



Bachelor of Science: Forestry

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MISSION STATEMENT

The mission of SRU's forest science programme is an interdisciplinary degree that prepares graduates for managing forest resources by combining core science courses with management, commerce, and technology. The degree follows a closely prescribed structure, with introductory courses in biology and forestry sciences, and advanced courses in forestry and industry.

PROGRAM LEARNING OBJECTIVES

The forest science program will allow graduates to:

- 1. Understanding of taxonomy and ability to identify forest and other tree species, their distribution, and associated vegetation and wildlife.
- 2. Understanding of soil properties and processes, hydrology, water quality, and watershed functions.
- 3. Understanding of ecological concepts and principles including the structure and function of ecosystems, plant and animal communities, competition, diversity, population dynamics, succession, disturbance, and nutrient cycling.
- 4. Ability to make ecosystem, forest, and stand assessments.
- 5. Understanding of tree physiology and the effects of climate, fire, pollutants, moisture, nutrients, genetics, insects and diseases on tree and forest health and productivity.
- 6. Ability to identify and measure land areas and conduct spatial analysis.
- 7. Ability to design and implement comprehensive inventories that meet specific objectives using appropriate sampling methods and units of measurement.
- 8. Ability to analyze inventory data and project future forest, stand, and tree conditions.
- 9. Ability to develop and apply silvicultural prescriptions appropriate to management objectives, including methods of establishing and influencing the composition, growth, and quality of forests, and understand the impacts of those prescriptions.
- 10. Ability to analyze the economic, environmental, and social consequences of forest resource management strategies and decisions.
- 11. Ability to develop management plans with specific multiple objectives and constraints.
- 12. Understanding of the valuation procedures, market forces, processing systems, transportation and harvesting activities that translate human demands for timber-based and other consumable forest products into the availability of those products.
- 13. Understanding of the valuation procedures, market, and non-market forces that avail humans the opportunities to enjoy non-consumptive products and services of forests.
- 14. Understanding of the administration, ownership, and organization of forest management enterprises.
- 15. Understanding of forest policy and the processes by which it is developed.
- 16. Understanding of how federal, state, and local laws and regulations govern the practice of forestry.
- 17. Ability to understand the integration of technical, financial, human resources, and legal aspects of public and private enterprises.

PROGRAM LEARNING OUTCOMES

The expected learning outcomes of the program include: emphasis on verbal, written and interpersonal communication skills, and development of critical thinking and problem-solving skills. Students will be expected to gain an awareness and understanding of differing viewpoints, and to demonstrate knowledge of international forestry, sustainable forest management, certification processes, and broad ecosystems services.

- 1. Demonstrate knowledge of forest ecology and silviculture principles to understand how forests and forested watersheds respond to natural disturbances or management activities.
- 2. Develop skills in geospatial analysis, basic surveying, mapping, and GIS.
- 3. Demonstrate ability to measure and inventory forest vegetation with precision and accuracy.
- 4. Develop an understanding of forestry investment analysis and be able to evaluate typical financial investments in forestry.
- 5. Demonstrate an understanding of the development and execution of strategic, tactical and operational forest plans that support achievement of desired future stand conditions and strategic goals.
- 6. Demonstrate an understanding of the social and political context of forestry and be able to describe current policies, laws, and regulations governing the management of forest lands.

ENTRY REQUIREMENTS

The student must have 6 passes in SGCSE/GCE/IGCSE O' level including a pass with Grade C or better in English Language and at least four other subjects. Special: Mathematics and any other two from Agriculture/Geography, Biology, Chemistry, Combined Science, Physics, Physical Science and/or Human and Social Biology. Faculty may set mature entry requirements subject to approval by Senate.

CAREER OPPORTUNITIES

- Land Conservation Specialist Develop and implement conservation programs for public or private landowners to improve forest or land restoration efforts.
- **Consulting Forester** Offer advice and services to private land owners about sale of forestland, landscape planning, pest control, timber stand improvement, wildlife management, timer sales and more.

- Environmental Biologist Conduct on-site research in your specialty field, as well as develop wildlife management strategies and environmental conservation efforts.
- Extension Agent Develop and deliver educational programs to assist with economic and community development, leadership, agriculture and environmental issues.
- **Certified Forester** Assess forests for timber sale, wildlife management, pest management, economic viability and landowner goals.
- Service Forester Conduct wildlife and natural resource management, enforce local and national laws, develop and implement educational programs, fight forest fires and provide emergency response when needed.
- **Timberland Appraiser or Procurement** Appraise, buy and sell trees, forests and forestland.
- Wetlands Specialist Improve and maintain water resource cleanliness, implement remediation projects, monitor and analyze wetland data, collect soil samples, track aquatic life, survey wetlands and write reports.
- **Forestry Technician** Conduct harvest preparation, reforestation, tree stand care, erosion control and habitat improvement, in addition to planning, assessing, inspecting and directing forestry projects.
- **Forest Management Specialist** Execute timber surveys, develop and maintain forest maps, analyze wildfire statistics and coordinate fire control, and provide technical consulting with industry and government.
- Research Forester represents a new option for business and technology leaders who need help solving problems, making decisions, and taking action to deliver results. The portfolio combines research-based insights, models, and frameworks with handson guidance in the forestry sector.
- **Planning Forester -** plan, maintain, and preserve forests and forest resources for public and private use. They may protect wilderness areas, enhance habitats for a variety of species, facilitate public recreation, and manage fires.
- **Harvesting Forester** Maintain and report **harvesting** crew production and ensure crews are issued with prescription and inductions prior to commencing a new **harvest** area.

