

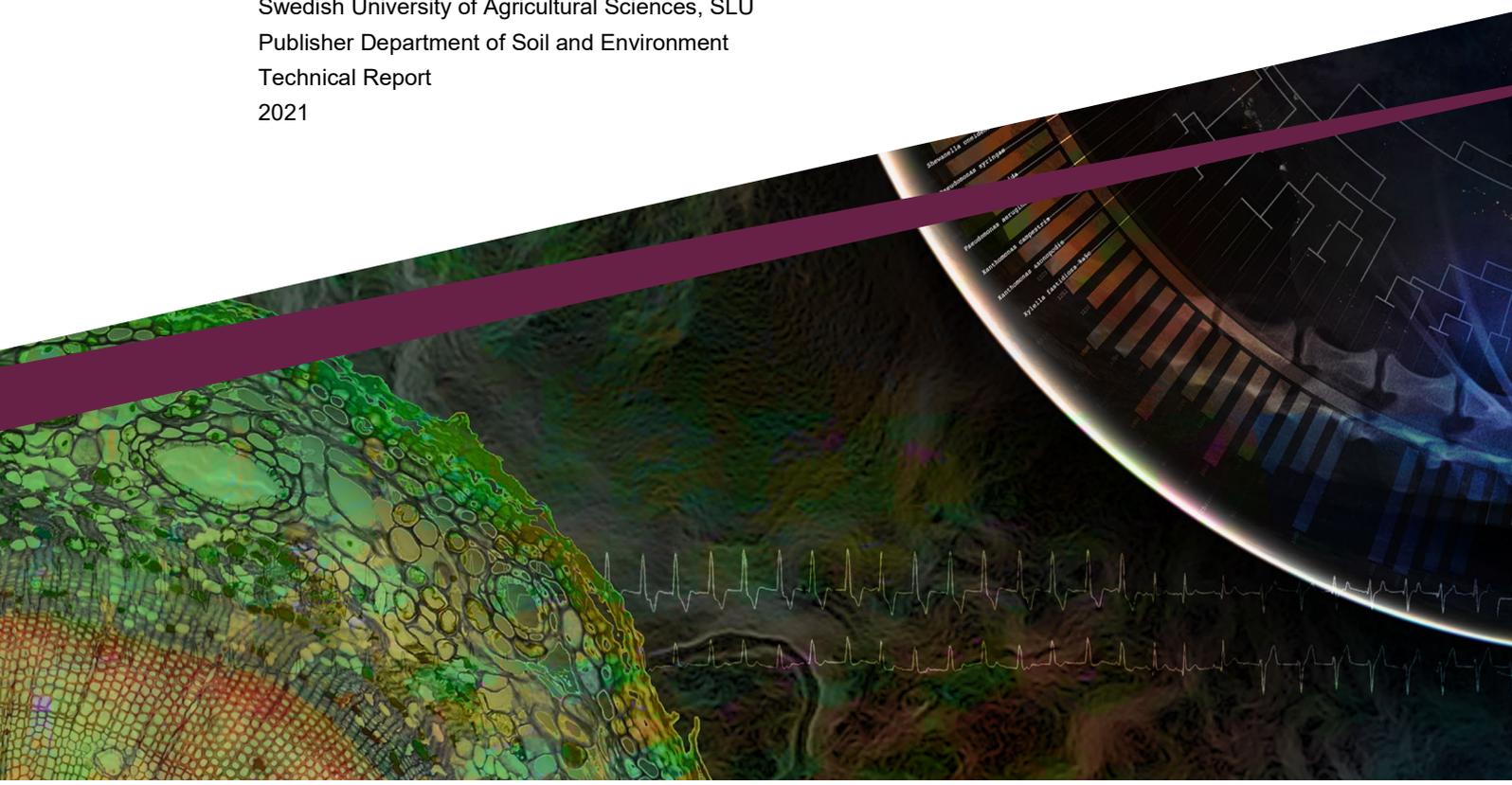


# Synthesis report of soil science capacity in Higher Education in Europe

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## EXECUTIVE SUMMARY

Soils and their management are fundamental to a range of essential ecosystems, societal and climate challenges facing humanity. In Europe, 25-30% of agricultural soils are considered degraded, affecting food systems, GHG emissions, habitats and water ways. To manage soil resources for multiple uses require expertise and competence from farmers and landowners to policy makers and the private sector. This report provides a synthesis on the current state of soil science in European Higher Education (HE), as a baseline to assess competency and resources for capacity development in soil science. A total of 120 survey responses were received in 2020-2021, representing Higher Education Institutes (HEIs) in 25 European countries. Results showed that only 13% of the HEIs hosted a dedicated soil science department. The majority of soil science is embedded in a department where environmental sciences, agricultural sciences and earth sciences are the main academic topics. Respondents reported an increased enrolment at BSc, and no change for MSc and PhD. Mixed trends could be seen for specific countries and universities, with both increases and decreases in student enrolment. Teaching capacity is high in soil science, with a majority of teachers having both PhD and training in HE teaching and learning. Yet, traditional lecture based teaching dominates soil science teaching and learning activities, both at BSc and MSc levels. At BSc level the proportion of courses that did not have any computer/modelling component was about 1/3. According to responses internationalisation is of great importance to many soil science HEI. Top three priorities for internationalisation were attracting students from abroad, providing more opportunities to send students abroad and developing strategic research partnerships. Finally, respondents' perception was that job opportunities for students have mainly increased in the past ten years, and one important explanation to this is an increased interest in soil, in relation to environmental concern, sustainability and climate change.

Based on the survey findings, we recommend three actions to support capacity building of soil science expertise in Europe with targeted calls for finance to:

- Support soil science HE collaborations at BSc and MSc level, with priority to HEIs in Europe that are relatively small (<50 academic staff members), and/ or underrepresented in European soil science collaborations in general. Collaborative efforts to benefit Higher Education should therefore focus on tertiary education of soil science, for example the development of teaching materials, and to enable European student and staff exchange.
- Support development of soil science curricula and courses preferably in collaboration with industry and the public sector, with more diverse teaching and learning approaches (TLAs) in HE, and support generic skills development.
- Complement this baseline survey of soil science in HE in Europe, with an assessment of vocational, professional and lifelong learning opportunities offered at HEIs to enhance opportunities for continuous learning in soil science as science evolves, and as job market change demand for skills and expertise.



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## List of acronyms and abbreviations

<b>BSc</b>	Bachelor of Science
<b>EJP SOIL</b>	European Joint Programme on agricultural soil management
<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>HE</b>	Higher Education
<b>HEI</b>	Higher Education Institution
<b>ISCE</b>	International Standard Classification of Education
<b>MSc</b>	Master of Science
<b>MOOC</b>	Massive Open Online Course
<b>PhD</b>	Doctor of philosophy
<b>SDG</b>	Sustainable Development Goal
<b>TLA</b>	Teaching and learning approaches
<b>WP</b>	Work Package



## 1. Introduction

Soil management is, and will continue to be, highly important for a number of challenges for sustainable development, food security and climate mitigation action, worldwide (IPCC, 2019) and in Europe (e.g. Veerman et al, 2020). According to Veerman et al (2020), where 25-30% of agricultural soils are currently in a degraded state. Soils sustains key ecosystem services, food, fodder and fibre supply, and supports habitats for essential biodiversity above and below ground. It is also a key regulator for storage and mitigation of carbon, and regulating freshwater supplies into soil moisture, groundwater and surface water (e.g. Falkenmark et al, 2014). Management of soils is therefore complex, knowledge and data intensive, with implications both societal and environmental goods. Human and institutional capacity, expertise and competencies for soil management is a key to resolve challenges of sustainable and climate smart soil management of today and the future.

Recently there has been a new urgency to address soil and land management in the global AGENDA 2030 and UNFCCC climate agreement, and for a number of important initiatives within the EU such as e.g. Green Deal, Water Framework Directive, Farm to Fork, and Common Agricultural Policy (CAP). The 2020 EU Skills Agenda provides a framework to advance sustainable competitiveness under the Green Deal, ensuring social fairness, and putting into practice the first principle of the [European Pillar of Social Rights](#): access to education, training and lifelong learning for everybody, everywhere in the EU, in which soil science will be one contributing expertise needed. The main question for this survey is therefore if the Higher Education (HE) in Europe is in a state to deliver and equip the needed human capacity to address the challenges? And if the HE in soil science is adaptive and responsive to new skills need for the future?

The objective of this report is to provide a standalone unique baseline of soil science in HE in European institutions. The specific questions that we explore are:

- 1) How is soil science embedded as an academic topic in HE at Bachelor (BSc), Master (MSc) and Doctoral (PhD) level currently offered in Europe?
- 2) What is current teaching capacity, and how is teaching and learning delivered in soil science in HEI?
- 3) Are there linkages and ambitions of national and international collaborative actions to advance soil science capacity building in Europe further?

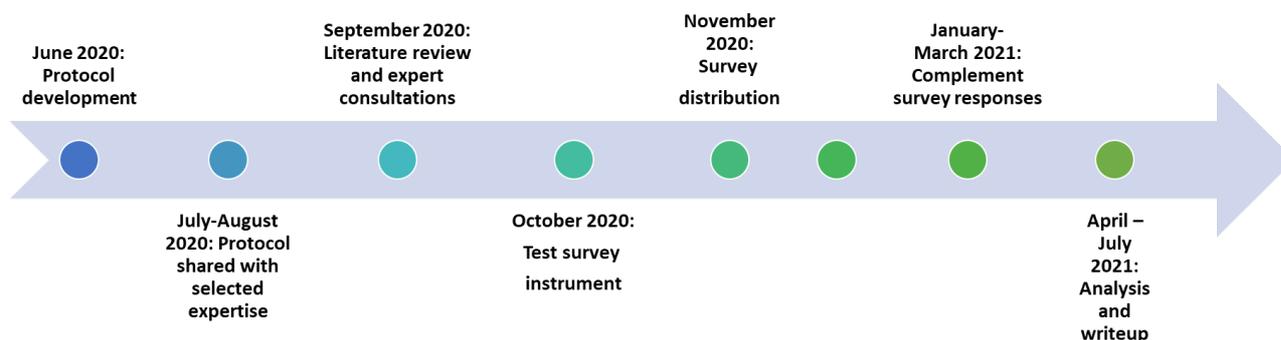
In this report, we present the findings of the survey of soil science in HE in European institutions. The study focus on tertiary education as provided in Bachelor (BSc), Master (MSc, MEng) and doctoral (PhD) degree levels. The report contains a section describing the material and method (section 2), followed by results (section 3) that present the qualitative and quantitative survey results. Finally, we discuss our findings (section 4) and compare with other international studies, and provide a set of recommendations (section 5).

## 2. Materials and methods

The protocol of the survey was developed through a mixed methods approach, by i) conducting a literature review, identifying HE surveys published in scientific journal (Hartemink et al., 2008, Diochon et al., 2017, Havlin et al., 2010) and 'grey' literature (EUA, 2013, EC, 2009a), in comparable natural



science academic topics, and ii) in consultation with selected expertise in the European Joint Partnership program “Towards climate-smart sustainable management of agricultural soils”<sup>1</sup> (EJP SOIL), EJP SOIL partners and expertise in HE and Learning (pedagogics) at SLU (Sweden). The intent of the survey instrument was to define a baseline in soils science HE in Europe and it was developed to be comparable to other HE surveys related to soil science e.g. (Diochon et al., 2017, Hartemink et al., 2008). The timeline of the survey development and data collection and analysis is presented in Figure 1. In full the study was instigated in June 2020, and the survey was distributed during November 2020 to March 2021.



