professional practice and a description how to reduce shortages of professional foresters in Ireland. Finally, a paper discussing the active role a forestry university can play in extreme events in her environment, precedes the concluding remarks.

Bologna Declaration

In June 2019, the twentieth birthday of the Bologna Declaration was celebrated at the University of Bologna. In his keynote, SIEGFRIED LEWARK reviews goals, implementation, impacts and perception from the perspective of a professor who, during these 20 years, has been involved in curriculum development and teaching in higher forestry education at the University of Freiburg, Germany, and in accreditation commissions. One of his general observations is that to the general public the Bologna Process is not an issue anymore. It was not an issue in SILVA Network either at the time of the anniversary or in the years before, notwithstanding heated discussions ten years ago.

The implementation of the three cycle study programme structure has meanwhile been completed to a large extent, the new study programmes have been accredited. The traditional mobility of students of higher forestry education had initially suffered, but most obstacles have been overcome with sophisticated amendments. However, many of the goals of the Bologna Process do not seem to be of high relevance any more in higher forestry education, nor in other disciplines.

Learning and teaching is considered one of the core tasks of universities. However, innovative learning and teaching approaches like student-centred methods have been included in the goals of the Bologna Process only recently. Some fundamental,

1 Author based this summary mainly on the authors' summaries.

expertise based publications for this topic are found, but a major impact on the ground is not to be expected very soon.
E-learning techniques and tools have been used in higher forestry education for many years for on-campus applications, but not much for distance learning. The new relevance as a consequence of the Corona pandemic is obvious and will be evaluated in the up-coming (2021) annual conference of SILVA Network.
Consideration of equity of gender and diversity also became a goal some years after the Bologna Declaration. The related teaching continues to have a meagre existence, in spite of the programmatic political priority on EU level.
Generally, LEWARK concludes that the Bologna Process mostly was not welcomed in higher forestry education, but implemented anyway. The faculties of forestry have arranged themselves with the regulations and structures. There is no new discussion on or vision of reforms in sight, although substantial, observable changes of learning and teaching have not yet been induced by the Bologna Process.

The implementation of the "Joint Declaration of the European Ministers of Education", or Bologna Declaration for short, strongly influenced structures and features of higher education in the fields of forest science. Expectations were raised with respect to the improvement of quality and flexibility of corresponding degree programmes. GERHARD MÜLLER-STARCK and MICHAEL SUDA survey major dynamics at the Technische Universität München (TUM), Germany, and try to answer the question, whether or not these expectations were fulfilled in the past two decades. In particular, they focus on structures and dynamics of study programmes, including new vocational combinations. They consider students´ mobility as another important aspect, as well as the improvement of the compatibility of module structures and the transferability of ECTS credits. Generally, an adequate response of higher education to the demands of the job market was challenging in the past and will remain so in future.

Amongst well established sites of education in forest sciences, Tharandt, the forestry department of the University of Dresden, Germany, belongs to those with the longest tradition. Graduates from this site influenced, according to NORBERT WEBER and STEPHAN BONN, forestry education and practice in quite a number of countries worldwide. During more than 200 years, there have been many changes in the education framework as a result of adaptation to changing conditions. After adoption of the Bologna Principles in 1999, the lecturers of the Tharandt Department of Forest Sciences decided to harness the underlying philosophy for fundamentally improving teaching and learning in programmes of forest sciences. Although some shortcomings are visible, overall feedback from graduates and stakeholders is positive, mainly due to the higher flexibility in comparison with the former Diploma system. Future challenges are arising both from higher education policy and implementation questions. Besides permanent adaptation to the needs of the job market, keeping the 'forest focus' will be one of the essential and decisive questions for the future.

Study programmes Forest Sciences

The development and new perspectives of forestry education at the Czech University of Life Sciences (CZU) in Prague, which is, according to JIŘÍ REMEŠ, one of the leading public universities in the Czech Republic, are the subject of the next paper. The development of the CZU during the last years, as a result of the international and national political and social processes, was dynamic. Currently, CZU has more than 19,000 students (20% from abroad) including the Faculty of Forestry and Wood Sciences (FFWS) with approximately 1700-2000 students. The modern history of FFWS began in 1990. Currently the faculty is one of the most respected educational and scientific institutions in forestry and wood sciences in the Czech Republic. The investment in technical equipment, including the construction of two new pavilions, made a significant contribution to this. Today, the faculty offers a wide portfolio of study programmes in Bologna format, from traditional forestry to arboriculture, game management, wood processing, and to wood-based constructions. Further development is aimed at increasing the quality of all processes at CZU and FFWS. All FFWS study programmes have been re-accredited by a new accreditation system and in 2019/20 their evaluation and quality assurance will take place.

According to CATARINA TAVARES and JOSÉ G. BORGES, the Master Programme Mediterranean Forestry and Natural Resources Management (MEDfOR) brought together the best expertise, human resources and facilities to educate the next generation of leaders in forestry, natural resources and land management throughout the Mediterranean region. The two-year programme started in 2012 and is implemented by a consortium of seven Mediterranean Universities, located in Portugal, Spain, Italy and Turkey. It offers a mobility path in which students can study at two or three different universities. It takes advantage of internships offered by associated partners and stakeholders from all around the Mediterranean basin, America, Africa, Asia and Oceania, organized in a consultation panel.
The number of applicants has steadily increased since 2012. It was greater than 200 in 2019 which highlights the quality and attractiveness of the programme. The contribution of the programme to graduate-level education and to address the challenges faced by Mediterranean countries is acknowledged by the EU Erasmus programme that twice selected this programme for funding in 2011 and 2017 in competitive calls. Since 2012, 98 students have graduated successfully. Most have already found jobs or are pursuing PhD degrees, thus fulfilling the ambition of the programme of contributing to address current forestry and natural resources challenges, namely in the Mediterranean region.

Study programmes and their regulations specifically aim to promote the acquisition of knowledge and skills by students. The design of such competence-based curricula in combination with extensive opportunities for individual specialisation requires, according to URS BRÄNDLE, FLORIAN KNAUS and HARALD BUGMANN, deeper planning that combines the acquisition of competences with diverse content. The Eidgenössische Technische Hochschule Zurich uses the relative proportions of forest,

landscape and management aspects in the core courses of its major programme to observe how the students prioritize differently depending on their professional goals. By visualizing students' choice behaviour with triangular coordinates, trends can be identified early on and the skills required for the professional market can be taught in a package that is dynamic and attractive for students.

The next paper provides an overview of the best practices in forest education in Europe based on the submissions received for a best practices global competition. JULIET ACHIENG OWUOR and SANDRA RODRÍGUEZ-PIÑEROS described this competition that was conducted between November 2018 and March 2019 and was inspired by the 2019 International Day of Forests, the theme of which was Forests and Education. The organizers of the competition were the Joint IUFRO-IFSA Task Force on Forest Education, University of Helsinki and the University of Helsinki Centre for Continuing Education HY+ in collaboration with the Food and Agriculture Organization of the United Nations (FAO). Despite the competition being conducted at a global scale, this paper only focuses on the submissions from Europe which accounted for 40% of the total submissions received. Europe was also the region with the highest number of submissions. Remarkable is that nearly half of the submitted activities were cross country collaborations. Moreover nearly one half of submissions were at tertiary level. The best practices initiatives are highlighted under four topics: the level of education (primary to tertiary/university), learning activities and their benefits, topics covered and learning beyond borders (cross country collaborations). These innovative education models provide insights that continue to shape the discussions on the future of forest education at all levels of education.

Students of Forest Sciences

Due to the growing expectations on forestry graduates an improved higher forest education is needed. According to MERLE KÜSTER, the International Forestry Students Association (IFSA) and their renowned partners offer opportunities to deepen the members' knowledge and broaden students' horizon by participating in annually organised IFSA-meetings or (inter)national conferences. As IFSA operates as a platform, the members get the possibility to network with experienced forestry or forest-related professionals. Students of the local IFSA group Tharandt organise and participate in meetings on national and international level, and present their new experiences at events with fellow students.

MAXIMILIAN AXER mentions that in 2017 in Germany, the Young Forestry Network (JNF, Junges Netzwerk Forst) was founded as a network for young foresters including students, graduates, and young professionals up to age 40. It has been established as the youth organisation of the German Forestry Association (Deutscher Forstverein e.V., DFV), which is one of the largest and oldest associations in the field of forestry in Germany. The JNF was founded to act as a networking platform for all protagonists, and with the aim of giving young foresters a voice. Due to the great generation change in the forestry sector nowadays, an exchange of experience between the generations

but also within the younger generation is necessary. This dialogue is enabled through various excursions, lectures and seminars, organized by the members themselves or by the parent organisation DFV. The great proactive and self-organized attitude of the members underscores the great demand of young foresters to exchange ideas and create a network.

Universities of Forest Sciences serving society

Ireland is not a country with a long history of forestry or forestry education. However, according to MARIE DOYLE, from a forest cover level of 1% of the land area in the early 1900s to 11% in 2020, mainly due to the prevailing temperate climate being ideally suited to the growth of coniferous species (for example *Picea sitchensis*), a thriving forestry sector has developed. Formal forestry education began in the 1920's. While student and graduate numbers were always modest, they increased during the 1990's, in line with the expansion of the private forestry sector. In recent years, there has been a reduction in the number of applications to study forestry and a shortage of forestry graduates has been noted right across the sector. To address this, representatives from across the forestry sector have come together as 'Forestry Careers Ireland' to create awareness of the potential of forestry as a career. Updated information on a careers portal, visits to secondary schools, printed materials and involvement in science festivals are all examples of work undertaken.

New university activities, stimulated by possible consequences of climate change were reported by MAURO MASIERO, DAVIDE PETTENELLA, LAURA SECCO and FEDERICA ROMAGNOLI. They stated that forest disturbances associated with extreme events and natural disasters are expected to increase continually in intensity, quantity, and frequency in the coming years, posing severe threats to the world's forests. This challenges many actors to cooperate in developing innovative and effective solutions to increase resilience of socio-ecological systems. Higher education institutions, including universities, are called to contribute to these solutions. An interesting case study is provided by the Vaia storm, an unprecedentedly extreme event that hit North-East Italy in October and November 2018. Post-event activities and reactions by Italian universities are reported and analysed in this paper, with a focus on the Department of Land, Environment, Agriculture and Forestry (in the Italian short version, TESAF) at the University of Padova. An overview of activities is provided, distinguishing among five main categories: (1) research initiatives by senior university staff, (2) PhD research activities, (3) education initiatives for students, (4) communication and dissemination activities, and (5) side initiatives developed in cooperation with partner organizations. Though mainly focused on a single university department, the overview confirms that higher education/research institutions had a key role in the post-Vaia phases, and supports the idea that they could have a more active role in developing and delivering knowledge and skills that can help moving closer to more resilient socio-ecological systems.

Concluding remarks

In his concluding remarks, NORBERT WEBER stated that the Bologna Process created positive (boosted international cooperation between universities, resulting among others to multi-university study programmes, better employability of graduates) and negative (missing employment opportunities after the Bachelor degree or increasing psychological problems of students due to high workloads perceived) developments over Europe. Moreover, the intended shift in focus from teaching to learning has not left the stage of "wishful thinking" in many universities.

NORBERT WEBER, after summarising three group-discussions, stated that obviously the Bologna Principles have transformed teaching and learning in European institutions of higher education, even if the grade of implementation differs between countries and universities. Irrespective of that finding, there are still a lot of challenges to be mastered.

KEYNOTE: 20 YEARS BOLOGNA – AND STILL MORE TO GO?

SIEGFRIED LEWARK

Abstract

In June 2019 the twentieth birthday of the Bologna Declaration was celebrated at the University of Bologna. In this keynote goals, implementation, impacts and perception have been reviewed from the perspective of a professor who has been involved in curriculum development and teaching in higher forestry education at the University of Freiburg, Germany, and in accreditation commissions. One general observation is that in the general public the Bologna Process is not an issue anymore. It was not an issue in SILVA Network either at the time of the anniversary or in the years before, after heated discussions ten years ago.

The implementation of the three cycle study programme structure has meanwhile been completed to a large extent, the new study programmes have been accredited. The traditional mobility of students of higher forestry education had initially suffered, but most obstacles have been overcome with sophisticated amendments. However, the many goals of the Bologna Process do not seem to be of high relevance in higher forestry education, nor in other disciplines.

Learning and teaching is considered one of the core tasks of universities. However, innovative learning and teaching approaches like student-centred methods have been included in the goals of the Bologna Process only recently. Some fundamental, expertise based publications for this topic are found, but a major impact on the ground is not to be expected very soon.

E-learning techniques and tools have been used in higher forestry education for many years for on-campus applications, but not much for distance learning. The new relevance as a consequence of the Corona pandemic is obvious and will be evaluated in the up-coming (2021) annual conference of SILVA Network.

Consideration of equity of gender and diversity also became a goal some years after the Bologna Declaration. The included related teaching continues to have a meagre existence, in spite of the programmatic political priority on EU level.
Generally, one can conclude that the Bologna Process mostly was not welcomed in higher forestry education, but implemented anyway. The faculties of forestry have arranged themselves with the regulations and structures. There is no new discussion of reform vision in sight, although substantial, observable changes of learning and teaching have not yet been induced by the Bologna Process.

Happy birthday, Bologna!

Twenty years of the Bologna Process may deserve an appropriate birthday party. At the same time this is a good reason for the stakeholders to look back and to evaluate the achievements.

There was a grand celebration indeed, few days after the SILVA Network annual conference in June of 2019, with an academic procession of Ministers and Rectors, the latter in their academic gowns, at the dignified University of Bologna. Fitting speeches were held.

As the Bologna Process was an ambitious undertaking and indeed fundamentally changed higher education all over Europe, this anniversary is also reason for reflecting on the goals of the process and the reality of learning and teaching in the universities in 2020, as the learning results are what it is all about.

That is to say universities are the places of learning and teaching, not the ministerial arenas on national and international level. Therefore, stakeholders in processes of study reforms are in the first place the learners and teachers, the students and professors. Next are the faculties that decide about the curricula. And only then come the administrations on university, national and international level that should do what they possibly can do to facilitate learning and teaching on the level where it happens.

These convictions are the fundaments for the following observations.

The perspective

My perspective is that of a university teacher in the first place, enriched by experience in curriculum commissions and accreditation bodies, and in academic networks on international level, mostly in IUFRO and, of course, in SILVA Network. In different functions, not to forget memories from own student times, I lived to see learning and teaching processes and study reforms, most of them long before the Bologna Declaration, then the implementation of the Bologna transformed study programmes and their early years.

The Bologna Process met quite different situations at the European faculties of forestry. At Freiburg university, there had been an intensively discussed, radical revision of the forest sciences programme in1995. That had resulted in a startling, theory-based, innovative study programme, described several times, including in SILVA Network publications (e.g. Lewark, 1998, 2002a, 2002b, Weber and Lewark 2004). A credit point system had been developed and been in use, one of the very few in Germany. Over its ten years of existence the programme had received internal and external evaluations and got a teaching reward of the State of Baden-Württemberg. There were favourable comments, and some proposed adjustments made. There was

thus no reason for a new radical change when the Bologna ideas came to university level some years after the Bologna Declaration. On the contrary. As the following years showed, most didactic and structural innovations of 1995 were abandoned when the new regulations were implemented. This was mostly because they were considered not fitting into the new structures required very strictly by the university.

The observations presented here are certainly subjective and only a limited selection of relevant issues, given the major changes in the learning and teaching situation over the last years. Some will relate to the process of implementation of the Bologna Process and early experiences, being more general, others more specific to the forest sciences curricula. In addition, I was asked to include two specific topics, because of own early teaching experiences, the subject of gender and diversity in the study programmes, and e-learning.

The Bologna Process, its structures and players

The celebration

The perception of the Bologna Process by the cooperating European governments after 20 years may be found condensed in the programme of the birthday celebration. Who held the speeches, who participated and listened, who was invited? There were many ministers, rectors and directors, but no university teacher dealing with learning and teaching is listed. This sheds some light on the focus of the celebration and thereby of the Bologna Process. The official programme includes the topic of learning just once, and three student speakers and two student facilitators of round tables, on the second day. An academic conference followed the celebration, its proceedings were presented at the Ministerial Conference of 2020[2].

The players

The Bologna Process is a voluntary process based on the Bologna Declaration of 1999 that defines the European Higher Education Area (EHEA), with 48 signatory states in 2020. Every two or three years a Ministerial Conference is held. The executive structure supporting the process between the conferences is the Bologna Follow-Up Group, with its BFUG Secretariat at the location of the upcoming conference. Then there are the Bologna Implementation Coordination Group (BICG) and workings groups like the Working Group on Policy Development for New EHEA Goals 2015-2018. The BICG under BFUG in October 2018 released a Work Plan 2018-2020, with, amongst others, three Thematic Peer Groups and its Advisory Groups on Social dimension and on Learning and Teaching. The European Association for Quality Assurance (ENQA) is responsible for setting accreditation standards.

2 The proceedings of the conference attached to the Bologna celebration are titled: Bologna Process beyond 2020 (Noorda *et al.*, 2020). This makes the Bologna Process look like a permanent process, after the first time frame for implementation to 2010, another one to 2020 and now to 2030. This text has been written before the Bologna follow-up conference in Rome in November of 2020.

In addition to the structures belonging directly to the Bologna Process, the main support and stakeholder agencies for facilitation and accompanying the process are the European Students Union (ESU)[3], the European University Association (EUA) as coalition of the universities, and the European Association of Institutes in Higher Education (EURASHE) as coalition of the universities of applied sciences[4]. Some are attached as official partner organizations, others are just part of the process follow-up like the European Council of Doctoral Candidates and Junior Researchers (EURODOC), the Council of Europe and UNESCO.

All agencies and organizations have created bodies of administration and staff and produced their respective statements and documents. In addition, there are the governmental institutions on national level of all 48 signatory states. Is it surprising, that this is sometimes called an over-bureaucratized monster, as put by one of the German state ministers of education in an interview (Deutschlandfunk, 2014)? It seems quite difficult to gain and keep an overview about the actions and documents of the Bologna Process, about goals and priorities over time. How was this administrative structure perceived on university level, by teachers and learners, in SILVA Network? What have all these documents and activities to do with the reality in forest sciences study programmes?

Achievements of the Bologna Process

The perception of the Bologna Process
The Bologna Process resulted in great commotion in the universities, when it was perceived there, only some years after it had been initiated, even though with the Bologna Declaration of June 1999 the governments and ministers had committed to fundamental changes on university level.

Very much has been written about the intentions and fields of action, especially between 2005 and 2010, when the implementation was supposed to be concluded. But today, twenty years after the declaration, Bologna is no longer an issue in the media. The fundamental structural changes and related issues seem to be forgotten by the teachers – while the actual students know little about the structures before Bologna.

Perception inside the SILVA Network
The shifting focus of attention is also found in the discussions within SILVA Network. Bologna has been an issue or even an explicit topic of SILVA Network annual conferences for some time, especially in Wageningen 2005, Valencia 2006, Thessaloniki 2009, Zagreb 2010, St. Petersburg 2011[5] – then no more until 2019 in Tharandt, on the occasion of the anniversary of the Bologna Declaration, where this

3 ESU has published several editions of detailed analyses, called "Bologna with Student Eyes", that are based on reports of national student organizations, the latest one in 2018 (ESU, 2018)
4 The respective internet pages are not listed as all organizations are easily found in the internet.
5 The proceedings of these conferences are found at www.silva-network.eu. See also the last pages of this volume.

keynote was presented. The discussions during the first years of implementation often were heated. They were reaching from descriptions of the single steps and elements of implementation and realized new study programmes at different universities to aggressive refusal, as also took place in other disciplines in times before and during implementation. Higher forestry education under the envisaged structures was often claimed impossible, it would suffer to a state beyond recognition. The traditional solid competences of a forest graduate, needed in working life, would be impossible to deliver. Later also more matter-of-fact presentations of new study programmes were given.

What information to look for – where to find it?
What has been achieved must be the overarching question at the time of the 20th anniversary of the Bologna Declaration. There were numerous reports, reviews and evaluations along the way and at the time of the anniversary, by the actors of the process, at different levels including the university level, on international and national level, by different stakeholders. There were apparently few related to higher forestry education – and not so many publications in general media.

Basically the impact of the changes triggered by the Bologna Process may be searched in particular in the documents published around the Bologna follow-up conferences, many of them written by the named agencies. Naturally, the anniversary documents include a good deal of self-praise.

The following observations do not cover all dimensions of the Bologna Process, e.g. within the three cycle structure not the third one (PhD programmes), which would certainly also deserve attention.

The goals
Success should be measured against goals and objectives, sometimes called principles, of the Bologna Process. In the general perception, also in SILVA Network, structures of the BSc programmes, mobility and employability were seen in the foreground (Lewark *et al.*, 2014). But from the beginning there were more goals and dimensions of the Bologna Process, some later added in the communiqués[6] of the first Ministerial Meetings. An overview is given in Figure 1.

In 2015 in the Yerevan Communiqué[7] four goals had been named as equally important:

- "**Enhancing the quality and relevance of learning and teaching** is the main mission of the EHEA."
- "**Fostering the employability of graduates throughout their working lives** in rapidly changing labour markets – characterized by technological developments, the emergence of new job profiles, and increasing opportunities for employment

6 All communiqués of the Bologna Process are accessible via www.ehea.info.
7 All communiqués are accessible via www.ehea.info.

and self-employment – is a major goal of the EHEA. We need to ensure that, at the end of each study cycle, graduates possess competences suitable for entry into the labour market which also enable them to develop the new competences they may need for their employability later …"

- "**Making our systems more inclusive** is an essential aim for the EHEA as our populations become more and more diversified, also due to immigration and demographic changes."
- "**Implementing agreed structural reforms** is a prerequisite for the consolidation of the EHEA and, in the long run, for its success. A common degree structure and credit system, common quality assurance standards and guidelines, cooperation for mobility and joint programmes and degrees are the foundations of the EHEA."

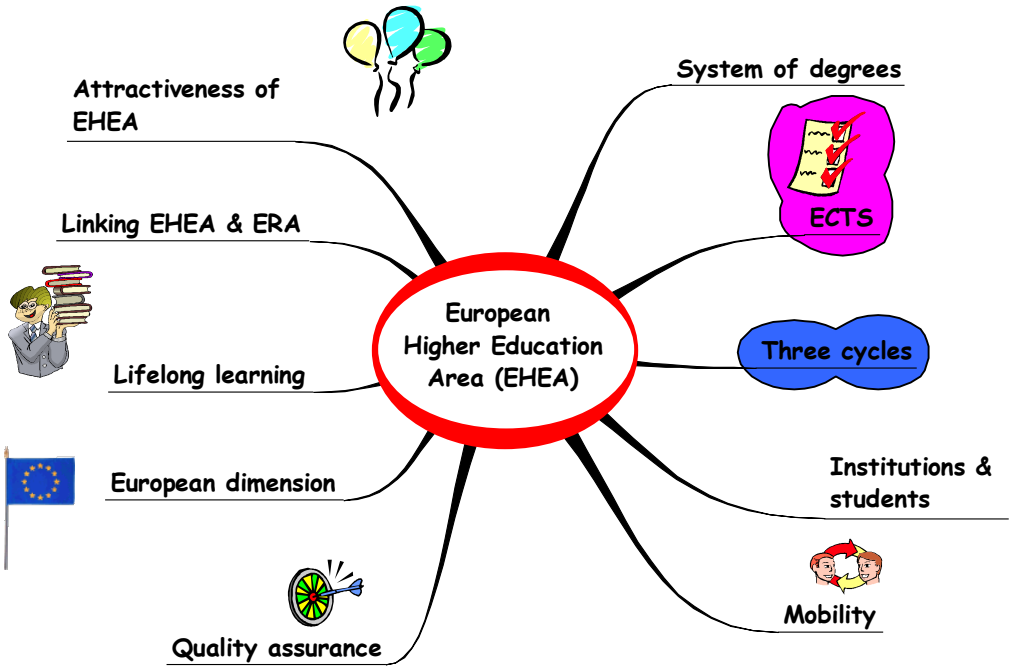

Figure 1: The dimensions of the Bologna Process (Lewark, 2008) (ERA: The European Research Area, ECTS: European Credit Transfer System).

Obviously these goals have not fully been achieved in 2015 – e.g. the three cycle structure that was planned for 2010 was not implemented at that time. This is true for the original signatory states, and even more for the later ones. Differences between disciplines are observed. Sometimes the priorities of the goals have been described differently. Recently highest priorities were mobility of staff and students and facilitation of employability (Box 1).

Box 1: Presentation of EHEA and Bologna Process in the introductory text on the occasion of the EHEA Rome 2020 Ministerial Conference on 19 November 2020 (EHEA, 2020).

"European Higher Education Area and Bologna Process
The European Higher Education Area (EHEA) is a unique international collaboration on higher education and the result of the political will of 48 countries with different political, cultural and academic traditions, which, step by step during the last twenty years, built an area implementing a common set of commitments: structural reforms and shared tools. These 48 countries agree to and adopt reforms on higher education on the basis of common key values – such as freedom of expression, autonomy for institutions, independent student unions, academic freedom, free movement of students and staff. Through this process, countries, institutions and stakeholders of the European area continuously adapt their higher education systems making them more compatible and strengthening their quality assurance mechanisms. For all these countries, the main goal is to increase staff and students' mobility and to facilitate employability. This official website of EHEA provides both general information on this process and detailed information for experts."
It is noteworthy that the process of learning and teaching and its quality and development in the first years is only included indirectly, at best. Other goals added later were lifelong learning (Prague Communiqué of 2001) and gender equity (Berlin Communiqué of 2003).

Stocktaking and Implementation Reports
The evaluations carried out within the Bologna Process resulted first in Stocktaking Reports and later in Implementation Reports of some hundred pages, the last ones from 2018 and 2020 (European Commission, 2018; 2020). They were commissioned by the BFUG and guided by the formulated or updated goals and priorities of the times of commission.

The data collection has been described in the Implementation Report of 2020. The documents refer mostly to goals and expectations, general views and experiences. The exhaustive quantitative data mostly stem from EU statistics. Qualitative data as well as narrative explanations were mostly provided by the respective responsible agencies on national level. Stakeholder involvement by some organizations is also referred to. Achieving the different goals requires different approaches. On university level, above all structures and accreditations were forced through first. Other "goals are confirmed" again and again, meaning that the implementation often is progressing slowly.

Criticism
Criticism in official documents is formulated as "should be addressed" or "action still to be taken". This is true for the documents produced in the Bologna Process, mentioned above, that are obviously a major source of evaluation of achievements (Lorenz, 2006).

Lorenz from the VUAmsterdam points out in his analysis "that the Bologna declaration is an essentially political document, full of 'empty containers', which make it useful for application in any national setting". Lorenz characterizes these documents further: "Therefore policy documents on higher education can be said to form a (more or less) coherent system of speaking and acting or a discourse. Moreover, educational policy discourse is an excellent example of what the German

sociologist Niklas Luhman has labelled a ‘self-referential system’ because its policy documents basically refer to one another and not to the outside world" (Lorenz, 2006).

There was a variety of public and stakeholder expectations for the Bologna Process and of perceptions of the achievements, related to the different goals, but also to the implementation process. Taking the German perspective as an example: The education researcher Wex (2019) named as prominent expectations for the Bologna Process, as perceived in the public, mobility, duration of studies, numbers of unsuccessful students and improvement of teaching and learning. In his harsh criticism he concludes that none have been achieved (Box 2).

Box 2: Conclusions on four expectations for the Bologna Process in Germany, in "Higher, faster, longer – 20th Birthday of the reform: a check of facts" (Wex, 2019):

• Enhanced mobility?	Just a pious wish
• Reduced years of study, Bachelor and Master?	Just a fairytale
• Reduced dropout numbers?	A flop
• Increased quality of teaching and learning?	Not at all

Another expectation – hotly debated during the first years, also in other countries, but seemingly widely forgotten already long time ago – was related to employability: The majority of BSc graduates were to be ready to leave universities for entrance into working life with a final degree qualifying for an occupation (in English: a degree, securing employability; in German: berufsqualifizierender Regelabschluss). They were supposed to leave university and get into a job. In reality around 80% went on as Master students in 2016.

Wex (2019) describes how the self-praise on the occasion of the Bologna anniversary by the German authorities left out such critical issues, while the few figures included even "often prove the opposite of the alleged success"[8].

Achievements in higher forestry education

On faculty level the implementation process was perceived as strictly top-down. In many faculties of forestry, no room for divergent decisions or refusal existed. Among the goals of the Bologna Process, mobility was named above all in SILVA Network, of course connected with the mutual recognition of credit points on international level. But the traditional great mobility of students of higher forestry education had initially suffered. The obstacles mostly have been overcome, with sophisticated amendments, so that mobility may be on the earlier level again.

The implementation of the three cycle study programme structure has meanwhile been completed to a large extent, the new study programmes have been accredited. The earlier frequent refusal of a transition of the one cycle higher forestry education programmes has been mentioned above. Sometimes also employability and

8 All quotations from Wex (2019) translated from German by the author.

occasionally lifelong learning have been discussed. Otherwise the many goals of the Bologna Process do not seem to be of high relevance in higher forestry education, nor in other disciplines. The impacts of the Bologna Process were mostly discussed, quite controversially, in relation to the new study programme structures.

Two annual conferences of SILVA Network were centered on experiences with accreditation and quality assurance (Valencia 2006, Padua 2018). The topics of improving lectures and alternative learning and teaching settings have been taken up related to competence orientation (Lleida 2012) and specialized versus general competence profiles (Thessaloniki 2009 and Vienna 2015).

Learning and teaching

The importance attached to learning and teaching in higher education always has to do with the complementary weight of research, the other key task of universities. The discussions about the priorities between the two tasks are often related to the paradigm of a unity of research and teaching in universities, as ascribed to Wilhelm von Humboldt (Dreijmanis, 2020). Humboldt's ideal of education was also discussed sometimes in conferences of SILVA Network (e.g. Schneijderberg, 2014).

Is this unity or holistic combination of research and teaching living reality or fiction? The analysis of the Bologna Process rather gives the impression of a dominance of administration over learning and teaching, while research is outside its scope – though linking EHEA and ERA is among the goals (Figure 1).

The reality in universities, as repeatedly stressed by university teachers committed to learning and teaching, is, that university careers depend almost exclusively on the merits in research (e.g. Handwerker, 2003). The relevance of research in careers of professors of forest sciences becomes obvious in their publications on learning and teaching, also in SILVA Network, which as a rule are based on broad experience, but not on a theoretical framework – unthinkable in research publications.

Learning and teaching was only mentioned expressis verbis from the Yerevan Communiqué (EHEA, 2015) onwards. The goal and the related didactical expertise, knowledge and experience therefore became visible only afterwards to some degree, as can be seen below. Here the learning situation and achieved improvements in the newly structured study programmes are relevant.

