Global Outlook on Forest Education (GOFE)

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ABSTRACT
Forestry and forests are changing under several drivers such as globalization, climate change, political instability, aging societies, new technologies, and bio economy/green economy. Holistic and integrative approaches are needed, such as ecosystem services and corporate social response (responsibility?). All these changes have considerable impacts on the education sector as well as several other service sectors. Within forest education there is an increasing demand for content knowledge of social effects, generic skills, as well as e-learning and Life Long Learning (LLL) approaches. As a structural change ever more traditional forestry programmes have been merged with other disciplines or even terminated at some institutions.

The objective of this research project is to produce a scientific policy report on global forest education, concentrating mainly on university level education. The specific objectives are:

1. To analyse the effects of forest curricula and teachers’ knowledge on learning outcomes. A specific research question is whether or not learning outcomes from forest science (FS) centred curricula are different from curricula focusing on multiple ecosystems (ME).
2. To make a comprehensive competencies gap analysis on an international scale using up-to-date scientific methods.
3. To analyse the possibilities of new learning methods and approaches, for example those related to e-learning and LLL.

The study is based on a mixed methodology. After a preliminary analysis we propose that the bundle of methods needed should consist of literary research, qualitative and quantitative surveys of teachers, students, graduates, and other stakeholders.

The research is going to be executed in each continent or region by local teams consisting of a principal investigator(s) working as supervisor(s) coordinating a group of students. Students are assumed to do the research as a part of their MSc/PhD theses. The project is now also seeking financing for data gathering and student grants.

The milestones of the research are recruitment of local teams, February 2016; recruitment of students, April 2016; preliminary data gathering and literature review October 2016; interviews and surveys, December 2016; and communication of the final results, June 2017 in IUFRO 125th Anniversary Congress 2017.
BACKGROUND

Overview of the rationale and objectives related to IUFRO-IFSA joint task force (JTF):

IUFRO and IFSA have a long history of cooperative work on educational matters. Over the past years, the topic of forest education has grown in importance, not least thanks to the collaboration between both organizations.

In the Memorandum of Understanding (MoU) established in April 2002, and renewed in October 2014, IUFRO and IFSA have recognized that both networks represent a similar field of interest on a global level and have expressed their commitment to further enhance their cooperation on issues of mutual concern.

In recent years, changes of the forest-based sector combined with evolving demands of society, have led to new trends in forest education globally. These developments are reflected in the labour market as well as in the demands on students to accrue an ever greater diversity of experiences and skills. In addition, the institutional environments for forest related research and education have changed.

Forest education is defined as any education related to forests. The term includes for instance education on forestry, forest sciences, agroforestry, environmental sciences, land use, environmental management or any combination of these. Programs educating about the forest and wood as a resource are being changed towards multidisciplinary programs; curricula exclusively addressing forestry are becoming rare. Real life solutions for problems like climate change call for holistic and cross-sectoral approaches.

The education relating to forests may take place on various levels like in kindergarten, elementary school, high school, college or university as well as when educating the general public. In this document and for this certain joint project, forest education refers mainly to the university level. Nevertheless, other types of education is not excluded by default. Therefore, the term “forestry students” used in this document relates to the definition of IFSA members as stated in the IFSA statutes: “IFSA’s vision is for global cooperation among students of forest and related sciences in order to broaden knowledge and understanding to achieve a sustainable future for our forests, and to provide a voice for youth in international forest policy processes” (IFSA Statutes, 2013).

Forest education has been insufficiently addressed in existing international efforts so far. Moreover, a worldwide decrease in the number of students interested in enrolling in forestry programs has been identified, underlining the importance of this joint project. Thus, a collaborative effort between IUFRO and IFSA will provide information in this field of research, which could be used to strengthen research on forests and practices, as well as highlighting how to make forest education attractive for young people again.
The objectives of the joint task force are thus:

- To bring together perspectives and knowledge of students, educators and other stakeholders
- To encourage discussion on international education and capacity building
- To identify, compile and communicate the gaps and challenges for forest education, especially highlighting new fields of forest education
- To enhance forestry students’ mobility and education opportunities

Activities have been divided into four (4) Work-packages (WP) jointly developed and coordinated by IUFRO and IFSA representatives as follows:

WP1: Global Outlook on Forest Education (GOFE)
WP2: Higher Forest Education interactive tool
WP3: Trainings of forestry students
WP4: Encouragement of students’ involvement in IUFRO events and counterbalance of extracurricular students’ activities

**Contribution towards the implementation of the IUFRO strategy 2015-2019**

Education is identified as an integral part in numerous international processes and agreements. In terms of forest education the partnership between IFSA and IUFRO is an opportunity to assume a position of global leadership in education on forests, as stated in the IUFRO Strategy for 2014-2019.