Springfield Research University

Bachelor of Science Forest Science

Proposed Course Modules and Synopsis

YEAR 1

Semester	Code	Course	Lectures (Hrs)	Practicals (Hrs)	Credits
1	SFR100	Calculus - Mathematics	70	0	7
1	SFR101	Trees, Forests and the Environment	60	20	8
1	SFR102	Forest Resources	60	10	7
1	SFR103	Commercial Aspects of Forestry	70	0	7
1	SFR104	Trees in the Landscape	60	30	9
1	SFR105	Forest Growth and Measurements	60	20	7
	TOTAL				41
2	SFR106	Ecology, Evolution and Conservation	70	30	10
2	SFRSTAT107	Statistics 1	60	0	6
2	SFR108	Introduction to Forest Engineering	70	30	10
2	SFR109	Introduction to Principles of Forest Economics	60	0	6
2	SFR110	Introduction to Forest Biology	50	10	6
2	SFR111	Academic Communication Skills	50	0	5
2	SFR112	Principles of Microeconomics	60	0	6
	TOTAL				49

YEAR 2

Semester	Code	Course	Lectures	Practicals	Credits
			(Hrs)	(Hrs)	
3	SFR200	Forest Biology	50	30	8
3	SFR201	Introduction to Silviculture	60	10	7
3	SFR202	Principles of Biometry1A	70	0	7
3	SFR203	Soil Fertility/Soil Science	50	30	8
3	SFR204	Intro. to Public Speaking or Environmental Communication Skills	50	10	6
3	SFR205	Chemistry	60	30	9
	TOTAL				45

4	SFRSTAT206	Biometry1B	60	0	6
4	SFR207	Plantation Silviculture 1	60	30	9
4	SFR208	Forest Management	60	0	6
4	SFR209	Wood Science	60	20	8
4	SFR210	Applied GIS	60	20	8
4	SFR211	Advanced Forest	60	20	8
		Measurement and Models			
	TOTAL				45

YEAR 3

Semester	Code	Course	Lectures	Practicals	Credits
			(Hrs)	(Hrs)	
5	SFR300	Plantation Silviculture 2	60	40	10
5	SFR301	Forest Pests and Diseases	60	30	9
5	SFR302	Wildlife Management for	60	30	9
		Forestry			
5	SFR303	Forest Research Methods	60	20	8
5	SFR304	Forest Fire Management	60	30	9
	TOTAL				45
6	SFR305	Industrial/Field Attachment	24	426	45
	TOTAL				45

YEAR 4

Semester	Code	Course	Lectures	Practicals	Credits
			(Hrs)	(Hrs)	
7	SFR400	Geospatial Science in Forest	70	10	8
		Monitoring and Management			
7	SFR401	Forest Practice	50	30	8
7	SFR402	Forest Harvest Planning	70	10	8
7	SFR403	Environmental Forestry	60	20	8
7	SFR404	Computer Applications in	45	5	5
		Forestry and Wood Technology			
7	SFR405	Forest Landscape Management	70	10	8
		and Planning			
	TOTAL				45
8	SFR406	Forest Products Marketing	50	4	5.4
8	SFR407	Forest Economics 2	50	4	5.4
8	SFR408	Forest Tree Breeding	32	22	5.4
8	SFR409	Biosecurity Risk Management	54	0	5.4
8	SFR410	Research Project	19	103	18
8	SFR411	Forest Resources Business,	50	4	5.4
		Marketing, and			
		Entrepreneurship			
	TOTAL				45

ELECTIVES

Semester	Code	Course	Lectures (Hrs)	Practicals (Hrs)	Credits
3	SFR212	Regression Modelling	45	9	5.4
3	SFR305	Nursery Practice	45	9	5.4
3	SFR306	Chainsaw Operation	45	9	5.4
3	SFR307	Contractor Management	45	9	5.4
3	SFR308	Forest Weed Science	45	9	5.4
	TOTAL				27

DESCRIPTION OF COURSES

SFR100 CALCULUS MATHEMATICS

This course provides an introduction to differentiation and its applications. Topics covered include: functions and their graphs, limits, continuity, differentiation, linear approximation, chain rule, min/max problems, and applications of derivatives, inverse trigonometric functions, Riemann sums, fundamental theorem of calculus, basic techniques of integration, volumes of revolution, arc length, exponential and logarithmic functions, and applications.

SFR101 TREES, FORESTS AND THE ENVIRONMENT

The course focuses on tree classification and identification. The nature and location of World's forests.. Forests as communities of plants, animals and micro-organisms. The role of forests in the conservation of soil, water and biodiversity, and in the provision of recreation and other forest products. Sustainable forest management. The course explores the interaction between forests and people, linking forest types and locations to their products and services. We discuss sustainable forest management, the role of forestry tackling climate change. Forests are an integral part of the landscape and natural environment. In this course you will learn that forests are communities of plants, animals and micro-organisms, and how they vary both in Eswatini and worldwide. As part of this, students will learn to identify and characterise Eswatini's most common commercial and indigenous forest tree species. The course will explore forest relationships with people and communities. The role of forests in ecosystem service provision will be explored and explained. Contemporary topics such as climate change, sustainable forest management, and forest certification will be discussed.

SFR102 FOREST RESOURCES

This course introduces the relationships within the forest and its various uses. Emphasis is placed on forest history, ecology, protection, management, policies, and practices. Upon completion, students should be able to discuss the relationship of the forest and its use to the welfare of mankind.

