New Forestry Curricula at the Technical University of Madrid

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ABSTRACT

Although the Bologna Process has aroused some resistance in several countries, it is proving to be a huge opportunity to harmonize higher education across Europe. This process, aiming at enhancing the employability and mobility of citizens to increase the international competitiveness of Europe through the creation of the European Higher Education Area (EHEA), is been developed in a different way and at a different pace depending on the country.

This contribution intends to describe the adjustment of the Spanish University System to the EHEA and the consequences of this process for Forestry Studies. It also presents the new study programs offered by the School of Forest Engineering of the "Universidad Politécnica de Madrid (U.P.M.)", the oldest centre of higher forestry education in Spain. Finally, the expected outcomes of the new system are outlined.

INTRODUCTION

In Spain, as in many other European countries, there have been some protests and demonstrations against the Bologna Process. The perception of society about the changes caused by the creation of the European Higher Education Area (EHEA) has not always been positive. Some groups have seen the Bologna Process as a risk for public education and a threat to public universities, and have stood up shouting slogans such as "education is not a business", "fight for a free education", or "we don`t want junk jobs". A common fear is that the whole process leads to an increase in tuition fees.

Therefore, there is a big misinformation about the meaning of the reform. The objectives of the Bologna Process can be summarized as follows:

- General objective:

  To enhance the employability and mobility of citizens and to increase the international competitiveness of Europe through the creation of the European Higher Education Area (EHEA) before 2010.

- Specific objectives:
  - ✓ To establish a common framework of readable and comparable degrees.
  - ✓ To implement a system based on two levels: Undergraduate and Graduate, structured along three cycles: Bachelor, Master and Doctorate. (Structure BMD).
  - ✓ To improve teacher/student and research mobility.
  - ✓ To set criteria and methods for quality assurance.

The new EHEA will promote a European dimension of higher education.

ADJUSTMENT OF THE SPANISH UNIVERSITY SYSTEM TO THE EUROPEAN HIGHER EDUCATION AREA

The adaptation of university studies to the European Higher Education Area provides an opportunity to fix the current deficiencies in the education of several disciplines and to modify the structures and curricula of the academic institutions in order to adapt to the new scenario. In Spain, the process of transition to the EHEA is moving somewhat behind schedule.

The main milestones of the reform are as follows:

- Foundation of the National Agency for Quality Assessment and Accreditation (ANECA) in 2002. (Cabinet meeting agreement, 19 of July 2002).

- Framework Document (2003) establishing the integration of the Spanish University System in the European Higher Education Area regarding the following aspects:
    - ⋆ Improvement of studies transparency.
    - ⋆ Quality Assurance System.
    - ⋆ Modification of the structure of the degrees.

- Royal Decree 1044/2003 establishing the procedure for the issuance by the universities of the European Diploma Supplement.

- Royal Decree 1124/2003 setting up the European Credit Transfer System (ECTS) and the grading system for official university degrees in Spain.

- Royal Decree 285/2004 by which the recognition and validation of foreign higher education degrees is regulated.

- Royal Decrees 55/2005 and 56/2005 by which university studies (both undergraduate and graduate) are regulated.

- Royal Decree 1393/2007 establishing the planning framework of official university studies.

- Ministerial Order CIN/324/2009 establishing the requirements for the verification of the official university degrees that entitle their graduates for the professional practice of Short-cycle Forest Engineering.

- Ministerial Order CIN/326/2009 establishing the requirements for the verification of the official university degrees that entitle their graduates for the professional practice of Long-cycle Forest Engineering.

In Spain the different branches of engineering are regulated professions, and the academic degree is linked to professional qualification. Therefore, the public administration must make sure that the education and training obtained at the university qualifies their graduates for professional practice. The two last regulations of the list above are aiming at this objective and, with that purpose, they establish a thorough list of competences that necessarily have to be acquired to become a professional forest engineer.

Structure of Undergraduate and Graduate Studies

The curriculum structure is being reformed to conform to the European Higher Education Area. The academic year 2010-11 will be the beginning of a new system within which three levels of studies will be offered: Bachelor`s degree (4 years), Master`s degree (1 or 2 years) and Doctoral Degree (at least two additional years after the completion of a research-oriented Master's degree). The proposed structure for university studies in Spain is shown in Figure 1.