A chapter in the Implementation Report of 2018 gives the impression of a growing consideration of learning and teaching (Box 2). Also the need of improving the teaching competence of teachers is stressed. Learning and teaching is also increasingly addressed in documents at national and institutional levels, with a clear emphasis on organizational approaches and on the essential role of teachers for improvement, as in the quotation in Box 3.

Box 3: Learning and teaching in the Bologna Process according to the Implementation Report of 2018 (European Commission, 2020).

"Improving learning and teaching is among the most fundamental objectives of the Bologna Process. Strategies to achieve this objective are now quite widespread across the EHEA, both at national level and within higher education institutions. Steering commonly promotes the development of international opportunities, academic staff development and measures to improve teaching. Digitally enabled teaching and learning is also increasingly addressed strategically at national and institutional levels. […]
Higher education teachers are the key players in enabling students' learning, and appropriate training in teaching skills both before being employed and throughout careers is an essential pre-requisite for a high quality system. Yet, regulations rarely require academics to hold a teaching qualification, and the development of teaching skills is often left to ad hoc measures."

Learning paradigms, student-centred learning environments

The Bologna Declaration was adopted 25 years after a paradigm change from the Instruction Paradigm to the Learning Paradigm was formulated in the ground-breaking publication on self-directed learning by Knowles (1975). There were different other concepts and terms for basically the same thing, the focus on centring activities of learning and teaching on the "active and self-organized student".

Barr and Tagg (1995) contrast several criteria of success, among them "Learning and student-success outcomes" (Learning Paradigm) and "Inputs, resources" (Instruction Paradigm). The authors conclude: "A Learning Paradigm college is concerned with learning productivity, not teaching productivity."

The theoretical foundation has been laid by didactics experts in publications on the paradigms associated to learning and teaching. During the last few years they, and also students and their organizations, not the celebrating ministers, have been elaborating on this topic at Bologna follow-up conferences.

The learning process of students, its structures or approaches, have been highlighted by Klemenčič (2020) in her keynote for the Bologna conference of 2018: "Successful Design of Student-Centred Learning and Instruction (SCLI) Ecosystems in the European Higher Education Area". Now mostly the shortened term Student-centred Learning[9] is used.

What is the state of Student-centred Learning Environments 20 years after initiation of the Bologna Process; is there any significant change? There are more encouraging related texts, in the proceedings of the Bologna follow-up conference of 2020, that are attempting to give answers. The ESU students Hovhannisyan and Šušnjar (2020) made their analysis from the students' perspective and conclude that "the 'paradigm shift' has not actually occurred", partly because of misconceptions. Different understandings are also pointed out by the Vice-Chair of BFUG, the historian Isaacs

9 Student-centred Learning (SCL) though seems to be a curtailed term and as such at the same time redundant and a misnomer, as not the learning but its environment is student-centred.

(2020), who described the roots of SCL before the Bologna Declaration and developments independent of the Bologna Process.

Also chapter 11 of the ESU evaluation (ESU, 2018) deals with SCL. It concludes that European Credit Transfer System (ECTS) seems thoroughly implemented, though in most cases not based on learning outcomes but on the student workload[10]. In contrast, the implementation of a learning outcomes methodology, on which SCL depends, has not made enough progress, nor that of the more ambitious SCL. "Part of the reason for this could be that the nature of SCL makes it difficult to implement top-down, in the way that many other Bologna Process tools were embedded" (ESU, 2018).

Impact of the Bologna Process on higher forestry education, perception in SILVA Network

Emphasis in this keynote is on the learning and teaching situation, also the development ahead would be relevant. How to find out about a possible improvement of learning and teaching in higher forestry education related to the Bologna Process? The learning situation may primarily be analysed by research based evaluations that are hardly found.

The contributions in SILVA Network as a rule are based on the experiences of the teachers attending the annual conferences, and thereby anecdotic evidence more or less systematically collected. An exemplary study has been conducted by Nippala *et al.* (2016). Learning and teaching are regularly addressed at the conferences of SILVA Network, e.g. also included in contributions at Lleida (2014). "From teaching to learning" was the topic of the conference in Istanbul (2013). There Dohrenbusch (2015) underlined, referring to the cited publication by Barr and Tagg: "This change means turning away from an input-management system which is based on contents to an output-management system, which is focused on the so-called learning-outcomes. While the traditional system is mainly orientated to the presentation of teaching contents, the proposed new system regards the results of learning." But he concludes that an adoption of the Learning Paradigm may not be suitable for higher forestry education as it may not be successful with achieving sufficient professional knowledge of the graduates. This would certainly deserve more discussion, which is still to happen, and more proper research.

It is to be suspected that with a more stringent organization of the new, shorter study programmes less room will be left for partly or fully elective courses like that presented by Paz Arraiza *et al.* (2014). This should be given more attention, as the options for choice of courses is regarded an essential quality factor as perceived by teachers and students (Schneijderberg and Lewark, 2014). Appropriate assessments are missing.

10 Student workload obviously not defined and used in a convincing and comparable way.

Jansen-Schulz in her keynote at the same conference pointed out that the shift from teaching to learning would "require a change in the teaching role as well as a change in methods" (Jansen-Schulz, 2015). She names and describes research-oriented learning, inter- and transdisciplinary learning, problem-oriented learning and transfer-oriented learning. There are but few examples describing their performance found in SILVA Network proceedings, so far.

Lifelong learning

In the Paris Communiqué (2001) lifelong learning was mentioned as a Bologna goal for the first time. Obviously this is a broad subject – the question here is what could have been an impact on higher forestry education. The Bologna implementation documents and the national reports tells that lifelong learning refers to open universities for non-traditional students, with a vocational qualification and work experience, but according to literature it may be much more than that. The official expectation is that national qualifications frameworks are to be developed, based on the European Qualifications Framework for Lifelong Learning (EQF). This latter includes descriptors of knowledge, skills and competences on eight levels, which deserve attention.

But the way from the Bologna conceptions to implementation in study programmes seems to be a long one. Certainly lifelong learning and achieving the described learning outcomes is connected to many aspects of teaching and learning, which is not to be detailed here. It has to do with employability and with learning methods of adult education and, together with that, with course organization, and also with practice orientation as dealt with at the SILVA Network conference in Bern (2014)[11].

Learning to learn and other generic skills, also attitudes like openness for continued learning and the insight into the need of lifelong learning must belong to it, as studied by Rekola *et al.* (2015) and Nippala *et al.* (2016). Concrete steps, on formal and informal level, that can be taken, concern problems from working life, or inviting experts from working life as expert teachers into courses. Also other measures should be considered, like opening university courses, e.g. introductory courses or selected others, to participants from working life, including giving certificates. Part-time courses and distance education may become more important for life-long learning, with their associated challenges (Rayment, 2016).

What is happening in this respect in higher forestry education? There are some notable examples, but it is assumed that these activities have been undertaken independent of the Bologna Process, hence they will not be covered here.

11 When referring to SILVA Network annual conferences only the place and the year are given, while the respective proceedings are found under www.silva-network.eu, and a complete list is found in the end of the proceedings. Single contributions at these conferences, if referred to, are included in the list of references.

Quality assurance

Similar conclusions may be drawn for quality assurance. Certainly accreditations were triggered by the Bologna Process. Standards and guidelines by different agencies have been formulated. But quality assurance should be seen in connection with the quality of learning and teaching, before all other aspects. Can quality assurance be seen as most important driver, or at least of some relevance, for learning quality? From the Implementation Reports and the national reports one cannot see if there were evaluations of accreditation processes. The description on the state of quality assurance is again based on data provided from the national agencies. Still quality assurance does not seem to be the powerful motor of change of the learning situation. One reason for that may be that it is conducted mostly by peers, professors of forest sciences in our case. So their attitudes are deciding about the accreditation process which are obviously mostly aimed at structures and organization, not on quality of learning outcomes. An appropriate analysis of impacts and focus would be desirable, but there seems to be no broad evaluation of accreditation processes for higher forestry education.

What did the Padua conference of SILVA Network in 2018 ("Quality management and accreditation for study programmes in forest sciences and related disciplines") reveal about quality assurance in higher forestry education? Again, most information is about the process of accreditation and about structures of study programmes, as indicators of quality. Course evaluations by students are presented a few times, while student satisfaction does not automatically imply information about the learning outcomes. To the extent that learning and teaching is addressed it is clearly mostly from the perspective of teachers and teaching as already the summary of the conference proceedings shows.

Short résumé

The rather late inclusion of learning and teaching (Klemenčič, 2020) again sheds light on the overall goals of the Bologna Process that are not directed to the learners' level. Basically, all improvements over the last fifteen years have been achieved in the study programmes in the new structures. At best some have been encouraged by the Bologna Process, perhaps through the growing need of the faculties and the study commissions to occupy themselves with study objectives, contents and evaluations. Sometimes project money given may have been helpful.

But certainly most improvements were not directly dependent on the Bologna Process regulations. Some learning conditions also certainly are more difficult under the new structures and regulations, often perceived as restrictive by the students, like the frequent exams. More studies on these issues are urgently needed.

Gender and diversity in forest sciences curricula

The Bologna documents wave the flag of gender equity in a few places, seemingly in duty bound, as this is EU policy, based on Treaty of Lisbon (2007). So e.g. gender equity is mentioned in the quality assurance standards on Bologna and national levels.

In reality, gender and diversity orientation apparently is not an issue of any relevance. In higher forestry education one finds some elective courses, given by engaged teachers. These courses often appear in the study programmes and disappear together with them. In spite of the topic belonging to the quality assurance standards and detailed examples published on how gender and diversity can be included in curricula and courses (e.g. in Becker *et al.*, 2006) no general change may be expected. The reason for its absence in accreditation processes is probably the same as for the limited role of student-centred learning environments, the subordinate role of these aspects in the attitudes of the peers. This assumption should be verified in appropriate evaluations respective studies.

In SILVA Network gender and diversity topics in study programmes of forest sciences sometimes have been presented in an exemplary way, but mostly repeatedly by the same teachers, for the last time so far by Jansen-Schulz and Lewark (2016).

E-learning in forest sciences curricula

At the assumed time of the publication of these proceedings the Corona pandemic will have caused at least three semesters of a hitherto unknown challenge, with severe limitations to hold classroom courses. By far most courses have been held since summer of 2020 in a digitized format as it is now called. This is a forced exercise of e-learning, without special preparation – perhaps it would rather be considered e-teaching.

So when presenting my keynote at the conference in 2019, ignorant of the coming Corona pandemic, I asked about an observable significant impact of the Bologna Process and new developments since my analysis of e-learning in higher forestry education at the SILVA Network conference at Thessaloniki in 2009 (Lewark, 2013). Some of the statements of 2009 were still relevant enough to be mentioned again, ten years later. They are outlined here, partly in order to challenge the presentations of the planned next annual conference.

In the résumé in Thessaloniki it was stated, that e-learning (e-teaching) courses were the domain of some engaged teachers, not offered sustainably, reliably over time. E-learning methods had been used widely for on-campus functions, but distance education was found to a very limited extent. No change seemed to be under way (Box 4).

Box 4: E-learning in higher forestry education in 2009 (Lewark, 2013).

"The main reason [for only few distance courses held] may lie on the side of the potential organisers, the universities, faculties and responsible professors: there seems to be little need and not sufficient will, which is needed in addition to competence and supporting organisational framework […]. In the universities there seems to be little incentive, on the level of the faculty there is not much demand anchored in study programmes, and only few professors have the competence and the drive to do it. Most professors in forest sciences – as in other disciplines – do have a high workload, often an overload, in teaching and other duties. They have their obligations in the traditional or many new study programmes. Why should they bother with e-learning? Those who do seem to do it because of their individual interest in developing their own e-learning competence or a special need they see for it for their specific course(s). Certainly courses existing for such reasons are interesting enough to learn from the experiences, though this kind of motivation does not show up in the accessible course information, but would require a deeper analysis."

Michalek described few years later, at the SILVA Network conference in Bern in 2014, that students, activating uses of the e-learning platform at BOKU, the University of Natural Resources and Life Sciences, Vienna, increasingly play an important role in many courses (Michalek, 2016).

Meanwhile also the Helsinki ICA Edu conference of 2016 was held, with the topic: "e-learning in the life sciences: exploiting open source materials in the curriculum". It added new perspectives with experiences from some universities, in particular with massive open online courses (MOOCs). Also the relevance of didactical design, of blended courses and of interactions between teachers and learners and among learners was stressed.

A new interest in these aspects seems to grow, also related to the current teaching practice during the Corona pandemic. I perceive this from readings of older publications on e-learning of my own working group. Indeed this is demonstrated by numerous readings[12] of publications like Längin *et al.* (2004), and another one in German, on e-learning experience (Lewark and Längin, 2007), related to the dissertation of Längin (2006).

Digitalization of courses in higher education initially has been partly industry driven and pushed by governments. But e-learning so far performed is not an achievement of the Bologna Process. Between technology and didactics, it does not need Bologna. But it needs realization of didactical opportunities, so that there will be more than just recorded lectures.

E-learning will be the topic of the next annual conference of SILVA Network, hopefully to happen in 2021[13]. It was announced with the title "Digitalization in higher forestry education – teaching and learning revisited", when nobody knew about the new importance of the topic. A review of the state of the art of e-learning in forest

12 In www.researchgate.net.
13 This annual conference actually took place in July 2021; the proceedings are planned to be issued in 2022.

sciences curricula was intended. In the current situation, certainly also some learner-centred e-learning courses, not so much for distance education, have been developed and tried out. It would be good to see them presented at the conference.

Conclusions and outlook

The Bologna Process induced fundamental changes of the structures of study programmes throughout Europe. Also the introduction of ECTS and regular accreditations were triggered by the associated activities and documents in the process and subsequently on national level. Is this enough reason for a celebration, in particular from the perspective of higher forestry education?

All considerations are or should be about the learning process of students, what students learned, what knowledge was acquired, what competences have been achieved. The celebration at the University of Bologna in 2019 showed a good deal of self-praise of Bologna actors in robes, the ministers of education celebrated assumed achievements of Bologna process. But their interest seems not to be aimed at a proper evaluation on the level of study programmes and learning and teaching. Lamentably, there are not many proper studies found that would give better-founded evaluations than the Bologna Implementation Studies referred to.

Learning and teaching was the – indeed subjective – focus of these observations. It could not always be sorted out, what are accessory phenomena, what are intended impacts. And, not all related issues could be covered, other issues – also often criticized in SILVA Network conferences and many discussions about the new situation of higher forestry education – had to be left out, like

- the frequent division of the study programmes into a minute course structure (in German Kleinstrukturiertheit) in the study programmes, with permanent evaluations and the related pressure on the students;
- the reproach that the new study programmes are too similar to schoolwork (which probably has not much to do with the actual reality at high schools), in a regimented system of the three cycles, even of the doctorate phase, connected with the need to compress traditional contents into less teaching time as perceived by the teachers;
- the recommended and the real use of Diploma Supplements and related experiences;
- the academic freedom, recently discussed in Bologna documents, including the questioned compulsory attendance at courses and bindingness of more and more regulations;
- the juridification of the performance in the new three cycle study programme structure;
- finally, the cost and the cost efficiency of the Bologna Process, including the related accreditations.

There are institutions, however, that engage in the future of higher education, with results like the "AHEAD-study on the university landscape 2030: departure from classical studies" (Orr *et al.,* 2019). The study concludes: "Digital change is creating completely new learning paths. The currently predominant model of a three- to five-year study block followed by lifelong work is losing relevance. It is replaced by more flexible, often lifelong study models. Universities and politics must create the conditions for this" (AHEAD, 2019). Four models of development are presented symbolized by popular games (as illustrated during the keynote presentation): Tamagotchi, Jenga, Transformer, Lego (Box 5).

Box 5: The four models of future university studies according to the AHEAD-study (AHEAD, 2019).

Tamagotchi: the "classic" model of the direct transition from school to higher education.
Jenga: a shortened first degree course, which is extended by new learning blocks in the further course of one's life.
Transformer: the concept of later transition to higher education, e.g. after completion of training and gainful employment.
Lego: individually combinable educational modules; based on the assumption that learners request different modules and learning units from different education providers; put together to form a degree.

Would it not be the time for visions like that in higher education and their discussion, also in higher forestry education? The ongoing activities related to higher forestry education within IUFRO and IFSA, make some expectations look justified (Rekola *et al., s.a.*). Also Stähli, at the SILVA Network conference in Bern in 2014, showed possible ways for quality development, by outlining how self-reflection of the teacher may contribute (Stähli, 2016).

After all in this résumé, with respect to higher forestry education, one should not forget the top-down process of implementation, with little chance of participation and against much resistance, with a delayed or fragmentary perception thereof at university and more so at faculty level. One is almost inclined to speak of an application of an Administrative Paradigm rather than of a Learning Paradigm. Looking at the achievements and situations in the faculties of forestry, at "our" universities, "our" students and "our" teachers of forest sciences "we" realize that on the whole the faculties have come to terms with the impacts of the Bologna Process that for the most part do not seem to have been welcome. The teachers seem to be tired of efforts of protest, while the students of today only know the present reality.

In summary, true also for higher forestry education, one may state: Didactical changes did and do not need the Bologna Process – it contributed little to improved learning and teaching, if anything at all. Whether the afore mentioned changes that have been induced by the Bologna Process, may help to overcome the challenges of the Corona pandemic for learning and teaching seems to be questionable.

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IMPACTS OF THE BOLOGNA DECLARATION ON FOREST SCIENCE DEGREE PROGRAMMES OF THE TECHNISCHE UNIVERSITÄT MÜNCHEN

GERHARD MÜLLER-STARCK AND MICHAEL SUDA

Abstract

The implementation of the "Joint Declaration of the European Ministers of Education" (Bologna Declaration, 1999), strongly influenced structures and features of higher education in the fields of forest science. Expectations were raised with respect to the improvement of quality and flexibility of corresponding degree programmes. The present contribution surveys major dynamics at the Technische Universität München (TUM), Germany, and tries to answer the question of whether or not these expectations were fulfilled in the past two decades. In particular, structures and dynamics of study programmes are the focus with inclusion of new vocational combinations. Students´ mobility is another important aspect, as well as the improvement of the compatibility of module structures and the transferability of ECTS credits. Generally, an adequate response of higher education to the demands of the job market was challenging in the past and will be in future.

Keywords: Forest science, study programmes, diploma, BSc, MSc, Technische Universität München

Introduction

The replacement of the Diploma curriculum by consecutive Bachelor (BSc) and Master (MSc) curricula may require an unexpected long period: In case of the Study Program Division *"Forest Science and Resource Management"* (FSRM, "Forstwisssenschaft und Ressourcenmanagement") of the Technische Universität München (TUM), the Diploma curriculum was offered parallel to BSc and MSc curricula for nearly 10 years. This long period was the consequence of authorisation of students of the Diploma curriculum to refuse the transit to BSc or MSc curricula, respectively. The obligation to offer parallel Diploma and BSc/MSc curricula longer than expected was a heavy load for the Study Programme Division FSRM due to the extended demand for teaching and room capacity.

Diploma

At the TUM Study Programme Division FSRM, the standard Diploma curriculum, required a duration of 4.5 years, i.e. 4 years studies, 4 months internship, and an examination period (9 terms in total). In the late 1990th the demand of our graduates by the job market decreased substantially. This was one main reason to change the

structure of the diploma programme. One main goal was to offer more flexibility and to balance in between the dimensions of sustainability (ecosystem, production and society; more details and perspectives e.g. Suda and Rollmann, 2001; Suda and Beck, 2001).

As an example, during the year 2003, a total of 296 credit points (CP; equivalent to the ECTS system) needed to be achieved, i.e. on average 33 CP per term, distributed as follows:

- Study year 1: 19 courses, mostly basics: 69 CP
- Study year 2: 22 courses, basics & FSRM specific: 67 CP
- Study year 3: 27 courses FSRM specific: 85 CP
- Study year 4: 3 extension blocks (out of 18): 45 CP
- Diploma thesis 30 CP

With respect to students´ mobility, the Diploma curriculum provided an extent of flexibility, which had grown during the last two decades before its termination. This tendency was the consequence particularly of the extended scope of action with respect to the chronology of examinations, the increased eligibility of subjects, and the acknowledgement of external course achievements in most cases. Students were given more flexibility and time possibilities to plan and execute their studies.
Consequently, students` mobility increased so that up to 5% of all students spent one term at an university abroad (ERASMUS programme and „free movers“). Problems with the acknowledgement of external course achievements were the exception rather than the rule. Anyway, these figures are still behind the ambitious goals of the EU-Leuven Communiqué which aims at a rate of 20 percent of all outgoing students within EHEA (European Higher Education Area), who collect at least a minimum of one credit point from another university (EU, 2009).

Quality management with respect to the Diploma curricula was the responsibility of the organizers of the respective programmes. Until 2009, the Study Programme Division FSRM was subject to programme accreditation by the "*ACQUIN Akkreditierungsagentur*" (Agency for accreditation).

PhD programmes follow the standards of the TUM (for survey see Müller-Starck *et al.*, 2013). In case of the Study Programme Division FSRM, small scale structured PhD student programmes were run in addition, lasting approximately three or four years. In case of a publication in a reviewed journal or in peer reviewed proceedings of an international congress, PhD students could (and still can) receive financial support from the TUM outside their employment contracts and scholarships, respectively. Today, for all PhD students it is mandatory to attend a Graduate School at TUM.

Since 1997, the organisation "*Münchener Forstwissenschaftliche Gesellschaft* e.V." (MfG), is active independently from the Alumni Network of the TUM. It maintains contacts among the alumni within the forest sector. It is dedicated as a dialogue platform between employed foresters, graduates and students. The MfG communicates current research activities, events at the Study Programme Division FSRM, and it provides contacts to enterprises for the graduates. Regular meetings and a publication series help to achieve these goals. Although it cannot be considered as an established career service, this alumni platform supplies links to the job market. Generally, the Diploma was, and still is, widely accepted by the state forest service as well as by municipal and private forest owners. Most of the employees in these sectors graduated together.

Bachelor

In contrast to the Diploma degree, the BSc degree offers a new dimension of flexibility because graduates´ expertise can be expanded, upgraded or generally increased in value in combination with an additional MSc curriculum at the same university or any other higher education institution, in the home country or abroad.

At early stages, the establishment of the BSc system caused a variety of problems. The main reason for this was the lacking ability to look at the BSc as a new and independent category: BSc curricula were derived from the former Diploma under substantial reduction of the study period, at least by one year, in case of the TUM by 1.5 years (from 9 to 6 terms). Consequently, workloads of students increased considerably in most cases, so that BSc curricula started suffering from compression and corresponding regimentation. Flexibility diminished due to the declining portion of elective fields and subjects, in comparison to the Diploma system.

Students´ mobility decreased considerably, with lowest values in 2011 and 2012 (a total of three and four outgoing students, respectively). Students risked an involuntary prolongation of their studies up to one year in case they wanted to study one term abroad. Suggestions were made to overcome these restrictions (Ziesak and Müller-Starck, 2014, Müller-Starck *et al.*, 2015) but the situation did not change essentially. This is one of the major reasons why the BSc curriculum had to be reorganized, starting in 2014 (for details see Müller-Starck and Weber, 2016). This new structure followed the demand of the quality management agency of TUM. In order to stimulate students to spend one term, or part of it, abroad without an involuntary prolongation of studies, the 6th (last) BSc term was, and still is dedicated as "mobility window" (summer term in Figure 1). The 30 CP are segmented as follows: Internship and Bachelor´s Thesis (10 CP each), "Elective subject" and "Examination module" (5 CP each). The examination period is kept flexible within a specific frame.

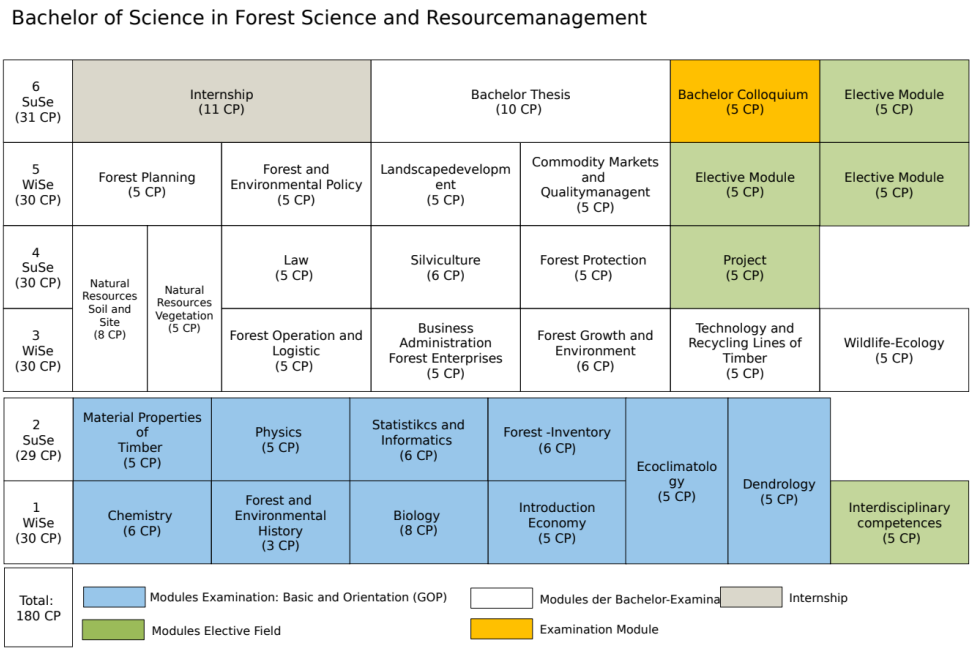

Figure 1: BSc curriculum Forest Science and Resource Management ("Forstwissenschaft und Ressourcenmanagement"). "SoSe", "WiSe" stands for summer and winter term (semester), respectively.

Courses in basic sciences are now offered jointly to all students of different faculties. At subsequent stages, students elect three out of four major "Fields of Concentration". Like every curriculum, the BSc curriculum is object to TUM´s quality management system and accreditation (Müller-Starck *et al.* 2021)..

The critical response of the job market was a severe problem at the beginning. Missing acceptance or at least sceptical attitudes by state and private forest services towards BSc graduates from universities was the rule rather than the exception. Different competences of BSc graduates of the TUM in comparison to those from universities of applied science ("Fachhochschulen") were the major reason. This constellation has not changed totally. BSc graduates' field of employment can match with their education in a great extent, as long as they attended a forest polytechnic engineers curriculum as shown for instance in Finland (Rekola and Lautanen, 2015).

Master

There are two Master curricula, "*Forest and Wood Science*" (courses in German), and "*Sustainable Resource Management*" (SRM, courses in English). Both are object to the TUM´s quality management system and accreditation. Each curriculum consists

of four terms, the last one dedicated to the Master´s thesis. Analogously as in the BSc curriculum, students can spend the last term (or part of it) abroad.

In case of the curriculum MSc in Forest and Wood Science ("Forst- und Holzwissenschaft", Figure 2), students select three "Fields of Concentration" out of the following six, which altogether offer a remarkable range of specialisations:

- Timber, raw material and wood-based products,
- Forest management in mountainous regions,
- Forest management,
- International forestry and agroforestry,
- Site assessment and land use,
- Landscape development and nature conservation.

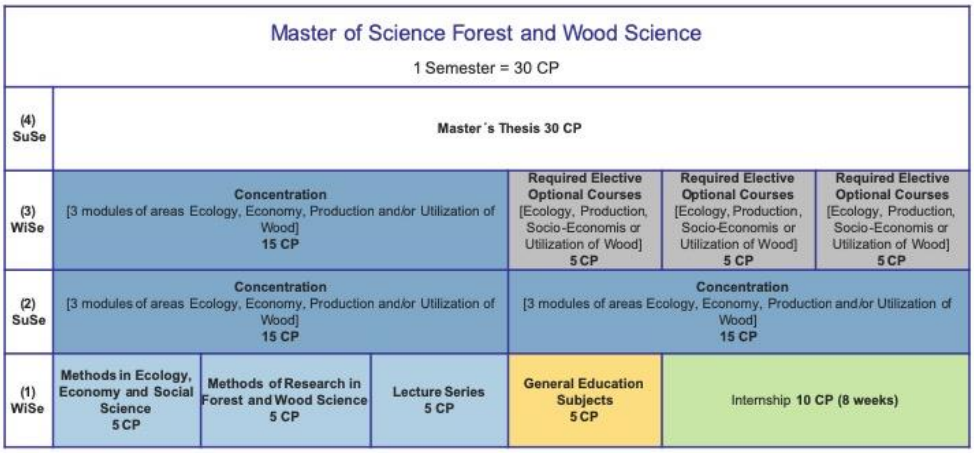

Figure 2: MSc curriculum Forest and Wood Science ("Forst- und Holzwissenschaft"). "SoSe", "WiSe" stands for summer and winter term/semester, respectively.

One demand of the quality management is, that the fields of concentration need much more flexibility. This offers the chance to include more topics in peripheral areas of forest science.

In the case of SRM (Figure 3), the flexibility of the MSc curriculum was increased by extending existing subjects (e.g. renewable resources includes non-matter sources such as wind and solar energy) or by condensing the curriculum via replacing compulsory courses by a limited number of major "Fields of Concentration", out of which students will select a defined number (for details see Weber and Müller-Starck, 2016). Furthermore, methodological competences are strengthened, e.g. by means of planning and modelling tools.

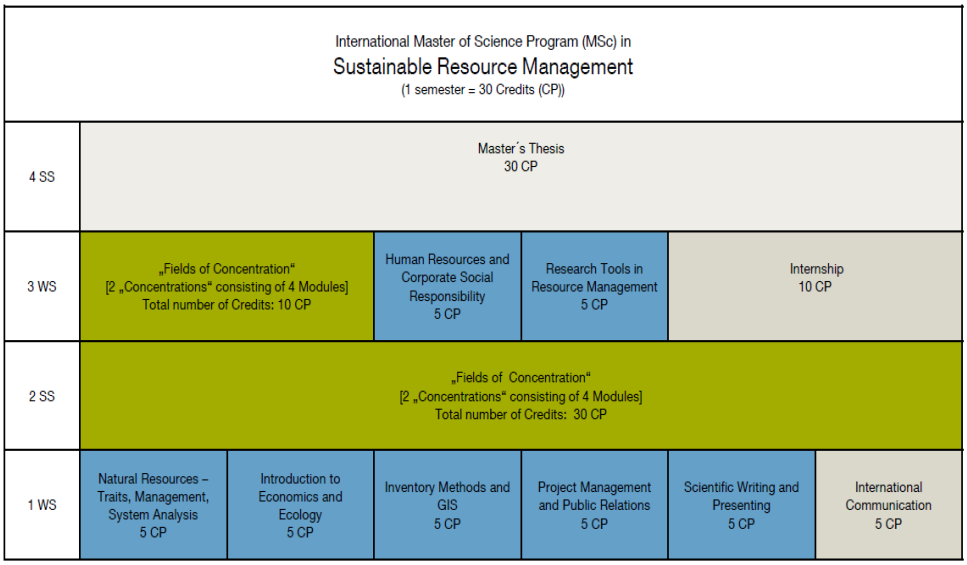

Figure 3: MSc curriculum Sustainable Resource Management. Duration is 4 terms, each with 30 credits (CP). “SS”, “WS” stands for summer and winter semester, respectively.

