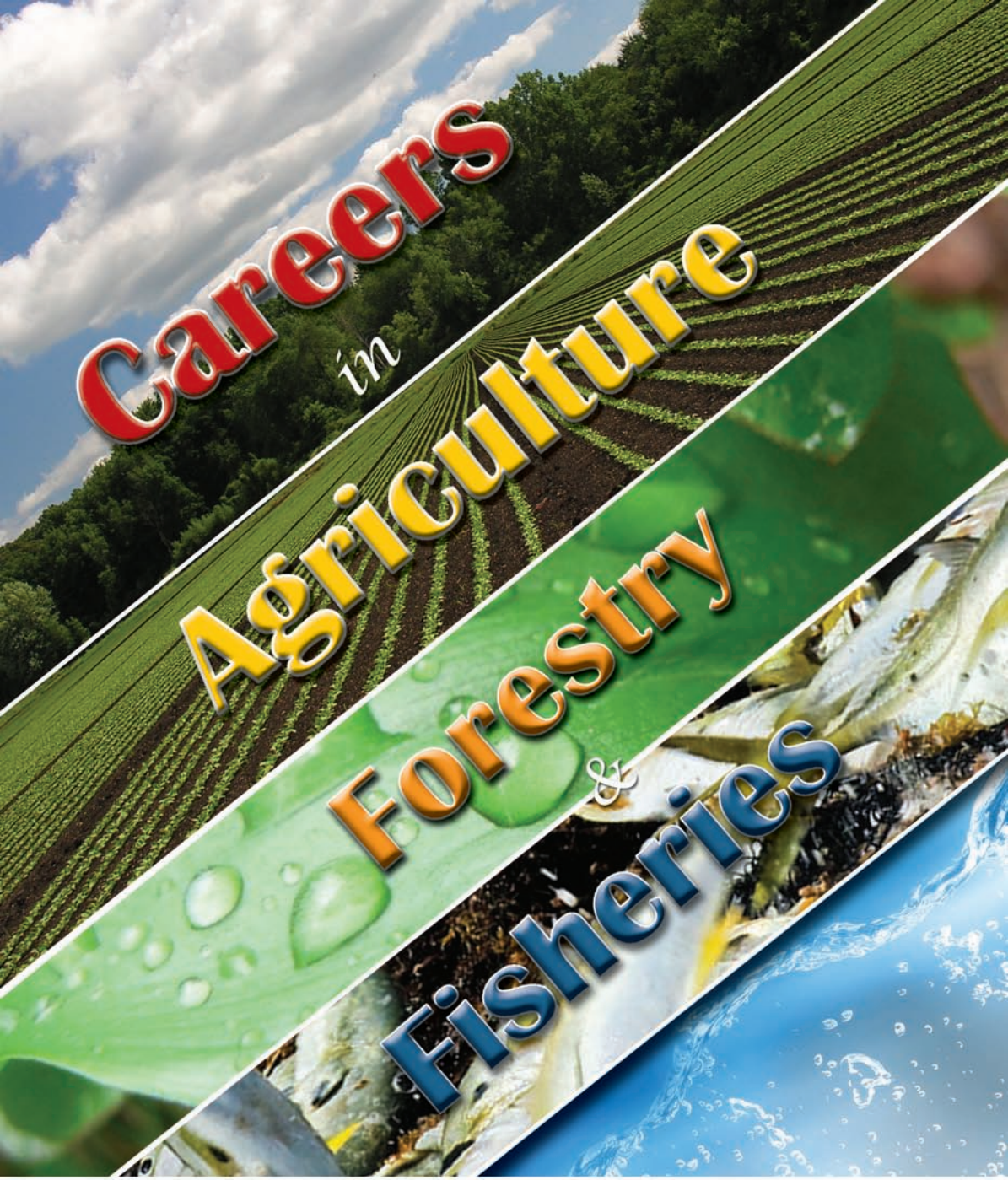


agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Contents

Introduction

This document was developed to inspire and capture the interest and commitment of the South African youth, particularly young Black people to agriculture, forestry and fisheries and related opportunities that exist in the sectors. Although the disadvantaged groups will be the primary focus, other non-target groups such as the White male youth will also be included. The aim is also to develop support structures and incentive opportunities for targeted groups, where possible. The purpose of this document is more than only creating interest in pursuing agriculture, forestry or fisheries as a career, but it is also about encouraging everyone who has an interest on embarking in related activities.

Awareness, training and education are not adequately addressed in primary or secondary school curricula for these sectors. The inadequacies of Mathemathics and Science subjects at school for black students have minimised these students' opportunities for acceptance into tertiary programmes. It is at this level that children should be made aware of careers in these sectors, and that agriculture, forestry or fisheries can be a career option worth taking. In order to achieve this, the Directorate Sector Education and Training came up with a Career Awareness Programme to conscientise children about agriculture and to promote careers in agriculture, forestry and fisheries.

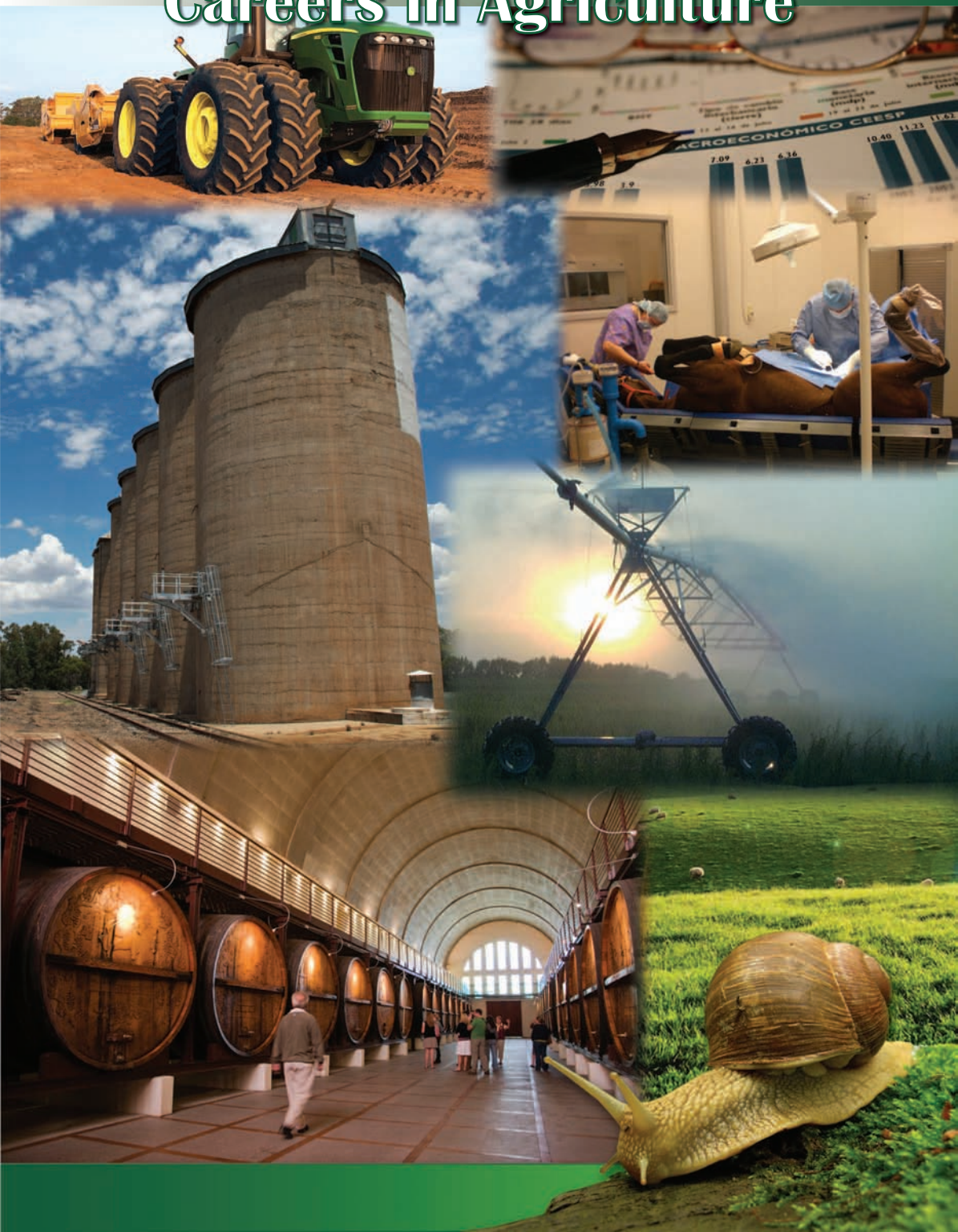
It is critical to understand that learners make two choices during the course of their high school career: subject choices and career choices. It is therefore very important for them to make informed choices while deciding on a career path. This will also assist in changing the attitude students have towards agriculture.