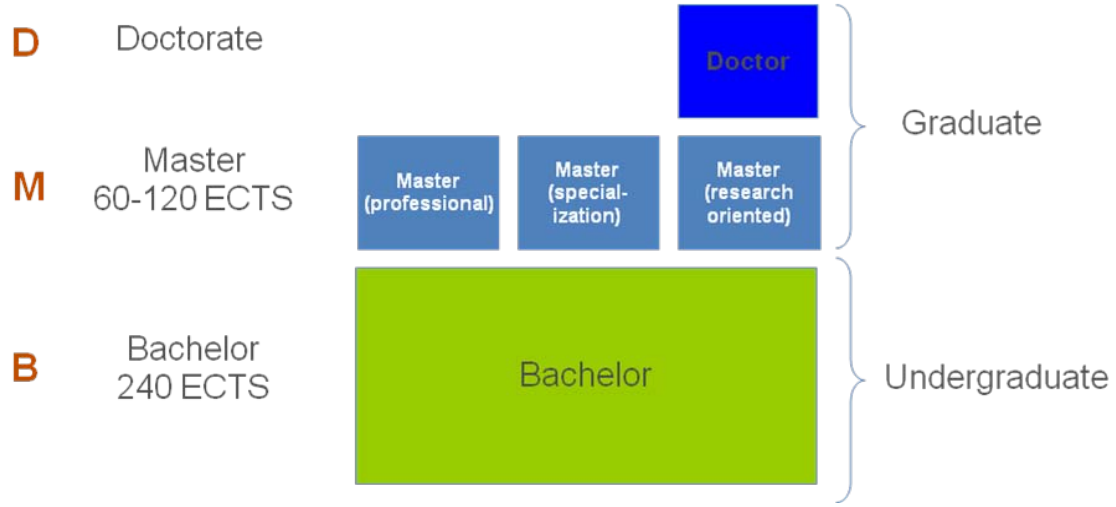

Figure 1: Structure of University studies based on three cycles (BMD).

CONSEQUENCES OF THIS PROCESS FOR FORESTRY STUDIES

For the University System as a whole, some consequences can be expected from this transition from a system based mainly on teaching to one based mainly on learning. Some of the differences between both systems are shown in Table 1.

Table 1. Methodological change associated to the reform of University studies.

Old system	New system
✓ Based on teacher's activity.	✓ Based on student's effort.
✓ High number of lectures.	✓ Lower number of lectures.
✓ Most contents explained in the classroom.	✓ The student must search references and go into the topics in depth.
✓ Secondary role of the students in the learning process.	✓ The student is the actor and not the passive object of the learning process.
✓ Evaluation mainly based on tests.	✓ Evaluation based on exams, essays, projects, classroom participation, …

Consequences for University Forestry Studies

In the old system, forestry studies were structured in two levels: Short cycle forest engineering, which was a three year practically oriented degree, and long cycle forest engineering, a five or six year degree (depending on the university), providing a scientific education leading to a conceptual forest engineer.

After the completion of the long cycle forest engineering studies, the graduates could enrol in a doctorate program leading to a doctoral degree awarded after at least three years of study and research and the submission and defence of a PhD thesis.

In the new system, the structure of undergraduate and graduate studies must conform to the diagram depicted in Figure 1. Therefore, the adjustment of forestry studies to the new system means new degrees (Bachelor in Forest and Wildland Engineering, Master of Forestry, …), new study programs, and a change in the length of the studies and the number of courses, as well as new methodologies based on students' effort. (See Table 1).

The new degrees offered by the Technical University of Madrid are the following:

- ➔ Bachelor in Forest Engineering
- ➔ Bachelor in Natural Environments Engineering
- ➔ Master of Science in Forest Engineering.

The two bachelor degrees have a length of four years (240 ECTS). The Bachelor in Forest Engineering entitles their holders for the professional practice of short-cycle forest engineering. The holders of the Bachelor in Natural Environments Engineering acquire some interesting competences but are not qualified for the professional practice of forestry because this degree does not meet the specific requirements set by Ministerial Order CIN/324/2009.

The Master of Science in Forest Engineering is a two year professional degree (120 ECTS) which meets the requirements set by Ministerial Order CIN/326/2009 and thus qualifies for the professional practice of long-cycle forest engineering. Direct access to this master's degree is only open to graduates coming from the Bachelor in Forest Engineering. Graduates from other degrees have to take some courses to meet specific admission requirements.

The School of Forestry of the Technical University of Madrid offers some other master degrees which have a shorter length (60 ECTS or 90 ECTS) and a different orientation (specialization, research, …).