All activities of a Joint IUFRO-IFSA Task Force fit integrally in the following strategic directions of the IUFRO Strategy:

**Institutional goals**

**Goal 1. Research excellence: strive for quality, relevance, and synergies**

Objectives: “To facilitate mobility and exchange of scientists and students across IUFRO member organizations.”

The JTF will integrate students and academic partners from all levels of forest education in the discussion about relevant research issues on forest education across various regions of the world.

**Goal 2. Network cooperation: increase communication, visibility, and outreach**

Objectives: The JTF will enhance communication at all levels of forest education, as for example vocational or university levels.

**Goal 3. Policy impact: provide analysis, insights, and options**

Objectives: “Strengthen education on forests”

The JTF will analyse and highlight the differences of access to the knowledge in the different regions and the diversity of forest education programs.
Global Outlook on Forest Education (GOFE)

Brief rationale, problem statement and objectives

There have been radical changes in the forest sector in past decades. These changes will most likely continue to affect the forest sector in the future. Some major drivers of changes in social, economic, and environmental issues are

- Globalization of the economy
- Political changes
- Climate change
- Economic instability, i.e., growing economies (e.g. BRICS) vs. stagnation in many OECD countries
- New technologies, such as IT, fibre based industry, energy industry
- Increasing demand for (vocational) education
- Aging societies
- Call for bio economy/ green economy
- Conflicts

Forestry and forests are linked to all these drivers and under pressure because of them. Holistic and integrative approaches are needed in response. These approaches can include ecosystem services, conventions on biodiversity and corporate social response. The drivers of change, mentioned above, provide new opportunities for the forestry sector as well, such as increasing needs for plantations and bioenergy. The traditional use of forest resources has to be renewed, as there is for example an increasing demand for packaging and tissue paper and a decreasing demand for newsprint (Hetemäki and Mery 2010, Katila et al 2014).

One of the biggest anticipated changes in the education sector is that IT will alter the ways people use services, and thereby alter the supply chains and business logics of these services. New technology has already decreased and modified the demand for traditional professionals - including the forest sector. It has been predicted that in the next 20 years almost half of current professions will disappear. If this becomes relevant for professions such as lawyers and medical doctors, why not forest professionals. IT will have a considerable impact on the education sector among other service sectors.

Major drivers in (higher) education and forest education have been (see for instance proceedings: Do our students...2014):

- Consolidation of traditional forestry programmes with other disciplines or termination of forestry programmes
- Multidisciplinary
- Increasing demand for social aspects of forests and generic skills component
- E-learning, blended learning
Internationalization of education

One of the major drivers in (higher) education and forest education has been the increasing number of multidisciplinary study programs. More and more traditional forestry programs are being merged with other disciplines or even terminated at some institutions. These days, forest science contents are frequently taught in programs where forests are only one ecosystem among others such as water, wetland, range, mountain, and agriculture. Competencies and learning outcomes related to forests are thus provided by more and more versatile types of curricula. Curricula can be here categorized as 1) forest sciences (FS) centred curricula based on and labelled with “forestry”, “forest sciences”, “forest management” or equivalent; and 2) multiple ecosystems (ME) study programs based on and labelled with “Natural resources management”, “Environmental science” or equivalent.