The job market acceptance of MSc graduates, including by state and private forest services, is much better than that of BSc graduates. In this sense, MSc can be considered to be equivalent to Diploma in the classical forestry related fields and better in adjacent fields, depending on the specialisation of the respective graduates.

Conclusions

The transition from the university Diploma curriculum to BSc and MSc curricula caused criticism, particularly by state and private forest services, and resulted in uncertainties with respect to the employability of graduates. After a period of adaptation, the matching of educational tasks and the demands of the job market seems to be improved in small steps. Today, even a lack of graduates on the job market may occur.

Generally, the combination of BSc and MSc, especially at different higher educational institutions, opens a new dimension of graduate´s employability and offers better options with respect to entrepreneurial independency and self-employment. Important devices are career service activities and in particular, life long learning strategies (e.g. Mapeto and Cossatti, 2017; Ziesak and Rosset, 2017). Both are on the way but need to be intensified. Alumni networks, which are active at the TUM and the Study Programme Division FSRM, supply contacts, impulses, and experiences with respect to the job market.

Parallel to the introduction of BSc and MSc curricula, quality management standards were considerably improved and degree programmes were stimulated to be attractive and internationally competitive. Impacts of the "Standards and Guidelines for Quality Assurance in the European Higher Education Area" are evident. Within two years both programmes have to be revised. One major aspect is, that the programmes should be kept flexible.

The overall impression is that the step from Diploma to BSc and MSc was beneficial but that further improvement is necessary, particularly with respect to the structure of BSc curricula. In order to enhance students´ mobility, a better compatibility of module structures and the transferability of ECTS credits among universities is needed. This may also hold for the majority of MSc curricula. Furthermore, links between MSc and PhD programmes (Bologna Cycles 2 and 3) could additionally strengthen expertise of graduates.

An adequate response to both, changing European educational standards and changing demands of the job market is challenging now and will be so in future.

Acknowledgements
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HIGHER EDUCATION IN FORESTRY IN THARANDT – BEFORE AND AFTER IMPLEMENTATION OF THE BOLOGNA PRINCIPLES

NORBERT WEBER AND STEPHAN BONN

Abstract

Amongst well established sites of education in forest sciences, Tharandt, Germany, belongs to those with the longest tradition. Graduates from this site influenced forestry education and practice in quite a number of countries worldwide. During more than 200 years, there have been many changes as a result of adaptation to changing framework conditions. After adoption of the Bologna Principles in 1999, the lecturers of the Tharandt Department of Forest Sciences decided to harness the underlying philosophy for fundamentally improving teaching and learning in programmes of forest sciences. Although some shortcomings are visible, overall feedback from graduates and stakeholders is positive, mainly due to the higher flexibility in comparison with the Diploma system. Future challenges are arising both from higher education policy and implementation questions. Besides permanent adaptation to the needs of the job market, keeping the 'forest focus' will be one of the fateful questions for the future.

Keywords: Forest sciences, forest history, Tharandt, study programmes, syllabi, graduate survey, public image

The early stages of forestry education in Tharandt

With regard to forestry education, Tharandt is one of the most traditional sites in the world. Although at the end of the 18th century there were previous deliberations to establish a Saxonian forest academy in Freiberg (Schuster, 2013), it was in 1811 when Heinrich Cotta opened his forest academy in the village of Tharandt, close to a large forest area and not too far away from Dresden. In the year 1816, the private institution was transformed into a Saxonian Royal Academy. Finally, the academy became part of Technische Universität Dresden in 1929.

- From the beginning on, there was a continuous discussion if the study programmes should be adapted to the needs of the state forest service only or if they should be open to a broader group of students. Consequently, the requirements for admission to the academy were modified several times (Lorenz, 2012):
- 1816: Minimum age 16 years, lower level of education, morality; open for all applicants, not only those interested in a career at the state forest service.

- 1832: One year of practical placement before enrolment necessary for aspirants of state forest service.
- 1846: Minimum age 17 years; one year of practical placement for all; knowledge level of Gymnasium or secondary school necessary for aspirants of the forest rangers career; final secondary-school examinations from Saxony for forest district officers education.
- 1852: One year of practical placement for aspirants of state forest service; examination report from a secondary school for all fulltime students.
- 1862: Final secondary school certifications obligatory for aspirants of state forest service.

During more than 200 years, the curricula have been permanently adapted to the respective framework conditions. While some disciplines disappeared from the timetables or have at least a modified title today, others kept their name until now. Taking the curriculum of the Royal Forest Academy for the winter term 1828/29 as an example, the then offered disciplines 'forest management planning' and 'forest protection' are still an integral part of the curriculum today while 'arithmetic exercises', 'drawing of plans', 'French language', 'Latin language' cannot be found in the study plans anymore and have been replaced. This is even more the case for lectures in 'Encyclopedia of forest science' or 'patriotic history'. Agricultural science was offered during nearly 40 years (1830-1869) when the Academy consisted of both an agricultural and a forestry department. Table 1 gives an example of teaching contents of the Royal Forest Academy at the end of the 1920s. All lessons listed were taught by the lecturers during summer term and during winter term, respectively. So Table 1 covers more than one batch.

In the 19th century, students had to pay study fees and also for reserving a seat in the lecture hall. It was possible to study as a remote student or guest student. There were consecutive study programmes and complex excursions combining different disciplines. These excursions, conducted per pedes at that time, lasted up to 10 days and gave students even the opportunity to visit remote forests bordering Bohemia (Weber, 2011).

Education in forestry at the Academy in Tharandt was always open to foreign students, although in the 19th century the categorization "foreign" also applied to people from neighbouring countries outside Saxony, i.e. Thuringia or Bavaria. Due to that fact the numbers of "real" international students are a little bit lower. In total, 1503 students from 48 countries were classified as foreign from 1811 to 1945. Additionally, during the period when Tharandt offered academic education both in forestry and agriculture, 177 students were inscribed in agriculture. Some of the students became famous representatives of the forestry profession in Russia, Finland, Japan, China and other countries.. Amongst others, Alexander E. Teplouchoff, Maxwell Jacobs, Seiroku

Table 1: Example for early teaching contents in forest sciences: Curriculum of the Royal Forest Academy in Tharandt, summer term 1928 and winter term 1828/29. Source: Cotta, 1828, translated by the authors.

Lessons in Summer Term	**Hours per week**	**Lessons in Winter Term**	**Hours per week**
Silviculture	6	Forest management planning	4
State forestry	1	Forest protection	3
Arithmetic	6	Theoretical geometrics	6
Theoretical forest botany	4	Practical geometrics	3
Practical forest botany	4	Encyclopedia of forest science	2
Orography	4	Basics of physics and chemistry	6
Soil science	4	Application of chemical	2
Physical geography	2	principles	
Natural history	4	German language style	3
German language	3	Zoology for hunting	2
Morale	1	Morale	1
Hunting & hunting ground	4	Hunting	3
management	4	Arithmetic exercises	6
Target practice	3	Drawing of plans	4
Geometric exercises	4		
Measurement exercises	4		
Taxation exercises	6		
Drawing of plans			

In addition, there was a private, voluntary offer by lecturers Krutzsch and Tappe in the fields of agricultural science, patriotic history, French language and Latin language

Honda and Risto Sarvas have to be mentioned here (Lochmann and Lochmann, 2011). Alexander E. Teplouchoff (1811-1895) studied forestry in Tharandt from 1834 to 1838 with excellent performance. After returning to Russia, he was responsible for the management of a forest area of about 500.000 ha on behalf of the countess Stroganova and established a forest botanical garden in Iljinsk. He married the daughter of a Professor of the Tharandt Forest Academy (Prof. Krutzsch), and their sons studied in Tharandt as well. Maxwell Jacobs (1905-1979) came from Australia, both for studying and accomplishing a PhD. As one of the leading forest scientists in Australia, he published a worldwide used book on Eucalypt trees and, received many honours in his home country. From Japan, Seiroku Honda (1866-1952) visited Tharandt in the summer term 1890. Later he was employed as a Professor for Forest Sciences at the Emperor's University Tokyo, and also received high honours as head of professional organizations and societies. Taizan Shiga, studying in Tharandt between 1885 and 1888, is a second prominent person from Japan that should be mentioned here. Risto Sarvas (1908-1974) came from Finland. Acting as professor of silviculture at the Finnish Institute for Forest Research for a long time, he gained recognition as one of the most productive researchers in forestry at that time. He was author of a monography about the conifers of the world, and many of his articles on blossoms and seeds still are cited today (Lochmann and Lochmann, 2011). Further remarkable professional traces of graduates from Tharandt can be found e.g. in France and Spain.

Actual questions of teaching and learning on the Campus of Tharandt[14]

As in many other universities in Europe, a fundamental change of study programmes in forest sciences occurred during recent decades. Many – but not all – of them are a consequence of switching from traditional higher education (in Germany Diploma programmes, still offered in some other disciplines) to the two-tiered system of Bachelor and Master degrees. In Tharandt, this opportunity was not only seized for formal adaptations. Rather, the underlying 'Bologna philosophy' was implemented on a large scale. A modularization took place where completely new and multi-disciplinary modules were developed. With regard to the contents or topics of teaching, in addition to knowledge, more emphasis was laid on competences and skills. Forms of teaching and learning were stronger oriented towards the needs of the job market, especially for the Bachelor programme. Finally, the Department of Forest Sciences took part in the development of an integrated Master programme on Spatial Development and Natural Resources at the level of the Faculty of Environmental Sciences.

While the introduction of the Bachelor and Master System has been commented critically for many study programmes in Germany, a lot of positive experiences have been gained with implementation of the new type of education in forest sciences Tharandt; it offers a higher flexibility in comparison to Diploma system. Graduates with a Bachelor degree can decide to continue with a 'classic' forest master or in another direction either at TU Dresden (e.g. wood economy and wood technology) or somewhere else.

- students are able to complete a study programme after six semesters, an opportunity for those who would not be able to continue successfully or are no longer interested in studying.
- the marks students achieved in a previous BSc programme is an indicator for the formal admission to studying a Master programme. Besides, within the application procedure for the Master programme, the aptitude of applicants can be evaluated again, partly even for special tracks of the Master.
- in contrast to other study programmes, for Bachelor students in forest sciences there is a clearly defined job profile available.
- the system encourages mutual exchange of graduates between universities and universities of applied sciences after the BSc grade.
- as was mentioned above already, a reconfiguration of the study programmes in forestry took place by interdisciplinary organization of modules and integration of soft skills, both within the modules and as separate offers.

14 Special topics of forest education in Tharandt have been addressed in several previous issues of SILVA Proceedings (Böhnke and Weber, 2013; Weber and Bonn, 2014; Weber and Stefke, 2015). The current paper is focused on the change from traditional to "modern" education in forest sciences against the background of the Bologna Principles.

- lifelong learning is encouraged by part-time options of study that have been fixed in the Bachelor programme of forest sciences recently and should also be introduced for the Master programme.

Some of the changes, e.g. reduction of disciplinary contents and stronger orientation along obligatory timetables, were initially perceived as shortcomings by some of the lecturers. However, in the meantime the new structure gained high acceptance.

Teaching at the Department of Forest Sciences in Tharandt today is characterized by several features:

- a site-specific, traditionally high commitment for aspects of teaching,
- scientifically based study programmes focused on topics around forests and forestry,
- obligatory defence of Bachelor and Master theses,
- a strong international orientation in teaching and collaboration.

Examples for the latter are the Master Programme in Tropical Forestry, some obligatory modules in English language, an increasing share of international topics in the lectures and the involvement of staff in international teaching projects like the UNEP/UNESCO/BMUB-CIPSEM course. Additionally, the modern and renovated buildings on the Campus, a well-equipped library, easy access to the neighbouring Teaching Forest and an outstanding Arboretum offer favourable conditions for teaching and learning. Last but not least, there is a strong connection to the city of Tharandt, the so-called Forststadt (forest city).

However, as everywhere there is room for improvement. That is why at the occasion of the 200-year anniversary in 2011, a Diploma thesis was assigned to find out more about the "external view" (Staudtmeister, 2011). This study offered interesting insights. From the view of the 73 respondents of the survey (graduates from forestry study programmes, practical forestry, forest industries and wood trade, nature conservation, specialists from other universities), Tharandt was regarded as a discrete site of university education, especially due to the long tradition. The local and regional meaning of the site was highly appreciated. However, the small size of the campus was seen as ambivalent. On the one hand, there is a familiar atmosphere and the campus received high values for attractiveness and sympathy, especially from graduates. On the other hand, some felt disadvantages in the infrastructural field as the campus is situated about 14 kilometers outside the main campus of TU Dresden and many of the students have to commute daily between Tharandt and their accommodation in Dresden. Practice-orientation of teaching, based on a well-established cooperation with external partners, was seen as strength. Yet, for some of the lecturers, the strong focus on teaching might have resulted, at least partly, while neglecting research.

In 2015, for the four German university faculties offering forest sciences programmes (Freiburg, Göttingen, München/Freising, Dresden/Tharandt) a survey was conducted with the aim to get insights into the professional career of graduates, both of Bachelor and Master programmes (Liebal and Weber, 2016). In comparison to the other three universities, graduates from Tharandt had a very idealistic motivation for the study programmes, they expressed the highest satisfaction with the programmes and showed high values with regard to self-assessment of imparted capabilities and skills. However, in comparison to graduates of the other German forestry faculties, they complained about more problems in the phase of job application and less satisfaction about the job due to lower incomes. It has to be mentioned here that the job market in Saxony or other parts of Eastern Germany has been more problematic than in the rest of the country. Apart from that, many students want to stay in the surroundings of Dresden what causes an excess supply of labour and lower wages (Liebal and Weber, 2015).

Actual challenges of teaching at TU Dresden in Tharandt, with about 800 students and 19 lecturers, are resulting both from general questions of higher education policy and technical questions. Higher education policy urges universities to conduct permanent evaluation of academic performance. While this causes a lot of additional work, evaluation criteria still are primarily oriented towards third-party funding and peer-reviewed publications. It has to be mentioned here that TU Dresden has been conformed as one of 11 universities of excellence in Germany in 2019. Besides, at the Tharandt site a unique teaching profile has to be developed that is different from the profiles of other universities. This is not also necessary because of the formal convergence of BSc and MSc degrees of universities and universities of applied sciences (UAS) but also because of the new Master programmes in forestry and related disciplines that have been established by the UAS. Continuous education and lifelong learning are a further point to consider. While the BSc / MSc system encourages an intermitted academic education (Bachelor – professional practice – Master), in fact only a few students choose that option. That is why the option of part-time studies is offered now as well.

Staff involved in teaching builds an important resource. The involved challenges in Tharandt comprise a slight reduction in the number of professorships, the educational profiles of newly appointed professors (forestry and non-forestry profiles), a low number of senior lecturers and only limited capacities of teaching by third-party funded staff. Finally, there is a kind of supplement of sectoral study programmes (forestry) by integrated programmes (e.g. Master in Spatial Development and Natural Resources Management) and “Single Issue-Masters”, e.g. Ecosystem Services, on faculty level.

In addition to higher education policy, further framework conditions are influencing higher education in forest sciences at Tharandt:

- The Quality Management System (TU Dresden opted for system accreditation in 2012 and implemented it subsequently) causes comprehensive reporting

obligations for all study programmes and leads to a permanent adaptation of examination regulations and other study documents.
- Within this broader framework, the quality aim of internationalization encourages the development of study programmes, or at least modules, in English language.
- For covering all aspects of student lifecycle management, new and comprehensive software applications are introduced at the university.
- Depending on the situation on the job market, the expected competences of graduates are changing. For instance, there is an informal „Catalogue of Requirements“ in which state forest enterprises and authorities in Germany have enumerated the indispensable knowledge fields for being hired in the state service.

For addressing these and other questions, an advisory board (Programmbeirat), consisting of students, faculty staff and representatives of professional fields in which graduates are employed, convenes once a year in Tharandt. This institution has proven as a valuable forum for continuous development of the study programmes that are offered by the Department of Forest Sciences.

Future challenges for higher forestry education – in Tharandt and elsewhere

On a worldwide scale, forests are providing a multitude of products and services for the wellbeing of billions of people, including climate change mitigation and protection of biodiversity. For the proper management and protection of these “green factories”, well-educated specialists are needed. These should be able to analyse the complex and dynamic societal demands with regard to feedstock, energy, biodiversity, climate, soil and water. They should be able to develop solutions to fulfil these demands without endangering the capacity of the forest ecosystem. Consequently, education of students in forest sciences needs to be balanced along several cleavages. Basic or traditional knowledge has to be amended (and partly also replaced) by current (but not just “fashionable”) topics that might be traditional in a few years from now. A balance is also necessary between disciplinary specialisation, with regard to theories and methods, and multi- or interdisciplinary approaches. While a narrow-minded teaching focus, oriented towards classical topics of forestry only, is not reflecting complex realities, thematic arbitrariness along ‘catchwords’ has to be avoided as well. With regard to relations between university and practice, scientific depth has to be accompanied by transdisciplinarity and political relevance. This is the only way to prevent researchers and lecturers being blamed for living in the “ivory tower” of science. Finally, a balance has to be found between traditional, proven and tested forms of teaching and innovative forms of teaching and learning, especially those supported by digitalization.

Besides the introduction of Bachelor and Master Programmes,, some further challenges have to be taken into consideration. These relate to the changing entrance qualification of students and the design of the introductory phase of the programmes; the delineation between tasks of universities and universities of applied sciences; the permanent evaluation and accreditation of study programmes and the connection to

practical professional qualifications (especially the European Qualifications Framework, EQF; European Commission 2018). But also changing societal attitudes towards forests and forestry are playing an important role. Last but not least, the dramatic challenges for practical forestry (extreme weather events, forest fires, adaptation to climate change, combating the loss of biodiversity, searching for the adequate role in bioeconomy) necessitate a permanent adaptation of teaching and learning, contents and methods.

Conclusions and outlook

Within more than 200 years of its existence, higher forestry education in Tharandt underwent many institutional, organizational and conceptual changes. Amongst others, there has been a permanent differentiation of admission requirements, dynamics in the teaching contents of the disciplines (cf. Weber, 2007), refinement of teaching methods and an increasing interest in internationalization. Much stronger than other external factors, the Bologna Principles had a decisive influence. Implementation of the principles did not only result in new formal structures of study programmes, i.e. change of the headlines from Diploma to BSc and MSc. Rather it encouraged the responsible actors to modify modes of decision making, including stronger involvement of stakeholders like students and employers. Even more important, it introduced a shift in attention from teaching to learning. Apart from that, the situation for graduates in forest sciences in Germany generally has improved considerably in recent years, and representatives of forest enterprises and administrations are actively approaching universities for recruiting purposes. At least for the nearer future, for graduates of forest sciences from TU Dresden there will be attractive job offers in forest administrations on national, sub-national and communal level, in research institutes, in the private sector and in many forest-related fields. The most important challenge for the future is to find a balance between competing interests on different levels of higher education policy (local, regional, national, European). While further professionalization in research and teaching, oriented at complex questions (e.g. land use, resilience etc.) is inevitable, centrifugal forces uncoupling forest sciences and education from their core focus, i.e. forest and forest landscapes, have to be controlled. Against that background, higher forestry education in Tharandt will still be competitive in the future.

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FOREST SCIENCE EDUCATION IN PRAGUE – HISTORICAL DEVELOPMENT AND NEW PERSPECTIVES

JIŘÍ REMEŠ

Abstract
The paper deals with the development and new perspectives of forestry education at the Czech University of Life Sciences (CZU) in Prague. CZU is one of the leading public universities in the Czech Republic. The development of the CZU during the last years, as a result of the international and national social and political processes, was dynamic. Currently, CZU has more than 19,000 students (20% are from abroad) including the Faculty of Forestry and Wood Sciences (FFWS) with approximately 1700-2000 students. The modern history of FFWS began in 1990, currently the faculty is one of the most respected educational and scientific institutions in forestry and wood sciences in the Czech Republic. The investment in technical equipment, including the construction of two new pavilions, made a significant contribution to this. Today, the faculty offers a wide portfolio of study programmes from traditional Forestry, to Arboriculture, Game Management, Wood Processing, and to Wood-based Constructions. Further development is aimed at increasing the quality of all processes at CZU and FFWS. All FFWS study programmes have been re-accredited by a new accreditation system and now is the time for their evaluation and quality assurance.

Keywords: University of Life Sciences Prague, Faculty of Forestry and Wood Sciences Prague, study programmes, internationalization, Forest Science Education.

Introduction

The current situation of the Czech University of Life Sciences is the result of a process initiated by changes in the political system of the Czech Republic in 1989. In addition to the necessary legislative changes, the so-called Bologna Process and the creation of the European Higher Educational Area (EHEA) were a major impetus. For the Faculty of Forestry, which was restored in 1990 after 25 years of disruption, it opened up opportunities for complex development and international cooperation. Especially the mobility of students and teachers was supported significantly (Eenes, 2013).
Another major change was the division of higher education into three cycles – bachelor, master and doctoral (BSc, MSc, and PhD). These changes also contributed to a significant increase in the number of students at universities in the Czech Republic. Within 10 years, this number has doubled and the maximum number reached in 2010 (Figure 1), but since then the number of university students has been decreasing.

This trend did not fully correspond to the demographic development in the Czech Republic. Here, after the change in the political system, there was a deep decline in the birth rate (-33%), which lasted until 2001 (Figure 1). During this period, the number of university students increased by almost 100%. It is clear that the opportunity to study at universities in the Czech Republic increased significantly (Remeš, 2014). The difference is noticeable when comparing the share of students enrolled in university studies for the first time in the population of 19-year-olds. In 1991, this share was only less than 17%, in 2018 it was more than 49%. This, on the one hand, removed undesirable politically motivated barriers, but on the other hand, the quality of incoming students decreased to some extent.

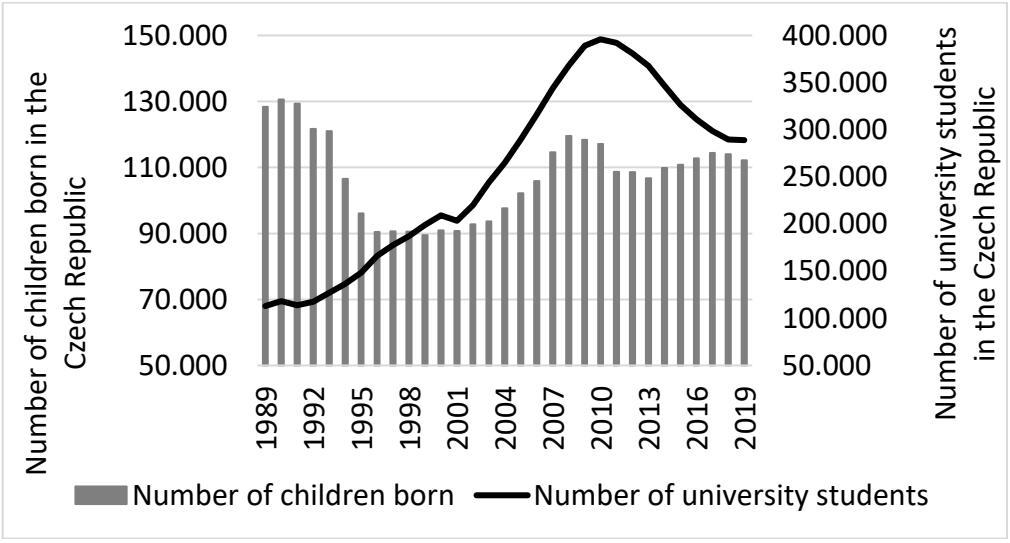


Figure 1: Demographic development and number of university students in the Czech Republic (Czech Statistical office – ČSÚ, 2019, Pačes, 2013).

Development of the Czech University of Life Sciences and Faculty of Forestry and Wood Sciences

The Czech University of Life Sciences (CZU) is one of the leading public universities in the Czech Republic. It is one of the six largest universities in the country. First lectures on agricultural sciences were delivered at the Faculty of Philosophy of the Prague Charles-Ferdinand University in Prague in 1776. A Department of Agriculture was subsequently established at the Czech Polytechnics in 1812. First lectures in forestry sciences were then given in autumn of 1848. The actual history of our university begins in 1906 with the establishment, by decree of the Austro-Hungarian Emperor Franz Joseph I, of a Faculty of Agriculture at the Czech Polytechnics in Prague. Reforms in the sphere of education in the newly founded Czechoslovak Republic (1918) led to structural changes of the Czech Polytechnics, which was renamed Czech Technical University in Prague in 1920. The Faculty of Agriculture

was transformed in 1920 into a College of Agriculture and Forest Engineering. It was still part of the Czech Technical University, in July 1952 the College became an independent University of Agriculture. The Faculty of Forestry was transformed into the Forest Research Institute in 1964 and fully restored in 1990. After the downfall of the Communist regime in 1989, and the establishment of democracy, the Czech University of Life Sciences (renamed in 2007) started a new chapter in its development.

The recent dynamic development of CZU, as a result of the above-mentioned international and national social and political processes, is clearly visible in all major activity areas. Currently the Czech University of Life Sciences has more than 19,000 students (Figure 2; 20% are from abroad) including the Faculty of Forestry and Wood Sciences with approximately 1700-2000 students. The university has about 2000 employees, of which more than 900 are Professors or Associate Professors. Since 2007 the CZU is member of the Euroleague for Life Sciences (www.euroleague-study.org).

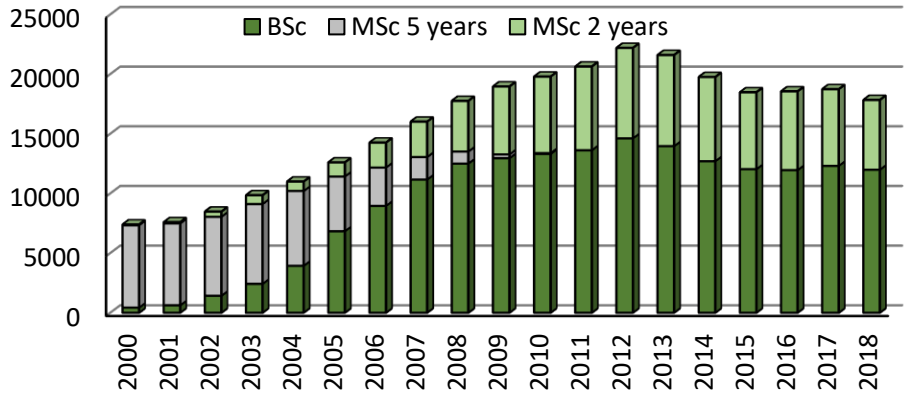


Figure 2: Development of the total number of students (Y-axis) in Bachelor's and Master's degree programmes at the CZU since 2000.

Today, the CZU offers around 200 combinations of study programmes at the Bachelor's, Master's and doctoral levels, one quarter is in English. A similar trend is also evident in the number of graduates, which increased in proportion to the increase in the number of students, with a maximum of 5,522 reached in 2014 (Figure 3). In 2018, CZU obtained institutional accreditation for a total of seven areas of education. This entitles the university to independently create and approve study programmes.
The modern history of Faculty of Forestry and Wood Sciences (FFWS) began in 1990, when two study programmes were opened – Forest Engineering and Landscape Engineering with a total of about 100 students. Today, the faculty offers a wide portfolio of study programmes from traditional Forestry, to Arboriculture, Game Management, Wood Processing, and to Wood-based Constructions. The faculty offers

seven study programmes and specializations at the Bachelor's level, five at the Master's and nine at the doctoral level. Twelve study programmes are also taught (in parallel) in English. The number of students has stabilized in recent years (Figure 4 and 5).

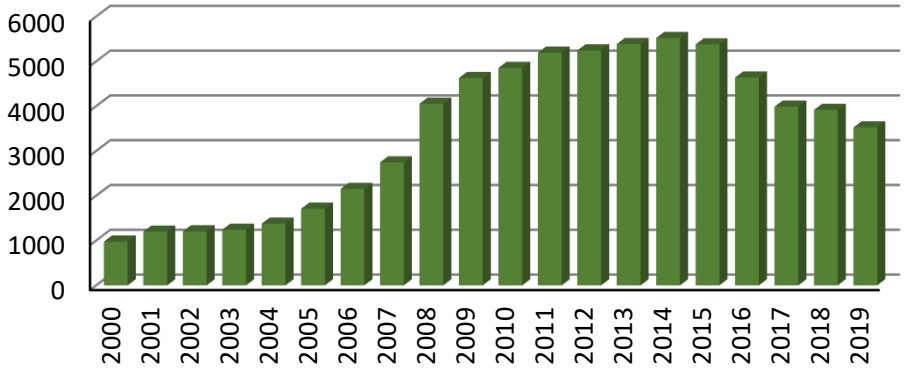


Figure 3: Development of the number of CZU graduates (Y-axis) in the years 2000-2019.

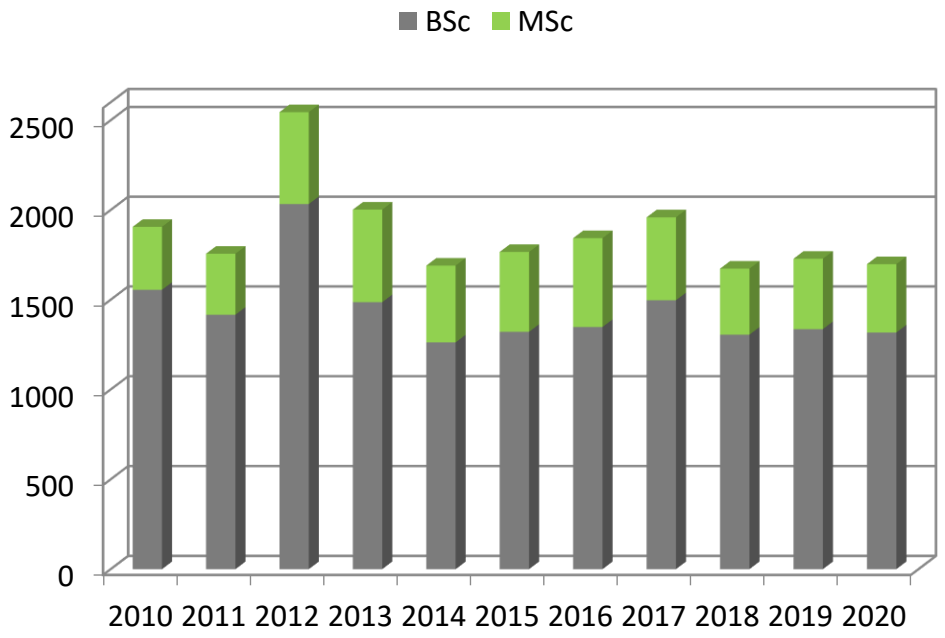


Figure 4: Number of students (Y-axis) in Bachelor's and Master's degree programmes at FFWS in the years 2010-2020.

