

Degree Program Documentation

Master's Program Sustainable Resource Management

Part A

TUM School of Life Sciences

Technical University of Munich

General Information:

- Administrative responsibility: TUM School of Life Sciences
- Name of degree program: Sustainable Resource Management
- Degree: Master of Science (M.Sc.)
- Standard duration of study and credits: 4 semesters of enrollment and 120 credit points (CP)
- Form of study: Full time
- Admission: Aptitude assessment (EV - Master's)
- Start: Wintersemester (WiSe) (2001/02)
- Language of instruction: English
- Main location: Campus Weihenstephan (Freising)
- Academic administrator (program design): Prof. Dr. rer. silv. Thomas Knoke
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1 Degree Program Objectives

1.1 Purpose of the Degree Program

The international, English-language master's program "Sustainable Resource Management" is an interdisciplinary and transdisciplinary program that prepares students from all over the world and from a wide range of disciplines for the diverse challenges of sustainable resource management. The purpose of the master's program is to educate students to innovative and analytically-sharp thinking sustainability generalists, who will develop comprehensive, scalable and resilient solutions for the sustainable management of our natural resources. Alumni of the degree program are endowed with future-oriented management competencies and extensive international networks to help transform the so far often unsustainable natural resource management systems into sustainable and resilient resource systems.

Natural resources such as soil, water, air and biodiversity form the essential basis of human life and economic activity. They serve as food, raw materials, and energy sources, as living and recreational space, or as means to reduce pollutant emissions. Their unsustainable consumption and exhaustion is increasing rapidly worldwide. Global trends such as population and economic growth will continue these trends. The current natural resource management results in serious environmental problems such as biodiversity loss, soil degradation, water shortages, and air pollution. In addition, competing uses and conflicts of interest are increasingly developing around the ever-scarcer resources. This is increasingly leading to political tensions at both national and international levels, including armed conflicts.

The world's political and economic systems focus on the efficiency of production and resource extraction, which has led to very vulnerable and fragile resource management systems. The consequences include, for instance, failure in agriculture, large-scale disturbances in temperate and tropical forests, food and energy insecurity, and high price volatility. The associated adverse ecological and political developments make it essential to manage natural resources sustainably while simultaneously considering social, ecological, and economic aspects, building and reinforcing resilience into the resource systems. A consistently sustainable, resilient and intelligently controlled resource management provides a great opportunity to increase the socio-political room for scope of action again. Management, from Latin *manus* (hand) and *agere* (to lead), refers in the course of study to correspondingly targeted, effective, and reflexive human actions about management, organization, planning, communication, evaluation, and strategic development in terms of socially responsible use, utilization and provision of resources as well as resource sinks. Challenges of sustainable resource management are characterized by a lack of oversight, complexity, high conflict potentials, many actors, and the absence of universal action orientations.

This requires that graduates must have multilayered competencies in order to be able to make decisions in the sense of management of natural resource consumption. Graduates are active both in developing solutions in the field of natural resource problems and in the moderation between different interest groups and their different approaches to solutions. To accept these challenges, the graduates require a profound knowledge of the various natural resources, but also a comprehensive understanding of the system, extensive planning and methodological skills. The international master's program "Sustainable Resource Management" provides the necessary future-oriented competencies to contribute to sustainable and resilient resource management. The program's focus is on

learning suitable management methods for solving problems. In addition, the professional and personal development of the students is a second focus of the program.

1.2 Strategic Significance of the Program

The master's program in Sustainable Resource Management contributes excellently to TUM's Sustainable Future Strategy 2030, aiming to position TUM of sustainable scientific, economic, ecological, and social development. As a life science program, the master's program in Sustainable Resource Management fits seamlessly the LS School's vision ONE HEALTH to foster interdisciplinary research and teaching in the fields of living environments, agriculture and forestry, food and nutrition, as well as molecular health. The contents and teaching formats complete the teaching and research mission of the LS, where health, sustainability, the environment and land use have been defined as critical themes within its future vision. The Sustainable Resource Management program's teaching of sustainability thinking gives our students a modern vision of sustainable resource management based on the four pillars of ecology, socio-economics, production and culture. International graduates of the Sustainable Resource Management program raise the profile of TUM and the LS in sustainable management and action. The program, as such, supports the mission statement of the TUM, who sees herself as a servant of society with responsibility for future generations. With its international orientation and students from all over the world and educating the students to become sustainability leaders, the program contributes significantly to TUM's global networking of society, science and technology. Also, it helps to promote cosmopolitanism and cultural tolerance.

The international degree program "Sustainable Resource Management" teaches sustainable management across a broad spectrum of resources, not limited to a single resource, such as forests. However, imparting to our students a modern image vision of sustainability based on the four pillars of ecology, socio-economics, production, and culture is also the strategic goal of the study area "Forest Science and Resource Management". Sustainability thinking is one of the objectives of the Bachelor's program "Forest Science and Resource Management" as well as of the two Master's programs "Forestry and Wood Science" and "Sustainable Resource Management." The Master's program Sustainable Resource Management thus outstandingly complements both forest science programs.

2 Qualification Profile

The content of the following qualification profile corresponds to the specifications of the *Qualifikationsrahmen für Deutsche Hochschulabschlüsse* (Hochschulqualifikationsrahmen - HQR) and the requirements contained therein (i) Knowledge and understanding, (ii) Use, application and production of knowledge, (iii) communication and co-operation and (iv) academic self-perception/professionalism. The formal aspects according to HQR (admission requirements, duration, degree options) are described in chapters 3 and 6 as well as in the corresponding subject academic and examination regulations.

Knowledge and understanding

After successfully completing their studies, the graduates have substantially enhanced their knowledge, holding a comprehensive knowledge and understanding of the fundamental scientific principles of the sustainable management of natural resources. Across all disciplines and management competencies, our graduates have internalized the key competencies of sustainable action and are able to make decisions based on these in terms of sustainable resource management. Graduates have obtained critical-analytical competences concerning, *inter alia*, the natural resources as such, their overexploitation, vulnerability and the associated environmental, social, technological, and economic problems, the history and theory of sustainability (including sustainability concepts from different disciplines), social and cultural contexts and conflicts, as well as sustainable, robust and resilient management concepts. Based on the current state-of-the-art the graduates have the scientific reading and writing skills to stay informed about and contribute to scientific innovations in the field of natural resource management.

The graduates can independently use various analytical tools and technologies, conduct environmental analyses, or create and assess land use plans. Based on the corresponding subject-specific competencies concerning the natural resources dealt with in the degree program, graduates can understand, analyze and evaluate information from the complex scientific methods and tools and use it in their work in a targeted manner for the conception of sustainable resource use plans.

Depending on the elective modules offered from a total of nine "Science Topics" in the degree program, students have extended expertise in the areas of management and protection of forest ecosystems, wildlife management and management of protected areas, landscape management, renewable energies, climatology, material and waste management, sustainable agricultural systems and products, soils and soil management, and economic and political dimensions of sustainability.

Based on their scientific competencies, graduates can analyze sustainability problems and contribute to scalable solutions in a critical-reflective and context-dependent way. Their solutions are always science-based, ensuring the correctness of their conclusions and solutions. In complex decision situations, the graduates can balance multiple aspects and decision criteria critically against one another to suggest transparent, effective, and resilient management solutions.

Use, application and production of knowledge

Our successful graduates have obtained deepened knowledge and apply their knowledge and understanding in sustainable resource management to contribute to solutions to the pressing problems

of the currently often unsustainable resource management. Following Wiek's sustainability competencies, strategic, anticipatory as well as normative and interpersonal competencies support holistic, interdisciplinary thinking. Graduates possess systemic competencies include holistic, interdisciplinary thinking and skills to combine ecological, social and economic sustainability and to independently create own concepts to reconcile the different interests. Furthermore, anticipatory competencies enable graduates to design scenarios, develop visions and deal with risk and uncertainty.

The graduates can collect sustainability values and orient themselves using different learned cooperation concepts. They have learned to collect, assess, and interpret scientific and secondary information from multiple sources in their degree program. That includes resource inventory techniques, experiments, social and household surveys, interviews, and extracting information from databases and literature reviews (meta-analyses). They can assess the information quality and deduce science-based recommendations. Graduates develop alternative solutions towards sustainable resource management based on the scientific state-of-the-art. They are team players and conduct application-oriented projects, for example, to derive sustainable wildlife management concepts or to use mathematical programming to suggest future forest and landscape compositions under multiple objectives. Their change management skills allow them to develop innovative solutions. They can define specific goals of sustainable resource management against the background of different expectations and interests and to develop suitable management strategies in cooperation with stakeholders. Our successful graduates are life-long learners.