It is fair to say that scientific research on forest education has not been extensively conducted. Research has, however, been carried out in some geographical areas and topics in a more intensive manner. To sum up there has been research at least in the following three categories of studies:

- **Pedagogical methods**, such as problem based learning, e-learning and life-long learning (LLL)
- **Gap analysis**, where competency needs of working life has been compared with competences provided by education
- **Student enrolment and graduate employability**, where the flows of incoming students and out coming graduates entering into labour market have been monitored

**Pedagogical methods** and learning opportunities are now under drastic changes because of new e-technology. Massive Open Access Online Courses (MOOCs) have been taking great steps since 2012. E-learning systems and the attitudes of the younger generation have made it possible to develop teaching and learning methods via different internet based platforms. Standiford (2015) presented an overview of distance learning and new models for forest education. The objective of distance learning and LLL is for continuous activity to increase knowledge, experiences, and competences. Research centres and academic education institutes – like universities – have a responsible role in the development and transfer of knowledge. They have to promote and deliver qualified education and they have to guarantee practice-orientated training (BMWF, 2012). It seems that LLL is one of the processes aiming at meeting the needs of a changing labour market (EHEA, 2012).

**Gap analysis** can be actually seen as a large framework covering the issues of competences (depending on curriculum, learning methods..) and working life needs. Gap analyses have been executed in the US for nearly 50 years. One of the major findings has been the fact that there is a need to have more training for generic competences such as communication, ethics, teamwork and leadership (Barret 1953, Miller & Lewis 1999, Sample et al 1999, 2015). Similar results have also been obtained from Europe (Schuck 2009) and South America (Arevalo et al. 2010).

Hooghiemstra (1992) defined a competency as an underlying characteristic of an individual, which is causally related to effective or superior performance in a job. It is useful to separate two categories of competences: first, *differentiating* competencies which separate low and high level performers, and second, *threshold* or essential competencies which indicate minimum or average requirements for performers (Campion et al. 2011). However, until now these categories have not been studied in the context of forest graduates.
The gap analysis methods within forest education should thus be developed further. Differentiating and threshold competences could be analysed, for example using the Behavioral Event Interview (BEI) methodology developed originally by McClelland (1973). The underlying notion with BEI is that it is easier for people to recognize those workers who are competent than what makes them competent (McClelland, 1998). As an analogy one might say this equates to determining how good a car is. Engineers may compare the performance of each component and arrive at a somewhat objective measure. Yet the customer can more easily arrive at the same conclusion by driving the car. Similarly, competence can be measured as a technical construct, but the BEI methodology aims at first recognising high performance and only afterwards determining which factors cause such an appraisal.

Student enrolment and graduate employability are a set of long term quantitative approaches to monitor education. Sharik et al (2015) describe the national natural resource students’ enrolment data collected in US. The data, starting partly already from year 1980, consists of information on field of study, gender and ethnicity/race. This data has made it possible to analyse long term trends in enrolment, the major findings being that enrolment has been highly cyclical relative to other fields of studies. Sharik et al. also present six factors behind these trends. For instance, changing social values, diversification of degree offerings beyond traditional forestry, and lack of forestry jobs are found to affect these issues. Results from graduate employment surveys are controversial, showing decreasing amount of jobs for traditional foresters, less than half of natural resource graduates working in the field of their own, and at the same time foresters’ salaries being one of the highest within natural resources field.

Data and studies similar to that obtained from the US (Sharik et al. 2015) are hard to find in other parts of the world. Ferguson (2012) presents some analysis of forestry students’ enrolment in Australia, but presented no quantitative data in support of this assessment. Most likely many studies on student enrolment and graduate employability are published in local languages and have thus not been available for more broad analytical endeavours.

All of the three topics above are critically important. The need of enrolment and employment data is evident. However, it seems that the establishing of a more effective international statistical system goes beyond the resources of JTF which is why this topic will not be the focus of this study.