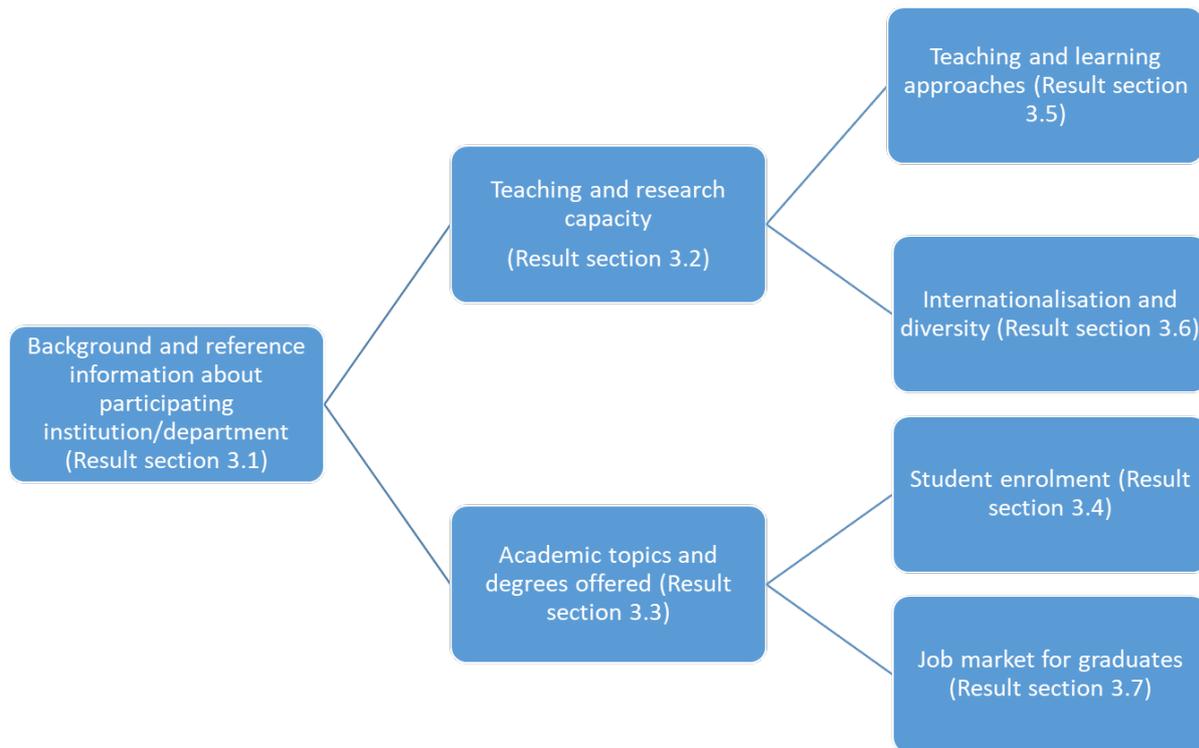
**Figure 2.1. Timeline for survey from June 2020 until July 2021.**

## 2.1. Survey design and content

The survey consisted of 7 sections: background and reference information about participating institutions/departments; teaching and research capacity; academic topics and degrees offered; student enrolment; teaching and learning approaches; internationalisation and diversity; and perception on job market for graduates. The result in this report will be presented according to the survey modules (Figure 2.2). The full survey instrument is presented in Annex 1. The survey focused on courses and degree programs at the BSc, MSc and PhD level. Other education and training activities offered, such as professional training, life-long learning initiatives, or commissioned training and education was not part of the survey, even though many HEIs offered these additional education and capacity building options.

<sup>1</sup> The European Joint Programme “EJP SOIL - Towards climate-smart sustainable management of agricultural soils” (2020-2024; <https://EJPSOIL.EU> )





**Figure 2.2. Principal modules of survey instruments , and associated section of results reporting.**

The survey instrument was designed to be comparable to other datasets, surveys and guidelines regarding HE in general and, in particular, soil science HE. The main references considered in the survey instrument are presented in the following:

- Teaching and research capacity: The main reference used was the “Tertiary education statistics” from EUROSTAT (2020b) that present statistics such as number of students and share of students to academic staff. Seeber and Lepori (2014) was also used for institutional indicators (e.g. size, research intensity, teaching intensity). Throughout the survey, the terminology that refers to the levels of education was the typology presented in the “International Standard Classification of Education - ISCED 2011” (UNESCO-UIS, 2012) which was also used in statistics presented by EUROSTAT. Thus, the terms “Bachelor’s or equivalent level”, “Master’s or equivalent level” and “Doctoral or equivalent level” were used in the survey together with “BSc”, “MSc” and “PhD”, respectively.

- Academic topics and degrees offered: The fields of academic topics (Annex 1: question 3.2) were selected from “Fields of Education and Training 2013” (UNESCO-UIS, 2015). This typology was selected to be comparable to EU statistics regarding tertiary education EUROSTAT (2020b). Different options were given to the respondents to select the fields that best described the academic program of the department: environmental science, natural environments and wildlife, earth science, environmental protection technology, crop and livestock production, forestry. For each of the academic topics, examples of programmes and qualifications also from the UNESCO-UIS classification were given for clarification.



- In addition, a question exploring evolution of soil science education in terms of generic competences included (e.g. communication skills and learning to learn) and programmes for part-time students was formulated from the “Flash Eurobarometer 260 (Students and Higher Education Reform)” (EC, 2009b) (Annex 1: question 3.10). This survey dealt with the students’ perception about the situation in the HE-system to be comparable to the HEIs’ perception in relation to the same issues.

- Student enrolment: Several surveys regarding student enrolment in soil science courses and programs were used as a reference and for comparative purposes (Diochon et al., 2017, Hartemink et al., 2008, Havlin et al., 2010). Particularly, question 4.4 (Annex 1) which deals with how the number of students has changed over the last ten years (giving options such as “increased by more than 25%”, “increased by less than 25%”) was formulated from Diochon et al. (2017) to describe the trends in student enrolment and completion in the different education levels.

- Teaching and Learning Approaches (TLAs): The discourse on healthy soils, and the role of healthy agricultural (and other) soil resources has evolved greatly in the last five years. Given this, the capacity and expertise to understand and work in this context must also be developed. In this section, the document “Education for Sustainable Development Goals – Learning objectives” (UNESCO, 2017) was used to select different learning objectives in relation to soil science (question 5.17). Misch (2011) was used for examples of different experimental learning methods (Annex 1: question 5.12) and Amador (2019) was used as a reference of an example in the use of problem-based learning in soil science education.

- Internationalisation and diversity: The main reference used regarding the different internationalisation related questions (6.5, 6.6 and 6.7 in Annex 1) was the report “Internationalisation in European Higher Education: European policies, institutional strategies and EUA support” (EUA, 2013). Questions related to the share of students from abroad (questions 4.6 and 4.7) and those related to participation of men and women in tertiary education (questions 4.8, 4.9 and 4.10) could be compared to the statistics presented in EUROSTAT (2020a) and EUROSTAT (2020b), respectively. The share of foreign academic staff (questions 6.1, 6.3 and 6.4) could be used to describe the internationalisation and diversity of the different HEIs and countries as described also in Seeber and Lepori (2014).

- The Flash Eurobarometer 260 (Students and Higher Education Reform) (EC, 2009b) could be used to compare students’ perception towards mobility (e.g. plans to study abroad and obstacles to studying abroad) and the strategies and priorities selected by HEIs for internationalisation.

- Job market for graduates: In this section questions address the HEIs’ perception on issues such as innovation and entrepreneurial mindset, job market opportunities or involvement of enterprises in curricula design and funding. Several questions from the Flash Eurobarometer 260 (Students and Higher Education Reform) (EC, 2009b) were used to be comparable, in particular, questions 7.3 and 7.6 (Annex 1).

## 2.2. Process of survey development and distribution

The draft survey instrument was sent out to four EJP SOIL partners (in Denmark, Finland, France and Norway), to two Directors of Studies at the Department of Soil and Environment at SLU (Sweden) and to two experts in statistics and survey instruments at SLU (Sweden). This was done to get feedback for improvement and potential additional questions. The feedback was positive and constructive and was incorporated for the final distribution.



The survey was distributed in the online platform of Netigate<sup>2</sup>. The survey was distributed to more than 270 departments at HEIs in European countries. The EJP SOIL program partnership was used for distributing invitations in 24 countries participating, and additional HEIs from non EJP Soil partner countries were invited to reach further across Europe. Invitations to fill the online survey was available during 20<sup>th</sup> November 2020 and 10<sup>th</sup> March 2021. In addition the survey was also offered via open invitations online. The key contacts at respective HEIs were selected as:

- Listed contacts for EJP SOIL Work Package 5: Education, training and capacity building.
- National coordinators<sup>3</sup> of EJP SOIL, invited to share key HEI contacts in their countries.
- Open invitation on EJP SOIL website, Twitter and LinkedIn.
- Targeted invitation and follow up, in case option 1 and 2 did not generate any response for a specific country.

### 3. Results and discussion

#### 3.1. Survey response and geographical distribution

A total of 94 complete survey answers were received, representing 20 European Union member states, and 5 non-EU members, but European countries (Bosnia and Herzegovina, Norway, Switzerland, Turkey, United Kingdom) (Figure 3.1). In addition, 26 respondents answered part of the survey. We estimate an approximate response rate of 40% given the known invitations of more than 270 distributed.

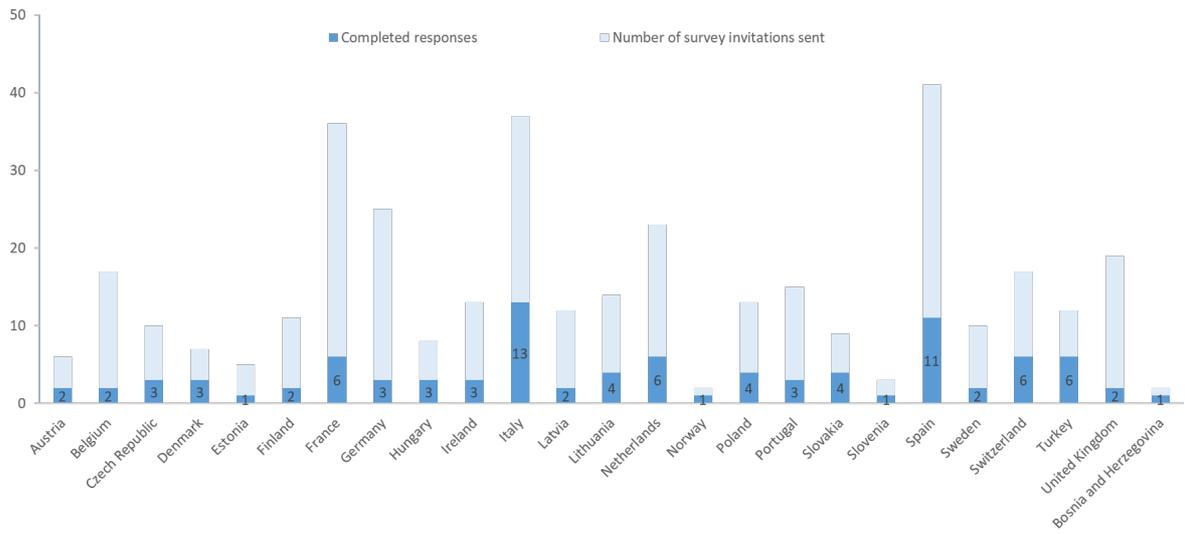
The HEIs responding to the survey had a wide range of sizes, using number of academic staff per department as an index (Figure 3.2). It is clear that 5 HEIs host a significant capacity, with >200 academic staff members per HEI. Approximately 70% of respondent HEIs stated they hosted a more modest number of staff members of ≤ 50. A number of HEIs, respondent academic staff members were in the range of 50-200. The median size in terms of number of academic staff of the departments was 30 (the mean was 60).

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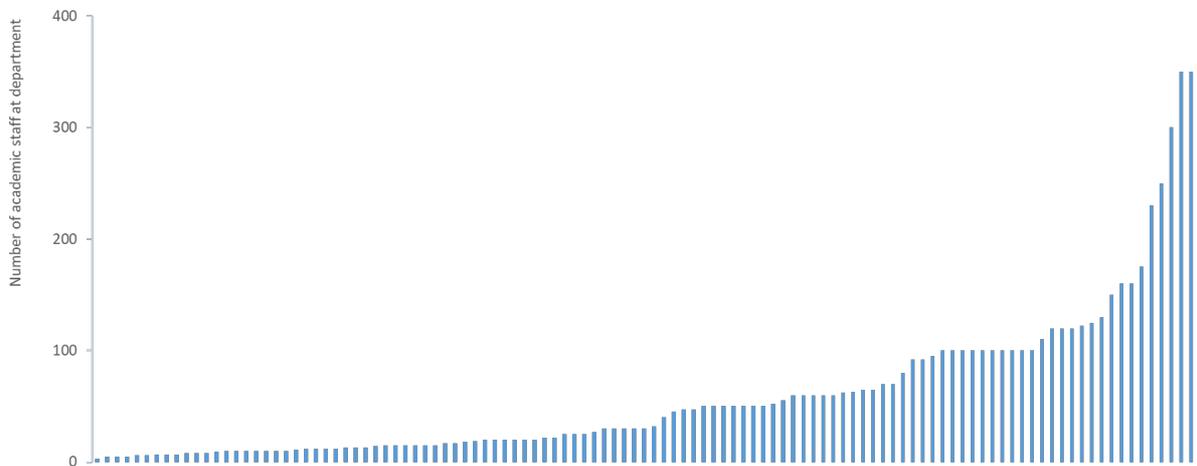
<sup>2</sup> Netigate software : <https://netigate.net>

<sup>3</sup> For full list of EJP SOIL partners and National coordinators , please see website European Joint Programme “EJP SOIL - Towards climate-smart sustainable management of agricultural soils” (2020-2024); <https://EJPSOIL.EU> )