Scientifically, the graduates deduce innovative research questions, for example in scientific proposals, papers and their master's theses. They are trained in providing the rationale and implementation of topical research questions, applying cutting-edge research methodology, and professionally presenting and explaining the results obtained.

Furthermore, the graduates can constructively accompany the practical implementation, evaluate the results, and critically question the success. Graduates are enabled to make data-supported decisions as critical actors and decision-makers in questions of sustainable resource management and to deal with conflicts. Students are encouraged to work efficiently and goal-oriented, independently and in teams, and to assume project responsibility. In addition to the professional education, the program promotes the students' personal competencies, which enable the graduates to act on a civic, political, and cultural level.

Communication and co-operation

The graduates of Sustainable Resource Management suggest resilient long-term problem solutions, focusing on the specific problems and contexts. They communicate and defend their suggestions in discussions with colleagues theory-based and methods-oriented. Graduates communicate and cooperate with colleagues inside and outside the sustainable resource management field to contribute to responsible solutions. They are reflective, apply a plurality of assessment methods (whenever possible), and analyze the problems under consideration always from different perspectives. The graduates are highly qualified contact persons, for e.g., analysts, environmental protection groups, companies, political representatives or stakeholders in civil society and are able to understand their respective professional discourses, research methods and results and evaluate these in the context of sustainability.

Interpersonal and communicative competencies play a central role in the moderation of conflicts. These competencies include skills in presentation, dialogue, and scientific discussion. In addition, the program graduates possess a high degree of social and intercultural competence (all lecturers have international experience and bring their intercultural expertise into their courses), which they can use internationally as the basis for successful conflict management, as well as a sound knowledge of foreign languages.

Academic self-perception/professionalism

Successful graduates of Sustainable Resource Management develop an appropriate self-perception, oriented towards the objectives and standards of professional activities, when working in professional fields mainly outside of science. They justify their professional activities and suggestions with appropriate theoretical and methods-based knowledge, critically reflect their potentials, and gainfully use and suggest problem-specific decision alternatives. Graduates can independently plan, conduct, manage, and evaluate subject-related research projects under applicable scientific standards. Research results can be presented using appropriate methods, and graduates have a scientific self-image and professionalism and can critically assess their scientific skills. This enables graduates to analyze and evaluate subject-specific discourses and positions to make them practically usable for sustainable resource management in cooperation with experts, researchers, and laypersons and to develop and implement management strategies from them.

3 Target Groups

3.1 Target Audience

The master's program "Sustainable Resource Management" is targeting nationally and internationally qualified students with a scientific-technical or socio-scientific background who want to expand and deepen their competencies in the field of sustainable resource management. The program is also aimed explicitly at students who already have professional experience.

3.2 Program Prerequisites

In addition to knowledge from the fields of engineering, natural sciences, economics, and social sciences, an excellent command of the English language is a particular prerequisite. In this respect, students should be able to present scientific and technical problems in a precise and goal-oriented manner.

Also required is a great and varied interest in the subject-specific areas and the will to deal intensively with the relevant issues in courses, internships, and the preparation of the Master's thesis. Students must also be prepared to participate in subject-specific excursions, field trainings, and exercises (some of which last several days).

Students should be open-minded and able to think in a networked and analytical way, having the principle skills for a method-oriented and scientific way of working. They should have a well-founded general system thinking and be able to apply their theoretical basic knowledge to specific problems. An independent and solution-oriented way of working individually and in a team is also an advantage. Good communication and presentation skills are helpful for a successful study. A basic information competence with regard to scientific publications is required.

The Aptitude Assessment was revised in December 2022 and for the first time applied for admission in winter semester 2023/24 due to the steady increase in applicant numbers. The aim of the revision was to improve comparability in the assessment of professional suitability and to speed up the procedure.

The revision included the introduction of an Online Aptitude Test in the first stage of the Aptitude Assessment Process.

The online aptitude test is a 40-minute, written test in English. The purpose of the test is to evaluate whether it can be expected that the applicant will attain the goal of the degree program and whether he or she has the general level of knowledge corresponding to the fundamentals of the relevant bachelor's degree program so that successful completion of the degree program is to be expected.

The test covers the following categories in its weighted assessment:

- Basic general and interdisciplinary knowledge related to global resource management challenges, research methods, and general knowledge of sustainability (75%);
- Specific knowledge in one of the fields of engineering, natural sciences, economics or social sciences (25%).

3.3 Target Numbers

The number of students enrolled in the degree programs offered by the study area of Forest Science and Resource Management has risen continuously in recent years, which indicates the popularity of the topics covered (Fig. 1). This is particularly true of the international master’s program in Sustainable Resource Management, which was introduced in the winter semester of 2001/02. The number of enrollments from applications increased rapidly after the program's introduction and has ranged between 84 and 198 students in recent years (see Fig. 2, blue line). Overall, the number of students in the Sustainable Resource Management program has an increasing tendency, and this trend is very much appreciated in the context of the growing importance of the topics covered in the program concerning current global ecological and political developments. The target cohort size is 100-130 students, which is well manageable with the teaching resources this degree program.

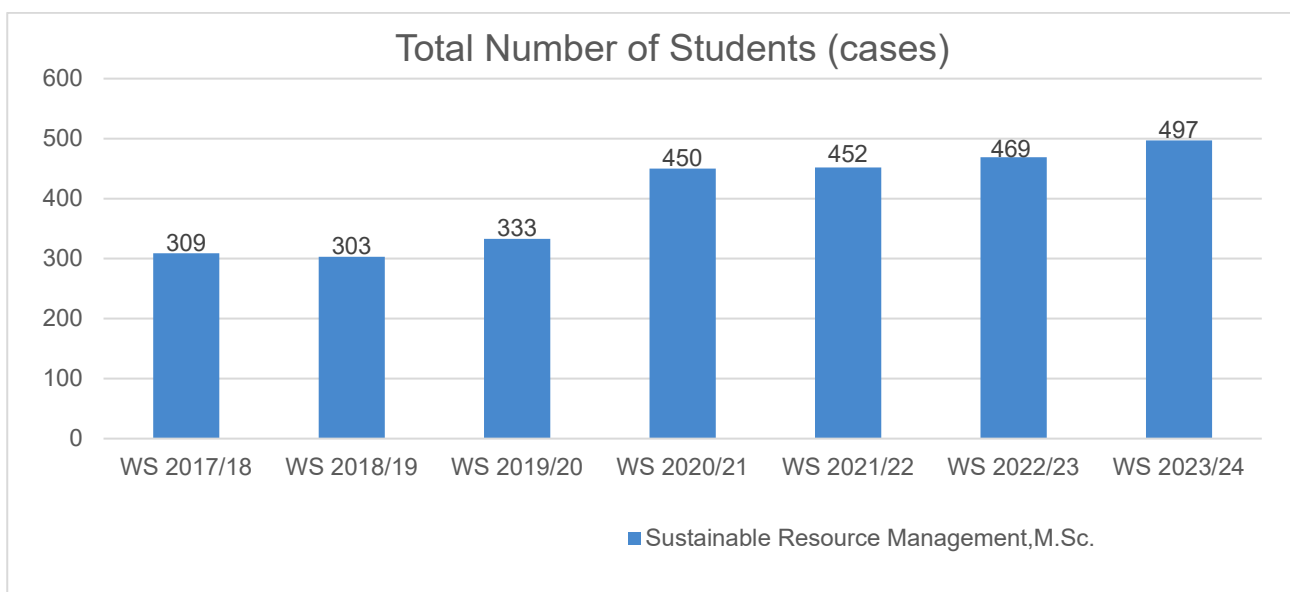


Figure 1: Total Number of Students in M.Sc. Sustainable Resource Management (Source: TUM Dashboard)

The attractiveness of the program is also reflected in the sharp rise in applicant numbers, which have now settled at a consistently high level (cf. Figure 2). The reduction in applicant numbers for the 2022/23 winter semester which might have been affected by the uncertainties of the Corona pandemic and visa situation especially for international students was much appreciated, because the extremely high enrollment level of the year 2020/21 could not be managed sustainably with the current resources. In the winter semester 2023/24 application and enrolment numbers have risen again.