Scope of Information

The following issues will be addressed under each career

- An explanation of the specific career
- School subjects required
- University entry requirements
- Qualifications acquired
- Career or job opportunities

Careers in Agriculture



Agricultural Economics

Agricultural economics and agribusiness management play a role in the effective functioning of an organisation concerned with the agricultural and agribusiness sector. Agricultural economists analyse and advise on the optimal use of production factors for the environmentally sustainable production of food and fibre in an internationally competitive milieu. They have a broad knowledge of agriculture, commerce and social science and are capable of solving problems relating to agricultural development, marketing and finance, agricultural policy and consumption affairs, agricultural sales and marketing, brokerage, market research, international trade and market development, finance, public relations, food manufacturing, processing, distribution and purchasing, and the farm input industry. Students wishing to be considered for admission at first-year level have to meet the following entry requirements:

Curriculum

Areas of study at university level include economics, agricultural economics, agricultural development planning, agricultural marketing, agricultural policy, accounting, labour law, business law and business management.

Entry requirements for B.Sc./B. Com. Agricultural Economics

Mathematics:	4 (50–59%)
Physical science:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Additional Language:	4 (50–59%)
Life orientation:	4 (50–59%)

(excluded when the APS is calculated)

Duration:

B.Sc. Agricultural Economics – four years
B.Com. Agricultural Economics – three years

Institutions:

University of Pretoria
University of Stellenbosch
University of the Free State
University of KwaZulu-Natal

Role of agricultural economists

Interesting and innovative careers and opportunities exist for agricultural economics graduates in agricultural corporations, agribusiness firms, food and fibre organisations, government institutions, NGOs and rural development institutions, farming and ecotourism, financial institutions (commercial banks), futures and commodity trading, research and policy institutions, international economic development and donor institutions, universities and consultation services, energy sources and mechanisation.

Agribusiness management

- Developing, designing and managing supply chains as well as value systems for specific products, industries and subsectors
- Examining the demand for resources by

businesses and their supply response
- Farm planning and control, farm information systems, data analysis and budgeting, organisation of capital, farm machinery management
- Economics, labour economics and management, financial leverage, farm enterprises' growth and liquidity, and risk management

Marketing

- Production, processing and distribution of goods, focusing on the flow of food and fibre to their final destination and the determination of prices at each stage
- Commodity futures trading: trading commodities such as maize, wheat and citrus between farmers and the market
- Market research, brand management, economic analysis (trend management), surveys, and import and export management (examining foreign trade relationships for food and fibre products)
- Agricultural statistics such as trend analysis in production, agricultural exports, prices, variations analysis, indices (CPI, PPI, Chain Index, etc.)
- Financial services (banks, financial institutions and agribusiness industries)

Resource economist (focuses on the use and preservation of natural resources)

- The application of economic principles to issues such as air and water pollution, resource conservation, land-use policy, and the evaluation of environmental resources
- Identifying and analysing policies and strategies for meeting the world food needs in ways that ensure the sustainability of the natural resource base

Agriculture and rural development

- Government programmes for specific commodities that will support incomes of farmers and provide food and fibre for low-income consumers
- Business plan formulation, capacity building (training) and support for small-scale farmers and resource-poor farmers
- Identifying and overcoming constraints to the development of agriculture in developing countries
- Financial needs analysis, risk and valuation analysis, feasibility studies, cash flow planning and profit management
- Financing and supply of capital to business

Potential employers

Interesting and innovative careers and opportunities exist for agricultural economics graduates in agricultural corporations, agribusiness firms, food and fibre organisations, government institutions, NGOs and rural development institutions, farming and ecotourism, financial institutions (commercial banks), futures and commodity trading, research and policy institutions, international economic development and donor institutions, universities and consultation services.

Bioresource Engineering

Bioresource engineering is the application of science and technology in agriculture, food and biological systems. The agricultural engineer's field of employment includes a wide spectrum of activities which are connected to nearly all other engineering dis-

ciplines. Students wishing to be considered for admission to the first year have to satisfy the following entry requirements:

Curriculum

The university curriculum consists of water resource management, which includes drought and floor planning, water quality, irrigation and drainage, and dam design. Engineering for food fibre production includes design, development and the efficient utilisation of machinery. Environmental engineering incorporates animal-friendly building and devices, soil conservation and animal waste management.

Entry requirements (NSC or equivalent level with an M of 33–35)

Mathematics:	6 (70–79%)
Physical Science:	6 (70–79%)
Life Orientation:	4 (50–59%)
English	4 (50–59%)
Three other subjects:	4 (50–59%)

Role of agricultural engineers

Bioresources engineering goes well beyond the farm boundaries into areas such as water resource management, forestry, mining rehabilitation, food processing, peri-urban and rural development, machinery development and manufacture, waste management and ecology as well as agricultural vehicles and systems.

Energy sources and mechanisation

Through innovation, research and development sourcing, agricultural engineers contribute to alternative sources of energy and machinery, and the improvement of existing machinery. Agricultural engineers select appropriate materials and manufacturing processes to carry out the construction and testing of basic devices.

Farm structures

Agricultural engineers also contribute to environmental control for livestock and plants such as poultry, piggery and dairy structures, greenhouses and agricultural production systems. In addition, systems for intensive meat, milk and egg production, and storing, drying, refrigeration, and processing of a large variety of other agricultural products are also designed by agricultural engineers. These structures are created in accordance with the animals' need and product demands.

Irrigation engineering

Irrigation engineers' services involve the design of new and improvement of existing irrigation and pumping systems such as centre pivot, microjet, drip, sprinkler and flood irrigation systems.

Engineering and environmental hydrologists

Engineering hydrologists' tasks encompass flood estimation, flow routing, dam design for agricultural and small catchments, spillway design, plunge and spray dip designs and water resource management.

Food engineer

Food engineers can make a meaningful contribution towards value adding and extension of the shelf-life of perishable products such as dairy products, meat, eggs, vegetables and fruit. This field of work includes the degree of cooling installations for milk products, long-term conservation of vegetables and fruit, milling and mixing processes as well as the spray-drying process used in the production of powdered milk.

Professional status

A B.Sc. Agricultural Engineering degree is recognised as a qualifying degree for registration as a professional engineer under the Professional Engineers Act, 1968. The degree is accredited by the Engineering Council of South Africa and the South African Institute of Agricultural Engineers.

Institution: University of KwaZulu-Natal

Duration: Four years

Potential employers

The profession offers exceptional opportunities in areas such as research, development, project management, consulting services and the establishment of private business enterprises and farming systems for individuals with the necessary entrepreneurial abilities and initiative. Interesting and innovative careers and opportunities open to agricultural engineering graduates exist in the Department of Agriculture, Forestry and Fisheries (DAFF), agricultural research institutes, universities, consulting and engineering organisations, food processing companies, and agricultural equipment and systems manufacturers.

Food Science and Technology

Food Science

Food Science involves the application of scientific principles in the development and supply of healthy, safe, nutritious and affordable food for human consumption.

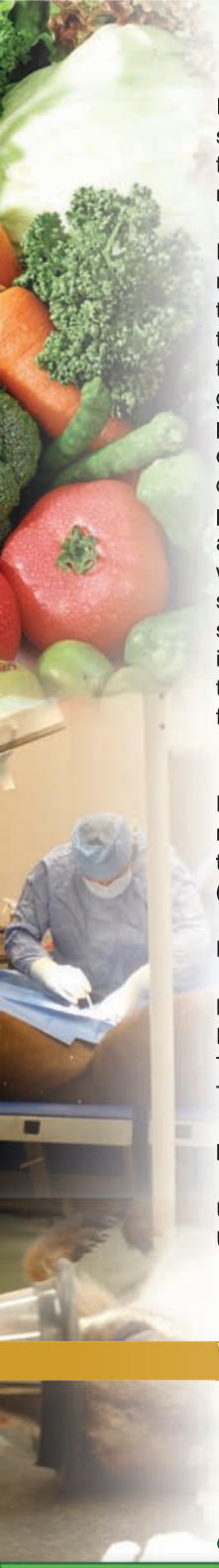
Functions of the food scientist include involvement in the development of many novel food products that are now freely available in shops, e.g. long-life milk, frozen and canned foods, snack foods and ready-to-eat meals. Secondly, food scientists are trained to meet the challenge of developing and supplying foods that comply with the ever-changing demands of the modern consumer. Finally, food scientists lead the fight against hunger and malnutrition through the development of affordable, nutritious foods. Examples are instant weaning porridges, components of cereals and legumes as well as staple foods fortified with vitamins and minerals.

A food scientist must be knowledgeable about the chemical composition, structure and nutritional value of food, food processing and preservation techniques, and the chemical, physical and biological changes that occur in food during processing, preservation and storage.

Food technology

Food technology is the study of the large-scale selection, production, processing and preservation of foods as well as the development and analysis of foodstuffs in industrial food-processing facilities. It further involves packaging, distribution and the use of safe, nutritious and wholesome food.

Food technologists are involved in areas of food manufacture such as quality assurance, processing technology, chemistry and microbiology.