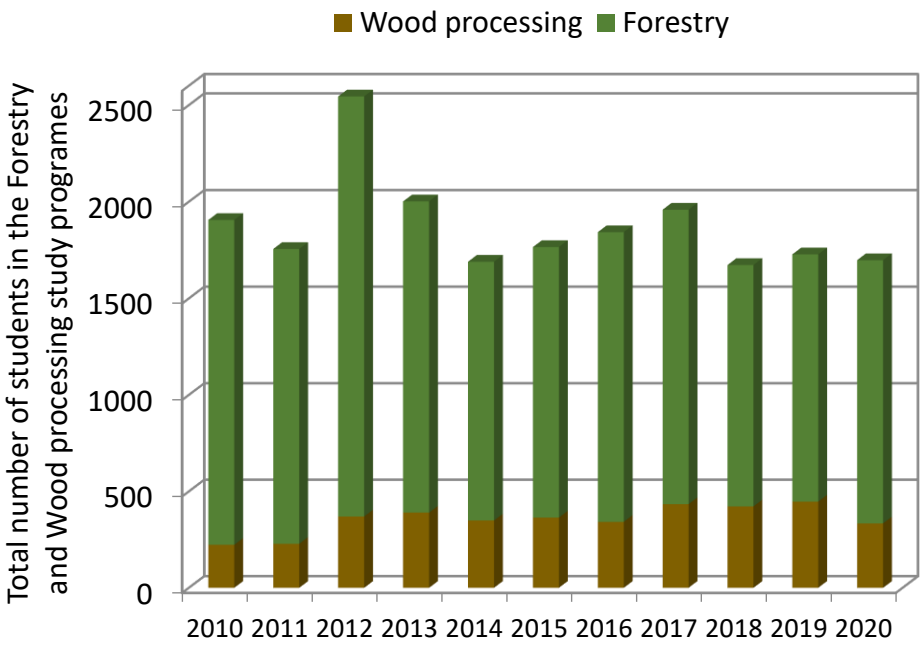


Figure 5: Number of students (Y-axis) in Forestry and Wood Processing study programmes at FFWS in the years 2010-2020.

The number of students in bachelor's programmes has stabilized at 1300-1400 and forms the main part of the students of the faculty (Figure 4). There are 350-450 students in master's programmes and around 150 students at the doctoral level. Most students study in forestry-oriented programmes (1300-1400), around 350-400 in programmes focused on wood processing and wood construction (Figure 5).

We no longer expect significant changes in the future, both in terms of the offer of study programmes and in terms of the number of students. Currently, we want to focus on the quality of study, especially with regard to teaching conditions and changing social and natural conditions, which must be reflected in the content of study programmes. The modernization of studies and study programmes must be the answer to the developments and changes such as globalization of the economy, climate change and new technologies.

A new innovation project was launched in 2017 and includes (Remeš, 2017):

- The construction of two new teaching pavilions – the Pavilion of Wood Sciences and a Hi-Tech pavilion for technological education (Figure 6) with more than 20 teaching laboratories (completed).
- Innovation of existing study programmes (completed).
- Preparation of new study programmes (completed).
- Implementation new teaching methods (ongoing).

- Deepening of the internationalization of studies at FFWS (ongoing).

This project is co-financed by the Operational Programme Research, Development and Education (OPRDE) of the EU. The Hi-tech pavilion for technological education (last step in innovation of the education and research at the FFWS) provides a range of laboratories equipped with the state-of-the-art technologies. The building boasts two lecturing halls with 3D projection equipment, 3D modelling laboratory, ergonomics studies and ballistics laboratory, forest and timber fire protection laboratories, or, among others, also electron microscope and CT scanning laboratory. Moreover, the building also features built-in sustainable technologies, including green roof and energy recuperation system (Anonymous, 2019).

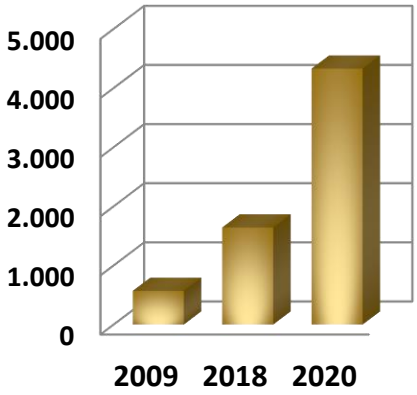
Figure 6: The Pavilion of Wood Sciences (left) and the Hi-tech pavilion for technological education (right).

Internationalization

The last major change was the amendment to the Higher Education Act of 2016 (Act No. 137/2016 Coll.), which included the evaluation of the quality of university activities and a new accreditation system. Recently, so-called institutional accreditation has been introduced, which gives the university the right to independently create and implement study programmes in specific areas of education. CZU has successfully passed this assessment and in 2018 received institutional accreditation for seven fields of education, including the Forestry and Wood Processing field of study. The possibility of creating multidisciplinary and international study programmes was opened for the CULS. The dynamic trend in the development of the number of foreign students at the CULS since 2009 is evident from Figures 7 and 8.

The number of foreign students in all study programmes (excluding Erasmus+) has increased by more than 3,500 within 12 years, reaching 4,329 in 2020, which corresponds to about 20% of all students at the university. Approximately half of them

studied in study programmes taught in the Czech language. In the study programmes taught in English, the number of students also increased significantly (it increased more than five times compared to 2009).



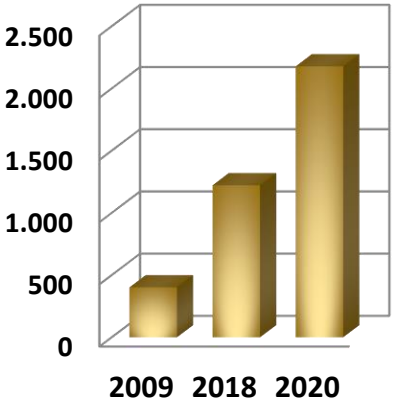


Figure 7 (left): Number of foreign students (Erasmus students are not included).
Figure 8 (right): Number of students in the English study programmes.

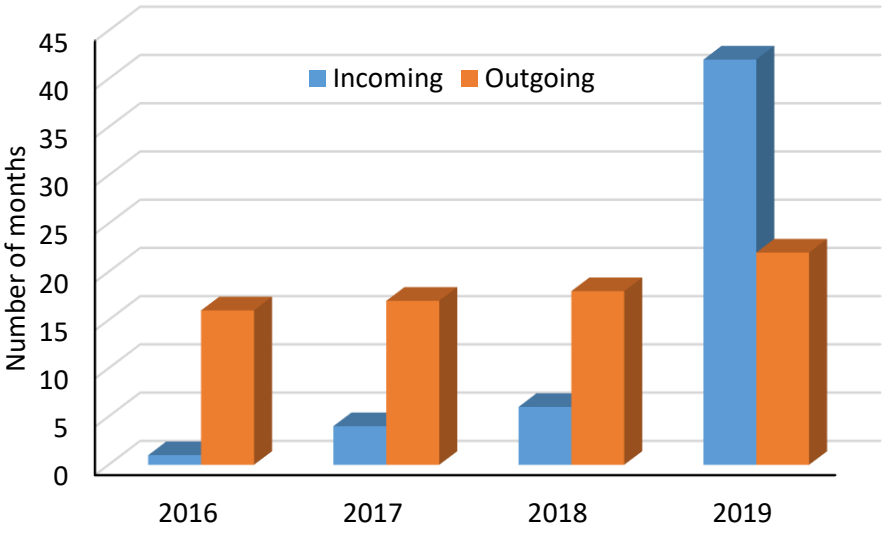


Figure 9: Development of FFWS staff mobility.

The FFWS also supports a multicultural environment. In total, there were 154 students in both Czech and English branches of BSc and MSc programmes in 2019, it represents approximately 10% of all students. Positive developments can be seen in the area of FFWS staff and student mobility (Figure 9 and 10). The number of outgoing teachers has long been higher than the number of incoming, but in 2019 the

situation changed. Among the students, incoming students predominate over ongoing students.

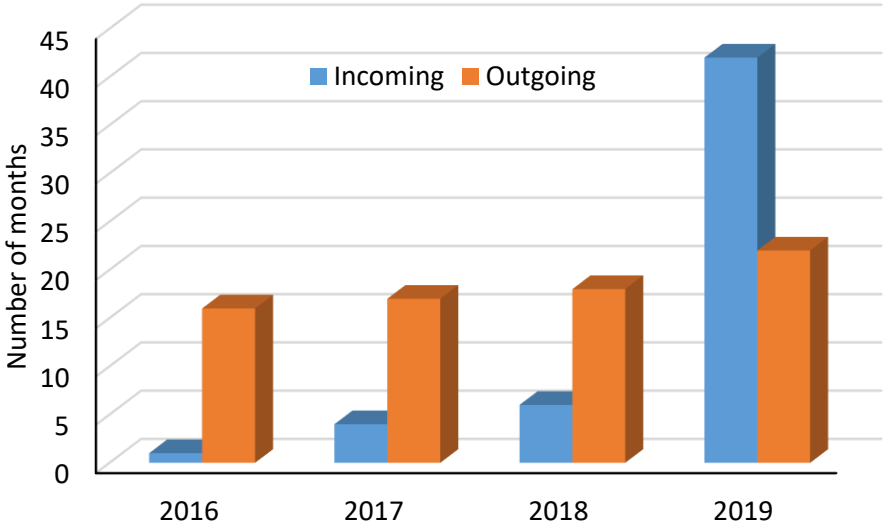


Figure 9: Development of FFWS staff mobility.

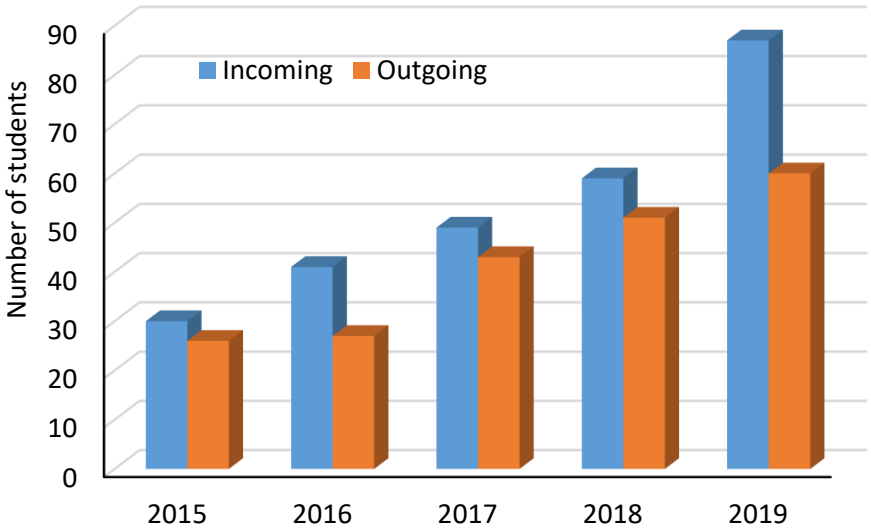


Figure 10: Development of FFWS student mobility.

Interest in studying at CZU and FFWS

Interest in studying at CZU is consistently high (Figure 11). The number of applications to study has reached more than 20,000 in recent years, which corresponds to the total number of students. A similar situation is also with interest in studying at the Faculty of Forestry and Wood Sciences. In recent years, the number of applications for Bachelor's degree programmes has been around 1400, and around 300 applications for Master's degree programmes are registered (Figure 12). The share of the faculty in the total number of students and applicants at CZU is approximately 8-10%.

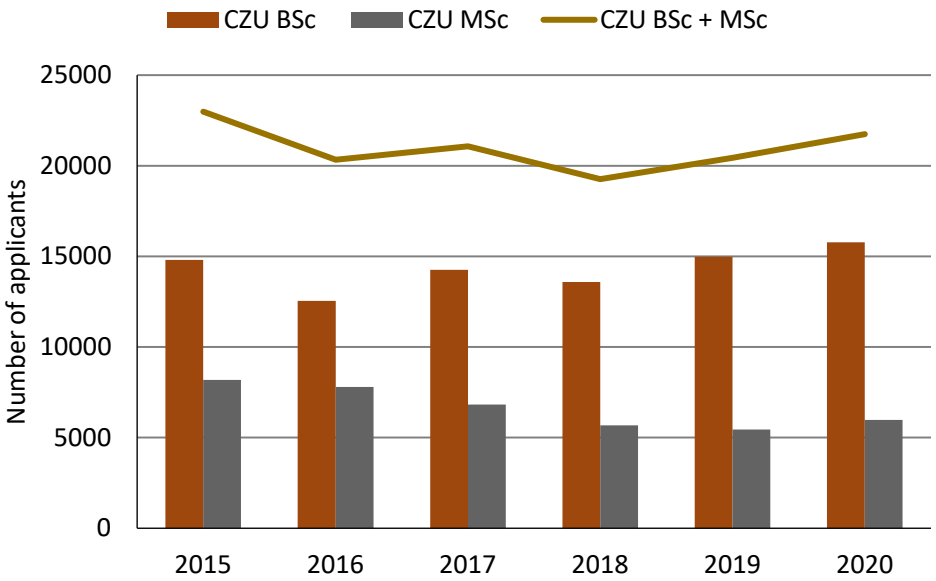


Figure 11: Development of the number of applications for studies at CZU.

New perspectives

At present, the stage of extensive development of the faculty has ended. Both in terms of the number of students, the portfolio of study programmes and technical equipment. There is a period when it is necessary to increase the quality of the educational process and ensure maximum usability and sustainability of the mentioned development projects. It is associated with finding resources for financial support of educational activities that without additional resources from the EU is still insufficient.

All FFWS study programmes have been re-accredited by a new accreditation system in the period 2019-2020 and now is the time for their evaluation and quality assurance. This also follows from the mentioned legislative changes in the Czech Republic. An internal quality evaluation system has been established at the university, which is centrally managed by the Internal Evaluation Council. The basic principles include

the evaluation of the quality of individual study programmes in the form of annual reports of the panel of study programmes. The guarantor of the study programme is responsible for this activity.

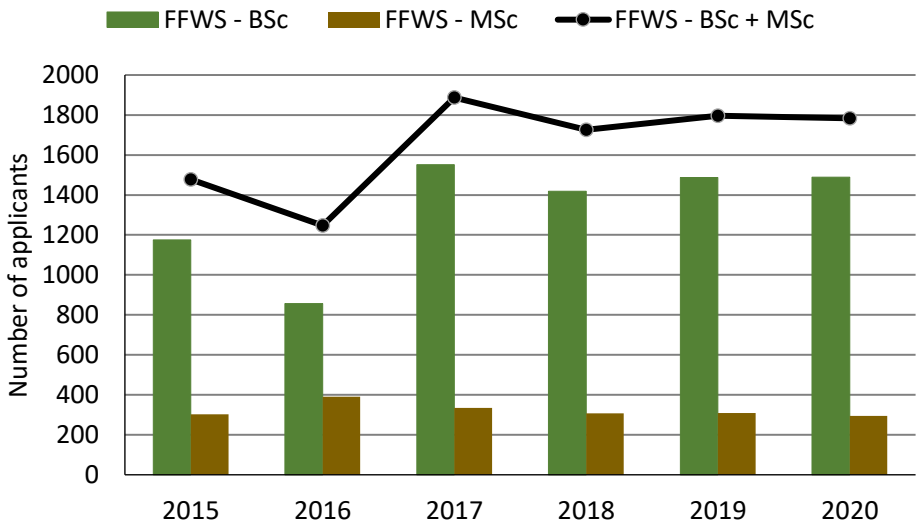


Figure 12: Development of the number of applications for studies at FFWS.

One of the main problems to be solved in forestry-oriented study programmes is the low success rate of students in their studies. The need to continuously update the content of study programmes in cooperation with forestry practice and the greater use of the university forest enterprise for teaching, including financial security (Remeš 2018), are also discussed.

Conclusion

The development of Czech University of Life Sciences as well as Faculty of Forestry and Wood Sciences has been very dynamic in the last 30 years. Political changes and subsequent reforms of tertiary education have made a major contribution to opening up higher education to a wide range of applicants. This led to a massive increase in the number of students at universities in the Czech Republic and also at the CZU in Prague. The culmination was reached in 2010-2012. Since then, the number of students has been declining slightly. During this period, the CULS became one of the six largest universities in the country with a total number of students around 20,000. Modern history FFWS began in 1990, currently the faculty is one of the most respected educational and scientific institutions in forestry and wood sciences in the Czech Republic. The development of technical equipment, including the construction of two new pavilions, made a significant contribution to this result. Further development is aimed at increasing the quality of all processes at CZU and FFWS and the optimal use of all products of the investment period.

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MEDFOR: THE EXPERIENCE OF AN ERASMUS MUNDUS MASTER PROGRAMME IN FORESTRY AND NATURAL RESOURCES

CATARINA TAVARES AND JOSÉ G. BORGES

Abstract

The Master Programme Mediterranean Forestry and Natural Resources Management (MEDfOR) brought together the best expertise, human resources and facilities to educate the next generation of leaders in forestry, natural resources and land management throughout the Mediterranean region. The two-year programme started in 2012 and is implemented by a consortium of seven Mediterranean Universities located in Portugal, Spain, Italy and Turkey. It offers a mobility path in which students can study in two or three different universities. It takes advantage of internships offered by associated partners and stakeholders from all around the Mediterranean basin, America, Africa, Asia and Oceania organized in a consultation panel.

The number of applicants has steadily increased since 2012. It was greater than 200 in 2019 which highlights the quality and attractiveness of the programme. The contribution of the programme to graduate-level education and to address the challenges faced by Mediterranean countries is acknowledged by the EU Erasmus programme that twice selected this programme for funding in 2011 and 2017 in competitive calls. Since 2012, 98 students have graduated successfully. Most have already found jobs or are pursuing PhD degrees, thus fulfilling the ambition of the programme of contributing to address current forestry and natural resources challenges, namely in the Mediterranean region.

Keywords: Bioeconomy, Climate change, Forestry, Graduate-level education, Natural resources, Mediterranean.

The start of MEDfOR

The beginning

The Mediterranean Forestry and Natural Resources Management Master Programme – MEDfOR – was outlined in 2009 by a group of internationally recognized specialists in the scientific field of Mediterranean forestry. That group worked together to develop the Mediterranean Forest Research Agenda (MFRA) (Palahí *et al.*, 2009) and collaborated also in several capacity building projects targeting the Mediterranean Southern Rim, e.g. AGORA (Palahi *et al.* 2012).

At the time, the MFRA and the Strategic Research Agenda of the European Forest Based Sector Technology Platform (FTP, s.a.) **(**http://www.forestplatform.org/#!/)

underlined the need for a Master course that might bring together expertise to build the knowledge base needed to address the specificity of the Mediterranean forestry.

MEDfOR was built by a consortium of the following seven universities:

- University of Lisbon (UL), Portugal.
- University of Padua(UNIPD), Italy.
- University of Lleida (UdL), Spain.
- University of Valladolid (UVa), Spain.
- University of Tuscia (UNITUS), Italy.
- Catholic Portuguese University (UCP), Portugal.
- University of Karadeniz (KTU), Turkey.

It is also supported by a consultation panel involving several organizations, such as NGOs and research centres, enterprises, associations and other universities. Most are located on the Mediterranean Basin. Nevertheless, for a broader perspective the panel also includes members from other countries in Africa, America, Asia and Oceania, thus highlighting the international perspective of the programme. The consultation panel offers advice, provides internships to the students, and sends invited scholars to teach at the partner universities. It has expanded to include 31 members by 2019.

Course structure

MEDfOR provides a relevant scientific anchor for students to pursue their academic interests in the four disciplines and areas listed in the MFRA (2009) as critical to address effectively the challenges of Mediterranean forestry and natural resources management. These include:

- The impact of climate and land-use changes on Mediterranean forest ecosystems functioning: assessing and monitoring main physical and biological processes including biodiversity.
- Integration of the risk of forest fires and other hazards in land-use and landscape planning and natural resources management.
- Policy, economic and institutional aspects for sustainable provision of forest goods and services.
- Forest and woodlands in the context of integrated management of land resources: models and decision systems for optimizing multi-objective and multi-actor problems

The programme is structured into four semesters (Table 1).

Table 1: Structure and mobility of the programme. See text for abbreviations.

<table>
<tr><th colspan="5">Year 1</th><th colspan="3">Year 2</th></tr>
<tr><td colspan="2">1st semester</td><td colspan="3">2nd semester</td><td>Summer break</td><td>3rd semester</td><td>4th semester</td></tr>
<tr><td>24 Credits</td><td>6 Credits</td><td>9 Credits</td><td>18 Credits</td><td>3 Credits</td><td>0</td><td>30 Credits</td><td>30 Credits</td></tr>
<tr><td>Coursework at UL</td><td rowspan="3">E-learning class by UVa</td><td rowspan="3">Winter school at UVa</td><td>Coursework at UL</td><td rowspan="3">E-learning class by UNIPD</td><td rowspan="3">Optional internship at an associated partner institution</td><td rowspan="3">Specialization coursework at UL, UdL, UNIPD, UVa, UNITUS, KTU or UCP</td><td rowspan="3">Thesis work and summer event</td></tr>
<tr><td>Coursework at UdL</td><td>Coursework at UdL</td></tr>
<tr><td>Coursework at UNIPD</td><td>Coursework at UNIPD</td></tr>
</table>

The first year of studies – 60 ECTS credits – prepares the students on the full range of disciplines essential to the use and management of Mediterranean forests (ecology, mathematics, social sciences and forestry). Each partner institution (UdL, UP and UL), where students do their 1st year of studies (Table 1), offers 42 ECTS credits. An e-learning course on Introduction to forestry and natural resources management is offered by University of Valladolid (Uva) in the beginning of the 1st semester (Table 1). Further, at the end of the 1st semester, all students attend the Winter school at UVa. The underlying theme is Mediterranean Forestry: the asymmetric impact of global change on Mediterranean forests. The Winter school takes three weeks, and it encompasses two seminars and a final research meeting.

During the 2nd semester, the University of Padua provides to all students a 3 ECTS credits e-learning course Research and project development methodology – applications (e-learning mode) to provide them with competences to the development of their future Master thesis. (Secco *et al.*, 2020).

Between the 1st and the 2nd year, students can take an optional internship at an associated partner institution (Table 1).

In the 1st semester of the second year, students acquire advanced knowledge in the framework of specialized coursework in any partner university under the supervision of researchers in the respective scientific areas (Table 1). Students may choose one of the listed specializations according to their interests:

- Multiple criteria decision support systems for Mediterranean forest management planning (UL).
- Social and environmental responsibility in Mediterranean forestry (UNIPD).
- Addressing risks in Mediterranean forest management planning – the case of fire (UdL).
- Adaptive forestry strategies to provide good and services while coping with global change challenge (UVa).
- Advanced tools for sustainable management of Mediterranean forests (UNITUS).
- Ecosystem based multi-use forest management planning in Mediterranean forests (KTU).
- Mediterranean sustainable forest management – An institutional economics approach (UCP).

In the fourth semester students develop their MSc thesis at any of the seven universities (Table 1). They can also develop internships provided by associated partners and stakeholders. They are encouraged to develop an important field/laboratory work component, taking advantage of on-going projects being carried out by lecturers and researchers at MEDfOR partner universities.

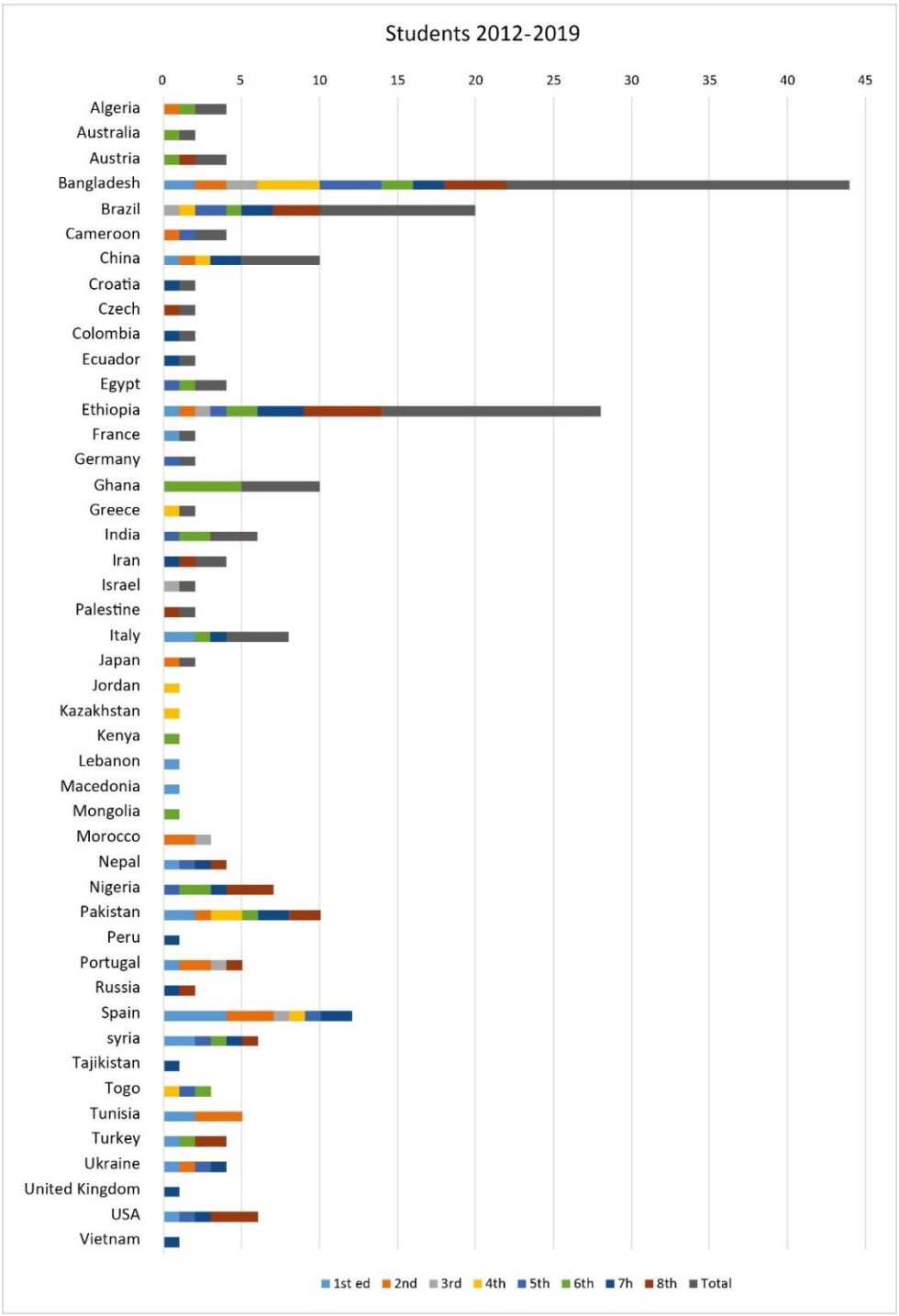

Figure 1: Students' and alumni country of origin for the eight MEDfOR editions.

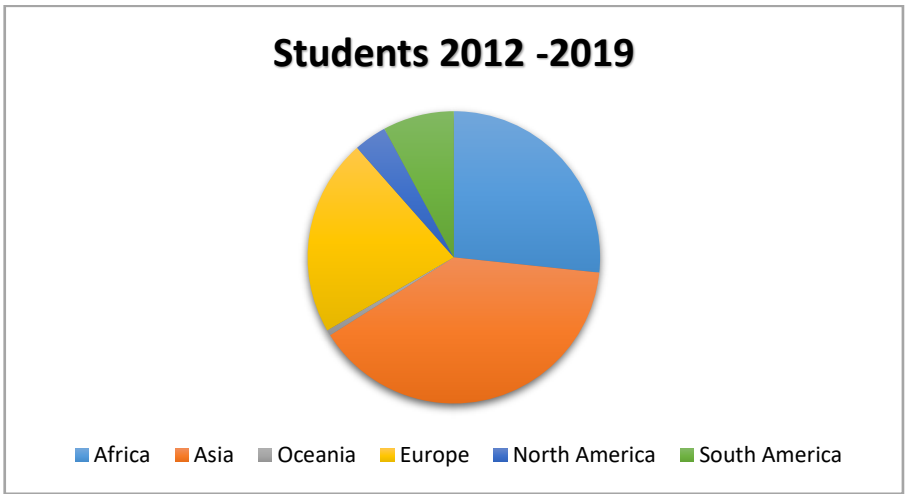

Figure 2: Continents of origin of students and alumni, for the eight MEDfOR editions.

The last event of the programme, the joint Summer Event is hosted each year by the University of Tuscia, in a forest host centre in the Alps. It provides students with the opportunity to exchange experiences, to present and discuss their dissertations with the Mediterranean forestry community and to check for further internships and employment opportunities.

Scientific publications
After the thesis defence, students are encouraged to publish the results of their thesis in a scientific journal. So far, the programme has been successful in this regard. Several students have presented their thesis results in peer-review papers and in different conferences. So far, 24 scientific papers have been published and we anticipate more publications to be released from ongoing work.

The Students

Who can participate?
Students of our Master Programme have different backgrounds, with Bachelor degrees in the fields of Sciences, Natural Sciences, Economics, Engineering, and Management. In any case, proficiency in English is mandatory.

Who are our students and alumni?
Since 2012, we attracted more than 750 applicants. MEDfOR students come from all over the world (Figure 1, Figure 2). Since most scholarships are attributed to partner countries and some scholarships are allocated to specific regions, the programme receives more applicants from some countries, and consequently we have more students from certain regions

MEDfOR has run eight editions, with the seventh and the eighth edition ongoing. So far we have graduated 98 students.

Addressing challenges to the implementation of the international programme students have different culture, educational and language backgrounds. This creates differences in the ways students learn, address different issues, intervene in the class, study, attend exams, etc. The success of the programme requires a flexible and adaptive approach that may address the full range of students' backgrounds. Addressing this challenge had thus required the adaptation of some of the courses and programme practices, e.g., the implementation of a new e-learning course addressing the basics of Mediterranean forestry in the beginning of the master programme, so that all students could fill in the gaps they had.

Students also face several administrative problems; related with the release of visas, residence permits, travels, search for accommodation, opening of bank accounts etc. In order to support students, all universities of the consortium allocated staff of their International offices, to support the students with these issues. Over the years we were able to improve some of the processes, although some – which don't depend solely on the work done by the universities, remain difficult, such as the issue of visas. One of the processes we manage to improve was the release of the diplomas in each university[15] , which was extremely complicated at the beginning, due to the fact that the transference of transcripts between partners was a very bureaucratic process which was facilitated by the consortium The process is much smother now, and although the release of diplomas still takes time, the students can receive their final certificates timely, after defending their thesis. This results too from the fact that partner universities are now recognizing the transcripts of records of the students in a digital format. Moreover, the consortium has decided to move to a joint accreditation process; a task which is beginning to take form.