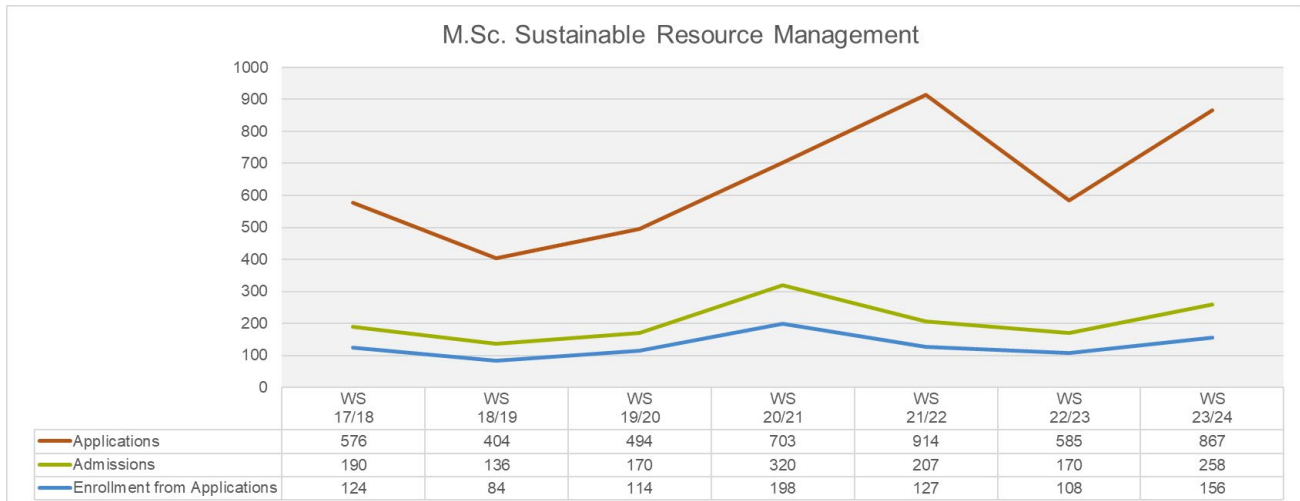


Figure 2: Number of applications, admissions, and enrollments for the M.Sc. Sustainable Resource Management since winter semester 2017/18 (Source: TUM Dashboard)

The international character of the program is well reflected by its global topics and their relevance, as well as in the English language of instruction, and in the proportion of international students, which has always averaged around 75% in recent years. The international students show a high diversity in their countries of origin. From study year 2015/2016 to 2023/24 (program versions 20151 to 20231), students originated from 90 countries around the world (see Figure 3, Table 1). Around 50-55% of the students came from least developed, low income, lower middle income, or upper middle income countries, as defined by the OECD list of developing countries (<https://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm>).

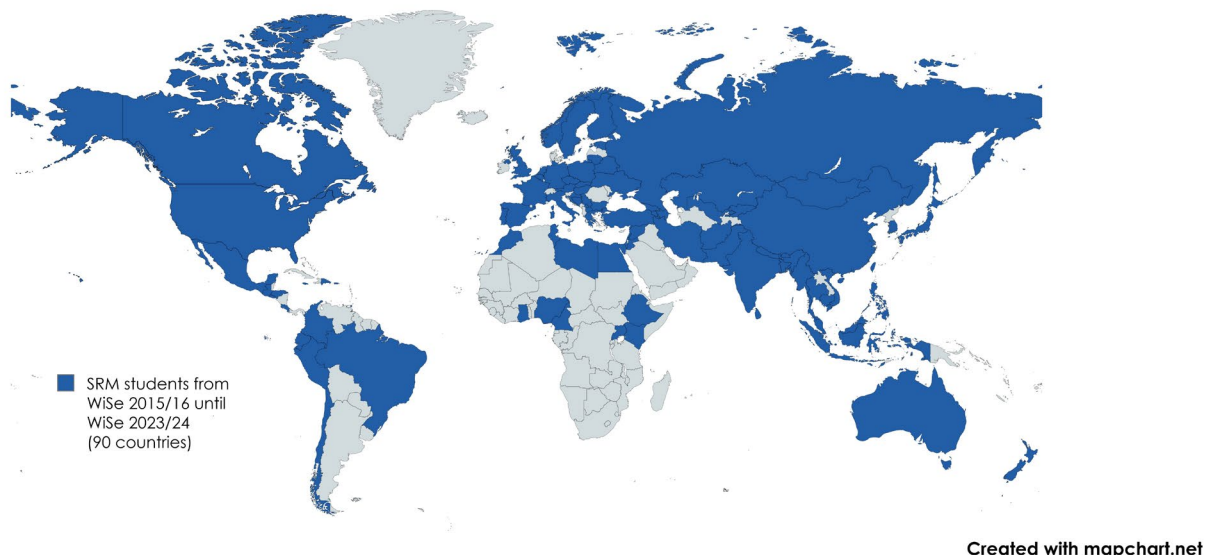


Figure 3: World map with countries of origin based on enrolled students from cohorts 2015/16 to 2023/24.

Table 1: Numbers of students in M.Sc. Sustainable Resource Management according from different continents (cases, WS 2023/24)

Number of Students/ Higher education entrance qualification (HZB) Continent	total	male	female	German	International
Overall result	497	208	289	100	397
Africa	21	9	12		21
America	73	27	46	1	72
Asia	250	129	121	1	249
Australia	2	1	1		2
Europa (EU)	124	33	91	98	26
Europa (non-EU)	27	9	18		27

4 Demand Analysis

The increasing global demand and consumption of natural resources and the associated environmental, social and economic problems represent some of the greatest ecological and political challenges of the 21st century due to the shortage of sources and the lack of renewability. For example, the progressive pollution of soils, air and water resources poses a significant threat to sustainable global development due to increasing pollutant emissions and a lack of education or deliberate ignorance. These factors are also reflected in the labor market, which increasingly requires employees in the field of environmental protection, renewable energies, or ecosystem management. The field of sustainability management is becoming increasingly important due to current global developments. For some years now, **sustainability managers** have been responsible in all larger companies and organizations for the integrative consideration and implementation of social, ecological, and economic concerns (sustainability controlling). Hence, sustainability management is an attractive field of employment for graduates of the master's program Sustainable Resource Management. Current developments such as climate change promote the frame conditions for the profession of resource manager more than ever, and the current economic and environmental situation contributes to a growing demand for qualified personnel in sustainable resource management and environmental protection.

In the European Union, employment in the environmental goods and services sector (also known as green economy) has grown by 59% from 2000 to 2020, while employment growth over all sectors was 10% in the same period (Figure 4 top). In 2020, more than 666,000 employees in Germany worked in the environmental goods and services sector. Since 2010, employment in the environmental goods and services sector has steadily increased (Figure 4 bottom). The development of the number of employees shows that environmental protection and green economy is an essential factor for the labor market. The labor market in the field of environmental protection includes not only jobs in the classic environmental protection areas, but also the upstream stages of the value chain. It is therefore also highly relevant to the field of activity of resource management. Other sectors of the economy, such as vehicle manufacturing, the chemical industry, and agriculture, are also linked to the fields of activity of environmental protection and resource management by ecological trends. An increase in employment can be seen, especially in environmental protection-oriented services. Figure 3 bottom shows that this is the most significant environmental protection industry sector, with approximately 1.7 million people employed.