In addition, they are trained to ensure that both legal and industrial food standards are monitored and maintained prior to marketing.

Food technologists are also part of research teams and have to solve technical problems when raw materials are converted into preserved foods in factories. Food technologists are concerned with issues pertaining to the production, preservation and development of high-quality foods. They also manage processing plants and quality assurance laboratories. They are charged with the monitoring of food quality standards by government bodies, such as the SABS. Students wishing to be considered for admission to the first year have to satisfy the following entry requirements:

Entry requirements for B.Sc. Agriculture Food Science and National Diploma in Food echnology (M score 30)

Food science

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Two languages:	4 (50–59%)
Two other subjects:	4 (50–59%)

Institutions

University of Stellenbosch
University of Pretoria

Duration: Four years

Job opportunities:

- Food production manager/ assistant
- Fresh food manager/assistant
- Food buyer
- Cookery school consultant
- Food stylist
- Consumer advisor
- Food promotion consultant, etc

Food technology

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Mathematics Literacy:	4 (50–59%)

Institution: Cape Peninsula University of Technology

Duration: Three years

Job opportunities:

- Industrial food manufacturers
- Beverage manufacturers
- Bottling plants
- Canning companies
- Dairies
- Fish and meat processors

Veterinary Science

Veterinarians play an important role in the economy of South Africa. They contribute to the creation of wealth by controlling epidemic diseases among

animals and increasing the profitability of commercial and small-scale farming enterprises. They also contribute to the production of sustainable sources of safe protein of animal origin and the prevention of the transfer of diseases from animals to humans, and they certify the disease (or disease-free) status of animals and the safety of products for local and international trade. They attend to the veterinary needs and general welfare of animals, both those of commercial importance and those kept as companion animals.

Curriculum

The duration of the course is six years (single degree structure). The core elective programme adopts an internationally recognised and recommended approach in which all candidates must complete a core curriculum over 4,5 years (nine semesters). They will then complete a chosen elective over four months which will give them increased competencies to enter the profession in their chosen career paths. The training will be concluded with approximately 14 months of experiential training in the core and chosen elective components. The first year of the programme will continue to be offered at the Hatfield campus of the University of Pretoria and students will only move to the Onderstepoort campus from the second year.

Role of veterinary scientists

Research: The veterinarian is involved in research in a wide spectrum of areas (veterinary, agricultural and biomedical sciences) in matters relating to product development, animal improvement and monitoring the utilisation of animals for experimental purposes.

State veterinarians: They render essential regulatory services relating to the diagnosis, surveillance, monitoring, control, prevention and eradication of notifiable diseases. They are also responsible for matters relating to the import and export of animal products and for food safety and security.

The provision of routine or forensic services involving disciplines such as pathology, clinical pathology, microbiology and toxicology in the private, state and diagnostic laboratories (Veterinarians are also involved in general matters pertaining to the welfare of animals through the promotion of appropriate husbandry practices, nutritional practices, disease prevention strategies and sound production systems.)

Veterinary public health: Veterinarians are responsible for ensuring the maintenance of meat and milk hygiene in abattoirs and milk processing plants and the control of zoonotic diseases (diseases transferred from animals to humans).

Private practice/Companion practice: Provide veterinary services for pet owners (dogs, cats, exotic animals and birds)

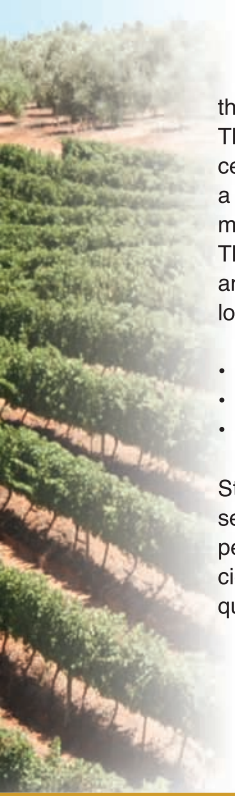
Rural practice: Provide veterinary services for farmers (sheep, goats, cattle, horses, pigs, poultry and game)

Breeders (dogs, pigs, sheep and goats)

Services for animal welfare organisations, game reserves and zoos

Selection of applicants

A total of 140 students will be admitted to the programme. The faculty endeavours to meet the veterinary needs of the country and the specific requirements of higher education legislation



through the selection of applicants. The recruitment and selection process is therefore structured in such a way that it will reflect national demographics and government policy. The procedure will be reviewed on an annual basis providing for the following categories:

- School leavers
- Students with tertiary exposure
- International students

Students with tertiary exposure are selected on the basis of academic performance, an institutional proficiency test and an interview as required.

Entry requirements for B.V.Sc. (M score 30)

Mathematics:	5 (60–69%)
Physical Science :	5 (60–69%)
Two other subjects:	4 (50–59%)
Two languages:	4 (50–59%)

(one of these must be English)

Institution: University of Pretoria

Duration: Six years

Potential employers

The majority of veterinarians offer clinical services, disease prevention strategies, advice in nutrition, management, production and reproduction of animals. Employment opportunities are available in government institutions, research organisations and meat-producing organisations.

Viticulture and Oenology

Viticulture

Viticulturists apply scientific principles to manipulate the vine to produce the kind of grapes necessary for the production of different wine types and styles as well as augmenting both the quality and quantity of grapes. Viticulturists share a mutual purpose, which is to make world-class wines to accompany food for pleasurable drinking.

Viticulturists learn theoretically and practically how the correct methods of anatomy, morphology, physiology, ampelography of scion and rootstock cultivars, plant improvement, natural and artificial disorders of the grapevine, spacing and trellising, pruning, canopy quality assessment and management as well as selection of cultivar and terrain, grape handling and packaging can contribute to the desired product.

The production of wine is done by striking a balance between soil, climate, geography, winery "softness" and winery hygiene. Students

wishing to be considered for admission to the first year have to meet the entry requirements.

Oenology

Oenologists learn about the principles and practices of wine-making such as applied chemical and microbiological processes involved in producing wines, sweet wines, grape juice, concentrates and brandy, wine stabilisation as well as analysis and sensory evaluation of wine and brandy.

Curriculum

Different curriculum choices enable students to major in any one of the following:

- Viticulture and Oenology
- Viticulture and Soil Science
- Viticulture and Entomology
- Viticulture and Plant Pathology
- Viticulture and Agricultural Economics
- Oenology and Chemistry
- Oenology and Enterprise Management

Entry requirements for B.Sc. Agriculture in Viticulture/Oenology

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
OR	
Physical Science:	3 (40–49%)
Life Science:	4 (50–59%)

Institution: University of Stellenbosch

Duration: Four years (B.Sc. Agric.)

Potential employers

Qualified viticulturists are employed in universities, at the Agricultural Research Council, in wine companies, on estates, in wine cellars, on farms, and in consulting companies and marketing companies.

Entomology

The entomologist is basically involved with research to ensure plant protection. He/She has a strong interest in scientific studies and research. There are various categories such as plant pathology, microbiology and insect diversity.

Entry requirements for B.Sc. in Entomology

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages:	3 (40–49%)

Institution: Most universities

Duration: Three years

Potential employers

Potential employers are the ARC, DAFF, and universities.

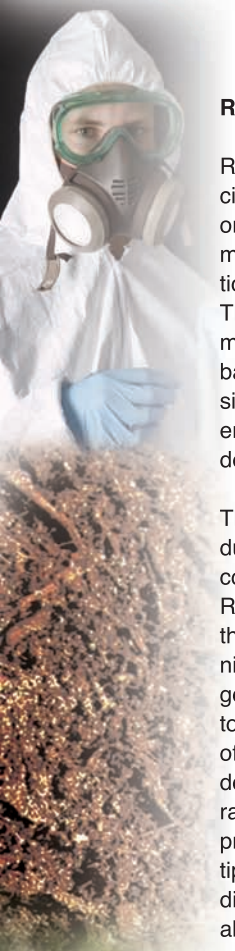
Grassland/Pasture Science

Grassland Science is divided into two categories: Rangeland Management and Grassland Management.

Rangeland Management

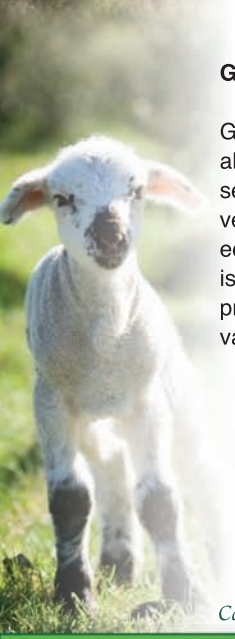
Rangeland Management is a discipline and an art that applies an organised body of knowledge accumulated by range science and practical experience for two purposes. The first is the protection, improvement, and continued welfare of the basic resources, which in many situations include soils, vegetation, endangered plants and animals, wilderness, water and historical sites.