**Figure 3.1. Total number of complete responses = 94. The response rate is approximately 40 %**



**Figure 3.2. Total number of academic staff per responding HEI in 25 European countries.**

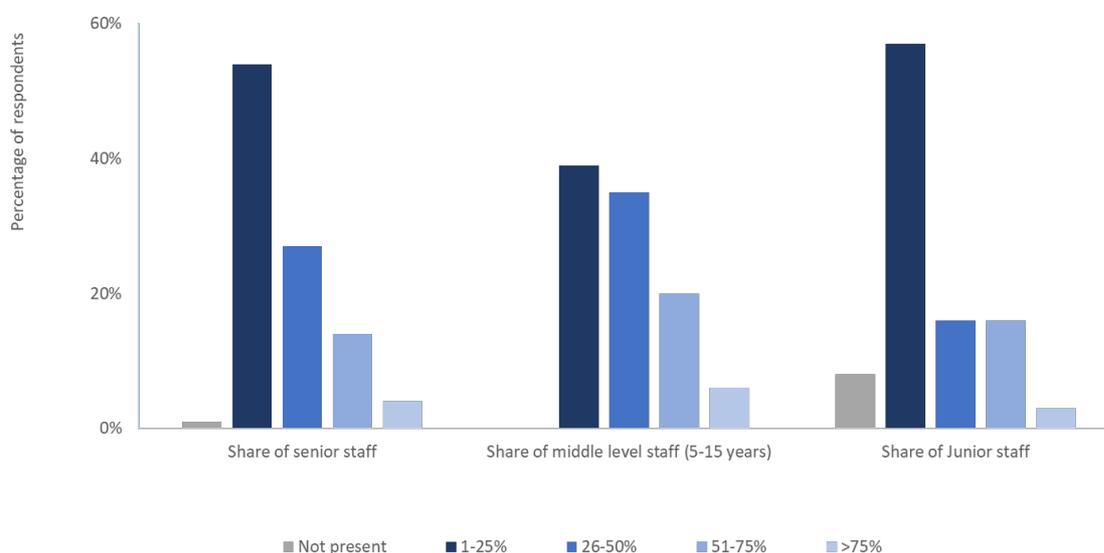


## 3.2. Teaching and research capacity

Soil science in HEI is taught at three academic levels in Europe, Bachelor level (BSc), Master level (MSc) and Doctoral level (PhD). A majority the respondents were part of a HE or academic institution (92%) while a minority stated it was part of a research institution and academic institution (10%). Overall survey responses, showed a diverse research and teaching staff mix across junior, mid and senior levels, although individual institutions displayed more skewed career stage distribution. The proportion of the different staff categories at the departments showed that in more than approximately 40% of the cases, staff from different categories (i.e. senior, intermediate and junior) were all present in the range of 1-25%. In individual cases senior and junior staff counted for more than 75%, respectively (Figure 3.3).

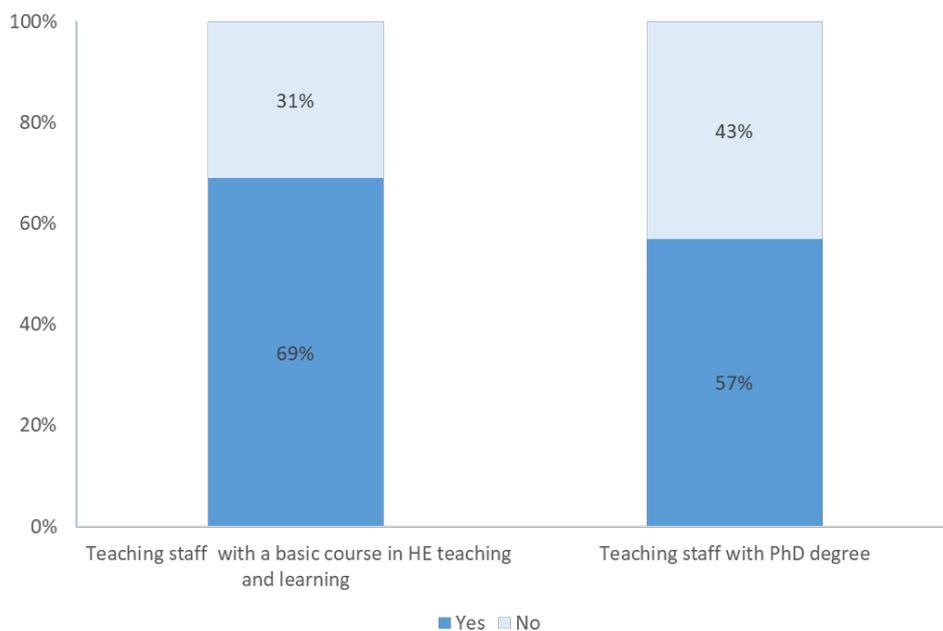
Regarding gender distribution among academic staff, overall there was a fairly even overall distribution of female and male staff members, with an average of 42 % female academic staff across the responding HEI. Individual HEIs showed, however, large variation, ranging from 0% female to 75% female, out of total academic staff, with a large variation also within individual countries. More than 50% of the respondents reported between 40% and 60% female.

More than 60% of HEIs stated that a majority of teaching staff had taken a basic course in higher teaching and learning (Figure 3.4). A majority of the respondents also states that teaching staff always holds a PhD. Among those that answered that this was not the case, some noted that they wanted to have teaching staff with other kinds of expertise, such as practical experience from industry, to enhance learning and exposure for students.



**Figure 3.3. Proportion of different staff members per category at the departments.**





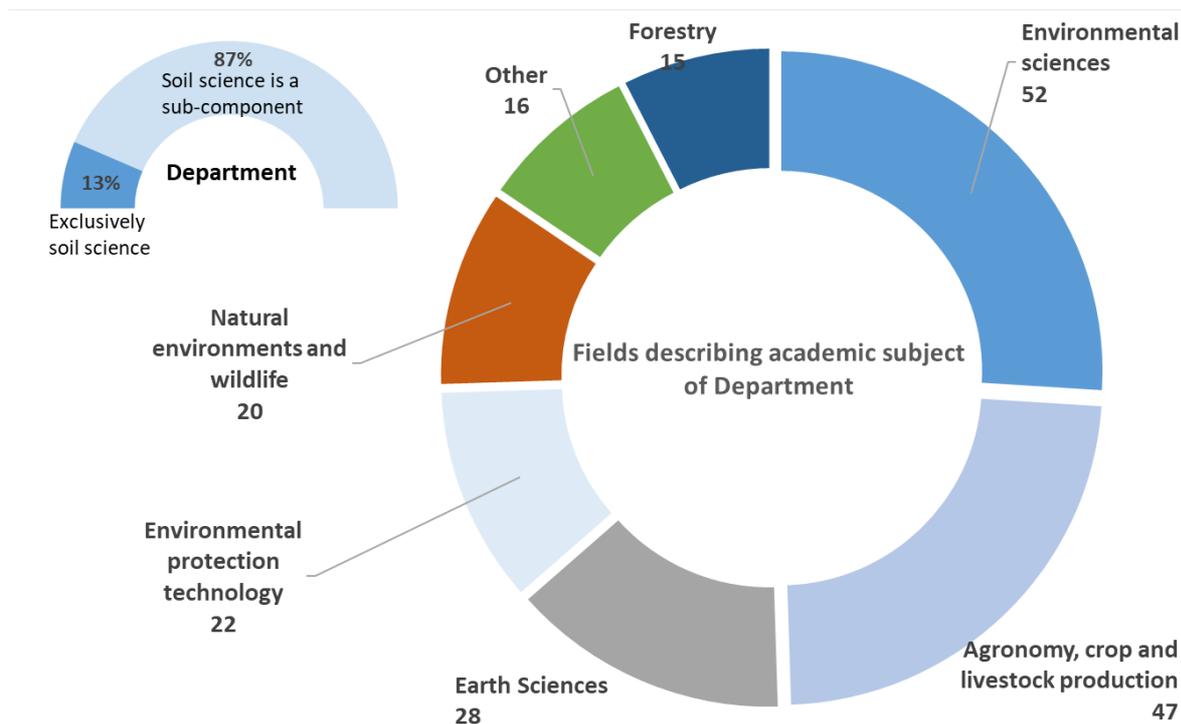
**Figure 3.4. Qualifications in teaching and learning for HE among HEI teaching staff.**

### 3.3. Academic topics and degrees offered in soil science

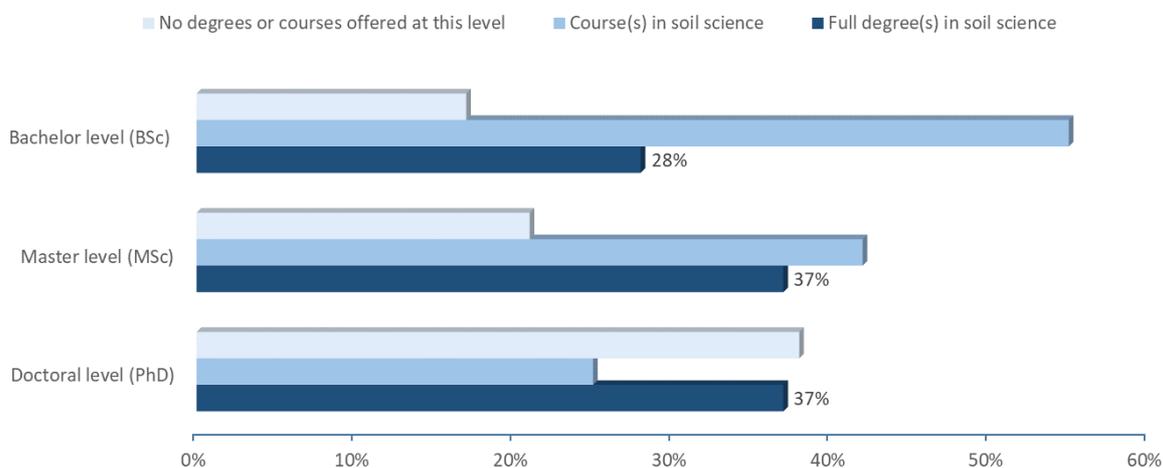
According to survey responses 15 HEIs (~ 13%) indicated they represented a dedicated soil science department. These were based in Austria, Czech Republic, Germany, Lithuania, Netherlands, Poland, Slovakia, Sweden, and Turkey. In ~87% of the responses, soil science was embedded into departments with different academic topic (Figure 3.5, left). About 25-30% of the respondents had soil science degrees/programs at BSc, MSc and PhD level (Figure 3.6), meaning that a majority of soil science is taught under other types of exams, degrees and majors such as Agricultural Science, Environmental Science and Earth Sciences degree programs. These were the main fields that best described the academic programs at the respondent HEIs (Figure 3.5, right). In 72% of the cases the respondents selected more than one option of academic topics, suggesting that soil science was an integrated part in multiple academic disciplines and degree curricula.

Among the respondents, there were 26 departments that offered full soil science programs at all levels (i.e. BSc, MSc and PhD level). When a HE offered soil science program at PhD level, it also offered soil science programs at MSc and BSc levels in a majority of cases. Of the 26 departments that offered full soil science programs at PhD level, only 6 did not offered full programs at BSc and/or MSc.