The objective of this research will thus be to produce a scientific based policy report on global forest education mainly concerning university level education. The specific objectives are:

1. To analyse the effects of forest curricula and teachers’ knowledge on learning outcomes. A special objective is to analyse whether learning outcomes from forest science (FS) centred curricula are different than the ones from curricula more focused on multiple ecosystems (ME).
2. To make a comprehensive gap analysis of an international scale using up-to-date scientific methods
3. To analyse the possibilities of new learning methods and approaches, especially those related to e-learning and LLL.
Framework

In order to provide a robust scientific analysis for meeting the aims of the study a comprehensive framework is needed. The framework is constructed using three following separate theories or models (Figure 1):

- Teacher’s knowledge (Shulman 1986)
- Integrative Pedagogic Model (Heikkinen et al, 2011; Tynjälä, 2008; Tynjälä et al. 2014).
- Constructive Alignment (Biggs 1996)

**Figure 1. Framework of the study (adapted from Tynjälä et al. 2014).**

*Teacher’s (pedagogical) knowledge* by Shulman (1986) states that both learning and teaching are results of teacher’s:

1. subject matter content knowledge
2. pedagogical content knowledge
3. curricular knowledge

The first knowledge is related to subject discipline, the second to teaching methods and cultures including learning environments, communication with students and learning outcome evaluations; the third area of knowledge is related to the need of teachers to know the other courses students are taking along the course that a teacher her/himself is teaching.
It is worth of underlining that the actual structure of curriculum is a separate concept of teacher’s curricular knowledge which can be described as a perception of curriculum. The actual structure of curriculum can be described with following items: general aims, visions and mission, models, intended learning outcomes, subject material and pedagogical methods. One key element of the study is the aim and subject material of the curriculum; i.e., FS vs. ME curricula.

The actual structure of curricula is assumed to have two ways of effects on learning, a direct one and an indirect one. An indirect effect is through the teachers’ knowledge. The direct effect takes effect through the subject related content of curriculum. It is thus assumed that it is not only the content of the curriculum itself (e.g. FS or ME based curriculum) but of the teacher communicating the knowledge which matters the most.

**Integrative Pedagogic (IP) model**, describing learning process and providing pedagogical principles for designing learning environments, is based on research concerning both expertise and different forms of intelligence (Hakkarainen et al. 2004). The basic idea of IP is that learning process and thus professional expertise is an integrated entity of theoretical, practical and self-regulative knowledge (Bereiter & Scardamalia, 1993; Eraut, 1994; Heikkinen et al, 2011, 2012; Tynjälä, 2008). There are a number of processes linking these concepts. In a transformation process conceptual or theoretical knowledge is converted and applied in practice. This can be said to be a typical focus for forestry education. In explication (conceptualization) process practical knowledge or work experience is translated into theoretical concepts and models. The third element of the IP model – self-regulative knowledge – including metacognitive and reflective skills can be developed through reflection process, which is not among the most prominent aspects of training in most forestry curricula (c.f., Kettula 2012).

The version of IP framework applied in this study (Tynjälä et al 2014) was previously adopted for a project on Technology-enhanced learning (TEL) in workplace competence development. The same model has been especially useful to develop and analyse modern e-learning methods (Tynjälä et al. 2014). These include topics such as computer supported collaborative learning (Goggins & Jahnke, 2013), knowledge building and networked expertise (Hakkarainen et al. 2004), simulations, virtual worlds and game like solutions (Krangel et al. 2012) and social media in the workplace (Dabbagh & Kitsantas, 2012; Fiehl, 2012; see also Cheng et al. 2014). The IP model can be thus be used to tackle the research objective 3: “analysing the possibilities of new learning methods and approaches, for example those related to e-learning and LLL”.

**Constructive alignment** by Biggs (1996) is a way of thinking where all educational elements, intended learning outcomes, teaching and learning activities, and finally evaluation, should support learning, i.e. they have to be aligned. Therefore,. In Table 1 these elements and their relationship with the elements of this study are described. It can be stated that in the framework (Figure 1) curriculum structure and teacher’s knowledge represent intended learning outcomes; learning processes represent teaching and learning activities and also evaluation. It can be seen that constructive alignment is a product of curriculum structure, teacher’s knowledge and learning processes and it mediates learning outcomes (see Figure 1).
Elements by Constructive Alignment model (Biggs 1996)  | Elements in the theoretical framework of this study (Figure 1)
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Intended learning outcomes | Curriculum structure, Teacher’s knowledge
Teaching and learning activities | Learning processes
Evaluation | Learning outcomes

Table 1. Comparison of constructive alignment model and theoretical framework of this study

The concept of learning outcomes and competences are applied as equivalent concepts in this study. There are several models of learning outcomes or competences varying somewhat on the jobs or field of employment. Using competency libraries/dictionaries to name and recognize competencies is useful. The best examples of these are the Position Analysis Questionnaire (McCormick, Jeanneret, &Mecham, 1972) and the Occupational Information Network (O*NET) developed for the U.S. Department of Labor (Peterson et al., 2001). In European Union there is a system of European Skills/Competences, qualifications and Occupations (ESCO) and European Qualifications Framework (EQF).