The second is the optimum production of goods and services in combinations needed by society. Rangeland Management requires the selection of alternative techniques for optimum production of goods and services with no damage to the resources. While emphasis is often placed on the management of domestic animals, the main goal is rangeland resource rehabilitation, protection and management for multiple objectives, including biological diversity, preservation and sustainable development for people.



Grassland Management

Grassland Science is the study of all aspects of the utilisation, conservation and improvement of the veld and cultivated pastures. The education of grassland scientists is essential for sustainable animal production, on rangeland and cultivated pastures.



Grassland Science not only plays an important role in the increasing demand for meat and other animal products, but it also make a large contribution to soil and nature conservation, game farming and the future of game parks, which are important for the tourism industry.

Entry requirement for B.Sc. in Pasture/ Grassland Science

Mathematics:	4 (50%–59%)
Physical Science/Biology (recommended):	4 (50%–59%)

Duration: Four years (full time)

Institution: Most universities

National Diploma: Nature Conservation

Mathematics:	4 (50%–59%)
Physical Science:	4 (50%–59%)

Duration: Three years (full time)

Institution: Most universities of technology

Potential employers

The profession offers exceptional opportunities for employees in the fertiliser and seed companies, the National Parks Board, various sections of nature conservation and the Department of Agriculture, Forestry and Fisheries (national and provincial level).

Plant Pathology

Plant Pathology is defined as the study of the organisms and environmental conditions that cause disease in plants, the mechanisms by which these factors cause disease, the interactions between these causal agents and the plants (effect on plant growth, yield and quality), and the methods of managing or controlling plant diseases. It also interfaces with knowledge from other scientific study fields such as Mycology, Microbiology, Virology, Biology, chemistry and Bioinformatics.

Entry requirements for B.Sc. in Plant Pathology

Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
Mathematics:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages:	4 (50–59%)

Institution: Most universities

Duration: Four years (full time)

Potential employers

The profession offers exceptional opportunities for research in national and provincial government departments, and as plant pathologists in the ARC, agrochemical companies, seed companies, fertiliser companies, universities, farms, nurseries and pharmaceutical companies.

Soil Science

Soil scientists specialise in the origin of soils and the formation thereof: origin/development and composition of soil and soil-forming factors. The field also covers the most important physical characteristics of soil: texture, structure, colour, consistency, overall density, soil air, temperature and water, as well as problems arising as a result of tillage, soil compaction and crust formation.

Focus areas

Soil Survey

This study field involves profile pit observation by drilling mechanical augers and later conducting physical and chemical laboratory analyses. The results obtained (also compiled as maps and aerial photographs) are used as vital information for infrastructural planning (urban planning, roads, pipelines, powerlines, etc.) and agricultural management purposes.

Soil Physics and Hydrology

Soil physicists and hydrologists study problems relating to water and soil interaction, soil air permeability, etc.

Soil Chemistry and Fertility

Soil chemistry is concerned with soil nutrient availability and deficiencies using specialised techniques for the purpose of compiling the most effective fertilisation programmes.

Soil Biology

The focus of soil biology is on transformation by means of microorganisms.

Entry requirements for B.Sc. in Soil Science
B.Sc. (Agric.) Soil Science

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages	3 (40–49%)

Duration : Four years (full time)

Institution: Most universities

National Diploma (Soil Science)

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages:	3 (40–49%)

Duration: Three years (full time)

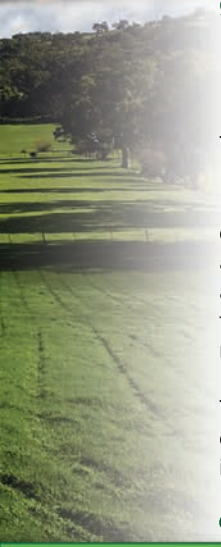
Institution: Most universities of technology

Potential employers

Potential employers are the ARC, DAFF (national and provincial), universities, agricultural cooperatives and manufacturers of fertilisers.

Agricultural Biotechnology

Agricultural biotechnology is a range of tools, including traditional breeding techniques, that alter living organisms or parts of organisms to make or modify products, improve plants or animals, or develop microorganisms for specific agricultural uses. Modern biotechnology includes the tools of genetic engineering.



Role of biotechnologists

The biotechnologist applies biological processes to the production of a wide range of organic substances and to ways of recycling waste. Multidisciplinary techniques applied in a number of scientific areas are used.

The biotechnologist can be concerned with microorganisms, genetic engineering or cell culture and may do some work on the development of new organisms. A biotechnologist can also

design and develop systems for industrial manufacture of materials such as fuel, animal foodstuffs or antibiotics.

Requirements of biotechnologists

As a biomedical scientist you should:
- Adopt a scientific approach
- Have an inquiring mind
- Be able to show initiative

- Be able to give attention to detail
- Be precise and methodical
- Be able to work as part of a team

Curriculum

Different curriculum choices exist in the field of biotechnology. Therefore, students should ensure that they major in biotechnology in order to be able to follow a career path in agriculture. In some institutions, this can only be done from the second year. For example, the University of Stellenbosch offers B.Sc. Molecular Biology and Biotechnology and students who wish to graduate in biotechnology have to major in Biotechnology I & II from their second year of study. Rhodes University also offers Biotechnology at the postgraduate level.

Entry requirements for B.Sc./ND in Biotechnology

B.Sc. Biotechnology
Matric exemption
Mathematics: 4 (50–59%)
Physical Science: 4 (50–59%)
Biology (recommended)

Duration: Three years (full time)

Institutions: University of Pretoria, University of the Western Cape, University of the Free State

National Diploma in Food Technology

Mathematics: 4 (50–59%)
Physical Science: 4 (50–59%)
Pass English

Duration: Three years (full time)

Institutions:
Tshwane University of Technology
Vaal University of Technology
Durban Institute of Technology

Potential employers

Possible employers include the ARC, the CSIR, other research institutions, government departments (national and provincial), food fermentation and pharmaceutical industries, private pathologists, the SABS, universities and universities of technology.

Agricultural Technical Services

Agricultural technician

Agricultural technicians assist agricultural scientists in their work and assist with the collection

of information. They also give advice and information to the farming industry.

Agricultural resource technician

- Works together with the agricultural resource officer
- Is involved in the classification, description and plotting of a region's natural resources

Agricultural extension technician

- Assists the agricultural extension officer
- Collects information to determine the needs of extension

Entry requirements for National Diploma in Agriculture (agricultural technician)

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages	3 (40–49%)

Institution: Most universities in the country

Duration: Three years

Qualification: National Diploma: Nature Conservation, Agriculture, botany, Analytical Chemistry, and Agriculture (Animal Production)

Potential employers

The ARC, DAFF, the DWAE, and agricultural co-operatives

Agronomy

Agronomy is the integration of the disciplines of Agricultural Engineering, Agro-forestry, Crop Production, Genetics and Plant Breeding, Horticulture, Plant Protection and Soil Science. All of these disciplines are supported by a strong foundation in the physical and biological sciences. Special attention is given to the sustainable intensive and extensive production of food and fibre crops, under rain-fed conditions or with irrigation, for local and export markets.

This degree covers an overview of the grain industry and more specifically the small-grain industry, the relationship between soil, climate, environment and production capacity, problem areas, marketing and market tendencies in the grain.

Entry requirements for B.Sc. and the National Diploma in Agronomy

Mathematics: 4 (50%–59%)
Physical Science/ Biology(recommended)

Duration: Four years (full time)

Institution: Most universities

Agronomy (Technician):

Mathematics
Physical Science

Duration: Three years (full time)

Animal Science

Animal scientists are qualified people involved in research and development, and they give advice to the livestock industry concerning the production of animals and animal products.

Focus areas

These scientists' focus areas are as follows:

Agricultural Genetics (Plant or Animal Genetics)

This course covers breeds and breeding standards of animals as well as basic breeding principles, selection systems, and performance. It also involves the most important dairy and beef cattle breeds in South Africa, qualitative and quantitative inheritance, responses to selection, methods of selection and selection system for dairy and beef cattle.

Animal Nutrition

Practical feeding of different farm animals and balancing of feed rations are covered in this field.

Dairy Science

Dairy Science involves the anatomy and physiology of the udder and the elements of milking procedure, the composition of milk, factors that influence the composition of milk, machine milking, milk hygiene, and bad tastes in milk and dairy products.

Poultry Science

This field involves the behaviour and biology of poultry, poultry management, the production of broilers, egg production, the hatching of eggs, the rearing of young hens and disease control.

Meat Science

The study of Meat Science involves growth, development and tissue composition and distribution in small and large stock. It also covers meat quality, meat processing and meat ageing.

Wool Science

The field covers the biology of the wool follicle and physical characteristics of wool, shearing and shearing-pen organisation (management), class and class standards of wool, wool processing and wool products, as well as byproducts of wool. The marketing of wool and other natural and synthetic fibres is also included in this field.