**Figure 3.5. Main areas and academic topics that best describe the departments with soil science courses.**

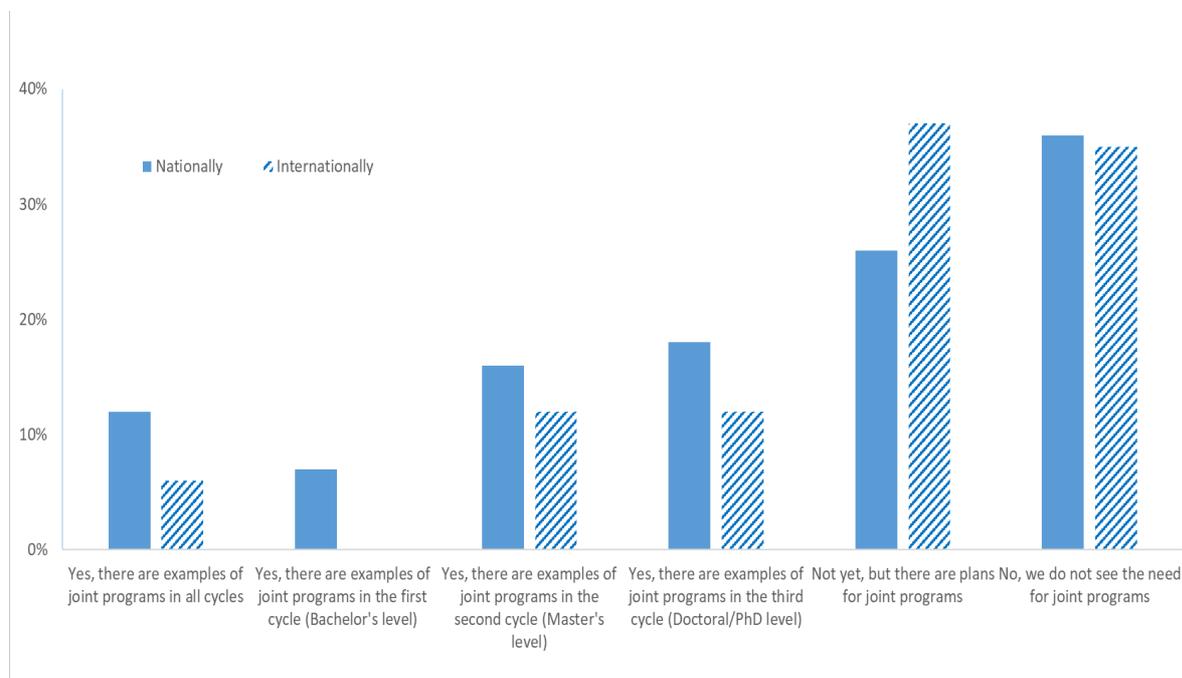


**Figure 3. 6. Proportion of soil science full programs and courses offered at the departments (N=75).**

More than 10% of the respondents indicated that they had national collaborations at all levels of the BSc, MSc and PhD education provided, for example, with a joint program with another national institution. The number of HEIs with national collaboration increased slightly to >15% of respondents for MSc and PhD level. A considerable proportion had plans for joint programs with institutions in the



same country (25%)<sup>4</sup> and 35% of the respondents had plans to develop international collaborations for teaching and learning (Figure 3.7). However, only in 28% of the cases (17) the responding HEI was involved in a soil related Research School for Doctoral (PhD) students, and consequently 72% HEIs stated that they were not involved in a Research School.



**Figure 3.7. Joint programs with soil topic offered in collaboration with other institution in the same and in other country.**

### 3.4. Student enrolment

In regard to student enrolment, the respondents reported an increased enrolment at BSc levels with soil science topics, and no change for MSc and PhD. There seemed to be mixed trends for specific countries and universities, with both perceived increases and decreases in student enrolment.

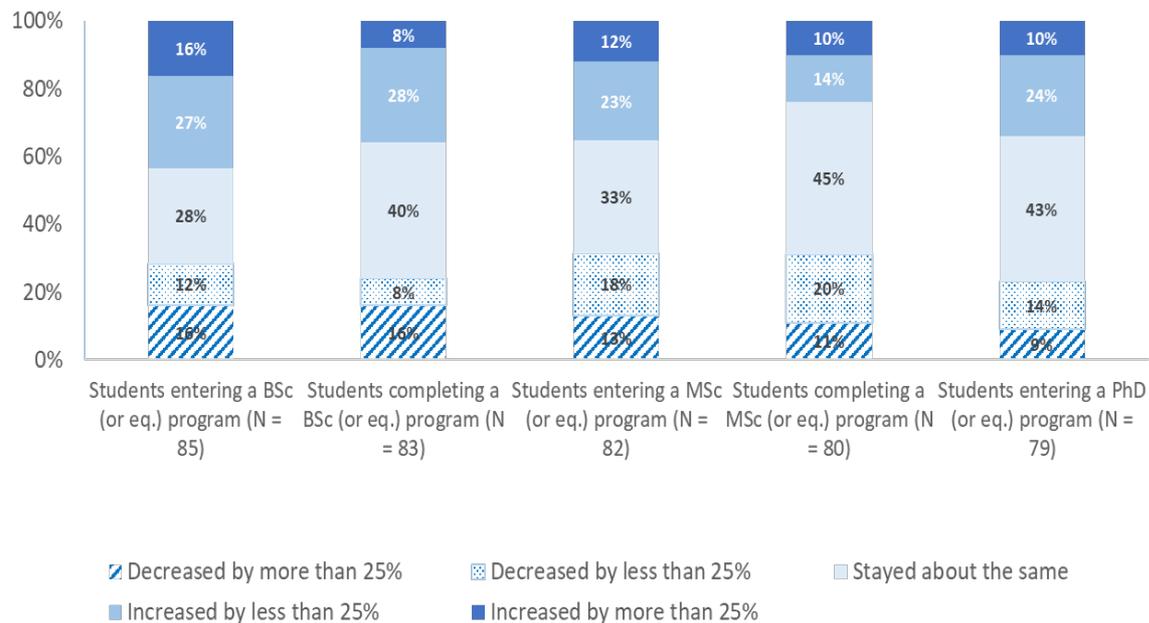
Of all the HEIs offering programs at BSc level, 43% reported increases in enrolment over the last ten years. In the case of students entering MSc study program, the percentage of increased enrolment was 36%, which was almost the same as the HEIs that indicated a decrease (34%). In the case of PhD programs, 44% of responding HEIs indicated that the student enrolment stayed about the same (Figure 3.8).

In the survey, decreases in student enrolment trends were reported in 10 countries for BSc programs and in 13 countries for MSc programs. As an example, in Poland and Slovakia all of the HEIs (4 in each

<sup>4</sup> The HEIs that have plans for joint programs at the same country are from: Belgium, France, Hungary, Italy, Latvia, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain and Turkey.



country) reported decreases in enrolment. In other countries such as in Spain and France there were cases of both increases and decreases reported.



**Figure 3.8. Responding HEI reports on changes in student enrolment rates at BSc, MSc and PhD levels in last 10 years.**

The survey also included a free text question on the potential reasons for the observed changes in enrolment. Among those that perceived a decrease in the number of students taking soil science courses, general changes in demography were often mentioned. Other potential explanations mentioned were decreased interest for geoscience, fewer stipends, the fact that many young people leave the country and higher interest for other programs. In countries where HEI reported an increased interest for soil science, awareness of climate change, grand societal challenges and circular economy was lifted as reasons for an increased interest for soil science among students and a more generally increased interest in higher education (in some cases possibly related to economic downturn), but in individual cases local or national infrastructure or irrigation projects were also mentioned as a reason for increased interest. Other individual comments related to marketing, more teaching in English (attracting international students) and increased number of study places (increased quota).

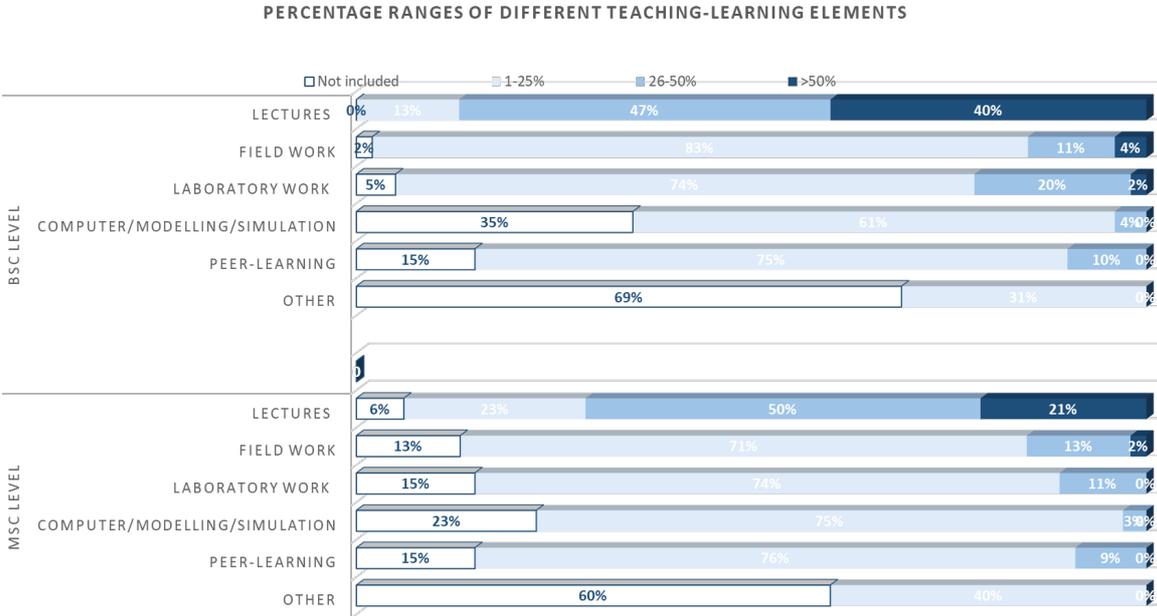
### 3.5. Degree topics and Teaching and Learning Approaches (TLA)

Current teaching practices for soil science is dominated by lectures, especially at BSc level, according to survey respondents. However, results suggested that study programs are evolving to strengthen more generic competences (e.g. communication skills, teamwork, and learning to learn) as well as active learning methods such as problem-based learning, field work and case studies. It is also noteworthy HEI respondents stated that 1/3<sup>rd</sup> of main soil science BSc courses did not have any computer/modelling component.



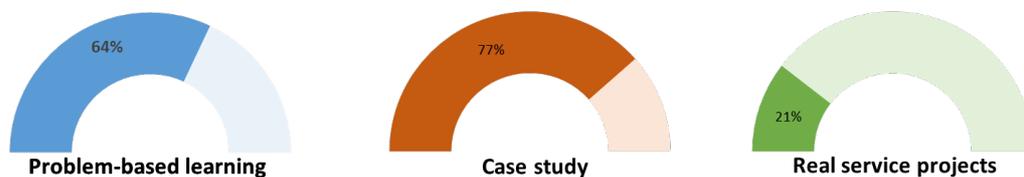
The survey suggested that ‘traditional lecture based’ teaching still dominates soil science teaching and learning activities across the responding institutions both at BSc and MSc levels (Figure 3.9). Yet it was recognized by the respondents that today’s students also need generic skills in communication, team work and learning to learn (Figure 3.11) to be prepared for careers related to e.g. soil management and other areas of work, requiring soil science knowledge and expertise. However, results showed that different ways of learning from traditional education, such as problem-based learning or case studies were also included in the courses (Figure 3.10). Only 14% of respondents answered that no diversity in TLAs were included in soil courses. Other methods were incorporated in 2% of the cases (e.g. inverted classroom).

In terms of other teaching elements, about 1/3 of all BSc courses did not, as noticed, have any computer/modelling component. However, the share of teaching and learning using computer modelling increased at MSc level. The balance of field work component and laboratory component was relatively similar at MSc and BSc level according to respondents. Peer-learning, as expected, also took a larger share compared to what is the case at BSc level.



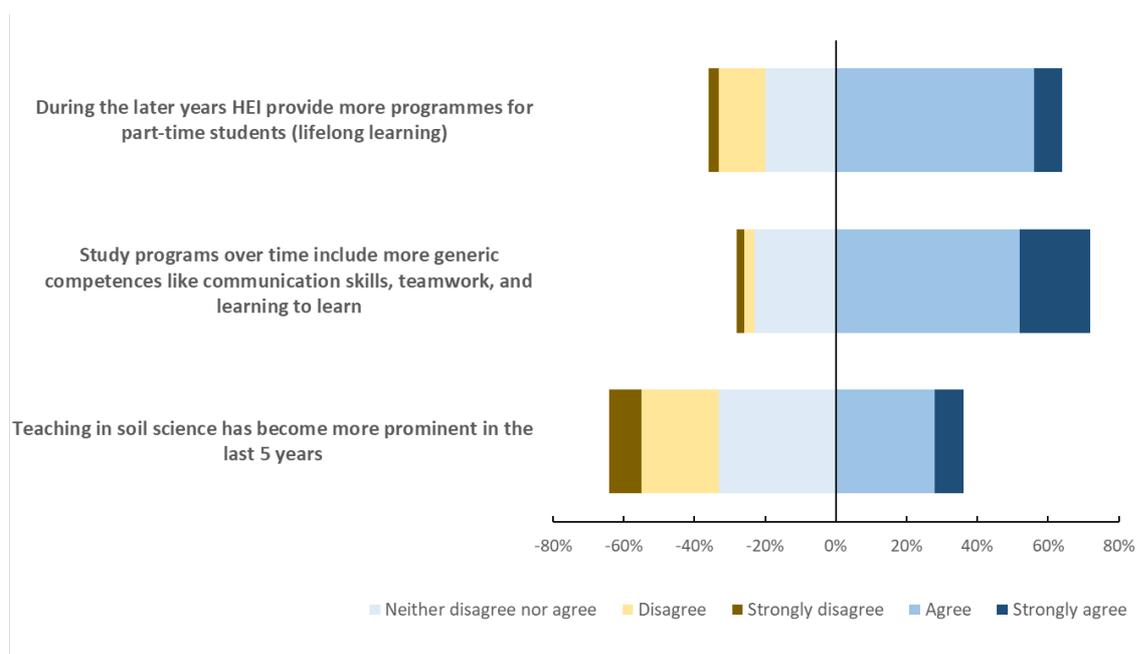
**Figure 3.9. Proportion of different teaching-learning approaches (TLAs) elements in soil courses**





**Figure 3.10. Experiential learning methods included in the soil courses. More than one option could be selected by the respondents.**

In terms of course development within soil science and development of study options, a majority of respondents (65%) stated that courses in soil science have not changed over the last 5 years. At the same time, 64% agree/strongly agree that the development of teaching and learning for lifelong learning/professionals/post degree courses have evolved and increased (Figure 3.11). These results therefore need more in-depth analyses. The low level of renewal opens for discussions of future content in soil science courses and curricula for existing programs. Efforts within lifelong learning/professionals/post degree courses might be new initiatives.