SFR104 TREES IN THE LANDSCAPE

The course provides an introduction to trees and their environment. A basic theoretical understanding of environmental and climatic effects on trees will underpin methods for species selection, growing and maintaining trees, and site-specific management. The theoretical component of the course is followed by a comprehensive examination of operational use of trees in a variety of urban and rural landscapes. The aim is to appreciate

how an understanding of tree function and growth can inform choices of species for use in environmentally and climatically different ecosystems and land use types.

SFR105 FOREST GROWTH AND MEASUREMENTS

This course aims to introduce students to tree measurements, forest stand variables, growth and yield modelling, sampling, forest inventory, log measurements, surveying and area measurement. Students will also be introduced to mapping and aerial photography as well as global positioning system (GPS) and geographic information systems (GIS). Effective management of forests requires the accurate measurement of their current status and the ability to forecast their future growth and development.

SFR103 COMMERCIAL ASPECTS OF FORESTRY

Evaluating forestry sector performance at the business and industry level. An introduction to the key commercial disciplines as they are applied to forestry. Understanding methods to assess the value of forests in providing timber and non-timber benefits. Identifying the strategic choices and issues facing the commercial forestry sector. This course will provide an introduction to the key commercial disciplines used in forestry. Analysis tools will be applied to evaluate forestry sector performance at the business and industry level. The course will introduce methods to assess the value of forests in providing timber and non-timber benefits, and identify the strategic choices and issues facing the commercial forestry sector.

SFR106 ECOLOGY, EVOLUTION AND CONSERVATION

An integrated course embracing the principles of ecology, behaviour, genetics, evolution and conservation biology. In this course you will learn the basics of evolution, ecology and conservation biology. You will see how evolution underpins both ecology and conservation and discover how these areas of biology impact every-day life. The first part of the course has an evolution focus and we will look at both genes (micro) and species (macro) evolution. We'll explore human diseases, drug resistance and invasive species. The course will enable students to understand how fossils have contributed to our understanding of life on Earth today.

SFRSTAT107 STATISTICS 1

This course targets an introduction to the ideas, techniques and applications of statistics and probability. The emphasis is on applying statistics to problems, selecting sensible techniques, following the methodology and interpreting the results. Understanding the concepts and computer-based solutions are emphasised and applications to commerce, the social sciences, the humanities, science and engineering are considered. Particular topics include data analysis, summary statistics, probability, statistical distributions, estimation and inference (including confidence intervals, hypothesis tests and modelling).

SFR108 INTRODUCTION TO FOREST ENGINEERING

This course will look at the history of logging and reasons for harvesting. Steps in the harvesting process; common equipment use in forest operations; machine capabilities and limitations. Developing harvesting systems, including ground-based, cable and helicopter. Introduction to harvest planning and forest roads; machine costing and system productivity. Environmental and safety aspects of forestry operations; the Resource Management Act and the Occupational Safety and Health Act. Forest hydrology; with a focus on minimising impacts of operations on water quality.

Forest Engineering covers many of the operational aspects of working with forest resources, whereby this course focuses on providing an introduction to harvesting and harvesting systems, roading, environmental best management practices, safety and planning harvesting operations. The course starts with a history of logging and provides reasons for harvesting, including possible economic and environmental benefits. An important focus is learning the steps in the harvesting process and the associated equipment used with machine capabilities and limitations. These include ground-based, cable and helicopter systems and also covers machine costing and system productivity estimation. An overview of forest construction is also given.

To successfully carry out forest engineering operations a person must have a very good understanding of both environmental and safety aspects of forestry operations. In this course we will cover the development of both, as well as review the relevant legislation being the Environmental Management Act 2002 and the Occupational Safety and Health Act 2001 respectively. The culmination of the course is the development of a harvest plan that takes all of the above elements into consideration.

Evaluation and comparison of options for the transport of forest products. Review of soil engineering characteristics and low-cost methods to determine the bearing capacity of subgrade soils. Vehicle/road interaction. Legal regulations for heavy vehicles operating on Eswatini public roads. Forestry truck and trailer designs and their impact on load capacity and vehicle safety. Road design for forest roads and the design of low-cost water crossings and drainage structures. Application of RoadEng road design software. Cost estimation and contract management for road construction.

This course covers two broad closely related topic areas, being forest transportation as well as forest (or low-volume) road design. For transportation it provides for evaluation and comparison of options for the transport of forest products. It moves to legal regulations for heavy vehicles operation on Eswatini public roads, and then covers forestry truck and trailer designs and their impact on load capacity and vehicle safety. To link the two parts of the

course vehicle / road interaction is investigated. For the roads part of the course, it reviews soil engineering characteristics and low-cost methods to determine the bearing capacity of subgrade soils. Road design for forest roads and the design of low-cost water crossings and drainage structures are taught. RoadEng road design software is the used to design a trial section of road, and the project includes cost estimation and contract management for road construction.

Topics covered include: Regulations pertaining to forest trucking; road location, design and construction; road geometric design; contracts, construction supervision, earthwork volume calculations; strengthening forest roads; road management systems; truck/road interaction; truck specifications and allowable loads; truck scheduling, logistics, network analysis; alternative transportation methods in forestry. The course makes use of RoadEng and ArcView GIS software.