Spencer & Spencer (1993) summarized the findings of 286 studies conducted in various types of organizations. The result is a competence dictionary for 21 competences that distinguish superior from average performers in middle- to upper-level jobs (Spencer and Spencer 1993). The rich competence literature is summarized e.g., by Campion et al (2011) or Rodriguez et al. (2002).

One framework commonly used is the “Big Five” personality traits also known as the “Five Factor Model” (FFM). This model is based on early work in the 1930’s and more widely accepted in the 1980’s and 1990’s (Goldberg, 1993). Another common general competency model is the so called “Great Eight” -model created by Bartram (2005). Several other competency models have been presented based on analyses of various fields, such as human resources management or Business Managers.

Campion et al (2011) classified competences with several ways and also hierarchically arranged as subcategories. An example of relevant classification in this study is the following:
1. baseline = threshold
2. differentiating
3. future oriented

The other important classification of competences is
1. technical (=subject specific)
2. generic (=fundamental, cross-jobs, sometimes leadership)

Data and methods
There are several research methods to be applied in this study. The study process is based on mixed methodology and learning process main data sources being literature review, quantitative and qualitative interviews of all stakeholders related to competences, and database of curricula.
In order to meet the aims of the study data will be collected so that it has variance in the structure of curriculum, that is teachers’ and graduates are included from both forest science (FS) centred and multiple ecosystems (ME) curricula and programmes.

*It is worth of note that the third aim of the study: “To analyse the possibilities of new learning methods and approaches, especially those related to e-learning and LLL” is so far not explicitly planned in this draft.*

According to Campion et al (2011) working with competence models can be divided into three basic operations:

1. Analyzing Competency Information (Identifying Competencies)
2. Organizing and Presenting Competency Information
3. Using Competency Information

In this study the first two are divided into several methods of analysis in order to more effectively triangulate issues concerning the structure and importance of competencies from the point of view of labour market. This information will then be used to perform gap analysis (differences between labour market and education) and provide information to be possibly put to use in ensuing curriculum development projects. More specifically, the following six phases of data collection are proposed (see Figure 2):

1. Set general framework
2. Survey on curricula
3. Definition of subject specific competences
4. Definition of generic competences
5. Collation of results
6. Validation study

**1. Set general framework.**

The starting point for competency analysis should thus first be to study this issue to define the general context of the (forest) labour market. However, it consists of several job titles, such as forest engineer or research forester. It is likely that not only the subject related competencies vary, but also the combination of generic competencies that are required and valued in different job titles.

A particularly promising methodology could be one similar to the one used by Vona et al. (2014 NBER working paper). They performed an analysis on previously collected job-analysis data from the US Labour department to define both the subject specific and generic competencies for jobs with “Green Skills”. The methodology is based on a list of job tasks compile by experts that are seen as being strongly related to the subject matter. Having formed a list of tasks relating to the field, they compared it to the total list of tasks for a wide variety of job titles to calculate a percentage of “greenness”. They then combine this information with an evaluation of green generic competencies to form, within the wider subject matter, distinct fields of employment with varying combinations of required competences. This method could also be applied to forestry. While the method relies somewhat on expert estimates instead of being a truly data driven methodology, it promises to make bridging the gap of the comparability of existing statistics.

While such a study would be vitally important in defining the scope of inquiry for the later gap analysis, it can also be considered as a method of analysing information acquired during other phases.
of the study. This issue will be discussed later in reference to the other methodologies.