During the implementation of the programme and its development, the consortium decided to add joint courses and events to promote students' integration. Currently, the programme offers a Winter School and a final Summer Event as well as two different e-learning courses in the first year, where the students have to interact. We found, that, since students start the programme in different universities, it was important to find gatherings and platforms of common learning and sharing. The UVa e-learning course underlies the beginning of their shared identity as a MEDfOR group, the Winter School strengths it, and the Summer Event marks the end of the programme and of their shared experiences. In the middle, they mingle in small groups while studying at the different universities. But this sense of belonging remains, and they keep contact, after studies, through social media.

15 Diploma is issued by each university, since we don't have a joint diploma yet.

Success Stories

The experiences of the six MEDfOR editions already completed highlights the success of the programme (Figure 3) in addressing the concern with students' employability. Our tracer study including information from graduates from the first five editions (72 graduated students) shows that two years after defending the thesis, most of them were: working in the field of forestry as professionals (40%), conducting research in the field forestry either as PhD students or as researchers (47%), working in top-level

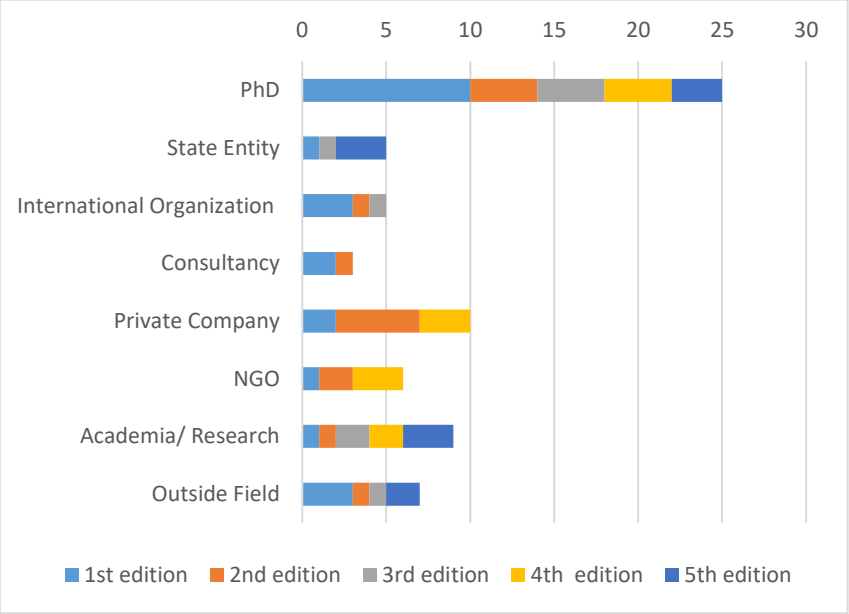

Figure 3: Students employment (2014-2019) from the first (2012-2014) to the fifth edition (2016-2018), up to three years after graduation.

universities in Europe, North America and Oceania or in their home countries in Africa and Asia. Seven percent are working in international companies and the remaining graduates (33%) are working in private companies, as independent consultants or in government agencies in their home country. We present the case of ten alumni, who represent cases of successful stories (Table 2).

Acknowledgments

Authors thank the Education, Audiovisual and Culture Executive Agency – European Commission.

Table 2: Ten examples of success stories, two from each of the first five editions.

Edition	Students' Name	Nationality	Employment
1st edition (2012-2014)	Hala Shahin	Syrian	PhD at University of Lisbon, Portugal.
	Ilaria Dalla Vecchia	Italian	Management Technical advisor at FSC Forest, Italy.
2nd edition (2013-2015)	Ghemina Ghemouri	Algerian	Chief desk on Environment Control at the National Agency of mines activity in Algeria.
	Luis Acevedo Muñoz	Spanish	Researcher in the Forest and Paper Research Institute (RAIZ) of The Navigator Company, Portugal.
3rd edition (2014-2016)	Nathalia Fomenton Cardoso	Brazilian	Forest Governance and Economics Consultant at FAO, Italy.
	Asaf Karavani	Israeli	Director of the Forest Management Department and Coordinator for Research and Foreign Relations in the Forest Service, Israel.
4th edition (2016-2018)	Bawinabadi Bagaram	Togolese	PhD student at the University of Washington, USA.
	Sidra Khan	Pakistani	PhD Student at University of Lisbon, Portugal.
5th edition (2017-2019)	Noélia Lopez	Spanish	PhD student at SLU - Swedish University of Agricultural Sciences in Sweden.
	Koffi Dodji Noumonvi	Togolese	Researcher at the Slovenian Forest Institute in Slovenia.

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THE "FOREST-LANDSCAPE-MANAGEMENT TRIANGLE" WITH ECTS AT ETH ZURICH

URS BRÄNDLE, FLORIAN KNAUS AND HARALD BUGMANN

Abstract

Study programmes and their regulations aim to specifically promote the acquisition of knowledge and skills by students. The design of such competence-based curricula in combination with extensive opportunities for individual specialisation requires deeper planning that combines the acquisition of competences with diverse content. We (i.e ETH Zurich) use the relative proportions of forest, landscape and management aspects in the core courses of our major programme to observe how our students prioritize differently depending on their professional goals. By visualizing students' choice behaviour with triangular coordinates, trends can be identified early on and the skills required for the professional market can be taught in a package that is dynamic and attractive for students.

Keywords: Curriculum planning, forest landscape management, elective courses, visualisation, internship

Introduction

The Eidgenössische Technische Hochschule Zurich (ETH) introduced the Bologna system starting with all BSc programmes in 2003. At the same time, the former Departments of Forest Sciences (D-FOWI) and Environmental Sciences (D-UWNW) merged to form the new Department of Environmental Sciences (D-UWIS, D-USYS since 2012) (Gisler, 2020). The former diploma programme in Forest Engineering was replaced by a major in Forest and Landscape Management as part of the MSc programme in Environmental Sciences. As a consequence of several retirements and the discontinuation of several professorships, the new MSc programme started in 2006 with a stronger focus on research topics, emphasizing the natural sciences, landscape aspects, and more holistic management approaches at the expense of engineering sciences. All subjects are dealt with in core and optional courses.

Sparked by feedback from students and two new professors coming in, a reform of the curriculum was initiated in 2011: Larger courses (5 instead of 3 ECTS credits) should offer more time for in-depth study of the contents, the landscape aspect should be strengthened and aligned with research topics of the new professorships. The structure of the major with superordinate categories and selectable subjects should also make it possible to individually adjust the acquisition of competences to the desired career goal (e.g., forest service, nature conservation agency, landscape management/rural planning, etc.) based on a certain diversity in content. During the

revision, the core courses were reviewed for their contribution to competences and content relating to aspects in the domains of forest science, landscape science, and management, respectively (Heinimann, 2014).

In this paper, we investigated whether the desired profiling of students has occurred as a result of the revised programme. We were also interested in whether there are differences between the groups of students who choose different professional fields for their internship. Finally, it was important for us to know whether a distinct profiling can be identified among non-consecutive master's students.

Data and Methods

The 55 core courses of the 2006 (MSc06) version and the 41 courses of the 2013 (MSc13) version of the major in Forest and Landscape Management of the ETH Environmental Science Master Programme were analysed for their relative contents in the Forest, Landscape and Management (F, L, M) dimensions. All content and activities were assigned to one of the dimensions so that the contributions would always add up to 100 percent. Whenever possible, interviews with the lecturers were carried out to accurately estimate (based on Meijers *et al.*, 2005), in some cases course catalogues and other materials were used.

These estimates were then used to calculate the partial credit points which each course contributed to the three dimensions. The average weight of each dimension in the total curriculum was derived from the sum of all partial credits per dimension. Figure 1 shows the size and F, L, M proportion of all included courses together with the category from which the course can be chosen.

135 students completed their studies under MSc06 regulations between November 2008 and August 2016, 97 students did so for MSc13 between November 2014 and December 2020. Of all students, seven had a previous (BSc) degree from a foreign university, 21 from another Swiss university. For each student, the partial credits of the F, L and M dimension, respectively, were summed up over all passed courses from the core categories to calculate the individual's F : L : M ratio. While a minimum of 40 credit points (CP) had to be covered from the core courses with at least five CP from each of five categories, students could attend more courses as further electives, such that an average of 48.4 CP (MSc06) and 47.1 CP (MSc13) per student was considered in the calculations. For groups of students, the relative F, L, M values were averaged across the group without weighting for total credit points. Table 1 shows the variation in numbers of credit points across groups.

Triangular coordinate figures were created in MS Excel by superimposing an equilateral triangle over a standard XY-Scattergraph. For the given design where the height of the triangle corresponds to 100% of a dimension, y is calculated as M*0.5*SQRT(3) and x is calculated as y/SQRT(3)+L

Table 1. Upper part: Credit points acquired in the F, L, M dimensions of the major core-courses, by study programme versions (MSc06, MSc13) and field in which the mandatory professional internship was conducted (waived for students with prior professional experience).
Lower part: average percentages of F, L, M credit points acquired by students and offered over all major core-courses.
Underlined values are different between the programme versions at the $p<0.01$ level (t-test). For both Forest and Landscape dimensions, the values within MSc13-columns differ significantly at $p<0.01$ (ANOVA).

Field of professional internship	**Number of students**		**Average number of credit points acquired in F, L, M dimensions**							
			Forest		Landscape		Management		Total	
	MSc06	MSc13	MSc06	MSc13	MSc06	MSc13	MSc06	MSc13	MSc06	MSc13
Applied Research	17	6	17.8	14.1	10.1	16.6	20.5	18.1	48.4	48.8
Education / Media	3	5	16.9	12.2	10.0	15.9	19.7	18.8	46.6	46.9
Industry, Services	10	1	15.0		11.6		21.3		47.9	
NGOs	25	12	17.3	12.6	11.0	13.6	21.3	17.6	49.6	43.8
Env. Offices	23	17	16.9	15.5	11.2	12.9	20.7	17.6	48.8	46.0
Public Admin	53	44	16.5	16.6	10.7	12.7	21.0	19.0	48.2	48.3
Waived	4	12	16.0	13.5	9.3	14.6	19.2	17.6	44.5	45.7
Total	135	97	16.7	15.2	10.8	13.5	20.9	18.4	48.4	47.1
Average percentage of credit points per dimension …										
…acquired in major core-courses			34.6%	**32.3%**	22.1%	28.6%	43.3%	39.1%	100%	100%
…offered over all major core-courses			33.5%	30.0%	24.4%	28.5%	42.1%	41.5%	100%	100%

Results and Discussion

For the revised curriculum, several smaller courses (2-3 Credit Points) of the MSc06 curriculum were combined into larger courses (5 CP) and the overall course number was reduced from 55 to 41. As shown in Figure 1, three courses with a landscape component of more than 50% (lower right of graph b) were introduced. Averaged over all eligible courses, the revision led to equal weights of the forest and landscape components, while the management component remained unchanged (Table 1, bottom line).

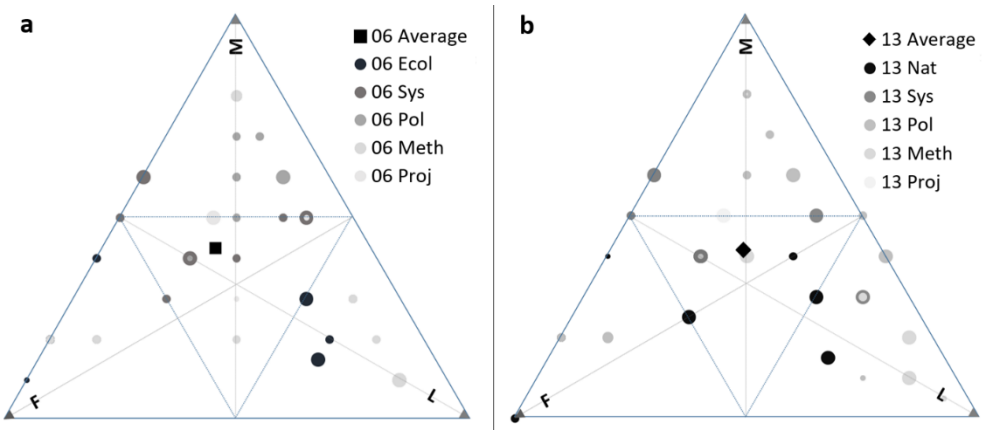

Figure 1 Relative content and overall average of the F, L, M-dimensions in the core elective courses 2006 (a) and 2013 (b) of the regulations for the Forest and Landscape major / MSc in Environmental Sciences. Grey scales indicate different course categories. Point diameters indicate number of credit points per course (5, 3, 2). A minimum of credit points in each of the 5 categories and 40 credit points in total must be acquired by the students.
Abbreviations of categories and minimum number of credit points to be acquired per category: 06 Ecol = Ecology (6), 06 Sys = Ecosystem Management (6), 06 Pol = Decision Making, Policy and Economics (6), 06 Meth = Methods and Tools of Landscape Science (6), 06 Proj = Project-related Work and Seminar (7); 13 Nat = Natural Science Foundations (5) , 13 Sys = Ecosystem Management (5), 13 Pol = Decision Making, Policy and Planning (5), 13 Meth = Methods and Tools (5), 13 Proj = Interdisciplinary Project (5).

The response to the augmented landscape component was immediately visible with the first students graduating under the new regulations in 2015 (Figure 2). While choice of the landscape component increased slightly less than expected, the management component was the first to drop, with the forest component remaining at the pre-revision levels until 2018. In the last two years, however, there has been a trend to favour landscape over forest content while the management component has remained stable.

Figure 3a summarizes students' individual preferences under the two regulations. The MSc06 cohort clearly favours forest over landscape components (left half of triangle) with only a few exceptions. The MSc13 cohort covers the same variation, but more

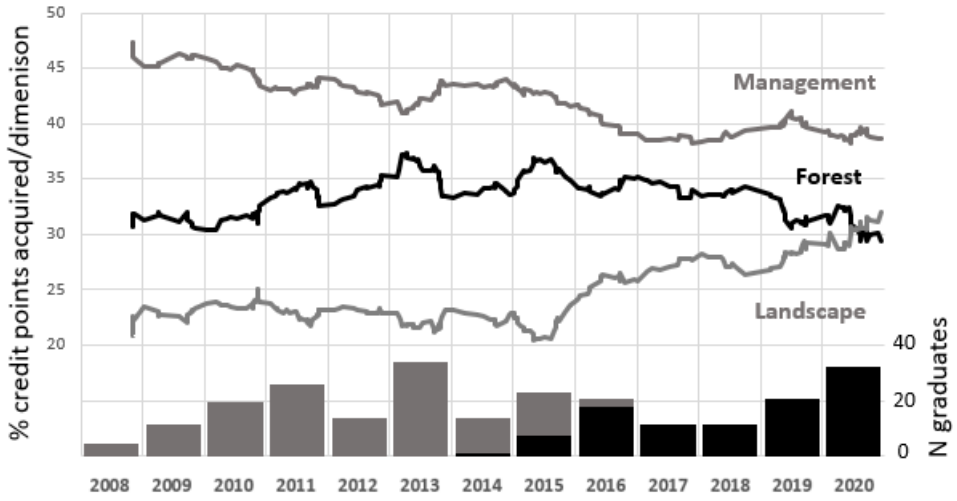

Figure 2. Individual relative content of the three dimensions F, L, M (per student and graduation date) and number of graduates per study programme version (■MSc06, ■MSc13) per year. Lines were smoothed by averaging backwards over 20 students.

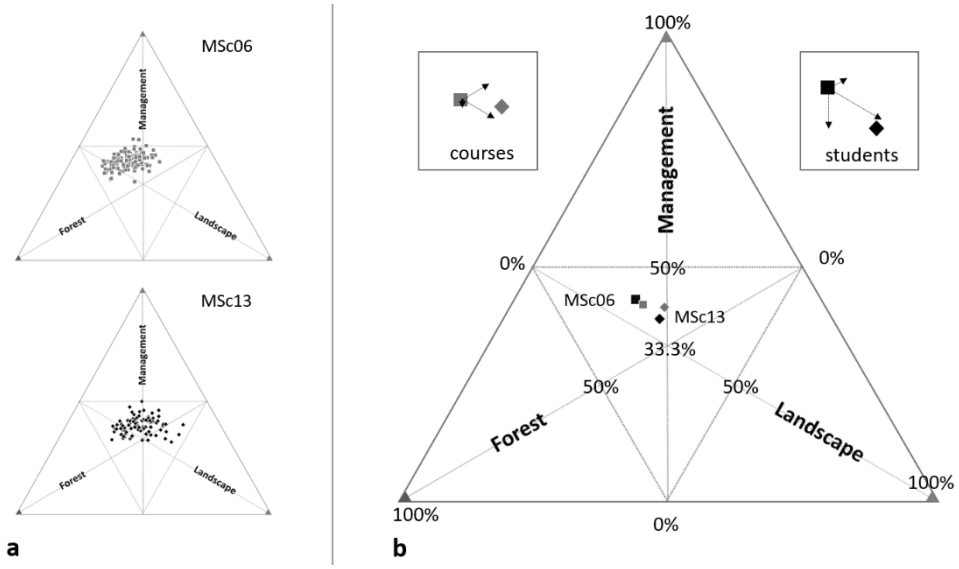

Figure 3 (a)Triangular coordinates for relative content of the three dimensions F, L, M per student graduating under MSc06 (n=135) and MSc13 regulations (n=97) (b) Average content shift from MSc06 to MSc13 in offered courses (■,◆) and students selection (■,◆) regulations. Arrows in the insets show relative sizes and directions of the shift along the three dimensions. For values cf. Table 1, two bottom lines.

individuals favour landscape over forest (right half of triangle). Additionally, several students earn more credits in the landscape than in the management dimension (triangle half below forest axis), and some earn almost half their credits in the landscape dimension (data points close to 50% line of L-axis). There is visibly more variation along the F- and L-axis than along the M-axis, where all values lie between 33% and 50%.

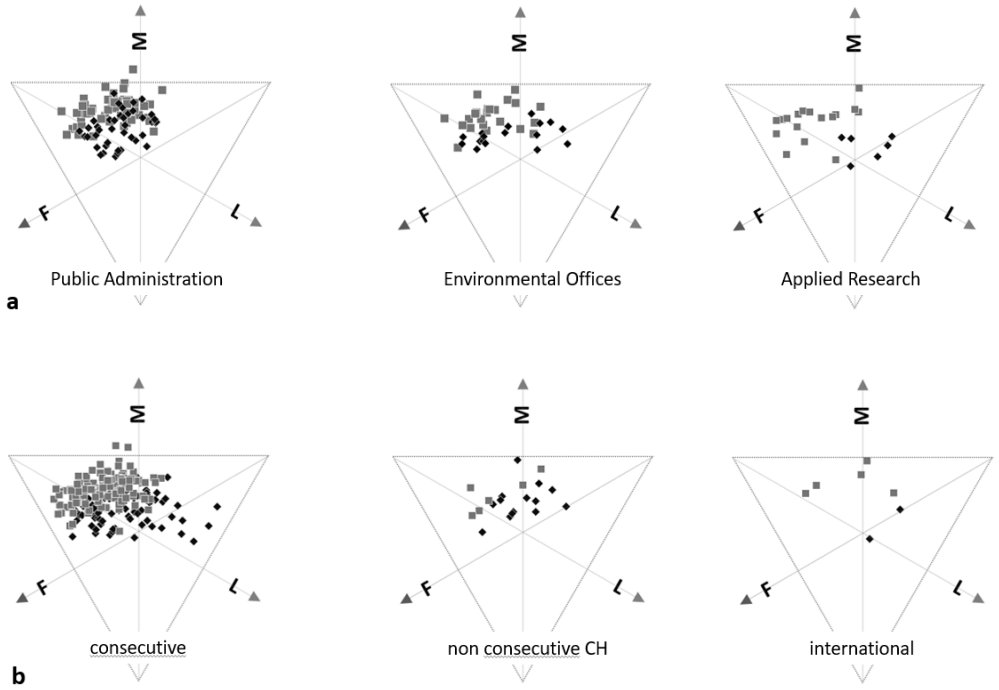

Figure 4 Triangular coordinates for F, L, M dimension per student graduating under MSc06 (■)and MSc13(◆) regulations by a) professional area where mandatory 4-month internship was conducted and b) by place of previous degree programme. Triangle outlines from previous figures are omitted, tips of triangles correspond to the origin of the respective coordinates, triangle centre at 33.3%, side lines intersect the coordinate axes at 50%.

The triangular coordinate graphs reveal distinct advantages when comparing the study behaviour of different cohorts as illustrated in Figure 4. The student groups with professional internships in public administration show relatively little difference between the two regulations. There is a tendency towards choosing course combinations resulting in a smaller management dimension which is pronounced among students who prefer the forest over the landscape component. We believe that most of this cohort is oriented towards a career in forest administration and therefore less interested in general landscape aspects. The choices of students seeking practical experience in private environmental offices are much more diverse and expanded along the landscape dimension. This corresponds quite well with the broad spectrum

that these companies cover, e.g. from species conservation to landscape planning to resource management concepts. The number of students who seek experience in applied research has significantly decreased since the curriculum change, but it seems that the remaining group has shifted their interests away from purely forest topics to landscape-related aspects.

Comparing students with an ETH BSc degree in Environmental Science (=consecutive) with incoming MSc students (Figure 4b) shows that the "new focus" of the major programme (more landscape than management, less than one third of credits in the forest dimension) is for now almost exclusively being explored by consecutive students. The group of Swiss students from other universities is comparable to the "Environmental Office" group. While the number of international students is too small for drawing conclusions, it does not show any similarity to the group considering a classical forest administration career.

Our data suggest that the revision of the major had the intended effect of directing students toward more landscape-oriented contents and competencies while preserving a broad choice of courses which allow for various profiles. This enables them to familiarize themselves very quickly with new problem settings in a wide range of topics when they enter the professional world. With more and more of our students building up a reputation for those aspects of the curriculum, it is very likely that the profile will become even more attractive for future incoming students.

The Bologna reform has strongly contributed to the attempts to quantify study programmes in terms of both content and competences, using ECTS credits as units of measurement. With the system presented here we will continue to include a student's elective course and internship preferences in future curricular development.

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BEST PRACTICES IN FOREST EDUCATION IN EUROPE FROM THE GLOBAL BEST PRACTICES COMPETITION

JULIET ACHIENG OWUOR, SANDRA RODRÍGUEZ-PIÑEROS

Abstract

This paper provides an overview of the best practices in forest education in Europe based on the submissions received for the best practices global competition. The competition was conducted between November 2018 and March 2019 and was inspired by the 2019 International Day of Forests whose theme was Forests and Education. The organizers of the competition were the Joint IUFRO-IFSA Task Force on Forest Education, University of Helsinki and the University of Helsinki Centre for Continuing Education HY+ in collaboration with the Food and Agriculture Organization of the United Nations (FAO). Despite the competition being conducted at a global scale, this paper only focuses on the submissions from Europe which accounted for 40.8% of the total submissions received, Europe was also the region with the highest number of submissions. The best practices initiatives are highlighted under four topics: the level of education (primary to tertiary/university), learning activities and their benefits, topics covered and learning beyond borders (cross country collaborations). These innovative education models provide insights that continue to shape the discussions on the future of forest education at all levels of education.

Keywords: Best practices, forest education, Joint IUFRO-IFSA Task Force, Europe, SDG 4.

Introduction

Sustainable Development Goal 4 (SDG 4) aims at promoting inclusive and equitable quality education as well as lifelong learning opportunities. One of the targets under this SDG, is to ensure that learners acquire knowledge and skills for sustainable development, which is to be achieved by mainstreaming education policies, curricula, teacher education and student assessment[16]. Although research about the contribution of forests to the SDG 4 is scarce (Kanowski *et al.*, 2020) it is widely known that forests are essential for humans to thrive; therefore, learning about forest services and forest management is an effort that must be made from the basic levels of education. At the primary and secondary levels forest related content is integrated in the context of the environment and sustainability education (ESE) with some successful initiatives in Europe (i.e., Forest Education Foundation, OWL Scotland) and in the United States (Project Learning Tree). In relation to higher forest education, discussions centre on

16 https://sustainabledevelopment.un.org/sdg4

how to harmonize the qualification systems, define skills and competencies needed by forestry professionals, and change forestry curricula and teaching methods (Arevalo *et al.*, 2010).

The Bologna Declaration of 1999 has been instrumental in significantly reforming higher education programmes in Europe. The coordinated higher education reforms strive to create the European Higher Education Area (EHEA) and to increase international competitiveness of the European higher education system (European Commission/European Education and Culture Executive Agency (EACEA/Eurydice, 2018). European Forest Programmes have adopted the declaration to increase students and faculty mobility as well as to make the programs more visible at the international arena.

Over the years, forest education has evolved to keep up with the changes in the forest sector, societal demands and expectations as well as student needs (FAO, *s.a.*). As such, a more integrated approach has been adopted compared to the resource-centred approach. Some universities are establishing holistic and interdisciplinary forestry-related programmes to ensure that missing elements from the curricular such as social skills that cannot be taught within forestry units can be taught by departments specialized in these areas (Shun and Feipin, 2018). The impact of the reforms at tertiary forestry education should be replicated at primary and secondary levels. School children have proven to be powerful agents of changing the attitudes of their parents, neighbourhoods and communities (FAO, *s.a.*).

The expanding scope of forestry has exerted so much pressure on professional foresters who are now facing a new set of challenges in their work due to the wide range of responsibilities and opportunities bestowed on them, most of which are different from traditional forestry that they were trained in. But there is a dilemma of how to train students to be versatile and to apply the knowledge acquired from the university to a wide range of jobs and not only the specific job they were trained for while at the same time ensuring that forestry programmes are robust (Temu and Kiwia, 2008). However, it should be noted that no curriculum can cover all forestry-related areas, therefore the success of forest education lies in its flexibility to solve the dilemma (Längin *et al.*, 2004; Kostilainena, 2005; Ratnasingam *et al.*, 2013). Good practices and models could help inform how to integrate what is missing from forest education curricula which is critical in shaping the direction forest education will take (Rekola *et al.*, 2017). It is hoped that the results of this competition will contribute to the debate among the relevant stakeholders on how to enhance forest education in Europe.

Limitations

This is not a research paper but a summary highlighting forest education initiatives from Europe that the authors believe offer valuable contributions to the different aspects of forest education including the Bologna Process. More initiatives may exist,

but the ones listed here are based on the submissions from the Best Practices Global Competition. Very little modification has been made to the original descriptions of the best practices provided by the nominators not to cause distortion of any kind.

About the Joint IUFRO-IFSA Task Force on Forest Education

The Joint IUFRO-IFSA Task Force on Forest Education is one of the task forces established by IUFRO to advance inter-disciplinary cooperation in forest research fields that span two or more IUFRO Divisions. This specific task force was established in 2015 and is a collaboration between two organizations. The first partner is IUFRO, a global network that brings together over 15,000 scientists from over 110 countries, with a mission of advancing research excellence and knowledge sharing, and to foster the development of science-based solutions to forest-related challenges for the benefit of forests and people worldwide. The second partner is IFSA, which has members in over 50 countries and represents the interests of over 10,000 students undertaking forestry and related programmes. IFSA's mission is to enrich the members' education through international events, networking and intercultural exchange.

The Joint IUFRO-IFSA Task Force on Forest Education has many ongoing activities seeking to promote and facilitate research and innovation around forest education, fostering international networking on forest education especially using modern online communication and social media applications, and providing capacity building opportunities for students and young scientists in both generic and specific skills, face to face and online. The Joint IUFRO-IFSA Task Force on Forest Education is committed to contributing to quality education which plays a critical role in ensuring that the next generation of foresters are well equipped to face the multitude of challenges that a dynamic society and changing forest landscape will inevitably provide.

About the Best Practices Global Competition

The competition was organized by the Joint IUFRO-IFSA Task Force on Forest Education, University of Helsinki and University of Helsinki Centre for Continuing Education HY+, in collaboration with the FAO. The competition aimed at raising awareness on education in the context of sustainable forest management. Specifically, the competition sought to share valuable information among educators, foresters, students and the general public on the best forest education practices carried out globally for improved learning and encouraging collaborations, which is a central tenet of IUFRO's structure. The competition inspired by the International Day of Forests (IDF) 2019 whose theme was "Forests and Education" also aimed at showcasing how sustainably managed forests provide a variety of contributions in this area. A detailed description of the Best Practices Global Competition and the winners is available in Rodríguez-Piñeros *et al.* (2020).

The competition was open to best practices in forest education related to teaching and learning methods for classroom or online education from primary (including kindergartens), secondary (including high school (lower (typically ages 13-16) and upper (typically ages 16-19) as well as specialized vocational programmes), to tertiary/university (Bachelor to PhD) level. Innovative teaching methods or learning material in the context of teaching and/or learning subjects related to sustainable forest management were also accepted. Evaluation of the applications was based on predefined criteria that included pedagogical quality, novelty of the practice and practical effectiveness. The international call was made on IUFRO's and other partners websites and social media channels. Nominators had to show the excellence or innovation of the practice and success stories in the form of testimonies or anecdotal evidence or through collected data. The competition was carried out from November 2018 to March 2019 in four steps as shown in Figure 1.

Best practices in forest education in Europe

Best practices submissions from Europe: levels of education, types and from where
Out of the 71 submissions received globally from primary to tertiary level, 40.8% were from Europe making it the region with the highest number of submissions (Rodríguez-Piñeros *et al.*, 2020). Tertiary level initiatives accounted for 75.9% (Table 1) of the submissions. The highest number of submissions was received for the Master of European Forestry Programme by the University of Eastern Finland which received

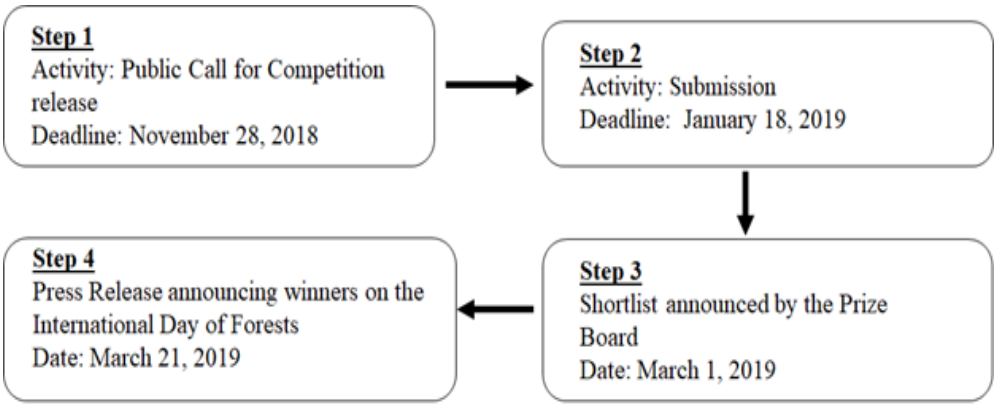

Figure 1: Best Practices Global Competition schedule.