SFR109 INTRODUCTION TO PRINCIPLES OF FOREST ECONOMICS

This course is to give a clear picture of the economic environment within which forestry operates, to help the students in understanding the many economic relationship which exist in forestry. The course is aimed at introducing students to the concept and practices of forest economics. The course is to establish the economic basis for forestry and to furnish the students with tools and methods of financial analysis in coping with economic problems as they arise in natural resource management. The course is designed to expose students to the classification of forest goods and services as well as review of economics principles in relation to forest resources. The course will start by reviewing important principles of microeconomic theory applicable to forest/natural resources. After establishing this solid foundation of microeconomic view of forestry, we will focus on studying timber supply and demand models, financial analysis and economic impact analysis, timber/ecosystem valuation and multiple-criteria decision making tools to aid better decision making in natural resource management. The course will provide an understanding of the principles of forest economics, and their application to investment analysis, forestry markets and evaluation of non-timber benefits of forests. Students will:

- understand the principles and tools used to evaluate forestry timber investments; - understand the principles and tools used to evaluate non-timber benefits of forests; and be able to apply economic principles to analysing the supply and demand of forestry products.

SFR200 FOREST BIOLOGY

This course provides an overview of forest biology including plant systematics, ecology and forest health, with a focus on both native and exotic forests and forest species. Structure, function, development and biology of forest vegetation and their relationships to forestry and natural resource applications. Systematic botany of forest trees and biology of Eswatini

indigenous forest species. Principles of ecology with an emphasis on population, community and ecosystem factors affecting Africa and selected continents forests. Science and management of forest pests, disease, wind, fire, biosecurity and risk. Students will have:

- An appreciation of the relationships amongst plant species, especially trees;
- An understanding of the biology and ecology of Eswatini's indigenous forests and their dominant tree species;
- An appreciation of the cultural significance of native plants and animals;
- An understanding of forest health issues associated with SADC's production and conservation forests;
- An appreciation of the basic ecological role of invertebrates, vertebrates and fungi in indigenous and exotic forest systems;

The ability to identify key Eswatini native and exotic tree species and insect orders;

A good familiarity with the major plantation forest invertebrate pests and diseases.

SFR201 INTRODUCTION TO SILVICULTURE

The course is designed to teach students in Forestry and general agriculture to acquire knowledge on the principles that relates to tree growth and productivity. The contents of the course include introduction to the problems of raising tree crops; application of ecological principles for establishment and maintenance of tree plantation; tree seed collection and processing; seed testing, pre-treatment and storage; photosynthesis; water uptake and loss in a tree; nutrient cycling in forest ecosystem; principles underlying choice of species; species and provenance trials. Classical silviculture systems: autecology; stand development and stand dynamics. Applications of tree physiology to silviculture; environmental ecophysiology; tree/soil relationships. Propagation; tree breeding systems; seed orchards; clonal forestry; molecular techniques in tree breeding. The objective of this course is to provide a biological background to the study of silviculture, and to apply biological principles to the management of natural forests in Eswatini and elsewhere. The course is broken down into five core topics: Introduction; Silvics - a review of the biological concepts relevant to silviculture; Silvicultural systems; Ecology and management of natural forests; and tree breeding and genetics. Students will have a basic understanding of classical silvicultural systems and their applications to Africa's indigenous forests; of how tree physiology impacts on silvicultural systems and forest production; and of tree breeding and propagation systems.

SFRE202 PRINCIPLES OF BIOMETRY 1A

This course provides an introduction statistical inference and to elementary statistical techniques commonly used by biologists. A practical introduction to commonly used statistical methods, designed to increase the breadth of statistical skills. The emphasis is the

application of statistical techniques to solve problems involving real data. Common statistical techniques such as sample surveys, experimental design, hypothesis testing and analysis of variance are introduced, with an emphasis on problem solving as applied to real data. The computer package R is used, but no prior knowledge is assumed. Students on this course may also be interested in enrolling in <u>SFRSTAT206/SFR212</u> Regression Modelling/Biometry 1B. Be able to use R-commander to analyse data understand sampling designs (e.g., simple random sampling, stratified sampling) and experimental designs (e.g., completely randomised, randomised block) be able to conduct statistical analyses using ANOVA and other techniques using R commander understand interactions in two-way ANOVA writing lab reports in which data are analysed and computer output is interpreted.

SFRSTAT206 BIOMETRY 1B

To provide a practical introduction to the fundamentals of linear regression modelling, with emphasis on application to real data and problems. This course is of interest to anyone majoring in statistics and forestry, as well as students from other disciplines (eg. biology, commerce, etc) who want to increase the breadth of their statistical knowledge base. Regression models are the most widely used statistical tools for examining the relationships among variables. The course covers the core concepts in regression modelling, with an emphasis on problem solving as applied to real data. On completing this course, students will be able to analyze data using simple and multiple regression models as well as logistic regression, understand the relationship between regression and ANOVA, understand diagnostics for testing modelling assumptions, understand methods for model selection, be able to interpret computer output, and be able to write reports that analyse data and interpret computer output.

SFR203 SOIL FERTILITY/SOIL SCIENCE

This course provides an general introduction to soils. It includes terminology used in soil science; soil and their physical, chemical and biological properties; soil formation; soils and spatial variability; soils inventory; examples of the use of soil information in crop production estimation and land use and management planning. Basic soil properties; soil formation and soils in the landscape; soil chemical and physical properties which are important to sustainable land use and environmental protection; assessment of soil nutrient availability, particularly with respect to forests.

Understand and be able to discuss differing soil properties; understand and be able to discuss sustainable land use and its role in environmental protection; and be able to practically apply their knowledge of soil nutrients in the context of plant growth.

SFR301 FOREST PESTS AND DISEASES

The major pests and diseases of forest trees. Taxonomy, biology and method of control of these diseases of forest, major pests and disease of forest trees. Brief outline of shortcomings and advantages of different pest assessment and control methods.