Entry requirements for B.Sc. Animal Science

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages	3 (40–49%)

Institution: Most universities in the country

Duration: Four years

Potential employers

The ARC, DAFF (national and provincial departments), universities, agricultural cooperatives and manufacturers of feeds

Biological Nitrogen Fixation

The biological nitrogen fixationist should be a person with a strong interest in biology and research, and should love to work with the soil under uncomfortable conditions.

What is biological nitrogen fixation (BNF)?

The availability of nitrogen in the soil is probably the single most

important factor limiting plant growth and crop yields. Some free-living and symbiotic bacteria directly influence the availability of nitrogen in the soil through the conversion of atmospheric dinitrogen to ammonia in the process termed BNF. Worldwide, BNF accounts for 65% of the nitrogen used in agriculture, of which the symbiosis of legumes with nitrogen-fixing rhizobia is by far the most important source.

Entry requirements for B.Sc. in Microbiology (nitrogen fixationist)

Biology
Agricultural Science
Chemistry

Institution: Most universities

Duration: Three years

Potential employers

Potential employers are the ARC, DAFF (national and provincial), universities, commercial inoculant manufacturers. It is also possible to run your own company or work as a consultant.

Horticulture and Hydroponics

Horticulture involves the application of scientifically based production systems for vegetables, fruit and ornamental plants. Hydroponics is a production system called soilless growing, in which fertilisers and minerals are added or mixed with water and supplied to plants.

Focus areas

Plant production
- Propagation technique
- Production practices

Plant knowledge
- Plant names
- Production practices
- origins

Horticultural management
- Plant names
- Production practices
- Origins
- Principles of horticultural enterprises /organisations
- Management of personnel
- Financial management

Entry requirements for B.Sc. Horticulture Science

B.Sc. Horticulture

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Agriculture Science:	4 (50–59%)

Duration: Four years (full time)

Institution: Most universities

B.Tech. Horticulture

- Mathematics:
- Physical Science:
- Agriculture

Duration: Three years

Institution: Tshwane University of Technology

Potential employers

Potential employers are the ARC, DAFF (national and provincial), universities, agricultural cooperatives and seed companies.

Microbiology

Microbiology is defined as the study of microorganisms such as bacteria, viruses and protista, which can only be seen with a microscope, and which are called “unseen multitudes”.

A microbiologist mostly works in a laboratory or a place where a microscope can be installed. It can be anywhere in the fields of nutrition, medicine, ecology, pharmacology, cosmetics, marine life or any place where animals and plants or people live. Identification is by means of DNA karyotyping.

Entry requirements for B.Sc. (Agric.) Microbiology

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
English/Afrikaans:	4 (50–59%)
Other languages:	4 (50–59%)

Institution: Most universities

Duration: Four years (full time)

Potential employers

Potential employers are the ARC, DAFF (national and provincial), food industries, wine cellars, universities, and private companies.

Statistics

Statisticians generate, collate, verify, maintain and disseminate statistical information on the agricultural sector, including the monitoring and projection of trends in agriculture, food security and food utilisation.

Entry requirements for becoming a statistician

Mathematics
Agricultural Science OR Economics
Business Economics

Institution: Most universities

Duration: Four years

Potential employers

Potential employers are DAFF, commercial banks and other financial institutions, and academic institutions.

Weeds Biocontrol Sciencs

Biocontrol scientists specialising in aquatic weeds regularly wade in populated, weed-infested rivers or dams wearing waders. They also use boats.

Role of weeds biocontrol scientists

The field involves searching for natural enemies (either insects or disease-causing organisms such as fungi) of invasive plants (weeds) in the weed's country of origin, and studying the natural enemies in quarantine to determine whether these have a potential use in controlling the invasive plant, and whether they are host-specific.

Host-specific and damaging insects and fungi are released from quarantine and placed onto their target weeds in the field. The release sites are regularly visited to see whether these insects or fungi have become established and are controlling the weed.

Entry requirements for becoming a weeds biocontrol scientist

Mathematics
Physical Science
OR
Agricultural Science

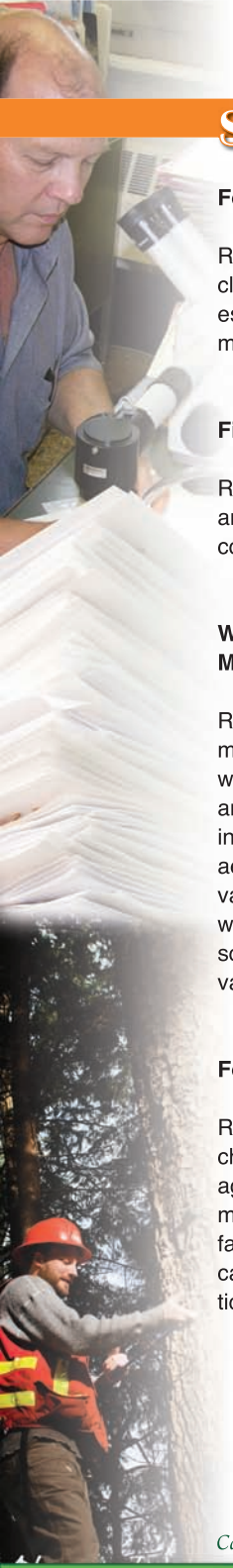
Institution: Most universities

Duration: Four years

Potential employers

Potential employers are the ARC, government departments, universities, private consultant, and private companies.

Careers in Forestry



Scarce Skills in Forestry

Forestry & Climate change

Role: Understanding the impact of climate change on forestry and forest resources and working towards mitigation of these impacts.

Fire Management

Role: Understanding fire behavior and utilizing information to prevent, control and combat forest fires.

Woodland and Natural Forest Management

Role: Is based on conservation and management of natural forests and woodland aimed at economic, social and environmental sustainability. It includes management for diversity, aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, forest genetic resources and other forest resource values.

Forestry Economics

Role: Deals more narrowly with choices about how forests are managed and used for optimal financial management and how the other factors of production like labour and capital are used in forest production.

Forest Biotechnology

Role: The use of scientific advances such as tissue culture, cell selection and genetic engineering to advance the critical steps of forest establishment as well as increase the productivity of stands.

Market analysts

Role: Entails the assessment of local and international markets and the drives behind the changes observed. Furthermore, studies the markets to identify opportunities and predict problems to guide the business strategies.

Product Development

Role: Covers innovative thinking and development of new and improved products from existing management plans and available resources.

Community Forestry

Role: Community forestry is a village-level forestry activity, decided on collectively and implemented on communal land, where local comunities participate in the planning, establishing, managing and harvesting of forest crops, and so receive a major proportion of the socio-economic and ecological benefits from the forest.

Agro Forestry

Role: Is a dynamic ecologically based natural resource management system that through integration of trees in farmlands and grassland diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels.

Forestry and Forest Science

A career in forestry is a combination of science, business and art. Here art refers to the imaginative skills of the graduate to interpret scientific knowledge and apply it as a technology in a particular situation and information on the development of trees and entire forests.

Forester

A forester is a person who practises forestry, which is the science, art and profession of managing forests. Foresters engage in a wide range of activities, including timber harvesting, ecological restoration and management of protected areas. Foresters manage forests to meet a

variety of objectives, including direct extraction of raw materials, outdoor recreation, conservation, hunting and aesthetics.

Role of foresters and forest scientists

The role of foresters and forest scientists is to manage commercial forestry plantation and natural forests in a sustainable manner. They protect the natural resource base by establishing and promoting the growth of planted trees and by harvesting the raw material (timber). The forester must be aware of forest pests and tree diseases, which, as far as possible, must be controlled. Foresters and forest scientists ensure that fires and environmental

Entry Requirements for B.SC. Forestry

Mathematics:	5 (60–69%)
Physical Science:	5 (60–69%)
Afrikaans or English (Home Language or First Additional Language):	4 (50–59%)

Duration: Four years

Institution:
- University of Stellenbosch
- University of KwaZulu-Natal

National Diploma in Forestry:

Mathematics:	4 (50–59%)
Physical Science:	4 (50–59%)
English:	4 (50–59%)
Other two languages:	4 (50–59%)

Duration: Three years

Institution: Nelson Mandela Metropolitan University

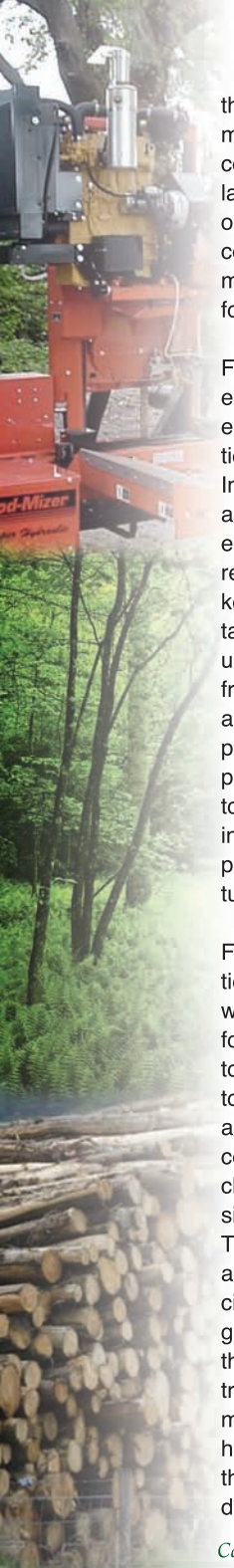
Career opportunities

Forest scientist

Forest ecologists and forest scientists are involved in tree breeding, forest tree seed production, nursery practice, establishing and tending, forest nutrition and management of ectomycorrhizal fungi.