According to the new system, the third cycle leads to the Doctor's degree, awarded after at least three years of study and research and the submission and defence of a doctoral thesis.

The study programs of the two professional degrees (Bachelor in Forest Engineering and Master of Science in Forest Engineering are described under the following heading in Tables 2 and 3.

NEW STUDY PROGRAMS AT THE MADRID SCHOOL OF FORESTRY

Two new forestry degrees adapted to the EHEA are offered by the Technical University of Madrid: Bachelor in Forest Engineering and Master of Science in Forest Engineering. The course list for the new undergraduate study program (BSc in Forest Engineering) is shown in Table 2. (U.P.M., 2010).

Table 2: BSc program of Forest Engineering (List of courses by semester).

BACHELOR'S DEGREE IN FOREST ENGINEERING				
LIST OF COURSES BY SEMESTER				
ECTS			**COURSE**	**Kind of course**
FIRST YEAR **60**	**30**		**FIRST SEMESTER**	
		6	Chemistry	Compulsory
		6	Physics I	Compulsory
		6	Mathematics I	Compulsory
		6	Drawing for Engineers	Compulsory
		6	Zoology and Forest Entomology	Compulsory
	30		**SECOND SEMESTER**	
		6	Mathematics II	Compulsory
		6	Forest Botany	Compulsory
		6	General and Firm Economics	Compulsory
		5	Biochemistry and Biotechnology	Compulsory
		4	Physics II	Compulsory
		3	Mechanics and Mechanisms	Compulsory
SECOND YEAR **60**	**30**		**THIRD SEMESTER**	
		6	Computer Science and Mathematical Modeling	Compulsory
		6	Statistics	Compulsory
		6	Plant Anatomy and Physiology	Compulsory
		6	Soil Science and Climatology	Compulsory
		3	Electrotechnics and Electrification	Compulsory
		3	Forest and Environmental Economics	Compulsory
	30		**FOURTH SEMESTER**	
		7	Forest Ecology. Phytogeography	Compulsory
		4	Forest Mensuration and Forest Inventory	Compulsory
		4	Hydraulics	Compulsory
		5	Construction	Compulsory
		3	Thermodynamics, Engines and Machinery	Compulsory
		7	Topography, Geographic Information Systems and Remote Sensing	Compulsory

BACHELOR'S DEGREE IN FOREST ENGINEERING

LIST OF COURSES BY SEMESTER

ECTS			COURSE	Kind of course
THIRD YEAR 60	30		**FIFTH SEMESTER**	
		6	Silviculture	Compulsory
		4	Forest Roads	Compulsory
			Major A: Forest Ecology and Management:	
		6	Range Management and Agroforestry Systems	Major A
		6	Forest Hydrology and Watershed Restoration	Major A
		5	Forest Pathology and Pest Management	Major A
		3	Forest Genetics	Major A
			Major B: Forest Products and Forest Industry:	
		5	Wood Anatomy and Wood Properties	Major B
		5	Thermal Installations	Major B
		5	Basic Operations in the Forest Industry	Major B
		5	Industrial Electronics and Control Systems	Major B
	30		**SIXTH SEMESTER**	
			Major A: Forest Ecology and Management:	
		5	Parks and Gardens. Degraded Areas Reclamation	Major A
		5	Game and Fish Management. Aquaculture	Major A
		5	Afforestation & Nurseries	Major A
		4	Landscape. Land Use Planning	Major A
		7	Forest Management and Agricultural Valuation	Major A
		4	Forest Fire Control	Major A
			Major B: Forest Products and Forest Industry:	
		5	Pulp and Paper Production	Major B
		4	Word Pathology and Conservation	Major B
		5	Machines and Industrial Electric Swithgear Sets	Major B
		5	Wood First and Second Transformation Processes	Major B
		4	Non-Timber Forest Products Industry	Major B
		7	Integrated Management Systems & Wood Industry Quality Control	Major B
FOURTH YEAR 60	30		**SEVENTH SEMESTER**	
		6	English for Professional and Academic Communication	Compulsory
		24	Professional Training in Forest Sector Companies, Elective Courses, or International mobility (Socrates-Erasmus Program)	Elective
	30		**EIGHTH SEMESTER**	
		6	Forest Logging and Forest Certification	Compulsory
		6	Law. Cadastre. Forest Policy and Sociology	Compulsory
		6	Engineering Projects. Environmental Impact Assessment and Restoration	Compulsory
		12	Bachelor's Final Project	Compulsory

The study program of the professional master's degree is shown in Table 3. (U.P.M., 2010)

Table 3: MSc program of Forest Engineering (List of courses by semester).