Specific objectives are to: • Understand concepts of ecology with emphasis on insect systems

- Learn where to look for insects and how to collect them safely
- Learn how to preserve and label insects specimens for scientific study
- Learn types of diseases that attack forest tree species
- Management of Forest pest and diseases

SFR404 COMPUTER APPLICATIONS IN FORESTRY AND WOOD TECHNOLOGY

This course is a follow-up course to FWT 204 (Introduction to use of computers in natural resources). It will provide students with more knowledge of computer applications in Forestry and Wood Technology. The course will be a practical course where emphasis will be on skill acquisition. Hence, real-life situations will be used to give students hands-on training in computer usage. Our main focus will be on how we can use computer technologies to better manage forests in a sustainable manner. As forestry and wood technology are very broad in scope, it would not be possible to cover specific computer applications in all aspects. However, the very essential aspects will be covered with the hope that each student can use the skills 2 acquired in the course as basis for extending the application to other areas. The objective of this course is to teach the students necessary skills to facilitate their use of computer in various aspects of Forestry and Wood Technology.

SFR207 PLANTATION SILVICULTURE 1

Plantation Silviculture aims to develop silvicultural techniques which help deliver sustainable plantation forest management based on a scientific understanding of how forests function. Research is founded upon ecological and physiological understanding of tree growth and development over time. Therefore the activities involve all stages of tree and forest development and the impact of different strategies upon the outputs from forests. Research provides information to support the development of national forestry policy and advice to forest sector, forest nurseries, tree seed producers, other research establishments, the academia such as universities and other tertiary institutions.

Plantation silviculture: species selection, genetic improvement, clonal forestry, establishment, manipulation of stand density harvesting impacts. Integrated decision making. Management for non-wood products. To provide an understanding of the principles of plantation silviculture which will enable students to make effective decisions about plantations anywhere in the world.

The course allows students to apply understandings of biology, finance, ecology and mathematics which they have acquired in previous courses to the management of single stands of trees. It builds on <u>SFR200</u> - Forest Biology and <u>SFR201</u> - Introduction to Silviculture. Students will: Understand the principles and tools associated with decision-making in plantations at a stand level, understand the key biological processes at work within plantations that affect decision-making, be familiar with interactions between social, financial and biological interactions, which are important in plantation systems, appreciate alternative treatment strategies (regimes), which can be applied in plantations from establishment through to harvest. The effects of these regimes on forest product outturn will also be covered.

SFR300 PLANTATION SILVICULTURE 2

Plantation Silviculture 2 aims to advance silvicultural techniques which help deliver sustainable plantation forest management based on a scientific understanding of how forests function. Research is founded upon ecological and physiological understanding of tree growth and development over time. Therefore the activities involve all stages of tree and forest development and the impact of different strategies upon the outputs from forests. Research provides information to support the development of national forestry policy and advice to forest sector, forest nurseries, tree seed producers, other research establishments, the academia such as universities and other tertiary institutions.

Plantation silviculture 2 deals with advanced: species selection, genetic improvement, clonal forestry, establishment, manipulation of stand density harvesting impacts. Integrated decision making. Management for non-wood products. To provide an understanding of the principles of plantation silviculture which will enable students to make effective decisions about plantations anywhere in the world.

SFR208 FOREST MANAGEMENT

Principles of Forest Management is a compulsory course designed for undergraduate students in the forestry degree programme, to provide them opportunity to learn basic concepts and techniques related to making decisions in managing both natural and plantation forests to achieve variety of management objectives. Forest management as decision-making. Information requirements for forest management planning. Stand level analysis. Forest estate level analysis. Integration of the forest estate with harvesting and marketing decisions. Human factors: role and style of leadership, communication, motivation, teamwork and problem solving.

SFR209 WOOD SCIENCE

A key management objective of forestry is the production of wood. The course provides the student with an understanding of the chemical and biological basis of the material properties of wood, how forestry can control these and the concept of wood quality. In the second part the course we will introduce the students to the various wood processing industries, ranging from sawmilling over engineered wood products to pulping and biofuels. Reference will be made to the most suitable resource for individual products and how forest management can impact on the value of the timber. Wood is unique in its material properties when compared to competing materials like steel, plastics or concrete. The difference is caused by its highly complex molecular and supra-molecular structure.

The first part of the course focuses on the chemical, biological and physical phenomena encountered when trying to understand the behaviour of wood as a material. Starting on the molecular scale, the chemical composition and ultrastructure of the woody cell wall will be explored followed by the biological processes responsible for the unique anatomy of wood from individual species. The chemical and biological aspects are essential to understanding the physical properties of wood such as strength and stiffness, as well as the interaction of wood with water. Finally, wood quality under the above-mentioned premises is considered and implications for silviculture forest management discussed. and are

The second part looks at the processing of wood, starting with the breakdown of logs in sawmills into solid wood products and involved processes; drying and preservation. These operations are highly complex and vary greatly with the available timber resource. A large portion of the wood resource is broken down into smaller particles of various size and shape and reconstituted into products like wood panels or LVL beams. Another sector using large quantities of wood as raw material is the paper industry. The relevant processes and products are discussed, and the advantages and disadvantages for processing wood in a particular way are explained. A final point are the possibilities of using wood as an energy source and the different technologies for converting the solid fuelwood into liquid or gaseous fuels.