31.3% of the nominations, followed by the coordinator of the Forest Policy and Economics Education and Research (FOPER) capacity building programme in Western Balkans with 17.2%. The nominators were from several European countries as well as regions outside Europe. Other submissions received include:

- Eco-programmes for kindergartens consisting of role plays and use of learning aids made from forest materials.

- Forest kindergartens and schools and their networks that bring together teachers, pedagogues passionately working in that field and guiding groups of children in the forest.
- Work camps aimed at fostering the exchange of issues and aspects of sustainable use of forests in selected regions of Brazil and Germany, as well as management of mountain forest ecosystems.
- The North-South expedition, a 30-day trip through several regions of Brazil for forestry undergraduate students.
- Forestry lecturers using creative teaching styles that have increased students' interests in forestry courses.
- Project/programme coordinators, who have successfully initiated or run the projects/programmes offering learning and research opportunities for students.
- Online education and learning materials in Ecosystem Services Entrepreneurship online course: from ideas to business and the forest virtual tours project based on panoramic pictures and virtual walkthrough programmes.

Learning activities and their benefits

Forest kindergartens and forest schools were common in the primary level submissions. The initiatives used forests as a classroom where all or some subjects are taught. The children developed work methods using natural materials found in the forests. In cases where schools and kindergartens have not adopted an area of the forest as their weekly classroom, the learners become "forest wanderers", who continue to explore new areas of the forest.

Games were common among the primary and secondary level submissions. Some of the materials used include sticks and strings of specified lengths to find objects in the forest with similar dimensions or create spider webs for performing movement tasks. The sticks were also used for art which involves creating drawings based on different themes. Specially designed on-line and board games, dance and songs, fairy tales, different types of visualization (such as Pigman dolls and other materials) were also used to teach children how to perform certain tasks as detectives such as assessing the good and the bad consequences of their actions on forests. Some games incorporated feeling, smelling, hearing, and tasting of objects obtained from forests. Digital cameras were also used by the learners to take pictures of the products they have identified in the forest. The findings and experiences were recorded on paper sheets which would be later shared with classmates. It is important to mention that while these initiatives started as school projects proposed by teachers, they have made a remarkable footprint at the national levels.

Table 1: Submissions: country, level of education and frequency of nomination (N).

Country	**Submission by**	**Level**	N
Austria	Coordinator of the Forest Policy and Economics Education and Research (FOPER) capacity building programme in Western Balkans	Tertiary	5
Finland	MSc European Forestry Consortium (https://sites.uef.fi/europeanforestry/)	Tertiary	9
Germany	"SOKO Wald – In the tracks of the Invisible"	Primary/ Secondary	1
	International Work Camp between Brazil and Germany	Secondary/ Tertiary	1
	International Youth Services (Internationale Jugendgemeinschaftsdienste (ijgd) (https://www.ijgd.de/)	Secondary/ Tertiary	1
	Brazil North-South Expedition for undergraduate forestry students including those from German Universities	Tertiary	2
Latvia	Pigman's Detectives (https://bit.ly/3urwaqR)	Primary	1
	The Slovenian Network of Forest Kindergartens and Schools (http://www.gozdnivrtec.si/en)	Primary	2
	Interdisciplinary learning ground: Forest for Today and Tomorrow (FTT)	Secondary	1
Spain	Bringing the forest to the classroom (https://silviweb.blogspot.com/2018/01/virtualtours.html)	Tertiary	1
	ECOSTAR project (www.ecostar.com)	Tertiary	1
	Sustainable Forest Management lecturer	Tertiary	1
Switzerland	Stiftung SILVIVA (https://www.silviva.ch/)	Tertiary	2
Turkey	Lecturer teaching Eco-tourism, Eco-entrepreneurship	Tertiary	1
Total			29

Workcamps were common in secondary and tertiary level submissions. They offered learners an opportunity to obtain both practical and theoretical knowledge in different forestry topics. Exchange visits are part of the workcamps enabling learners to travel to different countries for some time to learn about specific forest management aspects and the importance of forests for the local communities. Learners are expected to make summaries in the form of educational activities. The experiences have so far been developed into an educational book with the help of education experts who supplemented them with additional background knowledge on forests. Workshops, poster or group presentations, exciting playful elements of forest pedagogy and the daily support of experts are some of the activities carried out in combination with theoretical knowledge to ensure the knowledge is deeply engraved. The young learners were also equipped with a different perspective, experience in cross-cultural exchange and learned to develop empathy with the local communities.

Field trips and expeditions were used to provide learners at tertiary level with first-hand experience on different forest topics. The students were able to visit different biomes, factories, local communities and learn about different cultures. Photos, taken during the field trips, and reports are submitted at the end. E-learning was another tertiary level submission where the e-learning course was run on Moodle's e-learning platform. The course had a total of 150 learning hours including up to 40 hours of e-

modules (about 8-10 hours per week and 6 ECTS credits). The lessons included tutoring, exercises, discussion forums, and group work.

Group work was an important learning aspect in the primary-tertiary level submissions used to equip learners with communication, listening, collaboration, working in groups, and negotiating skills. At the primary level, moving around the forests ensured that learners developed strength, stamina, ability to respond quickly, coordination of their body, attention and creativity. The activities are reported to have cheered the young learners up and helped them relax. The use of naturally occurring materials in the forests enhanced creativity and provided room for the expression of thoughts and the feeling of meaningful inclusion. The submissions also reported that outdoor learning had contributed to increased blood flow, in turn activating broader capacity of the brain, which has a beneficial impact on concentration and memory. Based on the teachers' observations and reflections, regular visits to the forests help in the physical, emotional and social development of children.

Reflection during the activity and, most important, at the end of the lessons was employed to strengthen new knowledge by repeating and sharing between learners and their teachers at all education levels. Repetition on the other hand allowed learners to recall what they learnt previously or use the skills learnt in different contexts. Printed photos arranged in classrooms also aided the learners not to forget what they learnt.

While most of the submissions highlighted how forests are used as classrooms there were also some innovations that demonstrated how to virtually bring the forest to the classroom. This is particularly helpful in overcoming the challenges of logistical limitations related to field practical classes, costs, academic calendar, accessibility, etc. Appreciation of nature is of course an important component of forest education; however, the impact of COVID-19 pandemic on education has revealed the need for transforming education to enable the transition from classroom based to virtual interface.

The primary level submissions are examples of the wide array of activities that can be developed to incorporate forest content in other subjects and citizen engagement.

Topics covered by the submissions

All the submissions received were centred around sustainable forest management, which was the main eligibility criterion. The initiatives involved lessons on identification of forest products used in daily life, importance of forests and forest products and services, sustainable use of forests and forest management within their countries and beyond.

At primary level, waste and forest management was taught to instil a sense of responsibility in the learners by giving them a chance to play different roles to teach them the pros of protecting the forests and the cons of doing the contrary.

Mathematics, mother tongue and foreign languages, drawing, poetry, and art and craft from natural materials were also taught in the forests at this level.

Topics such as recycling of products, fair trade and certification by the Programme for the Endorsement of Forest Certification (PEFC) or the Forest Stewardship Council (FSC) were taught at secondary level to raise awareness on consumption habits, and to promote more sustainable lifestyles. Mountain forest ecosystem was taught at secondary and tertiary levels. Learners engaged in conservation forest projects, for example by establishing mixed tree species plantations, e.g. with silver fir, beech, yew, Scots pine, maple. They were also taught the importance of mountain forests, diverse ecosystems of great biodiversity value, among others.

Ecosystem services entrepreneurship: from ideas to business is an online course that was taught at tertiary level. The topics taught include: Natural Capital, Economic Evaluation, Sustainable Investments, Wild Forest Products, Payment for Ecosystem Services, Forest Certification, Carbon Market, and Ecotourism. Forest Policy and Economics, and Eco-entrepreneurship were also taught at this level.

Education for Sustainable Development was also evident from primary to tertiary level submissions. The initiatives were designed to empower learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations[17]. With the changed attitudes, increased understanding and practical experience, the learners would in turn be multipliers and influence those around them.

Silviculture was another topic taught at all levels of education. The lessons revolved around the local situations, but some were adopted and designed to tackle other challenges in the global forest sector: tropical forest and the challenge of clear-cuttings, Indonesian forests, Russian forests, forests in Africa or Mediterranean forestry. Other silvicultural aspects covered included planting of trees and their management, watching the felling of trees and helping to prune them. At tertiary level, the silviculture topic was taught through forest virtual tours based on panoramic pictures and virtual walkthrough programmes focusing on silvicultural diagnosis of different forests and silvicultural prescriptions, which would be uploaded to self-designed web pages by the students.

Dendrology, forest ecology, eco-social functions of forests, hunting and wild animals, planning in the forests, inventories (bat trees, diseased trees, dead wood, biotopes, etc.) were also covered at all levels of education.

Learning beyond borders: cross country collaborations
This trend was observed in more than 60% of the submissions from primary to tertiary level with two or more countries collaborating on projects or programmes. Other

17 https://en.unesco.org/themes/education-sustainable-development/what-is-esd

initiatives also provided opportunities for international participants to take part. They ranged from academic programmes, field trips to online courses. Tertiary levels submissions accounted for 48.3% of the initiatives outlined below.

The Slovenian Network of Forest Kindergartens and Schools was established in 2012 with the intention of systematically introducing forest pedagogics into Slovenian kindergartens and schools but currently incorporates kindergartens in Croatia with plans to expand the network to a Pan-European level. The network is managed and coordinated by the Institute for Forest Pedagogics. In the first year, six kindergartens and primary schools were involved in the network, but currently 83 kindergartens and 39 schools are actively involved in it, including two secondary schools and two primary schools for children with special needs.

The International Workcamp – Young Experts for Sustainable Forest Management project aims at fostering the exchange of ideas and aspects of sustainable use of forests in selected regions of Brazil and Germany and at developing educational material and activities for promoting competencies for sustainable development for pupils between 12 and 17 years. The two 10-days workcamps in Brazil and Germany enable the participants from both countries to learn about local forest management practices and the importance of forests for the local societies.

International Youth Services (Internationale Jugendgemeinschaftsdienste (ijgd)) brings together groups of young people (age 16-26; normally 12-16 participants) from different countries who live and work together for two to three weeks. The project combines, in a unique way, the theoretical and practical knowledge transfer about the mountain forest ecosystems. Students from all over the world actively participate in conservation forest projects.

The North-South Expedition is a 30-day trip through several regions of Brazil which has attracted forestry undergraduate students from several universities in Brazil and students from German Universities and other countries. Since 2008, more than 400 students have engaged in the expedition. A total of 20 students from four various German universities have joined the trip in the past few years.

The MSc European Forestry is a two-year interdisciplinary joint Erasmus Mundus Master's Degree Programme in the field of forest sciences and forest-based bioeconomy. It connects the increasing number of forest-related issues with a European dimension at international as well as national levels while offering a common applied research framework, unique both in terms of expertise and academic purposes. It is offered by a consortium of six European forestry universities: University of Eastern Finland (coordinator); AgroParisTech, France; the University of Freiburg, Germany; the University of Lleida, Spain; the University of Natural Resources and Life Sciences Vienna, Austria, and the Transilvania University of Brasov, Romania. Since 2004 over 186 students, from 72 countries globally have graduated from the programme.

The ECOSTAR project funded by the European Commission fosters collaboration between universities and innovative start-ups and successful businesses, operating in the field of Forest and Environmental Policy and Economics (FEPE) in Italy, England, Spain and Romania. Their innovative blended learning course and a European start-up support group on entrepreneurship and innovation targeted PhD researchers, research staff and professors at university departments working in the field of FEPE. The success of the e-learning course was such that they started a second edition at the end of 2018 that lasted until March 2019 titled ECOSTAR – The Nature Accelerator.

It is evident that some tertiary level submissions are in line with the Bologna Process, which is keen on promoting mobility (for students, teachers, researchers and technical and administrative staff) and promoting development of study plans, cooperation between universities, mobility programmes, integrated study plans, training and research[18]. These initiatives contribute greatly to the increasing trend in internationalization and are best practice examples that can be replicated.

Conclusion

This paper highlights some best practice approaches in forest education at different education levels including the tertiary level. The best practices also show that sustainable forest management is a very important topic which can be taught at all education levels using different learning activities either indoors or outdoors. The submissions from primary and secondary education provide insights on how to incorporate forestry content that will help to nurture pro-forest behaviour at the early ages of individuals (Kanowski *et al.*, 2020). The activities presented for primary and secondary levels can also be modified to suit different age groups and could also be replicated in different countries. At tertiary level, incorporation of innovative pedagogical methods, including online courses. Virtual forest tour programmes will help to create robust education programmes, equipping students with the right skills needed to meet the realities of the changing forest sector as well as the expectations of the different stakeholders. Student mobility, and cooperation between universities, mobility programmes, and integrated study plans, which are part of the objectives of the Bologna Process, were evident in some tertiary level initiatives.

The initiatives from the Best Practices Global Competition could go a long way in contributing to shaping forest education discussions and policies. Platforms such as this competition could be a starting point for information exchange, showcasing trends and providing advice on forest education at different levels. This idea should be embraced because of the huge potential of reaching a wider audience and bringing to light the existing best practices in forest education and their contribution to the SDGs. Such competitions could also provide ideas on how to adapt forest education to the challenges posed by the Covid-19 pandemic such as the abrupt transition of physical classes to online learning mode after the closure of educational institutions, reduced

18 https://www.unibo.it/en/international/agreements-and-networks/bologna-process

peer interactions among the learners, and limited technological infrastructure and capacity among others.

Authors' statement

The competition was organized and coordinated by all the Joint IUFRO-IFSA Task Force on Forest Education members, but the paper has been written by the two authors, based on the submissions received from Europe.

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IMPROVING HIGHER FOREST EDUCATION BY INTERNATIONALISATION AND INTERCULTURAL EXCHANGE: THE EXAMPLE OF A LOCAL IFSA GROUP

MERLE KÜSTER

Abstract

Due to the growing expectations on forestry graduates an improved higher forestry education is needed. IFSA and their renowned partners offer opportunities to deepen the members' knowledge and broaden students' horizon in participating in annually organised IFSA-meetings or (inter)national conferences. As IFSA operates as a platform, the members get the possibility to network with experienced forest or forest-related professionals. Students of the local IFSA group Tharandt organise and participate in meetings on national and international level, and present their new experiences at events with fellow students.

Keywords: IFSA, forestry education, student organisation, forestry student.

History of the IFSA

IFSA (International Forestry Students' Association) was founded in 1973 during an annual meeting of forestry students in Great Britain. The motivation of the meeting was to create an international platform for an exchange of information and making contacts all over the world. In 1994 the headquarter of the organisation moved to the University of Freiburg in Germany.

Since the establishment in the 1970's the organisation has grown, by now spreading over 50 countries on all continents. Today there are more than 130 local committees, which makes IFSA one of the largest international student organisations. The vision of the IFSA is to raise the awareness of the importance of forests for humankind and appreciate the different values that forests offer with the guiding principle "a world that appreciates forests"[19]. It's mission is to enhance the members education by organising international events, support networking and the exchange between different cultures.

In the strategy 2018-2022 the IFSA board identified the following goals:

- Goal 1: Strengthen the IFSA community.
- Goal 2: Take learning beyond the classroom.
- Goal 3: Enable students to engage globally.
- Goal 4: Ensure institutional stability.

19 See www.ifsa.net

Organisation of the IFSA

The association is managed by the IFSA Board, consisting of seven members. The Board is liable for the plans and processes of the organisation. As a non-governmental-organisation, IFSA is run completely by students for students. On a geographical level the organisation is divided into seven regions: northern America, Latin America, Asia-Pacific, northern Europe, southern Europe, northern Africa and southern Africa. Important annually meetings are held, to enhance the community and support the international relations between the members from different countries. The largest one is the International Forestry Student Symposium (IFSS). During this annual meeting the IFSA board and other officials get elected and important internal topics are discussed, as well as many excursions and workshops are held. Other meetings on international level are the seven annually organised regional meetings, taking place in a different country of the respective seven regions each year. The aim of the meetings is to network and make new friends, get to know IFSA and the opportunities the association offers as well as broaden students' horizons in workshops and through the exchange with other members. The Germany meeting is planned on national level for the exchange for all German local committee (LC). Highlights of each meeting are an international evening, organised for the cultural exchange, and an auction to raise money for IFSAs' development fund. The development fund supports members from low income countries in their LC projects or mobility to take part in IFSA meetings.

For more information, the author recommends the official website: www.ifsa.net

Partners

The Students' Association has many renowned partners, which support the engagement of the members to get active and involved in research projects. Examples of the many partners are EFI, IUFRO, CIFOR, FAO, Global Peatlands Initiative, UNEP, United Nation Forum on Forests and UNFF and many more. In the SILVA Network conference at Tharandt the joint IUFRO-IFSA task force was represented by Juliet Achieng Owuor (see Owuor and Rodíguez-Piñeros, this volume).

How does IFSA improve higher forestry education?

There have been changes in the last years in the curricula of the universities, the traditional courses are complemented by modern courses. But still, knowledge of the students is superficial about certain topics. IFSA functions as a platform for the exchange of information, contacts and ideas (Kostilainena, 2005). Due to its global network with different partners and renowned organisations from all over the world, IFSA offers the chance to deepen the knowledge in participating in international meetings, where political issues are discussed. The members of IFSA are motivated to improve their self-education, and take the opportunities to network with forest professionals from all over the world. In presentations or meetings in their local committees the students share their experiences with fellow students.

As known from previous SILVA Network conferences, IFSA also carries out surveys e.g. Lackner et al. (2016), to determine issues in forestry education. As IFSA is run by students, the organisation acts like the voice of forestry students. To have a stake in processes concerning the development and improvisation of forestry education it is important to have many active members who participate in conferences and meetings of the partners.

Local Committee Tharandt

The seven German Local Committees are located in Eberswalde, Göttingen, Freiburg, Rottenburg, Freising, Erfurt and Tharandt. The LC Tharandt, counts 12 active members, students from BSc Forestry and MSc Forestry. To get active in the IFSA and to learn about forests in other parts of the world we participate in meetings like the NERM (Northern European Regional Meeting) or the IFSS. We have a close relationship with the IFSA LCs from Prague and Brno, Czech Republic, which resulted in our 'forestry-friendship meeting'. It is an annual meeting, held alternately in Czech Republic and Tharandt, Germany. In April 2019 five members of our LC spent a weekend in the Bohemian carst area located in the National nature reserve Karlštejn. We enjoyed a botanical excursion (Figure 1), hiking trips in the local forest and evenings with campfire and guitars.

Figure 1: Forestry Friendship meeting 2019 in Czech Republic ©Marek Mejstřík.

We have also used the opportunity provided by IFSA to send some of our local members with observer status to the United Nation Framework Convention on Climate Change in Bonn, Germany. This gave us a chance to understand and get involved in political processes. To share our experiences with other students on the campus and interested persons we organise so called 'Fernwehabende', once a semester. These are events where we organise presentations about IFSA meetings, internships abroad, exchange semesters or other interesting experiences students want to share and have a round of discussions and questions afterwards. Furthermore, we help to organise events during the first week for the freshmen in October or our campus-party.

Our LC members agree that being part of IFSA is a great and worthwhile experience!

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THE NETWORK OF YOUNG FORESTERS IN GERMANY: LIVING LINKAGES BETWEEN HIGHER FORESTRY EDUCATION AND PROFESSIONAL PRACTICE

MAXIMILIAN AXER

Abstract

Founded in 2017, the Junges Netzwerk Forst [JNF; Young Forestry Network] is a network of young foresters including students, graduates, and young professionals up to age 40 in Germany. It has been established as the youth organisation of the German Forestry Association (Deutscher Forstverein e.V., DFV), which is one of the largest and oldest associations in the field of forestry in Germany. The JNF was founded to act as a networking platform for all protagonists and with the aim of giving young foresters a voice. Due to the great generation change in the forestry sector, an exchange of experience between the generations but also within the younger generation is necessary. This dialogue is enabled through various excursions, lectures and seminars organised by the members themselves or the parent organisation DFV. The great proactive and self-organized attitude of the members underscores the great demand of young foresters to exchange ideas and create a network.

Keywords: German forest association, networking, students, practical experience,

Introduction

The German Forestry Association (DFV, Deutscher Forstverein e.V.), founded in 1899, existed without a youth section for almost 120 years. Young people up to the age of 40 were underrepresented in the German Forestry Association resulting in a right-skewed age distribution. Due to the poor job prospects that prevailed in the forestry sector for a long time, the willingness to join forestry associations was very low and not attractive for young people.

Fortunately, the job situation has improved enormously in recent years despite staff cutbacks, hence a generation change is imminent in many forestry enterprises. The report on the state of Europe's forests stated that about 30 % of employees in forest-related jobs in Europe are 49 years old or older (Forest Europe, 2015) – this share still rising (UNECE/FAO Forestry and Timber Section, 2018). To avoid a loss of knowledge with retiring personnel, there must be a transfer of knowledge between the generations. At the same time, the attractiveness for young people to get involved in forestry associations has increased enormously due to the greater number of jobs available in traditional forestry professions (Liebal and Weber, 2016). However, a youth organisation for foresters was missing until 2017.

This paper points out how the gap of a youth organisation was filled by the establishment of the JNF. In addition to outlining the foundation of the JNF, the following will present and discuss the aims of the JNF, its member structure, and experiences during the first years.

Foundation of the network

Given the initial situation described above, the idea of founding a youth organisation as a network was developed by two young forestry professionals. As the concept of an association did not seem to be attractive for the young generation due to rigid structures, such as elections, association statutes and fixed memberships, a non-formal association in the form of a network was chosen. The JNF was founded in Regensburg, Germany in May 2017 on the initiative of Felix Ludwig Hofmann and Alexander Stute. The organization's goals and principles were determined in initial workshops: The JNF defines itself as a meeting place for young forestry professionals (< 40 years old) in Germany. As the youth organisation of the DFV, the JNF receives financial and conceptual support. In return, the JNF members familiarise themselves with the DFV, it´s programme offers and can join it – at the latest at the age of 40.

The JNF is politically independent. It is solely dedicated to forestry and career-oriented topics across all forest ownership types and professional groups. All members are invited to contribute ideas and personal initiative to ensure the further development of the JNF. The network cultivates an honest and open discussion culture – both, within the network itself and between JNF and DFV. "Young topics" such as career opportunities, career choice, career entry and compatibility of career and family are given space for discussion and impulses. The young foresters are to be connected to each other. In addition to maintaining contacts, the JNF serves the exchange of knowledge and experience e.g. with excursions, talks and events. The special bond between youth and parent organisation results in a bridge between the generations.

Organisation and members

The JNF is organized in accordance with the DFV. Corresponding to the regional forestry associations, eleven regional representatives are available as contact persons for questions and concerns regarding the JNF (www.forstverein.de/). Among other things, they take up regional issues, support the implementation of regional network meetings, organize information events and bring young people's issues to the attention of the regional forestry associations. Many of the regional JNF representatives have been accepted into the advisory board of the respective regional forestry associations.

Student university representatives are also involved at the eight forestry university locations in Germany (Eberswalde, Erfurt, Dresden, Freiburg, Göttingen (both university and university of applied sciences), Munich, Weihenstephan and Rottenburg). They make a significant contribution to active member recruitment, for example by organizing regular information events.

Membership of the JNF is open to anyone up to the age of 40 who is working in the forestry sector, has recently completed or is currently pursuing forestry related education. The age limit of 40 years was set because it is assumed that at this age everyone has completed their education and professional orientation. The JNF has gained 820 members within three years. There is an average increase of about five members per week. Analysing the JNF membership structure,

Figure 1 shows the age distribution of the members. Compared to the age distribution of members in the DFV, there is a clearly right-skewed distribution. The average age of the members is 27.5 years. The youngest member is 17 years old. A share of women of 30% (Figure 1) is particularly pleasing in terms of the gender balance in the forestry sector, as women only account for about 20% of forestry jobs. Nevertheless, Liebal and Weber (2016) showed that 36% of forestry university graduates were female. Here, an attempt should be made to adjust the proportion.

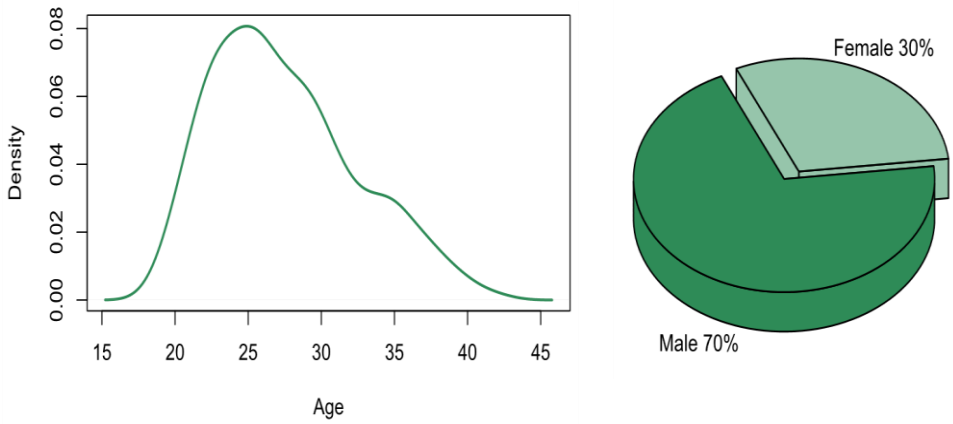

Figure 2: Age distribution (left) and gender distribution of the members (right).

The analysis of the current employment of members provides further insights into the membership structure: Almost 59% of the members are students of universities and universities of applied sciences (Figure 2) since their members can be easily recruited. At the same time, this underlines that students have a great interest in building up a professional network. Once people are at work it is harder to reach them. The JNF reckons that in the near future, when current student-members of the network will be distributed throughout various professions of the sector, they will spread awareness about the network. The professional activity of the members is diverse and ranges from forest workers to foresters in management and science. JNF members are employed in state forestry operations, private forestry operations, ministries and in consulting companies. 41% of the members are already working in forestry and gain initial experience (Figure 2): some in management positions, some self-employed, some do traineeships, some work as scientists. A comparison with other studies on university graduates is not possible, as students and forest workers were included in

this analysis. However, it is noticeable that the proportion of scientists is probably somewhat lower than mentioned in Liebal and Weber (2016), which did not included graduates of universities of applied science while the proportion of employees in classic forestry professions is higher.

However, it is evident that the network represents people from all professional groups. Furthermore, Figure 2 indicates a living link between young professionals on the one hand and students of universities and universities of applied sciences on the other hand. This provides a great opportunity to share professional experiences and give advice on career options. Based on the membership structure, a high diversity of professions, age and gender obviously bring along many ideas and opportunities for exchange.

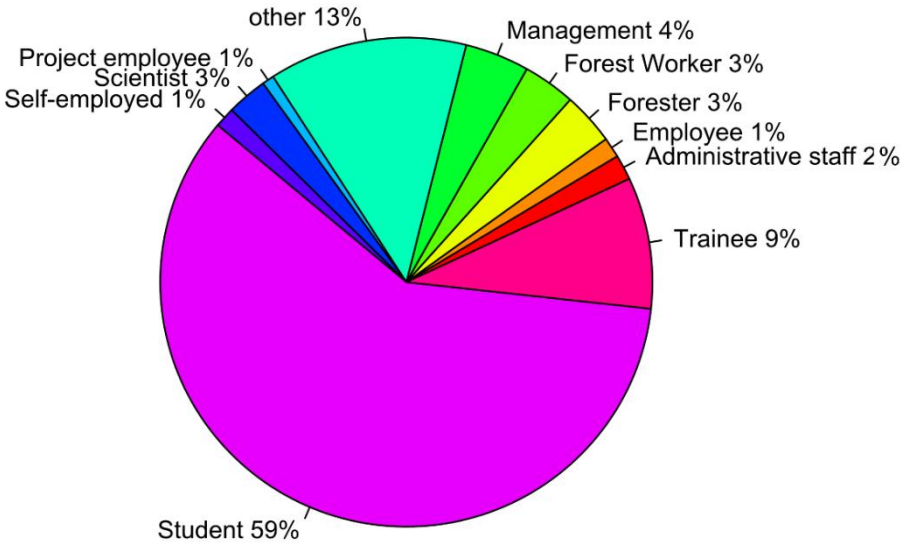

Figure 3: Distribution of professions of JNF members.

Corresponding to the increased recruitment of members at universities and universities of applied sciences, a regional distribution of members in Germany is evident (Figure 3). In the regional groups, where there are two universities or universities of applied sciences with higher forestry study programmes, the number of members is significantly higher (Bavaria, Baden-Württemberg, North-West Germany). The regional groups with one university of applied sciences or university (Sachsen, Thüringen, Brandenburg) show higher numbers of members compared to regional groups without.

However, after graduation, people are distributed widely throughout Germany and members are found in all federal states. The distribution of members in the federal states without a university indicates a slight tendency towards the availability of jobs

in these states. Further analysis on this would be desirable. In the future, further recruitment of members should be sought in these federal states.

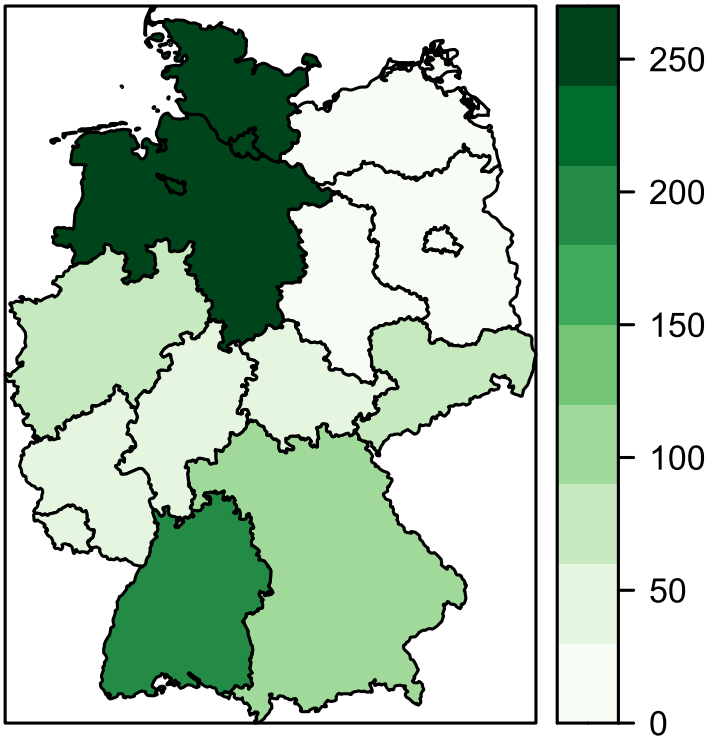

Figure 3: Geographical distribution of the number of members in the 11 regional groups. (Berlin & Brandenburg; Rheinland-Pfalz & Saarland; Niedersachsen, Hamburg, Bremen & Schleswig-Holstein are combined into one regional group each).