**Figure 3.11. Perception of changes in soil science education** (There were also those that neither disagreed or agreed and for the first statement it was one third that marked this option, for the second statement it was almost one fourth and for the third it was one fifth.)

In relation to MOOCs, there were only a minority of the respondents (16%) that offered these type of courses relevant to soil science. An example of such a course was “Partnering for Change: Link Research

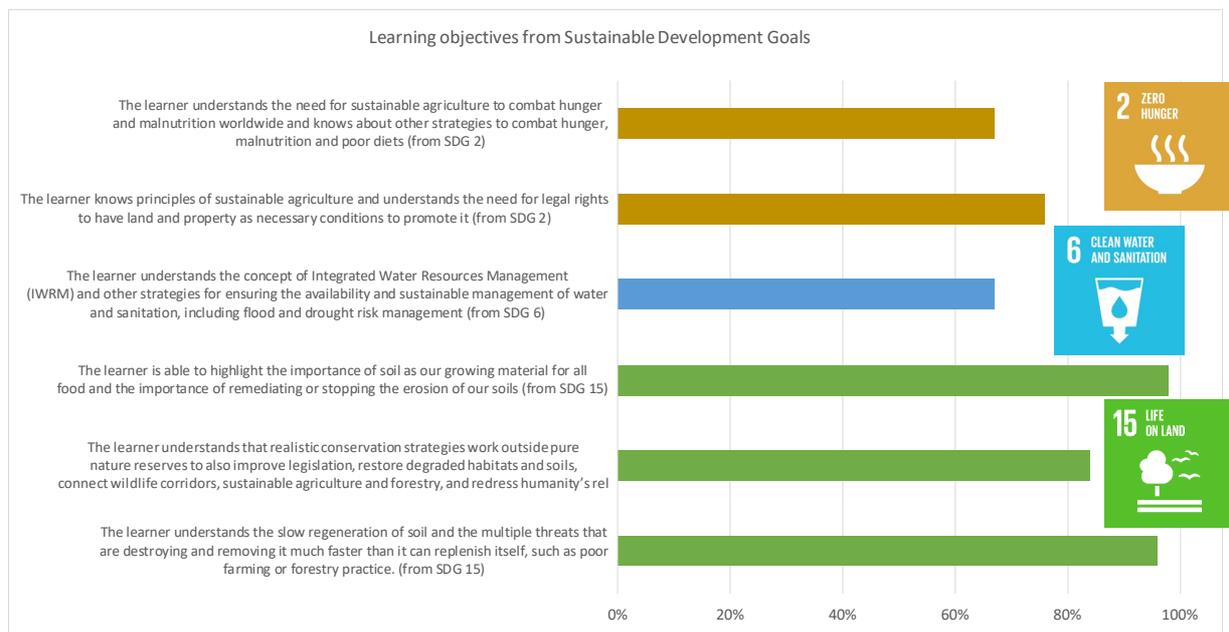


to Societal Challenges”<sup>5</sup> as answered by the University of Bern (Switzerland) and the course “An introduction to soils ecosystems and livelihoods in the tropics”<sup>6</sup> offered by KU Leuven (Belgium) in cooperation with ISRIC – World Soil Information. One more MOOC was planned to start 2021/2022 related to climate change, to be offered by the University of Vienna.

### 3.6 Policy related learning objectives in soil science courses

The survey show that different learning objectives from the Agenda 2030 (sustainable development goals, SDGs) related to soil (which include soil health and sustainable food production) (UNESCO, 2017) were included in a majority of the courses (70-96% depending on the learning objective) (Figure 3.12). The relevant global sustainability goals are, according to the survey, well covered in soil science teaching in HEI and the results indicate a high awareness on related issues.

When focusing on policy topics related to soil resources and management, results indicate that the CAP was included in half of studied soil courses. The EU Green Deal and EU Farm to Fork were also being covered in some of soil courses (37% and 33%, respectively) but to a lesser extent (Figure 3.12) than the Water Framework Directive (WFD), which was covered in more than half of the soil related courses (Figure 3.13).

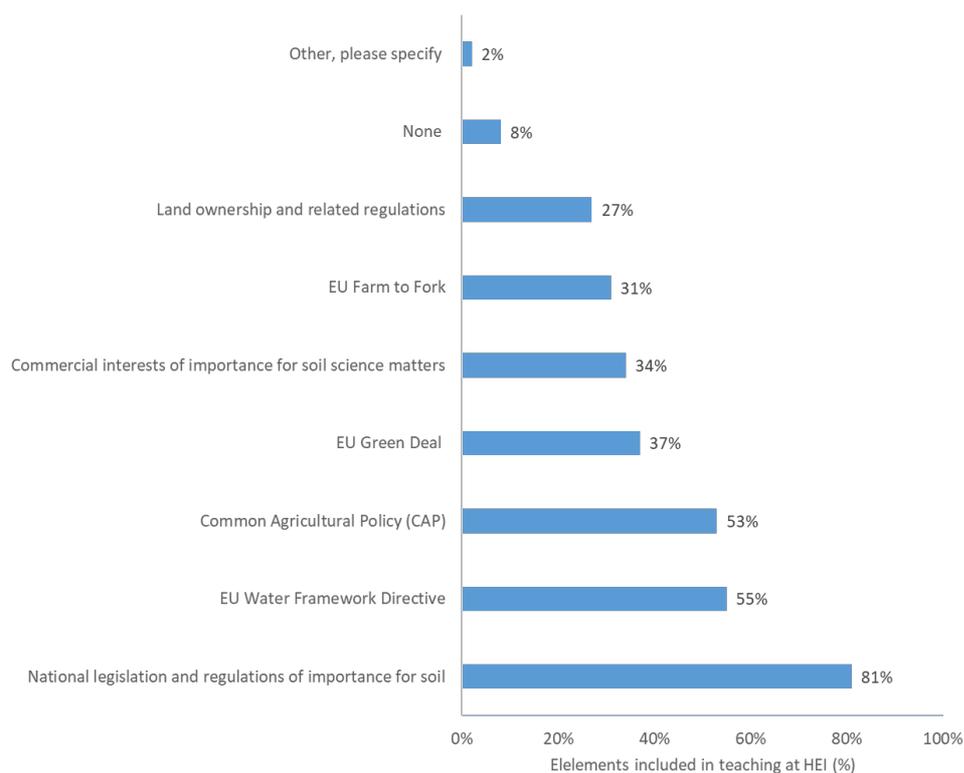


**Figure 3.12. Percentage of different learning objectives from the Sustainable Development Goals (SDGs) included in soil courses.**

<sup>5</sup> <https://www.unige.ch/gsi/fr/formations/partnering-for-change-link-research-to-societal-challenges-mooc/>

<sup>6</sup> <https://www.edx.org/course/as-above-so-below-an-introduction-to-soils-ecosity-2>





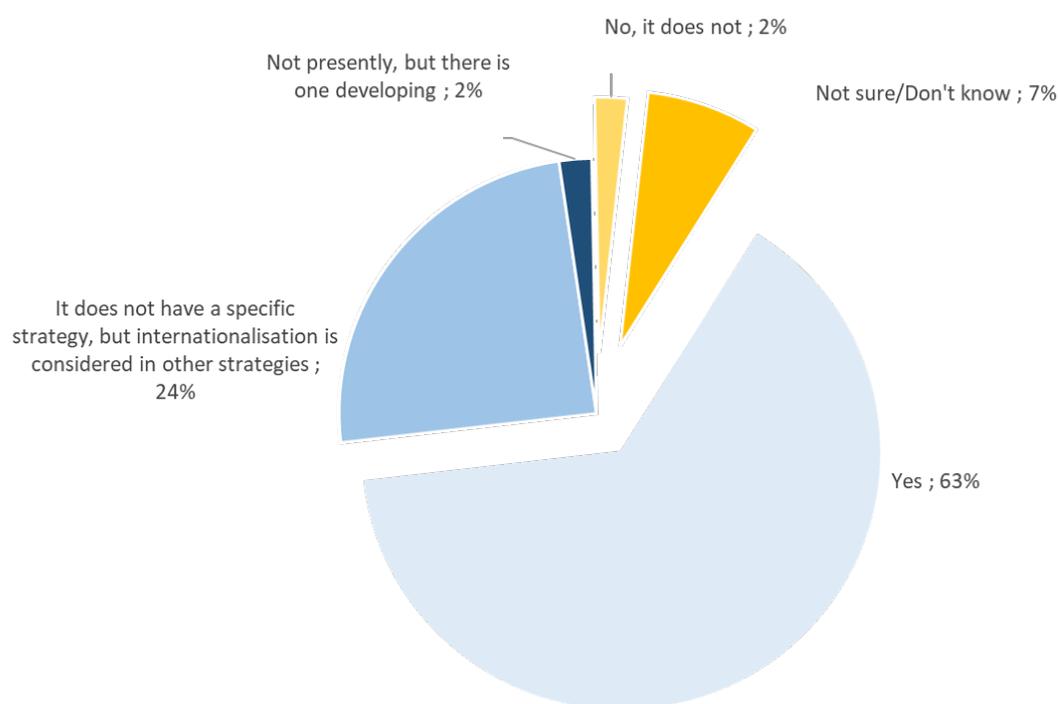
**Figure 3.13. Proportion of policy topics included in soil courses. More than one option could be selected by the respondents.**

### 3.7. Internationalisation and diversity

From the survey it is obvious that internationalisation mattered to the respondent HEIs. More than 60% of respondents stated having strategies for internationalisation related to soil science teaching and education undertaken at the HEIs. The preferred mechanism was to offer student exchange/offer students to study abroad. The second most mentioned effort was to develop strategic research partnerships with other institutions (c.f., Figure 3.7 regarding existing or planned international collaborations).

A majority of institutions had either an existing internationalisation strategy (62%) or internationalisation was considered in other strategies (24%) (Figure 3.14).



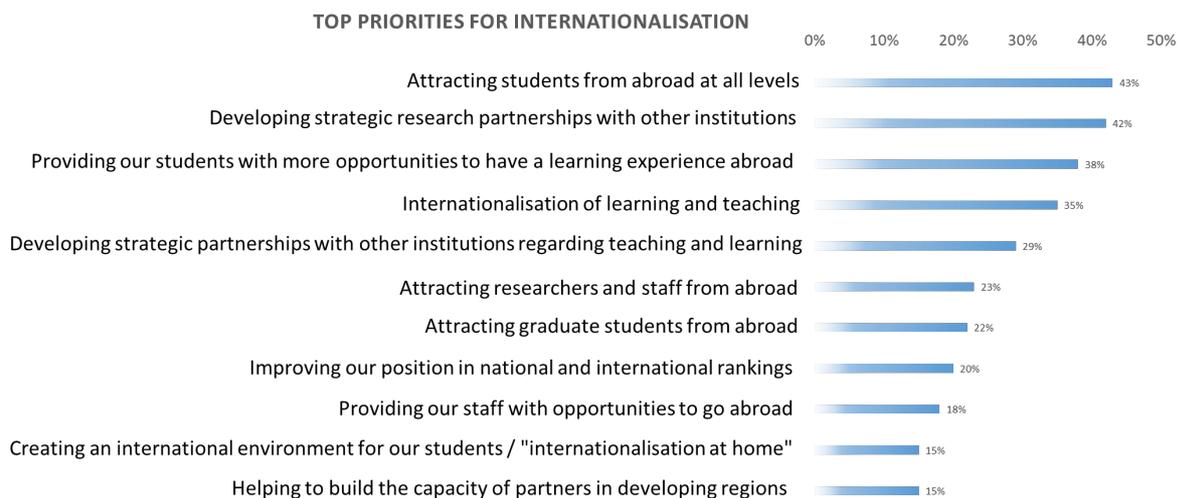
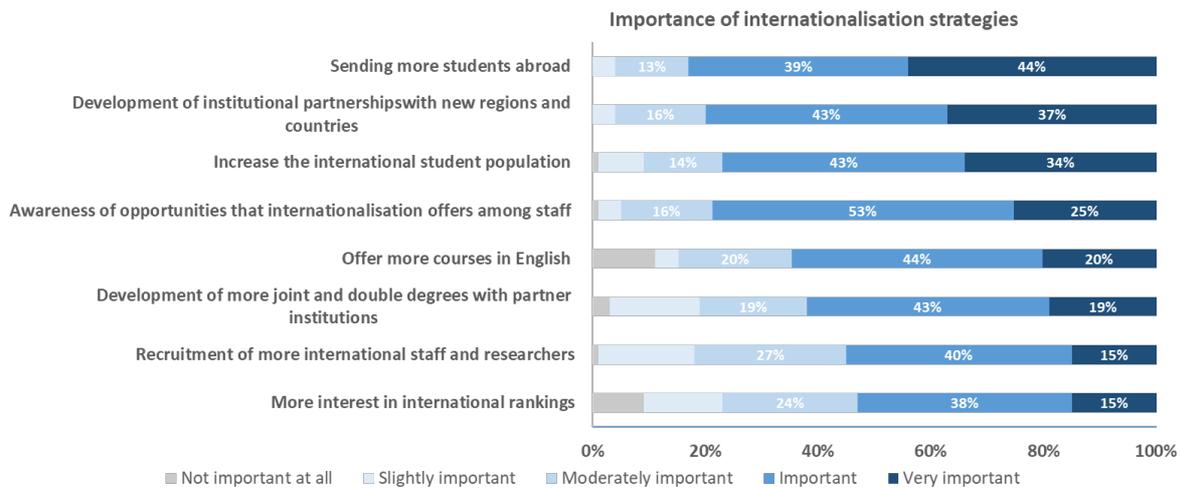