**Methods**: literature review, “Green skills” method  
**Data**: expert (teachers, senior professionals) opinions

![Proposed research phases diagram](image)

**Figure 2. Proposed research phases**

2. **Survey on curricula and teachers’ knowledge on learning outcomes**

One of the main aims in this study is to do comparative analysis of various curricula and their effects on learning outcomes. Curricula can be analysed for example using qualitative research methods such as content analysis. However, in order to keep the working load reasonable the analysis should be made using a common framework and most likely public materials describing the curricula. A formal survey (form) is planned to easily collect the curriculum information. Other options are to use accreditation materials, forthcoming IUFRO-IFSA database on forest education or any commercial databases of educational institutions to do a preliminary analysis.

**Methods**: content analysis  
**Person in charge**: principle investigator in each institution
Data: curriculum documents, accreditation materials, IUFRO-IFSA database, commercial databases of educational institutions

3. Definition of subject specific competences. To deepen our understanding of technical competencies we propose, as the third phase of the study (see fig. 2), the use of a method called Hierarchical task analysis (HTA) in addition to the general survey. The HTA method calls for a team of experts to essentially create a hierarchical structure for the skills required in each competence. An example study of the method has been conducted in the field of medical education, in which the competency-based knowledge space theory (CbKST) was then used to analyse the sequences in which certain skills need to be taught (Breen et al. 2014). This methodology has not only the benefit of creating specific information on the accumulative nature of competencies, and thus provide directly helpful data for curricula building, it is already useful for the discussion required for determining such links. This will in itself provide information on cultural differences in the understanding of technical competencies.[RM1]

For studying subject specific competencies, surveys such as those used by e.g. Sample et al. (1999 and 2015) or Arevalo (2014) provide a starting point. The measured technical, i.e. subject specific, competencies are widely based on the work done by Duncan et al. (1989) and Brown & Lassoie (1998) and have been revised only slightly since then. This should be considered in light of the need for continuity, which is beneficial for long term comparisons, but also through the lens of the requirements following from technological change.

Methods: literature review, (Hierarchical task analysis, HTA)
Person in charge: project core group
Data: expert opinions

4. Definition of generic competences. First, we propose that existing competence literature and competency libraries should be applied to create an a priori hypothesis for the competencies. The most important issue that should be addressed is which of the existing competency models should be used, that is the list of competences and their sub-competences has to be decided.

Most of the models proposed in various contexts share a common emphasis on socially focused, transferrable, or “soft” generic competencies. Indeed, all the models we are aware of have strong commonalities, and appear to vary mainly in terminology, and not content. It seems, essentially, that the models describe similar phenomena, but use different languages to describe them. If this indeed is seen to be the case, then the selection of some model through which phenomena are described in mutually understood and explicitly defined terms should be viewed as more important, than which model and terminology is used as such. Establishing a framework ahead of more detailed empirical research will help in planning, executing and analysing the results of the research. For this reason, the core group of researchers should select the model they find most suitable and intuitive for the purposes of forestry in particular.

A central issue in international studies is also the cultural differences in both the labour markets and the ways of understanding competencies (Liao, Sun & Thomas 2014). Culture has substantial effects on the way people think of and discuss issues. This is highlighted particularly in generic competencies. The lack of contextual definition should be addressed separately, but refining the
ways in which generic skills could be grouped to be understandable in an international context will give valuable information in and of itself, while enabling lighter surveys to accumulate higher response rates.

Second, after deciding the competence model (list of selected competences) the data is needed to estimate the importance of each competence and their mutual relationships in this model. There are various promising methodologies available. We propose that a repertory grid model be established based on triadic recitation interviews. This method first requires constructing a list of job tasks to be studied. Traditional job-analysis techniques can be used to select the appropriate tasks. The methodology used by Vona may also help in this selection process. Interviews of experts in the field will then be used to determine the essential skills for each task. This is done by presenting the experts with three tasks at a time, asking them to select the one least like the other two and then explain the reasoning behind their decision. The results from the multiple interviews are then assembled into a repertory grid with the specific work tasks being examined aligned against the skills that are viewed as necessary for conducting them. (Tan & Hunter 2002). This will help create a better understanding of the relationships of various competencies, and how strongly they relate to one’s competency in specific tasks.