SFR400 GEOSPATIAL SCIENCE IN FOREST MONITORING AND MANAGEMENT

This course explores the role and use of geospatial technologies in the context of vegetation management. Theory and practical application of geographic information system (GIS) software, global positioning system (GPS) technology, and remote sensing (e.g. satellite imagery, LiDAR) will be used to analyze and solve spatial problems in forests and other vegetated landscapes. This course is designed to illustrate how geospatial technologies can be applied to a range of vegetation management problems. Students will develop understanding and skills applicable to a range of spatial challenges in vegetated landscapes. The course emphasizes cutting-edge technologies. The course content is arranged into themes: • Data collection - this includes spatial data collection using global navigation satellite systems and attribute data collection using ground-based methods or remote sensing; Remote sensing - an applied introduction to the various remote sensing technologies including aerial photography, satellite imagery, and LiDAR; and
Geographic Information Systems - developing capabilities to analyze and solve complex spatial problems in vegetation management, inclusive of forests and other vegetated landscapes.

SFR401 FOREST PRACTICE

This course will enable students, individually and in small groups to make a comprehensive study of an actual management case and will produce and present a plan for the management of a specified forest or conservation area. The Case Study is an opportunity for students to bring together the knowledge gained through forestry studies. Constraints are provided to make the Case Study as realistic as practicable. The aim is to develop analytical reasoning and test creativity and practicality using a real forestry problem. It is not a test of student's ability to gather the latest detailed bit of information.

The general objectives of the course are:

• to synthesize previous coursework and fieldwork in order to independently analyze and report on a specified forest management problem for a Eswatini client. The exercise will incorporate ecological, silvicultural, financial and market realities; and to successfully communicate that plan in both written form and orally to the client. Students will have gained experience in: Integrating and applying forestry knowledge; carrying out a consultancy in which the student analyses information and produces reports for a client; managing time and operating in a structured and systematic way; and working as part of a team.

SFR402 FOREST HARVEST PLANNING

Harvest planning and analysis of harvesting systems. Machine capability and requirements. Impacts of terrain and stand variables on harvest systems. Ground-based planning including SKIDPC. Advanced cable yarding planning with CYANZ. Landing design and layout. Contract supervision and workforce management. Production planning and control systems. Harvest planning for forest operations is an important aspect of the management of commercial forests. This course will allow students to become familiar with how harvest planning fits into the forest cycle, as well as understand the requirements and considerations of harvest planning from small woodlots through to large coupes.

Important elements covered in the class include:

• Understanding capabilities and limitations of different harvesting systems and the operational conditions in which each system is best deployed.

- Environmental regulations and environmental best management practices.
- Methods of estimating harvest system production rates and costs.

Students will develop harvest plans using CYANZ harvest planning software. The course will also cover the practical aspects of contract supervision and workforce management between forest owners/managers and their harvesting contractors. Finally, students will be given an understanding of management approaches and systems used to control woodflow, to manage system breakdowns and for production quality control.

SFRE403 ENVIRONMENTAL FORESTRY

This course provides an overview of the broader environmental and cultural issues associated with plantation forestry in Eswatini within the framework of ecosystem services. Ecosystem services are the goods (such as food and fibre) and services (such as water yield) that the human population derive, directly or indirectly, from ecosystems and are fundamentally important because the well-being of human society is totally reliant on them. Forests are particularly important as they provide many key ecosystem services that are not necessarily provided by other comparable land uses such as farming. This course will focus on a range of the ecosystem services provided by plantation forestry including biodiversity conservation, soil and water conservation, and cultural services. However, fibre production and carbon sequestration will not be covered here as they are covered in other courses. We will also address the policy frameworks within which ecosystem services are managed in Eswatini. We will be placing a particular emphasis on bicultural competence and confidence as Emaswati are key players in Eswatini forestry as forest and forest land owners, as forest managers and as a people to whom forests are an essential part of life.

SFR406 FOREST PRODUCTS MARKETING

World forest resources. Patterns of world trade, shipping and policies of international trade. Roles of international institutions in free trade and economic integration. Trade, aid and economic development with special reference to forestry and forest industries. This course will provide students with an understanding of modern marketing tools required today by the forest products sector to compete internationally, along with an appreciation of international trade flows for forest products.

Students will be able to:

Demonstrate an understanding of international trade commodities and trade flows;

Demonstrate an understanding of marketing principles related to forest products;

Show the ability to develop future marketing strategies related to international trade of forest products.

SFR407 FOREST ECONOMICS 2

The course will cover a number of topics in economic theory and practical applications. The course is designed to extend knowledge and give practice at using the tools. There is an emphasis on economic tools to help analyze issues facing managers of commercial forests. Students will:

- analyse policy and economic issues using economic tools and concepts;
- be able to present and discuss the strategic issues facing Eswatini's commercial forestry sector.

This will include being able to access and analyse publicly-available data.

SFR408 FOREST TREE BREEDING

The course will cover all aspects of tree breeding. It will assist researchers with established tree breeding programmes and those who are planning to initiate programmes for the first time. Emphasis will be placed on techniques suitable for breeding eucalypts, acacia and pines grown under tropical and sub-tropical conditions. Review of tree breeding and conservation in the context of applied breeding programmes. This course provides students with an understanding of the principles of tree breeding and of tree propagation.

Students are expected to: Have a basic understanding of population and quantitative genetics as they are applied to tree breeding; identify the basic components of a tree breeding program - including breeding objectives and the concept of recurrent selection; understand the sexual and asexual options for the elopement of superior genetic material, with their respective advantages and disadvantages; and understand principles and practices of conservation of genetic resources.

