

## SOIL SCIENCE IN HIGHER EDUCATION IN EUROPE Current state and recommendations

**Soils and their management are fundamental to essential ecosystems, societal and climate challenges. To solve complex sustainability problems, the demand for soil science and land management expertise will increase. This policy brief sheds light on the current state of soil science in European higher education and recommends ways forward to secure European soil science expertise.**

Management of soils is knowledge and data intensive, with implications to both societal and environmental goods. Human and institutional capacity, expertise and competencies in soil science are key to resolve challenges of sustainable and climate smart soil management. Soil science expertise will be in high demand to serve academic, policy and practices of the European Green Deal, the EU Soil Strategy for 2030, the upcoming Soil Health Law, and sustainable food and nutrition production in the Farm to Fork Strategy. Students today will be the researchers, farmers, innovators and decision makers of tomorrow. Our higher education system needs to equip the new generations of experts to solve both known and unknown challenges.

Researchers at the Swedish University of Agricultural Sciences (SLU) explored the current state of soil science in European higher education as part of the European Joint Programme “Towards climate smart sustainable management of agricultural soils” (EJP SOIL). The results are based on a survey done in 2020/2021. 120 responses were received from Higher Education Institutions teaching soil science in 25 European countries (Figure 1). Not all respondents answered to all questions

### RECOMMENDATIONS

#### 1 Support European collaborations in soil science higher education

Collaborative efforts in higher education should enable European student and staff exchanges. Targeted collaborations could also address, e.g. barriers of language, internationalisation of teaching materials and development of MOOCs.

#### 2 Future soil experts need new skills and knowledge

Provide support to implement diverse active teaching and learning approaches in higher education, which enhance critical thinking, problem-solving and communication skills needed to address sustainability issues. Support implementation of practical and digital activities in soil courses, and update teaching materials to local conditions.

#### 3 Expand opportunities for vocational, professional and lifelong learning

Perform an assessment of vocational, professional and lifelong learning opportunities offered at higher education institutions to enhance opportunities for continuous learning in soil science.

Photo: Mona Mossadeghi, SLU.



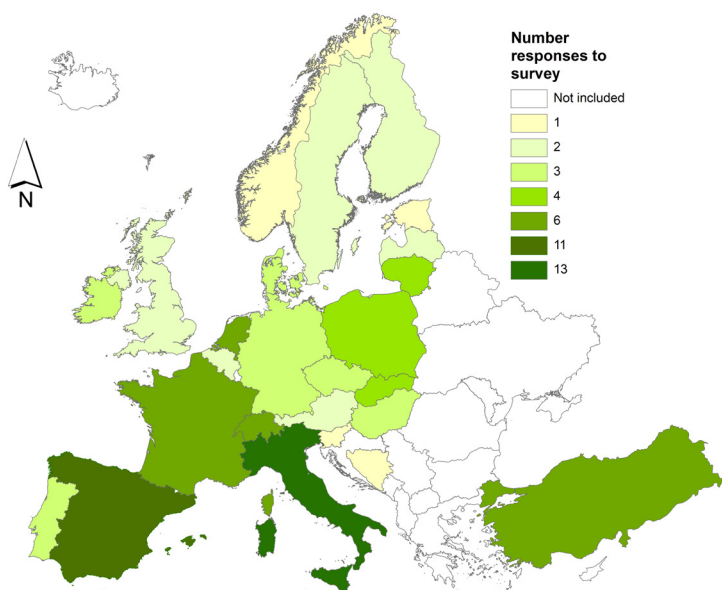
## Few higher education institutions have a dedicated soil science department

Results from the survey showed that only 16% of higher education institutions has a soil science department. The remaining institutions taught soil science as a component into academic topics of mainly environmental sciences and agronomy. European soil science is dominated by a few very large higher education institutions and many small. Five institutions exceed 200 employees while half of the institutions have less than 30 employees. Soil science is mainly taught in courses within other academic topics. A full degree in soil science at BSc level was offered by 28% of respondent higher education institutions, while at MSc and/or PhD level was offered by 37% of the respondent institutions (Figure 2). A majority (69 %) answered that the teaching staff at the department had achieved a basic course in higher education teaching and learning.

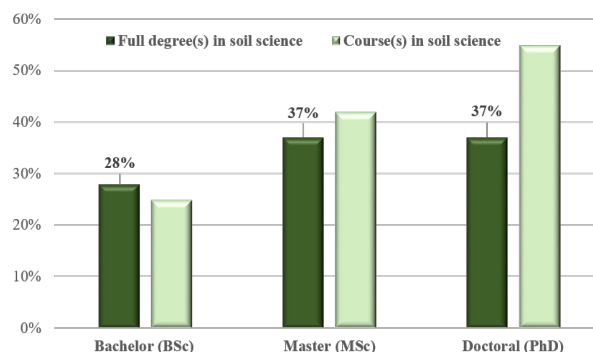
More than 80% of higher education institutions reported that the main language used in BSc courses was the national/local. At MSc level the use of English is more spread within countries, and up to 27 % of institutions reported that it was the main language used in soil courses. If programs and courses offered are only in native/local language of the country it reduces opportunities for e.g. exchange students from other countries.