Forester

Foresters manage the use and development of forests, rangelands and other natural resources. These areas supply wood products, livestock forage, minerals and water. They serve as sites for recreational activities and provide a habitat for wildlife. Some workers advise private landowners on the use and management of their land and may design and implement programmes



that make the land healthier and more productive. Others work to conserve or restore public or private lands. Foresters often specialise in one of several areas, such as soil conservation, urban forestry, pest management, native species and forest economics.

Foresters oversee our nation's forests and direct activities in these for economic, recreational, conservational and environmental purposes. Individual landowners, the public and industry own most of the forested land in this country and they require the expertise of foresters to keep the forests healthy and sustainable. Often, this means coming up with a plan to keep the forests free from disease, harmful insects and damaging wildfires, for example by planning when and where to plant trees and vegetation and when to cut timber. It may also mean coming up with ways to make the land profitable while protecting it for future generations.

Foresters have a wide range of duties, depending on whom they are working for. The primary duties of foresters include drawing up plans to regenerate forested lands, monitoring the progress of these lands and supervising the harvesting process. Land management foresters choose and direct the preparation of sites on which trees will be planted. They oversee controlled burning and the use of bulldozers or herbicides to clear weeds, brush and logging debris. Advice is also given on the type, number and placement of trees to be planted. Foresters then monitor the seedlings to ensure healthy growth and to determine the best time for harvesting. If they detect signs of disease or harmful insects, they will consult with specialists in forest pest management to decide on the best treatment. When the trees reach a certain size, foresters decide which trees should be harvested and sold to the sawmills.

Procurement foresters make up a large share of the total number of foresters. Their job is to buy timber, typically for a sawmill or wood product manufacturer, by contacting local forest owners and negotiating a sale. This activity usually involves taking an inventory of the type, volume and location of all standing timber on the property, a process known as timber cruising. Timber evaluations are made and negotiations on purchases take place before a purchase contract is drawn up. The next step is subcontracting with loggers or pulpwood cutters for tree removal and assisting with the laying out of roads to access the timber. Throughout the process, foresters maintain close contact with the subcontractor and the landowner to ensure that the work meets the landowner's requirements and national environmental regulations.

Throughout the forest management and procurement processes, foresters often are responsible for conserving wildlife habitats and creek beds within forests, maintaining water quality and soil stability, and complying with environmental regulations. Foresters must balance the objective to conserve forested ecosystems with the need to use forest resources for recreational or economic purposes. For example, foresters are working with landowners to a larger extent to find ways to generate funds from forested lands, such as using these for hunting or other recreational purposes, without cutting down trees. A major concern of foresters is the prevention of devastating wildfires. Using a variety of techniques, including the thinning of forests and controlled burns (to clear brush), foresters work with governments and private landowners to minimise the impact of fire on the forest. During a fire, they work with or supervise firefighters and plan ways to contain the fires.

Pulp and paper technologist

Pulp and paper technology is a specialist field of chemical engineering which involves the study of the processes required for the conversion of raw materials such as wood, into pulp and paper products.

Pulp and paper products are indispensable in our daily lives; products such as newspapers, books, toilet tissue, cardboard and wooden boxes, etc., are essential commodities of modern civilisation, without which life would be unimaginable.

A pulp and paper technologist must have a wide variety of skills. He or she must be able to understand how and why a given process works, in order to set up and operate equipment in the process. A pulp and paper technologist is a creative problem solver, who applies scientific knowledge and technical expertise to ensure that the process is run in the most cost-effective and efficient way, and with due regard for safety and the environment.

Forestry extension officer

These officers advise farmers and educate the public about the importance of trees.

Forestry researcher

They conduct research to ensure the preservation of trees and specialise in growth modelling, forest genetics, forest theology, conservation and ecology. They perform research on forest issues and related natural resources. This may include the study of tree improvement and harvesting techniques, global climate change, the protection of forests from pests, diseases and fire, improving wildlife habitats, forest recreation and other issues. State foresters may perform some research, but more often work with private landowners in developing forest management plans. They enforce relevant environmental legislation, including laws on water quality and fire suppression.

Forestry engineering

This field is concerned with the environmental, social, physical and economic impact of harvesting. It includes the management of the total supply chain, from felling to delivery to the mills. The harvesting methods and systems are analysed with regard to the impact on wood procurement cost and wood and fibre quality as well as ergonomics. Other factors are access development, forest road construction and networks.

Forestry nursery manager

The duties of the forestry nursery manager include the raising of seedlings in the pruning, thinning and felling of trees, the sawing of felled trees into logs and the loading process. They make firebreaks to protect the forests against fire and other damage.

Forestry technician

Forestry technicians help professional foresters to manage forest resources. They work for national government agencies that manage public forest lands used for recreation and conservation purposes. Some technicians work for private companies engaged in logging and manufacturing paper and wood pulp products. Others work for companies in the mining, petroleum and railroad industries.

Other career opportunities include the following:

- Plantation manager
- Forest enterprise development specialist
- Timber grower
- Forestry local development specialist
- Forestry global information system specialist
- Forest ecologist
- Forestry lecturer
- Forestry production manager
- Wood technologist
- Forestry logistics manager

- Forestry Pathology
- Rural Development Advisor
- Forestry Consultant
- Silviculturist
- Forest Geneticist
- Fire Advisor

Potential employers

- Department of Agriculture, Forestry and Fisheries
- Department of Environmental Affairs
- Private sector (forestry companies, contractors)
- Council for Scientific and Industrial Research
- Consulting Companies
- Universities
- Research Institutions

Careers in Fisheries

Marine Biology/Oceanography

This is the study of the ocean and life within it. The field of marine biology is often referred to as oceanography. Oceanography is an interdisciplinary science that uses insights from biology, chemistry, geology, meteorology, and physics to analyse ocean currents, marine ecosystems, ocean storms, waves, ocean plate tectonics, and features of the ocean floor, including exotic biomes such as cold seeps and hydrothermal vents. When describing their work, marine scientists talk about three different fields of study, namely physical, chemical and biological oceanography.

• Physical oceanography is the study of the physical properties of seawater and the forces that move it. Ship-based measurements, satellite imagery and automatic monitoring instruments are all used to measure ocean and coastal currents, waves, tides, temperature and salt content (salinity). Marine scientists who specialise in the field of physical oceanography also study the interaction between the sea and the atmosphere in an effort to demonstrate how the ocean influences weather and climate.

• Chemical oceanography is concerned with the composition of seawater and the effect of chemicals on the marine environment. Marine scientists who specialise in this field measure, among other things, trace elements, oxygen, major nutrients such as nitrates and phosphates and dissolved organic and inorganic carbon. Marine pollution poses a challenge for marine scientists who may be involved with monitoring the effect that pollution has on the marine environment.

• Biological oceanography is a field of study that seeks to understand what controls the distribution and abundance of different types of marine life, and how living organisms influence and interact with processes in the oceans. Biological oceanographers study all forms of life in the oceans, from microscopic plants and animals to fish and whales. In addition, biological oceanographers examine all forms of oceanic processes that involve living organisms. These include processes that occur at molecular scales, such as photosynthesis, respiration, and cycling of essential nutrients, to large-scale processes such as the effect of ocean currents on marine productivity.

Entry requirements for B.Sc. Marine Biology and Oceanography

Entry requirements

Mathematics:	6 (70–79%)
Physical Science:	5 (60–69%)

Duration: Four years

ND: Fisheries Science

Life Science:	4 (50–59%)
Mathematics:	4 (50–59%)
OR	
Mathematics Literacy:	5 (60–69%)
Additional two subjects:	4 (50–59%)

Duration: 4 years

Institution:
Cape Peninsula University Technology

Institution:

- Rhodes University
- University of KwaZulu-Natal
- University of Cape Town
- University of the Western Cape

Potential employers

- Marine aquaculture farms
- Marine and coastal management
- Institute of Marine Technology
- Council for Scientific Research(CSIR)

Ichthyology/Fisheries Science

An ichthyologist or a fisheries scientist is a person who devotes a career to studying and managing the fishery resources, which may involve shellfish or aquatic mammals as well as fish. Ichthyologists are involved in work all over the world.