**Figure 3.14. Existence of internationalisation strategy at institutions (N=74).**

When asked about the importance of different internationalisation strategies, almost half of the respondents (45%) considered it was very important sending students abroad (Figure 3.15). The same percentage answered as a top priority, attracting students from abroad at all levels (Figure 3.16). Sending students abroad however, needs to be coupled to the language in which the courses are given in the different countries. However, the dominating language used in courses at Bachelor's level was the local language (87%) in contrast to English (8%). The use of English as the most common language in teaching increased at Master's level up to 32% versus the local language (67%). Hence, language could potentially be a barrier for enhanced internationalisation, including inter European exchange of soil science students. This could be the case also at PhD-level even if English was reported as the language for teaching in about 50% of responses.

A very high share of respondents (80%) considered the awareness of opportunities that internationalisation offers among staff to be important or very important. In contrast, a minority (20%) chose "providing our staff with opportunities to go abroad" in the top three priorities for internationalisation. Almost 80% considered the development of institutional partnerships with new regions and countries important or very important (c.f. section 3.3). In terms of development of partnerships, 41% of the respondents answered that the development of research partnerships was in the top three priority as compared to 27% for the development of partnerships regarding teaching and learning (Figure 3.16).





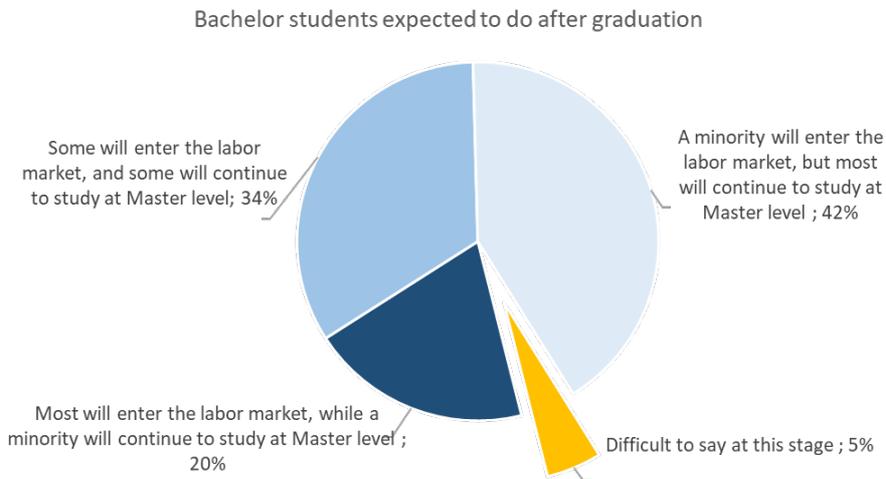
**Figure 3.16. Top priorities for internationalisation. Ranking of three top priorities per respondent HEI**

### 3.7. Job market for graduates

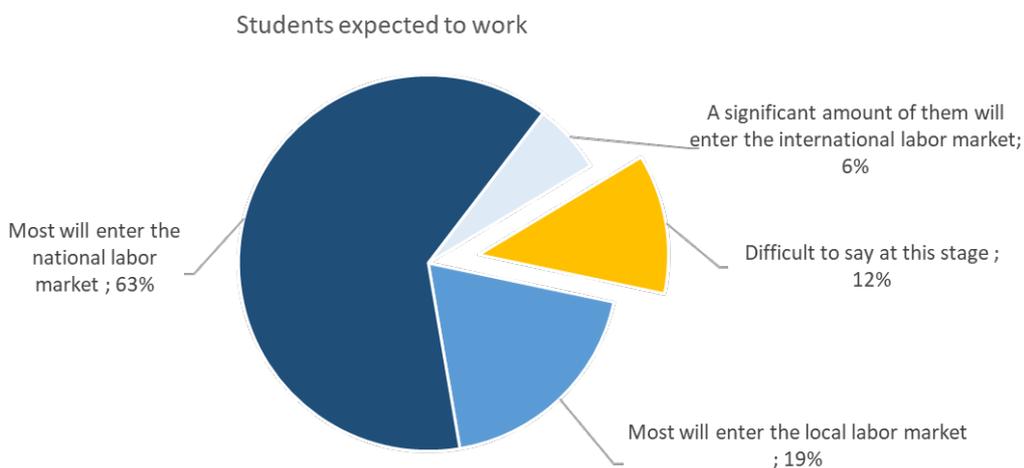
The overall impression of responding HEIs was that students in soil science had a positive future, in relation to job opportunities. A majority of the answers indicated an increase of job opportunities in the past ten years for students. Less than 5% of students were expected to find job internationally.

Questions were also raised regarding the future for students after graduation. A majority of the answers for BSc students pointed towards the continuation into MSc level studies (Figure 3.17). Only 20% answered that most of the BSc students will enter the labour market (Figure 3.17). A great majority of respondents reported that the students will most likely enter the national labour market (62%) versus the international (5%) and local (21%) labour markets (Figure 3.18).





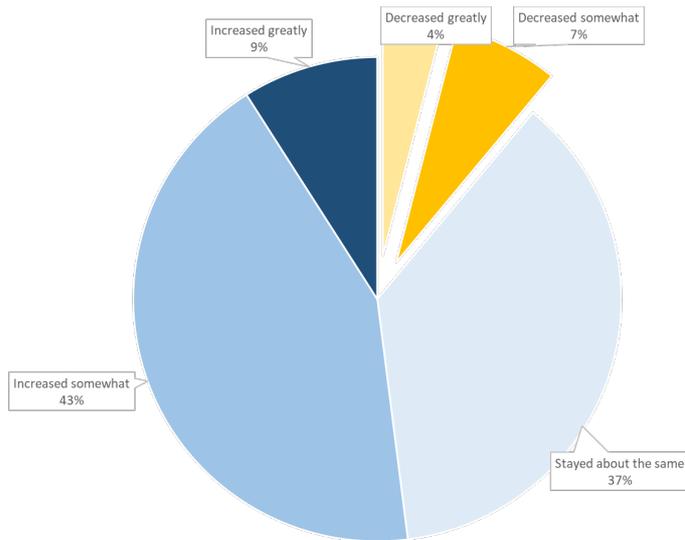
**Figure 3.17. Bachelor students after graduation (N=86).**



**Figure 3.18. Geographic ambit where students are expected to work when graduating (N=84)**

Regarding respondents' perceptions of job opportunities for students graduating, most of the answers indicated an increase of job opportunities in the past ten years (Figure 3.19), and the same percentage pointed that opportunities stayed about the same. Only 8% indicated that job opportunities decreased in the past 10 years. The respondents that indicated decreases in opportunities came from 6 different countries. In contrast, increases (either option "increased somewhat" and "increased greatly") were reported by respondents in 22 countries (out of a total of 25 countries that are represented in the survey).





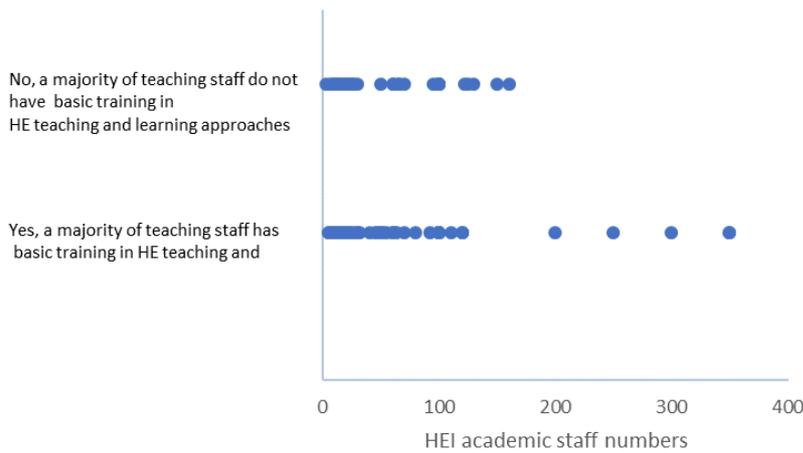
**Figure 3.19. Job opportunities for students graduating at the department (N=75).**

Within the survey there was place for free text comments to labour market opportunities. In a majority of the responding countries an increased interest in concern for climate change, sustainability and environment was mentioned as a major driving force for improved job opportunities for soil science students. Such comments were most often reported from north-western Europe. An increased interest in these areas was reported both from industry/the private sector and from the public sector. HEI from some countries reported a potential deterioration in job opportunities for soil science students. Structural changes and low profitability in the agricultural sector was mentioned in several responses. Such comments, or similar, were given from e.g. the Baltic States and a few central and eastern European countries.

### 3.8. Looking for trends and correlations in the survey

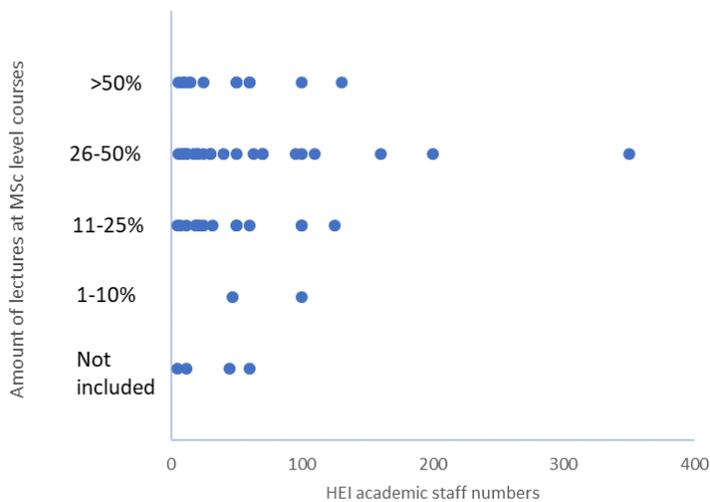
One observation from this survey is that HEI that teach soil science in Europe appears to have very diverse profiles and settings. As indicated from the results above. Soil science groups are often embedded in departments with other topics, soil science groups vary a lot in size, soil science is taught under many different academic subjects and degree programs, and we found often mixed responses among HEI in the same country etc. Here we illustrate this range of diversity with two examples. Firstly we explore if large departments more often state to have teachers with basic training in higher education teaching and learning (Annex 1: question 2.4). In figure 3.20, it is shown that the HEI staff size does not correlate to whether staff receive basic higher education training. Hence, we conclude that likely teaching staff at both smaller and larger HEIs teaching soil science, is likely to have undertaken training for teaching in higher education.





**Figure 3.20: Higher Education Institute (HEI) academic staff size and training of teaching staff in basic Higher Education teaching and learning approaches.**

Secondly, we investigate whether a HEI with large academic staff might have capacity to advance TLAs, relatively more than HEIs with less staff numbers, i.e., apply more diverse TLAs. In Figure 3.21, we shown that the use of lectures at MSc level does not correlate to the size of the departments that teach soil science in this survey. The same goes for the other TLAs and also for BSc and PhD level (not shown). I.e., HEI staff size does not necessarily explain neither teaching capacity nor diversity in TLAs for the soil science teaching HEIs responding in this survey.