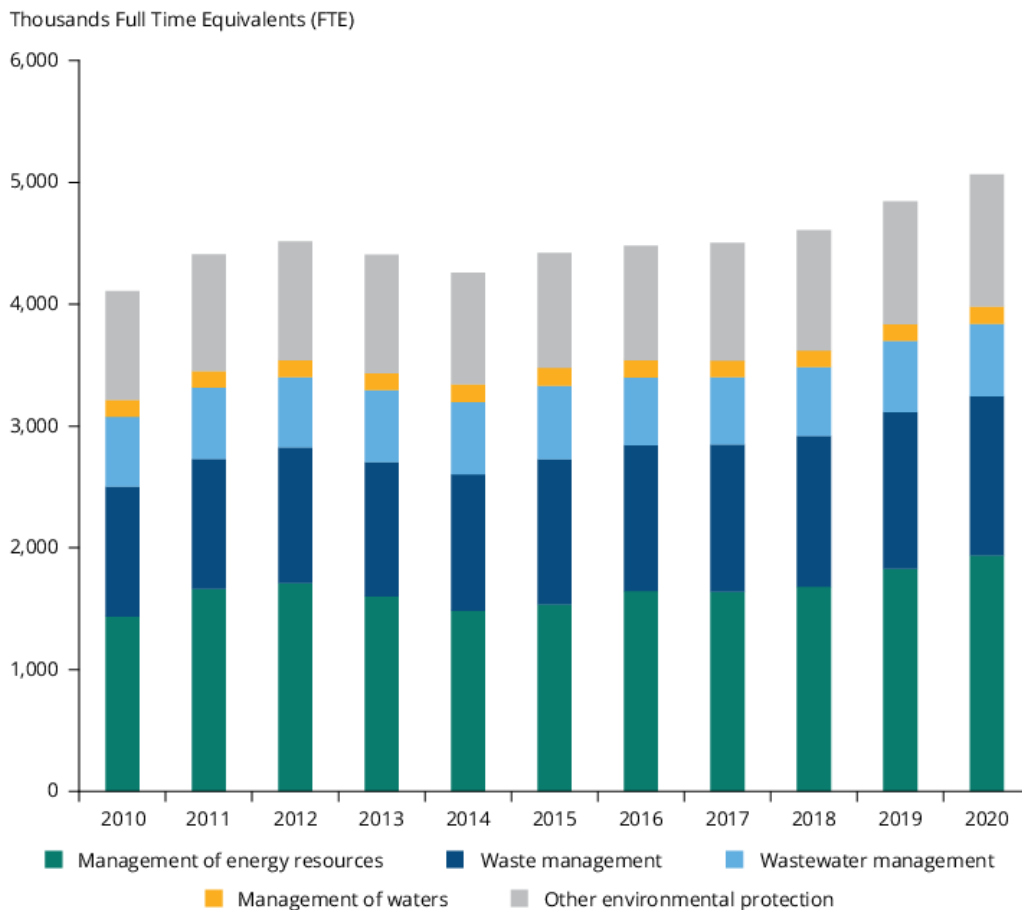
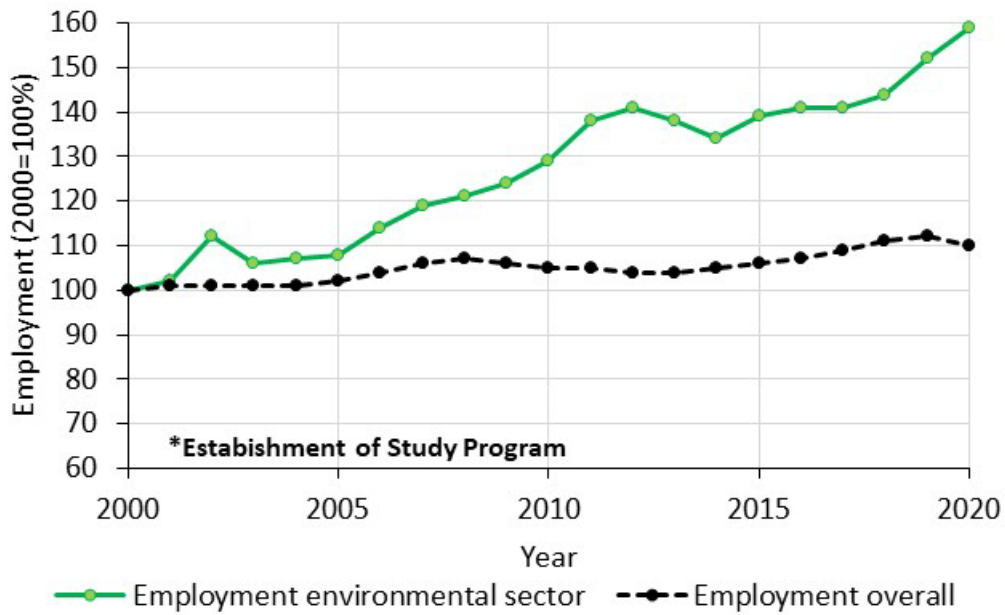


Figure 4: Top: Development of the employment in environmental protection in the European Union relative to the year 2000 (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_economy_%E2%80%93_statistics_on_employment_and_growth)

Bottom: Employment in the EU's environmental goods and services sector by domain, 2010-2020 (<https://www.eea.europa.eu/en/analysis/indicators/employment-in-the-environmental-goods>)

Environmentally oriented services cover a vast spectrum. This also includes fields of activity for graduates of the Sustainable Resource Management degree program. Environmentally oriented services embrace, for example, services for companies, including environmentally oriented databases and information systems, environmentally oriented legal and business advice, architectural and engineering offices, technical, physical, and chemical investigations. Public services, e.g. environmental legislation at various levels of local authorities, environmental consulting, environmental planning as well as control, testing and measuring activities also fall within the employment spectrum of graduates. The same applies to services in environmental education and other public and private services, such as non-governmental organizations or mobility services, including marketing, research, mediation, information, consulting, and transportation related to a more efficient and environmentally compatible use of the transport system. Environmentally oriented financial and insurance services, such as financing of environmental protection projects or regulation and financing of environmental damage, also fall into the sector of environmentally oriented services.

In addition to the growing green economy on a national level and the associated positive career prospects for graduates of the Sustainable Resource Management program, there is also an increasing demand for employees who have a high level of international experience, foreign language skills and intercultural competence. Fields of activity in the context of sustainable resource management include management activities in national and international governmental and non-governmental organizations (NGOs), environmental consulting and environmental information, ecosystem protection and management, environmental assessment and certification, and science and education. Graduate surveys show that graduates of the Sustainable Resource Management degree program are active in the relevant fields, with large to small companies, public administration, and universities playing a particularly important role as employers (Figure 5). According to the TUM graduate survey from 2023, graduates of the Master's degree program in Resource Management are predominantly employed in the sectors Consulting and Project Management. Given social and political developments, employees will be needed in the future who can act as guides for the future in times of political uncertainty and ecological challenges and who can make professionally sound decisions.

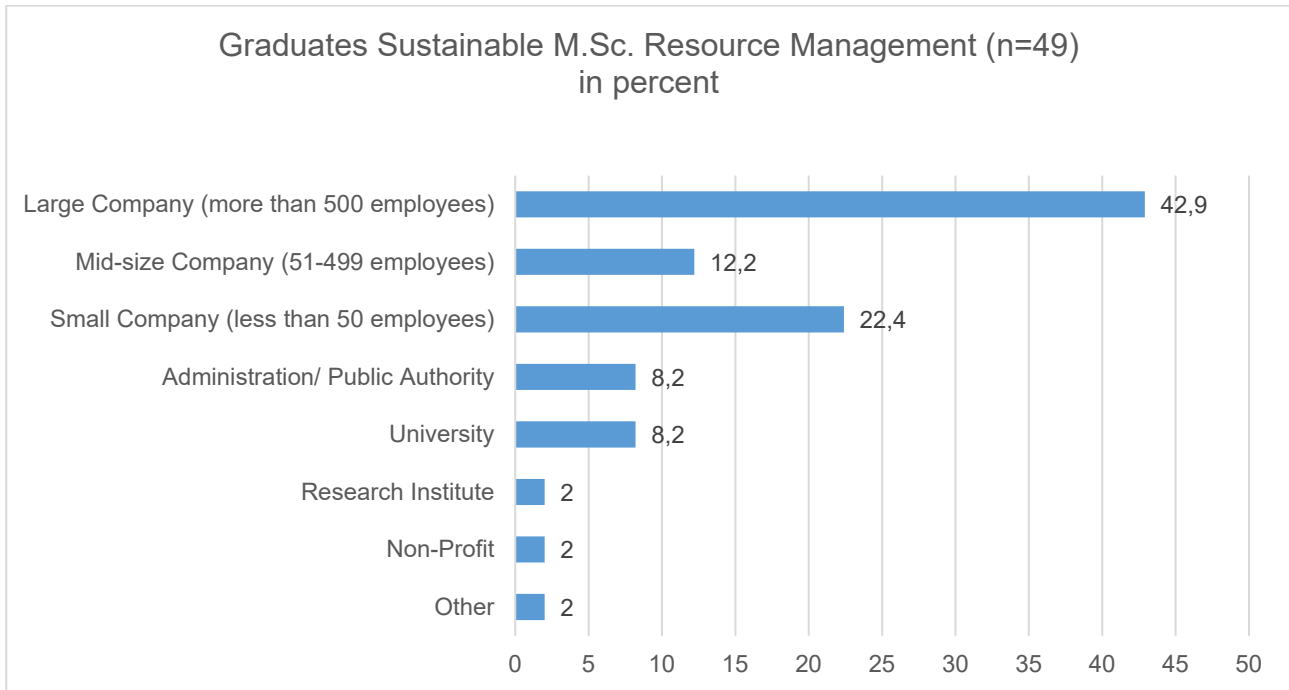


Figure 5: In which kind of company or institution are you currently employed? (Source: Graduate Survey, TUM 2023)

More than 40 % of the graduates are working as employees with middle-management function or executive employees, the remaining graduates are employees without managerial function, administrative staff or other functions (Fig. 6).