SFR409 BIOSECURITY RISK MANAGEMENT

This course provides students with an overview of the biosecurity system (legal, scientific, and practical), illustrates how the system operates, and highlights the consequences of a biosecurity incursion. Students will gain an understanding of the broad biosecurity issues faced by Africa. Students will gain an understanding of the particular biosecurity threats to forestry, including both natural and production forests and the export of wood products. Students will have an appreciation and understanding of the way in which biosecurity affects primary sectors, Africa, and Eswatini society in general. Students will have an understanding of understanding of management procedures and agencies involved in dealing with biosecurity threats in general. Students will gain an understanding of the methods by which biosecurity risks to forestry are

managed through legislation, surveillance and incursion response. To engage students in a problem-based learning environment to build their knowledge and skills in the area of biosecurity management.

SFRE410 RESEARCH PROJECT

The student will undertake an individual investigation of a subject approved by the School of Forestry and will submit a dissertation on this topic by a date specified by the Dean of Agricultural and Earth Sciences. The dissertation is an independent study of any topic within the broad disciplines of Forestry. Students enrolled are eligible for the award of Honours on the completion of the Bachelor of Forestry Science degree. The course is predominantly an independent study with guidance from a supervisor. There are some classes in Research Methods in Semester 1, and workshops scheduled in Semester 2 where a number of supervisors will be available to help with specific analytical or other issues. The objectives of the dissertation are to develop and apply research skills including the art and science of defining a research topic, data collection and analysis, presentation of data and results, interpretation and application of research results and to synthesize professional training and experience to date in the production of an original research paper of professional standard. Students' ability to organize their workload and plan over a whole year, and their ability to commit to deadlines for completion of components of the work are critical to success.

SFR411 FOREST RESOURCES BUSINESS, MARKETING AND ENTREPRENEURSHIP

This course is designed to provide a knowledge on forest resources business, marketing and entrepreneurship, and an understanding of the linkages between economics and entrepreneurship. Students will apply these concepts to the assessment of opportunities that might arise from participation in SRU projects. Students will engage in exploring how business, marketing and entrepreneurship can inform opportunity assessment within an ambiguous and uncertain context.

SFR302 WILDLIFE MANAGEMENT FOR FORESTRY

Theory History of wildlife management and conservation; cultural background. Habitat management: Purposes, principles, practices and tools-fire, cutting, grazing. Habitat interspersion and edge effect. Provision of water, saltlicks and food. Zoning - core, buffer, tourism and multiple use in protected areas. Wildlife damage control: Mitigating human - wildlife conflict: fences, trenches, walls, lure crops, repellents, translocation and compensation. Captive wildlife: Zoos and safari parks. Captive breeding for conservation. Wildlife census: Purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities. Protected areas -Sanctuary, National Park and Biosphere Reserves. Special projects for wildlife conservation.

Practical Field/laboratory studies of distinct and characteristics morphological and other features of fishes, reptiles, birds and mammals. Identification and study of wildlife in a nearby zoo. Bird watching: Preparation of inventory of an area. Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques. Wildlife damage and control: Questionnaire survey. Visit to wildlife sanctuaries, National Parks and Zoological parks - Wildlife damage -health management Zoonotic diseases - Planning and management of National Park and Sanctuary - studies on captive wildlife - methods of capture - taming and training.

SFR305 INDUSTRIAL/FIELD ATTACHMENT

Forestry Work Experience Programme for a period of 105 days in different forest divisions. Appraisal of the various aspects of range administration, resource management, wildlife management, tribal welfare, Agroforestry and social forestry programmes, soil and water conservation measures - tackling illicit poaching and tree cutting - census of wildlife -fire management, silvicultural practices - detailed study of working plan in the division - maintenance of daily records, submission of herbaria, seed samples - participatory rural appraisal exercises in field. conservation measures - tackling illicit practices - detailed study of working plan in the cutting - census of wildlife - fire management, silvicultural practices - detailed study of working plan in the division - maintenance of daily records, submission of herbaria, seed samples - participatory rural appraisal exercises in field.

SFR405 FOREST LANDSCAPE MANAGEMENT AND PLANNING

Forest planning, Forest mensuration, Growth and yield models and its application in growth and yield simulators. Quantitative silviculture. Yield regulation and forest economics. GIS and spatial analysis in forestry.

SFR303 FOREST RESEARCH METHODS

Development and analysis of statistical designs for forestry research. This course is designed to teach graduate students proper approaches to research methodologies, scientific proposal writing, oral and written presentation techniques, academic and professional ethics and responsibilities.

SFR210 APPLIED GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Applied Geographical Information Systems (GIS) provides the ability to analyse data spatially leading to better understanding of what is happening in different places informing decisions across all sectors of research, business, government, education, entertainment and leisure. This module develops the student understanding of GIS by using spatial data to discover solutions to real world applications. Student will not just be developing GIS skills but also discovering the numerous opportunities for a career in GIS. Discovery and learning will develop from click and point operations, to developing workflows, models, scripting GIS and an understanding of automation.

SFR205 CHEMISTRY

The course is an introduction to chemistry using the fundamental structures of atoms as a starting point. Emphasis is placed on discussing how all properties of matter as well as bonding mechanisms arise from atomic structure. Lewis structures and molecular orbitals are used to understand bonding, and the intermolecular forces present in chemicals systems are used as a prelude to reactivity patterns covered in future courses.

SFR111 ACADEMIC COMMUNICATION SKILLS

In this course students will practice analytical reading, writing, and thinking intensively, through a variety of exercises and assignments. Emphasis is placed on using various methods of organization appropriate to the writer's purpose and audience. Students will read and discuss a selection of non-fiction texts; these readings will form the basis for writing assignments in summary, critique, synthesis, and persuasion. The course also stresses the ability to understand, use, and document college-level non-fiction readings as evidence for effectively formulating and accurately supporting a thesis. This course is for international students who have already studied grammar extensively and need to refine the ability to produce acceptable academic English.