MÁSTER OF SCIENCE IN FOREST ENGINEERING				
LIST OF COURSES BY SEMESTER				
ECTS			**COURSE**	**Kind of course**
FIRST YEAR **60**	**30**		**FIRST SEMESTER**	
		4	Structural Design Projects	Compulsory
		5	Electrical Installations and Electrification Projects	Compulsory
		5	Pulp and Paper Technology	Compulsory
		3	Planning in Protected Natural Areas	Compulsory
		4	Land and Coastal Areas Management	Compulsory
		3	Forest Genetic Resources Conservation and Improvement	Compulsory
		3	Strategic Management	Compulsory
		3	Forest Management and Conservation International Strategies	Compulsory
	30		**SECOND SEMESTER**	
		3	Concrete Construction and Foundations	Compulsory
		5	Wood Technology and Processing	Compulsory
		4	Renewable Energy: Biomass	Compulsory
		4	Renewable Energy: Solar, Wind and Minihydroelectric	Compulsory
		3	Hydrological Planning and Combat against Desertification	Compulsory
		3	Pollution Control in Natural Environments	Compulsory
		5	Financial Management	Compulsory
		3	Commercial Management and Marketing	Compulsory
SECOND YEAR **60**	**30**		**THIRD SEMESTER**	
		30	Professional Training in Forest Sector Companies, Elective Courses, or International mobility (Socrates-Erasmus Program)	Elective
	30		**FOURTH SEMESTER**	
		4	Sustainable Management of Wildland and Mountain Areas	Compulsory
		3	Human Resources Management	Compulsory
		3	Forest Quality and Environmental Auditing Systems	Compulsory
		5	Wood Structural Projects	Compulsory
		3	Elective course	Elective
		12	Master's Final Thesis	Compulsory

There was a general feeling among graduates that most courses within the old Forestry curriculum were theoretically oriented, and more emphasis should be placed onto the practical aspects of Forestry. A more practice-oriented approach was demanded for

several disciplines such as Business Administration and Finance, Economics, Project Design and Management, or Forest Management.

There was also a demand for the implementation within the Forestry curriculum of training periods in private companies or public agencies which could provide the students with a practical learning experience and the recognition of a certain number of credits. In the new study program, the student can spend a whole semester at a private company or a public agency and obtain a maximum of 24 credits (Bachelor) or 30 credits (Master) for practical training. This will certainly contribute to strengthen the links with the professional world.

According to these requirements and those established by the Ministerial Order CIN/326/2009 aforementioned, the Master's degree consists of twenty compulsory courses structured in four modules: forest products industry, wildland resource planning, economics and business administration, and construction.

EXPECTED OUTCOMES

Since the new system has not yet started to be implemented, there are not any actual data on expected results which can support ground conclusions on the performance of the system. Therefore, all the expected outcomes listed below are impressions, opinions and personal ideas not supported by actual data.

It is not evident that the comparability of forestry degrees from different European universities will be higher after the reform than it used to be before. The length of the studies and the number of credits allocated to each discipline will be different. As a matter of fact, the comparability of forestry degrees within Spain will drop.

It must be acknowledged though that the transparency of the studies is increased as a consequence of the establishment of the European Diploma Supplement.

Regarding students' mobility, in the case of the School of Forestry of the Technical University of Madrid there is a huge uncertainty on inwards mobility since all the courses will be offered in Spanish and language is an important barrier. On the other hand, outwards mobility is expected to increase because the new study programs encourage English communication skills and make credit recognition easier.

It is unknown the effect of the new system on teachers' and researchers' mobility.

The new evaluation and assessment methodologies will require that professors carry out a detailed follow-up of the student's personal work. This implies a higher effort.

Students' workload will probably be higher than it used to be since the new system is more demanding in terms of dedication. It will become more difficult to combine work and study. This circumstance leads to a professionalization of the student, whose work hours will be the same as any other worker's.

Student achievement is unknown, but the academic performance is expected to go up and the dropout rate is expected to go down as a result of the implementation of new learning methodologies.

Graduates' employability is also unknown, since the traditional degrees are going to be replaced with the new ones and there is not any evidence regarding the acceptance of the new degrees by the market.

In Spain the implementation of the reform is being done at zero cost. In fact, during the last years less funding is available because of budget cuts. Therefore, the academic administrators must adapt to a whole new system but they are not getting the resources they need to be able to do it properly.

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