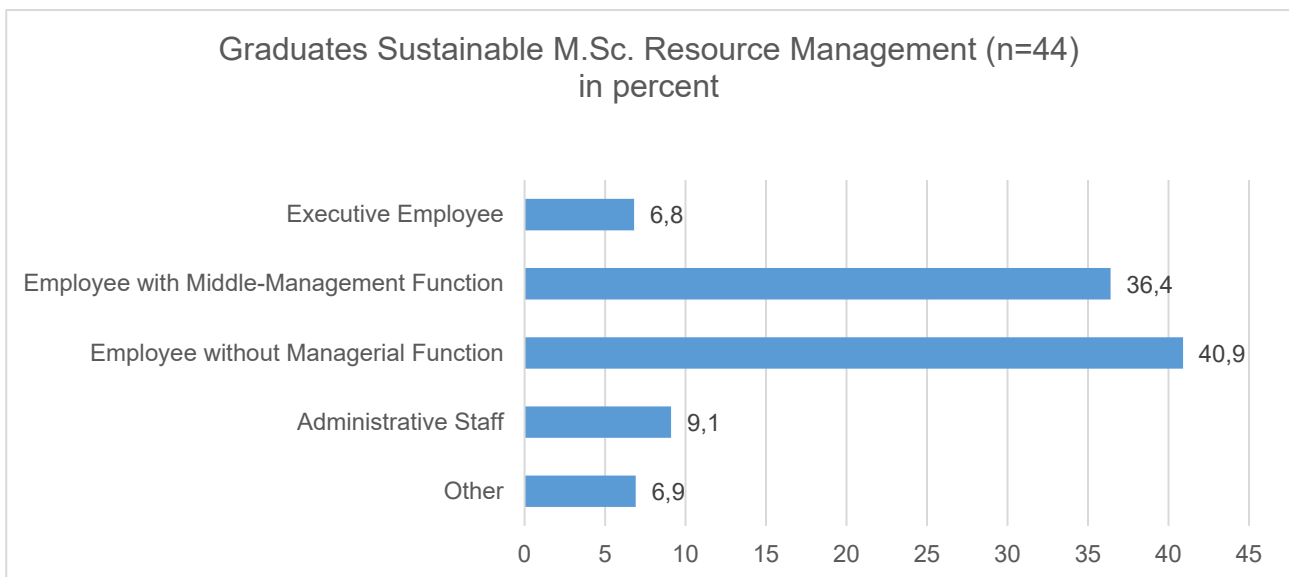


Figure 6: How would you describe your current professional status? (Source: Graduate Survey TUM 2023)

5 Competition Analysis

5.1 External Competition Analysis

The external competition analysis shows that both nationally and internationally, several universities offer Master's programs in the field of natural resource management, which are indirectly in competition with the Master's program "Sustainable Resource Management" at the Technical University of Munich due to their orientation. The orientation of other universities towards sustainability issues is an indicator of the fact that the universities are responding to an increased demand for graduates in this field. The master's program "Sustainable Resource Management" at the TUM stands out from its external competitors due to the following characteristics:

- The program has been recognized as an official project of the United Nations World Decade 2005-2014 "Education for Sustainable Development" for the years 2006/2007 and 2013/14. This international award is given by the United Nations in cooperation with UNESCO to high-quality and innovative initiatives for teaching sustainable thinking and action and underlines the high quality of the program.
- The study program area Forest Science and Resource Management has an own forest operation area near Landshut, which is managed by the Institute of Forest Management, for carrying out exercises and practical courses. This makes it possible, in vicinity to the Weihenstephan campus, to deepen and expand the theoretical content of the degree program together with the students on concrete objects.
- The program involves a large number of lectures from diverse disciplines at TUM and external lecturers from Germany and abroad, which gives students the opportunity to acquire skills in all areas of resource management and to establish contacts outside the university. In addition, these experts from various disciplines often have many years of experience in international cooperation and can pass this on directly to the students. Students also benefit from the large number of international projects and contacts of the various chairs and departments of the academic faculty.
- The high proportion of international students (approx. 75%) as well as the English teaching language contribute decisively to the special characteristics and atmosphere of the degree program. On the one hand, this promotes the intercultural competence of all students and lecturers and, on the other hand, significantly enriches the teaching by integrating a wide variety of individual professional backgrounds and experiences. In addition, students have the opportunity to network worldwide beyond their studies, which is supported by the faculty through an active alumni network.
- To promote sustainable resource management, the Audi Foundation for the Environment established the "SRM Award" for outstanding Master's theses in 2010. The award emphasizes the importance of the degree program for the green economy.

At the international level, there are numerous Master's programs related to sustainable resource management, which makes a competitive analysis difficult, but at the same time highlights the extremely high demand for academically trained experts in this field. Some of these degree programs have a similar holistic approach as the degree program Sustainable Resource Management, but many have a more narrowly defined subject area, e.g. within the disciplines of economics, ecology,

materials science, natural sciences, engineering or social sciences. In Table 2, selected 2-year English-language Master's degree programs at national and international level are listed which have a comparable portfolio of focus areas as the degree program Sustainable Resource Management.

Table 2: External competitive analysis Sustainable Resource Management (national and international master's programs)

University	Degree program	Main focus areas
National:		
Humboldt-Universität zu Berlin	Integrated Natural Resource Management (INRM)	Analysis of Natural Science and Social Contexts, Development and realization of concrete measures aimed at sustainable land use, Preservation of Natural Resources, Solving issues of natural, economic and social sustainability
Brandenburgische Technische Universität Cottbus-Senftenberg	Environmental and Resource Management	Environmental sciences, Environmental economics, Planning and law, Environmental engineering
Georg-August-Universität Göttingen	International Nature Conservation	Ecology, Nature conservation planning, Sustainability sciences (Ecological)
Christian-Albrechts-Universität zu Kiel	Sustainability, Society and the Environment	Ecology, Environmental management, Energy management, Sustainability sciences (Economic)
Technische Hochschule Köln	Natural Resources Management and Development	"Integrated water resources management IWRM", "Natural resources management and development NRM" and "Renewable energy management REM".
Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau	Environmental Sciences	Applied ecology, Aquatic systems, Chemicals in the environment, Environmental analysis, Landscapes and scales, Modelling, Socio-economics and environmental management, Soil systems
Leuphana Universität Lüneburg	Sustainability Sciences: Ecosystems, Biodiversity and Society	Biodiversity, Ecology, Resilience, Socio-ecological systems, Sustainability
Universität Potsdam	Climate, Earth, Water, Sustainability	Applied computer science, Environmental science, Geology, Geosciences, Hydrology, Sustainability Sciences (Ecological)
Universität Hohenheim	Environmental Science - Soil, Water and Biodiversity (Double Degree)	Climate change, Water and soil management, Environmental impacts, Land use, Ecosystem management, Biodiversity, Environmental management
International:		
Lincoln University in Canterbury, New Zealand (LU), the Czech University of Life Sciences Prague (CZU), and University of Natural Resources and Life Sciences, Vienna (BOKU)	Natural Resources Management and Ecological Engineering (NARMEE) - joint degree program	Agro-municipal resources management, Ecological engineering and risk management, Nature conservation and biodiversity management, Global resources and sustainability management, Human dimension and socio-economic aspects of sustainable development

Ghent University, Ghent, Belgium	International Master of Science in Sustainable and Innovative Natural Resource Manage- ment	From resource exploration to sustainable extraction pro- cesses and the development of more sustainable materi- als and recycling
University of South- ern Denmark, Esbjerg, Denmark	Environmental and Re- source Management	Natural science, Engineering, and Social science
University of Milano, Milano, Italy	Sustainable Natural Resource Manage- ment	Ecology and forest restoration, Green infrastructures and nature-based solutions, Environmental systems and anthropic impact, Forest management and planning, Ag- ricultural water management, Environmental bioremedia- tion
ETH Zurich, Switzer- land	Environmental Sci- ences	Atmosphere and climate, Biogeochemistry and pollutant dynamics, Ecology and evolution, Environmental sys- tems and policy, Forest and landscape management, Human health, Nutrition and environment

5.2 Internal Competition Analysis

The TUM offers related English language degree programs with different orientations to the master's program Sustainable Resource Management. These include, for example, the international degree program **Environmental Engineering** at the TUM School of Engineering and Design, which provides students with advanced knowledge and methods in a combination of two specific areas of specialization. Here, various relevant disciplines of the TUM School of Engineering and Design are combined. Out of 11 areas of specialization, two are chosen. The focus of the program is on an engineering education, which enables the students to derive engineering tasks and technical solutions in the field of environmental engineering.

The master's program **Sustainable Management and Technology** at TUM Campus Straubing and TUM School of Management offers two majors, one in Biotechnology and Material Sciences, the other in Sustainable Management. It specifically addresses students with a background in economics, management or business administration and bridges the gap between business and technical areas of enterprise.

The new master's program **Agri-Food Economics, Policy and Regulation** at TUM School of Life Sciences addresses the sustainable production of food in an economic and societal context by linking economics, politics, technology and ecology. Although sustainability issues, climate sciences, resources and ecology are addressed, the main focus is on agricultural economics, governance, and political sciences.