3. & 4 Definition of subject specific & generic competences. Behavioral event interviews
We propose conducting a series of behavioural event interviews (BEI) to define – in cultural context – the actions that lead to the external recognition of having distinguishing competences, both subject specific and generic ones. The BEI method entails an expert panel first classifying employees into average and above average performers (McClelland 1973, McClelland 1998). Both the high performing and average graduates are then interviewed using the BEI method, based on critical incident technique, to obtain as detailed a picture as possible of their thoughts, actions, and attitudes. The interviews typically focus on three particular successes and three failures in their professional lives. The method relies heavily on the know-how of the interviewer to estimate when sufficient information has been obtained, and to ask specifying questions, if it is deemed necessary. The appropriate level of detail is crucial in order for the subsequent coding of the interview data to be as reliable and consistent as possible.

Methods: a repertory grid model (triadic recitation interviews), behavioural event interviews (BEI)
Person in charge: principle investigators
Data: expert opinions, graduate interviews

5. Collation of results. Gathering, and reviewing the preliminary results from phases 1-4 is considered to be an independent the 5th phase of the study. The methods listed above provide what we consider to be a relatively complete picture of forestry related competencies. It provides a general overview of the types of jobs graduates occupy, as well as a tangible understanding of the tasks necessary in them. It provides an estimate for employee wishes for graduates, and an opportunity to compare observations of these effects in different cultural contexts. It studies the sequences needed to develop subject related competencies thus instructing us on issues relating to curriculum design. Finally, it provides us with two separately constructed expert views for generic competencies as well as an interview based empirical test to compare them to.

The final data gathering stage after the competence models are constructed (based on BEI) at least the faculty members (maybe also students and other stakeholders) have a chance to comments how
they see the curriculum and competence analysis are fitting together. This is a qualitative stage where a brief gap analysis is made for example based on discussions in a curriculum development seminar, stakeholder meeting etc.

**Method:** desktop work + comments from faculty members (students + other stakeholders)
**Person in charge:** core group + principal investigators
**Data:** material from phases 1-4

6. **Validation study.** Having thus constructed a comprehensive understanding of various definitions within the field, a carefully targeted mail/electronic survey should be operationalized to measure the desired construct as a validation study. The information gathered from previous phases of the study should be designed in a way that provides reliable inputs for designing the validation study. We propose the use of a 360-degree feedback survey such as the one used by Ulrich et al. (2008) in which surveys were sent to an initial sample group as well as their supervisors, co-workers, and outside associates. An option could also be to supplement this survey with an Experience Sampling Method (ESM) survey for a subsample. ESM aims to form a picture of routine experiences by sending short surveys using mobile phone applications to fill out intermittently for a longer period of time. Such information combined with a 360-degree survey would be deeply impactful in validating the study’s results.

**Method:** feedback survey, ESM
**Data:** graduates, only a sample of all interviews

**Ethical issues**
There are normal code of conduct related to social sciences and education research. Anonymity of the respondents is one important part of this set of ethical rules.

**Time schedule**
The milestones of the research are as follows
1. Detailed research plan, April 2016
2. Recruitment of research partners, May 2016
3. Recruitment of students, May 2016
4. Recruitment of research partners, April 2016
5. Kick-off meeting June, June 15, related ICA-EDU colloquium in Helsinki
6. Other follow up meetings: September 21-23, in Tartu (Silva Network) and 24-27 October 2016 in IUFRO Regional Congress for Asia and Oceania 2016
7. Literature review, September 2016
8. Curriculum and teachers’ knowledge analysis, October 2016
9. BEI Interviews, December 2016,
10. ESM study Feb 2016
11. Communication of the final results, June 2017
Resource implications and possible funding sources

Resources needed for WP1 are related to human resources, data collection, organization of meetings and seminars as well as communication. The main idea of executing the WP is conduct the research through MSc (and potentially PhD) thesis. Therefore it is possible to integrate IUFRO scientists as supervisors and IFSA members as researchers. Grants for students are to be applied through mainly local sources. Funding for data collection and other resource needs are to be applied for through mostly regional and international donors. However, so far there has been very few ideas about international funding sources. FAO for instance is rather inactive in terms of forest education.

There is now 15 000 USD travel grant from IUFRO to gore group and student travelling. New ideas are needed to raise funding.
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