Entry requirement for B.Sc. Ichthyology or Fisheries Science (Hons)

B.Sc. Zoology (majoring in Ichthyology) with 60% pass

Duration: 1 year

Institution: Rhodes University

Employment opportunities

Applied research

National and local agencies, such as Marine and Coastal Management, South African National Parks and the Water Research Commission (WRC), employ ichthyologists in research and

administrative positions. The responsibilities of these agencies include the management and development of commercial and sport fishing regulations, regulating the use of coastal and wetland areas for recreation, the identification of commercial adult and larval fish populations, and the protection of endangered or threatened species.

University and school teaching and research

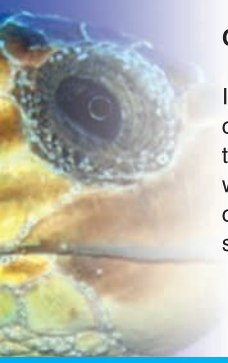
Many Ph.D. ichthyologists and fisheries scientists seek employment as university professors where their primary responsibilities are teaching, research and administration. Courses taught by ichthyologists usually include general biology and one or more specialised courses such as comparative anatomy, behaviour, biometry and ecology.

Museum curatorship and/or collection management

Many museum curators conduct research on a particular group of fish, examining preserved fish specimens as a primary source of data. Collection managers are responsible for the proper preservation and handling of fish specimens, maintaining records, and assuring that the collection is accessible to other scientists for study.

Public aquaria and the aquarium hobby

Jobs include aquarium maintenance and animal keeping, exhibit development, education, public outreach, and research on captive breeding and other aspects of maintaining live aquatic animal populations.



Conservation biology

Ichthyologists at conservation agencies, such as Conservation International and the World Wildlife Fund, work with other biologists to develop conservation plans for species and species communities.

Fish and shellfish farms

On a fish or shellfish farm you may work on ocean pens off the coast growing marine finfish, or you may work inland where freshwater species can be cultivated in ponds. The South African growing aquaculture industry is concerned with the raising of aquatic animals and plants for many purposes including the production of food and home

Zoology

In its broadest sense, zoology is the study of animals, and a zoologist is a scientist who studies animals and their environment or habitats. Animals, in this context, are any living organisms that are not plants, fungi, viruses or bacteria (the study of these organisms is the realm of botanists and microbiologists). Animals include creatures like the marine sponges (which don't look much like animals), jellyfish, worms, rock lobsters, snails, insects, fishes, frogs, birds and mammals.

The field of zoology has many different disciplines such as cell biology, physiology, marine biology, behaviour, and ecology, to name but a few. Zoologists can also study animals at the level of the cell, organ systems, whole animals, animal communities or whole ecosystems.

Zoologists can consequently be divided and classified on the basis of their area of specialty. An anatomist, for example, studies the body organisation of animals, an ethologist studies animal behaviour, a physiologist studies how animals work and an ecologist studies how animals interact with their environment and other animals in it.

Zoologists can also be divided on the basis of the animal groups on which they work. Entomologists study insects and herpetologists, ornithologists and mammalogists work on snakes and amphibians, birds, and mammals, respectively.

Some zoologists work in "pure" fields while others work in "applied" fields. Pure, basic or fundamental science can be interpreted as "science for its own sake" and is concerned with increasing our knowledge of how living things work. It provides the foundation for applied science. Applied science, as its name suggests, involves applying scientific knowledge to specific problems. For example, a zoologist (who may be a mammalogist) may study a population of mice in the wild in order to understand how population numbers of mice fluctuate and what environmental factors are responsible for these fluctuations. This is pure research. He/she (or another zoologist) may then apply this knowledge to controlling populations of mice that are causing an economic problem because they are eating stored grain. This is applied science. Many studies that fall into the applied sciences have major implications for people and the environment.

Curriculum

In the first year of study, students should enroll for the zoology course and in the second and third year, ichthyology is provided as a major subject.

Entry requirements for B.Sc. Zoology (major in Ichthyology)

Afrikaans or English:	4 (50–59%)
An additional language:	4 (50–59%)
Mathematics:	5 (60–69%)
Physical Science:	5 (60–69%)

Duration: Three years

Institution:

- University of Pretoria
- Rhodes University
- University of Limpopo

Potential employers

- Nature reserves
- Environmental consultancies
- Conservation planning agencies
- Biochemical and biotechnology industries
- Medical and veterinary research
- Pest management
- Educational and research institutions
- The corporate sector
- DAFF

Marine Botany

As an expert in the field of marine botany (the study of plants that live the sea), your major role is to provide your team with the botanical information they need to compete the task. You will be called upon to document your research in your in a journal and present your findings as part of the team's oral presentation.

It is a specialisation course that consists of zoology, marine biology, marine science and botany.

Entry requirements for B.Sc. Marine Botany

B.Sc. Zoology (majoring in Ichthyology)
OR
B.Sc. Marine Biology
OR
B.Sc. Botany
A 60% pass

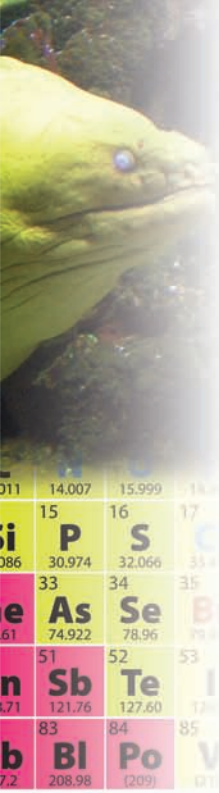
Duration: 1 years

Institution:

- Rhodes university
- University of Cape Town

Aquaculture/Aquatic Science

Aquaculture is the farming of aquatic organisms including fish, molluscs, crustaceans and plants in a controlled or selected aquatic environment (fresh, sea or brackish wa-



ters), with some forms of intervention such as regular stocking, feeding and protection from predators in the rearing process to enhance production.

Marine aquaculture presents an opportunity to substantially increase economic activity in coastal areas, with associated creation of skills-based employment and income, thereby also addressing government's principal challenges, namely poverty and unemployment. Economic resources provide an opportunity in terms of available infrastructure, though access to capital and markets is limited.

While low-cost unskilled labour may provide opportunities in certain labour intensive sectors, expertise on managerial level is limited - particularly with regard to large-scale intensive farming systems. Improved skills and competence to manage fish resources in an environmentally sustainable manner will also be of critical importance.

Focus areas

Focus areas include fish biology and physiology, principles of water quality and pond dynamics as a primary element to which aquatic organisms live – this concerns the quality of the environment suitable for the fish to grow optimally, principles of genetics and breeding technologies, fish diseases and parasites, dealing with the disease diagnosis and treatment, including various ways of health management through proper pond management and nutrition that concerns the quality of the feed utilised to produce quality fish meat for human consumption.

Entry requirements for B.Sc. in Biological and Environmental Aquaculture/ Aquatic Science

NSC with at least 35 points (APS)
Mathematics Literacy: 6 (70–79%)
OR
Mathematics: 5 (60–69%)
Physical Science: 5 (60–69%)
English and additional language: 4 (50–59%)

Duration: 3 years (full time) or 1 year postgraduate degree

Institution: Rhodes, Stellenbosch, University of Limpopo

Potential employers

The DAFF, universities, provincial agriculture and environment departments, aquatic product manufacturers and aquatic research organisations (not fully established).

Nature Conservation

Conservation is an ethic of resource use, allocation and protection. Its primary focus is upon maintaining the health of the natural world: its fisheries, habitats, and biological diversity.

Curriculum

Graduates are equipped with a comprehensive range of technical, managerial, research, communication and life skills for employment in the field of nature conservation.

Entry requirements for ND: Nature Conservation

English:	4 (50–59%)
Mathematics:	3 (40–49%)
OR	
Mathematics Literacy:	5 (60–69%)
Life Science:	4 (50–59%)
Agricultural Science:	3 (40–49%)

Duration: Three years

Institution: Cape Peninsula University of Technology

Career opportunities

Opportunities include the management of natural resources, research, environmental education, ecotourism, law enforcement and alien plant control.

Statistics

A statistician is someone who works with theoretical or applied statistics. The profession exists in both the private and public sectors. The core of that work is to measure, interpret, and describe the world and human activity patterns within it. The field shares much common history with positivist social science, but often with a greater emphasis on advanced mathematical methods.

Roles

It is common to combine statistical knowledge with expertise in other subjects. The applications are varied. Statisticians apply their knowledge to production, research, finance, medicine, the built and natural environments, insurance and government. They are often employed to support managerial decisions or to supervise quality control in manufacturing.

Entry requirements for B.Sc. (majoring in Statistics)

English:	4 (50–59%)
An additional language:	4 (50–59%)
Mathematics:	5 (60–69%)
Physical Science:	5 (60–69%)
Life Orientation:	4 (50–59%)
Life Science:	4 (50–59%)

Duration: Three years

Institution:
- University of Pretoria
- Rhodes University
- University of Limpopo

The qualification requires student to enroll for BSc plain in their first year of study and they will start majoring with statistics in second level.