The unique feature of the master's program **Sustainable Resource Management** is its holistic and global approach. The focus here is on the management of natural resources such as water, air, soil and biodiversity with a view to sustainable economics and development, highlighting the multi-disciplinary character of sustainability issues. Furthermore, the program unites students from many different nations and is a unique program due to its internationality and the commitment of its student body and faculty.

6 Program Structure

6.1 Curriculum

The master's program Sustainable Resource Management has a regular study duration of four semesters. Each semester comprises 30 credits according to ECTS, which are earned in module courses, summing up to 120 credit points (CP). As an international program, the language of instruction and examination in the master's program Sustainable Resource Management is English. Figure 7 shows the structure of the program:

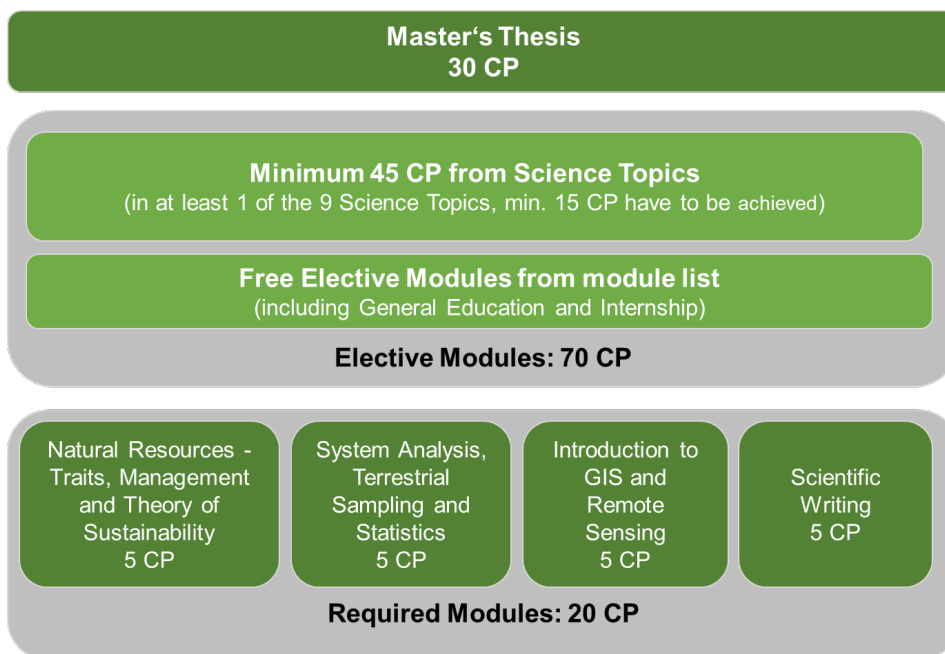


Figure 7: Schematic outline of the degree program structure.

The first semester is divided into four basic mandatory modules - in total 20 CP - and two elective modules (10 CP). Students have to achieve overall 70 CP in the elective area according to their personal profile. A minimum of 45 CP has to be earned in the area of Science Topics. In at least one of the nine Science Topics, a minimum of 15 credits has to be achieved.

In addition to elective modules from the Science Topics, there is a list of free elective modules that are not assigned to a specific Science Topic. To the extent of up to 4 CP, students have the opportunity to sign up for interdisciplinary competencies in the "General Education Subject", which is part of the free elective modules list and comprises modules from the TUM Language Center and the TUM School of Social Sciences and Technology (Kontextlehre WTG: Science, Technology, Society). Within the free elective modules, students also have the option to do an internship of 7 weeks which equates 10 CP. The final Master's Thesis comprises a total of 30 CP.

A sample curriculum with a focus on the Science Topics *Renewable Resources* and *Material and Waste Management* is shown in Table 3. In this example, three modules from the Science Topic *Renewable Resources*, three modules from *Material and Waste Management*, three modules from *Climate, Air and Water*, two modules from *Economical and Political Dimensions of Sustainability*, as

well as one module from *Landscape Management* were selected. In addition, the 7-week Internship was chosen as a Free Elective module.

Table 3: Sample curriculum (1) with a focus on the Science Topics 1. *Climate, Air and Water*; 5. *Material and Waste Management* and 6. *Renewable Resources*. The mobility window can be in the 2nd or 3rd semester.

Semester	Modules						Credits
1.	WZ1821 Natural Resources - Traits, Management and Theory of Sustainability (required) K 5 CP	LS50032 Systems Analysis, Terrestrial Sampling and Statistics (required) K 5 CP	LS50031 Introduction to GIS and Remote Sensing (required) K 5 CP	LS50030 Scientific Writing (required) W 5 CP	WZ4202 Political and Social Perspectives of Renewable Resources (elective) W 5 CP	WZ2732 Environmental Monitoring and Data Analysis (elective) K 5 CP	30/6
2.	WZ4098 Forestry Raw Materials and their Utilization (elective) K 5 CP	WZ2720 Renewable Energy Technologies (elective) K 5 CP	WZ4206 Material Flow Management and Application (elective) W 5 CP	ED130092 Waste and Waste Water Treatment (elective) K 5 CP	WZ2731 Hydrometeorology and Management of Water Resources (elective) M 5 CP	LS50026 Spatial Ecology (elective) K 5 CP	30/6
3.	WZ2723 Utilization and Treatment of Special Materials and Waste (elective) K 5 CP	WZ2724 Emission Control in Land-Use and Animal Husbandry (elective) M 5 CP	WZ2730 Climate Change Science, Impacts and Adaptation, Mitigation (elective) M 5 CP	WZ2936 Sustainable and Environmental Regulations (elective) PRÄ 5 CP	LS10013 Internship (7 weeks) (elective) B (SL) 10 CP		30/5
54	WZ2754 Master's Thesis B (SL) + W 30 CP						30/2
Key	dark blue = final thesis blue = elective modules grey = required modules			CP = credit points; SL = coursework; K = klausur (written exam); M = oral exam; PRÄ = presentation; B = report; PA = project work; W = research paper			

Table 4: Sample curriculum (2) with a focus on the Science Topics 4. *Management and Protection of Forest Systems* and 8. *Sustainable Agricultural Systems and Products*. The mobility window can be in the 2nd or 3rd semester.

Semester	Modules						Credits
1.	WZ1821 Natural Resources - Traits, Management and Theory of Sustainability (required) K 5 CP	LS50032 Systems Analysis, Terrestrial Sampling and Statistics (required) K 5 CP	LS50031 Introduction to GIS and Remote Sensing (required) K 5 CP	LS50030 Scientific Writing (required) W 5 CP	WZ1822 Introduction to Economics and Business Ethics (elective) K 5 CP	WZ0322 Ecological Colloquium: Scientific Foundations and Applications in Practice (elective) B 5 CP	30/6
2.	WZ1561 Value Chain Economics PA 5 CP	WZ4161 Forest Management (elective) M 5 CP	WZ4197 Protected Areas Biodiversity and Management (elective) K 5 CP	WZ4198 Wildlife Management and Wildlife-Human Interactions (elective) W 5 CP	LS10013 Internship (7 weeks) (elective) B (SL) 10 CP	30/5	
3.	WZ2717 Genetic Resources Management and Forest Protection (elective) K 5 CP	WZ4082 Plantation Forestry and Agroforestry (elective) M 5 CP	MGT001412 Sustainability Assessment of Agri-Food Supply Chains (elective) B 5 C	WZ2734 Soil Protection (elective) M 5 CP	LS10016 Environment, Agriculture and Food B 5 CP	LS10013 Modelling and Statistical Analysis of Large Arrays PO 5 CP	30/6
64	WZ2754 Master's Thesis B (SL) + W 30 CP						30/2
Key	dark blue = final thesis blue = elective modules grey = required modules			CP = credit points; SL = coursework; K = klausur (written exam); M = oral exam; PRÄ = presentation; B = report; PA = project work; PO = portfolio; W = research paper			

6.2 Modules

The degree program Sustainable Resource Management is characterized by a high degree of internationality as well as heterogeneity in the previous education of the first-year students. In order to create a common professional basis and to make it easier for international students to start and plan their studies, the first semester of the program consists of four compulsory basic modules with a total of 20 CP. The first semester also gives the option to choose two elective modules, that build on the students' academic background. In the second and third semester, students sharpen their individual professional profiles by choosing elective modules from the nine Science Topics.

Compulsory Modules:

In the module **Natural Resources - Traits, Management and Theory of Sustainability**, lecturers from a wide range of research areas provide an insight into the thematic diversity and depth of content of resource management. In addition, students become familiar with the term sustainability and the concepts associated with it.