**Figure 3.21: Higher Education Institute (HEI) academic staff size and use of lectures in teaching and learning approaches for MSc level soil science courses**

From the examples presented and the general impression of survey responses, we conclude that that HEI in soil science are very diverse, in Europe today. Assessing HEI soil science resources and/ or capacity to deliver will have to refine indices that goes beyond staff size for a fair and transparent measures.



## 4. Discussion

The discourse on healthy soils, and the role of healthy agricultural (and other) soil resources has evolved greatly in the last five years, as expressed e.g. in the focus on soil in EU with policies and strategies such as the Green Deal and Farm to Fork (EU, 2020), the Mission on Soil Health (Veerman et al, 2020), the EU Parliament Soil Resolution (European Parliament, 2021) and the relevance of healthy land and soil resources for climate mitigation and environmental sustainability (IPCC, 2019). In light of this, the survey provides a baseline for soil science in European HEI, and adds insights on strengths and potential weaknesses to provide current and future capacity and knowledge into operationalise the mentioned ambitions of soil management. Here we will discuss three key findings of the survey, relating to i) existing HE infrastructure and enrolment in departments and programs, ii) curricula, teaching capacity and TLAs, and iii) collaboration and internationalisation to serve current and future capacity needs in European soil science expertise.

### *Soil science in HE, and perceptions on enrolment and job opportunities*

The survey with 120 HEI respondents providing BSc, MSc and/or PhD soil science education in 25 European countries shows that soil science is dominantly part of a sub-unit of larger academic departments, where academic subjects such as environmental science, agricultural science and earth science are the main academic topics of the departments. This is the case for about 87% of the respondents. Accordingly, only 15 HEIs (13%) report they host exclusive soil science departments. However, irrespective of academic department, dedicated BSc, MSc and/or PhD degrees in soil science is offered, in 25-30% (depending on degree level) of responding HEIs. It is also reported that a majority of the HEIs taking part in the survey actually have limited number of academic staff (<50 academic staff) to ensure both teaching and learning, and research in soil science and other subjects at the department. This survey clearly indicates that it is relatively common with small groups of soil scientists working at departments with a much broader scope. Based on these indications of HEI academic staff members, we speculate that both capacity in HE of soil science as well as linkages to research may be affected. HEI of greater size can host capacity in a range of soil science expertise, whilst provide this expertise into education, which small groups of soil scientists may not have capacity to do. For a strengthened soil science capacity across all of Europe, it may be necessary for more strategic efforts in HE to complement and strengthen joint programmes and exchanges in soil science. This will be essential for countries with current smaller size HEIs of soil science education, but equally important is the role of the larger soil science groups as potential future hubs for extended collaboration and specialization.

Our survey reported mixed trends, with slight increase, for enrolment of students into soil science BSc, MSc and PhD programmes. Trends were more split between either increases or decreases, and could potentially be associated with geography, and recent structural changes in e.g. Baltic States and Eastern and Central Europe, reporting decreasing enrolment trends. The most common potential explanation for an increase in the interest in soil science was a higher awareness of and interest in issues related to climate change, grand challenges and sustainable development, especially in western EU-countries. These potential explanations for an increased interest in soil science by students were complemented with survey respondents reporting an impression for growth in job opportunities of soil expertise in both public and private sectors mainly as a result of an increased focus on the mentioned issues. We have no reason to believe that this kind of development should not continue. As noted, competence and skills in soil science is highly relevant for future societal development.



Our findings are comparable to existing literature on student enrolment in soil science. In comparison a study by Diochon et al. (2017), showed enrolment trends in Canada with a greater percentage (67%) of reported stable enrolment in undergraduate programs over the last 10 years (2005-2015) while 33% of institutions reported increases of less than 25%. Trends of first year earth science students at five Dutch universities showed a decline from the early 1990s, but stabilized since the late 1990s (and until 2005) (Hartemink et al., 2008), even if these figures are from a decade ago. The number of MSc level students with a soil science major peaked in the mid-1990s, decreased, but then had another peak in 2004. In the same study, the number of students were also surveyed in other parts of the world. The US reported an overall decrease but with mixed trends for specific countries and universities, which is similar to the results shown here.

Aligned with the increased importance of soil health and soil management, as listed above, our results indicated that >40% of HEI respondents already perceive positive trends in the labour market, but that HEIs in Europe foresee a very low in- and outflow of soil scientists in their respective labour markets. An increase in job availability is important to attract new students. This was stated as a main reason to choose soil science for a major by students in a survey conducted by Collins (2008). To attract students today to build future capacity, HEIs may need to better advertise job opportunities for soil science expertise. A more detailed study by the EJP SOIL initiative<sup>7</sup>, will help understand what may be the requirements, skills and knowledge of soil science for the future capacity of professionals in Europe.

#### *Teaching capacity, and teaching and learning approaches for changing demand of expertise*

An important aspect to meet a change in demand of expertise and skills in soil science, as discussed above, is to investigate how current teaching is undertaken. There is ample evidence from higher education research that building capacity in HE needs to develop both in content and on formations in delivery through curriculum and teaching and learning approaches (TLAs). A more varied TLAs provides more active ways of learning which enhance critical thinking and problem-solving skills, which are needed to e.g. address sustainability problems for a range of aspect alongside a range of generic skills demanded in today's and future job market (e.g., UNESCO, 2017; Virtanen & Tynjälä, 2018). In this survey, we identified two concerning trends. Firstly, responding HEIs stated that teaching at BSc and MSc levels were dominated by lecture based teaching and learning approaches, and notably, many had low or no computer based teaching at BSc level (Figure 3.9 above). Secondly, a majority stated that courses in soil science had not evolved over the last 5 years, despite more than 80% of respondents recognising the importance of supporting generic skills development alongside soil science (section 3.5). There was also low interest for new approaches, such as the development of MOOCs, despite expressions of the generally growing interest of soil expertise (as discussed above).

We find these results contradicting. The survey did not explore in detail why respondents do not evolve courses, and curriculum. Clearly there is an awareness of potential benefits as well as merging demands for generic skills in job market. Likely there are other structural barriers in HEIs that limit capacity to evolve HE in soil science. The study was also limited to the HE degree programs, and did not explore e.g. lifelong learning, vocational training and education, or professional training offered by the HEIs. We recommend that to support the capacity building in soil science, especially in HE in Europe, two aspects can be addressed. Firstly, work on capacity building on how to enable a more

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<sup>7</sup> EJP SOIL: Towards climate smart sustainable management of agricultural soils" (EJP SOIL, [www.ejpsoil.eu](http://www.ejpsoil.eu))



active learning environment, to support both soil science expertise (content) alongside strengthening capacity on generic skills. The second issue is to better develop the understanding on non-degree opportunities for building capacity in soil science expertise: What are options and opportunities for lifelong learning, vocational training and professional training offered? This could potentially be an important complement to build soil science capacity, awareness and expertise, beyond the specific soil science degree graduates of European HEIs.

### *Importance to build partnerships and strengthen internationalisation*

Partnership and internationalisation is becoming a more important strategy to align and complement expertise. This is also the case in this survey. Partnerships in national and international soil science HE was either already implemented or planned in 2/3<sup>rd</sup>s of respondents (Figure 3.7). A high percentage of institutions had either an existing internationalisation strategy (62%) or internationalisation was considered in other strategies (24%) (Figure 3.14). These numbers were very similar to the ones presented in the consultation conducted by the European University Association to HEIs in Europe. Respondent HEIs express a relatively high existing and future interest for national as well as international collaboration in soil science education, which seems to be a good ground for educational development. Collaboration may give future students, especially at MSc level, even better opportunities to combine strengths from more than one HEI in Europe. Collaboration with other HEI could likely also offer good opportunities to discuss curricula renewal and identification of areas where the “home department” might need strong complementing partners in soil science education. The EJP SOIL program (2020-2025) is a starting point for HEI collaboration, with a joint PhD school activity, but more is needed for an inclusive approach with other HEI in Europe to engage in such collaboration. Efforts are needed also to strengthen MSc and BSc level collaborations, in addition to PhD school collaborations under e.g. Horizon Europe initiatives.

The new post-Covid ambition to “Build back better”<sup>8</sup> in Europe provides a policy for active support to enhance and advance HE in soil science, with clear statements to support capacity building, skills development and lifelong learning. The question may be how to support financial means for HEIs to operationalise this ambition for soil science expertise. For the future it will be important with targeted support to enhance these HE educational collaboration and exchanges, facilitating partnerships and internationalisation. A more detailed analysis could also inform targeted efforts to enable the HEIs and countries which are not currently strong in internationalisation (here represented by 1/3<sup>rd</sup> of respondents stating little or no interest in partnerships in Figure 3.7).

One critical aspect for such potential development is the language used in teaching. Offering more courses, semesters and programs in a common language such as English opens for much broader student recruitment and will give European students increased opportunities. Collaboration, national or international, can also widen the options for skills development for staff and an increased mobility among teachers can also be important for the future skills among soil science students. If European students have experiences from more than one country, they may also be more interested in working in other countries, which may broaden the job market for future soil science specialists in Europe.

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<sup>8</sup> See e.g. recovery plan for Europe and key elements ([https://ec.europa.eu/info/strategy/recovery-plan-europe\\_en](https://ec.europa.eu/info/strategy/recovery-plan-europe_en)) and the cross-reference in the European Skills Agenda (<https://ec.europa.eu/social/main.jsp?catId=1223&langId=en>)



## 5. Conclusions and recommendations for further action

This report presents results from a survey sent to more than 250 HEI in soil science in Europe, of which 120 respondents provided insights from 25 countries. The survey provides a baseline on the current state of HE in soil science for BSc, MSc and PhD levels in terms of institutional size, teaching capacity, teaching and learning approaches, and ambitions for internationalisation and future capacity building needs. Based on survey results and analysis, we summarise as follows:

- HEIs in Europe teach soil science at BSc, MSc and PhD level as integrated into other academic topics, in environmental engineering, agriculture and forestry or earth sciences, and only 15% of respondents have dedicated soil science department, and about a 1/3<sup>rd</sup> of respondents host degree programs in soil science at BSc, MSc and/or PhD level.
- HEIs teaching soil science in Europe, has a broad range of sizes, in terms of academic staff, ranging from less than 10 to >300. Higher Education teaching staff is well educated, with more than 70% departments in survey having a majority of the teaching staff trained in Higher Education teaching and learning, and more than 60 % of departments stated all teachers holds a PhD.
- HE soil science teaching is dominated by lecture-based elements, especially at BSc level, and curricula and courses tend in many cases to evolve slowly or not at all, despite recognition that soil science is becoming an important food security, societal and environmental issue, and despite recognition that e.g. generic competences will probably be increasingly important for students.
- Internationalisation and collaboration in HE is considered important and strategies for this are in place. Yet, 1/ 3<sup>rd</sup> of respondents do not have plans for collaborations. A lack of a common language may be a barrier to increase exchange of students, teaching staff and possibly teaching material development.
- The HEIs that teach soil science in Europe is diverse in its focus, capacity and potential, both within and between countries. To assess HEI capacity to deliver HE quality in soil science need to go beyond staff size for transparent metrics

Based on the results of this survey there are opportunities to strengthen soil science teaching and learning in HE in Europe in the future, e. g. by:

- Supporting European soil science HE collaborations at BSc and MSc level: Such initiative could be particularly beneficiary for the many soil science groups in HEIs in Europe that are relatively small, and complementarities in teaching and learning programs could benefit students both for soil science content as well as the exchange experience in general. Targeted collaborations could also address, e.g. barriers of language and internationalisation of teaching materials.
- Support more diverse teaching and learning approaches (TLAs) in HE, and development of teaching materials in soil science HE: The survey indicates a stagnation in soil science HE and lack of incorporating TLAs that can provide next generation soil science experts with necessary skills for future jobs.
- Complement this baseline survey of soil science in HE in Europe, with an assessment of vocational, professional and lifelong learning opportunities offered at HEIs: It will be more important to enhance opportunities for lifelong learning in soil science as science evolves, skills



and job market change. Currently, there is no available study to help inform on the role of HEIs to support these capacity development demands of professional, vocational and lifelong learning elements outside of regular BSc, MSc and PhD degrees.

## ACKNOWLEDGEMENTS

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Disclaimer: The views expressed in this document are those of the author(s) and do not necessarily reflect the views or policies of the funder.



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- Population source: <https://ec.europa.eu/eurostat/web/population-demography-migration-projections/data/database>



## Annex 1: Survey

### 1. Respondent And Institutional Information

Please fill in the following background reference information from your home Higher Education Institution

#### 1.1. Please select from the list the country of your Higher Education Institution

Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kosovo, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom.