## An increased interest in internationalisation within soil science higher education

Results showed an increased interest in internationalisation. Around 80% of higher education institutions considered both awareness of opportunities, as well as the opportunity to develop institutional partnerships, to be important or very important aspects of internationalisation.



**Figure 1.** Participant countries in the survey carried out between 2020 and 2021. 94 responses from 25 countries were received.



**Figure 2.** Proportion of soil science full programs or courses offered at the higher education institutions that participated in the survey. The total number of answers was 75.

The top three priorities for internationalisation were to attract students from abroad (42%), develop strategic research partnerships (42%) and provide more opportunities to send students abroad (38%).

Only four (6 %) higher education institutions had international joint programs in place at all levels (BSc, MSc and PhD), whereas the double amount stated they were part of national collaborative programs in higher education. The engagement in international programs occurred more often at higher educational levels (MSc and PhD) (Figure 3).

Our recommendation is to actively support soil science higher education collaborations and networks, especially at BSc and MSc level. Priority should be given to higher education institutions in Europe that are relatively small, and/or underrepresented in European soil science collaborations. Targeted collaborations could also help to overcome e.g. barriers of language and internationalisation of teaching materials. The development of Massive Open Online Courses (MOOCs) in soil science will foster internationalisation at home activities and are also a mean for more collaborative teaching and learning in higher education.

## More active teaching and learning approaches and digitalisation are needed

Results from the survey showed that traditional lecture based teaching still dominates soil science teaching and learning activities across the responding institutions both at BSc and MSc levels. 40% of institutions reported that BSc courses were lecture intensive. There was a low engagement in digitalisation reported as 1/3 of respondents answered that BSc courses did not have any computer/modelling component. The share of computer exercises or modelling in soil courses increased at MSc level.

The balance of fieldwork and laboratory components was relatively similar at MSc and BSc level according to respondents. Some respondents provided comments to implementations in courses that they would like to make but were not able to. Most would like to implement practical and active learning activities



to courses including fieldwork, laboratory work and computer activities.

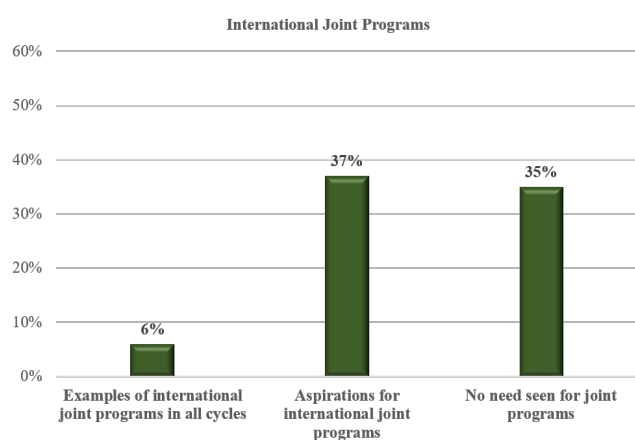
Several respondents mentioned the need of new teaching materials with updated contemporary issues and applied to local conditions. The main reasons that hindered the implementation of new teaching and learning activities were the lack of resources, constraint by the study plans and lack of materials.

It is recommended to update teaching and learning approaches in soil science higher education. More varied and active student-centered teaching that actively help to develop generic skills alongside soil science knowledge in BSc, MSc and PhD curricula and teaching materials. Examples of new teaching and learning materials to be developed are open textbooks (on contemporary topics such as managing agricultural soils in a changing climate). The development of soil science curricula and courses could be done in collaboration with industry and the public sector,

including diverse teaching and learning approaches in higher education. In addition, support to develop local teaching materials in soil science is needed.

### Expand opportunities for vocational, professional and lifelong learning

Soil science and knowledge will keep evolving. The life long learning opportunities for soil expertise need to continue to be updated during work life and careers. This baseline survey of soil science in higher education in Europe needs to be complemented with an assessment of vocational, professional and lifelong learning opportunities offered at higher education institutions to enhance opportunities for continuous learning in soil science as science evolves, and as job market changes demand for skills and expertise. Higher education institutions teaching in soil science will have a major and growing role in this field as the focus of soil health and management increase for food, environment and climate.



**Figure 3.** Share of international joint programs with soil topic offered by the higher education institutions participating in the survey.



Most respondents would like to include practical and active learning activities in courses, such as fieldwork. Illustration: SLU.

## Further reading

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## References

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