SFR204 INTRODUCTION TO PUBLIC SPEAKING OR ENVIRONMENTAL COMMUNICATION SKILLS

This course is for international students who want to develop their academic writing skills through a sequence of essay assignments, with emphasis on rhetorical and grammatical issues particular to second language learners (ESL). Students will concentrate on producing coherent paragraphs, developing short essays in a variety of rhetorical modes, and improving mechanics (grammar and punctuation) and vocabulary usage. Both personal and academic writing assignments provide practice in the process of writing and revising work for content and form.

SFR112 PRINCIPLES OF MICROECONOMICS.

The course focuses upon the implications of reliance upon markets for the allocation of resources in a society, at the household, firm, and community level. Outcomes of current market systems are examined in terms of the efficient use of natural and other economic resources, as well as their impact upon the environment, fairness, and social welfare. of special interest in these analyses is the role of prices in the determination of what commodities are produced, their means of production, and distribution among households. In cases where current market outcomes have features subject to widespread criticism, such as the presence of excessive pollution, risk, discrimination, and poverty, the analysis is extended to suggest economic solutions. There are no prerequisites for the course.

SFR110 INTRODUCTION TO FORESTRY BIOLOGY

The Forest Biology course provides forestry education that spans the entire range of experiences necessary to understand and manage forests. Curricula include a background in the biological, physical, social, and management sciences.

SFR 402 - ADVANCED FOREST MEASUREMENTS AND MODELS

A continuation of the topics including methods used to measure log, tree, stand, and forestlevel attributes. Students will also learn how to sample and analyze forest resources data including use of spreadsheets, databases, and stand projection models. Course may have field trips during class times.

SFR304 FOREST FIRE MANAGEMENT

The course will give understanding of the physical process of fire and factors that influence surface and crown fire spread, extreme fire behavior and what fire danger rating is. It will cover the basic use of terminology and fire models used in fire management, fire regimes and fire effects in a variety of ecological systems, the philosophical, historical, legal, ecological, social and cultural aspects of land management and how that relates to fire management, understanding of monitoring, the adaptive management process, and the components of a monitoring program, understanding of sampling, variation, standard deviation, p-values and hypothesis testing, different types of experiments, independence, confounding factors and the basics of experimental design and different sampling methods and different federal fire monitoring programs.

SFR212 REGRESSION MODELING

The course aims to provide quantitative/econometrics modeling skills through Descriptive Statistics, Correlation Techniques, Regression, Predictive and Econometrics Modeling skills. Quantitative methods and predictive modelling concepts could be extensively used in understanding the financial markets movements, huge datasets and statistics and studying tests and effects. The course picks theoretical and practical datasets for econometrics/quantitative/predictive analysis. The course also emphasizes on the regression models. Econometrics Modeling and Analysis in EViews, AIMS to also cover Auto-Correlation, Co-Integration and ARCH (Auto Regressive Conditional Heteroscedasticity) models. The course works across multiple software packages such as Eviews, MS Office, PDF writers, and Paint.

SFR305 NURSERY PRACTICE

The course will introduction and lay the importance of nursey practice. Some of the topics covered will include types of horticultural nurseries, management practices (water) insectpests, management practices (water), management practices (nutrient), management practices (weeds), management practices (diseases), management practices (insects-pest). Protection against temperature extremities and radiation, and important nursery operations. Propagation methods and their importance, propagation through seed, propagation method (Budding), propagation method (grafting) etc. Rootstocks for temperate fruits, rootstocks for temperate fruits, rootstocks for temperate fruits, rootstocks for temperate fruits, etc. Raising of stock seedlings, raising of stock seedlings, Pre-sowing treatments of seeds, and apomixis and polyembryony, stionic interactions, graft compatibility and incompatibility and use of growth regulators for propagation.

SFR306 CHAINSAW OPERATION

This course deals with skills to safely, efficiently and effectively operate a chainsaw for basic forestry, agricultural, conservation and garden services application. It includes felling of timber as well as chainsaw maintenance. In line with "best practice" guidelines the course encompasses both theory and practical lessons covering the following; legal requirements surrounding chainsaw use, use of PPE, chain sharpening and bar dressing, pre-start checks, correct starting and operating techniques.

SFR307 CONTRACTOR MANAGEMENT

The course covers contractor safety principles, owner/contractor engagement, safety leadership, capture critical components for successful contractor training programs within a PSM environment, evaluate contractor performance, manage contractor safety in process or facility turnarounds, address critical safety training issues for foreign contracted workforces, and collaboratively build a personal compilation of recommendations to apply on-the-job. This coursee discusses the importance of CSM and examines several incidents where proper CSM would have mitigated the risks, compare and contrast Capital Expansion, Turnarounds (TARs), specialty contracts, and one-time and supplemental labor maintenance contracts. It will cover the steps for planning contractor work, including project justification, engineering due diligence, and project scope, among others. It will also cover parameters of contract administration including prequalification, bidding and awarding, management commitment, and more.

SFR308 FOREST WEED SCIENCE

The course covers biological potential of weed populations and its impact on crops, chemical and alternative control methods and fate of herbicides in plants and environment and impact of weeds on crop. The following topics are covered: Weed biology and morphology, weed dispersal and proliferation, allelopathy, weed crop competition, weed dormancy, weed control, chemical weed control, herbicides classification, fate of herbicides, properties, modes and mechanisms of action, biological control methods and integrated weed management.