Events and actions – How does it work in practice?

At the heart of the JNF is the member list, which is accessible to all members. Contact details of all members can be viewed, enabling fast and easy networking. Access is ensured via a password-protected cloud. Members gave permission for sharing this information. The member list is updated on a monthly basis. Many members make use of the list for internships, during their traineeship, or to organize excursions. Since not all members have access to social media, internal communication takes place via a mailing list. Members are informed about JNF activities at regular intervals.

Continuing education is one of the main pillars of the JNF. Particularly at the beginning of a career, one is dependent on a regular exchange with colleagues in the same field. This exchange is supported by networking. In addition to the biennial conference at the federal level (alternating with the DFV's conference), regional

network meetings are organized regularly. Those events are held during the year at the local level with the aim of introducing participants to each other and exchanging information on current regional and national forestry issues. For this reason, the regional network meetings serve not only to provide professional training, but also to allow members to exchange ideas. Different event formats like joint excursions, indoor lectures, small conferences or social evenings are suitable for this purpose. In addition to topics of interest for the younger generation, emphasis is always placed on the exchange between the younger and older forestry generation. In the face of a massive generation change, benefiting from the knowledge of experienced colleagues is to be institutionalized through the JNF and DFV. Regular get-togethers have been organized for this purpose. At these informal meetings, an exchange with the older generation is fostered especially by the convivial nature of these gatherings.

Forest professionals from all types of forest ownership, forestry experts, from science, education, different stakeholder groups, timber marketing and wood processing are invited to attend the regional network meetings. So far, 45 regional network meetings have taken place, with an average of about 20 participants, bringing together a large number of people. This dynamic shows how many young forestry professionals have already been introduced to each other. A diverse range of topics have been discussed at regional network meetings up to this point: company and product presentations, excursions to private and state forestry enterprises, digitization in forestry, hunting, forest conservation, and exchange of experiences for starting a career or career options.

The 2018 federal conference in Buchenbühl was held under the motto "Let's talk – communication builds bridges". Topics such as public relations in forestry, conflict management in everyday working life, and leadership of employees as young managers were addressed by selected experts from science, practice, and administration. With 80 participants, the 2018 conference attracted great interest and was fully booked. The content of the seminars is indicative of what topics members would like to learn more about:

- Communication models.
- Communication about one's own work.
- Leadership tasks.
- Modern personnel management.
- Assessment centre training.

These topics indicate a need for more transferable skills in addition to contents of the current curricula of higher educational institutions.

The 2020 federal conference with the title Confidently developing the forest of tomorrow (*Glück auf – Voll Zuversicht den Wald von morgen gestalten*) was planned to take place in Münchehof near Seesen (Northern Germany) and focus on the

challenges and opportunities following calamity events. Due to the Covid-19 pandemic and associated restrictions, the conference was postponed to 2022.

Within the framework of the DFV's conferences, the JNF is involved in the programme planning and design, in order to facilitate the inclusion of young topics and thus actively reduce the participants' age average – in the sense of generation exchange. This was impressively demonstrated at the 2019 DFV meeting in Dresden, where new programme items such as the science slam (see Box I) or the forester party were successfully introduced.

Box I: Science Slams
Originating in traditional poetry slams, in a science slam, scientists compete for the audience's favour in a short 10-minute talk. The speakers must succeed in presenting scientific research and findings in a clear, entertaining and, at best, funny way. The winner of the first science slam was Anne Austen, a forestry student, with her interesting and witty presentation on "Forest dieback".

Besides contributing to the conferences programme, incentives to participate were created in the form of a JNF discount, discounted accommodation and sponsored bus transfers for JNF members. For the meeting in Braunschweig in 2022, the JNF again is going to participate with young topics in terms of the programme content.

Conclusion

The previous analysis demonstrates the rapid dynamic the JNF took on during the first few years after its creation. The large number of members indicates the great demand of students and young foresters for a networking opportunity.

The membership analysis points at the diverse composition of the JNF members. The large proportion of students will probably even out somewhat in the coming years, as the network ages with its members. The proportion of women members compared to the overall gender distribution of the forestry sector is good but should be further increased. This diverse membership structure has proven to be very enriching for the exchange among the members.

The internal communication and the variety of events offer a high potential for the exchange between professional practice and students of universities and universities of applied sciences. The integration of JNF into DFV also provides the opportunity to establish an exchange between generations, institutionalizing intergenerational knowledge transfer.

For the JNF's future development, it is expected that the number of members will continue to increase. Digital events will be provided to complement analogue events in times of contact restrictions and beyond. Through online presentations, exciting topics can be presented with little effort and members can network without geographic constraint. In the next amendment of the DFV statutes, JNF will be given a voice in the DFV bodies. This will allow the interests of the young people to be directly

represented in the DFV. Overall, JNF has accomplished a lot in its young years and has a proven to be a successful model for networking of young foresters, securing the future of the forestry sector in Germany.

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ADDRESSING SHORTAGES OF PROFESSIONAL FORESTERS IN IRELAND

MARIE DOYLE

Abstract

Ireland is not a country with a long history of forestry or forestry education. However, from a forest cover level of 1% of the land area in the early 1900s to 11% in 2020, mainly due to the prevailing temperate climate being ideally suited to the growth of coniferous species (for example *Picea sitchensis*), a thriving forestry sector has developed. Formal forestry education began in the 1920's and while student and graduate numbers were always modest, they increased during the 1990's, in line with the expansion of the private forestry sector. In recent years, there has been a reduction in the number of applications to study forestry and a shortage of forestry graduates has been noted right across the sector. To address this, representatives from across the forestry sector have come together as 'Forestry Careers Ireland' to create awareness of the potential of forestry as a career. Updated information on a careers portal, visits to secondary schools, printed materials and involvement in science festivals are all examples of work undertaken.

Keywords: Ireland, forestry, education, graduate shortage, career promotion

Ireland and the Bologna Agreement

The Bologna Agreement was formally signed in 1999 by 29 European countries, including Ireland, and saw the establishment of the European Higher Education Area (EHEA) (European Commission/EACEA/Eurydice, 2020). Membership has since expanded beyond Europe and, in 2019, there were 48 signatories to the Agreement.
In Ireland, the majority of higher education students exit formal education having achieved a Bachelor's degree; the length of degree programme is dependent on the subject of study but the majority are of three or four years' duration. At the time of writing, the latest national report for Ireland on the EHEA website relates to the period 2012-2015. During the 2012-2015 period, approximately 50% of first cycle higher level degrees were awarded after completion of 180 ECTS credits, approximately 50% had a weighing of 240 ECTS credits and a very small number of degree programmes required 300-360 credits (predominately in dentistry, medicine and veterinary medicine) (ehea.info, accessed 07/06/2021). In terms of student numbers, 56% of students were enrolled in courses of 240 ECTS credits (EHEA, 2020).

Prior to the Bologna agreement, Ireland had begun to develop a framework of undergraduate and postgraduate degrees as well as a system to reflect the structure and relationships between various levels of qualifications. These processes became

associated with Ireland's implementation of the Bologna agreement; Ireland's National Framework of Qualifications (NFQ) identifies ten levels of educational qualifications – levels 7 and 8 correspond to the first cycle in the EHEA framework (nfq.qqi.ie, accessed 07/06/21). It should be noted that holders of a level 7 ('ordinary') Bachelor's degree are not automatically entitled to progress to the second cycle (Masters level) unlike holders of the level 8 ('honours') level Bachelor's degree.

Ireland and forestry education

Forestry education in Ireland has formally been offered in University College Dublin (UCD) since 1913 with the appointment of Augustine Henry as the first Professor of Forestry (Gardiner and Nieuwenhuis, 2014). Alongside this, there were informal training schools in Avondale, County Wicklow and later in Shelton Abbey, County Wicklow and Kinnitty, County Offaly; these were managed by the Government department in charge of agriculture and all had ceased to operate by 1985.

With the expansion of private forestry in the 1980's, two other higher education programmes in forestry were developed, one in Waterford Institute of Technology (WIT) and the other in the Galway-Mayo Institute of Technology (GMIT). Both were initially Level 7 or Ordinary Bachelor degrees, and while the GMIT course stopped accepting students in 2008, the WIT course continues and has developed a one year 'add-on' course that enables students to graduate with a Level 8 or Honours Bachelor degree.

The UCD forestry programme is a specialisation within the Level 8 Bachelor of Agricultural Science degree. The degree programme was traditionally five years in duration – a year of basic sciences, followed by two years of subject-specific modules, then a full year of professional work placement and a final year of intensive subject-specific study. This structure was altered in the mid-1990s to shorten the programme to four years to bring it more in line with other Bachelor programmes with the objective of increasing the attractiveness to potential students (Gardiner and Nieuwenhuis, 2014). This consolidation was achieved by amending academic content and reducing the required period of professional placements.

In the early years of the forestry programme, there was sometimes only one graduate, or in some years, none. The total number of graduates from 1913 to 2013 was 483; 87% of whom were male.

Ireland and forestry

Through many years of exploitation, mismanagement, and forest clearance, as well as an increasing population which necessitated an expansion in agricultural output, forest cover in Ireland in the early 1900s was estimated to have fallen to approximately 1% of the land area. With the founding of the Irish state in 1922, the Government launched a plan to increase forest cover with the objective of self-sufficiency in wood supply

and also as a source of employment opportunities. Records indicate that in the year 1923, the planting programme was a mere 388 ha and it was considered that the role of growing trees for timber should be taken on by the State, given the long-term nature of the rotation (OCarroll, 2004).

It was well accepted that agricultural production and protection of the rural economy had precedence over afforestation; to protect and maintain the country's capacity for food production, the maximum price which was to be paid for land to be afforested was set at a very low level. This ensured that only 'low quality' land, i.e. land considered marginal for agricultural production, could be planted. The next conundrum was what to plant on such land, and species trials were necessary to identify what would not only survive, but grow and produce timber on often relatively inhospitable site conditions. Thus began the association of Ireland with Sitka spruce (*Picea sitchensis*), and for several years with lodgepole pine (*Pinus contorta var latifolia*); both species of northwest American origin.

It was not until the 1980s that considerable financial incentives were made available to encourage private landowners to undertake tree planting; this period also saw the development of the private forest sector as nurseries, contractors and forestry consultants expanded to meet growing demands. In 1988, the management of the public forest estate was legally transferred to an entity called 'Coillte Teoranta': the shareholders are the Minister of Finance and the Minister for Agriculture, Food and the Marine, and the company was given a remit to operate as a commercial company. The company now has three distinct businesses: forestry, land solutions and panel board production.

The 1996 Government strategic plan established an ambitious target of achieving 17% forest cover by 2030; however, the planting targets needed to achieve this were never realised and in more recent years, even the more modest annual planting targets of 6,000 ha are not being met (Figure 1) (Department of Agriculture, Food and the Marine, 2020; Department of Agriculture, Food and Forestry, 1996).

Forest cover is now approximately 770,000 ha or 11% of the land area, one of the lowest rates in Europe (Department of Agriculture, Food and the Marine, 2020). Ownership, in terms of area, is almost evenly split between the public and private sectors with the privately owned areas dominated by forests less than 30 years old. Sitka spruce remains the most widely planted species and now accounts for just over 50% of the forest estate (Department of Agriculture, Food and the Marine, 2020).

Demand for qualified foresters

There are an estimated 25,000 private forest owners, each owning an average of eight ha of forest; these small disparate forest areas present quite a challenge in terms of forest management due to their often inaccessible locations and the variety of objectives of the forest owners. Given the relative 'newness' of forestry as a land use,

most forest owners have little expertise in forest management and rely on the guidance of professional foresters. In recent years, a series of Government funded initiatives have been developed to equip private forest owners with the knowledge and skills required to become more proficient and confident in the active management of their forest properties.

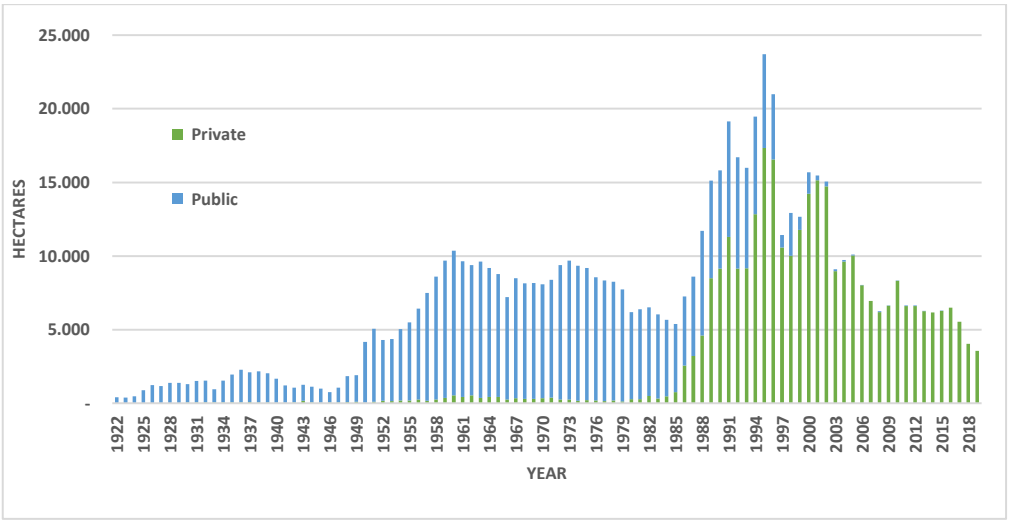

Figure 1: Public and private annual afforestation, 1922-2019 (DAFM, 2020).

Roundwood production in Ireland is forecast to grow to 8 million m3 per annum by 2035 (this represents a doubling of output from approximately 4 million m3 in 2016) and the growth in output is expected to come from the maturing private estate which for the first time exceeded one million m3 in the period 2017-18 (O'Driscoll and Moore, 2020; Phillips et al., 2016). This, coupled with increased societal expectations from our forests, has resulted in an increasing demand for suitably qualified forestry professionals. However, there has been no corresponding increase in applications to study forestry in either of the third level institutes where forestry is taught. In fact, over recent years, there has been a reduction in applications; a phenomenon that seems to have been mirrored in many other forestry programmes for several years (Innes, 2010; Nyland, 2008).

Accessing higher education in Ireland

Access to the majority of third level – or higher education – programmes in Ireland is dependent on the grades achieved in the Leaving Certificate examination which is undertaken in the final year of secondary school. Grades are converted to numbers and summed to provide what are commonly referred to as 'CAO points' – the Central Applications Office being the entity that manages the higher education application system.

Broadly speaking, programme places are allocated on the basis of supply and demand. There is a perception that 'higher points' programmes are more prestigious and that those requiring relatively low points may not be of good quality or may not result in a worthwhile degree. This is somewhat contradicted by the findings of a 2006 study, which indicated that, in the majority of cases, students actually apply for programmes based on their preferences while other factors, like the 'points race' and location play a smaller role in their decision-making (Gormley and Murphy, 2006).

Accessing the UCD Forestry programme

For the forestry degree at UCD, the knock-on impact of a reduction in applications is a reduction in the CAO points (which is a reflection of academic achievements scored by future students at the final examination of secondary school) needed to access the programme as the law of supply and demand takes hold (Figure 2). This has meant that a proportion of students offered places on the programme in recent years have found themselves academically unsuited and the drop-out rate in the early stages is relatively high when compared to other specialisations of the Bachelor of Agricultural Science. A number of students also find themselves in Forestry by default as they list Forestry lower in their CAO list of preferred Agricultural Science programmes. Ultimately, many discover a fascination for Forestry and become committed to the study of Forestry. There is also routinely a cohort of students whose preferred course of study is Forestry – these are the students that take little convincing from the outset that a varied, rewarding, and challenging career awaits.

For many years, the suite of specialisations in the Bachelor of Agricultural Science degree were accessed through one CAO offering; the entry points were the same for all programmes. Denominated entry came in 2001 and the 'gap' between several smaller programmes, including Forestry, was evident from the outset (Figure 2). From 2008, the gap appeared to widen and for the 2017 intake, a decision was made to reduce the number of places available for forestry.

There has been a proliferation of higher education programmes in recent decades and navigating through these offerings has proved somewhat confusing for applicants. As a consequence of this, the CAO has been trying to encourage a more consolidated and streamlined applications process. For some years, the Forestry programme staff, and those of other smaller programmes, rallied against this as it was felt that a separate listing for each of the specialisations of the Agricultural Science degree seemed to at least offer some visibility and a distinct identity. There was also the very real fear that amalgamating smaller 'less popular' programmes with those that historically have had high demand for places (and significantly higher CAO points requirements) could result in extremely low student numbers for the smaller programmes. However, the pressure to amalgamate prevailed and in 2021, the Forestry programme will be accessed under the same listing as many other UCD Agricultural Science programmes. It remains to be seen whether there will be a positive or negative impact on intake to the Forestry programme.

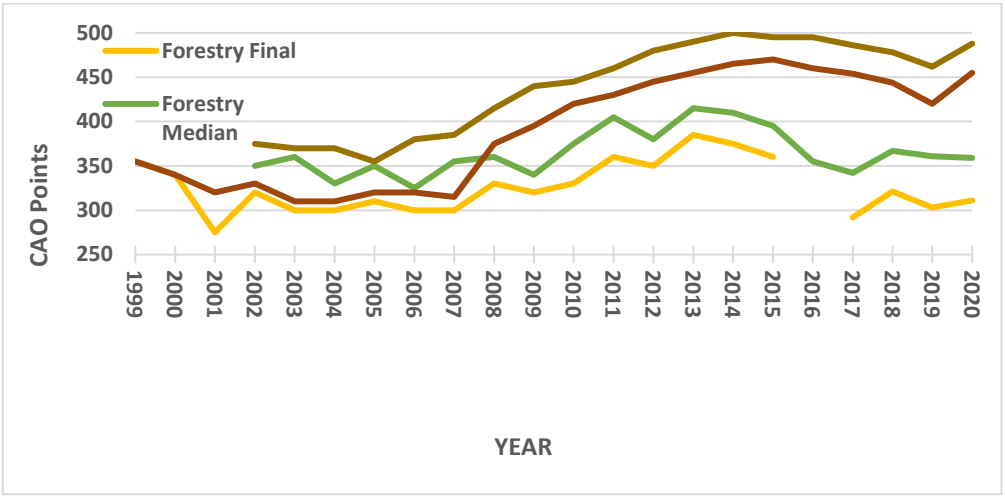

Figure 2: A comparison of CAO points required for general UCD Agricultural Science and the Forestry programme 1999-2020 (the 'final' CAO points refers to the points associated with offers made if all places on a programme are not allocated after the first round of 'offers'). (source: cao.ie, accessed 14/04/21).

Why the lack of interest in Forestry programmes?

Given the rapid expansion of forestry in Ireland, one might have thought that there would be a demand for forestry education. It is not immediately clear why this is not the case although it has long been considered that the lack of visibility of forestry and the lack of awareness of what a forester does, has contributed to this. It is quite telling that in Ireland, the secondary school senior cycle Agricultural Science syllabus was renewed in 2017 and despite the fact that 11% of the land area is classified as forest, forestry is not specifically referenced as a land use.

During the final year of the UCD programme, Forestry students must complete a research project. One such project in 2018 investigated the awareness and perceptions of senior cycle secondary school students about forestry as a career choice. A survey of three schools found that 80% of respondents were not aware that forestry could be studied at third level in Ireland and most associated the role of a professional forester with the physical aspects of planting, harvesting and tending to forests (Maher, 2018). This misconception may well contribute to the ongoing poor level of applications by female students in particular.

Coupled with this, there is a somewhat negative perception of both, the type of forests and how they are managed; society in general would seem to prefer mixed native woodlands that are maintained in the landscape. The focus on the value of the natural world, on trees as havens of biodiversity and as the ultimate 'lungs of the world' begins very early during primary education. The notion of removing trees is very often

portrayed as a negative thing; perhaps our efforts to communicate the facts of well managed forests, the challenges of meeting SFM principles and the joy and necessity of wood and wood products, need to happen at a much earlier stage in formal education.

Since 2019, Forestry has been in the news for all the wrong reasons; there have been orchestrated appeals to licences for afforestation, road construction and harvesting and due to the unforeseen volume of appeals, there is now a serious logjam in issuing licences and the industry is at a 'standstill'. This does little to attract entrants to forestry either in terms of afforestation or formal study.

It has also been reported more generally that the term 'forestry' implies an element of industry or production and that potential students now being environmentally aware are more drawn to ecology or nature-based programmes. Many forestry programmes internationally have amended their titles, and their content, to reflect this and it has been previously discussed at UCD.

Steps to address the graduate shortage

In recognition of the seriousness of the shortage of Forestry graduates, the regulatory authority, industry representatives, the third-level educational institutes, and professional forestry societies have come together under the umbrella title of 'Forestry Careers Ireland' (FCI) to develop an action programme to raise awareness of forestry as a career.

The first action was to provide a coherent and up-to-date offering on forestry as a career on the "careersportal.ie" internet page. This resource is widely used to support students in identifying careers choices and appropriate college programmes. Not only was accurate information about the Irish forest sector provided but also video and text testimonials, along with photographs, from a range of foresters. A presentation highlighting the extent of forestry, forest ownership and the positive role that forests can play in Irish land-use was made to the national conference of the representative body of Agricultural Science teachers. A prize was also sponsored for the best 'forestry project' in a national competition for secondary schools called 'SciFest' which aims to promote student engagement in STEMM (Science, Technology, Engineering, Mathematics, and Medicine) subjects.

The most ambitious initiative of FCI was the establishment of a Schools Ambassador programme. With funding secured from a government initiative to promote forestry, high quality print materials were developed and circulated to all secondary schools in the country (Figure 3).

The material introduces the scale of the forest sector and the range of opportunities that exist with a forestry qualification. An offer to have a professional forester make a presentation to Transition Year (TY) students was also included; TY is a year

between the junior and senior cycles in secondary school and often has flexibility in the timetable and can therefore more easily facilitate school visits. Unfortunately, after only a few months of the programme, the global pandemic caused school closures and halted such visits.

Figure 3: Print material produced by FCI to promote forestry as a career.

Discussion

While feedback to FCI on the success of the Ambassador programme was only collected on an ad hoc basis, the initial findings seem to indicate that there has been a relatively poor level of uptake by schools, despite the enthusiasm and willingness of the Ambassadors. When the author sought comment from a TY co-ordinator (who had been an enthusiastic supporter of the programme), she replied that it is mostly likely too early for students to hear about career choices and that targeting Career Guidance counsellors during the senior cycle of secondary school and/or offering TY students a practical exposure to forestry could well yield better results. On foot of this, plans have been developed to field test a 'forest based' experience with TY students to conduct a multi-resource inventory and demonstrate how the information is used to predict timber volumes, plan for biodiversity management and calculate carbon stocks. It must be noted that the potential benefits of such initiatives are somewhat in the future as TY students in 2021/22 will be applying for higher education courses commencing in 2024.

Forestry education in UCD is at a critical juncture – the loss of denominated entry for potential students may see a reduction in enrolments for the 2021/22 academic year.

Conversely, this may have a positive impact on the forestry programme in that, with some time and effort, the impression of being a 'low points' course might be eroded. What remains to be seen is whether the university will continue to recognise the value of the forestry degree specialisation.

On a larger scale, the current licensing issues surrounding forest management need to be addressed as a matter of urgency if trust is to be restored in forestry as a viable land-use choice for landowners.

It is hoped that ongoing efforts to market forestry as the vibrant, challenging, rewarding career that it is, reach the intended targets and that the next generation of foresters become the custodians of a robust and sustainable forest resource and a thriving and diverse industry.

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DEALING WITH EXTREME EVENTS AND FOREST MANAGEMENT: CAN UNIVERSITIES HAVE A ROLE? THE CASE OF THE VAIA STORM IN ITALY

MAURO MASIERO, DAVIDE PETTENELLA, LAURA SECCO AND FEDERICA ROMAGNOLI

Abstract

Forest disturbances associated with extreme events and natural disasters are expected to increase continually in intensity, quantity, and frequency in the coming years, posing severe threats to the world's forests. This challenges many actors to cooperate in developing innovative and effective solutions to increase resilience of socio-ecological systems. Higher education institutions, including universities, are called to contribute to these solutions. An interesting case-study is provided by Vaia storm, an unprecedentedly extreme event that hit North-East Italy between October and November 2018. Post-event activities and reactions by Italian universities are reported and analysed in this paper, with a focus on the Department of Land, Environment, Agriculture and Forestry (in the Italian short version, TESAF) at the University of Padova. An overview of activities is provided, distinguishing among five main categories: (1) research initiatives by senior university staff, (2) PhD research activities, (3) education initiatives for students, (4) communication and dissemination activities and (5) side initiatives developed in cooperation with partner organizations. Though mainly focused on a single university Department, the overview confirms that higher education/research institutions had a key role in the post-Vaia phases and supports the idea that they could have a more active role in developing and delivering knowledge and skills that can help moving closer to more resilient socio-ecological systems.

Keywords: forest disturbances, windstorm, resilience, research, education.

Introduction

Forests can contribute to climate change mitigation by conserving and enhancing the carbon sink, through reducing greenhouse gas emissions from forest degradation and by producing bio-based energy and materials to replace fossil fuels (Grassi *et al.*, 2017). At the same time climate change can have long-term effects on forests (e.g., through higher temperatures, altered precipitation patterns etc.) and meanwhile lead to an increased occurrence of extreme events and disturbances directly/indirectly affecting the contribution of forests to mitigate climate change and forest resources as well (Lidskog and Sjödin, 2015). Windstorms, prolonged droughts, heat waves, wildfires, pest infestations etc. have increasingly occurred in the last decades and their impacts grew, together with the growing stock and average age of forest stands across

Europe (Seneviratne *et al.*, 2012; Gardiner *et al.*, 2013; de Rigo *et al.*, 2017; Gregow *et al.*, 2017). Besides damaging forest resources in environmental and ecological terms, extreme events have also socio-economic impacts, affecting (among others) timber markets, management/investment choices, and ecosystem services, not mentioning damage costs, and losses of human lives and public goods. Coping with them needs a multidisciplinary and cross-sectorial approach, calling for new management models, both in terms of technical forest management solutions, and specific policy and governance mechanisms/approaches favouring resilience and adaptation capacity. While extreme events and natural disasters are perceived among the most likely and impacting global risks (World Economic Forum, 2018), the overall increase in their frequency and associated economic costs emphasises the importance of society adapting its future planning to deal with these new extremes (EASAC, 2018).

Actions for adaptation and resilience challenge many actors, stakeholders, and social groups. These include research and higher education institutions, in particular those dealing with forestry, that are called to provide students and future professionals with appropriate knowledge and skills vis-à-vis the emerging threats for forests and consequent societal needs. Besides adapting curricula across a diverse range of disciplines, this should also call for providing cutting-edge research results in natural and social sciences and collaborating with local communities and experts to identify innovative and effective solutions aiming to increase forest and social resilience. How are higher education programmes in forestry dealing with extreme events? How can university networks contribute to the identification/implementation of effective solutions for preventing, mitigating and managing them?

The paper addresses these questions with a specific reference to the Italian context and a specific focus on the Department of Land, Environment, Agriculture and Forestry (in Italian Dipartimento Territorio e Sistemi Agro-Forestali, TESAF) at the University of Padova (North-Eastern Italy). Reasons behind this focus are explained within section 2 below. In the last years, extreme events have occurred in Italy at an intensity regime unseen before. 2017 has been the worst year ever for forest fires in Europe and Italy was heavily affected as well. On October 29th 2018, the Vaia storm hit five regions/autonomous provinces in the North-East of Italy, causing windfalls totalling several millions m3 of timber and exceptional impacts from an environmental, social and economic point of view. Wind is by far the most prominent among disturbances affecting European forests, being responsible for about 51% of all recorded damage (Schelhaas, 2008) and totalling some 900 million m3 windthrows since 1950s (Gardiner *et al.*, 2103). However, while windstorms are relatively common in Central and Northern Europe, in Southern European countries, like Italy, they mainly occur under the form of minor events. Due to its intensity, Vaia storm represented an unprecedented event, being the single largest natural disturbance event affecting forests in the modern history of the country. It shed light on the forestry sector and marginalised areas, calling research and education institutions (among others) to reaction. Building on this case, the paper presents examples of initiatives

currently under development in terms of applied research, training and technology transfer and discusses the possible role higher education and research programmes can have within this domain.

Methodology

This paper is not aimed to perform a systematic and exhaustive review of all Vaia-related initiatives developed by Italian universities, rather to provide an overview of different initiatives by TESAF, a leading forestry department that is located close-by affected areas and is actively involved in the post-event management. This is also driven by convenience sampling as, to our best knowledge, the TESAF Department is the only forestry university department in Italy that developed a collection of Vaia-related materials. While limiting the focus to a single department implies the exclusion of initiatives by other research organizations, likely resulting in an underestimation of the general picture, it still allows to get a preliminary idea of how academia reacted to an extreme event like Vaia.

The paper builds on two methodical components:

- a literature-based summary overview of the Vaia storm main impacts, and
- data mining, to collect and analyze data on post-Vaia initiatives developed by Italian higher education institutions specialized in forestry. In particular reference has been made to the dedicated public-available repository hosted by the official TESAF website (TESAF, 2021).

Although several Italian research and education institutions have developed initiatives in the wake of Vaia windstorm, the focus on the TESAF Department is justified by the fact that this is the largest university department with a focus on forestry-related matters within the area hit by the storm. It is also the only department offering a full programme (i.e., Bachelor, Master and Doctorate courses) in forestry within the same area and the most popular forestry programme at the national scale with a total number of 634 enrolled students as per the 2017-18 academic year (about 21% of forestry students enrolled in Italy) (MIUR, 2019). It also hosts, since early 1990s, the largest among the local Forestry Students Associations in Italy (AUSF Padova, 2021).

Last but not least, in 2018 TESAF Department has been officially requested by the Regional Implementing Authority for Planning Operations in Veneto[20] – appointed within the framework of extraordinary measures adopted in the post-Vaia phase – to provide technical and scientific support to all regional Implementing authorities and the Regional Emergency Support Unit for the management of the post-event phase.

20 Veneto, in the North-East of Italy, is the administrative region (NUT 1) where Padova is located.

The Vaia storm: a summary overview

On the night between the 28th and 29th of October 2018, the Northeast of Italy was hit by a storm with wind speeds higher than 190 km/h, affecting four out of the five regions in the area (from West to East, Lombardy, Trentino and South Tyrol, Veneto and Friuli-Venezia Giulia) (Figure 1).