Mathematics

This is the science that is concerned with structure and relationships. In "structure" and "relationship" we do not think only of geometric structures and relationships, but also of logical (deductive) structures and relationships between abstract concepts. The mathematician solves problems by means of logical deductions made from abstract models of concrete cases. In most scientific disciplines, knowledge of mathematics is essential, since the scientist translates a practical problem into mathematics and solves it according to mathematical rules and systems.

Pure mathematics concerns abstractions and their methods in order to achieve better insight, while applied mathematics involves the use of these methods for solving specific problems.

Entry requirements for B.Sc. (majoring in Mathematics)

English:	4 (50–59%)
Mathematics:	5 (60–69%)
Physical Science:	4 (50–59%)
Life Orientation:	4 (50–59%)
Life Science/Agricultural Science/Geography:	4 (50–59%)

Duration: Three years

Institution:
- Pretoria
- Rhodes
- Limpopo

The qualification requires student to enroll for BSc plain in their first year of study and the will start majoring with mathematics in second level.

Career Opportunities

Mathematicians are in demand not only for the mathematical knowledge that they possess, but also for the logical approach which they have been trained to bring to diverse scientific and technical problems. They find employment in commerce and industry, research institutes and various government departments. Careers in, for example, the physical sciences, engineering, actuarial science, computer science and statistics are impossible without a sound preparation in mathematics. The biological, social and economic sciences depend increasingly on mathematical model building, and those subjects will have an ever-increasing need of mathematical knowledge. Since there is a great shortage of trained mathematics teachers in South Africa, the prospects for teachers of mathematics at all levels are excellent.

Analytical Chemistry

Chemistry is a basic science whose central concerns are –
- The structure and behaviour of atoms (elements)
- The composition and properties of compounds
- The reactions between substances with their

accompanying energy exchange
- The laws that unite these phenomena into a comprehensive system

Entry requirements for B.Sc. (majoring in Analytical Chemistry

English:	4 (50–59%)
Additional language:	4 (50–59%)
Mathematics:	5 (60–69%)
Physical Science:	5 (60–69%)
Life orientation:	4 (50–59%)

(excluded when calculating points)

Duration: Three years

Institution: Most universities in the country
The qualification requires student to enroll for BSc plain in their first year of study and they will start majoring with analytical chemistry in second level.

Career opportunities

- Research and development (for which an M.Sc. or Ph.D. is essential)
- Industrial production and technical support in areas such as fuels, explosives, fertilisers, plastics, pharmaceuticals and paint

Physics

This is a fundamental science that underpins all of the other natural sciences. It is an exciting intellectual endeavour that is both challenging and rewarding. Physics serves two apparently disparate purposes in our society: one almost intangible and the other very practical. On one hand it satisfies our intellectual curiosity about all the objects and processes in the universe, and on the other it spawns the technologies that improve our quality of life. Physics has fuelled the incredible expansion of knowledge and technology that has occurred in the recent past, and will continue to be a major influence in our lives in the future.

Roles

Physicists are acknowledged to be valuable assets in our modern society. They provide us with an understanding of the fundamental processes that govern the universe,

and they harness the laws and materials provided by nature to stimulate economic growth and improve our standard of living. Some physicists study exotic and ethereal objects, such as subatomic quarks and massive black holes, while others develop practical technologies that are used in common commodities, such as cell phones and computers. Some physicists even manage to combine their esoteric research interests with the development of practical technologies. The skills of the physicist have applications far beyond the classroom and the laboratory. Physicists are trained to apply logical and rational reasoning in all situations, and to use systematic and analytical techniques when solving problems. These attributes are highly valued in all spheres of society, and many respected leaders in finance, industry and politics were trained as physicists.

Entry requirements for B.Sc. (majoring in Physics)

English:	4 (50–59%)
Mathematics:	5 (60–69%)
Physical Science:	5 (60–69%)
Life Science/Agricultural Science/Geography:	4 (50–59%)
Life Orientation: (not included in APS)	4 (50–59%)

Duration: Three years

Institution: Most universities in the country

The qualification requires student to enroll for BSc plain in their first year of study and the will start majoring with physics in second level.

Career opportunities

Broad areas of employment opportunity include academic research and teaching, school teaching, health science, manufacturing and mining industries, law, journalism, finance and commerce.

Annexure

Universities

UNISA

Private Bag X 6
FLORIDA
1710
Tel. (012) 352 4170/ 4031/ 4255
Fax (012) 352 4117/ 320 3557
www.unisa.ac.za

Fort Hare University

Private Bag X 1314
ALICE
5700
Tel. (040) 602 2232
Fax (040) 653 1730
www.ufh.ac.za

North West University

Private Bag X 2046
MMABATHO
2735
Tel. (018) 386 1321
Fax (018) 386 2686
www.uniwest.ac.za

University Of Free State

PO Box 339
BLOEMFONTEIN
9301
Tel. (051) 401 2535
Fax (051) 401 3728
www.uvs.ac.za

University Of Kwa-Zulu Natal

Private Bag X 1
SCOTTSVILLE
3209
Tel. (033) 260 5183
Fax (033) 260 5969
www.ukzn.ac.za

University Of Limpopo

Private Bag X 1106
SOVENGA
0727
Tel. (015) 268 2142/2208
Fax (051) 268 2893/ 3206
www.ul.ac.za

University of Pretoria

PRETORIA
(ONDERSTEPOORT for Veterinary science)

Private Bag X 20
HATFIELD
0028
Tel. (012) 529 8201
Fax (012) 529 8313
www.up.ac.za

University of Stellenbosch

Private Bag X 1
MATIELAND
7602
Tel. (021) 808 4792
Fax (021) 808 2001
www..sun.za

University of Cape Town

Private Bag
RONDEBOSCH
7701
Tel :(021) 650 2105/6
Fax :(021) 650 5100
www.uct.ac.za

University Of Venda

Private Bag X 550
THOHOYANDOU
0950
Tel. (015) 962 8110
Fax (015) 962 8647
www.univen.ac.za

Rhodes University

PO Box 94
GRAHAMASTOWN
6140
Tel: (046) 603 8276
Fax: (046) 603 8300
www.ru.ac.za

University of the Western Cape

Private Bag X 17
BELLVILLE
7535
Tel :(021) 959 3901
Fax :(021) 959 1369
www.uwc.ac.za

Universities of Technology

Cape Peninsula University of Technology

PO Box 652
CAPE TOWN
8000
Tel. (021) 460 3168
Fax :(021) 460 3854
www.cput.ac.za

Central University of Technology

Private Bag X 20539
BLOEMFONTEIN
9300
Tel. (051) 507 3113
Fax: (051) 507 3435
www.cut.ac.za

Mantec

PO Box 12363
JACOBS
4026
Tel. (031) 907 7630/70
Fax (031) 907 7611
www.mantect.ac.za

Tshwane University of Technology

Private Bag X 680
PRETORIA
0001
Tel. (012) 382 5119/5919
Fax :(012) 382 4224
www.tut.ac.za

Nelson Mandela Metropolitan University

PO Box 7700
PORT ELIZABETH
6031
Tel. (041) 504 2873/2369
Fax:(041) 504 2369
www.nmmut.ac.za

Colleges of Agriculture

Cedara College of Agriculture
Private Bag X 6008
PEITERMARITZBURG
3200
Tel. (033) 355 9304
Fax. (033) 355 9303

Elsenburg College of Agriculture
PO Box 54
ELSENBURG
7607
Tel: (021) 808 5018
Fax (021) 808 7705

Fort Cox College of Agriculture

PO Box 2787
KING WILLIAM'S TOWN
5600
Tel. (040) 653 8033/4/5
Fax (040) 653 8036

Glen College of Agriculture

Private Bag X 01
GLEN,
9360
Tel. (051) 861 1012
Fax (051) 861 1122

Grootfontein Agricultural Development Institution

Private Bag X 529
GROOTFONTEIN
5900
Tel. (049) 8421477
Fax (049) 842 4352

Lowveld College of Agriculture

Private Bag X 11283
NELSPRUIT
1200
Tel. (013) 753 3064
Fax (013) 755 1110

Madzivandila College of Agriculture

Private Bag X 5024
THOHOYANDOU
0950
Tel. (015) 962 7200
Fax (015) 962 7239

Owen Sithole College of Agriculture

Private Bag X 20013
EMPANGENI
3880
Tel. (035) 795 1345
Fax (035) 795 1379

Potchefstroom College of Agriculture

Private Bag X 804
POTCHEFSTROOM
2520
Tel. (018) 299 6739
Fax (018) 293 3925

Tompi Seleka College of Agriculture

Private Bag X 9616
MARBLE HALL
0450
Tel. (013) 268 9300/1
Fax (013) 268 9305

Taung College of Agriculture

Private Bag X 532
TAUNG
8584
Tel. (053) 994 9800
Fax (053) 994 1130

Contact Details

Sector Education and Training
Career Awareness Office
20 Beatrix Street, Arcadia, Pretoria
Private Bag X 250, Pretoria, 0001
Tel: (012) 319 7854
Fax: (012) 319 6851
www.daff.gov.za