#### 1.2. Please give the name of your Higher Education Institution

#### 1.3. Please give the name of department/section/sub unit within organization with relevance to soil science

#### 1.4. Is your organization primarily (select one option)

Higher education or academic/learning institution (e.g. university)

Research institution (public or private)

Other (please state): \_\_\_\_\_

#### 1.5. Please indicate what is your role at the department

#### 1.6. Please indicate the years of employment (in any capacity) at the department

### 2. Teaching & Research Capacity

This section includes questions regarding the composition and characteristics of your department

#### 2.1. Please indicate approximately the total number of academic staff at the department

#### 2.2. Please provide an approximate percentage of the following staff members per category indicated below

Not present 1-25% 26-50% 51-75% >75%

Senior staff. Examples of senior staff categories: Professor, Principal/senior researchers/investigator, Research leader/manager

Number of staff with approximately 5-15 years of expertise. Examples in this category: Associate professor, Lecturer

Number of staff with approximately <5 years of expertise. Examples from this category: Junior researcher, Junior lecturer, Postdoc

#### 2.3. Does the teaching staff always hold a PhD degree?

Yes

No, please indicate the approximate percentage (%) that does not hold a PhD

#### 2.4. Has the majority of the teaching staff been formed with a basic course in higher teaching and learning?



Yes No

### 3. Academic Topics and Degrees Offered

You will now find questions regarding the academic fields and the degrees offered by your department

#### 3.1. Is your department exclusively soil science, or is soil science a sub-component of a larger department?

Exclusively soil science

Soil science is a sub-component (please indicate which is/are the other sub-component(s) of the department):

\_\_\_\_\_

#### 3.2. Which of the following fields best describes the academic program of your department (more than one option may be selected)

**Note: The fields are selected from the International Standard Classification of Education**

Environmental Sciences (including programmes such as Ecology, Environmental Science)

Natural environments and wildlife (including programmes such as National parks and wildlife management, Nature conservation, Wildlife)

Earth Sciences (including programmes such as Earth science, Geography (physical), Geology)

Environmental protection technology (including programmes such as Ecological technology, Environmental engineering, Industrial discharge control, Water pollution control)

Crop and livestock production (including programmes such as Agricultural sciences, Agronomy and crop science, Crop growing, Soil science)

Forestry (including programmes such as Forest keeping, Forest product techniques, Logging tree felling)

Other, please specify the field: \_\_\_\_\_

#### 3.3. Please select if your department offers full degrees in soil science or courses

Full degree(s) Course(s) Non applicable (e.g. no degrees or courses offered at this level)

At Bachelor level (BSc) or equivalent

At Master level (MSc) or equivalent

At Doctoral (PhD) level or equivalent

#### 3.4. Does your department offer joint programs with soil topic with other institutions in your country?

Yes, there are examples of joint programs in all cycles

Yes, there are examples of joint programs in the first cycle (Bachelor's level)

Yes, there are examples of joint programs in the second cycle (Master's level)

Yes, there are examples of joint programs in the third cycle (Doctoral, PhD level)

Not yet, but there are plans for joint programs

No, we do not see the need for joint programs

#### 3.5. Could you please provide the name(s) of the joint program(s) in your country

#### 3.6. Does your department offer joint programs with soil topic with other institutions in another country?

Yes, there are examples of joint programs in all cycles

Yes, there are examples of joint programs in the first cycle (Bachelor's level)



Yes, there are examples of joint programs in the second cycle (Master's level)  
Yes, there are examples of joint programs in the third cycle (Doctoral, PhD level)  
Not yet, but there are plans for joint programs  
No, we do not see the need for joint programs

**3.7. Could you please provide the name(s) of the joint program(s) with other institutions in another country**

**3.8. If you wish, you can comment any general changes in curricula for programs/change in content over the last 10 years**

**3.9. Does your department offer any MOOCs (Massive Open Online Courses)?**

No

Yes, please provide name of the course(s) \_\_\_\_\_

**3.10. How much would you agree or disagree with the following statements?**

Strongly disagree, Disagree, Neither disagree nor agree, Agree, Strongly agree  
Teaching in soil science has become more prominent in the last 5 years  
Study programmes over time include more generic competences like communication skills, teamwork, and learning to learn (acquire learning skills for later life)  
During the later years Higher Education Institutions provide more programmes for part-time students (lifelong learning)

#### **4. Student Enrollment**

In this section you will find questions regarding the number of students at Bachelor's, Master's and Doctoral (PhD) level

**4.1. Please indicate the approximate number of students at Bachelor's level or equivalent in your department in the academic year 2019/2020**

**4.2. Please indicate the approximate number of students at Master's level or equivalent in your department in the academic year 2019/2020**

**4.3. Please indicate the approximate number of students at Doctoral (PhD) level or equivalent in your department in the academic year 2019/2020**

**4.4. Please indicate how has the number of students changed over the last ten years (2010-2020) for the different options below**

Increased by more than 25%, Increased by less than 25%, Stayed about the same, Decreased by less than 25%, Decreased by more than 25%

Students entering a Bachelor or equivalent study program

Students completing a Bachelor's or equivalent study program

Students entering a Master's or equivalent study program

Students completing a Master's or equivalent study program

Students entering a Doctoral or equivalent program

**4.5. What do you see as the main reason(s) for projected changes in student enrollment?**



**4.6. Please indicate the approximate total join number of foreign Bachelor and Master students at your department**

**4.8. Please indicate what is the approximate percentage (%) of women at Bachelor's level or equivalent**

**4.9. Please indicate what is the approximate percentage (%) of women at Master's level or equivalent**

**4.10. Please indicate what is the approximate percentage (%) of women at Doctoral level or equivalent**

### **5. Courses and Learning Approaches**

This section deals with courses offered by your department (number of courses, teaching/learning elements and other content,...)

**5.1. How many courses with soil topic is your department responsible for at Bachelor's level or equivalent?**

**5.2. How many credits (ECTS) with soil topic is your department responsible for at Bachelor's level or equivalent?**

**5.3. How many courses with soil topic is your department responsible for at Master's level or equivalent?**

**5.4. How many credits (ECTS) with soil topic is your department responsible for at Master's level or equivalent?**

**5.5. How many courses with soil topic is your department responsible for at Doctoral (PhD) level or equivalent?**

**5.6. How many credits (ECTS) with soil topic is your department responsible for at Doctoral (PhD) level or equivalent?**

**5.7. Please give the name of the main soil courses (maximum 3) that your department offers including the level (Bachelor, Master, Doctoral/PhD). If possible please give the webpage link to the course/course plan**

**5.8. Please indicate the percentage (%) of the different teaching-learning elements that are used in the main courses you have selected at Bachelor's level.**

not included 1-10% 11-25% 26-50% >50%

Lectures

Field work

Laboratory work

Computer/modelling/simulation

(including GIS-RS and other big



data)  
Peer-learning (e.g.  
group/project work)  
Other

**5.9. Please indicate the percentage (%) of the different teaching-learning elements used in the main courses you have selected at Master's level.**

not included 1-10% 11-25% 26-50% >50%

Lectures  
Field work  
Laboratory work  
Computer/modelling/simulation  
(including GIS-RS and other big  
data)  
Peer-learning (e.g.  
group/project work)  
Other

**5.10. Have new soil science courses been added to your department's core curriculum within the past five years?**

No

Yes, please specify the name(s) of the new courses \_\_\_\_\_

**5.11. Please indicate the most common language used in courses at each of the following levels**

Local English  
Other non-local  
language  
Non applicable (e.g.  
no courses offered at  
such level)  
Bachelor's level or  
equivalent  
Master's level or  
equivalent  
Doctoral level or  
equivalent

**5.12. Does any of the soil courses incorporates experiential learning methods such as (more than one option may be selected):**

Problem-based learning  
Case study  
Real service projects  
Other, please specify: \_\_\_\_\_

**5.13. Is your department involved in a soil related Research School for Doctoral (PhD) students?**

No

Yes, please specify name: \_\_\_\_\_



**5.14. Would you like to add if there is something that you would like to implement in the soil courses but are not able to do it?**

**5.15. In the case that you would like to implement something in the soil courses what do you consider to be the main reason for not being able to do it?**

Lack of time to plan

Constraint by the study plans

Lack of resources

Lack of support

Other, please specify if possible \_\_\_\_\_

**5.16. Would you like to add anything in relation to teaching and learning methodologies you are currently developing in soil science?**

**5.17. Please indicate if the following learning objectives from the Sustainable Development Goals (SDG) are included in your soil courses**

Yes No

The learner understands the slow regeneration of soil and the multiple threats that are destroying and removing it much faster than it can replenish itself, such as poor farming or forestry practice. (from SDG 15)

The learner understands that realistic conservation strategies work outside pure nature reserves to also improve legislation, restore degraded habitats and soils, connect wildlife corridors, sustainable agriculture and forestry, and redress humanity's relationship to wildlife (from SDG 15)

The learner is able to highlight the importance of soil as our growing material for all food and the importance of remediating or stopping the erosion of our soils (from SDG 15)

The learner knows principles of sustainable agriculture and understands the need for legal rights to have land and property as necessary conditions to promote it (from SDG 2)

The learner understands the need for sustainable agriculture to combat hunger and malnutrition worldwide and knows about other strategies to combat hunger, malnutrition and poor diets (from SDG 2)

The learner understands the concept of Integrated Water Resources Management (IWRM) and other strategies for ensuring the availability and sustainable management of water and sanitation, including flood and drought risk management (from SDG 6)

**5.18. Is any of the following topics related to policy covered in the soil courses (more than one option may be selected):**

Common Agricultural Policy (CAP)

EU Green Deal

EU Farm to Fork

EU Water Framework Directive

National legislation and regulations of importance for soil

Commercial interests of importance for soil science matters

Land ownership and related regulations



Other, please specify \_\_\_\_\_

## **6. Internationalisation and Diversity**

In this section you will find questions regarding the international dimension contributing to the education at your department

### **6.1. Please indicate the total number of foreign academic staff at your department**

### **6.2. Please indicate the number of international recruitment (academic staff) the department has done in the last 5 years**

### **6.3. Please indicate the approximate percentage (%) of women in your department (of the academic staff)**

### **6.4. Please indicate the approximate % of women with a Professor position in your department**

### **6.5. Does your Higher Education Institution have an internationalisation strategy?**

Yes

It does not have a specific strategy, but internationalisation is considered in other strategies

Not presently, but there is one developing

No, it does not

Not sure/Don't know

### **6.6. According to you, how important is it to develop each of the following strategies in higher education?**

Not important at all Slightly important Moderately important Important Very important

Development of institutional partnerships with new regions and countries

Sending more students abroad

Increase the international student population

Awareness of opportunities that internationalization offers among staff

Offer more courses in English

Development of more joint and double degrees with partner institutions

More interest in international rankings

Recruitment of more international staff and researchers

### **6.7. Please select the top three priorities for the internationalisation of your department**

Attracting students from abroad at all levels

Internationalisation of learning and teaching

Providing our students with more opportunities to have a learning experience abroad

Developing strategic research partnerships with other institutions

Attracting graduate students from abroad

Creating an international environment for our students / "internationalisation at home"

Developing strategic partnerships with other institutions regarding teaching and learning

Improving our position in national and international rankings

Attracting researchers and staff from abroad

Helping to build the capacity of partners in developing regions

Providing our staff with opportunities to go abroad

## **7. Job Market for Graduates**



This last section deals with questions regarding job opportunities for students

**7.1. What do you expect your students to do after the Bachelor's level education?**

Most will enter the labor market, while a minority will continue to study at Master level

Some will enter the labor market, and some will continue to study at Master level

A minority will enter the labor market, but most will continue to study at Master level

Difficult to say at this stage

**7.2. Where do you expect your students will work after exam(s)?**

Most will enter the local labor market

Most will enter the national labor market

A significant amount of them will enter the international labor market

Difficult to say at this stage

**7.3. In your opinion, in which sector do you think your students will work after exam(s). Please rank the following**

**in order of importance (where 1 is the highest important and 6 the least important)?**

1 2 3 4 5 6

Industry

Public

service/government

Education and

training

Agriculture/agro

industry

Consultancy

Research

**7.4. In your opinion, how have job opportunities in soil science for students graduating from your department**

**changed over the past ten years?**

Increased greatly

Increased somewhat

Stayed about the same

Decreased somewhat

Decreased greatly

**7.5. What would you consider to be the main reason for the change in job opportunities?**

**7.6. How much would you agree or disagree with the following statements?**

Not important at all important, slightly important, moderately important, very Important

Higher Education Institutions (HEIs) should foster innovation and an entrepreneurial mindset among students and staff

There should be a possibility to undertake work placements in private enterprises as part of the study programme

HEIs should provide tailor-made study programmes for enterprises to help upgrade their work force

Enterprises should be more involved in higher education management, curricula design and funding



**7.7. Please indicate if your department or your higher education institute offer continuing vocational education and training in a topic related to soil science**

No

Yes