The module **Systems Analysis, Terrestrial Sampling and Statistics** teaches methods and tools of systems analysis, sampling and statistics. Using examples and data from existing research projects and the literature, complex issues such as ecosystem development and processes are analyzed with the help of simulation models. The module also introduces important terrestrial inventory methods for sustainable resource management and statistical methods and concepts, which are a prerequisite for the application-oriented elective modules of the higher semesters.

The module **Introduction to GIS and Remote Sensing** gives a basic understanding of Geographical Information Systems, the physical background and sensor concepts. In addition, evaluation strategies and spatial information extraction are elucidated. The methods and concepts learned in theory are practiced and deepened in practical exercises.

In the module **Scientific Writing**, students are introduced to the topic of scientific work. The module is intended to prepare students from different disciplinary and international backgrounds for the generally applicable standards of scientific work, the mastery of which is indispensable for the further successful course of studies.

Elective Modules - Science Topics:

From the first semester on, students have the opportunity to choose elective modules according to their main interests. For this purpose, they can choose from nine Science Topics, which they can freely take in their elective area. A minimum of 45 CP has to be reached and at least one Science Topic has to be covered with three or more modules.

Nine Science Topics and correspondingly assigned elective modules are offered in the program (Table 4).

Table 5: Science Topics and Elective Modules

Science Topics	Elective Modules			
1. Climate, Air and Water	Climate Change - Science, Adaptation, and Mitigation	Environmental Monitoring and Data Analysis	Hydrometeorology and Management of Water Resources	Mountain Catchments under Changing Climate
2. Economic and Political Dimensions of Sustainability	Economics of Environmental and Climate Policy	Environmental and Natural Resource Economics	Introduction to Economics and Business Ethics	Sustainable and Environmental Regulations
3. Landscape Management	Landscape Management – Application Study	Landscape Planning	Remote Sensing and Image Processing	Spatial Ecology
4. Management and Protection of Forest Ecosystems	Forest Growth and Forest Operations	Forest Management	Genetic Resources Management and Forest Protection	Plantation Forestry and Agroforestry
5. Material and Waste Management	Emission Control in Land-Use and Animal Husbandry	Material Flow Management and Applications	Utilization and Treatment of Special Materials and Waste	Waste and Waste Water Treatment
6. Renewable Resources	Integration of Renewable Energies	Forestry Raw Materials and their Utilization	Political and Social Perspectives of Renewable Resources	Renewable Energy Technologies
7. Soils and Soil Management	Analytical Characterization of Soil Resources	Introduction to Soil Science	Soil Protection	World Soil Resources
8. Sustainable Agricultural Systems and Products	Environment, Agriculture and Food	Live Stock Production and Global Grasslands	Sustainability Assessment of Agri-Food Supply Chains	Value Chain Economics
9. Wildlife and Protected Area Management	Fisheries and Aquatic Conservation	Protected Areas Biodiversity and Management	Wildlife and Conservation Biology	Wildlife Management and Wildlife-Human Interactions

In the **Science Topics**, the methods learned in the first semester are applied using selected natural resources as examples. The focus is on the development of concepts for the sustainable use of the resources dealt with, taking into account ecological, economic and socio-political factors. In principle, students are free to choose the modules from the Science Topics. Due to the complexity of some topics, modules from the Science Topics can build on each other. In this case, recommendations are made to choose certain modules in a coherent way.

After participating in the Science Topic **Climate, Air and Water**, students understand the importance of climate, water and air in ecosystem management and are able to assess the main impacts of changing environmental conditions. They know different analytical methods for quantitative and qualitative characterization of climate and water properties and are able to apply them and interpret the obtained results. Furthermore, they are able to make statements about possible future developments and to develop concepts for sustainable land use in the water nexus and for climate protection.

In the Science Topic **Economic and Political Dimensions of Sustainability**, students receive an introduction to economics with a focus on the environmental and welfare effects of economic activity. Students are introduced to classical concepts of duty, consequentialism and management virtues in the context of corporate social responsibility and corporate governance. Students learn the fundamental concepts of sustainable development, its theoretical and empirical implications related to

important policy fields. Students will learn the economic view of environmental and resource problems and policy options of overcoming them. Policy measures for environmental and climate protection will be analyzed theoretically based on welfare economic approaches whereas the implementation in practice will be discussed based on the public choice theory.

After completing the Science Topic **Landscape Management**, students are able to plan and implement measures for the development of the landscape under the premise of sustainable development on the basis of comprehensive analyses. To this end, they are familiar with the most important survey, analysis, planning, and evaluation procedures and are able to coordinate these and apply them independently. In particular, the students are able to use the possibilities of geographical information systems. Furthermore, they are able to assess the effects of interventions in the landscape and to apply suitable techniques for the limitation and elimination of damages.

After participating in the Science Topic **Management and Protection of Forest Ecosystems**, students understand the socio-political, economic and ecological significance of forest ecosystems. They know the basics of sustainable forest management and are able to analyze the ecological interrelationships with significance for forest growth and to apply their knowledge for the sustainable use and protection of forest ecosystems. In addition, students are taught technical skills in the field of silvicultural planning, forestry technology and forest management planning.

In the Science Topic **Material and Waste Management**, students are taught skills in the area of goods, material, substance, and residue management. Graduates understand various methods of residual material disposal and can apply their knowledge to different problems. They know the methodical basics for systems analysis and determination of material and substance flows and, based on this, are able to independently develop concepts for resource and residual substance management, taking into account aspects of resource availability and environmental impact. In doing so, they are able to apply evaluation methods and to check different environmentally compatible variants and to consider aspects of air, soil, water, and health protection.

Graduates of the Science Topic **Renewable Resources** understand the significance, potential, and possible applications of various renewable raw materials and regenerative energy sources. They are familiar with the essential process steps of the different utilization lines with their respective advantages and disadvantages and are able to assess the economic and ecological consequences of different forms of utilization. They are also able to assess potentials and risks with regard to the use of regenerative energy sources. Furthermore, the graduates know the most important basics of plant breeding and understand their importance in relation to renewable resources.

After participating in the Science Topic **Soils and Soil Management**, students understand the role of soils in terrestrial ecosystems. They know the physical, chemical and biological properties of soils, understand their genesis and can assess the potential of their use and the threats to their functions for all soils of the world. They master the most important methods for addressing soils in the field and for analysis in the laboratory and can interpret the analytical results. They are able to characterize soils in terms of their natural fertility and in terms of human-induced degradation. They are able to develop concepts for the remediation of contaminated soils. They know the central importance of soil in the global carbon cycle and climate change.

Sustainable Agricultural Systems and Products offers a comprehensive examination of the economic, environmental, and societal aspects shaping modern agri-food systems. Through interdisciplinary study, students analyze value chain economics, global trends, challenges, and regulatory frameworks influencing agricultural markets. They assess the impacts of climate change, land use,

and biodiversity conservation on agricultural practices worldwide, and scrutinize livestock production and grassland management for their ecological, societal, and economic implications, employing sustainability metrics and scenario analysis to inform decision-making. Additionally, students assess sustainability within agri-food supply chains, identifying and addressing key drivers and hotspots through quantitative methods and case studies. By integrating these diverse perspectives, the program equips students with the knowledge and tools to navigate the complexities of modern agriculture and to contribute to sustainable global agri-food systems.

In the Science Topic **Wildlife and Protected Area Management**, students are taught skills related to the protection and management of wildlife and their habitats. Graduates understand the relevant ecological relationships and are able to derive from these the essential principles of sustainable wildlife and protected area management. They know the importance of protected areas for nature conservation and environmental protection as well as for environmental education and are able to develop concepts for the sustainable use of these areas. They are able to identify possible conflicts of interest and to develop appropriate solution strategies.

Free Elective Modules Sustainable Resource Management

In addition to the elective modules offered in the Science Topics, students can choose from a range of “free” elective modules that are not assigned to a specific Science Topic. The list will be continuously extended with suitable modules that fit in the scope of the degree program. The following elective modules are part of the subject examination regulations and can be taken freely by the students.

- Ecological Colloquium: Scientific Foundations and Applications in Practice
- Modelling and Statistical Analysis of Large Arrays
- Urban Ecology
- Urban Forestry

Students in the master’s program have the option to complete a professional internship of at least seven weeks in the field of resource management which yields 10 CP. The internship is intended to give students an insight into the wide range of activities in the field of sustainable resource management and an understanding of its different significance outside of university education. In addition, the internship offers the opportunity to already establish contacts with potential employers. The internship can be completed either in the home country or abroad. In the context of the internship, the writing of an internship report is required.

As an additional option, students can earn up to 4 CP from the category General Education Subject, which includes courses from the TUM Language Center and the TUM School of Social Sciences and Technology (Kontextlehre WTG: Science, Technology, Society), to improve their language competencies or soft skills.