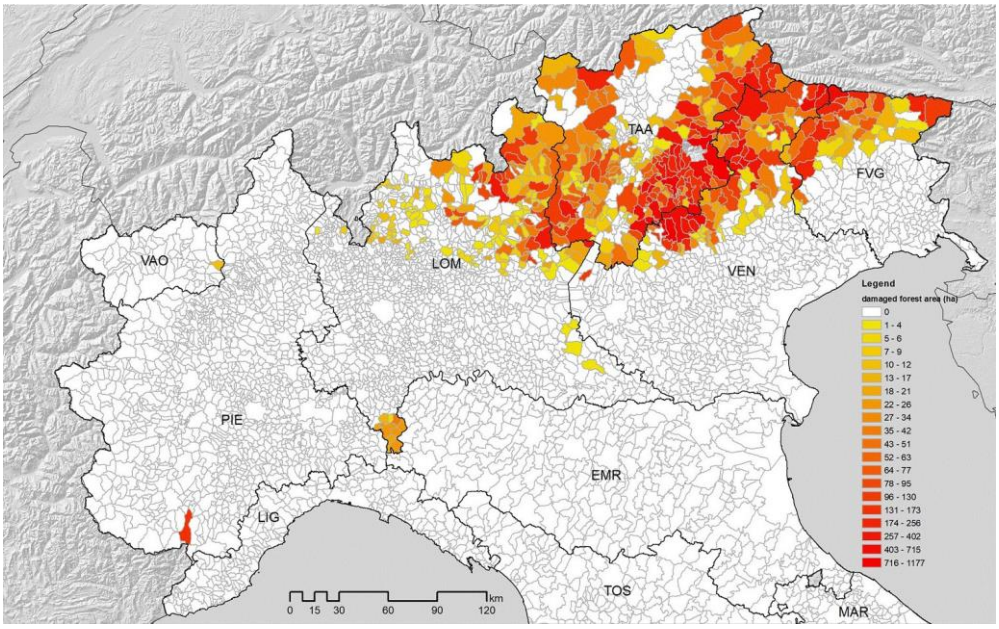

Figure 1: Forest areas damaged by Vaia, per municipality (Nomenclature of territorial units for statistics, NUTS 3). Note: LOM – Lombardy, TAA – Trentino-Alto Adige/South Tyrol, VEN – Veneto, FVG – Friuli-Venezia Giulia. Source: Chirici *et al.* (2018).

More than 41,000 hectares of forest were destroyed, about 10 million m3 of timber were windthrown and damages totalling more than 3 billion € were caused to both grey and green infrastructures (Chirici *et al.*, 2018). The Vaia windstorm has shattered the Italian forest sector but has also had many severe direct and indirect environmental as well as socio-economic impacts on mountainous areas. About 20,000 ha of forests within protected areas – i.e., natural and national parks, including Natura 2000 sites – were heavily damaged (Provincia Autonoma di Bolzano, 2020; Provincia Autonoma di Trento, 2020; Sitzia and Campagnaro, 2019). Several green and grey infrastructures were heavily damaged, including power and mobile lines, water facilities, roads, forest road networks, hiking and bike paths, protection infrastructures (e.g., against rockfalls, avalanches), riverbanks, urban green areas and facilities, protection forests etc. The assessment of timber trade data on pre- and post-Vaia timber sales via different sources shows that the increase in the supply of timber after the storm created market saturation conditions. This reflects on a decreasing trend of standing tree prices for industrial logs that diminished from an average pre-Vaia value of about 80 €/m^3

to 10-25 €/m^3 few weeks after the storm, with some slight recovery (40-45 €/m^3) after a few months. The downturn in prices was associated to the increase in the number of timber auctions with no bids, which reflects the decreasing number of logging operators actively participating to large auctions due to the financial risks associated to them. The increase in timber supply posed additional problems in terms of processing capacity by local sawmills: although the primary processing industry performs differently across regions and autonomous provinces in the North-East of Italy, local sawmills were not able to process such an amount of timber in the short-medium term. The ultimate consequence was the need to export towards traditional (Austria) and new (China) markets a large proportion of the harvested timber at low prices, losing the added value potential associated with the processing of low-cost raw material in the local territory (Romagnoli *et al.*, 2020).

Due to the huge total impact of the storm, two years after the event, forest and mountain communities are still striving to recover and find a new equilibrium.

Post-event initiatives by research and education organizations: the case of the TESAF Department at the University of Padova

Initiatives and actions undertaken by the TESAF Department are distinguished into five main groups: (1) research initiatives by senior university staff, (2) PhD research activities, (3) education initiatives for students, (4) communication and dissemination activities and (5) side initiatives developed in cooperation with partner organizations. Some information and details for each of these groups are provided below.

Research initiatives by senior permanent university staff
Research activities led by senior permanent university staff have been implemented in the wake of Vaia windstorm. In some cases, existing research activities were re-shaped and adapted to take into consideration the storm impacts and effects. For example, post-event forest regeneration and ecological dynamics have been targeted by a research project focused on a public forest area in the Dolomites (Malgonera forest) damaged by the storm. About 500 seedlings have been planted in a test plot and are being monitored within a larger network of pilot sites hit by the storm across Northern Italy. Other research activities that have been developed with regard to a broad range of post-event topics focussed on soil conditions and management, impacts on the timber market and prices, hydraulic risks in mountainous streams etc.

In addition to spot initiatives by single (or groups of) researchers, mainly addressing the topic from a monodisciplinary perspective, a two-year multidisciplinary research project developed by TESAF staff has started in October 2019. The project, titled VAIA-FRONT (FROm lessons learNT to future options), is funded by the TESAF Department and aims to analyse present and future vulnerabilities of forest socio-ecological systems to wind-related threats in the target area of North-East of Italy, and to preliminarily test a risk assessment procedure for selected ecosystem services in one pilot case study in Veneto region. To this end, the project includes four main

actions: i) to collect and organise data on storm events and on their impacts in the European and Alpine areas, included the area affected by Vaia; ii) to review current approaches to wind-related hazard, vulnerability and risk assessment, and governance analysis for forest socioecological systems; iii) to adapt existing frameworks for wind-related hazard and vulnerability assessment to one selected pilot area in the target region; iv) to implement a preliminary risk assessment and management for key forest ecosystem services in the selected pilot area. The ultimate ambition of VAIA-FRONT project is to identify key lessons to be learned from the Vaia event, both for planning and management practices and for policy interventions, to enhance the resistance and resilience of forest socioecological systems in the Italian Alps as well as in other Alpine regions (TESAF, 2019). The project is organised into five work-packages (Figure 2) and counts on the scientific support of an Advisory Board made-up of four highly qualified scientists from European universities and research centres, who assess project progress and provide guidance.

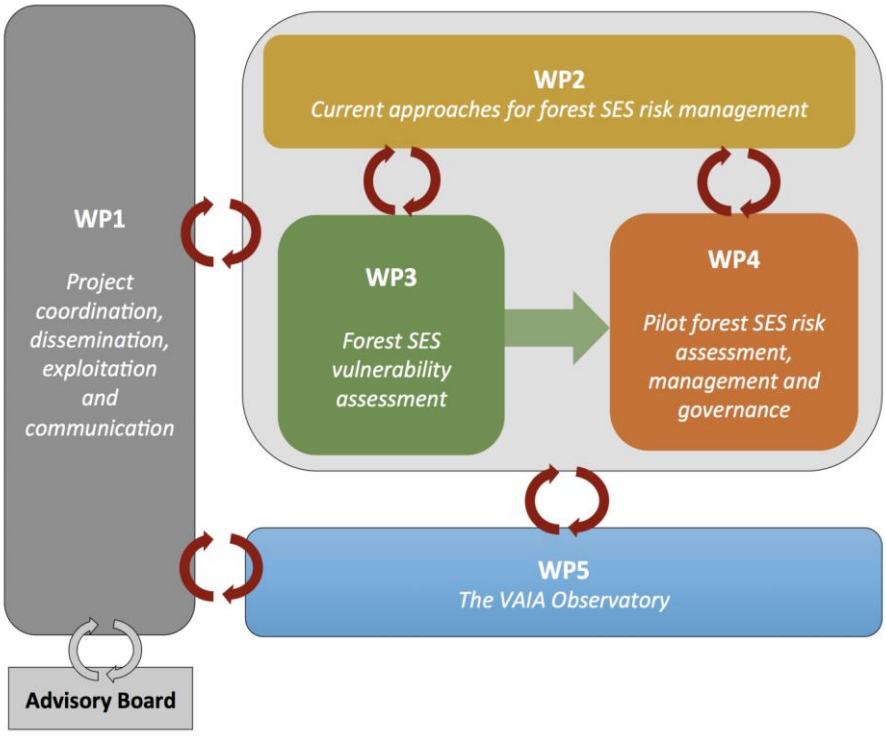

Figure 2: Structure of the VAIA FRONT project. WP = work package; SES = socio-ecological system. Source: TESAF (2019a).

The role of young researchers: PhD research activities

Research activities developed within the framework of VAIA-FRONT project are complemented by those implemented by Young Scientists for Vaia, i.e., a group of PhD candidates currently developing their PhD projects within the Land, Environment, Resources and Health (LERH) PhD programme at the TESAF

Department. Four thematic areas have been identified for PhD candidates who applied to the LERH programme in 2019 and five research projects have been funded via three-year long scholarships and are currently ongoing under the guidance of a multidisciplinary group of scientific supervisors (Table 1). An additional, sixth, PhD research project is being developed within the Crop Science PhD programme offered by the Department of Agronomy, Food, Natural Resources, Animals and the Environment (DAFNAE) of the University of Padova. DAFNAE Department is a twin Department to TESAF, focused on crop and animal science, hosted on the same campus where TESAF is based. All the above-mentioned PhD research projects are expected to be finalised by 2022.

Table 1: PhD research projects being developed by Young Scientists for Vaia within the LERH PhD programme at (a) TESAF and (b) DAFNAE Departments, University of Padova. Source: own elaborations based on data retrieved from LERH (2021) and DAFNAE (2021).

Main thematic Areas and issues	**Research projects**
TESAF Department, LERH PhD programme	
1. Forest policy and economics, governance of natural resources Addressed issues: risk perception, total economic value of damages and impacts, social attitudes towards mitigation programmes	Adaptive strategies and community resilience after extreme climatic events: the case of the Vaia storm in Italy
2. Forest ecology and silviculture Addressed issues: protection forests and hazards, ecosystem services, forest regeneration, deadwood manipulation	Impact of windstorm events on the ecosystem services of Alpine forests Short-term regeneration dynamics and influence of coarse woody debris on regeneration patterns after the Vaia storm in north-east of Italy
3. Mechanics and logistics Addressed issues: salvage logging, road networks, wood logistics	The eco-efficiency of salvage logging and wood transportation logistics in complex scenarios and the rule of the primary and secondary road network
4. Hydrology Addressed issues: gravitational hazards, hydrological risks	The Vaia flood event: observations and prediction of sediment and large wood dynamics
DAFNAE Department, Crop Science PhD programme	
5. Crop science Entomology, pest attacks and diseases, pathology	The VAIA windstorm: understanding outcomes and future trends on forest biodiversity through a DNA metabarcoding approach

Initiatives for students

Forest disturbances and their associated impacts, post-event activities and preventive management choices to improve forest resilience became topics increasingly addressed within forestry programmes. While field activities are traditionally part of learning curricula in forestry, visits to sites damaged by the Vaia storm provided tremendous learning opportunities. Before limitations imposed by anti-Covid measures starting from Spring 2020, many of these sites have been used as open-air labs for teaching, training and research activities since early spring 2019. Within the framework of forestry courses – in particular Master Degree (MSc) ones – offered at the university of Padova, field visits have been organized to damaged areas, to identify and estimate damages by the storm as well as encourage discussions around post-

event management activities, including regeneration options and planting, observe skidding operations and logistics, consider safety aspects associated with windthrows removals, meet local experts, professionals and operators, etc.

Besides field visits, indoor learning activities were integrated with additional teaching activities inspired by Vaia and further complemented by seminars, workshops and conferences organized as integrative learning opportunities offered to forestry students at the University of Padova. This included a round table with experts from the regional Forestry Departments of the five administrative regions/autonomous provinces hit by the storm. Some of these events were organized in cooperation with the local university-based Forestry Student Association.

Vaia also became a topic for thesis research by students: by querying the University of Padova online public thesis repository using "Vaia" as a keyword within both the title and abstract fields, six Master theses were identified, five of which developed at the TESAF Department (ecology and silviculture) and one at the Department of statistics (climate physics and statistics). No Bachelor thesis was found however.

Ad hoc activities have been organized within the framework of courses delivered outside standard forestry curricula. For example, the 55th edition of the "Ecology culture" course (June 2019), a week-long event organized by the TESAF Department every year at the Centre for Studies on Alpine Environment located in the Dolomites and targeted at national and international PhD students, was fully dedicated to storm damages to forests (TESAF, 2019b). Learning activities and a field module were offered to students attending the short specialization course in Prevention and emergency in the mountains and high altitude, organized by the Department of Cardiac Thoracic and Vascular Sciences and Public Health of the University of Padova (Gruppo operazioni forestali Università degli Studi di Padova, 2020). The focus, in this case, was on risk assessment of the work activities in mountain areas hit by the storm. Finally, the annual Summer School of the Erasmus Mundus MSc Programme on Mediterranean Forestry and Natural Resources (MEDfOR) (July 2019) hosted a seminar on "Dealing with extreme climatic events: the challenges after the windstorm Vaia" delivered by TESAF staff. The seminar followed a field trip to areas damaged by the storm (MEDfOR, 2019).

Communication and dissemination activities

Given the magnitude of the event, Vaia gained momentum in media and high visibility among both experts (researchers, practitioners, public administrations) and the public at large, exposing the national forest sector to an unprecedented visibility within the Italian audience[21].

21 As an empirical confirmation of this, the docu-reality programme Undercut was broadcast by the Italian TV channel DMAX between June and July 2019. The programme showed activities by lumberjack teams from four different forestry enterprises engaged in removing windthrown caused by Vaia windstorm in Trentino area. Given the success achieved by the first season, a second (December 2019) and third (July 2020) editions have been produced and broadcast.

As reported in Table 2, the TESAF Department staff was involved in several communication and dissemination activities, targeting a broad and diverse audience. Most of these activities concentrated in 2019, although the number of communication initiatives per month was much higher in late 2018 (18 initiatives/month), just after the event (October-November 2018), than during other periods reported here. While this figures and trends may reflect the general interest for the topic and its visibility, they might have influenced by restrictions imposed by Covid-19 pandemic since February 2020 that limited to some extent both research and communication activities, in particular with reference to conferences. On the other hand, figures presented are likely underestimated as they do not cover some minor initiatives or activities that were not made publicly available through the TESAF website and communication channels.

Table 2: Media and dissemination activities on Vaia involving TESAF research staff. Source: own elaborations based on data retrieved from TESAF (2021).

Years	**Online and offline media interviews**		**Online and offline media articles**		**Workshops, seminars and conferences**		**Video interviews**		**Total**		
	N.	%	N.	%	N.	%	N.	%	N.	%	Average N. per month
2018	16	23.9	4	25.0	7	24.1	9	25.7	35	23.6	18
2019	39	58.2	11	68.8	18	62.1	22	62.9	89	60.1	7.5
2020	12	17.9	1	6.3	4	13.8	4	11.4	21	14.2	1.8
Total	67	100.0	16	100.0	29	100.0	35	100.0	148	100.0	5.8

A bunch of conferences/workshops were directly organised by the TESAF Department, including, among others, the kick-off meeting of the VAIA–FRONT project (Padova, October 2019), a joint webinar of the VAIA–FRONT project and the Young Scientists for Vaia group (online, July 2020) and a conference on the role of the University of Padova in developing research activities with reference to the Vaia storm (Belluno area, September 2020). Besides above-mentioned initiatives directly organised or co-organised by the TESAF Department, staff members were invited as speakers to a number of additional events among those referred to in Table 2, organised by other institutions, including Alpine Clubs, cultural and industrial associations, scientific bodies etc. About 45% of these events took place in Padova and close-by areas (not directly hit by the storm) taking advantage of the proximity to university staff and facilities, while another 35% took place in areas that were directly affected by the storm, both within and outside Veneto.

TESAF staff proactively cooperated with many media by providing information and materials for articles and being available for interviews. About 60 interviews (90% of total media interviews) were published by newspapers, mainly local ones (89%), while an additional 10% were published by national newspapers, thus reaching a broader audience. Additionally, 35 video interviews involving TESAF staff were

recorded. Of this, about 60% were made via country-wide television or radio programmes, while the remaining 40% were performed by regional media (29%) and Padova university media and communication channels (11%).

Communication and dissemination activities on Vaia were organised also by other academic and non-academic organizations. For example, the Italian Society of Silviculture and Forest Ecology co-organised several events, including conferences and a thematic exposition, as well as coordinated ad hoc technical and dissemination reports and publications. Some of these initiatives were supported by non-academic actors, like local foundations, regional administrations, specialised media and the National Federation of Wood-working and Trading Industries.

Side initiatives developed in cooperation with partner organizations
Additional initiatives were developed in cooperation with partner organizations. As an example, in late 2018 Etifor, a spin-off of Padova University, launched the WOWnature platform[22] that allows single citizens and private sector organizations to contribute to nature-restoration and forest development projects in various areas. At present there are projects running on about 70 different sites, both in Italy and abroad: 12 of these refer to areas damaged by the Vaia storm. The platform allows fundraising to support projects aimed to generate positive impacts by either improving existing forests or creating new forest areas. Positive impacts in terms of ecosystem services generation are independently verified and monitored according to the Ecosystem Service Procedure developed by the Forest Stewardship Council (FSC®) and all forest areas are committed to be managed in compliance with (and become certified according to) FSC forest management standards. Projects are (co)funded by private citizens, who are directly involved in planting operations, and private sector organizations that can take advantage of benefits generated by these projects to compensate negative environmental impacts they cannot avoid, reduce or mitigate. Among the most prominent initiatives it is worth mentioning the case of Arte Sella (Sella Valley, Trentino), a large and famous permanent land-art exposition that was damaged by the storm and restored with the support of Levico Acque, a local mineral water company committed to become plastic-free and climate positive (WOWnature, 2021), and the case of Agordo (Belluno area, within the Dolomites), where Luxottica – a leading company in premium, luxury and sports eyewear, controlling over 80% of the world's leading eyewear brands (Luxottica, 2021) – invested in the restoration of a large forest located just behind the company’s headquarter.

Etifor and the TESAF Department are also providing scientific and technical support to the Angelini Foundation for Mountainous Areas in the organisation of an online and public available collection[23] of studies, reports, documents and video on Vaia as well as other windstorm events that occurred in Alpine areas in the past (Fondazione Angelini, 2021).

22 www.wownature.eu
23 www.angelini-fondazione.it/vaia-per-approfondire/

Another relevant initiative – Oltre Vaia (i.e., Beyond Vaia) – was launched in 2020 as a collaboration between the TESAF Department, FSC Italy – the FSC national office for Italy – and Treedom, an online platform promoting tree-planting activities worldwide. The initiative aims to restore forests destroyed by the Vaia storm in Asiago municipality (Asiago Plateau, Veneto) by supporting both tree planting and natural regeneration dynamics. The areas targeted by the initiative will also provide opportunities for developing on-site research activities on post extreme event forest dynamics.

Some final considerations

Forest disturbances associated with extreme events and natural disasters are expected to continue to increase in intensity, quantity and frequency in the coming years, posing increasing threats to the world's forests (Moore and Allard, 2011). Effective preventive measures aimed to increase forest resilience as well as rapid response to such disorganizing, catastrophic, psychologically shocking events rarely produces good results unless there is already a deep understanding of forest ecology and governance firmly embedded in management rules and culture (Vallauri, 2005).
In the case of the Vaia storm, institutional and voluntary bodies promptly reacted on emergency issues (safety, basic services and infrastructures), while in the management of post-emergency issues different reactions by regional/provincial Public Administration bodies were observed in terms of timing, implemented mechanisms, effectiveness etc. (Romagnoli *et al.*, 2020). On the other hand, civil society organizations, the private sector, mayors and institutions at the local level as well as education institutions (schools and universities) proved to be more reactive. Though mainly focused on a single university department, and although many of the above-mentioned initiatives are still ongoing or just terminated so it is not possible to draw general conclusions on their impacts/effectiveness, the overview provided within this paper confirms that higher education/research institutions had a key role in the post-Vaia phases and supports the idea that they could have a more active role in developing and delivering knowledge and skills that can help moving closer to more resilient socio-ecological forest systems. If making these systems more resilient implies change, education or research institutions, and in particular universities, should be and shall be part of such a change and actively promote and guide transformation. A high-quality research and education system is a prerequisite to sustainable and transformational efforts by increasing competencies available within society and facilitating their responsible use via a transparent, participative processes and a close dialogue across multiple disciplines, sectors and actors (Herget, 2018). As suggested by TESAF experience, University's three missions seem to fit very well this role:

- The first mission, i.e. education, should qualify human capital by continuously and effectively incorporating research results on how to cope with extreme events and improve resilience of forest socio-ecological systems into learning programmes. This may be done for example by making research results available

via teaching materials, seminars, etc. as well as by making research on these topics part of the education process, e.g., via thesis development.

- The second mission, i.e. research programmes and activities, including those involving or promoted by young researchers and conducted in cooperation with other universities and research centres around the world, should ensure the production of new knowledge to cope with extreme events and improve resilience to rapidly changing conditions. The adaptation of ongoing research activities, the development of new research projects and the sharing and capitalization of results may serve this purpose.
- The third mission should encourage cooperation with non-academic bodies – private sector, public administration and civil society – in order to address societal needs and catalyse innovation. Applied research and activities developed in cooperation with organizations outside the university can favour the transfer of knowledge into real-world solutions and help dissemination of good practices.

Extreme events like Vaia have a huge impact on media and can give unusual visibility to the forest sector, however inappropriate, partial or misrepresented perceptions can also be passed to the public: universities may therefore also have a role in rethinking how to communicate forests and forestry, to bring them closer to people and reinforcing educational and cultural role at a broad spectrum.

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CONCLUDING REMARKS

NORBERT WEBER[24]

Twenty years after the adoption of the Bologna Principles, participants of the SILVA Annual Conference 2019 identified both positive and negative impacts of this paradigmatic change in teaching and learning in forest programmes. On the one hand, the Bologna Process, in combination with the creation of the European Higher Education Area, boosted international cooperation between universities and supported student and teacher mobility. Sometimes, as in the example of Czech University of Life Sciences, at least temporary it also increased the number of students. New Master Programmes like MEDfOR, involving seven Mediterranean Universities, or EUROFORESTER, originally designed for the Baltic Sea Region, were launched. According to experiences of the Technische Universität München, the Bologna Principles also improved employability of the graduates, encouraged entrepreneurial independency and self-employment. Career service activities and life-long learning strategies were established in other universities as well.

On the other hand, critical views could be heard. This regards the length of studies, missing employment opportunities after the bachelor degree or increasing psychological problems of students due to high workloads perceived. In addition, there are still uncertainties with respect to the employability of graduates. Taking a look at mobility, the compatibility of module structures and the transferability of ECTS credits among universities remain bottlenecks. Finally, as complained by keynote speaker Siegfried Lewark, the intended shift in focus from teaching to learning has not left the stage of "wishful thinking" in many universities.

SILVA Network Annual Conferences always provide a forum for current topics outside the main conference theme. That is why further contributions were admitted about the shortage of foresters in Ireland and the severe damage in Italy caused by the Vaia storm; the network of young foresters in Germany and the role of local groups of the International Forestry Students' Association (IFSA). Due to the fruitful connection of SILVA Network with IUFRO agencies dealing with education, the Joint International Union of Forest Research Organizations and International Forestry Students' Association (IUFRO-IFSA) Task Force on Forest Education (JTF) presented innovative best practices through the "Global Competition on Best Practices in Forest Education". This competition can help establish a community of common practice and also seems suitable for exchanging methods globally.

Interactive sessions were organized along three topics. Group 1 should look for arguments why to keep specific forest science study programmes / profiles in higher

24 Partly based on minutes by Gijs Elkhuizen (group 1), Catarina Alvares (group 2) and Lauritz Schader (group3).

education, while Group 2 was asked for taking the opposite viewpoint, i.e. collecting arguments for integrating forest sciences education into overarching study programmes (land use, environment, bioeconomy…). The topic of Group 3 was as following: What can be done to strengthen the role of forest sciences education in European universities (e.g. with regard to equipment, staff…)? As all groups provided short minutes, the results are displayed as following:

Group 1: Arguments for keeping specific forest sciences study programmes / profiles in higher education

- Forest Sciences (FS) is a relatively small discipline that has links to other disciplines such as economics, tourism, landscape architecture or environmental sciences. One could question if it should be integrated with these other disciplines instead of remaining a discipline in its own. We believe that, because FS is related to many other disciplines and can be applied in many ways in society, FS is more important than ever before and should remain a discipline in study programmes in higher education. By keeping FS as a discipline you can build upon experiences from the past, strengthen the inter/transdisciplinary character and raise the level of expertise from within the discipline. Prospective students know what to expect and can also choose FS as an entrance to other disciplines. In order to use the full capacity of its applications, students must first understand the functioning of (forest)ecosystems and management options before looking at the (forest)ecosystem services it provides. FS is at the centre of all related disciplines and services and should therefor remain visible in study programmes in higher education. By keeping FS as a discipline in its own it also remains visible for other scientific disciplines, hence FS is also visible for students who enrol in the study programmes related to those other scientific disciplines. When the future generation is educated in a setting in which FS is a strong independent discipline, a discipline that is connected to many other disciplines, FS also remains visible in society.

Group 2: Arguments for integrating forest sciences education into overarching study programmes (land use, environment, bioeconomy…)

- The group started the discussion by finding arguments to integrate "forest sciences" under other study programmes. Arguments discussed:
  - in the light of climate change it would be important to integrate forestry courses in other programmes;
  - perhaps it would be wise to integrate some courses of forest sciences in other BSc programmes; so that students would be interested in pursuing MSc programmes in forest sciences;
  - in order to safeguard some forestry courses, or programmes or even departments on Forestry, it may be necessary to put some forestry courses under other umbrellas. Such umbrellas could be Bioeconomy, Nature Preservation or Climate Threats.

- After this point the discussion shifted. The group agreed though that in fact, forest sciences should be the umbrella for other courses. So, the question became:
  - "Arguments for integrating other study programmes into forest sciences education."
  - A single conclusion was reached: Forest sciences is a multidisciplinary field dealing with social sciences, economics, ecology, climate threats, natural resources management, etc. It makes sense that other study programmes should be integrated under its umbrella.

Group 3: What can be done to strengthen the role of forest education in European universities (e.g. with regard to equipment, staff…)?

- The perceived main problem is a lack of communication between foresters and other faculties or departments of the university. By promoting the importance of forests and increasing the cooperation with related working fields, foresters may be able to create synergy effects and strengthen their role inside university.
- Besides enhancing the communication inside universities, foresters have to stay in contact with the whole society as well and create awareness of the importance of forests. But they also have to adapt to the changing demands of the society regarding forests.

Obviously, the Bologna Principles have transformed teaching and learning in European institutions of higher education, even if the grade of implementation differs between countries and universities. Irrespective of that finding, there are still a lot of challenges to be mastered.

In the General Assembly of SILVA Network Annual Conference 2019, participants decided that the next meeting should focus on digitalisation and distance teaching and learning. Nobody could know at that time how red-hot that topic would become in 2020/2021.

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PROCEEDINGS OF THE SILVA NETWORK CONFERENCES

See also www.silva-network.eu

Year	Location	Title	Editors	Published in, as
1997	Wageningen, Netherlands	New requirements for university education in forestry	Schmidt, P., Huss, J., Lewark, S., Pettenella, D. & Saastamoinen, O.	1998, DEMETER SERIES 1
1998	Joensuu, Finland	Forestry in changing societies in Europe. Information for teaching module. Part I and Part II.	Pelkonen, P., Pitkänen, A., Schmidt, P., Oesten, G., Piussi, P. & Rojas, E.	1999, SILVA Network
2002	Warsaw, Poland	ITC in higher forestry education in Europe	Tahvanainen, L. & Pelkonen, P.	2004, SILVA Network Publications 1
2003	Beauvais, France			
2004	Freising, Germany	Quality and competence in higher forestry education	Tahvanainen L., Pelkonen, P. & Mola, B.	2004, SILVA Network Publications 2
2005	Wageningen, Netherlands	Forestry education between science and practice.	Schmidt, P. & Bartelink, H.H.	2006, SILVA Network Publications 3
2006	Valencia, Spain	Quality assurance and curriculum development in forestry and related sciences.	Schmidt, P., Rojas-Briales, E., Pelkonen, P. & Villa, A.	2007, SILVA Network Publications 4
2007	Freiburg im Breisgau, Germany	Design and functioning of international forestry curricula: considerations and experiences	Schmidt, P. & Lewark, S.	2008, SILVA Network Publications 5

2008	Copenhagen, Denmark	What do we know about our graduates? Graduate analysis for forest sciences and related curricula	Schmidt, P. Lewark, S. & Strange, N.	2010, SILVA Network Publications 6
2009	Thessaloniki, Greece	Development of forest sciences curricula in Europe	Schmidt, P. Lewark, S. & Aravanopoulos, F.A.	2013 SILVA Network Publications 7
2010	Zagreb, Croatia	Bachelor / master education in forest sciences – Ready for the next decade?	Schmidt, P., Susnjar, M. Müller-Starck, G. & Lewark, S	2013, SILVA Network Publications 8
2011	Saint Petersburg, Russia	Bologna cycles 1 to 3 in higher forestry education – Objectives and reality	Schmidt, P., Müller-Starck, G., Chubinsky, A. & Lewark, S.	2014, SILVA Network Publications 9
2012	Lleida, Spain	Do students learn what they will need later? About expected learning outcomes and competences of graduates	Schmidt, P., Vega-Garcia, C., Müller-Starck, G. & Lewark, S.	2014, SILVA Network Publications 10
2013	Istanbul, Turkey	From teaching to learning – When will we take it seriously in forest sciences education?	Schmidt, P. & Lewark, S.	2015, SILVA Network Publications 11

2014	Zollikofen, Switzerland	Practice orientation in forestry curricula in universities and universities of applied sciences	Schmidt, P., Lewark, S., Müller-Starck, G. & Ziesak, M.	2016, SILVA Network Publications 12
2015	Vienna, Austria	Should all forestry students learn the same? Generalist or specialist approaches	Schmidt, P., Hasenauer, H. & Lewark, S.	2016, SILVA Network Publications 13
2016	Tartu, Estonia	Forest science education: Self-study and activation of the learner	Schmidt, P., Lewark, S. & Reisner, V.	2017, SILVA Network Publications 14
2017	Prague, Czech Republic	Forest for university education: Examples and experiences	Schmidt, P., Lewark, S, Remeš, J. & Weber, N.	2018, SILVA Network Publications 15
2018	Padua, Italy	Quality management and accreditation for study programmes in forest sciences and related disciplines	Schmidt, P. Lewark, S. Pirotti, F. & Weber, N.	2020, SILVA Network Publications 16
2019	Tharandt, Germany	Twenty years after the Bologna declaration. Challenges for higher forestry education	Schmidt, P. Lewark, S. & Weber, N.	2021, SILVA Network Publications 17