Students can also choose elective modules from TUM's overall range of courses to round off their own profile and develop particular strengths (up to 30 CP, via individual approval by the Board of Examination).

Master's Thesis

The fourth semester of the program is completely available for the preparation of the Master's Thesis. The Master's Thesis comprises 30 credits and can be freely chosen by the student. At the beginning of the thesis, the student defines a project plan with the respective supervisor and prepares a topic-related Master's Thesis proposal.

In the Master's Thesis, students demonstrate that they are able to work independently on a topic in the field of sustainable resource management using scientific methods. In doing so, the students apply the skills they have learned in the modules of the program in the area of scientific work and project management.

Teaching Concepts in the context of (inter)disciplinary qualifications

In seminars, students learn to discuss subject-specific and methodological content with fellow students and lecturers in academic discourse. They acquire additional professional skills in the areas of conversation and presentation techniques. Students are trained in teamwork and conflict resolution in an intercultural environment in the seminars and as part of their final thesis. They acquire cooperation and communication skills in contact with academics at an international level. By working in study groups with fellow students from different countries with diverse linguistic and cultural backgrounds, they also acquire skills in international communication.

6.3 Stays abroad on the degree program

If desired, students have the option to use the 2nd or 3rd semester as a mobility window, which allows them to bring in credits from modules that are in the scope of the Sustainable Resource Management program and which are offered by other German or international universities. The TUM Global & Alumni Office and the International Office at TUM School of Life Sciences assist in choosing appropriate exchange programs and host universities.

Students on the master's degree program in Sustainable Resource Management at the TUM School of Life Sciences can take part i.a. of the following funding programs for their stay abroad:

Within Europe:

- Erasmus+ SMS (study semester)
- Erasmus+ SMP (internship)
- SEMP (Switzerland)
- Athens EU (short term mobility)
- Self organized study semester (Free Mover)

Worldwide:

- TUMexchange
- Erasmus+ (international dimension)
- TUM Without borders
- Scholarship abroad (internships & self organized study semester)

Further:

- PROMOS (final theses and seminar papers)
- PROMOS (TUMexchange applicants)

- PROMOS (study- & competition trips)

The Academic Program Unit of Forest Science and Resource Management at the School of Life Sciences has agreements with 32 partner universities in the following EU and partner countries:

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- France
- Italy
- Netherlands
- Norway
- Poland
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland

7 Organization and Coordination

The master's program Sustainable Resource Management is offered by the TUM School of Life Sciences.

Areas of responsibility might be listed as follows:

The following administrative tasks are performed partly by the TUM Center for Study and Teaching (TUM CST) and its administrative units, partly by offices in the schools or departments:

- Student Advising: Student Advising and Information Services (TUM CST)
studium@tum.de
 +49 (0)89 289 22245
 Provides information and advising for prospective and current students (via hotline/service desk)
- Departmental Student Advising: Dr. Eva Bauer
srm.co@ls.tum.de
 +49 (0)8161 71 4464
- Academic Affairs Office (within department/school), Infopoint, etc.: Campus Office Weihenstephan
campus.office@ls.tum.de
- Study Abroad Advising/ Internationalization: TUM-wide: TUM Global & Alumni Office
internationalcenter@tum.de
 Departmental: Campus Office Weihenstephan
international.co@ls.tum.de
- Gender Equality Officer: Prof. Aphrodite Kapurniotu
akapurniotu@mytum.de
- Advising – Barrier-Free Education: Service Office for Disabled and Chronically Ill Students (TUM CST)
handicap@zv.tum.de
 +49 (0)89 289 22737
- Admissions and Enrollment: Admissions and Enrollment (TUM CST)
studium@tum.de
 +49 (0)89 289 22245
 Admissions, enrollment, Student Card, leaves of absence, student fees payment, withdrawal

- Aptitude Test (EV): TUM-wide: application and enrollment (TUM CST)
Departmental: Campus Office Weihenstephan
Dr. Sabine Köhler
application.co@ls.tum.de
+49 (0)8161 71 3336
- Semester Fees and Scholarships: Fees and Scholarships (TUM CST)
beitragsmanagement@zv.tum.de
Scholarships and semester fees
- Examination Office Central Examination Office (TUM CST)
Graduation documents, notifications of
examination results,
preliminary degree certificates
- Departmental Examination Office: TUM School of Life Sciences;
Campus Office Weihenstephan
Team Examination Office
examination.co@ls.tum.de
- Examination Board: Prof. Dr. Gabriele Weber-Blaschke (Chair)
Susanne Minges (Secretary)
- Quality Management -
Academic and Student Affairs: TUM-wide: Study and Teaching -
Quality Management (TUM CST)
www.lehren.tum.de/startseite/team-hrsl/

Departmental: Campus Office Weihenstephan
Team Quality Management
qm.co@ls.tum.de
Organization QM Circle, Evaluation, Coordination
Module Management

8 Enhancement Measures

Considerations on the sustainability of the use of our natural resources gained a lot of attention towards the end of the last millennium. The World Summit in Rio de Janeiro (1992) on the relationship between environment and (economic) development brought movement into the discussion, which had already begun in the early 1970s with the studies on "Limits to growth" in the general public. It was clear that this challenging issue could only be tackled on an international level. Against this backdrop, a small group of Weihenstephan forest scientists conceived a broad-based international course of study that covered important areas of sustainable resource use and extended far beyond the purely forest science horizon. Fortunately, the German Academic Exchange Service granted generous start-up funding so that the degree program could begin with about 20 students and with the help of broad support from many disciplines at the Weihenstephan campus in 2001.

Since then, demand for places has increased steadily, reaching a consistently high level of around 400 to 600 applications per year. To date, students from more than 90 different countries have been admitted to the Master's program "Sustainable Resource Management". Especially students from the fields of engineering and economics see very good complementarity in our course of studies to their previous knowledge. The course has been reformed several times. First, the choice of semesters was extended from three to four. Elective options and aspects of flexibility have been continuously and specifically improved. The principle of educating generalists in the diverse aspects of sustainable resource management is a shared guideline for the degree program.

Following the last EQMZ (in 2022) the following desirable activities were mentioned:

Due to the record-high application and enrolment numbers the vast majority of lectures experienced "limits to growth" of the study program. Specifically, the high-quality education in partly small groups cannot be maintained long-term with these extremely high beginner numbers. A reduction of the numbers of the beginners were thus considered as desirable. The following measures have been taken to achieve this aim:

- Better communication the unique selling points and distinguishing the study program better from other offered programs in the same field

- Better information of the prospective students about contents and intended qualification profiles so that the applicants have a more realistic picture about what they have to expect from the study program

- To renovate the applicant selection process, a more efficient aptitude assessment has been established using an online admission test

The reinforcement of the following suggested fields has been considered when renovating the study program:

When redesigning the degree program, for example, it was suggested that the political goals for sustainable development should be included more intensively without losing the scientific depth. Life cycle assessment (LCA) was strengthened by the addition of Prof Livia Cabernard.

Table 6: Comparison of the new and previous division of compulsory and elective modules

Validity	SPO 20231	SPO 20241 (from WS 24/25)
Required Modules	33 CP	20 CP
Internship (Required Module)	12 CP	0 CP
Elective Modules	45 CP <ul style="list-style-type: none"> • 8 Science Topics 30 CP • Free Electives 15 CP 	70 CP <ul style="list-style-type: none"> • 9 Science Topics: a minimum of 45 CP, and at least 1 Science Topic with a minimum of 15 CP • Free Electives: (including Internship, 10 CP)
Master's Thesis	30 CP	30 CP

Compared to other Master's degree programs, the Master's in Sustainable Resource Management previously required a large number of compulsory modules. In order to make the program more flexible, the number of compulsory modules in the first semester were reduced. The content of the remaining compulsory modules has been revised and the workload has been optimized in coordination with the students (e.g., new organization of Systems Analysis, Terrestrial Sampling and Statistics). Students can now already choose two elective modules with a total of 10 Credits in the first semester. The compulsory area now comprises a total of 20 Credits, instead of the previous 30 Credits.

The elective area has been expanded to a total of 70 CP, to enable students thereby to develop an even stronger individual profile. It includes former compulsory modules such as Internship and some modules from the list Management Aspects. The Science Topics area were reorganised and now comprise nine Science Topics, like the new Science Topic *Economic and Political Dimensions of Sustainability*. General Subject has been moved from the compulsory area to the list Free Electives.

In the current reaccreditation, the following topics were included in the newly named Science Topic: Sustainable Agricultural Systems and Products (previously Sustainable Agricultural Value Chains) by newly appointed professors Prof. Livia Cabernard and Prof. Rufino: Environment, Agriculture and Food, Live Stock Production and Global Grasslands, Sustainability Assessment of Agri-Food Supply Chains.